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IMPORTANCE OF SYMPTOM CONTROL: SELF-REGULATION IN CHILDREN WITH DIABETES TYPE 1 AND ASTHMA

Symptom control in chronic illnesses like diabetes type 1 and asthma may be related to children's self-regulation both negatively and positively. We show how quality of symptom control is related to parents' and children's assessments of their self-regulatory skills (eg. behavioral inhibition, shifting, planning, monitoring and emotional control). Children with both chronic illnesses are compared with healthy peers and children with ADHD. According to parent's reports patients with diabetes with a history of acute hipo- or hyperglycemia and higher glycated hemoglobin as well as patients with poorly controlled asthma symptoms, more intensive treatment and acute attacks manifest more problems in self-regulation than their healthy peers but less than children with ADHD. Children with diabetes with low-glycated hemoglobin assess their behavior regulation better than their healthy peers.

Key words: self-regulation, symptom control, asthma, diabetes type 1

INTRODUCTION

Diabetes type 1 and asthma are chronic illnesses whose prevalence is increasing in most countries, especially among children (GINA Report, 2008; National Diabetes Statistics, 2011). Thanks to advances in medical techniques both conditions can be now controlled well, with limited complications, allowing children to lead an active life. However, this requires parents and children to master the skills of self-control, including systematic monitoring of the symptoms, complying to specific restrictions and reacting properly in case of exacerbations. Therefore, psychosocial factors, such as low socioeconomic status or non-compliance to doctor's orders may constitute a serious hinderance to effective diabetes and asthma management. Uncontrolled asthma leads to recurrent exacerbations with acute episodes of coughing and breathlessness, and poorly controlled diabetes leads to frequent complications as hypo- and hyperglycemia, which constitute a risk for neuropathy. The fear of acute complications is frequent among parents and children with both asthma and diabetes.

According to several meta-analyses (Desrocher & Rovet, 2004; Northam et al, 2006; Gaudieri et al, 2008; Naguib et al, 2009) diabetes type 1 constitutes a risk for neurocognitive functioning in children with frequent hypo- and hyperglycemia. In children with diabetes disturbances in several aspects of memory (Northam et al, 1999; Hannonen et al, 2003; ; Hershey et al, 2003, 2004, 2005), attention (Bjorgass et al, 1997; Rovet &

Alvarez, 1999), executive functions (Northam et al, 2001), and lower school competences (McCarthy et al, 2002; 2003; Hannonen et al, 2010) were found. Neuroimaging studies indicate that acute hypo- or hyperglycemia is related to neurobiological changes (Wootton-Gorges & Glaser, 2007; Musen, 2008). However, some authors question the negative impact of hypoglycemia, especially when diabetes is controlled restrictively (Musen et al, 2008). Research shows that frequent hyperglycemia is related to externalizing problems (McDonnel et al, 2007), whereas sustained improvement in behavior control is observed after commencement of insulin pump therapy (Knight et al, 2009, 2011). It is unclear whether the externalizing problems hamper children's ability to control diabetes properly (e.g. by non-compliance to doctor's orders, McDonnel et al, 2007) or whether it is frequent hyperglycemia which interferes with the cognitive processes underlying self-regulation.

Several studies indicate that asthma constitute a risk to children's self-regulation and cognitive functioning when it is poorly controlled. Research shows that children with poorly controlled asthma manifest difficulties in emotion regulation (Klinnert et al, 2000), are often diagnosed with an internalizing disorder (Goodwin et al, 2004; Meuret et al, 2006), conduct disorder and ADHD (Blackman & Gurka, 2007; Arif, 2010), are assessed as more fearful, impulsive, hyperactive and inattentive by their parents (Klinnert et al, 2000; Reichenberg & Broberg, 2004; Halterman et al, 2006; Yuksel et al, 2008; McQuaid et al, 2008), and manifest slight difficulties in several aspects of attention (Annett et al, 2000; Yuksel et al, 2008; McQuaid et al, 2008). Disturbances in self-regulation and attention may hamper children's ability to notice symptoms of exacerbation and respond to them in a coordinated fashion, making the illness even more difficult to manage (McQuaid et al, 2008). On the other way, children-s self-regulation may be impaired due to poor symptom control (e.g. recurrent exacerbations, fear of asthma attacks) or neuroendocrine disturbances on the HPA-axis (Annett et al, 2005; Priftis et al, 2008).

