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Type 2 diabetes mellitus in relation to place of residence: evaluation of selected aspects of socio-demographic status, course of diabetes and quality of life – a cross-sectional study

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Abstract

Introduction and objective: This study aims at answering what are the differences in socio-demographic status of patients with type 2 diabetes living in the city and the countryside and what is the impact of a place of residence on the level of metabolic control, the incidence of complications of diabetes and quality of life (QoL).

Materials and methods: 274 patients were divided into 2 groups: residents of rural areas-28,2% (n=77) and residents of urban areas-71,9% (n=197). Self-reported questionnaires was used: EQ-5D, DQL-BCI and DSC-R.

Results: The group of residents of the countryside was characterized by a lower income and education level and a higher number of persons with disability pension. Patients living in the country had a higher body mass index in comparison to town inhabitants (32.6kg/m^2 vs 30.9kg/m^2, p=0.008) and shorter diabetes duration (8.4 versus 11.3years, p=0.008). There were no differences between residents of the countryside and towns in terms of the method of treatment (oral antidiabetic drugs: 70.1% and 65.5%, p=0.3, Insulin: 29.9% and 36.5%, p=0.3, respectively), occurring chronic complications of diabetes (retinopathy: 14.3% and 14.2%, neuropathy: 6.5% and 7.6%, coronary heart disease: 44.45 and 37.1%, respectively) and the availability of diabetologists. Patients living in the countryside did not differ from town inhabitants in metabolic control and QoL assessment (EQ-5D index: 0.80 vs 0.79, p=0.9, EQ-VAS: 56.2 vs 54.3, p=0.2, DQL-BCI: 56.0 vs 53.9, p=0.1, DSC-R: 29.6 vs 29.4, p=0.7).

Conclusions: The socio-demographic differences between groups dependent on the place of living did not exert a significant influence on the level of metabolic control of diabetes, the incidence of late complications or QoL assessment in the population studied.

Key words

type 2 diabetes, rural and urban population, metabolic control, complications, Quality of Life.

INTRODUCTION AND OBJECTIVE

The challenge for the health service is not only to reduce the number of new cases of chronic diseases, but also to extend the life of patients and improve its quality. Diabetes is a chronic disease of high social importance. It is expected that by 2030 the number of people suffering from diabetes worldwide will have increased to about 430 million [1].

The avalanche growth in the number of patients with diabetes, the chronic nature of the disease, which is burdened with many complications, and the high costs of treatment contribute to a rising demand for high quality diabetes care. The concept of diabetes care should be construed to have the degree to which medical services, in relation to individual buyers and to the entire population, increase the likelihood of obtaining desired outcomes of treatment and are consistent with current knowledge [2]. Striving for the highest quality of patient care, as well as multidirectional action to improve the health and living conditions of people with diabetes, is of great importance, especially in the context of a number of reports based on a multi-centre clinical trials, which confirm the importance of good metabolic control in preventing complications and improving the quality of life of patients [3, 4, 5, 6].

The course and level of metabolic control of type 2 diabetes are affected by many factors related to lifestyle, in particular to diet and physical activity, as well as the quality of medical care. The place of residence of the patient also matters as it determines the availability of health care, specialist advice, education, therapy, and the degree of patient adherence to medical recommendations.

The presented study aims at answering the following questions: what are the differences in socio-demographic status of patients with type 2 diabetes living in urban and rural environments, and what is the impact of the place of residence on the level of metabolic control and the incidence of late complications of diabetes and quality of life (QoL).

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MATERIALS AND METHODS

Study population. The presented study was cross-sectional and involved 274 patients with type 2 diabetes (153F, mean age 62.2±9.8years), treated in the Department of Endocrinology at the Medical University of Lublin, Diabetes Outpatients Clinic or District Diabetes Outpatient Clinic in Lublin, Poland. Inclusion criteria covered patient's agreement, type 2 diabetes lasting over ≥ 6 months and required a patient to be sufficiently healthy both physically and psychologically in order to fill in the questionnaire independently.

All studied patients were divided into 2 groups according to place of residence. Residents of rural areas constituted 28.2% of the whole group (n=77), and residents of urban areas 71.9% (n=197), including 140 inhabitants of cities with more than 100,000 inhabitants (51.1%) and 57 people (20.8%) inhabitants of towns with less than 100,000 inhabitants.

