







INSULIN SELF-APPLICATION IN ADULTS WITH DIABETES MELLITUS IN THE HOME CONTEXT: INTEGRATIVE REVIEW

AUTOAPLICAÇÃO DE INSULINA EM ADULTOS COM DIABETES MELLITUS NO CONTEXTO DOMICILIAR: REVISÃO INTEGRATIVA

AUTOUSO DE INSULINA EN ADULTOS CON DIABETES MELLITUS EN EL CONTEXTO DOMICILIARIO: REVISIÓN INTEGRATIVA

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ABSTRACT

Objective: to synthesize the scientific production on the technique of self-administration of insulin in adults with diabetes Mellitus in the home context. Method: integrative review carried out between December 2019 and January 2020, based on the search for publications in journals indexed in PubMed, CINAHL, EMBASE, SCOPUS, Web of Science, LILACS and BDENF using the controlled terms diabetes Mellitus, self-care, insulin, health education, disposable equipment, medical waste disposal and self-administration and their corresponding words in Portuguese, combined with the Boolean operator AND. Original articles published between 2009 and 2019, in English, Portuguese and Spanish, were included, which answered the guiding question: what is the scientific production on the technique of self-administration of insulin in adults with diabetes Mellitus in the home context in the last 10 years? Results: the final sample comprised eight articles. Studies carried out in Brazil by nurses in the context of primary health care predominated. Regarding the insulin self-administration technique, the results were grouped into four axes: pre-administration, insulin preparation technique, administration, and post-administration. Inadequate actions were observed in all axes such as: transport, storage, self-application, reuse of needles and incorrect disposal. Such inadequacies can result in painful procedures, impaired glycemic control, and health complications for the person with diabetes Mellitus. Conclusion: the results showed that the reality of self-administration of insulin in adults with diabetes Mellitus at home can be modified based on health education by nurses, as well as collaborating in the planning of strategic actions to reduce such problems.

Keywords: Self care; Insulin; Diabetes Mellitus; Health Education; Nursing; Primary Health Care.

RESUMO

Objetivo: sintetizar a produção científica sobre a técnica da autoaplicação de insulina em adultos com diabetes Mellitus no contexto domiciliar. Método: revisão integrativa realizada entre dezembro de 2019 e janeiro de 2020, a partir da busca de publicações em periódicos indexados no PubMed, CINAHL, EMBASE, SCOPUS, Web of Science, LILACS e BDENF utilizando-se os termos controlados diabetes Mellitus, self care, insulin, health education, disposable equipment, medical waste disposal e self administration e seus correspondentes em português, combinados com o operador booleano AND. Foram incluídos artigos originais publicados entre 2009 e 2019, nos idiomas inglês, português e espanhol e que responderam à questão norteadora: qual a produção científica sobre a técnica da autoaplicação de insulina em adultos com diabetes Mellitus no contexto domiciliar nos últimos 10 anos? Resultados: compuseram a amostra final oito artigos. Predominaram estudos realizados no Brasil, por enfermeiros no contexto da atenção primária à saúde. Em relação à técnica de autoaplicação de insulina, os resultados foram agrupados em quatro eixos: pré-aplicação, técnica de preparo da insulina, aplicação e pós-aplicação. Observaram-se ações inadequadas em todos os eixos tais como: transporte, armazenamento, autoaplicação, reutilização de agulhas e descarte incorreto. Tais inadequações podem resultar em procedimentos dolorosos, prejuízos no controle glicêmico e complicações para a saúde da pessoa com diabetes Mellitus. Conclusão: os resultados evidenciaram que a realidade da autoaplicação de insulina em adultos com diabetes Mellitus no domicílio pode ser modificada a partir da educação em saúde pelo enfermeiro, bem como colaborar para o planejamento das ações estratégicas para diminuir tais problemas.

Palavras-chave: Autocuidado; Insulina; Diabetes Mellitus; Educação em Saúde; Enfermagem; Atenção Primária à Saúde.

