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Review

Adherence to national diabetes guidelines through monitoring quality indicators—A comparison of three types of care for the elderly with special emphasis on HbA1c

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ABSTRACT

Aim: To compare adherence to Swedish guidelines for diabetes care between elderly people living at home with or without home health care, and residents of nursing homes.
Methods: Medical records of 277 elderly people aged 80 and older, with known diabetes in a Swedish municipality, were monitored using quality indicators to evaluate processes and outcomes.
Results: Monitoring, in accordance to diabetes guidelines, of HbA1c, lipids, blood pressure and foot examinations was lower among residents of nursing homes ($p < 0.001$). The HbA1c value of ≤6.9% (52 mmol/mol) was achieved for 48% of those in nursing homes with medication, 35% and 39%, for those living at home with or without home health care, respectively. Insulin was used to a greater extent in nursing homes. Metformin was frequently used, even at reduced e-GFR. Systolic BP ≤140 mmHg was achieved by 71% vs 80% and 85% of those living at home, those with home health care and residents of nursing homes in the respective groups.
Conclusions: Adherence to guidelines was deficient particularly in nursing homes. Clearer guidelines and interventions aimed at the improvement of quality in diabetes care in elderly people and sustainable coordination between health care providers is needed.

Abbreviations: ATC, Anatomical Therapeutic Classification System; BMI, Body mass index; DBP, Diastolic blood pressure, mmHg.; DM, Diabetes Mellitus; DCCT, Diabetes Control and Complications Trial; e-GFR, Estimated glomerular filtration rate, mL/min/1,73m^2, estimated from serum creatinine by the Modification of Diet in Renal Disease (MDRD) equation; EPRS, Electronic patient record system; fP-chol, Fasting plasma-cholesterol, mmol/L; fP-LDL, Fasting plasma low density lipoprotein, mmol/L; GP, General Practitioner; HbA1c, Haemoglobin A1c, mmol/mol; ICD10, International Classification of Diseases; IFCC, International Federation of Clinical Chemistry; Kg, Kilogram; NDR, National Diabetes Registry (Sweden); NGSP, National Glycohemoglobin Standardization Program; OAD, Oral antidiabetic drugs; P-crea, Plasma creatinine, μmol/L; SBP, Systolic blood pressure, mmHg; SU, Sulphonylureas.

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Contents

1. Introduction

The proportion of the population over 80 is increasing in Sweden (5.5%) due to greater life expectancy and improved health status [1]. The reported prevalence of diabetes in Sweden among the population of those 75–84 is increasing, affecting 14% of the male population and 17% of the female [2]. The management of diabetes for the elderly requires well-implemented routines within the health care system [3]. During the last years, several international guidelines including disease management for the elderly have been published [4–7].

Lately, recommendations ranging from stringent glycemic control [8] to emphasis on the need for individualized glycemic targets have been presented [9]. Recent studies indicate that the elderly are over treated, with excessively strict glycaemic controls [10], suggesting the necessity of improving the quality of diabetic care [3,11]. However, Swedish guidelines from 2010 apply chiefly to the general diabetic population [12], and do not address the heterogeneous group of elderly patients [13,14]. It is important to consider the benefit and harm of decisions concerning individualized targets. Data from observational studies displayed a *U*-shaped curve showing increased mortality risks at low HbA1c levels, and an increased risk of any complication at high levels [15]. Elderly people in Sweden have access to home-based, advanced medical health care to facilitate independent home living. In time, care needs may increase and long-term care with continuous medical assistance in a community dwelling or nursing home may be provided. A county employed nurse in the municipality, together with general practitioners (GP) and diabetes specialized nurses in primary health care form the link to quality care for the elderly. Public hospitals provide emergency care, highly specialized medical care, monitoring of Type 1 diabetes and the management of patients with severe diabetic complications.

The Swedish National Board of Health and Welfare [16] showed deficiencies in adherence to National guidelines for monitoring diabetes care, between elderly people living at home compared to residents of nursing homes. Non-adherence was addressed to all health care providers, to eliminate disparity in the municipalities and counties. Even the Organization for Economic Co-operation and Development [1] encourages improvements in the Swedish health care system, through measurements of the quality of care to assure improved coordination between health care providers. The purpose of this study was to outline adherence to guidelines by comparing the monitoring of diabetes care of the elderly aged 80 or older, living in different forms of senior housing.

