

Relationship of the patient age and intensity of type 2 diabetes treatment

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Abstract: Introduction. Analysis of results of research on aging indicates that negative stereotypes about diminished needs and abilities to achieve satisfaction in elderly have negative impact on well-being of persons in late adulthood. These negative stereotypes are shared by older people and the other members of society, including physicians. However, only few research on the impact of negative stereotypes on the way of older patients treatment have been done. **Objectives.** To verify a hypothesis that elderly patients with type 2 diabetes are treated less intensively than younger patients. **Patients and methods.** The method of treatment was analyzed in two groups of patients. The first group contained 1199 patients aged 17–93 years, treated for a period of less than one year to 36 years, that were beginning insulin therapy. The second group contained 1693 patients aged 22–97 years, treated for the less than one year till 70 years, that were beginning treatment with insulin analogues. **Results.** The moderate negative correlation between an age and treatment intensiveness measured as a number of injections per day was found ($r = -0.253$; $p < 0.01$), as well as the lower average age in groups of patient receiving more injections of insulin a day (post-hoc Least Significant Difference test: $F(891.3) = 25.21$; $p < 0.0001$). The mean age of patients intensively treated with analogues of insulin was lower than those treated less intensively (57.9 vs. 63.4, respectively; t-Student test: $t = 8.36$, $p < 0.0001$). **Conclusions.** The older patients with type 2 diabetes received less intensive treatment than the younger. The stereotype of overestimation of the decrease of cognitive abilities in aging and eventually of difficulties in adherence to more complex by older people may be a reason of their undertreatment.

Key words: age, diabetes treatment, insulin therapy, type 2 diabetes

INTRODUCTION

The analysis of up-to-date knowledge concerning psychological changes during physiological aging [1] indicates that despite these changes the majority of elderly persons estimate their level of life satisfaction as high and they cope well with the challenges encountered in life. This point of view is confirmed by the review of findings of various studies. Nevertheless, even persons who function well at advanced age are susceptible to existing in society, groundless, negative stereotypes regarding lower abilities of satisfaction achievement in different spheres of life, e.g. sexual or physical activity. The above-mentioned negative stereotypes concerning changes during the aging period are recognized not only by the elderly but also by the young. Both positive and negative stereotypes of

the aging period form themselves through the whole life and in late adulthood they become self-stereotypes [2]. Negative and groundless stereotypical approaches may be the source of stress and can therefore negatively influence the health status [1]. The challenges facing a contemporary society are to increase the elderly's life satisfaction level and to decrease the number of negative stereotypes about the natural functioning and mental state of people at advanced age. Thinking stereotypes concerning elderly patients are the following [3]:

- 1) they have insufficient functional capacity
- 2) they have a shortened life expectancy
- 3) they will get little benefit from primary and secondary intervention
- 4) they have limited ability to communicate their needs or preferences.

To date, in Medline database there is no data directly concerning the effect of negative stereotypes of elderly people on the diabetes therapeutic regime. There were reports about less optimal treatment of other types of diseases, for instance neoplastic disease [4], and the limited use of some drugs in elderly persons, e.g. statins [5]. Special attention should be given to the study performed in 160 patients at the age of 65–94 years [6]. Its results indicate that therapists passed less information

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to older patients, they were less involved and gave the elderly less support. Furthermore, a negative correlation between the age and visits duration time as compared to attitudes towards the patient based on partnership was observed. The verification of hypotheses about negative influence of beliefs concerning the elderly is important for treatment of type 2 diabetes patients because the majority of the type 2 diabetics are in the late adulthood. The confirmation of legitimacy of such studies determines the results of the study involving 945 diabetic patients [7]. Statistically significant correlations between the age and the type of insulin administration pen were found, which showed that elderly patients more often obtained the simplest and, at the same time, the least accurate equipment for insulin administration. There is a shortage of other data about the relationship between the type 2 diabetes-affected patients' age and the treatment intensity indicated in these patients.

The purpose of the study was to verify the hypothesis that elderly patients with diabetes type 2 are treated less intensively than the younger.