The survey used 4 self-reported questionnaires; the first one dealt with demographic aspects and data concerning diabetes duration, treatment and other parameters connected with diabetes care. The following 3 questionnaires collected data on the health-related quality of life: EQ-5D, DQL-BCI and DSC-R.

The study was designed to be observatory, the researchers not involved in the diagnostic or therapeutic process. Clinical data including: body mass index (BMI), presence of diabetes complications, parameters of metabolic control (HbA_{1c}, blood pressure and lipid profile) were obtained from patients' medical records. In case of 95.3% (n=261) of examined patients, the immunochemical method ADVIA 1650 Chemistry Systems (Siemens) was used to measure levels of glycated haemoglobin and lipids. For the remaining 4.7% (n=13) of those examined, immunochemical method AxSYM HbA1c and Konelab 60 Prime for lipids were used. The percentage of patients with metabolic control parameters measured with the latter method was similar in both examined groups (n=7 in the urban inhabitants group and n=6 in the rural inhabitants group.

Characteristics of questionnaires. The EQ-5D is questionnaire designed for evaluating the general quality of life (QoL) and consists of 2 parts. The first part is the EQ-5D descriptive system with 5 dimensions: mobility, self-care, usual activities, pain-discomfort and anxiety-depression. The total score was acalculated by converting the 5 sub-dimensional scores into one score (EQ-5Dindex) by using data from population researches. An obtained score is a number between 1 (complete health) and 0 (meaning death); however, it is possible to attain a score below zero, meaning that a given patient assesses his/her health condition as worse than death [7, 8, 9]. The results of the EQ-5D descriptive system were computed based on the Polish value set created by Golicki et al. [9].

The second part of the EQ-5D questionnaire is a visual analogue scale (EQ-VAS), designed to resemble a thermometer with a scale from 0 – 100, by means of which patients assess their present health condition. On the scale, 0 stands for "the worst imaginable health state" and 100 for the best; thus, the higher the score the better the health condition reported [7,8]. According to the best knowledge of the authors, this is the first study conducted among patients with diabetes type 2 in Poland using the EQ-5D.

Diabetes Quality of Life – Brief Clinical Inventory (DQL-BCI) is a disease-specific questionnaire designed for evaluating the quality of life of patients with diabetes types 1 and 2 [10]. This form was created on the basis of the DQOL questionnaire designed for DCCT study [11], as shorter and a more patient-friendly form [10]. Fifteen questions in the questionnaire concerned problems faced by patients, such as: satisfaction with therapy, amount of time devoted to diabetes treatment and self-control, frequency of treatment-related pain, frequency of breaching diet restrictions in order to avoid admitting being a diabetic, and worries about psycho-social aspects. The score of the questionnaire lies between 15 points (the worst imaginable quality of life) and 75 points (the best imaginable quality of life) [12].

The DQL-BCI was standardized and up to now has been available only in English (USA). Prior the presented study, the questionnaire had never been used in Poland. For the purpose of this study, validation and cultural adaptation of the questionnaire were undertaken (details described elsewhere [13]). According to the best knowledge of the authors, the present study is first to use the DQL-BCI in Europe and in Poland.

The disease-specific **Diabetes Symptom Checklist – Revised (DSC-R)** is a standardized questionnaire consisting of 34 items grouped into 8 symptom subscales: cognitive distress, fatigue, neuropathic pain, neuropathic-sensory, cardiovascular distress, ophthalmologic function, hypoglycaemia and hyperglycaemia. Each question asks about the presence and the level of nuisance of the symptoms on a Likert-type scale [14, 15]. The total score of the form, as well as subscales score, ranged from 0 – 100, the higher score means a higher level of nuisance related to diabetes or its complications and the worst QoL. A Polish version of the questionnaire was received through the MapiResearch Trust [16].

Statistical analysis. The results of the study were analysed statistically. The values of the considered parameters were measured in the nominal scale, characterised by means of multiplicity and proportion, as well as in the quotient scale, which referred to mean values and standard deviation. In order to identify any differences or relationships a χ-square test was conducted (for the size, <5 Yates correction for continuity was applied). In order to compare 2 independent groups, the Mann-Whitney U test was used (depending on the count of analysed subgroups, the U statistics for subgroups amounting < 20 was used, and Z for subgroups amounting to ≥20). A 5% inference error and a significance level of $p<0.05$ were assumed, indicating the existence of statistically significant differences or relationships. The statistical analysis was carried out using STATISTICA v. 8.0 software (StatSoft, Poland).

