NURSING EVALUATION OF DIABETES SELF-MANAGEMENT IN TERTIARY HEALTHCARE SETTINGS IN CROATIA

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SUMMARY

Background: Systematic and efficient education on patient self-management behaviour represents one of the key approaches to diabetes treatment. The aim of this paper was to evaluate the current process and content of nursing assessment of illness self-management behaviour in persons with diabetes treated at a tertiary healthcare facility.

Subjects and methods: Electronic patient records of N=15,116 persons with type 2 diabetes (51.3% men) who took part in nursing evaluation and education throughout 2011 were collected. The patients' mean age was 65.0±11.1 years, with mean diabetes duration of 12.6±8.3 years; they were mostly treated with oral anti-diabetic drugs (38.4%) or insulin therapy (38.5%). The likelihood of non-participation in the nursing evaluation was predicted based on a number of patient characteristics using a multivariate logistic regression.

Results: The nurses mostly rated the patients' self-management knowledge and real-life application of that knowledge as appropriate; however, in a large number of patients, the nursing evaluation was not evidenced in the electronic patient record. Multivariate logistic regression revealed that longer diabetes duration, insulin treatment and better glyceamic control as measured by glycated haemoglobin were associated with a higher likelihood of participating in a nursing evaluation and diabetes re-education.

Conclusion: Diabetes specialist nurses may use informal criteria when deciding which type 2 diabetes patients to interview about diabetes knowledge and self-care. Participative research on the processes of nurses' decision-making may be needed.

Key words: *diabetes mellitus - type 2 - patient education as topic - self-care*

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INTRODUCTION

Patient education of persons with diabetes is one of the primary tasks of their healthcare teams, and the goal of this process is to achieve and maintain the patients' independence, competence and self-efficacy in managing their illness. Chronic illness self-management education has a long-lasting tradition. Nevertheless, traditional models of patient education can hardly fit into the model of chronic care seen as a partnership between the healthcare team and the patient, which has led to novel approaches to patient education. Traditional patient education models mostly teach facts about the disease and elaborate the technical aspects of self-management, with the assumption that knowledge (seen as the amount of information that a patient has) is sufficient in motivating a patient to alter their health-related behaviour. This approach to patient education corresponds to a paradigm that views the physician as the only person in charge of evaluating the success or failure of chronic illness treatment, while the patient's task is to comply as fully as possible with the physician's recommendations. As opposed to the traditional, compliance-oriented approach, patient education targeted at self-management competencies and skills entails teaching problem-solving skills, and is driven by those disease-related issues that the patient perceives as personally relevant. The rationale behind such an educational approach is that the way to achieve better disease control is to increase the patient's self-efficacy in managing the disease.

One of frequently studied outcomes of patient education is the patients' knowledge on the disease and its treatment. Meta-analyses have shown that patient education does indeed increase the patients' knowledge (Deakin et al. 2005, Loveman et al. 2003, Norris et al. 2002a), but that those changes do not correlate with changes in glycated haemoglobin (HbA1c) values (Loveman et al. 2003). This lack of correlation demonstrates that even though knowledge is necessary, it alone is insufficient in achieving optimal disease regulation – which is in disagreement with the assumptions underlying the traditional model of diabetes education. Although the number of studies that analysed disease self-management as an educational outcome is modest, it seems that similar results have been found: even though patient education increases the frequency of blood glucose self-measurements, this does not correlate with changes in HbA1c. Nevertheless, analyses of randomized controlled trials have shown an overall impact of diabetes education in lowering HbA1c: clinically significantly larger improvements in HbA1c were found in patients who were assigned to self-management education programs, as compared to patients who were randomized to control groups with no diabetes education. However, the impact of patient education on glycated haemoglobin seems to be transient, as these inter-group differences are consistently found only over

fairly short, 3-month follow-up intervals (Loveman et al. 2003, Norris et al. 2002a, Norris et al. 2002b, Ellis et al. 2004).

