Esc Anna Nery 2018;22(3):e20170387

RESEARCH | PESQUISA

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Construction and validation of a low-cost simulator for training patients with diabetes mellitus and/or their caregivers in insulin administration

Construção e validação de simulador de baixo custo para capacitação de pacientes com diabetes mellitus e/ou de seus cuidadores na aplicação de insulina

Construcción y validación de simulador de bajo costo para capacitación de pacientes con diabetes mellitus y/o de sus cuidadores en la aplicación de insulina

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Abstract

Objective: The objective of this study was to construct and validate a low-cost simulator to train diabetes mellitus patients and their caregivers on the administration of insulin. **Method:** Action research study with a qualitative approach, through a validation methodological study. **Results:** A low-fidelity simulator was constructed with the areas recommended for insulin administration adapted to allow skill training. Validation was done by nine experts on the subject. **Conclusions:** The prototype has low cost and greater anatomical functional fidelity than the models currently available in the market. **Implications for practice:** The simulator developed can be used by health professionals, caregivers or by the patients themselves as a tool in the training for insulin administration. Its use may favor the identification of critical points related to the application technique, allowing the planning of more directive and effective educational interventions.

Keywords: Simulation; Low-cost technology; Teaching; Insulin; Health education.

Resumo

Objetivo: Este estudo teve como objetivo a construção e validação de um simulador de baixo custo para uso na capacitação de pacientes com diabetes mellitus e de seus cuidadores para a aplicação de insulina. **Método:** Pesquisa-ação de abordagem qualitativa e estudo metodológico de validação. **Resultados:** Foi construído um simulador de baixa fidelidade com as áreas recomendadas para aplicação de insulina adaptadas para permitir o treinamento da habilidade. A validação foi feita por nove experts no assunto. **Conclusões:** O protótipo apresenta baixo custo e maior fidelidade anatômico funcional do que os modelos atualmente disponíveis no mercado. **Implicações para prática:** O simulador desenvolvido pode ser utilizado por profissionais da saúde, cuidadores ou pelos próprios pacientes como ferramenta na capacitação para aplicação de insulina. Seu uso pode favorecer a identificação de pontos críticos relacionados a técnica de aplicação, permitindo o planejamento de intervenções educacionais mais diretivas e eficazes.

Palavras-chave: Simulação; Tecnologia de baixo custo; Ensino; Insulina; Educação em saúde.

Resumen

Objetivo: Este estudio tuvo como objetivo la construcción y validación de un simulador de bajo costo para uso en la capacitación de pacientes con diabetes mellitus y de sus cuidadores para la aplicación de insulina. **Método:** Investigación-acción de abordaje cualitativo y estudio metodológico de validación. **Resultados:** Se ha construido un simulador de baja fidelidad con las áreas recomendadas para la aplicación de insulina adaptadas para permitir el entrenamiento de la habilidad. La validación fue hecha por nueve expertos en el tema. **Conclusiones:** El prototipo presenta bajo costo y mayor fidelidad anatómica funcional que los modelos actualmente disponibles en el mercado. **Implicaciones para la práctica:** El simulador desarrollado puede ser utilizado por profesionales de la salud, cuidadores o por los propios pacientes como herramienta en la capacitación para aplicación de insulina. Su uso puede favorecer la identificación de puntos críticos relacionados con la técnica de aplicación, permitiendo la planificación de intervenciones educativas más directivas y eficaces.

Palabras clave: Simulación; Tecnología de bajo coste; Enseñanza; Insulina; Educación en salud.

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Submitted on 12/22/2017.
Accepted on 05/25/2018.

DOI: 10.1590/2177-9465-EAN-2017-0387

INTRODUCTION

Compliance to treatment is a challenge for patients with diabetes mellitus, their families and health professionals.[1] Currently, it is estimated that the world population with diabetes mellitus is 415 million, with the prospect of reaching 642 million in 2040.[2] The chronic nature of the disease and the severity of the complications resulting from its inadequate control make diabetes mellitus expensive, not only for the affected individuals and their families, but also for the health system.[3] As a result of chronic complications, patients with diabetes mellitus have high morbidity and mortality, with a reduction in life expectancy[4] when compared to the non-affected population.

To minimize complications since the diagnosis, patients with diabetes mellitus and their caregivers should get some knowledge and develop skills for self-care and insulin administration, a fact that requires participation of all those involved, with emphasis on health professionals.[5] These professionals should, from a dialogic perspective, negotiate priorities, monitor compliance, and motivate patient participation in self-care.[6]

Insulin is the drug of choice for patients with type 1 diabetes mellitus, but many patients with type 2 diabetes mellitus also benefit from its use.[7] In patients with type 2 diabetes mellitus, insulin should be initiated when the combination of non-pharmacological and oral drug therapies is not effective for glycemic control. Its onset demands a rigorous titration of doses, based on the results of capillary blood glucose.[3]