RESULTS

Characteristics of examined patients. The features of the patient population examined are shown in Table 1. No statistically significant differences regarding patients' age, gender, marital status were observed; however, there was a difference in the diabetes duration between the examined groups. Residents of urban areas were characterised by longer

diabetes duration than in the case of residents of rural areas (p=0.008).

Differentiation was also marked in relation to patients' income levels. Among the rural population, a lower level of net income per family was significant (p=0.00004). Also in this group there were significantly more people receiving disability pensions (32.5% vs. 17.3%, p=0.04), and for a smaller number of persons in comparison with the urban inhabitants the main source of income was an occupation. For patients living in rural areas there were also more people with primary and vocational education, while among the urban population there was a statistically significant higher percentage of people with secondary and higher education (p=0.001).

In both groups, a similar percentage of persons were treated in specialist clinics and within the framework of the so-called combined care. Among the rural population, a higher percentage of patients were under the supervision of a GP, but the difference did not reach statistical significance (Tab. 1). No difference was found in the extent of glucometer or taking self-control measures (diabetes care booklet) (Tab. 1).

Among all examined patients, the majority – 65.3% (n=179) were treated by oral anti-diabetic drugs (OAD), whereas 34.7% (n=95) received insulin. In the rural population, the percentage of patients treated with OAD was slightly higher than among the urban population (70.1% and 65.5%, p=0.3, respectively). Patients treated with insulin accounted 29.9% of rural residents and 36.5% of urban inhabitants (p=0.3). There was no important difference between groups in these parameters.

No significant differences were found between the groups in relation to the prevalence of chronic diabetic complications, neither micro- nor macrovascular (Tab. 2). Moreover, a similar percentage of patients from both groups reported occurrences of hypoglycaemia (Tab. 2).

Table 1. Socio-demographic characteristics of the groups of patients studied.

Variable	Rural inhabitants	Urban inhabitants	p-value[3]
Age[1] [years]	60.8 ±9.2	62.7 ±10.0	0.1
Duration of diabetes[1] [years]	8.4 ±5.3	11.3 ±7.6	**0.008**
No. of cases	77	197	
females[2]	46 (59.7%)	107 (54.3%)	0.3
males[2]	31 (40.3%)	90 (45.7%)	
Working[2]	10 (13.0%)	39 (19.8%)	0.18
Main source of income[2]			
paid work	8 (10.4%)	33 (16.8%)	
pension	25 (32.5%)	34 (17.3%)	**0.04**
retirement	42 (54.6%)	124 (62.9%)	
other	2 (2.6%)	6 (3.1%)	
Level of income (per family member)[2]			
below 500 PLN	21 (27.3%)	15 (7.6%)	
500-1,000 PLN	44 (57.1%)	115 (58.4%)	**0.00004**
1,000-1,500 PLN	8 (10.4%)	38 (19.3%)	
1,500 PLN and above	4 (5.2%)	29 (14.7%)	
Education[2]			
elementary	25 (32.5%)	30 (15.2%)	
vocational	25 (32.5%)	52 (26.4%)	**0.001**
secondary	21 (27.3%)	78 (39.6%)	
higher	6 (7.8%)	37 (18.8%)	
Marital status[2]			
single	4 (5.2%)	9 (4.6%)	
married	58 (75.3%)	146 (74.1%)	0.9
widowed	12 (15.6%)	33 (16.7%)	
divorced	3 (3.9%)	9 (4.6%)	
Place of diabetes treatment[2]			
General practitioner (GP)	17 (22.1%)	24 (12.2%)	
GP+specialist	51 (66.2%)	142 (72.1%)	0.1
Specialist	9 (11.7%)	31 (15.7%)	
Possession of a glucometer[2]	67 (87.0%)	184 (93.4%)	0.1
Keeping a diabetes booklet[2]	51 (66.2%)	144 (73.1%)	0.4

[1] mean ± SD
[2] n (%)
[3] Mann-Whitney U test for age, diabetes duration χ^2-test for other variables for differences between groups.