Self-regulation is defined broadly as the spectrum of processes thanks to which one has control over inner states and behavior (Baumeister & Vohs, 2004). Development of self-regulation is described from a neurocognitive perspective in the model proposed by M. Posner and M. Rothbart (2000). The authors assume that self-regulation development is determined by a broad cognitive process: executive attention, defined as the ability to inhibit unwanted reactions and solve cognitive conflicts by interference control[1]. Currently, most researchers understand executive function (or functions) as a collection of separate but interrelated cognitive processes responsible for the ability to control cognition and behavior, being situated in the prefrontal and parietal cortex (Collette & Van der Linden, 2002; Collette et al, 2005). Three fundamental executive functions proposed by A. Miyakie et al, (2000) are: inhibition, shifting between tasks and working memory updating. However, many authors include metacognition processes like planning, organization and monitoring of behavior as well as emotional control in the executive functions classification (Gioia et al, 2000; Best et al, 2009). Authors of Behavior Rating Inventory of Executive Function (Gioia et al, 2000) emphasize that the term *executive function* represents an umbrella construct that encompasses the abilities to initiate, plan, organize and sustain future-oriented problem-solving in working memory, as well as the ability to shift cognitive set and modulate emotions and behavior via inhibitory control. Development of executive function starts in preschool years, when working memory span and the ability to

[1] The concept of "executive attention" is close to "executive functions" and both are used depending on whether the authors consider process of cognitive control as either homogeneous or heterogeneous.

solve cognitive conflicts both increase (Posner & Rothbart, 2000). In older children, the abilities to shift attention between tasks and to plan and monitor activities develop (Best et al, 2009). It is known that disturbances in executive function are related to children's impulsivity and social problems, whereas attention training reduces them (Rueda et al, 2005; Berger et al, 2007).

In the current study we assumed that both in diabetes and asthma symptom control may be related to children's self-regulation. It is possible that poorly controlled illness may hamper children's self-regulation via psychosocial or neurophysiologic pathways. It is also possible that children's problems with self-regulation (independent of the illness) make diabetes or asthma more difficult to manage. Therefore, we can consider the possibility that symptoms management training can stimulate the development of self-regulation in those children whose illness is controlled properly. Due to the fact that the relationship between symptom control and self-regulation may be reciprocal or moderated by other variables we decided not to imply causal inferences.

In summary, the aim of our study was to assess how symptom control in diabetes type 1 and asthma is related to children's self-regulation assessed by both parents and children. We compared children's results with two control groups: healthy peers and children with ADHD, whose self-regulation and executive function are usually distorted. According to the neurocognitive model of self-regulation development, we decided to assess behavioral manifestations of children's executive function in an ecological setting (Gioia et al, 2000). We hypothesized that:

1. Children with poor symptom control have more problems with self-regulation than healthy peers and those with good symptom control but less than children with ADHD.
2. Children with good symptom control have an equal or fewer amount of problems in self-regulation than healthy peers.

Method

Participants

One hundred and thirty eight Polish children 8-11 years old (mean 9,53) and 138 parents participated in the study. The first experimental group consisted of 36 children with type 1 diabetes, being patients of a diabetologic clinic. The second experimental group consisted of 30 children with asthma, all of whom were patients at a pulmonologic clinic. The first control group consisted of 36 healthy peers, being students of three primary schools and similar to the experimental groups in terms of demographic variables. The second control group consisted of 35 children with ADHD combined type, all of whom were clients of psychological clinics and had been diagnosed by a child psychiatrist or neurologist. Children with ADHD were chosen to be a control group due to the difficulties with executive functions and self-regulation that usually occur in them. Patients with diagnosis of any chronic disease (other than diabetes or asthma in the experimental groups), allergies with breathing difficulties, intellectual disability or psychiatric disorder were excluded from the study. Additional criteria for the experimental groups were: at least two years since diagnosis of a chronic illness and for children with asthma a minimum of step II of treatment, defined by the GINA Report (2006) as taking controller medications daily. Parents whose children met the criteria of inclusion were invited to participate in the study by the experimenter in their clinic/school. Those who decided to participate signed an agreement form after the study procedure was fully explained to them. For the safety of the children with diabetes a normoglycemia (defined as blood glucose level within 75-160mmol) before the study was required. Demographic characteristics of the groups are described in table 1.