2. Methods

The study population was derived from a small municipality in southeastern Sweden, in Kalmar County, consisting of both rural and urban areas. At the time of data collection, the studied municipality comprised 26,175 individuals (13,165 men and 13,010 women) and a total of 5.8% were 80–105 years of age [17]. The municipality is served by one public hospital providing both in- and out-patient care. Three primary healthcare centres with a total of 15 GPs and 4 diabetes specialist nurses follow up almost all patients with Type 2 diabetes.

Municipal nurses, mostly without diabetes specialist training, provide diabetes care for residents living in nursing homes, and for the elderly with home health care. All GPs supervise the 23 nursing homes with a total of 224 residents. All blood sample analyses and diabetic retinopathy screenings are performed at the public hospital. There are no private health care providers practicing in the municipality. The healthcare centres and hospital are equipped with electronic patient record systems (EPRS), while the EPRS version used in municipal health care is not accessible for other health care providers. All visits are registered in the EPRS by national identity number, and the registration of diagnoses is mandatory using the ICD 10-based classification system [18]. The EPRS has an integrated drug prescribing module where all prescriptions are automatically registered according to the Anatomical Therapeutic Classification System [19] and a laboratory module.

The present cross sectional study was performed between June 2011 and May 2013. The EPRS identified 304 patients 80 and older with a diagnosis of diabetes. Twenty-seven were

Table 1 – Study population characteristics aged 80 or older with diabetes among 277 elderly people, distributed into different types of senior housing.

Characteristics	Living at home (1) $n = 176$	Home health care (2) $n = 62$	Nursing homes (3) $n = 39$
	n (%)	n (%)	n (%)
Age (years)*	84.3 ± 3.97	87± 6.64	87± 5.85
Sex, n (% female)	98 (56)	40 (65)	29 (75)
Diabetes duration (years)*	10.67 ± 8.76	12.24 ± 8.60	14.55 ± 10.20
Hypertension	144 (82)	47 (76)	30 (77)
Coronary heart disease	89 (51)	41 (66)	22 (56)
Cerebrovascular incident	28 (16)	14 (23)	12 (31)
Dementia	6 (3)	16 (26)	20 (51)
Amputation	1 (0.5)	4 (6)	3 (7)
Hypertension + CHD	73 (42)	31 (50)	19 (49)
Hypertension + CVI	25 (14)	11 (18)	7 (18)
Hypertension + Amputation	1 (0.5)	2 (3)	3 (7)
Combined diagnoses H + CHD + CVI	16 (9)	7 (11)	4 (10)

Abbreviations: CHD, coronary heart disease; CVI, cerebrovascular incident.
* Values in mean SD. (1–3) = group number.

subsequently excluded, due to various circumstance; they were no longer residents of the municipality (2); they had been given an incorrect diagnosis (15); some had entered a palliative phase (7); and three had died. Consequentially, 277 patients were included.

The data was classified into three groups, based on housing status; elderly people living at home without home health care; elderly people living at home with home health care; and residents of nursing homes.

All patient records including those retrieved manually from the municipal health care provider were examined. The chosen indicators [20] based on Swedish National Guidelines for Diabetes Care, 2010 were used to outline the quality of care and treatment of the elderly with known diabetes. To find the indicator values, keywords were used in the filtering function of the EPRS (cited elsewhere). Where the indicator was not found by keyword, the medical record document text was searched.

