

The Effect of Continuous Monitoring of Hypertension and Type 2 Diabetes Mellitus on the Number of Visits to Medical Specialists and Hospitalization: a Retrospective Study

Ruth Kalda¹, Katrin Västra²

¹Department of Family Medicine, University of Tartu, ²Estonian Health Insurance Fund, Estonia

Key Words: quality system; primary healthcare; monitoring of chronically ill patients.

Summary. *Objective.* The aim of the study was to determine whether the implementation of the quality system (QS) in primary healthcare made the care of chronically ill patients in family practice more consistent and reduced the load in specialized medical care.

Material and Methods. A quantitative retrospective cohort study using the database of the Estonian Health Insurance Fund was provided. Patients with diagnosed essential hypertension (HYP) and/or type 2 diabetes mellitus (DM2) formed the study group. If the family physician met the criteria for the monitoring of patients with DM2 and HYP set in the QS, the result was defined as positive. The number of disease-specific hospitalizations, the length of hospital stay, and the number of visits to family physicians and medical specialists due to HYP or DM2 in 2005–2008 were evaluated.

Results. Chronically ill patients (DM2 and HYP) in the lists of family physicians with a positive QS result were 1.26 times more likely (95% CI, 1.25–1.28) to be continuously monitored than those in the lists of family physicians with a negative QS result. The 2 coexisting chronic diseases (DM2 and HYP) increased the chance of being continuously monitored and increased the number of visits. The chance of being monitored by a medical specialist alone was reduced if the family physician participated in the QS (OR, 0.66; 95% CI, 0.64–0.69) and had a rural practice (OR, 0.53; 95% CI, 0.51–0.55) and if the patient was a woman and older and had a diagnosis of HYP alone. The participation of family physicians in the QS reduced the hospitalization risk (OR, 0.9; 95% CI, 0.88–0.94) as well as the number of hospitalizations for the patients with HYP (OR, 0.93; 95% CI, 0.87–0.99).

Conclusions. The implementation of the QS in primary healthcare reduces the load in specialized medical care. A more detailed analysis of the effect of the QS on the workload and the organization of family practice as well as on the patients' morbidity and satisfaction could be done in the near future.

Introduction

Cardiovascular diseases (CVDs) are the main cause of the loss of working capacity and death in Estonia and have the highest mortality rate in all the countries worldwide (1).

CVDs and diabetes cause 54% of all the deaths from chronic diseases in Estonia (2), while the morbidity rate of chronic diseases is increasing both in Estonia and globally. In many developed countries, the task of continuous monitoring of chronic illnesses has been assigned to primary healthcare (PHC) professionals. Every country has its own specialties and unique requirements, along with conditions for providing PHC services. The principles of funding also vary from country to country. Yet, the importance of providing continuous monitoring of

patients with chronic diseases at the level of primary care has been acknowledged everywhere.

Detecting diseases at early stages is important for the prevention of accompanying complications. The treatment of chronic diseases is efficient when it is carried out in a manner that allows continuous monitoring of the indicators of the disease course and treatment efficacy. The Estonian Society of Family Doctors started developing the quality system (QS) of family physicians in 2001, with the objective of improving the quality of preventive measures and monitoring of chronically ill patients. In 2006, the “pay for performance” (P4P) system, which is based on the voluntary participation of family physicians, was implemented. If a family physician wishes to join the QS, he/she will provide the Health Insurance Fund with a list of chronically ill patients; this is considered as an application for joining the system. The Health Insurance Fund summarizes the monitoring year by April 1 of the following year.

Correspondence to R. Kalda, Department of Family Medicine, University of Tartu, Puusepa 1a, Tartu, Estonia
E-mail: ruth.kalda@ut.ee

The criteria for the QS of family physicians are provided by the regulations of the Ministry of Social Affairs and are also included in the contracts between family physicians and the Estonian Health Insurance Fund (EHIF) as an operational guide (3). Family physicians who have joined the system monitor patients with a certain group of diseases according to specified instructions (4, 5).

It is assumed that regular analysis and examinations, along with patients' counseling, will lead to a decreased progression of diseases and lower the occurrence of complications (5). Although it is generally believed that better monitoring of patients with chronic diseases should improve the effectiveness of treatment (6–10), the actual effect of implementing the QS on PHC received by chronically ill patients during specialized medical care has not been studied in Estonia yet.

Each person in Estonia can choose his or her own family physician who is the first contact in the case of any health problem. In 2008, there were 802 family physicians with approved practice lists, and 99.6% of insured persons were included in practice lists.