Literature reviews and meta-regressions have identified some of the characteristics of the educational interventions that are likely to be more successful (Norris et al. 2002b, Ellis et al. 2004, Glazier et al. 2006). Interactive interventions, especially those that include cognitive restructuring seem to be more successful than other types of educational interventions, in particular those didactic in nature. From the organisational standpoint, interventions that are implemented face-to-face are delivered by interdisciplinary education teams, that include a greater number of sessions, and that have longer total duration of patient-educator contact, seem to be more efficient in lowering HbA1c compared to other educational interventions. Finally, literature reviews have shown that, when working with socially vulnerable patient populations, who are at a higher risk of poor glycaemic control, interventions should be individually tailored, adjusted to the patient's cultural context, and directed towards achieving high disease management self-efficacy. Of note, a recent meta-analysis (Sigurdardottir et al. 2007) has failed to demonstrate that the methods and the content of patient education, or the duration of patient-educator interaction, are predictors of HbA1c lowering. However, this might be attributed to the fact that single-session didactic interventions are no longer implemented as widely as before. When predicting and evaluating the impact of patient education on lowering HbA1c, patient characteristics should be taken into account. Most importantly, patient education has been shown most effective in patients with poor glycaemic control, while its impact is considerably smaller in persons with good glycaemic regulation, partly due to ceiling effects (Duke et al. 2009).

Studies that examined the clinical outcomes of diabetes treatment – the incidence of chronic complications and mortality rates – are very few. Interventions that included these endpoints have not found differences in the incidence of foot ulcers or retinopathy mortality rates between educational and control groups, possibly because they included follow-up periods of only one year (Deakin et al. 2005).

This study aimed at gaining insight into the results of a nursing evaluation of persons with diabetes treated at a tertiary healthcare facility. From the expert and practical standpoint, the results of this research could provide data that substantiate the need for changing the existing nursing evaluation model so as to make it more suitable for a wider range of patient populations.

This study examined two research problems. The first was the frequency of nursing evaluation of diabetes patients' knowledge on disease self-management, the application of that knowledge and obstacles to its application. It was hypothesised that the nursing evaluation of patients' knowledge on the self-management of the disease, the patients' application of that knowledge and

obstacles to its application, shall differ based on the type of disease self-management behaviour. The second issue of concern was the differences in socioeconomic and diabetes-related characteristics between patients who participated and did not participate in the nursing evaluation. The assumption was that patients with shorter diabetes duration, those with poorer glycaemic control and persons treated by insulin would be more likely to be included in the nursing evaluation than persons with longer diabetes duration, those with better glycaemic control and treated by oral anti-diabetic drugs.

SUBJECTS AND METHODS

Study protocol

Data used in this research were gathered during the course of the regular nursing evaluation of diabetes self-management that takes place as an integral part of control visits scheduled on the premises of Vuk Vrhovac University Clinic. Such an evaluation is carried out through a patient interview that concerns the following disease self-management aspects: compliance with the appropriate dietary regimen, physical activity, foot care, appropriate insulin self-administration, blood glucose self-measurement, and the ability to recognise hypoglycaemia and respond to it in a proper and timely manner.

Regarding dietary regimen, the nursing evaluation assessed whether the patient understands the importance of an appropriate diabetes-tailored healthy diet and the impact of the type of foodstuffs and the manner of food preparation on blood sugar levels. The survey on physical activity identified whether the patient is familiar with the therapeutic importance of regular exercise and with the principles of harmonisation of physical activity, diet and blood sugar levels. The foot care survey evaluated whether the patient understands the importance of proper foot care in persons with diabetes, is familiar with the appropriate foot care and protection techniques, and applies these techniques in everyday life. In persons who were treated by insulin, the nurses evaluated whether the patient understands the principles of insulin action, their knowledge on adjusting insulin doses based on blood sugar levels, diet and physical activity, the appropriateness of their insulin self-injection technique, and their capability to recognize and manage hypoglycaemia. Finally, in evaluating blood sugar self-measurement, nurses assessed whether the patient understands the importance of regular glycaemia self-control, implements the knowledge in daily life, suitably responds to the measurement results, and uses the self-measurement device in a technically appropriate way.

