

Difficulties presented by patients with diabetes in self-administration of insulin: scoping review

Dificuldades apresentadas por pacientes com diabetes na autoadministração de insulina: revisão de escopo

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ABSTRACT

Introduction: Diabetes is a disease with a high incidence in the world population. One of the treatment alternatives for this disease is the use of subcutaneous insulin therapy, daily, most often applied by the patients themselves. As a result, patients that are not properly trained in insulin self-administration may develop complications from its use.

Objectives: Describe the evidence in order to explain the difficulties of patients with diabetes in the process of self-administration of insulin.

Methods: A literature review was carried out using the scoping review method, in LILACS, CINAHL, PubMed, Cochrane Library, SCOPUS, SciELO, *Biblioteca Digital de Teses e Dissertações USP*, *Busca Integrada USP*, and CAPES Thesis Bank. We included articles that had insulin users as participants; that explored the difficulty presented by patients; and that studied the process of insulin self-application. **Results:** Twenty-six studies published between 1998 and 2020 were selected. The analysis pointed to 12 categories about the difficulties encountered in the self-application process, of which the most relevant were: pain, fear, difficulty in knowing the correct dose and/or adjusting it based on capillary glycemia, lack of knowledge about the application technique, and functional alteration.

Conclusion: Pain was the most common objection found in the studies, which reflects its relationship with other difficulties. The difficulty in knowing the dose and/or adjusting it according to capillary blood glucose was presented in a considerable amount, in order to infer the deficiency of health education conducts in Primary Health Care.

Keywords: Self-care; Diabetes mellitus; Subcutaneous injections; Procedural pain; Health knowledge, Attitudes, and Practice; Medication errors.

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RESUMO

Introdução: A diabetes é uma doença com alta incidência na população mundial. Uma das alternativas de tratamento para essa doença é a utilização da insulino-terapia por via subcutânea, diariamente, na maioria das vezes, aplicada pelo próprio paciente. Com isso, pacientes não treinados adequadamente na autoadministração da insulina podem evoluir com complicações do seu uso. **Objetivos:** Descrever as evidências de forma a explicitar as dificuldades dos pacientes com diabetes no processo de autoadministração de insulina. **Métodos:** Realizou-se uma revisão da literatura com o método *scoping review*, nas bases LILACS, CINAHL, PubMed, biblioteca Cochrane, SCOPUS, SciELO, Biblioteca Digital de Teses e Dissertações USP, Busca Integrada USP e banco de Teses CAPES. Foram incluídos artigos que tinham como participantes usuários de insulina; que explorassem a dificuldade apresentada pelos pacientes; e que estudaram o processo da autoaplicação de insulina. **Resultados:** Foram selecionados 26 estudos publicados entre 1998 e 2020. A análise apontou 12 categorias acerca das dificuldades encontradas no processo de autoaplicação, das quais as mais relevantes foram: dor, medo, dificuldade em conhecer a dose correta e/ou ajustá-la baseado na glicemia capilar, desconhecimento sobre a técnica de aplicação e alteração funcional. **Conclusão:** A dor foi a objeção mais encontrada nos estudos, o que reflete a relação dela com as outras dificuldades. A dificuldade em conhecer a dose e/ou ajustá-la de acordo com a glicemia capilar foi apresentada em quantidade considerável, de modo a inferir a deficiência de condutas de educação em saúde na atenção primária à saúde.

Palavras-chave: Autocuidado; Diabetes mellitus; Injeções subcutâneas; Dor processual; Conhecimentos, atitudes e prática em saúde; Erros de medicação.

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder of several causes, characterized by hyperglycemia and disturbances in the metabolism of carbohydrates, proteins, and fats that result from defects in the secretion or action of insulin. As a result, hyperglycemia may present with symptoms of polyuria, polydipsia, and blurred vision or acute complications capable of leading to urgent and emergency situations¹.

The prevalence of diabetes in Brazil in 2020 was 9.2%, varying within a range of 5.4% to 14.7% among the 5 geographic regions of Brazil and the sex of the affected individuals². However, it is estimated that only 50% of diabetes cases in adults have their diagnoses known, configuring a challenge to the Brazilian health system³.

DM is often subdivided into 4 types: Type 1 DM, Type 2 DM, Gestational Diabetes, and other specific types, with the terms “insulin dependent” and “non-insulin dependent” currently considered obsolete. Type 1 DM is a condition in which the beta cells of the pancreas are destroyed, generating an absolute deficiency in insulin secretion. Type 2 DM is a heterogeneous entity, characterized by disturbances in the mechanism of action and/or secretion of insulin¹.