Estonian family doctors serve as gatekeepers because most medical specialists can be accessed only via referral by the family doctor. Chronically ill patients who are continuously monitored only by medical specialists represent a burden to healthcare funding because of increased costs in specialized medical care. They are also a source of concern for family doctors who do not have adequate information about such patients.

The aim of the current study was to determine whether the implementation of the QS made the monitoring more consistent and whether more active participation of family physicians in the monitoring of chronically ill patients reduced the load in specialized medical care.

Material and Methods

The study was conducted as a quantitative retrospective cohort study.

Subjects of the Study. Patients with type 2 diabetes mellitus (DM2) and essential hypertension (HYP) were included in this study. The patients' medical data were collected from the database of the EHIF, which covers 96% of the Estonian population. The database was created based on health service invoices sent by both family physicians/medical specialists and hospitals. These invoices list all the services provided to patients as well as their diagnoses according to the ICD-10. The data of service-providing physicians are also included in the health service invoices.

Patient Identification and Data Abstraction. The

inclusion criteria for the patients were as follows: ICD-10 diagnosis of E11 (DM2) or I10–I15 (HYP) made at least once during the last 3 years, as recorded in the health service invoices, and inclusion in family physicians' lists of chronically ill patients. The subjects were excluded from the study sample of a particular study year if they were dead before January 1. Code 1 or 0 was assigned to a subject, depending on whether the family physician had joined the QS (code 1) or not (code 0). The code was assigned to each eligible subject on a yearly basis because each individual can freely choose and change his or her own family physician whenever he or she wants. A family physician was defined as the person's family physician as of January 1 of the year preceding the monitoring. If the subject was not registered with any family physician, the code was "undetermined."

To evaluate the annual effect of implementing the QS, the eligibility of the subjects was determined as of January 1. The registers were compiled separately for DM2 and HYP. However, they were subsequently pooled because the 2 chronic diseases are often comorbid. A code was added, indicating whether a patient belonged to the DM2 or the HYP group alone, or to both groups simultaneously.

If the family physician met the criteria for the monitoring of DM2 and HYP patients set in the QS, the result was defined as positive. According to the criteria, family physicians should perform certain tests and investigations and provide at least one family nurse's counseling visit to DM2 and HYP patients during a certain period. For all the criteria, a fixed level of coverage was defined.

Measurements. The following healthcare services provided to the patients with DM2 and HYP in 2005–2008 were evaluated:

- 1) The number of disease-specific hospitalizations during the particular study year;
- 2) The length of hospital stay during the particular study year in case of disease-specific hospitalizations.
- 3) The number of visits to family physicians (including family nurses) during the particular study year.
- 4) The number of visits to medical specialists due to DM2 and/or HYP during the particular study year.

The BW analysis system implemented in the SAP economic software (SAP Business Information Warehouse) was used for collecting the register data for the study sample. The SAP BW delivers data for the study sample according to previously set search criteria. The statistical analysis of the sample data was performed using Excel and Stata10. The most frequently used statistical methods (the generalized

linear Poisson regression model and the logistic regression model) were employed for the data analysis and were adjusted according to the study characteristics. The level of statistical significance was set at $P < 0.01$.

Results

Background Data of the Study Sample. In total, 96% of the Estonian population were covered by health insurance as of December 31, 2007. The DM2 and HYP patients in the sample accounted for 24.4% of all the insured persons in 2008. Patients belonging to the 2 chronic disease groups accounted for 23.3% of the Estonian population as of January 2008 (Table 1).

In 2008, 80% of the family physicians joined the QS program when compared with 63% in 2006. Only 4% of the family physicians achieved a positive result in 2006, which increased to 33% in 2008 (Fig. 1).

The number of chronically ill patients in the practice lists of family physicians increased over the years. The number of monitored chronically ill patients in 2008 was 312 476 in comparison with 272 039 in 2006 (Table 2).

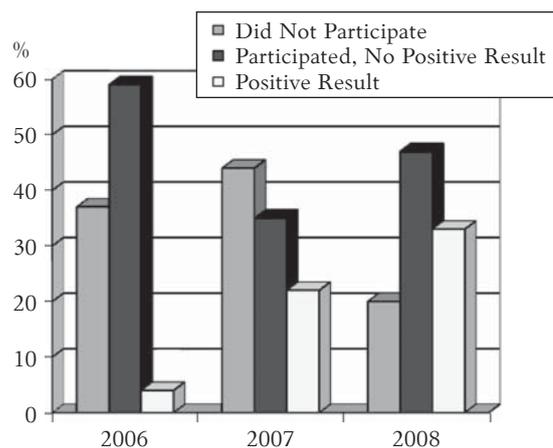


Fig. 1. Family physician's practice lists included in the quality system program in 2006-2008 (percentage of all the practice lists in a particular study year)

The increase was more pronounced in the group with coexisting DM2 and HYP (Fig. 2).