PATIENTS AND METHODS

In order to verify this hypothesis we decided to analyze the results concerning the relationship between age and type 2 diabetes treatment intensity. These findings resulted from two studies concerning other topics associated with diabetes treatment. The material of the presented analyses is as follows:

- 1) retrospective analysis of the results of a cross-section study concerning relationships between the patient's perception of self-influence on the course of the disease and the method of the diabetes therapy. This study included a group of 1199 patients who were subjected to insulin therapy [8]
- 2) collecting and analyzing data from the studies concerning relationships between ways of coping with the disease and the mode of insulin analogues therapy, which included a group of 1693 persons starting the therapy with these preparations.

Studied subjects

The first study included 1199 type 2 diabetes patients – 655 women (54.6%) and 544 men (45.4%); their age ranged from 17 to 93 years, the mean was 62.03 (SD = 11.57). They had been treated for diabetes for the periods from less than one up to 36 years, the mean, 8.03 (SD = 5.54). The participants of the study were in the course of insulin therapy initiation, which intensity can be grouped into four models. These models are different, among others, due to the number of insulin daily injections. A one-injection insulin therapy model is associated with the administration of sustained action insulin or insulin mixture once daily. This is the simplest model of insulin therapy. A more advanced therapeutic approach is a model of two insulin injections that is most frequently associated with the insulin mixture administration before breakfast and

supper. The next step leading to the optimization of treatment results is to increase the numbers of insulin injections in order to mimic as much as possible a physiological insulin profile. A model of three insulin injections, which is sometimes used (intensified insulin therapy), is based on insulin mixture administration before breakfast and supper, as well as extra injections of short-acting insulin at lunch time. The most advanced therapeutic model (excluding personal insulin pump therapy) is an intensive insulin therapy, which is based on the administration of short-acting insulin before each main meal and one or two basal (long-acting) insulin injections. To make things easier, it can be stated that the more insulin injections a patient obtains the more intensive a particular insulin therapy is.

The second study included 1693 type 2 diabetes patients (906 – 54.2% and 767 – 45.8% women and men, respectively) at the ages of 22–97 years; the mean, 62 years (SD = 10.5), who had suffered from the disease for less than one up to 70 years. The participants of the study were in the course of initiation of therapy with the use of insulin analogues, which administration was indicated in one of two possible ways:

- 1) less intensive – self-administration of two-phase insulin analogue twice a day directly before breakfast and supper
- 2) more intensive – self-injection of fast-acting insulin analogue directly before each main meal (usually three times a day) and basal insulin injection in the evenings. To simplify, it can be stated that the less intensively treated patients made insulin injections twice a day, whereas the ones who were treated more intensively – not less than four times a day.

Variables

Dependent variables: treatment intensity was measured by the number of insulin injections per day and by the choice of a therapeutic model (conventional or intensive).

The main independent variable was the age of a studied person. Additionally, several other lateral independent variables were taken into consideration, namely: glycosylated hemoglobin level, duration of the disease and the incidence of severe hypoglycemia during the last 3 months.

Statistical analysis

In order to test the existence of the relationship between treatment intensity and patient's age, the r-Pearson's correlation analysis and the mono-variance analysis (ANOVA) were used. Since the numerical forces of groups distinguished with regard to the number of injections per day were different, post-hoc tests were used. In this way the significance of differences between all respective pairs was tested. In the case of the second dependent variable (the choice of a therapeutic model: conventional or intensive) the t-Student test for the unrelated groups was used. In the analysis of the lateral independent variables influence on the dependent variables, nonparametric tests, like χ^2 test, were also used.

Table 1. Average age in groups of patients treated with 1, 2, 3 or 4 doses of insulin daily

Number of injections daily	Number of patients	Average age	SD
1	126	63.94	11.94
2	654	63.13	9.77
3	46	59.00	10.97
4	66	51.70	15.90
Total	892	62.18	11.15

Significant correlation ($p < 0.05$ – in test post-hoc Least Significant Differences, which compares groups in pairs) relating to all pairs besides one comparison (group with 1 injection daily with group with 2 injections daily)

Study procedures

Patients with diabetes from 300 diabetic out-patient clinics in Poland were qualified for the study during the years 2003–2005. In the presented studies only observational methods were implemented, i.e. no procedures were used besides the questionnaires of perception of self influence on the course of the disease and the style of coping with the disease. The questionnaires were filled in by the patients at the point of their enrollment into the study. In both studies patients who, according to attending physician's opinion, required the changes of therapeutic regime, were included in the observation. In the first study it was the treatment intensification which was to be differentiated with the use of various insulin pens. The other one involved the introduction of fast-acting or two-phase insulin analogue into the treatment. Each questionnaire returned by physicians was included in the analysis.