Nurses used a semi-structured clinical nursing interview to assess three aspects of patient self-management capabilities: 1) information/knowledge on the topic; 2) application of that knowledge; and 3) reasons behind the inadequate application of that knowledge (when applicable). The degree of information on the topic was

registered as either satisfactory or unsatisfactory. In cases where the interviewing nurse assessed patient's knowledge on the topic as unsatisfactory, the patient was re-educated so as to increase his or her knowledge on the relevant disease-related topic. In the next step, the nurse evaluated the degree in which a patient applies the knowledge. In evaluating adherence to proper diet, foot care, insulin self-administration and blood glucose self-measurement, the interviewing nurse recorded the results in the following categories: "applied regularly by the patient"; "applied incorrectly by the patient"; "applied irregularly by the patient", or "not applied by the patient at all". Regarding patients' physical activity, the ranking read as follows: "extremely rare physical activity", "irregular physical activity"; "moderate physical activity", or "demanding physical activity 2-3 times a week", with the last two categories perceived as satisfactory answers. Recognition of and responding to hypoglycaemia was categorised as: "no hypoglycaemia episodes at all"; "hypoglycaemia recognised and responded to in an appropriate and timely manner"; hypoglycaemia recognised, but not responded to in an appropriate and timely manner"; "hypoglycaemia not recognised nor responded to". In cases where the interviewing nurse established that the patient lacked knowledge about a certain aspect self-management or implemented it inappropriately (improperly or irregularly), she registered the reasons behind such patient's behaviour. The possible reasons for the lack of or improper disease self-management were: "emotional hindrances/stress", "incorrect health beliefs", "lack of information", "lack of support", and "inadequate personal engagement". When explaining the reasons behind their lack of/inadequate physical activity, patients could also opt for physical disability as the main reason.

The patient sample included in the study was composed of every person with type 2 diabetes entered into the CroDiab Net electronic database (Poljičanin et al. 2005) maintained by Vuk Vrhovac University Clinic. Upon the approval of the Registry administrator, socio-demographic data (gender, age), data on diabetes (duration of the disease, type of therapy (diet only, oral hypoglycaemic drugs, insulin, combined insulin plus oral hypoglycaemic drug treatment), data on body mass index (BMI), data on glycated haemoglobin (HbA1c) levels and the data on nursing evaluation above elaborated were gathered.

The study sample comprised a total of 15,116 persons (out of which 7,761 men and 7,355 women; χ^2=10.905, p<0.001) with type 2 diabetes, who attended a control visit at the Vuk Vrhovac University Clinic throughout 2011. A majority of these patients participated in the nursing evaluation (N=10,307; response rate 68.2%). The patients in the sample were aged 65.0±11.08 years on average, with the average diabetes duration of 12.59±8.31 years. The vast majority of the patients were treated with oral hypoglycaemic drugs (38.4%), followed by those insulin-treated (21.3%) and those treated by a combination of insulin and oral hypoglycaemic agents (17.2%), while the representation of the persons treated exclusively by diabetic diet was negligible (0.3%). Glycaemic control, as measured by glycated haemoglobin was 7.4±1.19% on average, while their body weight was established to be above the recommended (BMI=29.5±4.53 kg/m^2) (Table 1).

Table 1. Descriptive sample data

	N (%)	M	SD
Age	15,116 (100)	65.0	11.08
Diabetes duration	8,109 (53.6)	12.6	8.31
Body Mass Index	13,139 (86.9)	29.5	4.53
HbA1c	13,193 (87.3)	7.4	1.19
Type of therapy			
diet	42 (0.3)		
OHD	5,802 (38.4)		
insulin and OHD	2,597 (17.2)		
insulin	3,219 (21.3)		
unknown	3,456 (22.9)		

OHD = oral hypoglycaemic drugs

Table 2. Nursing evaluation of patient knowledge on various disease self-management behaviours