The following information was collected; age, sex, DM-type and duration; presence of individual care planning; co-morbidity such as stroke (ICD10, I60–I69); ischemic heart disease (ICD10, I20–I25); hypertension (ICD10, I10–I15); dementia (ICD10, F00–F09); or amputation (ICD10, Y 83). Information regarding medication related to the treatment of diabetes, hypertension and lipid control was also collected, along with the presence of ongoing foot ulcers, last registration of foot examination, incidence of hypoglycaemia, last registration of diabetic retinopathy screening, and the presence of retinopathy, haemoglobin A1c (HbA1c, mmol/mol), according to IFCC standardization [21], plasma creatinine (P-crea, μmol/L), estimated glomerular filtration rate (e-GFR mL/min/1.73 m^2), fasting plasma-cholesterol (fP-chol, mmol/L), fasting plasma low density lipoprotein (fP-LDL, mmol/L), body weight (kg), body mass index (BMI), systolic blood pressure (SBP, mmHg), and diastolic blood pressure (DBP, mmHg) and presence of registration in National Diabetes Register (NDR) during the study period. All data was stratified in periods" <12 months" and "12–24 months". Documentation of diabetes-related indicators of quality of care outside the study period were recorded as ">24 months".

2.1. *Statistical analysis*

Descriptive statistics are summarized by mean and standard deviation (SD). Distribution is presented in tables and figures. Differences in frequencies between any of the three groups were analyzed by the Chi-square test for proportions, followed by Fisher's exact test in case of significance. Differences between the means of HbA1c, P-crea, e-GFR, lipids, BP, weight and BMI, were analyzed by ANOVA followed by Duncan's post hoc test in case of significance.

Results were considered significant at $p < 0.05$. Statistics were performed using STATISTICA (StatSoft.Inc).

3. Results

3.1. *Studied population characteristics*

Type 2 diabetes was found in 276 persons, and one was diagnosed with Type 1 diabetes, with 18% prevalence in the age group 80–89, and 16% of those over 90. Among residents of nursing homes the prevalence of diabetes was 17.4%. Females dominated all three groups. Hypertension and coronary heart disease were the most common comorbidities in all groups. Population characteristics are summarized in Table 1. A total of 16% had diabetes for more than 20 years. Over the previous 2 years, 53% of those with home health care and residents of nursing homes, and 92% of those living at home without home health care were registered in the NDR.

3.2. *Adherence to guidelines*

There was an overall significant difference in adherence to Swedish guidelines in relation to the 10 measured quality indicators during the previous 12 months. Poor adherence was seen in nursing homes, in contrast to those living at home, in the recording of fP-lipid controls, BP controls, foot examinations and diabetic retinopathy screening during the last 24 months ($p < 0.001$) (Table 2). Adherence to HbA1c measurement in those being treated with glucose-lowering medication was

Table 2 – Adherence to guidelines—through monitoring quality indicators within 12 months or 12–24-month periods and outside study timeframe, > 24 months in relation to different senior housing.

Quality indicators	Months	Living at home (1) $n = 176$	Home health care (2) $n = 62$	Nursing homes(3) $n = 39$	p^*	$p1–2^{**}$	$p2–3^{**}$	$p1–3^{**}$
		n (%)	n (%)	n (%)				
HbA1c	<12	165 (94)	55 (89)	28 (72)	<0.001		0.030	<0.001
	12–24	8 (5)	4 (6)	6 (15)	0.905			
	>24	3 (2)	3 (5)	5 (13)	–			
HbA1c with treatment	<12	116 (96) $n = 120$	38 (88) $n = 43$	23 (76) $n = 30$	0.005			0.039
Plasma-creatinine	<12	168 (95)	59 (95)	32 (82)	0.007		0.032	0.029
	12–24	3 (2)	2 (3)	6 (15)	0.633			
	>24	5 (3)	1 (2)	1 (3)	–			
e-GFR	<12	166 (94)	57 (92)	31 (79)	0.002	0.029	0.004	
	12–24	0 (0)	0 (0)	2 (5)	–			
	>24	10 (6)	5 (8)	6 (15)	0.115			
fP-cholesterol	<12	145 (82)	33 (53)	12 (31)	<0.001		0.004	<0.001
	12–24	13 (7)	5 (8)	4 (10)	0.068			
	>24	18 (10)	24 (39)	23 (59)	<0.001	<0.001		<0.001
fP-LDL cholesterol	<12	141 (80)	32 (52)	12 (31)	<0.001	<0.001	0.039	
	12–24	11 (6)	5 (8)	3 (8)	0.476			
	>24	24 (14)	25 (40)	24 (62)	<0.001	<0.001		<0.001
Blood pressure	<12	166 (94)	50 (81)	26 (67)	<0.001	0.004		<0.001
	12–24	7 (4)	8 (13)	4 (10)	0.245			
	>24	3 (2)	4 (6)	9 (23)	<0.001		0.029	<0.001
Weight	<12	158 (90)	52 (84)	30 (77)	0.035			0.009
	12–24	8 (5)	4 (6)	4 (10)	0.926			
	>24	10 (6)	6 (10)	5 (13)	0.226			
Body mass index	<12	141 (80)	31 (50)	10 (26)	<0.001	<0.001		<0.001
	12–24	8 (5)	3 (5)	2 (5)	0.980			
	>24	27 (15)	28 (45)	27 (69)	<0.001	<0.001		<0.001
Screening retinopathy	≤24	120 (68)	32 (51)	9 (23)	<0.001		0.007	<0.001
Foot examination	≤24	159 (90)	43 (69)	17 (44)	<0.001		0.012	<0.001