RESULTS

Part I: Retrospective analysis of cross-sectional study results concerning relationships with the perception of self-influence on the course of the disease and the method of the type 2 diabetes therapy.

Complete data enabling an information analysis concerning the relationships between age and treatment intensity were obtained from 892 subjects. A moderate negative Pearson's correlation between the patients' age and the intensity of treatment measured by the number of insulin injections per day ($r = -0.25$; $p < 0.01$) was recorded. This correlation confirmed the hypothesis about the relationship between an advanced age and a lower intensity of diabetes treatment. The results of the performed variance analysis together with

the post-hoc Least Significant Differences test [$F(891.3) = 25.2$; $p < 0.0001$] showed a statistically significant diversity of the mean age for the determined groups with respect to the number of injections. Older persons obtain fewer injections per day than the younger. Detailed results are shown in Table 1 and Figure. No statistically significant differences were found for the disease duration time between the less intensively treated group ([Mixtard] mean = 8.3 [SD = 5.6]) and the more intensively treated one ([Actrapid + Insulard] mean = 7.5 [SD = 7.5], t -Student test).

Part II: Data from the studies concerning the relationships between styles of coping with the disease and a model of insulin analogue therapy.

Two hundred and ninety-seven patients with type 2 diabetes, who received insulin analogues therapy in a more intensive therapeutic model, were significantly younger when compared to 1063 subjects using a less intensive therapy. The mean age in both groups was 57.9 (SD = 10.5) and 63.4 (SD = 10) years for the younger and the older, respectively. This difference was statistically significant as calculated by the t -Student test ($t = 8.4$; $p < 0.0001$ [Tab. 2]).

No significant correlation between age and glycosylated hemoglobin level (r Pearson = -0.067) was found in this group. The level of the patient's glycosylated hemoglobin level had no effect on the type of insulin analogues therapy chosen. The mean glycosylated hemoglobin level was 8.72% and 8.66% in patients, who were just starting the more intensive therapy and in the ones initiating the less intensive therapy, respectively. The difference was of no significance in the t -Student test (-0.67). Persons who started the more intensive therapy suffered from the disease statistically longer than those who used the less intensive therapy (mean duration times were 10.6 and 9.4 years, respectively [t -Student value -4.6 ; $p < 0.0001$]). A significantly lower incidence of severe hypoglycemic episodes was also assessed during the three month period prior to the study in the group which obtained the more intensive treatment (198 subjects; 11.4%), rather than in the group of less intensively treated 235 subjects; 13.6%; (χ^2 test – 22.6; $p < 0.0001$).

DISCUSSION

The obtained results of both studies unambiguously indicate that during the decision making about the changes in the type 2 diabetes treatment, either in human insulin or insulin analogues therapy, persons at an advanced age much more frequently obtain a less intensive treatment. Presented findings come from the studies which have other fundamental goals and thus they do not give the answer to the question about the causes of the assessed differences. However, it seems quite

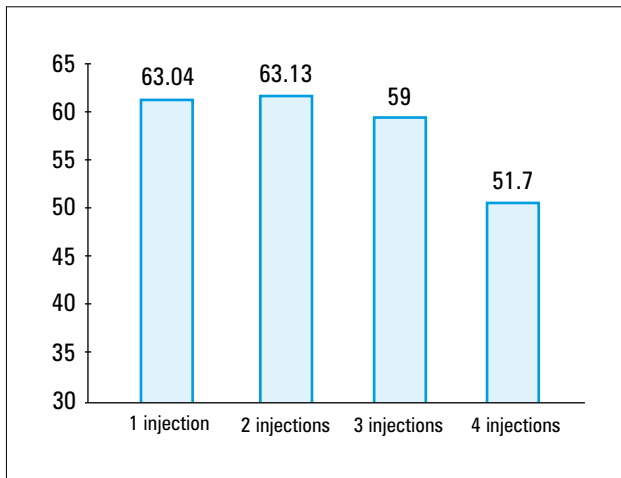


Fig. Average age in groups of patients treated with 1, 2, 3 or 4 injections of insulin daily age and number if injections daily. Significant correlation ($p < 0.05$) regards all pairs besides one comparison (group of patients with 1 injection daily and group of patients with 2 injections daily)