Table 1 Descriptive statistics of demographic variables

Group	Child's medium age	Child's gender	Residence	Parent's education	Number of children in the family
Children with asthma	9.5	F = 14 M = 16	City = 6 Small town = 9 Village = 15	University = 5 High school = 21 Vocational = 4	One = 5 Two = 13 Three = 12
Children with diabetes	9.68	F = 16 M = 20	City = 7 Small town = 8 Village = 21	University = 12 High school = 12 Vocational = 12	One = 5 Two = 14 Three = 17
Healthy children	9.38	F = 19 M = 17	City = 14 Small town = 10 Village = 12	University = 12 High school = 12 Vocational = 12	One = 2 Two = 16 Three = 18
Children with ADHD	9.57	F = 2 M = 33	City = 26 Small town = 7 Village = 2	University = 14 High school = 17 Vocational = 4	One = 11 Two = 18 Three = 6

Measures

To assess children's self-regulation the BRIEF Inventory – Parent Version (Gioia et al, 2000) and the modification of the BRIEF Inventory – Self-Report Version (Guy et al, 2004) were used. Both versions have been translated and accepted by the publisher, Psychological Assessment Resources, Inc. The modified format of the BRIEF-SR cannot be used without the written permission of PAR. The Asthma Control Test (Quality Metrics Inc., 2002) and two medical protocols were used to assess illness variables. A full description of measures is presented below.

1. ***Behavior Rating Inventory of Executive Function (BRIEF, Gioia et al, 2000)*** is a questionnaire for parents and teachers of 5-18 year olds created to measure behavioral manifestations of executive function in home and school environments. It contains 86 items within 8 clinical scales: Inhibit, Shift, Emotional Control and Working Memory (Behavioral Regulation Index) and Initiate, Plan/Organize, Organization of Materials and Monitor (Metacognition Index). The test was adapted to the experimental version during ~~a pilot study of 7~~5 parents of healthy children and achieved high reliability scores (α = .74-.93 for each scale, and α = .98 for whole inventory).

2. ***Modification of Behavior Rating Inventory of Executive Function – Self-Report Version (BRIEF-SR)*** (Guy et al, 2004) is a shortened version of the original questionnaire, but adapted for 8-11 year olds. It contains half of the items of the original version (40 items) within the same 8 clinical scales: Inhibit, Shift, Emotional Control and Working Memory (Behavioral Regulation Index) and Plan/Organize, Organization of Materials, Monitor and Task Completion (Metacognition Index). The items from the original version were chosen by a team of child clinical psychologists on the basis of an analysis of reliability during a pilot study of 75 healthy children. After modification the test achieved high reliability scores (α=.67-.82 for each scale, and α = .95 for whole inventory).

3. ***Medical Protocol for Children with Type-1 Diabetes*** contains information from parents' interviews confirmed through a chart review about 1) glycated hemoglobin level (HbA1c) over a one year period, 2) number of acute hypo- and hyperglycemia episodes. An acute hypo- and hyperglycemia is defined as an episode, during which a child needs assistance in taking sweet drinks, glucose or water.

4. ***Asthma Control Test For Children 4-11 years old (ACT) (Quality Metrics Inc. 2002)*** is a standard medical test measuring the quality of symptom control over the most recent four weeks. It contains eight questions (half for parent and half for child) about daily and nocturnal symptoms, limitation of child's activity and the frequency of taking rapid-acting β-2 agonists.

5. ***Medical Protocol for Children with Asthma*** contains information from parents' interviews confirmed through a chart review about 1) actual stage of treatment according to the GINA Report 2006 defined by type and doses of prescribed medicines, and 2) number of acute asthma attacks during the course illness. An acute asthma attack is defined as an exacerbation, during which a child needs medical help or hospitalization instead of taking rapid-acting β-2 agonists at home.

Procedure

Each child and their parent met an experimenter once in a hospital ambulatory before medical consultation (experimental groups) or in a school/psychological clinic (control groups). Each meeting was conducted by a psychologist or a student trained in child clinical psychology and took place in a separate, quiet room. Before the study the parents of children with diabetes were asked to provide information about their child's blood glucose level[2]. If the blood glucose level exceeded 75-160mmol, it was suggested that the parent provide their child with a snack/water or insulin, with the study starting when normoglycemia was achieved. During the meeting the BRIEF-SR was read to the child by the experimenter and the child selected answers with a pencil. The parent sat in another part of the room so as not to disturb the child, and completed the BRIEF Inventory – Parent Version. At the end the parent participated in a short structured interview about illness management. Parents of children with asthma completed the Asthma Control Test together with their children. After three months participants received a mail with their results. The project got the approval of the ethical committee at the Jagiellonian University in Krakow.

