

Factors Related to the Stages of Change in Health Behaviour of Adolescents with Type 1 Diabetes Mellitus

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Research Article

Received date: 28/10/2021

Accepted date: 10/11/2021

Published date: 17/11/2021

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Keywords: Diabetes, Nursing education, Self-care.

Abstract

Objective: To investigate the factors associated with the stages of change in health behaviour, based on the Trans theoretical model, associated with type 1 diabetes (DM1), among adolescents.

Background: The adherence to the treatment of DM1 during childhood and adolescence is a challenge that affects diagnosed individuals and their caregivers.

Design: Transversal study, supported by the Trans theoretical model, developed inside a paediatric ambulatory in Brazil with 97 adolescents. The measurements were a social demographic and clinical survey about Diabetes Self-Care Activities. The following tests were used for the analysis: Chi-square, Likelihood ratio, Kruskal Wallis and Spearman's correlation.

Results: Most were female, in intermediate adolescence, with a diagnostic time of 1 to 3 years and from families with high socioeconomic vulnerability. About the Trans theoretical model, more than 50% were found in the maintenance of daily activities: feeding, glycaemic control and insulin therapy, differently from the physical activity, where only 37.1% were in this phase. One verifies a large number of adolescents in inadequate glycaemic control, with values of glyated haemoglobin outside the established target.

Conclusion: Nursing must promote the adolescent's holistic care, transcending the teaching of the glycaemic self-monitoring and application of insulin, and favouring the empowerment in their health care. Relevance to clinical practice: For research and practice in nursing, the study has proven to be possible in an ambulatory care service for diabetes. The nurse, as a member of the health team uses theoretical references that support his/her practice, thus stimulating the self-care along with the adolescent. Moreover, direct costs with the worsening of diabetes may be decreased and this can directly influence the management of health care

INTRODUCTION

It is estimated that, per year, 96,000 individuals under 15 years old develop Diabetes Mellitus 1 (DM1) around the world. This number may be elevated to 132,000 when the age group is extended up to 20 years old. The global estimative is that 1,106,500 children and adolescents are affected by DM1 (International Diabetes Federation, 2017) ^[1]. Currently, Brazil is the third country in the ranking of new DM1 cases, affecting 9,600 individuals up to 20 years old (International Diabetes Federation, 2017). In

childhood and adolescence, the bio psychosocial immaturity may hinder the control of the disease. Additionally, it may lead to high costs of treatment for metabolic control and complications, which represents a huge socioeconomic impact on the health system^[1]. Adolescence may be affected a person's image construction and self-perception, thus intervening in the treatment for diabetes (Collet, Batista, Nóbrega, Souza, & Fernandes, 2018)^[2]. The adherence to the treatment of DM1 during childhood and adolescence is a challenge that affects diagnosed individuals and their caregivers. Even with the available therapeutic advances, researchers have been highlighting the importance of self-care by means of physical activities, eating habits, as well as glycemic control, since adolescents with DM1 are often not able to maintain the ideal level of glycated haemoglobin (HbA1c) of 7%, which is needed to reduce the associated risks Rasbach^[3]. Furthermore, the adherence to healthy habits, such as healthy food therapy, is vital for the management of the disease, as well as for the prevention of the development of chronic complications resulting from DM, in developing countries like Brazil. There are a number of benefits attributed to regular physical activities provided that, in addition to improving physical conditioning, they increase the uptake of glucose by the muscles, reduce arterial pressure, and improve the lipidic profile and endothelial function (Brazilian Diabetes Society, 2017). It is highlighted that health education concerning diabetes must walk alongside the therapeutic management throughout the whole treatment (Sy, 2016), with emphasis on the co-responsibility of the care services and health professionals, encouraging self-care in parallel with the comprehension of the impact of DM1 in regard to an individual's daily activities, as well as their acceptance regarding the disease Sparapani^[4]. Bearing in mind the need for changes concerning the diagnosis of chronic diseases, such as DM1, it is valid to highlight that the process of change in behaviour is not linear in all individuals, especially in childhood and adolescence. Therefore, strategies of health education cannot assume that all people are in the same level of disposition and motivation to take attitudes that will facilitate their process of health-disease and diagnostic. As a result, theories and models involving health behaviour seek to understand individual's psychological readiness to make health decisions and to adhere to the suggested treatment^[5]. Among them, one of the most important theories of change in the behaviour is the Stages of Change Model or Trans theoretical Model (TTM), developed by Prochaska and Diclemente.