Among these types of diabetes, the one with the highest prevalence is type 2 DM, present in 90 to 95% of diabetes diagnoses. Regarding age, type 2 DM is more frequently observed after 40 years of age, with a peak incidence around 60 years of age¹. As for type 1 DM, it occurs in 5 to 10% of all DM cases, and in general, has its initial manifestation abruptly and affects mainly children, adolescents, and young adults, most of the time requiring the use of insulin early and permanently after diagnosis^{4,5}.

Besides the biological characteristics of DM, because it is a chronic disease and requires daily changes in the individuals' routine, feelings correlated to anxiety, regression, stress, depression, loss of self-esteem, insecurity, and denial of the situation presented are common in these patients, directly impacting treatment compliance and quality of life⁶.

When it comes to the perspective of treatment and follow-up of the person with DM, there is a vast combination of possibilities for achieving a better quality of life for the patient. In general, lifestyle changes are mostly indicated in both types of DM, but specifically in the treatment of type 1 DM, insulin administration is required, while in the other types of diabetes this hormone should be used in specific cases, giving preference - initially - to other types of hypoglycemic agents^{7,8}.

In this sense, as demonstrated by Fernandez et al. (2016)⁹, although most patients with type 2 diabetes use oral hypoglycemic agents or simply diet, 11.8% require the use of insulin, alone or in combination in more advanced stages of the disease or in face of hyperglycemic decompensation, which significantly increases the number of routine or occasional insulin users.

The discovery of insulin is attributed to the pancreatic islet extraction experiments carried out by Banting and MacLeod between 1920 and 1921, and its commercial production and distribution to the world began in 1923¹⁰. As an endocrine peptide hormone, insulin, by binding to membrane receptors on target cells, orchestrates an anabolic response in the body integrated with the supply of nutrients. Its role in glucose homeostasis is typified by direct effects on skeletal muscle, liver, and adipocytes, with subsequent reduction in blood glucose under usual conditions¹¹.

Insulin therapy, a treatment that is based on the application of the hormone insulin, is a form of therapy with subcutaneous application performed, most often, on the arms, abdomen, thighs, and buttocks. This process requires a particular attention regarding the storage of equipment and insulin, its preparation (dosage, aspirated amount, mixtures, among others) and, finally, its administration. This treatment is performed, most of the time, at home and by the patients themselves, requiring them to have skillful knowledge to perform the procedure in order not to generate complications resulting from inappropriate procedures^{4,12}.

According to Moreira et al. (2018)¹³, about two-thirds of insulin users self-administer the medication, while one-third of patients receive it from other people (health professionals, caregivers, and the like). When considering the large public that requires daily use of insulin, the present review aimed to describe the evidence in order to explain the difficulties of patients using insulin in the process of self-administration of this medication.

METHODS

Study designed as a scoping review, as proposed by the Joanna Briggs Institute¹⁴. This study had its protocol registered in the Open Science Framework under the following URL link: <https://osf.io/h93wz/> (identifier: DOI: 10.17605/OSF.IO/H93WZ). For the construction of the research question, the PCC strategy was applied, which represents a mnemonic for Population, Concept, and Context, defined as follows: P = children and adults with diabetes using insulin, C = difficulties, and C = performing self-application of insulin. For the search and selection of studies, the following guiding question was established: "What are the difficulties presented by patients with diabetes in the self-administration of insulin?"

The individual search strategy according to Joanna Briggs Institute (JBI)¹⁴ was applied to the following databases: Scientific Electronic Library Online (SciELO),

Latin American and Caribbean Health Sciences Literature (LILACS), National Library of Medicine (PubMed), CINAHL, The Cochrane Library, Digital Library of Theses and Dissertations USP, SCOPUS, Busca Integrada USP, and CAPS Theses Bank. Therefore, primary studies, reviews, meta-analysis and/or meta-synthesis, books and guidelines, theses and dissertations, published in indexed sources or gray literature, without exclusion due to methodological issues, available in Portuguese, English, and Spanish were considered eligible.

Descriptors, keywords and/or their synonyms were used according to the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH). The search was performed with the following search preset: ((difficulty) OR (difficulties) OR (difficulties) OR (difficulty) OR (difficulty) OR (difficulties)) AND (((insulin) OR (insulin)) AND ((self care) or (self-care))) AND (diabetes).