RESUMEN

Objetivo: sintetizar la producción científica sobre la técnica de autoadministración de insulina en adultos con diabetes Mellitus en el contexto domiciliario. Método: revisión integradora realizada entre diciembre de 2019 y enero de 2020, a partir de la búsqueda de publicaciones en revistas indexadas en PubMed, CINAHL, EMBASE, SCOPUS, Web of Science, LILACS y BDENF utilizando los términos controlados diabetes Mellitus, self care, insulin, health education, disposable equipment, medical waste disposal y self administration y sus equivalentes en portugués, combinados con el operador booleano AND. Se incluyeron artículos originales publicados entre 2009 y 2019, en inglés, portugués y español, que respondieron a la pregunta orientadora: ¿cuál es la producción científica sobre la técnica de autoadministración de insulina en adultos con diabetes Mellitus en el contexto domiciliario en los últimos 10 años? Resultados: la muestra final estuvo formada por ocho artículos. Predominaron los estudios realizados en Brasil por enfermeros en el contexto de la atención primaria de salud. En cuanto a la técnica de auto aplicación de insulina, los resultados se agruparon en cuatro ejes: antes de la aplicación, técnica de preparación de insulina, aplicación y post aplicación. Se observaron acciones inadecuadas en todos los ejes, tales como: transporte, almacenamiento, auto aplicación, reutilización de agujas y disposición incorrecta. Tales deficiencias pueden resultar en procedimientos dolorosos, deterioro del control glucémico y complicaciones de salud para las personas con diabetes Mellitus. Conclusión: los resultados mostraron que la realidad de la insulina autoadministrada en adultos con diabetes Mellitus en el hogar puede modificarse a partir de la educación en salud brindada por enfermeros, además de ayudar a planificar acciones estratégicas para reducir dichos problemas.

Palabras clave: Autocuidado; Insulina; Diabetes Mellitus; Educación en Salud; Enfermería; Atención Primaria de Salud.

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INTRODUCTION

Diabetes Mellitus (DM) is a chronic non-communicable disease (CNCD), characterized by high glycemic levels, when decompensated.¹ To maintain quality of life, treatment should include self-care activities with consideration of eating habits, regular physical activity, glycemic self-monitoring, adherence to prescribed pharmacological therapy and essential foot care.²

Insulin is the drug of choice for the treatment of type 1 diabetes Mellitus (DM1), and is also used in people with type 2 diabetes Mellitus (DM2).¹ The administration of this drug is part of the list of practices to be developed by the person with DM or by his/her caregiver for good glycemic control.³ The application of insulin, however, adds complexity to the treatment, due to the steps that involve this procedure, and it is necessary for the person, their family members or caregivers to develop skills to do so.⁴

The steps of self-administration of insulin at home are storage, transport, drug application technique, glycemic self-monitoring, and disposal of sharps residues. These steps, when performed correctly, reduce the incidence of undesired outcomes such as hypoglycemia, hyperglycemia, and lipodystrophy.^{1,5}

The care for people with DM, in the public services of the Sistema Único de Saúde (SUS), is part of the daily work of nurses in primary health care (PHC), in direct and indirect care, in the planning and development of promotion actions, prevention and health education. In the Nursing consultation, the nurse has a prominent role in educational actions, especially aimed at building the autonomy of the individual who becomes the protagonist of actions and decisions that involve their own health condition.^{3,6}

However, in the current scenario of the health work process, due to the high demand of health services for punctual and unscheduled consultations, especially at times of worsening DM, it makes health education actions difficult by healthcare workers and by nurses.⁷⁻⁸

In addition, it is observed that there are many published studies that aim to analyze the technique of insulin administration, the knowledge of people with DM and educational groups about the administration of the drug, however, in the process of reviewing the literature on the subject, no studies were found of integrative review.

Thus, the synthesis of this knowledge makes the present study valuable, since the integrative review studies, by synthesizing the knowledge about a given problem, allows the healthcare professional to have a clinical practice based on scientific evidence.⁹

Based on the repercussions that DM and its treatment generate in people's lives, it is considered important to identify how self-administration of insulin is developed in adults at home, since this knowledge can help healthcare professionals in health education actions that respond to people's real needs. Therefore, this research aims to synthesize the scientific production on the technique of self-administration of insulin in adults with diabetes Mellitus in the home context. In addition to the drug application technique, the insulin transport and storage process and the handling of sharps residues at home are analyzed in the studies.