Abbreviations: HbA1c, haemoglobin A1c; e-GFR, estimate glomerular filtration rate; fP, fasting plasma.
* Chi squared-test.
** Fisher's exact-test between groups.

found to be significantly lower in nursing homes compared to those living at home ($p = 0.039$).

3.3. *Glycemic control*

There was high dispersion in the SD from the mean value of HbA1c results, among the population with home health care and in nursing homes. The differences revealed were even greater when those with blood glucose-lowering therapy were distinguished from those without treatment. HbA1c value of ≤6.9% (52 mmol/mol) was obtained for 48% in nursing homes and for those without and with home health care, 35% and 39%, respectively, in treatment with insulin and/or oral antidiabetic drugs (OAD). Hypoglycemic episodes could not be visualized.

Blood glucose-lowering therapy was most common in nursing homes, and insulin therapy, comparing with OAD, was used to a greater extent (Fig. 1). Of 83 elderly patients, the dominating OAD treatment in single or combination therapy was metformin, 89%, and the second dominating was sulphonylurea (58%) in all groups. No elderly patients in the municipality were treated with "modern" blood glucose-lowering drugs such as Glucagon-like peptide-1 and inhibitors of dipeptidyl peptidase 4. The use of pre-mixed insulin

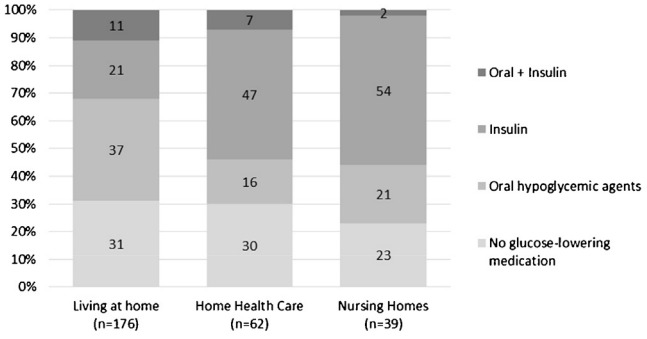

Fig. 1 – Diabetes treatment choice (%) in relation to different senior housing.

Table 3 – Biochemical and clinical outcomes: Laboratory findings and physical examination during the previous 12 months, and achievement of recommended targets among the 277 elderly with diabetes in the municipality. Mean ± SD (followed by % recorded measures of available subjects in parenthesis) for continuous and number (% of recorded measures) for categorical parameters.