Results

Statistical approach

Analysis were performed with the program R (R Development Core Team, 2011). In the case of each effect a linear model was fitted, with alpha of .05 (two-tailed). In order to obtain easily interpretable coefficients all dependent variables were normalized. *R* squared adjusted for the number of explanatory terms is reported. Analysis were divided into two groups. Firstly we compared the efficiency of self-regulation in children from experimental and control groups (the child's health status was used as the only independent variable). Four groups were compared in each model: children with asthma, children with diabetes, healthy children and children with ADHD (a summary of estimated means is shown in table 3 and table 4 in the appendix). Secondly we examined the con-

[2] The measurement of blood glucose level is a standard procedure before the medical consultation in a hospital's diabetological clinic. Children were not asked to perform additional measurement due to participation in the study.

nections between the self-regulation and illness variables. Four groups were compared in each model in this part: two control groups (similar to the first part) and two asthma/diabetes groups divided according to a child's illness variable. In the group with asthma three factors which can put children's functioning at risk were identified: (a) poor symptom control in the last four weeks (b) more intensive treatment (c) and the occurrence of acute asthma attacks. In the group with diabetes two factors were identified: (a) higher glycated hemoglobin level and (b) the occurrence of acute hypo- or hyperglycemia. A full description of the factors is presented in table 2.

Self-regulation of children with asthma and diabetes compared to control groups

According to children's self-reports both children's age ($F[1,136] = .44$, $R^2 = 0$, $B = -.05$, $p = .5$), parent's education ($F[2,135] = .88$, $R^2 = 0$, $p = .42$) and number of children in the family ($F[2,135] = .21$, $R^2 = 0$, $p = .81$) were not related with children's self-regulation. More problems with self-regulation was reported by boys than girls ($F[1,136] = 7.45$, $R^2 = 04$, $B = .47$; $p = .007$). Child health status and parent's residence did not explain significantly more variance of self-regulation than child health status itself ($F[7] = .98$; $p = .45$)[3].

Table 2 Numbers of subjects in each level of illness conditions

Asthma

Variable	Condition	Description	Number of subjects
Symptom control in last 4 weeks	Poor	< 20 points in Asthma Control Test	14
	Good	> 21 points in Asthma Control Test	16
Treatment intensity	Less intensive	II stage of treatment (GINA 2006)	19
	More Intensive	III stage of treatment (GINA 2006)	11
Acute asthma attacks	Yes	Presence of acute asthma attacks	16
	No	No acute asthma attacks	14

Diabetes

Variable	Condition	Description	Number of subjects
Medium glycated hemoglobin (HbA1c) in last year	Higher	Medium HbA1c ≥ 6,5%	18
	Lower	Medium HbA1c < 6,5%	18
Acute hypo- or hyperglycemia	Yes	Presence of acute hypo- or hyperglycemia	16
	No	No acute hypo- or hyperglycemia	20

[3] According to differences in proportions of children with ADHD living in city, small town and village, we have controlled children's health status while analysing relation between parent's residence and reported self-regulation.

Parents of children with diabetes reported more problems with their self-regulation than parents of healthy peers ($B = .49$, $p = .006$), but less than parents of children with ADHD ($B = -1.3$, $p < .000$). However, comparisons of self-regulation profiles revealed that the only domain in which parents of children with diabetes observed more problems than parents of healthy peers was with organization of materials ($F[3,134] = 9.36$, $R^2 = .15$, $B = .7$, $p = .002$). Parents of children with asthma reported generally more problems with their self-regulation than parents of healthy peers ($F[3,134] = 38.18$, $R^2 = .49$, $B = .45$, $p = .015$) but less than parents of children with ADHD ($B = -1.35$, $p < .001$). Comparisons of children's self-regulation profiles revealed that parents of children with asthma reported more difficulties in their emotional control ($F[3,134] = 15.9$, $R^2 = .24$, $B = .58$, $p = .008$), holding information in working memory ($F[3,134] = 24.09$, $R^2 = .34$, $B = .58$, $p = .005$), and initiating everyday activities ($F[3,134] = 22.88$, $R^2 = .32$, $B = .46$, $p = .024$) than parents of healthy children. Healthy children did not differ from their peers with asthma ($F[3,134] = 12.41$, $R^2 = .2$, $B = .071$, $p = .74$) or diabetes ($B = .35$, $p = .1$) in their assessments of self-regulation. Only children with ADHD reported more problems with their daily behavior than their healthy peers ($B = .88$, $p < .001$).