METHOD

An integrative literature review study, which gathers and synthesizes research results.¹⁰ The protocol for conducting this review included the following steps: formulation of the question; search in the literature for primary studies; data extraction; critical evaluation of included studies; analysis and synthesis of the review results; and presentation of the integrative review.¹⁰

The included studies were chosen based on the use of the PICOT acronym (P: population; I: intervention; C: comparison; O: result; and T: time).¹⁰ For this review, adults with DM1 or DM2 were designated as population; intervention of interest, self-administration of insulin at home; comparison, the correct process of administration of this drug described in the literature; result, good practices; and time, the last 10 years. Thus, the guiding question elaborated was: what is the scientific production on the technique of self-administration of insulin in adults with diabetes Mellitus in the home context in the last 10 years?

Access to the databases took place between December 2019 and January 2020. Searches for primary studies were performed in the following databases: PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Excerpta Medica dataBASE (EMBASE), SciVerse Scopus (SCOPUS) and Web of Science (WoS). The Latin American and Caribbean Health Sciences Literature (LILACS) database and the Nursing database (BDENF) were accessed through the Virtual Health Library (VHL).

The inclusion criteria established were studies published in Portuguese, English, and Spanish, available in full online, whose participants were 18 years of age or older who performed self-administration of insulin at home with a syringe and needle device. The reference used to compare good practices in the administration process was the Brazilian Diabetes Society (BDS) Guideline,¹ therefore, studies were considered that presented at least one of the following steps recommended by

the BDS: transport and storage of insulin, technique for the administration of this drug and the management of sharps residues at home.

Studies published between 2009 and 2019 were considered. This time frame was due to the increase in the prevalence of people with DM worldwide, in which in 2009 there were about 285 million people with DM, whose number jumped to 463 million in 2019, which represents about 9% of the population aged 20 to 79 years and is also one of the biggest health problems today.^{1,11} Gray literature, dissertations, theses, book chapters, letters, comments and studies of literature reviews were excluded (integrative and narrative). In addition, research in which the insulin self-administration technique was performed with a pen, as well as research developed with children, adolescents, and pregnant women.

The following combinations of descriptors were used for the search: 'diabetes Mellitus' AND 'self-care' AND 'insulin'; 'diabetes Mellitus' AND 'self-care' AND 'health education'; 'diabetes Mellitus' AND 'disposable equipment' AND 'insulin'; 'medical waste disposal' AND 'diabetes Mellitus' AND 'insulin' and 'diabetes Mellitus' AND 'insulin' AND 'self-administration', which are contained in the Health Sciences Descriptors (DeCS) and the Medical Subject Headings Database (MeSH). Their correspondents in Portuguese with the Boolean operator AND were also used to search the VHL.

The studies identified in the databases were imported into the Rayyan[®] software,¹² for organization and verification of duplicate references, as well as for the selection of studies, through independent evaluation, by two authors, and subsequent comparison of the results found and conflict resolution by a third author to ensure the inclusion of texts that answered the guiding question of the review and met the pre-established inclusion criteria.

Data from primary studies were descriptively organized in an instrument created by the authors in Microsoft Office Word. The instrument contained information on the title of the article, country of origin, area of expertise of the authors, year of publication, study design and level of evidence. For the evaluation and standardized categorization of studies, the hierarchy system of levels of evidence was used: level 1 - meta-analysis of multiple controlled studies; level 2 - individual study with experimental design; level 3 - study with quasi-experimental design; level 4 - study with a non-experimental design;

level 5 - case reports or data obtained in a systematic way; and level 6 - opinion of authorities or expert committees.¹³

In addition, the instrument had questions about the objectives of the studies, the participants, the data collection technique, the interventions used for the administration of the drug, the main results, and conclusions. For the organization of data on insulin therapy, all data related to the transport and storage of insulin, the drug administration technique, and the management of sharps residues at home were described, as stated in the studies, following the steps of the BDS.¹ This organization of data allowed for comparison according to similarities and differences in relation to the review question. The findings were then analyzed and grouped into thematic axes according to the steps for self-administration of insulin as recommended by the BDS.¹

RESULTS

The search in databases covering journals published between 2009 and 2019 resulted in 2,816 localized studies. Five-hundred and twenty-three studies were excluded because they were duplicates, resulting in an initial sample of 2,293 articles. Figure 1 presents the researched databases and the respective numbers of studies located.