The TTM considers the change in the behavior as a dynamic process which hardly follows a linear path, and includes

Five stages of change that progress when the behaviour changes, as described below:

Pre contemplation: The individual believes that there is no need for changes in his/her behaviour.

Contemplation: The individual is aware of his/her problem, however, there is no action to change his/her behaviour.

Preparation: The individual starts to think about the change in a near future.

Action: Changes in the behaviour, experiences or even in the environment are achieved.

Maintenance: Persistence in the behaviours that were modified. These may begin in any stage and move throughout the five stages^[6].

This study assumes that knowing the determinants which influence the self-care related to DM1 in adolescents allows the nurse to implement strategies to face each stage, accordingly with what was proposed in the Trans theoretical Model, thus promoting a care plan that values the behaviour stage in which the adolescent is. In this context, it is important to highlight the information about daily life habits, such as diet, level of physical activity, glycemic monitoring and insulin therapy. Therefore, the objective of this study is to investigate the factors associated with the stages of change in health behaviour, based on the Trans theoretical Model, in adolescents with Type O1 Diabetes Mellitus.

METHODS

The participation of adolescents in the study was previously authorized by their relatives. The current study was submitted to the Ethics Committee and approved, following the ethical principles in the development of the research, accordingly with the Resolution 466/2012 (Brazil, 2012). The study was developed in an important pediatric walk-in clinic in Fortaleza, Northeast Brazil. The estimated population of Fortaleza in 2016 was 2,609,716 (Brazilian Institute of Geography and Statistics, 2016), and the Municipal Human Development Index (MHDI) was 0.732, which puts the city in the range of High Human Development (MHDI between 0.700 and 0.799). In contrast, Fortaleza is characterized by the high disparity of income and levels of violence. The dimension that gives the city the higher contribution to MHDI is longevity, followed by income and education level (Brazilian Institute of Geography and Statistics, 2013). Children and adolescents diagnosed with DM1 can participate in groups of education in diabetes composed of a multi-professional team which includes nurses, nutritionists, physiotherapists, and psychologists. Moreover, they can count on individual consultations when needed. The type of sampling was not probabilistic. A total of 115 adolescents took part in the study and 97 participants made up the final sample, from April to December 2017. The inclusion conditions were: diagnosis of DM1, age between 10 and 19 years old, and a medical follow-up of at least a month. The exclusion conditions were: possess other chronic pathologies in addition to DM1 and/or apparent cognitive deficiency that could hinder the application of the survey. Eighteen adolescents were ineligible for having other comorbidities. A survey was applied with variables referring to age, sex, diagnostic time, family income, and educational level. The survey was applied in a private and calm place. The variable related to glycated haemoglobin (HbA1c) was gathered from the participant's handbook, for being a standard procedure accomplished by the nurses in each consultation, thus being considered a reliable source about the monitoring. In the second part of the survey, the instrument Summary of Diabetes Self-Care Activities Questionnaire – SDSCA of Toobert, Hampton, and Glasgow (2000) was applied. The material was cross-culturally adapted in Brazil's Portuguese by Michel's, Coral, Sakae,

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Damas and Furlanetto (2010), to investigate relevant aspects of self-care in individuals, such as diet, physical activity, glycemic monitoring, and insulin therapy. A high reliability was shown with the adaptation of the instrument with Cronbach's alpha of 0.86, close to the original instrument in English.