Although the number of chronically ill patients in practice lists was increasing, the proportion of persons who made outpatient visits during a particular study year remained at the same level. Of the DM2 and HYP patients, 65%-66% made at least one out-

Table 1. Main Indicators of Ethnicity, Insurance Status, Number of Family Physicians' Practice Lists, and Funding of General Medical Care in Estonia in 2005-2008

Description	2005	2006	2007	2008
Estonian population as of January 1*	1 347 510	1 344 684	1 342 409	1 340 935
No. of insured persons as of December 31	1 271 345	1 278 016	1 287 765	1 281 718
Including persons in DM2 and HYP groups, %	16.1	21.3	23.4	24.4
Funding of general medical care from EHIF budget, EEK†	592 155	666 609	886 076	1 047 224
Family physicians' practice lists	788	797	800	802
Included in QS, %	NA	62.7	56.5	80.2
No. of visits to family physicians	4 513 223	4 828 955	5 000 312	5 189 830
No. of persons who made visits to family physicians	919 766	949 162	978 873	983 466
No. of visits to medical specialists	3 411 785	3 536 036	3 695 585	3 797 861
Length of stay in inpatient institutions of specialized medical care, days	1 677 449	1 579 573	1 590 749	1 560 768

*According to Statistics Estonia as of January 1; †Estonian currency: 15.6 EEK=1 Eur.

DM2, Diabetes mellitus type 2; HYP, hypertension; EHIF, Estonian Health Insurance Fund; NA, not applicable.

Table 2. Outpatient Monitoring in Type 2 Diabetes Mellitus and Hypertension Groups in 2006-2008

Group	Year	No. of Persons in Practice Lists	No. (%) of Persons Who Made Outpatient Visits	% of These, Monitored Only by Medical Specialists	95% CI
Total	2006	272 039	180 469 (66)	4.1	4.1-4.2
	2007	301 745	196 517 (65)	4.2	4.1-4.3
	2008	312 476	206 442 (66)	3.6	3.5-3.7
DM2	2006	39 342	32 254 (82)	6.5	6.2-6.8
	2007	45 879	37 424 (82)	6.2	6.0-6.5
	2008	50 146	41 018 (82)	5.2	5.0-5.5
HYP	2006	264 854	176 167 (67)	3.9	3.8-4.0
	2007	293 930	192 098 (65)	4.0	3.9-4.0
	2008	304 054	20 184 (66)	3.4	3.4-3.5

DM2, type 2 diabetes mellitus; HYP, hypertension.

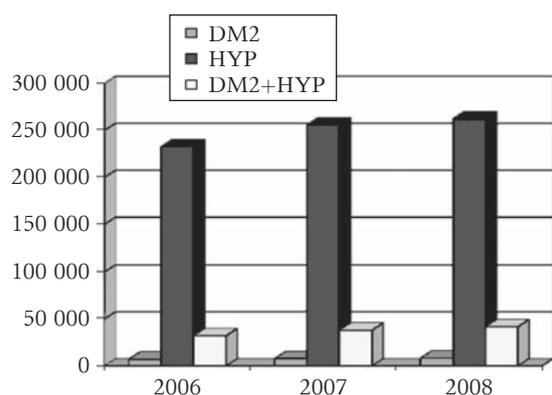


Fig. 2. Number of patients with type 2 diabetes mellitus (DM2) or hypertension (HYP) alone and with coexisting type 2 diabetes mellitus and hypertension in the practice lists of family physicians in 2006–2008

patient visit during a particular study year; the corresponding figure for the DM2 patients is 82% (Table 2). The number of persons monitored only by a medical specialist decreased over the study years. This trend is more evident among the DM2 patients.

Table 3 shows the results of the generalized linear regression model and the logistic regression model adjusted for different indicators (participation of family physicians and a positive QS result, rural or urban location of the practice, patients' age, and diagnosis). The patients' access to continuous monitoring was evaluated using the probability indicator, which shows the patient's chance of being regularly monitored (at least 1 outpatient visit during a particular study year). The effect of various factors on the number of visits during the study years was also evaluated.