Initially, 2,265 studies were excluded, as they dealt with the development of software for self-care, insulin pump, closed circuit, nutritional aspects and physical activity, guidance to health-care professionals, educational programs, use of the insulin pen and psychosocial aspects. In addition, studies whose population

Figure 1 - Databases and studies identified in absolute numbers. Ribeirão Preto, SP, Brazil, 2020 (n=2,816)

Database	Studies (n)
PubMed	1028
CINAHL	62
Web of Science	127
BVS	190
EMBASE	129
SCOPUS	1280
Total	2816

Source: Authors' database, extracted from Rayyan (2020).

consisted of women in the pregnancy-puerperal cycle, adolescents and children were excluded.

The final selection resulted in 28 articles for full reading, of which 20 were excluded: eight because they had people who used insulin pen as the study population; seven for not addressing aspects of the insulin self-application technique, transport, storage, or disposal of sharps; three because they had children or adolescents as participants; and two that did not answer the guiding question.

Thus, the search in the literature for answers to the question about the technique of self-administration of insulin in adults with DM in the home context resulted in the selection of eight studies, as shown in Figure 2, according to the recommendations of the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA).¹⁴

Regarding the eight selected studies, six (75%) were written by nurses; one (12.5%) by a nurse and one by a physicist; and another (12.5%) did not have the author's professional category revealed. Two publications (25%) were identified in the year 2011 and the years 2009, 2012, 2016, 2017, 2018 and 2019 had one publication each.

Of the articles analyzed, four (50%) were developed in Family Health Strategy units (FHS), two (25%) in basic health units (BHS), one (12.5%) in a diabetes reference body and hypertension and another (12.5%) in a hospital. It is worth noting that in three studies (37.5%) the administration of insulin was performed by family members, neighbors and/or caregivers. In addition, seven studies (87.5%) applied questionnaires to obtain data and only one (12.5%) performed the direct observation of the procedure.

In order to facilitate the identification of the studies that make up the final sample of this review, Figure 3 was created to summarize them according to the title, arranged in alphabetical order. It presents the following information: authors, data collection technique, country of origin, year of publication, level of evidence and study population.

As established by the BDS regarding good practices in the insulin administration process,¹ it was decided to group the topics covered in the studies in the following thematic axes: pre-administration, insulin preparation technique, administration, and post-administration, as it can be seen in Figure 4.

