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Relationship between number of contacts between previous dropouts with type 2 diabetes and health care professionals on glycaemic control: A cohort study in public primary health care

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ABSTRACT

Aim: Previous study findings have shown that more frequent contacts with the diabetes care team predict better diabetes control. It is unknown whether this is true also for previous dropouts with type 2 diabetes (T2D). The aim of this study was to evaluate if those previous dropouts with T2D who succeeded to improve their glycaemic control had more frequent contacts with health care professionals in the public primary diabetes health care system than those dropouts who did not show improvement.

Methods: In this "real life" retrospective cohort study, we identified 115 dropouts with T2D who were contacted by trained diabetes nurses and who returned to a public T2D-care system. Those previous dropouts who had baseline haemoglobin A_{1c} ≥53 mmol/mol (7%) and had a reduction in HbA_{1c} ≥ 6 mmol/mol (0.5%) during the follow-up were compared with those with unsatisfactory change in HbA_{1c} (baseline HbA_{1c} ≥ 53 mmol/mol and change <6 mmol/mol, or HbA_{1c} < 53 mmol/mol at the baseline measurement but above that in the end of the study period) or with those who remained at good glycaemic control over the study period. Trained diabetes nurses collected quantitative data from the patient records about visits and contacts during the follow-up.

Results: Previous dropouts showing improvement had more visits to the diabetes nurse ($p = 0.003$) and other nurses ($p < 0.001$) than those with no improvement or those with satisfactory glycaemic control. Telephone calls not focusing on diabetes ($p < 0.001$) were also more frequent among previous dropouts with improvement than among the others.

Conclusions: Especially previous dropouts with T2D who had poor glycaemic control, may benefit from more frequent contacts including visits and telephone calls. Recalling dropouts

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does not seem to lead to overuse of the T2D care-system by those recalled patients whose glycaemic control does not require special care.

1. Introduction

Type 2 diabetes (T2D) is a major health burden globally [1]. It has been estimated that one in 11 adults has diabetes [1]. The general treatment goal of diabetes is to prevent acute complications, reduce the risk of long-term complications including macro- and micro-vascular complications, and ensure an optimal quality of life [2–4].

An optimal treatment of diabetes consists of both lifestyle modifications and drug treatment [2–4]. Treatment efficacy evaluation is based on patients' subjective well-being, physical assessments and laboratory tests performed by health care professionals. A proportion of patients with T2D does not attend diabetes clinics as prescribed by the health care personnel. These dropouts may be exposed to a notable risk for diabetic complications thus reducing their quality of life and raising the costs of diabetes treatment.

In the public primary health care centre of the city of Vantaa, Finland, we carried out a study focusing upon the phenomenon of dropout. According to our study findings, one in ten patients with T2D was a dropout from the public primary diabetes health care system [5]. Further, the dropouts with T2D were difficult to bring back to the system [6]. Those who had poor glycaemic control and were successfully re-attached to the diabetes treatment system (e.g. previous dropouts) seemed to benefit from recalling [6].

Recalling T2D dropouts is not necessary without problems. First, although there are former studies suggesting that more frequent contacts with the diabetes care centres predict better diabetes control [7–10] it is not known whether this is true also among the previous dropouts with T2D. Further, we do not know whether this intervention leads to increased use of the T2D care system by those patients gaining the most from it. Second, increased supply of care may lead to a situation where those patients whose clinical condition does not require enhanced treatment find this service and start to use the care system more than their clinical status would require. This has been shown to happen in various clinical settings [11–13]. We do not know if there is a risk of overuse of T2D care system among previous dropouts.

The aim of this "real life"-study was to evaluate if the number of contacts with health care professionals in the public primary diabetes health care system among previous dropouts with T2D was associated with improved glycaemic control after their return to the system.