Symptom control and self-regulation in children with diabetes

Parents of children with higher glycated hemoglobin (HbA1c $\geq$ 6,5%) assessed their self-regulation worse than parents of healthy peers ($F[3,103] = 42.83$, $R^2 = .54$, $B = -.62$, $p = .002$), whereas parents of children with lower HbA1c did not differ from parents of healthy children ($B = -.35$, $p = .087$). Similar differences were observed in parents of children with acute hypo- or hyperglycemia ($F[3,103] = 41.87$, $R^2 = .54$, $B = -.48$, $p = .04$). However, further analysis revealed that parents of healthy peers reported less problems in the Metacognition Index than parents of children with poorly controlled diabetes ($F[3,103] = 30.14$, $R^2 = .45$, $B = -.64$, $p = .013$), but not in the Behavior Regulation Index of the BRIEF Inventory (respectively $F[3,103] = 35.36$, $R^2 = .5$, $B = -.19$, $p = .43$). This finding means that according to parents' reports these group of children instead manifest difficulties in planning, initiating, organizing and monitoring behavior rather than in behavioral inhibition, shifting or holding information in working memory. According to self-reports, healthy children reported more problems in Behavior Regulation Index than children with low glycated hemoglobin (HbA1c < 6,5%, $F[3,103] = 10.42$, $R^2 = .21$, $B = .57$, $p = .043$).

Symptom control and self-regulation in children with asthma

Analysis revealed that all three illness variables moderated the self-regulation of children with asthma. Parents of children with poor symptom control in the previous four weeks ($F[3,98] = 38.61$, $R^2 = .53$, $B = -.65$, $p = .006$) and parents of children with more intensive treatment ($F[3,98] = 39.22$, $R^2 = .53$, $B = -.74$, $p = .004$) assessed their self-regulation worse than parents of healthy peers. More difficulties in everyday behavior were reported by parents of children with acute asthma attacks compared to parents of those without attacks ($F[3,98] = 40.86$, $R^2 = .54$, $B = .62$, $p = .003$) and controls ($B = .65$, $p = .002$). These findings mean that according to parent's reports, children with asthma manifest disturbances in self-regulation only when illness is not well-controlled.

Discussion

The results of our study confirm that parents of children with diabetes and asthma generally observe more problems with their self-regulation than the parents of their healthy peers, however these problems are not as large as in

the ADHD group. In children with asthma most difficulties are seen in the emotional control domain, working memory and initiating behavior, which is in accordance with the results of other authors suggesting that children's problems are mainly of the internalizing nature (Goodwin et al, 2004; Meuret et al, 2006). In children with diabetes slight difficulties are seen in the organization of materials domain. One possible explanation for this result are parents' expectations that children themselves will be able to deal with such things as using a glucometer or remembering a meal.

Although parents of children with diabetes and asthma observe more problems in their self-regulation, children themselves do not notice them, and these discrepancies are consistent with other findings (Klinnert et al, 2001; Knight et al, 2011). There are several possible explanations for this result which could be considered in further studies. For example, behavioral disturbances which are observed by parents of patients with diabetes and asthma may be relatively small so possibly do not affect children's self-esteem. It is also possible that parents of chronically ill children perceive them as less self-reliant because they are more protective and fearful than parents of healthy children. Concurrently they may regard behavioral disturbances as part of the consequences of the illness, causing them to be less critical of their children than parents of children with ADHD. Due to discrepancies between parents' and children's reports additional measures of self-regulatory skills (eg. teacher's reports or tasks doing with experimenter) can make further studies more informative.