Quality indicators	Living at home (1)	Home Health Care (2)	Nursing homes (3)	p^*	$p1–2^{**}$	$p2–3^{**}$	$p1–3^{\times}$
	$n = 176$	$n = 62$	$n = 39$				
HbA1c (mmol/mol)	55.0 ± 11.7 (94%)	57.6 ± 17.9 (89%)	56.9 ± 19.7 (74%)	0.471			
With treatment ($n = 193$)	58.3 ± 11.3 (97%)	60.2 ± 19.2 (88%)	59.5 ± 0.3 (77%)	0.651			
≤52 with treatment (n;%)	41 (35%)	15 (39%)	11 (48%)	0.710			
Insulin + SU treatment ($n = 159$)	60.1 ± 11.4 (97%)	61.5 ± 19.3 (88%)	61.8 ± 20.8 (80%)	0.836			
Plasma-Creatinine (μmol/L)	95.7 ± 35.5 (95%)	108.8 ± 50.5 (95%)	84.8 ± 25.6 (82%)	0.012		0.001	
e-GFR (mL/min/1.73^2)	52.9 ± 11.1 (94%)	47.6 ± 13.8 (92%)	55.6 ± 8.6 (79%)	0.002	0.017	0.000	
<30 (n; %)	12 (7%)	5 (9%)	0 (0%)	–			
30–60 (n; %)	65 (39%)	33 (58%)	12 (39%)	0.066			
>60 (n; %)	89 (54%)	19 (33%)	19 (61%)	0.025	0.007		
fP-Cholesterol (mmol/L)	4.5 ± 1.1 (82%)	4.3 ± 1.2 (53%)	4.6 ± 1.2 (31%)	0.528			
fP-LDL Cholesterol (mmol/L)	2.4 ± 0.99 (80%)	2.4 ± 1.3 (50%)	2.6 ± 1.1 (29%)	0.863			
>2.5 mmol/L (n; %)	54(38%)	9 (28%)	5 (42%)	0.947			
Systolic blood pressure (mmHg)	136.3 ± 15.4 (94%)	130.5 ± 20.2 (81%)	125.5 ± 16.4 (66%)	0.003			0.002
≤140 mmHg (n; %)	118 (71%)	40 (80%)	22 (85%)	0.450			
Diastolic blood pressure (mmHg)	72.1 ± 9.6 (94%)	69.6 ± 10.7 (81%)	69.5 ± 9.3 (67%)	0.181			
Weight (kg)	77.9 ± 13.6 (90%)	74.6 ± 16.3 (84%)	70.3 ± 11.3 (77%)	0.016			0.008
BMI (kg/m^2)	27.7 ± 4.2 (80%)	27.3 ± 5.1 (50%)	24.4 ± 4.7 (26%)	0.076			
[a]Retinopathy <24 months (n; %)	22 (13%)	12 (19%)	6 (15%)	0.411			
Foot ulcer, ongoing (n; %)	7 (4%)	15 (24%)	14 (36%)	<0.001			0.005

Abbreviations: HbA1c, haemoglobin A1c; SU, Sulphonylureas; e-GFR, estimate glomerular filtration rate; fP, fasting plasma; LDL, low-density lipoprotein; BMI, body mass index.

[a] Proportion of diabetic retinopathy findings (not disaggregated by severity) during previous 24 months.

* Differences between groups: Frequencies analysed by Chi-square test followed by Fishers exact test if significant and continuous variables analysed by ANOVA followed by Duncan's post hoc test in case of significance.

** Post hoc significance levels where $p1–2$ is the difference between group 1 and 2, etc.

dominated all insulin treatment, 58%, and NPH/long-acting insulin, 32% and Aspart/Lispro, 10%, respectively.

3.4. *Biochemical and clinical outcome*

Both the percentage of performed analyses of P-crea and the numerical mean result during the previous 12 months were significantly lowest at nursing homes, 82%, $p = 0.007$ and $p = 0.001$, respectively. Even mean body weight and BMI were significantly lower at nursing homes (Table 3). At reduced e-GFR < 60 (mL/min/1.73^2), 29% were treated with Metformin, while one had e-GFR < 30 (mL/min/1.73^2). The prescription of lipid-lowering drugs was 61% for those living at home, 43% of those with home health care, and 30% in nursing homes. Despite an elevated fP-LDL >2.5 mmol/L, 30% with a history of macrovascular complication were without lipid-lowering drugs.

SBP of ≤140 mmHg was obtained by 71% vs. 80% and 85%, and ACE inhibitors both as a single drug and in combination with other BP-lowering drugs were used in 58% vs. 35% and 50%, respectively for those living at home, those with home health care, and residents of nursing homes. Nevertheless, of 39 elderly people in the study population without BP-lowering medication, 33 were normotensive (SBP of ≤140 mmHg), while 6 had SBP within the range of 142–150 mmHg.