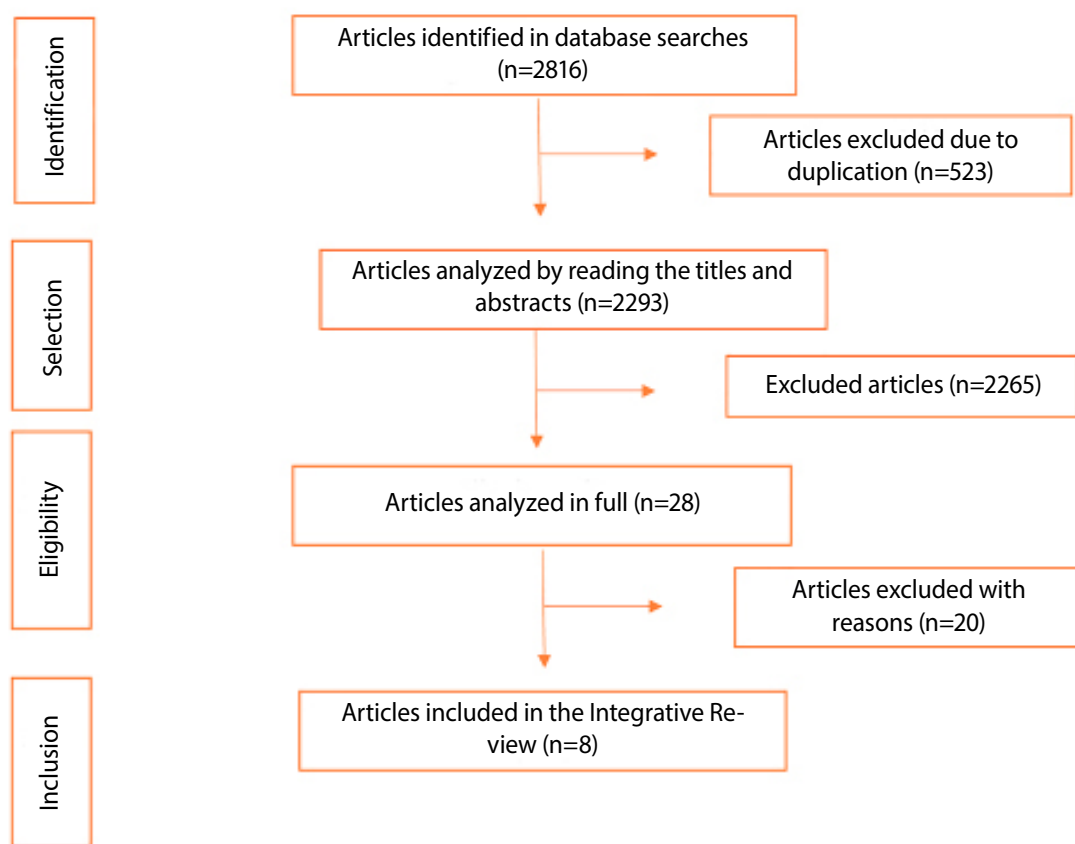


Figure 2 - Flowchart of the study selection process, adapted from PRISMA. Ribeirão Preto, SP, Brazil, 2020

The BDS¹ does not recommend the reuse of syringes and needles, however, some studies^{15-16,18,20} addressed the action and, therefore, it was decided to discuss it in the present research.

DISCUSSION

Pharmacological management includes behaviors that integrate care in the healthcare service and at home.²³ Thus, the contents addressed were chosen because they constitute necessary knowledge for the pharmacological management of DM at home. In addition, insulin is considered a potentially dangerous drug and, when not transported, stored, and administered correctly, it can make glycemic control unfeasible, with the risk of considerable damage to the patient's life.¹

In the 'pre-administration' theme, the most common way of transporting insulin was in a Styrofoam box with ice, followed by transport in a bag and, less commonly, in Styrofoam without ice. It should be considered that, in some municipalities, insulin was only delivered if there was Styrofoam with ice to transport it.¹⁵⁻¹⁶ A study in primary health care (PHC) showed that about 93% of the participants carried insulin vials in Styrofoam with ice and, of these, almost half in direct contact with ice. However, it is known that direct contact with ice can freeze the drug and cause the loss of its effect.^{1,24}

The correct storage of the drug preserves its physical-chemical characteristics and, therefore, its action.^{1,25} However, one of the places mentioned for storage was the refrigerator door, followed by the lower shelf, freezer, and inside small boxes of styrofoam.¹⁵⁻²⁰ It is worth mentioning that the

Figure 3 - Characteristics of the studies that addressed the steps of self-administration of insulin at home. Ribeirão Preto, SP, Brazil, 2020

Authors	Data collection technique	Year; Country	Evidence level	Population
Barros AE, Souza EM ¹⁵	Application of questionnaire	2011 Brazil	IV	80 people with DM registered in the Hiperdia of a municipality in the interior of Minas Gerais
Stacciarini TSG, Caetano TSG, Pace AE ¹⁶	Application of a questionnaire and direct observation of the procedure	2011 Brazil	IV	169 people with DM, distributed in 37 FHS units in a municipality in Rio Grande do Sul
Pereira FGF, Diógenes MAR, Ataíde MBC, Mendonça Júnior JO, Leal DE, Xavier ATF ¹⁷	Application of questionnaire	2016 Brazil	IV	87 people registered and monitored at the FHS in the city of Fortaleza - CE
Diógenes MAR, Souza AKP, Cavalcante IZ, Lopes LCO, Rebello MMB ¹⁸	Semi structured interview	2012 Brazil	IV	55 people with DM2 who were being followed up at a reference body for diabetes and hypertension in Ceará
Yosef T ¹⁹	Application of questionnaire	2019 Ethiopia	V	245 people with DM1 followed up in a referral hospital in Ethiopia
Marques CR ²⁰	Semi-structured interview with open and closed questions	2017 Brazil	IV	24 patients using insulin in the city of Porto Alegre-RS
Estequi JG, André SCS, Souza RS, Figueiredo RM ²¹	Application of questionnaire	2018 Brazil	IV	98 individuals with DM, insulin users, from a municipality in the interior of São Paulo
Stacciarini TSG, Pace AE, Haas VJ ²²	Directed interview with closed and structured questions	2009 Brazil	IV	169 people with DM who used insulin in a municipality of Minas Gerais

refrigerator door changes its temperature every time it is opened, and the freezer, in turn, can freeze the drug and inhibit the desired action. It is important to note that authors found that some participants, despite carrying out the transport and storage incorrectly, stated that they had received prior guidance on storage and transport from health professionals.¹⁵