The original survey has seven domains, general supply, specific supply, physical activity, glycemia monitoring, foot care, medication and tobacco use; from these domains, foot care and tobacco use were not used in this study. Furthermore, the topic related to medication was adapted to the context of patients with DM1. For the adherence analysis to the items of the survey, they were parameterized in days per week, from 0 to 7, being zero the less desired situation and seven, the most desired one. In the items related to a specific supply that approached the consumption of foods rich in fats and sweets, the values were inverted (7=0. 6=1. 5=2. 4=3. 3=4. 2=5. 1=6. 0=7).

Considering the aforementioned parameterization and considering that the study uses the TTM as theoretical reference, it was decided to adapt the instrument response levels in relation to self-care based in the stages of change in behavior proposed by the model, with only five response options, each one representing a stage of change. It is worth to highlight that the same individual may find himself in different stages of the TTM depending on the considered health behavior. An example is the situation in which the individual may be in the precontemplation stage for physical activity and maintenance stage for glycemic monitoring.

Response options considered equivalent for the stages were:

- Maintenance
- Action
- Preparation
- Contemplation
- Pre contemplation

In addition to this, the period of six months was considered as ideal for the change in behavior, accordingly to what is recommended in the study of Finckenor and Byrd-Bredbenner (2000), which used the transtheoretical model in patients with diabetes.

Regarding their eating habits, the following responses were considered:

- Yes, I have had healthy eating habit for six months or more
- Yes, I have had healthy eating habits for less than six months
- I do not have healthy eating habits, but I want to in the next 30 days
- I do not have healthy eating habits, but I want to in the next six months
- I do not and I do not want to have it in the next six months.

For the physical activity, it was considered:

- Yes, I am active for six months or more
- Yes, I am active for less than six months
- I am not active, but I want to be in the next 30 day
- I am not active, but I want to be in the next six months
- I am not active and I do not want to be in the next six months.

Considering the glycemic monitoring, the response levels were:

- Yes, I have done glycemic monitoring every day for six months or more
- Yes, I have done glycemic monitoring every day for less than six months
- I do not make glycemic monitoring every day, but I want to do it in the next 30 days
- I do not make glycemic monitoring every day, but I want to do it in the next six months
- I do not make glycaemic monitoring every day and I do not want to do it in the next six months.

The data was compiled in Microsoft Office Excel and analysed in the Statistical Package for the Social Sciences (SPSS), version 22.0 for Windows and presented in tables. A descriptive statistic was used, via absolute, relative, and average frequencies and standard deviation. A confidence interval of 95% (IC 95%) and a significance level of 5% were used for all tests - Chi-square, Likelihood ratio and Spearman's correlation.

The Kruskal Wallis test ($p < 0.05$) with 2-to-2 comparisons was applied for the descriptive statistic accomplished with data

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about glycated haemoglobin related to self-care practices referent to healthy eating habits, physical activity, glycemic monitoring that concerns the stages of change in the behaviour, allowing us to observe at which categories the participants differ. In this context, the adolescents are symbolized by the letters [a] and [b], which represents that in the ones with at least one equal letter, there is no statistical difference at 5% of significance. On the other hand, if there is no equal letter between 2 categories, the groups are statistically different, with a significance of 5%.

RESULTS

Among the 97 participants, 51.5% were female; in the age group of 13 to 15 years old (39.2%). The diagnostic time varied between one to three years old, with 33% of the participants within this interval. Regarding family income, 41.3% affirmed to receive between 200 and 600,00 dollars. Additionally, most of the samples income per capita was between a quarter to half minimum wage, and 61.9% had 4 to 5 people living in the same house. The highest interval of level of school was between 6 to 9 years, in 47.4% of the participants, accordingly with Table 1.