Although there are general differences in reports of parents in both the experimental and the healthy group, our study confirms that most problems in self-regulation are seen in those children whose illness is poorly controlled. Higher HbA1c rates (>6,5%) and a history of acute hypo- or hyperglycemia are factors related negatively to children's metacognition skills. Also actual poor control of asthma symptoms, more intensive treatment and history of acute asthma attacks are the factors influencing self-regulation negatively. These results confirm our first hypothesis and are also consistent with the findings of other authors (Reichenberg et al, 2004; Halterman et al, 2006; McDonnel et al, 2007; Yuksel et al, 2008; McQuaid et al, 2008). It is noteworthy that most difficulties in children with poorly controlled asthma are seen in emotional control, working memory and the initiating domain, whereas in poorly controlled diabetes – in metacognition skills. Further research is needed to determine whether self-regulation of children with asthma and diabetes has similar or different characteristics. It can be assumed that asthma constitutes a risk for children's emotion regulation (Klinnert et al, 2001; Goodwin et al, 2004), whereas metacognition skills may be particularly important for proper diabetes control and constitute a significant area for children's self-esteem.

There are several possible explanations for the moderate disturbances in self-regulation in patients with less well controlled diabetes and asthma. According to neurocognitive models, experience of illness limitations and unpredictability may cause hypersensitivity in a child's motivational defense system (Derrybery & Tucker, 2006) as well as problems with directing attention volitionally (Posner & Rothbart, 2000). Also the subtle neurocognitive changes associated with illness complications may influence complex, executive processes which develop intensively during preschool years (Berger et al, 2007). On the other hand, disturbances in children's self-regulation may be independent of the illness and make its symptoms more difficult to control (McQuaid et al, 2008).

According to the second hypothesis, our study confirms that children with well controlled illness do not differ from healthy peers in self-regulation or assess it even better (in the group with low glycated hemoglobin). Longitudinal studies are

needed to test the hypothesis that proper illness management may protect children against some adverse effects of chronic illness. For example, it may significantly reduce limitations associated with the disease, strengthen children's sense of control and self-esteem or produce positive expectations for the future. (Fryt & Gacek, 2011). Such result is in accordance with the findings of S. Knight et al (2009, 2011), where improvement in mood and behavior control were reported after commencement of insulin pump therapy.

Occurrence of both poor symptom control and poor self-regulatory skills (as well as lack of behavioral disturbances when illness is controlled properly) may also indicate that relationship between symptom control and self-regulation is moderated by salient characteristics of the child and his or her family. In further studies temperament and personality variables (eg. behavioral undercontrol, neuroticism) transmitted from parents to child as well as family socioeconomic status should be tested as potential moderators of symptom control and self-regulation.

Our study has several limitations. Results need to be confirmed with larger and more homogenical groups. Designs of future studies should allow for separation of the psychosocial and neurocognitive factors related to children's self-regulation. There is also a need for investigation into the long-term effects of diabetes and asthma in longitudinal research. Adherence to medical treatment and socioeconomic status should be monitored more carefully as these parameters potentially influence both symptom control and children's self-regulation. Both versions of the BRIEF Inventory (Gioia et al, 2000; Guy et al, 2004) should be fully adapted in the Polish population to allow comparisons with other measures of children's self-regulation and executive function. In children with diabetes a history of acute hypo- and hyperglycemia should be analyzed separately. In children with asthma doses of glicocortycosteroids and antileukotrienes should be also separately controlled.

Our study confirms the need for the inclusion of psychological assistance for children whose illness is not sufficiently controlled, with a history of acute or recurrent complications. It is important to notice disturbances in patients' self-regulation (increased anxiety, impulsivity, low tolerance to frustration, problems with attention and self-organization) and identify factors which perpetuate them (eg. family's failure to manage symptoms, non-compliance to treatment). In diagnosis of cognitive functioning it is worth putting a greater emphasis on the assessment of children's executive function rather than their general intellectual ability. Cognitive and behavioral trainings (including stimulation of executive function and metacognition skills) may be potentially beneficial for patients with poorly controlled illness.