Also in this thematic area, 100-unit (IU) syringes with a removable 13 mm needle are available on the market, but which have residual space for up to 10 IU of insulin, which can lead to drug waste, make the association of two types of insulin unfeasible or favor inadvertent intramuscular (IM) administration, therefore not being recommended for home use.¹ Studies have shown that participants use a syringe coupled with a needle^{17,20-21}, which are found in models of 100, 50 and 30 IU, which are distinguished by the grading scale, respectively, 2 in 2 IU, 1 in 1 IU and ½ in ½ IU, allowing the aspiration of even, odd and fractionated doses.¹ For this reason, it is important to know the material that is being used.

As some people may have difficulties to visualize the graduation scale,¹⁷ professionals should be aware of this

problem throughout the health education process, since about 9% of the world population between 20 and 79 years old live with DM.¹ The senescence process reduces visual acuity and, in addition, increases complications such as diabetic retinopathy, which make it difficult to read and, therefore, to identify the insulin vial and the graduation printed on the syringe.^{1,26}

Self-monitoring of blood glucose is recommended before the main meals and two hours after, because, based on the interpretation of the results, it is possible to reduce cases of hypoglycemia and ketoacidosis, for example.¹ However, although people have the glucometer, strips are missing reagents in the Sistema Único de Saúde (SUS) to perform the test and the frequency of performing the procedure was at the times prescribed by the doctor¹⁷ or once a week.²⁰ Similar results were described in another study, in which only 47% of the participants performed this procedure about five to seven times a week, that is, at the frequency recommended by the medical professional.²⁷

In the theme 'insulin preparation technique', it is important to wash your hands. As the skin, due to its extension and

Figure 4 - Topics covered in the articles according to the steps for self-administration of insulin recommended by the Brazilian Society of Diabetes, Ribeirão Preto, SP, Brazil, 2020

Thematic axes	Actions recommended by the BDS	Studies
Pre-administration	Domestic transport of insulin vials	15-16
	Insulin vial storage	15-19
	Knowledge of supplies: syringes with fixed or removable needles	17, 20-21
	Knowledge of inputs: needle length	-
	Blood glucose monitoring	17, 20
Insulin preparation technique	Sanitization of hands	16, 18, 21
	Skin antisepsis with 70% alcohol and wait for it to dry	15-16, 21
	Performing the subcutaneous fold	16, 21
	Removing Insulin from the Refrigerator Before Applying	-
	Insulin vial homogenization	16-18, 21
	Disinfection of the rubber cover	18, 21
	Injection of air corresponding to the prescribed dose	16, 18, 21
	Checking for bubbles	18, 18, 21
	Checking the prescribed dose	15, 18, 21-22
Insulin administration	Needle insertion angle	16, 18, 21
	Needle maintenance after drug administration	21
	No on-site massage	19, 21
	Knowledge of insulin injection sites	17, 19
	Carrying out the rotation	15-19
	lipodystrophy	15-17
Post-administration	Family member/neighbor performs the technique	15-16, 18
	Disposal of sharps waste	16-18, 20

location, is in constant contact with particles in the environment, cleaning with water, soap and mechanical friction is capable of reducing resident microorganisms and eliminating transient ones. hands was frequent among those who applied insulin,^{16,18,21} being able to reduce the transmission of infections by preventing contamination of the materials used.²⁹ However, cleaning with alcohol at a concentration other than 70%^{18,21} was also described, and it is worth noting that this is not a viable alternative, as alcohol should only be used to sanitize hands when it is at a concentration of 70% and, in addition, only when the hands are not visibly dirty.²⁸ A gap identified involves removing the insulin vial from the refrigerator about 15 to 30 minutes before using it, as none of the selected studies discussed this topic, which tends to generate a procedure painful and more irritation at the administration site.¹ Another important aspect is the homogenization of Neutral Protamine Hagedorn (NPH) insulin,^{16-18,21} which guarantees the expected response of the drug, but, for that, it must be performed with 20 gentle inter-palm movements before use, so that the components mix and form a milky liquid.^{1,29} In carrying out the homogenization,¹⁸ in two studies the participants did not perform this procedure¹⁷⁻¹⁸ and in most of the studies people promoted vial agitation^{16-18, 21}, which generates air bubbles and consequent error in the aspired dose.