To select the articles, the title and abstract were carefully read, and when these were not sufficient, the entire article was read by two independent researchers. For the selection, inclusion and exclusion criteria were considered, guided by the guiding question.

Inclusion criteria were: (1) Studies that had insulin-using patients as participants; (2) Studies that explored the difficulty presented by patients and; (3) Articles that studied the process of insulin self-application. The exclusion criteria were: (1) The study did not answer the research guiding question and (2) articles unavailable in full with the CAFE institutional access of the CAPES Periodicals

Data extraction was carried out using a specific extraction tool for the fundamental questions of the study, namely: Author, sample size, mean age, methodological design, study objectives and main reported difficulties. Finally, data analysis was performed in order to summarize the evidence in relation to the objective of the present study¹⁴.

RESULTS AND DISCUSSION

A total of 563 potential articles were identified, of which 26 comprised the scope of this review. The synthesis of the steps of the search and analysis of articles, subdivided into identification, screening, eligibility, and inclusion are shown in Figure 1.

The years of article coverage were from 1998 to 2020. The years with the highest prevalence of publications were 2016 (18.5%), 2018 (11.1%), and 2020 (11.1%). The journals that most published in the area of interest were *Revista Latinoamericana de Enfermagem* (7.4%) and *Diabetes Research and Clinical Practice* (7.4%). Brazil was the country with the highest number of studies included (40.7%), followed by Japan (11.1%) in second place and Australia and Portugal with the same percentage (7.4%). Most of the included studies used the observational study (84.6%), followed by serial case reports (7.7%), clinical trials (3.8%), and systematic review (3.8%).

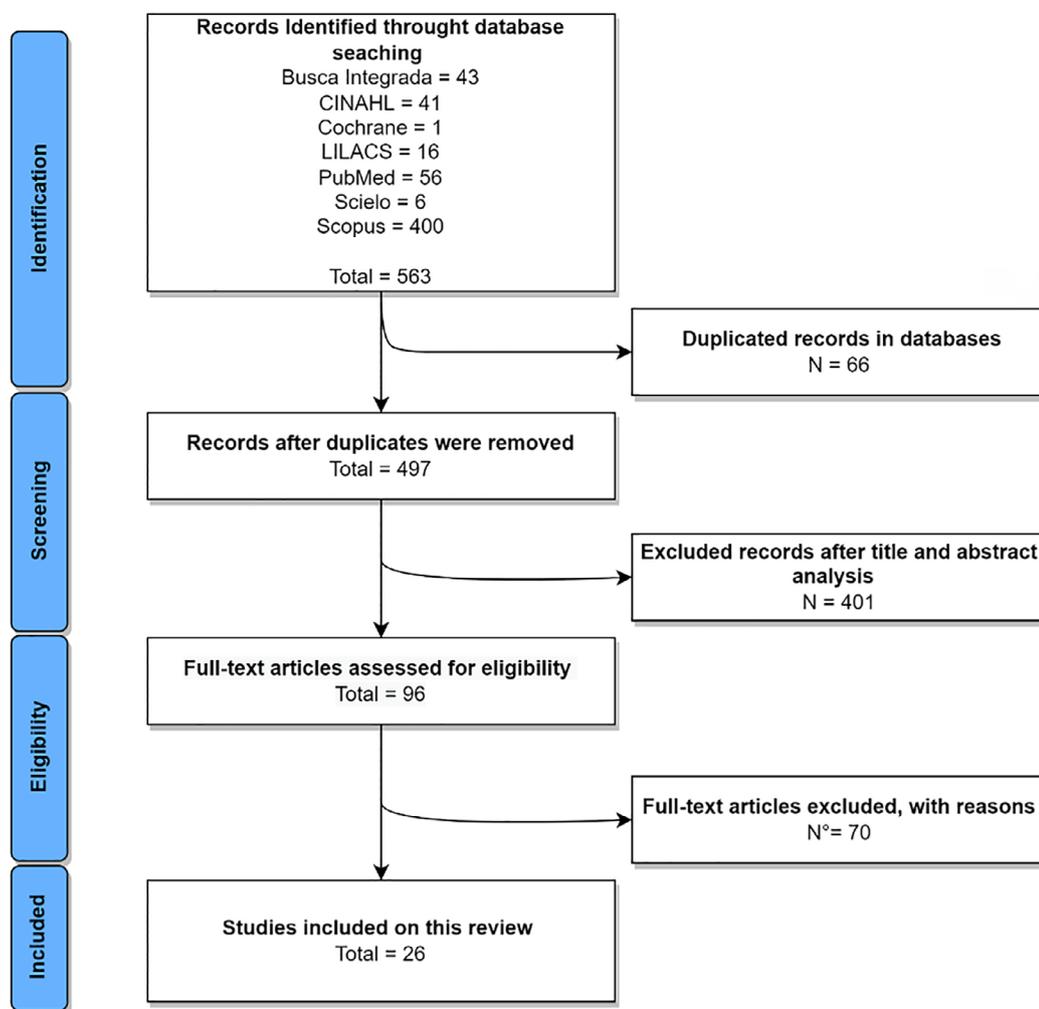


Figure 1. Scoping review search flowchart.