	Sufficiently informed N (%)	Insufficiently informed N (%)	Not assessed N (%)
Proper diet	10,224 (67.2)	50 (0.3)	4,842 (32.0)
Physical activity	7,590 (50.2)	19 (0.1)	7,507 (49.7)
Foot care	3,996 (26.4)	16 (0.1)	11,104 (73.5)
Self-control BG*	4,185 (72.0)	5 (0.1)	1,626 (28.0)
Insulin self-administration*	3,403 (58.5)	5 (0.1)	2,408 (41.4)
Hypoglycaemia*	3,432 (59.0)	7 (0.1)	2,377 (40.9)

BG = blood glucose;   * Only data on insulin-treated patients have been included

Data Analysis

Descriptive data were presented as frequencies and percent shares for categorical variables, while arithmetic means and standard deviations were calculated for continuous variables. Differences between categorical variables were calculated using the chi-square test, while the differences between continuous variables were calculated using the *t*-test. The likelihood of participation or non-participation in the nursing evaluation was predicted based on a number of patient characteristics using multivariate logistic regression.

The statistical significance level was set at p<0.05 in all analyses. Statistical analyses were made using SPSS 16.0 Software.

RESULTS

Knowledge of disease self-management, application of that knowledge and possible hindrances to its application

Knowledge related to diet was evaluated in roughly two-thirds (67.5%) of the patients; information on physical activity were evaluated in roughly one-half (50.3%) of them; while the share of patients evaluated for their knowledge on appropriate foot care was only about one-quarter (26.5%) (Table 2). Data on the level of information on blood glucose self-measurement practices, self-administration of insulin and hypoglycaemia self-management were gathered only in insulin-treated patients (N=5,816). Judging by the obtained data, all of these self-management behaviours were assessed in over one-half of the patients, with the blood glucose self-monitoring being the subject of the nursing evaluation in the relatively highest number of patients on insulin therapy (72.1%). Virtually all patients that took part in the evaluation were assessed as sufficiently informed about disease self-management behaviours.

Table 3 displays the appropriateness of the application of patients' knowledge of disease-tailored diet, foot care, blood glucose self-control, and insulin self-administration. Less than one-half of the patients were deemed to comply with an appropriate diet (48.6%), while the behaviour was not evaluated in nearly one-third (32.3%) of the patients. Among those who inconsistently follow the appropriate diet, the vast majority is represented by those who adhered to it sporadically. Blood glucose self-control was estimated in the majority of insulin-treated patients (although over one-quarter of that subsample remained unevaluated), who were mostly (68.1%) assessed to adequately perform blood glucose self-control. The appropriateness of insulin self-administration was neglected to be evaluated in almost one-half (41.5%) of the patients on insulin therapy. In those who were evaluated in that regard, the nurses assessed most patients as knowledgeable about the proper insulin self-administration.

Data on physical activity evaluation revealed that the behaviour was not evaluated in nearly one-half of the patients (N=7,550, 49.9%). As for the evaluated patient pool, 6,458 (42.7%) of them had been assessed as moderately physically active, while a regimen of vigorous physical activity 2-3 times a week was recorded in 256 (1.7%) of them. The remaining evaluated patients were physically active either sporadically (n=535, 3.5%) or extremely rarely (n=317, 2.1%).

Table 3. Assessment of the frequency of disease self-management practices

	Performed regularly N (%)	Performed inappropriately N (%)	Performed sporadically N (%)	Not performed N (%)	Not assessed N (%)
Diet	7,349 (48.62)	881 (5.83)	1,740 (11.51)	265 (1.75)	4,881 (32.29)
Foot care	3,914 (25.89)	0 (0)	3 (0.02)	1 (0.01)	11,198 (74.08)
Self-control*	3,958 (68.05)	36 (0.62)	174 (2.99)	17 (0.29)	1,631 (28.04)
Insulin*	3,282 (56.43)	19 (0.33)	101 (1.74)	2 (0.03)	2,412 (41.47)

* Only data on insulin-treated patients have been included

Table 4. Nursing evaluation of reasons behind non-application of various aspects of disease self-management knowledge

	Not assessed	Physical limitations	Incorrect health beliefs	Insufficient support	Insufficient personal engagement	Lack of information	Psychological issues
Proper diet	1,002	N/A	107	95	1,533	28	121
Physical activity	323	463	4	3	59	0	0
Foot inspection	3	N/A	0	1	0	0	0
Insulin self-administration	109	N/A	2	3	5	3	0
BG self-measurement	124	N/A	8	11	70	3	11
Hypoglycaemia	100	N/A	0	0	0	0	0