Variables	N	%	Mean ± SD
Sex			
Male	47	48.5	-
Female	50	51.5	-
Age			
10-Dec	25	25.8	14.6 ± 2.5
13-15	38	39.2	-
16-19	34	35.1	-
Time of Diagnosis in years			
Up to 1.0	20	20.6	3.6 ± 2.6
1.1-3	32	33.2	-
3.1-5	26	26.8	-
5.1-14	19	19.6	-
Monthly Family Income*			
<200	24	24.7	-
201-350	29	29.9	1484 ± 728.7
351-600	40	41.3	-
>601	4	4.1	-
Adolescents' Years of Study			
05-Aug	30	30.9	-
09-Dec	46	47.4	10.1±2.9
13-17	21	21.6	-

Table 1. Characterization of the research's subjects. Fortaleza, Ceara, Brazil, 2017 (n=97).

Regarding the stages of change in the behaviour, in relation to their eating habits, 58.8% were found in the maintenance stage, followed by 21.6% in the preparation stage. In relation to the practice of physical activities, only 37.1% affirmed to having practiced one type of physical activity for over 6 months, which allows us to conclude that a higher number of participants were in the maintenance stage. Concerning the glycemic monitoring, the maintenance stage was of 58.8%. Lastly, in regards of the insulin therapy 62.9% said they applied it for over 6 months, accordingly with Table 2.

Stages of Change in the Behavior	Feeding		Physical Activity		Glycemic Monitoring		Insulin Therapy	
	n	%	n	%	n	%	n	%
Pre-contemplation	4	4.1	12	12.4	7	7.2	10	10.3
Contemplation	8	8.2	17	17.5	7	7.2	6	6.2
Preparation	21	21.6	16	16.5	7	7.2	-	-
Action	7	7.2	16	16.5	19	19.6	20	20.6
Maintenance	57	58.8	36	37.1	57	58.8	61	62.9

Table 2. Stages of Change in the Behaviour Referent to the Self-Care Related to Feeding, Physical Activity, Glycemic Monitoring and Insulin Therapy. Fortaleza, Ceara, Brazil, 2017 (n=97).

Additionally, considering the habit of healthy eating, there were differences between participants in the maintenance stage or the action stage from the rest, in accordance with the benchmark used in the study. In this context, it was verified that the average of HbA1C was 6.97% and 5.41%, respectively. Those values are acceptable for a good glycemic control. On the other hand, the average values of HbA1C for the participants who reported not having healthy eating habits, but wanting to have in the next 30 days, in the next 6 months or that do not want to in the next 6 months is, respectively, 8.13%, 7.50% and 8.50%.

Still in Table 3, via 2-to-2 comparisons, it is possible to observe in which categories the participants differ. Regarding eating habits and physical activity, we detected that: a) the stages of maintenance and action are statistically equal; b) the preparation, contemplation, and pre contemplation stages are statistically equal among themselves, and that c) the stages of maintenance

and action are significantly different from the stages of preparation, contemplation, and pre contemplation. Therefore, the teens that reported to having healthy eating habits and to practicing physical activity showed lower rates of glyated haemoglobin than the ones that are sedentary.

Self-care and the Stages of Change in the Behavior	n	Average	Standard	Min	Max	Value of p*	Comparisons**
		HbA1C	Deviation				
Healthy Feeding							
Maintenance	57	6.97	2.48	0	12.8	-	[a]
Action	7	5.41	3.71	0	7.9	-	[a]
Preparation	21	8.13	2.27	0	13.4	<0.001	[b]
Contemplation	8	7.5	3.11	0	10	-	[b]
Pre-contemplation	4	8.5	0.47	8	9.1	-	[b]
Total	97	7.22	2.6	0	13.4	-	-
Physical Activity							
Maintenance	36	7.2	2.35	0	13.4	<0.001	[a]
Action	16	6.17	3.23	0	11	-	[a]
Preparation	16	7.9	2.28	0	10	-	[b]
Contemplation	17	7.61	2.05	0	9.1	-	[b]
Pre-contemplation	12	7.2	3.4	0	10	-	[b]
Total	97	7.22	2.6	0	13.4	-	-
Glycemic Monitoring							
Maintenance	57	7.15	2.64	0	13.4	0.02911	[a]
Action	19	7	2.57	0	10	-	[a]
Preparation	7	7.03	3.19	0	9	-	[a][b]
Contemplation	7	7.3	3.3	0	10	-	[a][b]
Pre-contemplation	7	8.47	0.49	7.9	9.1	-	[b]
Total	97	7.22	2.6	0	13.4	-	-