Source: Prepared by the authors (2021).

Chart 1 presents the general characteristics of the included studies, such as authorship, country, year of publication, sample size, mean and age range, and the main difficulties reported.

A total of 12 difficulties were identified. The most cited difficulty was application pain, with a total of 10 articles (38.5%). In addition, the difficulty in knowing the right dose or adjusting it based on capillary blood glucose and the lack of knowledge of the technique and/or failure to apply it correctly were also seen more frequently. Table 2 lists the difficulties encountered and their respective frequencies.

Pain is a component often reported to be present in the lives of many insulin users. Thus, this constant report can be seen as a difficulty in carrying out the application, since, through thoughts related to pain, the execution of the administration technique can be made difficult, which can increase the discomfort of the process and even be a factor of decreased adherence to treatment^{16,18,29}. In Karges et al. (2008)²⁸, not feeling pain during the insulin application process was reported as an important to extremely important criterion by 77.8% of the study participants. However, Soares et al. (2010)¹⁹ report pain associated with another constituent other than the act of being “pierced”, which is the temperature at which the

medication is kept, and the fact that the insulin being cold is a cause of pain and discomfort at the application site, even after ten minutes of waiting after removal from the refrigerator, with the Brazilian Society of Diabetes (BSD) recommending the use of 15 to 30 minutes after removal from the refrigerator⁴¹.

It is important to highlight that the BSD guidelines have a specific chapter addressing the safe practices for the preparation and application of insulins. The most important aspects point to the need to know the recommended places for the application (thighs, arms, buttocks, and abdomen - and their specificities during pregnancy); the care with the skin; the rotation of the application points in order to prevent lipodystrophy; the care with the storage and handling of insulin bottles; the homogenization of insulin; the correct application technique (including antisepsis, the correct angle, the proper equipment, the subcutaneous fold, and keeping the needle in the subcutaneous tissue for a few seconds after applying insulin); the association of two types of insulin in the same syringe (only with a fixed needle); and the disposal of equipment in an appropriate place⁴¹. Due to the number of details in each of the aspects pointed out, it is important that health professionals and patients take a closer look at the document and get to know the recommendations laid out in the document.

Table 1. General characteristics of the included studies.

Code	Authorship	Country and year of publication	Sample size	Average/age range	Main difficulties reported
1	Stacciarini et al. ¹⁵	Brazil, 2011.	169	NT*	77% reported difficulties to visualize the dose in the syringe, 29.5% had motor difficulties to aspirate the requested dose and 36.1% prepared a dose different from the prescribed one.
2	Stacciarini et al. ¹⁶	Brazil, 2008.	269	NT*	55% some type of functional alteration (visual deficit, tremor, joint immobility, cognitive deficit, and bedridden), 37% fear of pain and of making errors in the application.
3	Banca et al. ¹⁷	Brazil, 2019.	2	10.5 years old	Follow all the steps of the step-by-step, perform asepsis of the rubber of the insulin bottle, not knowing how to check the validity of the insulin.
4	Reis et al. ¹⁸	Brazil, 2010.	16	NT*	Obtaining correct guidance on insulin use, fear of injection, poor access to supplies.
5	Soares et al. ¹⁹	Brazil, 2010.	23	NT*	Inadequate insulin storage, pain from cold application, correcting the aspirated dose, access to adequate supplies (syringes and needles), fear of administering the application in the abdomen, lack of knowledge of the application angle.
6	Dall'Antonia e Zanetti ²⁰	Brazil, 2020.	34	11 years old	32% pointed out difficulties with the technique; 5.9% with pain, anger, and crying.
7	Simon et al. ²¹	Netherlands, 2014	20	55 years old	Pain, shame to apply in public, difficulties in knowing the right dose.
8	Pimentel ²²	Brazil, 2017.	16	Between 6 e 12 years old	Fear of pain, tenderness at the injection site, aspirating the dose, application to difficult areas such as the arm, difficulty using the syringe, lack of privacy, storage location at school.
9	Flora e Gameiro ²³	Portugal, 2016.	51	Between 12 e 19 years old	Adjusting insulin in the face of capillary blood glucose assessment, where 29.4% of adolescents had a lot of difficulties.
10	Spínola e Silva ²⁴	Portugal, 2017.	10	Between 10 e 16 years old	Pain: "I've been tired of poking my belly for so many years, and sometimes it hurts when I hit a lump or something."
11	Junges e Camargo ²⁵	Brazil, 2020.	10	67.4 years old	Fear, difficulty in storage, and cleaning.
12	Dunning e Manias ²⁶	Australia, 2005.	30	Between 33 e 84 years old	Aspirate the correct dose.