2. Methods

2.1. Design and setting

This study is an observational retrospective register-based cohort study using data obtained from an electronic patient record system. In 2009, a project for improving the glycaemic control in people with T2D in the primary health care in the city of Vantaa, Finland was initiated. The ethics committee of the Hospital District of Helsinki and Uusimaa (Nr 91/13/03/01/2011, 9.1.2013) and health authority of the Vantaa city (Dno SOSTER 3124/2011/092) approved the study. According to the ethics committee of the Hospital District of Helsinki and Uusimaa, and health authority of the Vantaa city the study participants do not need to sign a Statement of Informed Consent because the study was retrospective, based on patient charts and the investigators did not contact the dropouts.

In Finland, primary care and especially treatment of T2D is mostly run by the public system and funded with taxes. T2D care is mostly provided by general practitioners (GPs) and, in more severe cases, by GPs specialized in diabetes treatment. If the patient has severe T2D complications he or she is referred to a specialist in the secondary care but the GP still follows the treatment and takes the overall responsibility of the treatment during stable phases. Finnish primary care follows the present guidelines of T2D treatment and in uncomplicated cases with good glycaemic control the patient is supposed to visit laboratory and meet his or her GP at least once in the year [2,4]. If the glycaemic control or clinical status requires more frequent controls they are arranged according to international recommendations: regular and frequent visits, e.g. every three months, and evaluation of the therapy until stable glycaemic control is achieved [2,4].

This retrospective observational cohort study was performed based upon clinical data obtained from the public primary health care of the eastern districts of the City of Vantaa. At the time of the study, Vantaa had a population of 195 397 inhabitants and in the eastern districts there were 118 802 inhabitants. We identified all patients aged 18–80 years who had an International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) code containing an E11 code in the patient charts or who were prescribed specific anti-hyperglycemic drugs for T2D from 1-January-2005 to 31-December-2009. In Finland, the primary health care used ICD-10 codes to classify diseases, health related disorders, injuries, infections, and symptoms. A computer-based search was made from Finstar (Logica, Helsinki, Finland) patient chart system with a specific report generator.

Patients who fulfilled the described T2D criteria but had not contacted the public health care system during the past 12 months (year 2009) were entered into the data base; altogether about one in ten of patients with T2D. To detect whether these patients were true dropouts or whether they were receiving treatment elsewhere (e.g. having the treatment arranged in another system, private or secondary care), the nurses of the public health care system contacted them by phone. In order to improve diabetes treatment of all these putative dropouts and to bring them back to the public primary diabetes care system a trained diabetes nurse contacted these persons. We recorded

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Table 1 – Characteristics of the study population (N = 115).

	Study subjects		p-Value	Study subjects, all N = 115
	Males	Females		
Gender, percentage (n)	53.9 (62)	46.1 (53)	0.099	
Age, years	64.0 (56.8–68.3)	61.0 (53.5–68.0)	0.210	61.4 (9.4)
Duration of diabetes, years	7.0 (3.5–10.0)	4.5 (2.0–9.0)	0.040	6.7 (5.0)
Baseline HbA_{1c} (mmol/mol)	50.0 (42.8–60)	46.0 (40.5–63.5)	0.678	55 (20)
Body mass index (kg/m^2)	30.3 (27.7–33.4)	33.5 (30.2–35.9)	0.050	31.9 (7.0)
LDL-cholesterol (mmol/l)	2.59 (0.84)	3.07 (0.94)	0.006	2.81 (0.91)
Diabetes visits to physician, n	1.0 (1.0–2.0)	1.0 (0.0–2.0)	0.127	1.2 (1.1)
Other visits to physician, n	3.0 (2.0–5.0)	3.0 (1.50–6.0)	0.863	4.0 (5.0
Visits to diabetes nurse, n	4.0 (2.0–5.8)	4.0 (2.0–7.0)	0.365	3.2 (2.4)
Visits to unspecialized nurse, n	3.0 (2.0–4.0)	2.5 (1.0–5.0)	0.607	3.4 (2.5)
Diabetes-related telephone calls, n	2.0 (1.0–3.5)	3.0 (1.0–5.5)	0.207	3.7 (3.8)
Not diabetes-related telephone calls, n	5.0 (2.0–9.0)	4.00 (2.3–8.0)	0.837	6.6 (6.3)

Results are presented as mean (standard deviation) and p-values as t-test or median (interquartile range 25%–75%) and p-values as Mann–Whitney U-test unless otherwise mentioned.

afterwards the effects of the work performed by the community primary health care nurses and general practitioners [5].