Documentation regarding foot examination was significantly inferior at nursing homes, compared with the two other groups (Table 2), which may reflect the 36% ongoing foot ulcers in nursing homes (Table 3). Broadly, 15% of the study population were recorded as being diagnosed with diabetic retinopathy without differences between groups (Table 3). Significant differences were found in the number of performed screening tests between groups (Table 2).

4. Discussion

Our results show a significant lack of adherence to diabetes guidelines in relation to the measured quality indicators. Poor

adherence was seen in frequency of performed monitoring at least once a year of HbA1c, lipids, BP and of performed foot examinations, among residents in nursing homes. Guidelines [12] recommend annual checkups with the possibility of individual variations, based on the person's situation, treatment and status.

Adherence to Swedish guidelines may have been influenced by patient or organizational aspects. The study results reflect a higher annual follow-up frequency among elderly people living at home without home health care, when making appointments and regularly visiting primary healthcare for checkups. Comparing poor results in our study, elderly people with home health care and residents of nursing homes tend to be excluded from follow-ups. Contact with primary health care (GPs) gradually becomes problem-oriented, acute and temporary rather than for the monitoring of health, medication and prevention, which could be explained by a lack of routines between primary health care and municipal health care. The current Swedish guidelines on the management of Type 2 diabetes lacks differentiated care, as presented in IDF guidelines concerning older people with diabetes [7], providing recommendations stratified into three groups; those fit, healthy and independent; those functionally dependent, which contains the subgroups—frailty, dementia. The prevalence of known diabetes in nursing homes is in line with other studies from Europe [22,23]. The hazard of hypoglycemia in the elderly may lead to falls, fractures and aggravation of co-existing disabilities, and may even influence cognitive functions during a hypoglycemic state. Like Fahey et al. [24] we found differences in HbA1c monitoring among residents of nursing homes compared to elderly persons living at home. Similar to results from other studies [22,25–27] our study also showed low HbA1c $\leq$6.9% (52 mmol/mol) values in nearly half the residents of nursing homes. The insufficient documentation in medical records, both for primary care and municipal caregivers, made it impossible to obtain episodes of hypoglycemia, which should be of great concern due to the fact that residents of nursing homes presented with low HbA1c values.

Given the serious consequences of hypoglycemia, it is noteworthy that the lack of monitoring HbA1c, when more than half the residents in nursing homes are on insulin therapy, is inadequate.

Metformin has, under normal circumstances, a good safety profile, does not affect the frequency of hypoglycemia, and is considered the drug of choice in patients with normal renal function and e-GFR > 60 (mL/min/1.73^2) [28]. Values of e-GFR below 60 (mL/min/1.73^2), and metformin treatment were found in 29% of our study population. Similar numbers have been reported in other studies [3,22]. Treatement with metformine in elderly persons requires close monitoring and dose adjustment adapted to declining renal function [29].

Another issue of importance is that elderly people have a higher atherosclerotic disease burden and multi-morbidity [30]. This study showed that only 16 of 277 elderly patients presented with no macrovascular event. It is likely that some elderly people may benefit from more intense blood pressure goals to reduce mortality and morbidity, but current evidence is not so compelling [31,32]. The Swedish guidelines recommend SBP $\leq$140 mmHg. This BP value was reached by the majority of nursing home residents in contrast to findings in other studies [14,22,24], but this is doubtful since only two-thirds of nursing home residents had their blood pressure checked during the preceding 12 months. Despite the simplicity of measuring BP, registration was unsatisfactory, and was in line with findings of Pham et al. and Fahey et al. [24,26].

Dementia in this study was overrepresented in residents of nursing homes. In contrast to findings of Bouillet et al., Mann et al., and Pham et al. [22,25,26] which may be explained by formal requirement that all residents of nursing homes in Sweden must be examined. The fact that half the residents are diagnosed with dementia may, of course, also influence the monitoring and interpretation of diabetes measures outcomes negatively. Individuals with dementia need support in order to maintain their empowerment and influence their care. With an established individualized care plan with clear procedures and follow up routines, incorrect or unwanted actions can be avoided. However, none of the 277 persons in our study had individualized care planning regarding diabetes.