Disinfection of the rubber cover^{18,21} is important to reduce the number of microorganisms on an inanimate surface, through the use of chemical agents such as 70% alcohol. Studies have shown cleaning the insulin vial and also the needle used,¹⁸ which is not recommended. In addition, those who performed the disinfection used alcohol in a concentration different than 70%.²¹ As with hand hygiene, disinfection prevents contamination of the needle when puncturing the rubber cap, so that the omission of this step or the use of alcohol sold in supermarkets can increase the risk of infectious diseases.²⁹

When performing aspiration of insulin with a syringe, it is recommended to introduce a volume of air in the medication vial corresponding to the prescribed volume.¹ However, this was a recurrent error^{16,18,21}, as most did not perform air injection, which can generate a vacuum inside the vial and, therefore, make it difficult to aspiration of the drug. Research carried out with the elderly found that 74% of them also did not perform this procedure or did it incorrectly.²⁶

In addition, after aspirating the drug, one should check for bubbles^{16,18,21} and check the prescribed dose,^{15,18,21-22} to avoid difficulty in administration or risk of administering an incorrect dose.^{1,25} It is noteworthy that those who assess whether there are bubbles, for the most part, aspirate them and return them to the vial.^{18,22} However, with regard to

dose verification, studies revealed administration of up to 38 IU higher than prescribed and 10 IU lower than prescribed, which makes glycemic control unfeasible.²² On the other hand, the autonomy achieved by some people with DM allows the correction of the dose to be applied based on the blood glucose value/carbohydrate count.¹⁵

In the thematic axis 'administration of insulin', studies have shown that antisepsis of the area is frequent before insulin administration.^{15-16,30} This procedure, as well as hand hygiene and disinfection of the rubberized cap, is capable of reduce the transmission of infections, however it should be considered that some people use substances other than 70% alcohol, such as saline solution, damp cloth with water, cotton and tap water, hydrogen peroxide with cotton, dry cotton, water and soap, cloth dry and with alcohol sold in the supermarket, which does not guarantee the reduction of the transient microbiota.^{15-16,21} Only one study²¹ reported that individuals wait for the alcohol to dry before administering the dose, which is an essential conduct to reduce pain.¹

The skin fold should preferably be performed with the thumb and index finger and undone only after the needle is withdrawn.¹ However, although studies have identified the performance of the subcutaneous fold^{16, 21} as a routine, they pointed out the habit of undoing it during administration. of insulin or before needle withdrawal.²¹ The skin fold aims to highlight the subcutaneous tissue (SC) and ensure that insulin is not administered intramuscularly (IM), which has rapid absorption and increases the chance of hypoglycemia.²⁶

After applying the insulin, it is important to wait five seconds before withdrawing the syringe. A study showed that people did not wait the recommended time,²¹ which can cause drug leakage.^{1,25} Research carried out in southern Brazil showed that only 12.5% of the participants waited the recommended time.²⁴

In addition, a study that analyzed self-care in elderly people with diabetes revealed that 31.1% of respondents perform massage after administering insulin, which is not recommended, as it increases the speed of insulin absorption and can cause hypoglycemia. It is considered that the studies included in this review agreed not to recommend massage,^{19,21} reinforcing what was found in another research, in which about 67% of the participants also did not perform it.²⁴

As well as syringes, the market offers needles of different sizes, which is a determining factor for performing the SC fold and choosing the angle of administration.¹ The habit of performing the administration at an angle of 90° was identified,^{16,18, 21} although there is no evidence of prior

knowledge regarding the size of the needle being used, nor the person's body mass index (BMI), although both are decisive factors to avoid IM administration in individuals with little SC tissue.¹ Furthermore, administration at an angle of 15° can generate intradermal administration (ID).¹⁸ It is recommended to use an angle of 90° for needles of 6 and 8 mm and of 45° for those of 13 mm.¹