Code	Authorship	Country and year of publication	Sample size	Average/age range	Main difficulties reported
13	Stephenson et al. ²⁷	USA, 2018.	400	NT*	Calculate the correct dose.
14	Karges et al. ²⁸	Germany, 2008.	112	Between 11.6 e 17.6 anos	Logistical difficulties, time, and pain.
15	Berenguera et al. ²⁹	Spain, 2016.	43	NT*	Fear of being pierced with a needle.
16	Péres et al. ³⁰	Brazil, 2007.	24	Between 25 e 76 years old	Correct time to take it, forgetfulness, fear, thinking that it can become dependence.
17	Nishio et al. ³¹	Japan, 2016.	15	NT*	Adjust dose based on need.
18	Cavini et al. ³²	Brazil, 2016.	7	NT*	Adjust the dose/dose control.
19	Vanstone et al. ³³	Canada, 2015.	865	NT*	Feelings of awkwardness, shame, and withdrawal during self-application.
20	Bonnet et al. ³⁴	France, 1998.	85	NT*	Dose adjustment.
21	Maneze et al. ³⁵	Australia, 2019.	18	69,6 years old	Dosage adjustment due to lack of concrete information about this process.
22	Lundberg e Thrakul ³⁶	Thailand, 2018.	27	Between 28 e 70 years old	Deficiencies impacting the self-application of insulin, in the case in question of the article, visual impairment.
23	Niknami et al. ³⁷	Iran, 2018.	347	45 years old	31% reported having a lot of difficulty remembering to take their medication/insulin, while another 64% reported less difficulty. Only 4.9% reported having no difficulty remembering to take their medication/insulin.
24	Bouchi et al. ³⁸	Japan, 2011.	6	64 years old	Visual impairment due to proliferative diabetic retinopathy was given as the main reason for the inability to self-inject insulin in all patients; however, 3 patients had hemiparesis due to stroke, a factor that was also considered a complicating factor.
25	Dias e Junqueira ³⁹	Brazil, 2020.	17	Between 41 e 78 years old	Difficulty in identifying the insulin dosage, mainly because they could not see the syringe. Besides, there was difficulty in handling syringes, needles, and lancets.
26	Nagai et al. ⁴⁰	Japan, 2016.	22	78	Cognitive dysfunctions, paralysis, visual impairments and other impairments impaired insulin self-application.

Legend: NT* - Not testable/Information not available

Source: Prepared by the authors (2021).

Table 2. Difficulties encountered and their reporting frequencies.

Problem	Article codes	Frequency
Pain	2, 4, 5, 6, 7, 8, 10, 14, 15, 16	10
Fear	2, 4, 6, 8, 11	5
Difficulty in knowing the correct dose and/or adjusting it based on capillary blood glucose	7, 9, 13, 17, 18, 20, 21, 24	8
Lack of knowledge about the application technique	3, 4, 5, 6, 8, 24, 26	7
Functional alteration (visual deficit, tremors, joint immobility, cognitive deficit)	1, 2, 22, 24, 25, 26	6
Preparing a different dose than prescribed	1, 5, 12	3
Inadequate storage	7, 8, 11	3
Shame to apply in public	7, 8, 19	3
Difficulty in sanitizing the bottle	3, 11	2
Poor access to supplies	4, 5	2
Difficulty remembering to take insulin at the correct time.	16, 23	2
Difficulty identifying vial information (expiration)	3	1

Source: Prepared by the authors (2021).