Table 2. Diabetes complications and the occurrence of hypoglycaemia in the whole group and rural and urbaninhabitants.

Variable	Rural inhabitants n=77	Urban inhabitants n=197	p-value[1]
Diabetes complications[2]			
coronary heart disease	34 (44.2%)	73 (37.1%)	0.3
diabetic retinopathy	11 (14.3%)	28 (14.2%)	0.9
diabetic neuropathy	5 (6.5%)	15 (7.6%)	0.6
diabetic nephropathy	3 (3.9%)	12 (6.1%)	0.1
history of myocardial infarction	11 (14.3%)	33 (16.7%)	0.6
previous PCI/CABG	12 (15.6%)	27 (13.7%)	0.3
cardiac insufficiency	9 (11.7%)	27 (13.7%)	0.6
peripheral artery disease	3 (3.9%)	10 (5.1%)	0.5
history of stroke	4 (5.2%)	8 (4.1%)	0.6
Self-reported hypoglycaemia[2]			
never	37 (48.1%)	96 (48.7%)	0.9
seldom	33 (42.9%)	83 (42.1%)	
often	7 (9.1%)	18 (9,.%)	

[1] χ^2-test for differences between groups
[2] n (%)
PCI-percutaneus coronary intervention, CABG-coronary artery bypass graft

Table 3 presents the results of assessing the level of glycemic control, lipid profile and blood pressure, with no statistically significant differences found between groups. Residents of rural areas were characterized by significantly higher BMI (p=0.008).

Table 3. Evaluation of glycaemic control, blood pressure, lipid profile and BMI in the groups of patients surveyed.

Variable	Rural inhabitants n=77	Urban inhabitants n=197	p-value[1]
HbA_{1c}[2] [%]	7.6 ±1,4	7.5 ±1.6	0.4
RR systolic[2] [mmHg]	138.2 ±13.4	136.1 ±16.7	0.2
RR diastolic[2][mmHg]	83.2 ±10.3	81.8 ±9.3	0.2
Total cholesterol[2] [mg/dl]	184.4 ±36.6	183.7 ±47,8	0.5
HDL[2] [mg/dl]	46.6 ±12.3	49.9 ±16.0	0.2
LDL[2] [mg/dl]	108.4 ±35.2	102.8 ±36.0	0.2
TG[2] [mg/dl]	161.4 ±91.5	147.6 ±83.0	0.3
BMI [kg/m^2]	32.6 ±5.4	30.9 ±5.4	**0.008**

[1] Mann-Whitney U test for differences between groups
[2] mean ±SD

Comparison of the results of the quality of life survey for the two groups are shown in Tab. 4. General QoL assessed using the EQ-5Dindex was not significantly different between groups. In the second parameter assessed, EQ-VAS, a tendency for better health self-assessment among rural residents was demonstrated, but the difference did not reach statistical significance. The results obtained using

Table 4. Results of quality of life assessment depending on place of residence.

Variable	Rural inhabitants n=77	Urban Inhabitants n=197	p-value[1]
EQ-5D index[2]	0.8 ±0.13	0.79 ±0.14	0.9
EQ-VAS[2]	56.2 ±13.0	54.3 ±15.2	0.2
DQL Brief Clinical Inventory[2]	56.0 ±6.5	53.9 ±8.4	0.1
DSC-R total score[2]	29.6 ± 13.0	29.4 ±15.8	0.7
DSCR subscales[2]:			
cognitive distress	23.8 ±17.4	25.2 ±20.4	0.8
cognitive fatigue	41.0 ±18.8	40.0 ±22.3	0.8
cardiovascular distress	32.9 ±20.2	30.7 ±22.4	0.3
neuropathic pain	31.1 ±22.9	29.4 ±23.9	0.5
neuropathic sensoric	28.1 ±19.4	27.3 ±20.8	0.6
ophthalmologic function	26.0 ±19.6	27.3 ±22.0	0.9
hyperglycaemia	34.9 ±22.2	34.5 ±25.7	0.8
hypoglycaemia	18.2 ±18.2	19.8 ±20.2	0.6

[1] Mann-Whitney U test for differences between groups
[2] Data are presented as mean ± SD

the other instrument were similar. Patients living in the rural environment rated their diabetes-dependent quality of life – using the DQL-BCI – as slightly better compared to residents of urban areas; however, the difference did not reach statistical significance. Moreover, there were no differences between the groups in QoL dependent upon the severity of diabetes and its complications in both the DSC-R total score and individual subscales of this questionnaire.