Rotating insulin administration sites¹⁵⁻¹⁹ is essential for better glycemic control and also to prevent the onset of lipodystrophy. The places available for administration must be divided into small quadrants and, between one administration and another, a distance of 1 cm must be maintained, following clockwise, and it is important to avoid this place for up to 14 days.¹ However, despite claiming to rotate,¹⁶⁻¹⁸ the participants mentioned preference for two places, abdomen and lower limbs, and in another study, rotation was not found.¹⁵ The abdomen is considered the first place of choice and also the region that presents the most lipo-hypertrophy in 90% of cases.³⁰

Lipo-hypertrophy, the most frequent type of lipodystrophy,^{15,17} is characterized by the accumulation of fat forming nodules under the skin, with the main risk factor being the duration of insulin use and the frequency of administration in a given location. At these sites, there is reduced sensitivity to pain, as well as slower and irregular absorption of the drug. This can cause hyperglycemia, hypoglycemia, and fluctuations in glycemic values even with the correct treatment.^{1,24}

Some people do not carry out the administration^{15-16,18} due to fear/insecurity and delegate this task to family members, neighbors, or caregivers. The factors associated with this difficulty/resistance are age and people with little education.³ In addition, with increasing age, physical and cognitive limitations also increase, at the same time that visual acuity decreases, which can prevent the handling of materials.^{3,15} It should be considered that the presence of the family member in the pharmacological management of the disease has been shown to be positive in the treatment of the disease, in which there was greater adherence to the prescribed medication, diet control and monitoring of the glycemia, and the healthcare professional should include it in the health education process.³¹⁻³²

In the 'post-administration' axis, needles, lancets, and insulin vials are considered sharp and need to be stored in a container with rigid walls and a cap; after filled, they must be delivered to the health unit, which will be responsible for disposing them correctly.^{1,20} Studies demonstrate the improper disposal of these materials in domestic waste^{16-18,20} and also the landfill of waste in the backyard.¹⁸ Research concluded that more than 50% of people who discarded sharps in household waste stated that they had received information

from a health professional about the correct way to do this disposal.^{24,33} It is important to note that incorrect disposal can lead to accidents with sharps and contaminate the person with hepatitis B or C or with the human immunodeficiency virus (HIV), especially recyclable and garbage collectors, family members or children.³³

Although it is not recommended to reuse syringes and needles,¹ reuse is frequent, especially in countries with limited resources.^{15-16,18,20} Studies report that people reused the syringe at least once,^{15-16,18,20} with cases of reuse have been reported up to 60 times.¹⁵ These are worrying results, which corroborate other studies in which this practice was identified as routine.^{24,33} Reuse may be motivated by insufficient distribution or lack of supplies in some municipalities.²⁴

Research has shown that reuse can increase the risk of infection by *Staphylococcus spe*, in addition, people who adopted this conduct had more bruises, lipo-hypertrophy, erythema and edema at the site.³³ However, it is noteworthy that the Ministry of Health considers reuse up to eight times, as long as care is taken to avoid contamination.³²

As limitations of the study, the large number of publications found initially stands out, which may be related to the choice of the Health Education descriptor. Furthermore, it is possible that some references available in databases not included in this review have been neglected. Furthermore, it should be considered that, of the eight studies selected, seven were based on referred information, that is, collected through instruments and interviews, and only one carried out the direct observation of the procedure, which may not represent the reality of insulin therapy at home.

This study proved to be important, as it made it possible to know the inappropriate practices in the self-administration of insulin. Such knowledge can support Nursing care, especially in health education actions, so that it can dialogue with the person in the face of the main difficulties encountered, in which Nursing must continue to invest efforts to overcome the decontextualized care of living conditions. of people.

CONCLUSION

The present study showed that inadequate practices still occur in the self-administration of insulin at home, such as: inadequate storage, reuse of needles, use of syringes with attached needles and incorrect disposal. Few studies have been carried out on this topic in other countries, perhaps because they use other administration equipment, such as the insulin pen. In addition, the predominance of studies developed through interviews reveals the need for new observational

studies and with other methodological approaches on this topic, such as intervention studies.

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