Similarly, the link between skin reactions and increased pain propensity is quite recurrent among adults, in whom most of the local reactions of bruising and swelling caused by insulin injection are found to be conducive to both the painful sensation at the time of self-application and after, leading to prolonged pain and then to constantly recapitulating the discomfort of insulin use²¹. Such evocation discourages the continuous use of the medication, being a powerful predisposing factor for non-compliance with what had been instructed, in which, for example, instead of doing the self-application twice a day, in a case instructed by the doctor, performing it only once within 24 hours.

Some studies brought up the difficulty of the participants related to the adjustment of the insulin dose due to the lack of knowledge of the correct dosage in a basal way or to adjust the dose as needed. In this perspective, an observational study conducted by Stephenson et al. (2018)²⁷ with 400 patients showed that the difficulty of knowing the correct dosage is a factor of direct interference in the performance of self-administration, since in addition to corroborating to the inadequate application, it has shown the increase of forgetfulness of at least 1 basal dose per month by other participants.

With that, Maneze et al. (2019)³⁵ and Simon et al. (2014)²¹ explored misinformation as a factor for not adjusting the dose correctly, but difficulties that may be linked to handling the equipment must still be considered, causing the dosage not to be adjusted correctly. Another view regarding the difficulty in dosing is the adjustment according to capillary blood glucose, a fact that also takes into account the process of reading portable measurement devices^{23,27,31,32}.

Ignorance of the processes involved in the application of insulin or the presence of knowledge and inadequate administration procedures are predictive factors, for example, of malabsorption of the medication and both systemic and local complications of DM⁴¹. Thus, Reis et al. (2020)¹⁸ found that the difficulty in self-application occurs mainly at the beginning of insulin use and this function ends up being transferred to another person, usually in the family. This situation becomes, therefore, an obstacle in the continuity of treatment, due to dependence on someone, due to factors such as the applicator not always being able to be present at the correct time of application. However, it was found that, after teaching the technique and demystifying the use of insulin, self-administration can be learned and, along with this learning, the perception of oneself as the center of the insulin therapy process, understanding self-care as the most important therapeutic means.

In line with the most common errors, Soares et al. (2010)¹⁹, when conducting a workshop with twelve insulin users over 60 years of age in their study, noticed that none of the participants knew the correct administration technique, because, even with the use of the proper needle, measuring 12x0.45mm, the application angle used was incorrect, 45°, as opposed to the recommended by BDS, 90°⁴¹; in addition, it was observed that three participants had motor or visual difficulties, including those resulting from chronic complications of DM, which interfered with the performance of insulin self-application skills.

Likewise, in a qualitative research, through conversation circles and semi-structured interviews in a Primary Care Facility (PCF) in São Paulo, it was possible to confirm the erroneous practice of technical knowledge by users in the self-application of insulin, especially regarding the use of syringes, needles, and lancets³⁹.

Regarding problems in the procedure, reported by children who self-administer insulin, in a descriptive study with 34 participants, it was found that 41.1% had difficulties and, therefore, performed the self-application inappropriately, in addition to 17.8% that said they had not learned self-management. In addition, it is necessary to highlight the fact that 44% claimed that they learned to administer insulin from someone in the family - mother, father, or uncles²⁰. In view of these findings, one can infer the incorrect teaching of the application technique, with a possible relationship with the circumstance that a significant number of children have been trained by family members, while the most advisable would be the instruction by a health professional from the Primary Health Care (PHC) or any other type of service that they perform to monitor their illness.

In this study, seven articles cited difficulties in self-application due to functional changes in patients, such as visual impairment, tremors, joint immobility, or cognitive impairment. In this sense, the Brazilian research by Stacciarini et al. (2011)¹⁵ brings, through a cross-sectional study, the perspective of difficulty in visualization as a factor that contributes to an aspiration of erroneous dosage, as well as motor difficulties, such as tremors and joint immobility, to handle the instruments necessary for self-application. With this, it is necessary to highlight the importance of a health professional to assess the skills and limitations of the user that can interfere with the correct and safe practice of self-administration of insulin, encouraging them to develop skills for self-application with disposable syringes, adopting, finally, the best strategy to achieve the desired goals¹⁶. Thus, Stacciarini et al. (2008)¹⁶ had previously demonstrated within the Primary Health Care scenario that some patients reported difficulties in self-application due to physical limitations. It is interesting to mention that diabetes itself is a risk factor for the development of these limitations, especially those resulting from diabetic retinopathy^{42,43}.