DISCUSSION

A group of 274 patients with type 2 diabetes were studied for the occurrence of differences in their perception of the disease, in particular the quality of life, depending on place of residence. According to the answers given by the inhabitants of rural areas and cities, there were no significant differences between the parameters analyzed, except the duration of the disease, and certain socio-economic factors and education.

An advantage of the study is the broad perspective which was adopted: both socio-demographic aspects and relevant clinical variables of the disease, supported by the Quality of Life Survey, which makes the presented study unique in the Polish context. Three different complementary instruments were used to assess QoL. One of the questionnaires used for the purpose of this study was translated and adapted for Polish conditions, which provides an additional advantage in extending to Poland the research and assessment of QoL in patients with diabetes.

In this analysis, differences were found between groups in terms of certain socio-demographic factors. In the group of rural residents there were lower levels of income, a higher proportion of pensioners, as well as lower levels of education. Given the nature of the work undertaken in rural areas and the living conditions, these dependencies seem to be understandable, especially in relation to income and education levels. However, these findings may be connected with a lower level of health education and a different assessment of the quality of life. The higher percentage of pensioners in the rural population may be a result of hard physical labour, as well as the fact that diabetes type 2 impedes the ability to work in farming to a greater degree than the ability to perform other kinds of work, which are usually undertaken in the urban environment. Moreover, lack of education and advanced age that make vocational retraining difficult, combined with the very limited work available outside agriculture, leave rural diabetics unable to be vocationally active. It can also be assumed that migration from the rural to urban the urban environment of better educated people still able to perform work other than farming is an additional factor that causes the high percentage of pensioners in this group. Similar results were obtained in another study in which there was a larger share of people receiving disability pensions among patients living in rural areas [17]. Other researchers [18] also confirmed that people receiving disability pensions rate their quality of life considerably lower. In addition, the higher the patients' education and income levels, the higher they evaluated their health and quality of life [18]. According to analysis conducted at another health centre in Lublin, health status was evaluated better by professionally active patients with type 2 diabetes, then by the retired, and it was evaluated the worst by persons receiving disability pensions. It is worth noting that only patients treated with diet and oral agents were the subjects of this study [19].

Among the patients in the presented study – subjects living in rural areas with a similar mean of age – suffered from diabetes significantly less than residents of urban areas. These results should be interpreted with caution, since the analyzed group of patients is not representative of the entire population. This may also result from late diagnosis of diabetes in rural areas. This suggests the need for widespread screening to enable earlier diagnosis of diabetes among rural patients. Such an interpretation is supported by the findings of Łopatyński et al. [20, 21], who revealed that in rural areas the proportion of unknown diabetes is estimated at over 70%, and is significantly higher than in the urban population (about 50%).

In the presented study, no significant difference was found between residents of urban and rural areas in the quality of diabetes care. Bearing in mind the possibilities offered by diabetes clinics, one would assume that people treated there would feel better and safer, which should improve the quality of life. In this study, similar percentages of both residents of urban and rural areas were under the care of a specialist, which was due in part to the location of the study. About 80% of patients living in rural areas and 88% of residents of urban areas were treated with specialist or combined care. In a close to representative population of the PolDiab study, this percentage reached less than 50% [22]. In the presented study, as in the work of Jaworska [17], no difference was found between the two groups in terms of the possession of a glucometer or frequency of self-control. According to studies by other authors, patients of diabetes clinics are mostly residents of urban areas, and people with diabetes living in rural areas often remain exclusively under primary care [17, 23, 24].