BG = blood glucose

The appropriateness of patients' response to hypoglycaemia episodes was not evaluated in 41.1% of insulin-treated patients (n=2,389). The remaining 41.3% of patients (n=2,402) were deemed to recognise their hypoglycaemia and respond to it in a proper and timely manner, while 15.9% (n=925) of eligible patients had not experienced symptoms or signs of hypoglycaemia. Forty-four patients (0.8%) failed to recognise hypoglycaemic episodes, while 56 (1%) were assessed to respond in an inadequate manner.

The frequencies of reasons recorded by nurses as the causes of inadequate diabetes self-management are displayed in Table 4. The reasons behind the non-compliance with the appropriate diet and those behind the negligence to exercise on a regular basis were recorded in 65.3% and 62.1% of patients, respectively. The predominant reason for diabetes diet non-adherence, as assessed by the nurses, was inadequate personal involvement (recorded in 53.1% of the eligible patients), while the main reason for physical inactivity was physical disability (recorded in 54.3% of the patients). The appropriateness of foot care was assessed in only 4 patients, which precluded a meaningful analysis of the reasons for the non-application of knowledge on foot care. Among the self-management aspects specific for insulin-based therapy, most of the interviewed patients (45.4%) were evaluated for the regularity of their blood glucose self-measurement; the nurses attributed non-compliance most commonly to inadequate personal involvement (30.8% of the patients). The number of

patients in which the reasons behind inadequate insulin self-administration had been sought was too low to be meaningfully analysed (n=13), while the reasons behind the inadequate response to hypoglycaemia failed to be recorded in any of the patients.

Comparison between the patients who did and who did not take part in nursing evaluation

Testing of differences in socio-demographic characteristics of persons who did and those who did not take part in nursing evaluation, revealed that older patients (t=-11.40, $p<0.001$) were more likely to take part in the evaluation in reference, while gender differences between the participants and non-participants were not statistically significant (χ^2=1.093, p=0.303). With respect to disease characteristics, nursing evaluation was more commonly performed in insulin-treated participants than in patients on oral hypoglycaemic drugs (χ^2=47.033, $p<0.001$). Participants and non-participants did not differ in disease duration, body mass index and glycated haemoglobin values (Table 5).

A multivariate logistic regression model revealed that patients who were included and who were not included in the nursing evaluation differed in diabetes duration, type of therapy and glycaemic control (Table 6). Patients with longer diabetes duration were more likely to be included in the nursing evaluation and education, with the likelihood of participation rising by 1% per year of illness (OR=1.01, 95% CI=1.00-1.02, p=0.010).

Table 5. Comparison between patients who were and who were not included in the evaluation

	Included		Not included			
	M (N)	SD	M (N)	SD	t (χ^2)	p
Age	65.5	10.10	63.5	12.82	-11.396	<0.001
Disease duration	12.5	7.96	12.8	8.92	1.608	0.108
BMI	29.5	4.48	29.6	4.72	1.465	0.143
HbA1c	7.4	1.16	7.4	1.29	-0.200	0.841
Gender						
male	(5262)		(2,499)		(1.093)	0.296
female	(5045)		(2,310)			
Therapy*						
OHD	(4,297)		(1,505)		(47.03)	<0.001
insulin	(4,620)		(1,196)			

BMI = body mass index;   OHD = oral hypoglyecemic drugs;   * Due to their small number, diet-only patients were excluded from the study, while those on combined OHD + insulin therapy were included into the insulin-treated group

Table 6. Multivariate model of differences between participating and non-participating patients

	OR	95% C.I.		p
		Lower	Upper	
Gender (male=1)	1.01	0.89	1.15	0.847
Age	1.00	0.99	1.01	0.870
Body Mass Index	0.99	0.98	1.01	0.312
HbA1c	0.93	0.89	0.98	0.011
Type of therapy (insulin=1)*	0.75	0.65	0.87	<0.001
Diabetes duration	1.01	1.00	1.02	0.010