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ZNACZENIE KONTROLI OBJAWÓW: SAMOREGULACJA U DZIECI CHORYCH NA CUKRZYCĘ TYPU 1 I ASTMĘ

ABSTRAKT

Kontrola objawów w takich chorobach przewlekłych jak cukrzyca typu 1 i astma może być powiązana z samoregulacją w negatywny lub pozytywny sposób. Celem artykułu jest ukazanie związków między kontrolą objawów a zdolnościami samoregulacyjnymi dzieci (m.in. hamowaniem zachowania, przełączaniem, planowaniem i monitorowaniem oraz kontrolą emocji). Dzieci chore są porównywane ze zdrowymi rówieśnikami oraz dziećmi z ADHD. Rodzice dzieci chorych na cukrzycę, z historią ostrych stanów hipo- i hiperglikemii oraz wyższym poziomem hemoglobiny glikowanej oraz rodzice dzieci, u których objawy astmy są gorzej kontrolowane, intensywniej leczone i występują ostre ataki duszności, oceniają ich zdolności regulacyjne niżej niż rodzice dzieci zdrowych, wyżej jednak niż rodzice dzieci z ADHD. Dzieci chore na cukrzycę z niskim poziomem hemoglobiny glikowanej oceniają swoje zdolności w zakresie regulacji zachowania wyżej niż ich zdrowi rówieśnicy.

Słowa kluczowe: samoregulacja, kontrola objawów, cukrzyca typu 1, astma

APPENDIX

Table 3 Estimated means and 95% confidence intervals (CI) of dependent variables for compared groups of asthma

Group	Lower 95% CI	Estimated mean	Upper 95% CI
Symptom control in last 4 weeks – BRIEF Inventory – Parent Version, $F(3,98) = 38.61$, $R^2 = .53$, $p < .001$			
Poor symptom control	-.43	-.039	.35
Good symptom control	-.89	-.036	.17
Healthy	-1.1	-.65	-.19
ADHD	.69	1.15	1.61
Symptom control in last 4 weeks – BRIEF Inventory – Self-Report Version, $F(3,98) = 8.69$, $R^2 = .19$, $p < .001$			
Poor symptom control	-.47	-.0076	.46
Good symptom control	-.96	-.33	.3
Healthy	-.66	-.1	.44
ADHD	.22	.77	1.32
Treatment intensity – BRIEF Inventory – Parent Version, $F(3,98) = 39.22$, $R^2 = .53$, $p < .001$			
More intensive	-.094	.45	.99
Less intensive	-.72	-.4	-.072
Healthy	-.69	-.29	.12
ADHD	1.1	1.5	1.9
Treatment intensity - BRIEF Inventory – Self-Report Version, $F(3,98) = 8.33$, $R^2 = .18$, $p < .001$			
More intensive	-.5	.16	.81
Less intensive	-.64	-.24	.15
Healthy	-.36	.13	.62
ADHD	.51	1	1.5
Acute asthma attacks - BRIEF Inventory – Parent Version, $F(3,98) = 40.86$, $R^2 = .54$, $p < .001$			
Yes	-.35	-.036	.28
No	-.1.17	-.62	-.069
Healthy	-1.04	-.65	-.25
ADHD	.75	1.15	1.54
Acute asthma attacks - BRIEF Inventory – Self-Report Version, $F(3,98) = 8.91$, $R^2 = .19$, $p < .001$			
Yes	-.43	-.051	.33
No	-1.1	-.43	.24
Healthy	-.54	-.066	.41
ADHD	.34	.82	1.3

Table 4 Estimated means and 95% confidence intervals (CI) of dependent variables for compared groups of diabetes

Group	Lower 95% CI	Estimated mean	Upper 95% CI
Medium HbA1c in last year - BRIEF Inventory – Parent Version, $F(3,103) = 42.83$, $R^2 = .54$, $p < .001$			
Higher	-.19	.26	.72
Lower	-.66	-.33	.0011
Healthy	-.76	-.35	.052
ADHD	1.04	1.44	1.85
Medium HbA1c in last year - BRIEF Inventory – Self-Report Version, $F(3,103) = 10.96$, $R^2 = .22$, $p < .001$			
Higher	-.46	.16	.77
Lower	-.99	-.54	-.096
Healthy	-.12	.43	.97
ADHD	.76	1.3	1.86
Acute hypo- or hyperglycemia - BRIEF Inventory – Parent Version, $F(3,103) = 41.87$, $R^2 = .54$, $p < .001$			
Yes	-.47	.015	.5
No	-.6	-.2	.2
Healthy	-.94	-.48	-.021
ADHD	.85	1.31	1.78
Acute hypo- or hyperglycemia - BRIEF Inventory – Self-Report Version, $F(3,103) = 10.92$, $R^2 = .22$, $p < .001$			
Yes	-.52	.13	.79
No	-1.08	-.55	-.016
Healthy	-.18	.43	1.05
ADHD	.7	1.31	1.93