The data of the table show that the chronically ill patients (DM2 and HYP) in the lists of family physicians with a positive QS result were 1.26 times more likely to be continuously monitored than those in the lists of family physicians with a negative QS result. The latter patients were also at a higher risk of visiting physicians more frequently. The women had a significantly better chance of being continuously monitored and making more outpatient visits. Additionally, with increasing patient's age, the chance of being monitored was higher as was the risk of making numerous visits. The 2 coexisting chronic diseases (DM2 and HYP) increased the chance of being continuously monitored as well as the number of visits. The chance of being monitored by a medical specialist alone was reduced if the family physician participated in the QS and had a rural practice and if the patient was a woman and older and had a diagnosis of HYP alone.

The participation of family physicians in the QS was found to reduce the hospitalization risk as well as the number of hospitalizations for the HYP patients (Table 4). The hospitalization risk was also reduced in the case of having only one chronic disease and being female. The risk was increased in rural family practices and for older patients. The overall hospitalization risk as well as the number of hospitalizations was lower in 2007 and 2008 than in 2006.

Discussion

The topic of the study was chosen owing to the need to evaluate the effect of implementing the QS on the continuous monitoring of patients with 2 major chronic diseases, namely, HYP and DM2, by family physicians, as well as to assess the changes

Table 3. Factors Affecting Outpatient Monitoring and Number of Patients' Visits (Analyzed by the Adjusted Regression Model and the Generalized Linear Regression Model, $P < 0.01$ for All Factors)

Factor	OR for Regular Monitoring		Risk Ratio for a Larger Number of Visits		OR for Being Monitored by Specialist Alone	
	OR	95% CI	IRR	95% CI	OR	95% CI
Did not participate/had no positive result	1.00		1.00		1.00	
Had a positive result	1.26	1.25–1.28	1.18	1.17–1.18	0.66	0.64–0.69
Practice location in urban area	1.00		1.00		1.00	
Practice location in rural area	1.14	1.12–1.15	1.06	1.06–1.06	0.53	0.51–0.55
Practice location is not defined	0.19	0.14–0.25	0.27	0.23–0.31	7.50	4.21–13.37
Being a male	1.00		1.00		1.00	
Being a female	1.36	1.34–1.37	1.18	1.18–1.18	0.79	0.77–0.82
<45 years	1.00		1.00		1.00	
45–54	1.88	1.85–1.91	1.50	1.49–1.51	0.67	0.64–0.71
55–64	2.61	2.57–2.65	1.68	1.67–1.69	0.57	0.54–0.60
65–74	3.16	3.11–3.21	1.74	1.73–1.75	0.45	0.43–0.48
75+	2.76	2.71–2.80	1.56	1.55–1.57	0.29	0.28–0.31
Coexisting DM2 and HYP	1.00		1.00		1.00	
DM2 alone	0.24	0.24–0.25	0.56	0.55–0.56	2.42	2.28–2.57
HYP alone	0.28	0.28–0.29	0.47	0.46–0.47	0.64	0.61–0.66

DM2, type 2 diabetes mellitus; HYP, hypertension.

Table 4. Chance of Chronically Ill Patients Being Hospitalized With Main Disease and Probability of Frequency of Hospitalization

Factor	OR for Hospitalization				Risk for Frequency of Hospitalization	
	DM2		HYP		OR	95% CI
	OR	95% CI	OR	95% CI		
Did not participate	1.00		1.00		1.00	
Participated	0.95	0.89–1.02	0.91	0.88–0.94	0.93	0.87–0.99
Practice location in urban area	1.00		1.00		1.00	
Practice location in rural area	1.33	1.23–1.45	1.19	1.15–1.24	1.32	1.24–1.42
Practice location is not defined	NA	NA	1.08	0.48–2.42	NA	NA
Being a male	1.00		1.00		1.00	
Being a female	1.36	1.34–1.37	1.00	0.96–1.03	0.90	0.85–0.96
<45 years	1.00		1.00		1.00	
45–54	1.55	1.25–1.91	1.67	1.54–1.82	1.53	1.26–1.86
55–64	1.78	1.46–2.18	2.21	2.04–2.40	1.76	1.46–2.12
65–74	2.08	1.71–2.53	2.86	2.65–3.10	2.12	1.77–2.55
75+	1.79	1.46–2.19	3.56	3.29–3.85	1.80	1.49–2.17
Coexisting DM2 and HYP	1.00		1.00		1.00	
Either DM2 or HYP	0.77	0.69–0.84	0.63	0.60–0.65	0.75	0.68–0.82
2006	1.00		1.00		1.00	
2007	0.92	0.85–0.99	0.93	0.89–0.96	0.90	0.84–0.97
2008	0.80	0.74–0.87	0.94	0.91–0.98	0.82	0.76–0.88

DM2, type 2 diabetes mellitus; HYP, hypertension; NA, not applicable.

in the need for specialized medical care services received by these patients' groups in Estonia. The aim of this study was to determine whether the implementation of the QS was successful. The strength of the study is the lack of similar studies that 1) have analyzed healthcare services received by chronically ill patients at the levels of both primary and specialized medical care and 2) have used the data of the majority of the population. Moreover, the effect of implementing the QS in primary care on the use of specialized medical care services has not been studied so far. The World Health Organization (WHO) health reports state that most of the attention should be directed toward studying the interactions between monitoring and hospitalizing chronically ill patients at the primary care level (11, 12).