* Due to their small number, diet-only patients were excluded from the study, while those on combined OHD + insulin therapy were included into the insulin-treated group

Furthermore, patients treated with oral hypoglycaemic drugs were established to be 25% less likely to take part in the nursing evaluation than insulin-treated patients (OR=0.75, 95% CI=0.65-0.87, p<0.001). Finally, patients with higher glycated haemoglobin values were less likely to participate in nursing evaluation as compared to those having lower HbA1c values (OR=0.93, 95% CI=0.89-0.98, p=0.011). Each 1% rise in glycated haemoglobin values lowered the chance of patient participation in nursing evaluation by 7%.

DISCUSSION

Data has shown that the majority of patients were assessed to be well informed and knowledgeable on diabetes self-management behaviours; a lack of disease-related information and knowledge was recorded in only 0.1-0.3% of the patients who participated in the evaluation.

This study strived to assess the regularity of self-management practices in patients established to be sufficiently knowledgeable about their disease. The nurses assessed that the interviewed patients typically performed self-care behaviours with adequate regularity. Although this might be true, one cannot dismiss the possibility that these results are a consequence of insufficient specificity of measurement and/or recording tools used for patient self-management evaluation. In view of that, future clinical research should attempt to validate the evaluation criteria and methodology employed that nurses use in assessing patient diabetes self-management practices. For instance, semi-structured interview schedules with open-ended questions might turn out to be more informative than the ones currently in use.

The study results show that nursing evaluation and education is far more likely to include patients with a longer duration of diabetes; in fact, the likelihood including a patient into the evaluation and re-education process rises by 1% per year of illness. Similarly, patients taking oral hypoglycaemic drugs are 25% less likely to participate in nursing evaluation compared to those on insulin. These results partly reveal the criteria driving the decisions on patient education priorities taken by nurses in understaffed facilities. It appears therefore that precedence in nursing evaluation and education might be given to persons who have a need for a more detailed education, due to their more complex therapy or to chronic disease complications that are more likely in patients with longer illness duration.

A possible limitation of this study lies in the fact that the knowledge on various self-management behaviours was not assessed, i.e. recorded at all, in a considerable percentage of interviewed patients. For instance, 32% of patients were not evaluated for the appropriateness and regularity of their disease-tailored diet, and 73% of patients were not evaluated for their knowledge on proper foot care.

The results of this study are possibly limited also by the fact that data were collected in only one institution, the only tertiary diabetes clinic in Croatia. For this reason, it is impossible to exclude potential organization-level sources of bias (e.g., nurses' practices in evaluating diabetes knowledge and self-care may be a reflection of specific conditions in this institution), and to generalize the results to other levels of diabetes care (e.g. primary care).

CONCLUSIONS

These results point towards two possible areas of improvement in the implementation and recording of regular nursing evaluations of patients with diabetes. First, even the patients assessed to have sufficient knowledge about their disease are likely to vary considerably in the degree of that knowledge, but the existent, binary format of recording evaluation outcomes is not able to reflect that. Therefore, future efforts should be targeted at establishing a more detailed and more substantial standard of minimum patient knowledge to be considered sufficient in a nursing evaluation. Such standards also need to accommodate for the needs and limitations of individual patients who participate in a nursing evaluation and re-education. The second important area of improvement lies in the fact that a considerable number of patients were not evaluated for their knowledge on specific self-management behaviours, especially regarding foot care. A possible reason for this situation might be the work overload of the nurses who must decide on the target evaluation and patient re-education area on a case-by-case basis. It is therefore possible that nurses consider some of the self-care behaviours (e.g., diet) a higher priority than other behaviours (e.g. foot care). Therefore, future clinical research should attempt to identify the rationales underpinning healthcare professionals' decisions on patient education priorities. On an operational level, alternative education modalities that would allow for a more detailed patient education on certain self-management practices (such as foot care) should be explored and tested for their efficiency (for instance, the possibility of community nursing services involvement), taking thereby into account limitations to patient education arising from an everyday work overload.

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