The available literature does not provide much data assessing the course of diabetes, depending on the place of residence. The analysis by Szurkowska et al. [25] found that the level of diabetes control (in terms of HbA1c) among rural residents is worse than among urban inhabitants (the observation concerned males). Similar results were obtained by Malec et al. [26], and were explained by a lower accessibility of specialist diabetes care. In this study [26], the mean HbA1c was 7.8%, a result slightly higher than that in the presented analysis in which the level of glycaemic control, as assessed

by HbA1c (mean HbA1c=7.5%), was similar to that observed among the DINAMIC 2 study participants treated in primary care (mean HbA1c=7.47) [27], and better than in the group of PolDiab study participants. This is representative for the population who were treated both in primary care and by specialists (mean HbA1c=7.9%) [22]. The level of metabolic control assessed by HbA1c was worse in a retrospective study of patients with diabetes living in rural areas carried out in the same health centre in Lublin in 2010 (mean value of HbA1c=8.1% for the whole population), with a similar RR control level and lipid metabolism as in the presented study. There was no difference between urban and rural patients in terms of the metabolic balance of diabetes or chronic complications of diabetes [28]. In a study based on the German population, the HbA1c mean was much higher (9.5±1.9%) among type 2 diabetic patients living in rural areas than in the presented study, but – as mentioned by the authors – none of the patients examined were treated regularly by a diabetologist [29].

In the presented study, there were no differences between the groups in the incidence of diabetic complications. Other authors also have not found any differences between patients in the occurrence of microangiopathic complications dependent on the place of residence [17, 28]. The situation was similar when it came to the incidence of macroangiopathic complications, although a greater incidence of stroke among people with diabetes living in rural areas was observed [17].

In the presented study, as well as in an earlier study from the same health centre [28], a higher proportion of overweight and obesity was found among rural residents compared to urban residents, which is not confirmed by the observations of other authors [17, 21]. The presented results are in agreement with the newest publication of Befort et al. [30], and with other reports [31] which also indicated a higher percentage of obesity in rural areas compared to urban areas. This phonomenon can be explained by the generally lower level of education, worse diet based mainly on carbohydrates as well as multiple cultural, environmental and social factors [31]. This observation may be also a result of a tendency for obesity among people who stopped performing manual labour after retirement.

The available literature provides little data on the QoL of patients with type 2 diabetes, depending on place of residence. As reported by Thommasen et al. [32], rural diabetics experience significant impairment in their health-related quality of life. These observations have also been confirmed by other authors [33]. In a study conducted among patients living in the Lublin Province, people with diabetes living in rural areas were more likely to perceive the use of insulin as more onerous, and believe that diabetes has a negative impact on their family life, than residents of urban areas [17].

Many studies show the effect of diabetes duration on patients' quality of life: the longer patients suffer from diabetes, the worse they assess their QoL [34, 35, 36]. On the other hand, other researchers have not confirmed this association [37]. The authors of a Swedish population study found that among the patients they assessed the quality of life deteriorated with age and lower socio-economic status [38]. These reports have been confirmed by authors of other studies, also indicating lower education as one of the factors linked with a lower QoL [39]. In the presented study, the residents of urban areas were shown to have a significantly higher economic status and had a better education than rural residents, but they suffer longer from diabetes. No significant differences in their quality of life is most likely caused by the fact that the rural patients had suffered from diabetes for a shorter period of time, and they have lower education and income level, which balanced the potential differences in the assessment of the QoL. Comparable results have also been obtained by other authors [23].

A limitation of the presented study is the fact that the patient sample was non-representative for the whole population of people with type 2 diabetes. These were patients who were sent to the clinical centre (hospitalization) or received treatment (only specialist or combined care) in 2 diabetes clinics in Lublin. It can therefore be assumed that the expansion of research on patients living in rural areas and being under the care of only the primary care or other specialist could demonstrate differences in the assessed variables. In the future, it would be advisable to assess a sample representative for the population: a large group of people with a random selection of subjects suffering from both type 1 and type 2 diabetes.

CONCLUSIONS

1. Patients with type 2 diabetes living in rural areas differed significantly from patients living in urban areas in terms of shorter disease duration, lower education and income levels; they also received disability pensions more frequently.
2. Patients living in rural areas were characterized by higher body weight compared to urban residents.
3. The socio-demographic differences mentioned above did not exert a significant influence on the level of metabolic control of diabetes and the incidence of late complications.
4. In the groups of patients evaluated there were no differences in the availability of specialized diabetes treatment.
5. The differences depending on place of residence found in the population of persons with type 2 diabetes did not cause variation in the assessment of the quality of their lives.

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