At the baseline visit the participant's status was assessed, laboratory tests were taken, diabetes counselling was given and treatment was enhanced when needed [5]. The "second follow-up" visit was the closest visit more than one year after the first visit (13–30 months after the baseline visit) and included the same assessments as the baseline visit. At the "second follow-up" visit haemoglobin A_{1c} ($HbA1_c$) levels were assessed to detect the success of treatment. Of the dropouts, about one third (n = 115) remained in the study [6]. These previous dropouts composed the study cohort of the present study.

The recalled dropouts were divided into three groups according to their glycaemic control at the baseline visit and at the follow-up visit. Group 1 consisted of those previous dropouts who had a HbA_{1c} level $\geq$ 53 mmol/mol (7%) at the baseline visit and a reduction in $HbA_{1c} \geq 6$ mmol/mol (0.5%) during the follow-up time. They were defined as previous dropouts with improvement in glycaemic control. Group 2 consisted of those dropouts who had a HbA_{1c} level $\geq$ 53 mmol/mol (7%) at the baseline visit and the decrease of HbA_{1c} level was <6 mmol/l (0.5%) or those dropouts who had a HbA_{1c} level < 53 mmol/mol (7%) at the baseline visit but more than that after the follow-up visit. They were defined as previous dropouts without improvement. Group 3 consisted of those dropouts who had a HbA_{1c} level < 53 mmol/mol (7%) and the HbA_{1c} level remained under this value during the follow-up time. They were defined as previous dropouts with good glycaemic control.

According to international guidelines and epidemiologic studies [2,4] diabetic complications increase significantly if level of HbA_{1c} is >53 mmol/mol (7%) this level was chosen as an indicator of good glycaemic control. The level of change in HbA_{1c} (6 mmol/mol, 0.5%) was chosen because previous studies have shown that reducing HbA_{1c} by this amount reduces incidence of complications in T2D [14,15].

2.2. *Primary outcomes*

Trained diabetes nurses collected data from the patient records on number of diabetes and non-diabetes related visits to physicians, number of visits to diabetes nurses, number of visits to unspecialized nurses, number of diabetes and non-diabetes related telephones calls.

2.3. *Statistical analysis*

Data are reported as percentage (n) or mean (standard deviation, SD) or median (interquartile range, IQR 25%–75%). Percentage differences were tested using cross-tabulation and Chi-Square test. Comparisons were carried out with t-test, Mann–Whitney U-test parametric, or non-parametric ANOVA (Kurskall–Wallis) followed by Dunn's post-hoc test between the groups. Statistical analyses were carried out using IBM SPSS, version 23.0 (IBM, Armonk, NY, USA). A P-value of less than 0.05 was considered statistically significant.

3. Results

Duration of diabetes was significantly longer among men than among women. Of the study subjects, 60.9% had HbA_{1c} < 53 mmol/mol (7.0%). No significant differences were observed in age between men and women, neither in number of visits to physicians, nurses or in telephone contacts. Body mass index and LDL-cholesterol concentrations were higher in women than in men. The baseline characteristics of the study subjects are shown in Table 1.

Baseline BMI was higher in dropouts with improvement than in the other groups. (Table 2). Previous dropouts with improvement were significantly younger than those without improvement. Previous dropouts with improvement had more visits to physicians and especially more visits to nurses focusing on diabetes than those without improvement. Number of telephone calls were more frequent among previous dropouts with improvement than among those without improvement; telephone calls focusing on diabetes and, telephone calls not focusing on diabetes, respectively. Duration of T2D was longer among those without improvement than those with good glycaemic control. There was no difference in the distribution of males and females into the improvement, no improvement or good control groups (p = 0.715, Chi-Square).