Table 3. Descriptive statistics of glyated haemoglobin in face of the self-care practices referring to healthy feeding, physical activity, glycemic monitoring in accordance with the stages of change in the behaviour. Fortaleza Ceara, Brazil, 2017 (n=97).

It is valid to highlight that concerning physical activity, the average of the maintenance and pre contemplation categories are equal to 7.20; however, the 2-to-2 test showed that they are statistically different. This occurs due to some outlier response in the sample, i.e., some response that was very different from the rest, thus causing the average to be higher, or lower, than it should have. As the comparison test does not take this bias into account, provided that it mainly considers the sample's rank, this fact can, occasionally, occur. In relation to the glycemic monitoring, we can infer that the pre contemplation stage seems to possess higher rates of glyated haemoglobin.

DISCUSSION

Regarding the TTM, we found that more than half of the adolescents were in the maintenance stage in the following daily activities: eating habits, glycaemic control and insulin therapy, differently from physical activity, where only 37.1% referred to be in this stage. One verifies a large number of adolescents in inadequate glycaemic control, with values of glyated haemoglobin outside the established target. Concerning the socio demographic data, one highlights the socioeconomic vulnerability that shows that this population suffers great influence from the physical and social environment in which they are inserted. This way, the vulnerability mat directly affects the adolescent's health and other bio psychosocial aspects^[7]. A study in the South of Brazil, with children and adolescents with DM1, showed that most of them were female, with an average age of 11.2 years old, a family income of 4 to 10 minimum wage and most of their parents had completed secondary school^[8]. One highlights that the fact that the diagnosis is more prevalent among female refers to the gender discussion about access to health. One perceives that men's life expectancy is lower than that of women, which may be associated to the male difficulty in seeking for health services^[9]. Since there are social and cultural barriers involved in this process since adolescence^[10]. Regarding the time of diagnosis, a study by Botton A, et al.^[11] pointed out that the average was of 4 years and this finding was close to the ones in the current study. This data is relevant because the longer the time of diabetes diagnosis is and as the used insulin dosage is higher, the more difficult the glycemic control in children and adolescents with DM1 is and this is a relevant aspect for the planning of a care plan for the adolescents. About the education level, most of the adolescents were in primary school, this variable is expressly important for the adhesion and self-care of diabetes. According to the Brazilian Society of Diabetes (2017), the low education level and the lack of knowledge about the disease on the part of the patient and his caregiver become important factors due to the complexity of the therapeutic scheme, in addition to hinder the professionals' approach. The most prevalent interval of HbA1C was 7.1% to 9%, with an average of 7.22%. Above the recommended values, the aforementioned interval had values close to a research made in Rio de Janeiro, Brazil, in which the predictors' factors of glycemic control of children and adolescents were analyzed and showed an HbA1C average of 8.13%. Although this HbA1C average is higher in comparison with the one found in the current study, one