probable that they originate from the factors of psychosocial nature rather than form the health status itself of the studied persons. This hypothesis is quite probable due to the commonly known fact that type 2 diabetes is characterized by the progressive failure of endocrine function of the pancreas and along with its exacerbation, in most cases therapy intensification is essential in order to compensate the progressive insulin deficiency [9]. Treatment intensification is associated with the increased number of injections, predominantly due to the necessity of short-acting insulin preparations use [10]. Therefore, one may expect that along with age progression, the intensity of treatment and indirectly the number of injections will increase. This study results reveal an opposite tendency. Given that it is hard to assume that in the group of the elderly the diabetes developed and maintained in a more stabilized manner. Contrast evidence to this assumption is a positive correlation between advanced age and higher glycosylated hemoglobin levels as assessed in the first study. This correlation confirms the worsening of the glucose level control in the groups of older patients. Based on data review involving natural aging process [1], one can presume that the most probable reasons for less intensive treatment of the elderly are prejudices against these subjects, which can be held by both patients and physicians and which do not have confirmations in the study re-

sults. The neuropsychological research results of the cognitive processes in the elderly indicate the following phenomena: diminished velocity of information processing; decreased motor reactions velocity; mild depletions in spontaneous recollecting, action abilities, complex attention processes (the simple ones do not change significantly), complex visual-perception abilities and visual-constructive abilities. However, in spite of these changes the abilities of the majority of the elderly to solve out cognitive tests were within the normal ranges [9]. These data indicate that a natural drop in cognitive processes efficiency is relatively small and does not provoke a relevant limitation of the quality of action. Nonetheless, it is perceptible, but its importance is probably overestimated. It is a commonly known fact that among old patients with diabetes a more intense process of the cognitive efficiency decrease is observed in comparison with the general population [11]. Data concerning the decrease in cognitive processes are not completely unambiguous. From the review of available data we have inferred that in 6 out of 11 studies comparing cognitive processes efficiency by screening methods, no statistically significant differences between groups of persons with diabetes and control groups were found [11]. Relationships between diabetes and cognitive functions disturbances are complex and complicated [12]. In Polish studies the presence of cognitive disturbances was observed in 38.6% of diabetic patients aged over 50. However, the majority of studied patients (61.4%) did not have such disturbances [13]. In the context of the above-mentioned data some doubts may arouse whether the extent of the cognitive processes efficiency decrease in most type 2 diabetes patients prevents them from using a more intensive type of therapy. It seems more probable that the importance of the drop in cognitive abilities is overestimated by both patients and physicians and, as a consequence, a less optimal model of therapy is used in the patients' treatment

A serious limitation of the first part of our study is a relatively large number of patients not included in statistical analysis due to the lack of complete results. Lacking data concern the description of implemented treatment, which was not the main goal of this study, and this is probably the reason why part of the researchers imprecisely described the ordered treatment. However, this fact is of no importance for the main aim of the study, that is the assessment of relationships between the perception of self-influence on the diabetes course and the choice of insulin administration pen and a more generally estimated model of treatment [8]. Owing to this, the results of the first from the presented studies need to be treated with

Table 2. Age and kind of therapy chosen by doctor

Therapy	n	Age mean	SD	Value of t-Student	Significance
Less intensive treatment (NovoMix 30)	1063	63.43	9.98	8.36	0.0001
More intensive treatment (NovoRapid + Insulatard)	297	57.89	10.51		

some circumspection. A higher rate of severe hypoglycemic episodes in the group, which had been subjected to more intensive treatment suggests that fears of hypoglycemic recurrence could give way to the inclination to choose a less intensive treatment. We have found that older patients with type 2 diabetes were less intensively treated than the younger. The tendency can also be observed in other populations, and one of the underlying reasons for that may be a groundless stereotypic belief that because of lower cognitive processes efficiency the elderly are unable to follow more complicated therapeutic recommendations. The causes of the discussed practice need to be explained and educational actions should be initiated in order to provide an optimal treatment to elderly patients with type 2 diabetes.

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