A limitation of this study is the data obtained from the registry database because register data can contain some data-entry errors and the reliability of the source data cannot be checked without conducting a follow-up study. Health service invoices that are electronically submitted to the EHIF registry are governed by specific rules. As the registry health service invoices are also financial documents, a number of health service invoices for the same case could have been excluded (treated as not acceptable). Previous studies on data quality in the Cancer Registry and Birth Registry have shown that although medical data in the registries are reliable, the descriptions of diagnoses can be erroneous or inadequate (13, 14).

The present study was based on the assumptions that only licensed and competent physicians had entered the descriptions of diagnoses and that any inaccuracies were distributed evenly all over the Estonian population. Furthermore, the validity of the diagnoses was not evaluated.

The main result of the current study is that the important healthcare indicators (number of specialist visits and number of hospitalizations) decreased among the patients in the lists of family physicians with a positive QS result. The DM2 and HYP patients in these lists have a higher chance of being monitored continuously. The fact that men are significantly less consistently monitored than women is an interesting, but expected, result. Other studies have also demonstrated that men attend their family physician approximately twice less frequently than women; this trend is similar in other European countries (15, 16). Similar results were obtained in the study of the 3 Baltic countries where the chance of using PHC services was 1.7 times greater among women. In case of outpatient specialized medical care, the corresponding figure was 1.87 (17). Therefore, the major challenge for family physicians is to change the habits among men toward attending the physician more regularly and, thus, to reduce their chance of hospitalization and the early mortality rate due to CVDs. It can be concluded that continuously monitored chronically ill patients were hospitalized less frequently in 2008 than in 2006. This is a positive result for both patients and healthcare

resources. In addition, the overall number of hospitalizations also decreased.

Evidently, the most important problem is how to ensure the access of consistently unmonitored chronically ill persons to family physicians. It is necessary to conduct more proactive outreach work, both at the national and local government levels, to help individuals with chronic diseases better understand the need to visit a physician at least once a year.

It is also necessary to inform people of the need to detect diseases at an earlier stage to reduce the risk of complications and premature mortality. As the death rate from CVDs is higher among men and the study showed that men visited their family physician less frequently, a larger proportion of outreach work should be directed toward men. Furthermore, as the implementation of the QS positively affected the continuous monitoring of the DM2 and HYP patients who were included in the lists of family physicians with a positive QS, it can be stated that the main goal of the QS was achieved. We did not study the influence of the QS on the other aspects of healthcare, such as workload of PHC, changes on practice organization or satisfaction of the whole practice team, like it was done in the studies by Checkland and Harrison (18) or Maisey et al. (19). Maisey et al. found that the pay-for-performance system might have a negative aspect for continuity of care and patients' autonomy on the one hand, but higher nurses' autonomy and satisfaction on the other hand (19). Greater satisfaction of medical roles among physicians and nurses in the system of the Quality Outcome Framework was noticed by Checkland and Harrison as well (18).

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Unlike the P4P financing systems in the United Kingdom, the United States, and Australia, the Estonian registry does not analyze major health indicators such as blood pressure, cholesterol levels, etc. (20–22). Thus, the inclusion of the abovementioned indicators in the contracts of family physicians would allow evaluating more specific health indicators of patients with chronic diseases.

Conclusions

Although tentative, the results show that continuous monitoring of chronically ill patients after the implementation of the quality system in primary healthcare reduces the load in specialized medical care. A more detailed analysis of the effect of the quality system on the workload of family practice as well as on the patient-related outcome, such as morbidity, quality of life, and satisfaction, could be done in the near future.

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Statement of Conflict of Interest

The authors state no conflict of interest.

Authors' Contributions

K.V. made substantial contributions to design, acquisition, analysis, and interpretation of the data and in drafting the manuscript. R.K. was involved in the design of the study, interpretation of the data, and in revising the manuscript critically as well as in giving the final approval of the version to be published.

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