Therefore, some articles also analyzed the issue of functional changes impacting self-application through exploratory qualitative studies, such as Lundberg and Thrakul (2018)³⁶ and Dias and Junqueira (2020)³⁹, both bringing visual changes as complicating factors. Corroborating this, it is still known that psychosocial reasons influence the change in the promotion of self-care beyond cognitive issues, a factor that is closely linked to the possibility of loss of body functionality, resulting in fear and aversion of people to the diagnosis of DM^{44,46}.

Although many cases of incorrect aspiration of the insulin dose are due to functional changes, a portion of these cases did not come from them. The correlation between low

education (fewer than 8 years of study) and difficulties in correct aspiration found by Stacciarini et al. (2011)¹⁵ may point to issues of limited access to information related to communicative skills - writing, reading, speaking, and understanding of activities educational activities carried out by health professionals in the role of instructors.

Soares et al. (2010)¹⁹ reported the case of an elderly patient where, for a prescription of 10IU, equivalent to 0.1mL, 1mL was aspirated, a dose ten times higher than the indicated dose, which in the context caused reports of frequent fainting. Participation in a workshop on knowledge and practices in the self-care of insulin users, with the socialization of experiences and the presence of health professionals, was identified as a good strategy to deal with this difficulty. There are reports of incorrect dose aspiration occurring in 16 to 36% of cases, revealing a worrying incidence even though the samples were small^{15,16}.

In this sense, incorrect knowledge about self-administration by children with type 1 DM was also detected in the study by Pimentel (2017)²², in which the lack of knowledge about not being able to reuse syringes, considered a common action, was exposed, in addition to not knowing that the withdrawal of insulin from the refrigerator is recommended to be made 15 minutes before, as directed by BDS⁴¹. Incorrect counting of units in the syringe was also observed, although it is necessary to take into account the numerical and spatial cognitive development in the participants' age group from six to twelve years old. Following this theme, Banca et al. (2019)¹⁷, in a case study with two school-age children, through the teaching of the insulin pen with a toy to simulate the application, noticed the failure to perform the asepsis step of the pen rubber when connecting the needle and forgetting not to count to 10 before withdrawing the needle from the injection site.

Pimentel (2017)²² also addresses insulin therapy involving children in a more closely spaced age range, from six to twelve years and found that the most commonly reported difficulty in the self-administration within his sample of 16 participants was fear of pain, making the correlation with factors that increase this sensitivity to discomfort, such as lipo-hypertrophy. Among adolescents, pain and discomfort associated with insulin use are similarly stated²⁴.

In view of all that has been exposed, it is necessary to emphasize that fear is not always present as a component of pain. In this bias, Stacciarini et al. (2008)¹⁶ showed that 37% of their sample of 269 people claimed not only the fear of pain, but also the fear of making mistakes in self-application, correlating these aspects with lower adherence to treatment and negligence in the behaviors of self-care. Still from this perspective, in a phenomenological approach, it was possible to collect the description of fear linked to other approaches, such as experiencing difficult situations with the use of insulin, due to the proximity to other people with the disease who have already gone through similar situations²⁵.

Regarding the relationship between the apprehension regarding the self-administration of the medication and the treatment time, Reis et al. (2020)¹⁸ address the perspective of fear in the parallel between the beginning of insulin use and after a certain time in use, through excerpts from the speeches of the study participants, highlighting that, at the beginning of the treatment, the administration of the drug by the subcutaneous route represented a challenge, especially for those who were already afraid of needles, making the moment of self-application synonymous with negative feelings, due to such discomfort. On the other hand, after being able to comply with insulin treatment on a regular basis, it was reported that these feelings, in some, were replaced by the idea that self-application is something routine and common, warding off fear. In addition, it has been shown that knowledge about possible harm from untreated DM corresponds to a motivation for adherence to insulin use.

Furthermore, Dall'Antonia e Zanetti (2000)²⁰, in their study, sampled 34 children with type 1 diabetes, aged between ten and twelve years old, a period in which parents usually transfer responsibility for insulin administration in the child to the child with the disease. It was possible to identify that the majority mentioned the fear of starting self-application in the abdomen in two ways: in the factor of insecurity in making a mistake in the technique and in the issue of fearing greater pain when they are administering the insulin.

The action of insulin only presents its biological action preserved if it is stored effectively from its proper transport to its place of conservation inside the refrigerator⁴⁷. In this sense, Soares et al. (2010)¹⁹ and Junges and Camargo (2020)²⁵ bring up impasses about storage based on qualitative studies, evidenced through patient self-reports, demonstrating that the main difficulty or error was inadequate positioning in some parts of the refrigerator. In addition, in work and school environments, this difficulty can be highlighted because the storage of insulin is, in most cases, impossible²².