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Table 2 – Characteristics and numbers of contacts to the health care professionals among study subjects with[a] and without improvements[b] in glycaemic control and among the study subjects with good glycaemic control.

	Group 1 Subjects with improvement[a] n = 36	Group 2 Subjects without improvement[b] n = 27	Group 3 Subjects with good glycaemic control n = 52	p-Value (ANOVA)
Male/female, number	20/16	16/11	26/26	
Age, years	56.5 (52.3–64.8)**.#	67.0 (55–70)	64.5 (59.0–69.0)	0.003
Duration of diabetes, years	6.5 (3.3–10.0)	10.0 (6.0–10.0)***	4.0 (2.0–8.0)	<0.001
Baseline HbA1c, mmol/mol	71.5 (52.8–94.3)***	54.0 (50.0–61.0)***	41.0 (39.0–44.0)	<0.001
Diabetes visits to physician, n	2.0 (1.0–2.0)*	1.0 (0.0–2.0)	1.0 (0.0–1.0)	0.009
Not diabetes-related visits to physician, n	3.0 (2.0–5.0)	3.0 (2.0–5.0)	3.0 (2.0–5.5)	0.964
Visits to diabetes nurse, n	6.0 (4.0–8.0)*.##	3.0 (2.0–6.0)	3.0 (2.5–5.0)	0.003
Visits to unspecialized nurse, n	4.0 (2.0–7.0) **.#	2.0 (1.0–4.0)	2.0 (1.0–3.0)	<0.001
Diabetes-related telephone calls, n	4.0 (1.5–7.5)**	2.0 (1.0–9.0)	2.0 (1.0–2.0)	0.009
Not diabetes-related telephone calls, n	7.0 (5.0–12.5)***.#	3.5 (1.0–12.0)	3.5 (2.0–6.0)	<0.001
LDL-cholesterol at baseline visit, mmol/L	2.8 (2.2–3.4)	2.8 (2.2–3.3)	2.6 (2.0–3.4)	0.788
Systolic blood pressure at baseline visit, mmHg	141 (19)	145 (26)	145 (21)	0.708
Diastolic blood pressure at baseline visit, mmHg	84 (11)	85 (10)	84 (10)	0.909
Body mass index, kg/m^2	33.6 (30.6–38.0)*.#	30.1 (26.7–32.9)	31.0 (26.9–34.8)	0.015

Results are presented as mean (standard deviation) and p-values as t-test or median (interquartile range 25%–75%) and p-values as Mann–Whitney U-test unless otherwise mentioned.

*p < 0.05, **p < 0.01, ***p < 0.001 vs. subjects with good glycaemic control, Dunn's post-hoc-test.

#p < 0.05, ##p < 0.01 vs. subjects without improvement, Dunn's post-hoc- test.

[a] With improvement: HbA_{1c} level ≥ 53 mmol/mol (7%) at the baseline visit and a reduction in HbA_{1c} ≥ 6 mmol/mol (0.5%) during the follow-up time.

[b] Without improvement: HbA_{1c} level ≥ 53 mmol/mol (7%) at the baseline visit and the decrease of HbA_{1c} level was <6 mmol/l (0.5%) or those dropouts who had a HbA_{1c} level < 53 mmol/mol (7%) at the baseline visit but more than that after the follow-up visit.

4. Discussion

Previous T2D dropouts with significant improvement in their glycaemic control seemed to have more frequent visits or telephone contacts focusing on diabetes with health care professionals than those who did not show improvement in their glycaemic control. This was seen in all studied parameters but especially in contacts with nurses. Those who had impairment in their level of treatment did not show increase levels of contacts concerning diabetes when compared with previous dropouts doing well. Our study observations suggest that previous dropouts with T2D in non-optimal glycaemic control may benefit from frequent contacts with health care professionals. Yet, if T2D had lasted long it seemed difficult for dropouts to improve glycaemic control. Those previous dropouts with satisfactory glycaemic control do not need a high frequency of contacts focusing on diabetes and, in line with that, they did not seem to use the health care system excessively.