One of the guideline recommendations concerns the prevention of diabetic foot complications. Regrettably, the present study shows that less than 50% of residents of nursing homes had documented foot examinations during the preceding 24 months. Results from other studies regarding the documentation of foot examinations (either sensory testing or vascular pulse examination) ranges from 0 to 87%, which may be explained by deficient local documentation procedures or strict follow-up routines [14,22].

However, regardless of whether deficiency is related to the absence of monitoring or deficient documentation, measures are needed [33]. Nevertheless, 36% of all residents of nursing homes had ongoing foot ulcers and 7% were leg or foot amputated in contrast to those living at home without home health care where almost all had undergone annual foot examination, and the number of foot ulcers was scarce. When developed, severe foot ulcers are managed by the multidisciplinary foot team in a public hospital setting, but demands well established communication pathways between primary health care and municipal elderly health care for effective coordination of efforts. Aspects discussed are mainly related to the differences between nursing homes and elderly people living at home without home health care, but shortcomings at follow-ups occur for the same indicators, including those living at home with home health care, but to a slightly lesser extent.

To ensure good health and avoidance of improper interventions, it is mandatory to create an organization of care for the growing number of elderly people with complex needs, suggesting that sustainable coordination be provided between primary health care and municipal care.

Municipality nurses with diabetes education on a specialist level are necessary to ensure all elderly people with diabetes in home health care and residents of nursing homes follow-ups in line with national guidelines.

The aim of our study was not to find causation or hypotheses, therefore, no deeper analyses of statistical associations or of agreement during outcomes, was performed.

A strength of our study was that data included the entire population in a municipality without selection bias to

provide an overview of health care quality for those 80 and older presenting with known diabetes.

Further, the study will provide health care organizations with new knowledge, since the evaluated municipality in Kalmar County is demographically consistent with the rest of the country. This knowledge can be utilized for allocating and developing health resources concerning elderly patients with diabetes.

We may find ourselves in a paradigm shift towards establishing individualized treatment and monitoring goals in forthcoming Swedish National Guidelines (Preliminary version, 2015) [34] targeting elderly people with and without multi-morbidity. It would be desirable to have more distinct, variable recommendations in the new guidelines such as IDF's [7]. Only then would the controls and targets lead to better consideration focusing on quality of life, especially in terms of frailty, dementia, and the end of life within the foreseeable future.

Further research is needed since there is a lack of studies focusing on the elderly population's health care situation depending on the transition of medical care between different health care providers. During the implementation process of new guidelines it is imperative to follow and evaluate the impact of interventions that may influence older people, their relatives, and care providing organizations, especially for people in Swedish nursing homes and the elderly living at home with home health care to determine best practice and outcomes.

Conflict of interest

The authors state that they have no conflict of interest.

Ethics

The study was approved by the Ethical Committee of Linköping, Sweden, Dnr: 2013/199-31.

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Appendix A.

List of process and outcome indicators

Quality and Efficiency of Diabetes Care in Sweden National Board of Health and Welfare 2011

A Outcome of diabetes care

A1 Cardio-vascular mortality

A2 Amputation above the ankle

A3 Diabetic patients with end stage renal failure (renal insufficiency)

A4 Intrauterine fetal death and neonatal mortality

A5 Severe congenital malformation and chromosomal abnormalities

A6 Presence of diabetic retinopathy

B Effectiveness

B1 HbA1c-target < 52 mmol/mol

B2 HbA1c > 73 mmol/mol

B3 Blood pressure target < 130/80 mmHg

B4 Blood pressure > 140/90 mmHg

B5 LDL cholesterol target < 2.5 mmol/L

B6 Presence of macro albuminuria

C Treatment

C1 Foot examination

C2 Retinopathy screening

C3 Screening for urinary albumin excretion

C4 Treatment with metformin

D Lifestyle

D1 Physical activity

D2 Non-smokers among persons with diabetes

E Avoidable hospitalization

E1 Avoidable hospital admissions

F* Diabetes care structures

F1 Trained diabetes nurse

F2a Group-based patient education

F2b Culturally-adapted patient education

F0* Patient reported outcome

F01 Perceived quality of diabetes care

F02 Perceived self-care ability

F03 Perception of diabetes as an obstacle in life

F04 Perceived feeling of safety

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