Rapid-acting insulin should be given just before a meal, unless there is a medical reason not to. Simon et al. (2014)²¹, Pimentel (2017)²² and Vanstone et al. (2015)³³ reported difficulties in performing this procedure in a public environment such as restaurants, parties, social events, schools, with shame being a factor often cited by patients. With the feeling of bullying suffered by children and adolescents, discomfort in the midst of social situations and fear that they will be seen as sick, many patients choose to delay, not perform or perform self-application inappropriately, leading to episodes of acute decompensation.

Banca et al. (2019)¹⁷ described that some children, during the process of preparing the injection for self-application, had difficulties remembering the process of correctly cleaning the insulin vial. This difficulty was improved with the use of a therapeutic toy that simulated the application. Junges e Camargo (2020)²⁵ also reported that one patient had difficulties in performing correct asepsis and, therefore, developed wounds and bruises.

Since the enactment of Federal Law No. 11,347 of 2006, all people living with diabetes, residing in Brazil, and registered in the Unified Health System (*Sistema Único de Saúde* - SUS), have the right to receive, free of charge, the necessary supplies for the proper treatment of diabetes^{48,49}. In disagreement with this procedure, a qualitative study carried out in Brazil by Reis et al. (2020)¹⁸ demonstrated that patients' access to supplies, such as syringes, needles, tapes, reagents and glucometers, does not occur properly, resulting in treatment abandonment or inappropriate reuse of syringes and needles, which may lead to lipodystrophies and consequent hyperglycemia⁵⁰.

Furthermore, Soares et al. (2010)¹⁹ showed that even with the availability of syringes and needles by the PCF, some of these inputs were inadequate for the application of insulin mixtures and the exact application of the prescribed volumes, since they had dead spaces, thus resulting in waste of insulin and suboptimal dosages.

Forgetting to administer insulin was also one of the difficulties pointed out. For Pères et al. (2007)³⁰, the forgetfulness that is often cited as a difficulty may be linked to a refusal or rejection of treatment while associated with feelings of "hate, terror, and bad mood". The study by Niknami et al. (2018)³⁷ identified that, between insulin and other drugs, up to 64% of the participants reported some difficulty or serious difficulty in remembering self-medication.

Daily insulin administration is common in children with type 1 diabetes mellitus, sometimes self-administration⁵¹. A difficulty reported by Banca et al. (2019)¹⁷ in this age group was the weakness in assessing the validity of the insulin vial. The authors attribute this reality to possible poor education on the practice of checking, however they also comment that validity is often managed by parents.

FINAL CONSIDERATIONS

Twelve difficulties were identified in relation to self-administration of insulin. These include fear, pain, difficulty in knowing the correct dose and/or adjusting it based on capillary blood glucose, lack of knowledge about the application technique, functional alteration, preparation of a dose different from the prescribed one, inadequate storage, shame of administering it in public, difficulty bottle hygiene, poor access to supplies, difficulty remembering to administer insulin at the correct time, and difficulty identifying information on bottles.

Based on the results, pain was the most common objection found in the studies, which reflects its relationship with other difficulties, since erroneous insulin self-application techniques even contribute to painful processes. In addition, not only because it is recurrent, but also a component of important rejection, pain affects the rates of adherence to insulin treatment. Considering that the difficulty in knowing the dose and/or adjusting it according to capillary blood glucose was presented in a considerable number of selected studies, a deficiency in health education conducts in PHC is inferred.

The study therefore aimed to expose the difficulties most commonly reported in the literature regarding insulin self-administration, regardless of the division between age groups, educational level, or subjective, social, and cultural issues. Studies considering such clippings could improve the understanding of difficulties, their genesis, and inform specific strategies, since subjective, social, and cultural issues are directly linked to insulin management. It is also necessary to highlight the fact that some difficulties are still little studied and reported in the literature. Due to methodological limitations, it was not possible to make greater identifications and inferences. In view of what was said above, we encourage the development of systematic reviews about the theme.

AUTHORS' CONTRIBUTION

We describe contributions to the papers using the taxonomy (CRediT): All authors contributed in all levels of execution of the protocol. Research, methodology, writing, analysis and editing: Amanda Karen Gonçalves da Costa; João Victor Gregório de Azevedo Pereira; Sérgio Saraiva Forte Júnior. Conceptualization, investigation, analysis and editing: Raphael Raniere de Oliveira Costa. Analysis and editing: Érico Gurgel Amorim.

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