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highlights that this value was inserted in the prevailing interval above, allowing to infer that the findings are similar (Fortins et al., 2019). A systematic review made in Qatar that used the TTM in patients with diabetes showed positive results with the model's implementation, which includes improvements in the action or maintenance stage after the intervention with its presumptions. Consequently, these intervention bases in the model were capable of supporting individuals to follow the diet, in the practice of physical activities, and still observed the reduction of HbA1C^[13]. Another review published in Chile corroborates with these findings and highlights that the TTM was effective in the increase of physical activity and adherence to the pharmacological treatment for individuals with DM^[12]. A study in Mexico^[14] showed that this model promoted the stages of action and maintenance for the application of insulin, glycemic control and adherence to the diet. When referring to physical activity, the number of individuals in the preparation or contemplation stages overcame the other stages, which differed from the current study. These findings show the relevance for the nurse's acting in the promotion of health and self-care of the adolescent with DM1 (Collet et al., 2018), valuing life activities, identifying them and, from the findings, using methodological theoretical references, such as the TTM to guide the care^[15]. A study made in Taiwan showed in its results that school nurses were finding a lot of challenges in taking care of students with DM1, suggesting that there was an increase in the competence of these professionals^[16]. On the other hand, in Brazil, there are no nurses dedicated only to the schools. A study made with 250 Brazilian teachers showed that there is common-sense knowledge about DM and its treatment. However, it was with incomplete information, besides that, most of them could not inform the correct handling in face of some kind of emergency. It is also important to highlight that, regarding healthy eating habits, the HbA1C average was 6.97% among the ones in the maintenance stage and 5.41% among the ones in the action stage. Thus, adolescents with healthy eating habits, as well as the ones that practice physical activities, showed lower ratios of glycated haemoglobin^[17,18]. Therefore, the knowledge about healthy eating habits motivates the individuals to enter in the last stages of changing behaviour, which, by its turn is associated with better glycemic control (Tseng, 2017). About the glycemic monitoring, one emphasizes that adolescents in the stage of pre contemplation had higher average levels in this exam. It is evident that based on the factors that influence the stages of changing behaviour, the patients must be supported with a new lifestyle, now with diabetes, and also to strengthen social support as a type of care. In Turkey, it was made a random clinical test to determine the effect of a motivational interview-based in TTM for individuals with DM2. In which it was verified that the number of participants in the action stage from the intervention group of diet, exercises, and the use of medication significantly increased in relation to the control group ($p < 0,05$). Concerning to the practice of insulin application, although the study has not shown the influence in the rates of glycated hemoglobin, we found that adolescents with DM1 have difficulties in the adjustment of insulin, and the comprehension of the biochemical market. Therefore, it is necessary to correct mistakes that involve the self-care of adolescents with DM1 to accomplish interventions that are adequate and directed to fragilities. Consequently, one defends the health education as an effective tool with low cost, to assure the self-care, in addition, to sensitize the individual and its support network for a healthy lifestyle. Facing what has been exposed, one observes the importance of the personification and individualization of education practices in health/diabetes, because as it can be evidenced by these study's results that corroborate with the literature, many factors interfere in the care of DM1. Thus, there must be a planning of educative activities, considering the stage of changing behaviour where the individual is.

Strengths and limitations

The study approached a reference service for diabetes in a region of Brazil, with high socioeconomic inequality, and that has been promoted with specific health politics for this population. But, at the same time suffers from an overview of chronic diseases, emerging and re-emerging diseases, besides the violence in great urban centres. This context highlights that there is an importance in consolidating nursing as a relevant profession for society, insofar as one uses a theoretical reference for the care.

One emphasizes that the study was made in a service of reference for diabetes in adolescence, providing a specialized service to adolescents and youngsters of several places from the state. However, even with regional coverage, one of the limitations might be referred to as the methodological drawing of transversal character which seeks inferences to causal factors, however, without establishing a temporal link. Therefore, it is needed to develop multicentre studies with higher territorial coverage, for the amplification of sample and acquisition of more reliable results.

CONCLUSION

Implications for nursing research and practice

For research and practice in nursing, the study has proven to be possible in an ambulatory care service for diabetes. The nurse, as a member of the health team uses theoretical references that support his/her practice, thus stimulating the self-care along with the adolescent. Moreover, direct costs with the worsening of diabetes may be decreased and this can directly influence the management of health care. To know the determinants that may influence in the adherence or not of the main activities of self-care inherent to diabetes, and the perception of the user about this disease are essential for the population's empowerment. In this context, the health education for diabetes must not be restricted to the teaching of glycemic self-monitoring and the application of insulin but must also include the care with the body.

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