Previous studies focusing on the phenomenon of dropouts with T2D have concentrated mainly on prevention of relapses and/or on description of the dropouts [5,16–19]. Although T2D is significant in view of public health [20] studies concerning how previous dropouts from T2D care use health services do not exist. According to our previous study findings from this same study cohort, these dropouts are challenging to bring back to the health care system; even when trained diabetes nurses contacted them personally, only one third were re-attached [6]. To the best of our knowledge, studies focusing upon the importance of number of contacts between previous dropouts and health care professionals in relation to glycaemic control are missing.

Among patients with unsatisfactory glycaemic control, an association between visit frequency and better diabetes control has been shown in several studies [7–10]. According to a U.S. study, patients with T2D with relatively poor glycaemic control showed significant and clinically meaningful improvements in HbA_{1c} when contacted weekly by members of the health care system [7]. Our study observations endorse the U.S. study findings: those previous dropouts with T2D who achieved an improvement in haemoglobin defined as A_{1c} ≥ 6 mmol/mol (0.5%) had typically non-optimal glycaemic control at baseline. During the follow-up they had 50% more frequent diabetes focused visits or telephone contacts with health care professionals than those without improvement. The international diabetes guidelines recommend regular and frequent visits, e.g. every three months, and evaluation of the therapy until stable glycaemic control is achieved [2,4]. These recommendations about check-up rates are well in line with what we observed in the previous T2D dropouts with good glycaemic control.

The present intervention seemed to be beneficial for the patients with non-optimal glycaemic control (HbA_{1c} > 53 mmol/mol [7%]). Those patients who did not improve their glycaemic control had already satisfactory or good glycaemic control and thus, there was no need for more frequent contacts. Those patients whose glycaemic control was poor and who did not improve or those patients whose control was good at baseline but unsatisfactory in the end did not differ from the dropouts who were doing well already at baseline in any of the studied parameters.

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Among the dropouts, the reasons for poor glycaemic control are multiple. Patient with chronic diseases including diabetes, are reported to have poor medication adherence, which is certainly one continuing problem for health care providers [21]. There are various underlying factors for poor adherence such as patient related factors (e.g. remembering to take medications, health beliefs), medication related factors (e.g. complexity, cost, side effects) and system related factors (e.g. inadequate follow-up or support) [4].

Every effort to improve glycaemic control and well-being in T2D patients is important in order to reduce diabetic complications [12]. According to our present and previous data [8], all health care professionals have the opportunity to influence the situation, even in case of dropouts with T2D.

This study material was extracted from patient records. The contact related data is complete and contains all the dropouts from public T2D care system. However, to comply with ethical permission we were only able to use retrospective real-life information from the patient charts to get information about the previous dropouts. Personal contacts and further interviews were not possible. No more detailed information was therefore available. The present study describes only behaviour of dropouts from the public primary care diabetes treatment system. Data on dropouts' lifestyle factors, including physical activity, dietary or sleeping habits, smoking and alcohol consumption, as well as other medications than diabetes medications were not available. These factors may influence the results and should be addressed in future studies. Further, almost all our participants were of Caucasian ancestry, which may influence the generalizability of the results.

5. Conclusions

Efforts for improving glycaemic control in patients with T2D and with poor glycaemic control are worth performing, also among dropouts with T2D. To ensure contacts between the patients and the health care system seems to be essential for success. When recalling dropouts with T2D, it is worth to allocate resources to the patients with worst glycaemic control.

Especially previous dropouts with T2D who had poor glycaemic control, may benefit from frequent controls by visits and telephone calls when improving their glycaemic control. Those previous T2D dropouts who have appropriate glycaemic control do not seem to induce an inappropriate work load to the health care system.

Conflict of interest

The authors state that they have no conflict of interest.

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Informed consent

We confirm that all patient/personal identifiers have been removed or disguised so the patient/person(s) described are not identifiable and cannot be identified through the details of the story.

Availability of data and materials

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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