Insulin can be classified as a potentially dangerous medication because it poses a risk of harm when its use is not adequate.[8] The inclusion of insulin in the treatment of patients with diabetes mellitus adds complexity to care self-management. Therefore, it is fundamental to understand and overcome any barriers that may compromise treatment success.[9]

Undesirable outcomes can be avoided with educational actions aimed at preventing injuries and maintaining quality of life.[4] The training of patients with diabetes mellitus, and of their caregivers, for insulin administration is a health educational challenge, and demands the development of feasible and accessible solutions.[10] Short time is spent by the health team to improve the technique of insulin self-administration with patients; the focus of care is usually directed to dose adjustments of the medication in face of laboratory findings and home registry of capillary blood glucose.[11]

Self-care monitoring in the evaluation of educational outcomes in the short-, medium- and long-term should be the focus of healthcare professionals' actions.[4] The incorrect application technique can result in serious complications such as hypoglycemia, hyperglycemia and lipohypertrophy.[12,13] Other problems related to an inadequate technique of administration of the drug are also frequent, such as the injection in an area that is not recommended, use of improper application devices, no use of a skin fold, no rotation of injection site, among others.[14]

However, the complexity and the amount of information provided by health professionals to patients when insulin is started makes it understandable that some instructions are not assimilated by patients and caregivers.[15] In addition, essential aspects of the procedure, such as injection site rotation, correct needle angulation to the tissue, can often not be mentioned by professionals during the approach to patients and their caregivers.

To minimize these possibilities, regardless of the strategy adopted for the training, demonstrations performed by the patients to the professionals regarding the insulin administration technique need to be performed periodically, in order to identify knowledge and skill gaps.[16] Thus, clinical and patient simulations may be the most appropriate means to be used.

Clinical simulation favors the identification of critical points in the execution of skills and knowledge. It can be considered an effective, relevant and innovative tool to implement, teach or update procedures.[17] It can be defined as an experience where the singularities of a given real situation are mimicked, aiming at its better understanding, achievement and management. It is a strategy that uses an artificial environment, recreating and anticipating a real situation, with the aim of practicing, learning, evaluating, testing or developing the understanding of human systems or actions.[18]

Clinical simulation can be classified as of high, medium, or low fidelity. The term fidelity describes the realism of experience, and is not related to simulators robotization.[19] Fidelity and technology should be analyzed separately.[20]

Regarding the classification of the simulators, those of low fidelity have little technology integration and are intended for learning and practice of simple abilities, and can be exemplified by the anatomical pieces, like those used in the training of injection administration. Meanwhile, those of medium and high fidelity are characterized by the integration of increasing levels of technology, which allow the provision of physiological responses to the interventions practiced.[21]

The selection of the simulator should be preceded by the definition of the learning objective to be achieved.[22] Cadavers were previously considered gold standard when used as simulators for training surgical skills.[23] However, despite their anatomical fidelity, the functional fidelity of cadavers can vary according to the degree of preservation of the tissues, which can compromise the realism of the experience.[24]

In this context, since the level of comprehension and apprehension of information in training based on fundamentally verbal orientations is low, simulation should be explored as a learning-teaching tool that supports the problematization of abstract concepts, taking them to the concrete field, which may promote understanding of the insulin administration process for patients and/or caregivers. A study with parents of children with type 1 diabetes mellitus used clinical simulation to enable parents to act in situations of hypoglycemia, hyperglycemia and seizures. The possibility of practicing skills in the simulator, before it was necessary to develop them in their children in an emergency situation, reduced the level of parents' anxiety significantly.[25]

Also regarding the use of simulators to train patients, it was demonstrated that the simulation has assisted patients and caregivers in the development of skills for the care of children on mechanical ventilation in the home environment,[26] for the performance of intermittent urinary catheterization,[27] among others.

However, despite the successful experiences reported, clinical simulation is not a widely disseminated teaching strategy among health professionals to train patients and caregivers. Its access faces obstacles ranging from the knowledge of professionals to its expensive costs and difficulty of access. Even low-fidelity simulators are considered expensive within some economic and sociocultural realities. Low cost, realism and clinical relevance are desirable characteristics for the use of a patient training simulator.[28] A study carried out in Africa with the objective of developing and evaluating a low-cost portable simulator for the training of midwives and nurse midwives in rural areas of the country showed that such investments are quite effective.[29]

In this regard, to minimize this situation and propose more effective teaching strategies for patients using insulin and/or their caregivers, this study aims to develop, test and validate a low-cost simulator for the training of diabetes mellitus patients and/or their caregivers for the application of insulin.

MATERIALS AND METHODS

This study was carried out in two phases: Phase 1 - Action research, with an applied, exploratory and qualitative approach,[30] and Phase 2 - Methodological study for a simulator validation.

Phase 1: Action research

Action research is characterized by a systematized process, in which practitioners try, through the research, to make transformations in their own practices.[31] Research and practice, as dichotomous actions, do not favor the exploration of the complementarity of the two fields, leaving both to the margin of their real potentialities.

In action research, the improvement of practice occurs through the systematic oscillation between acting in the field of practice and investigating it. This type of research follows a classic cycle: problem identification, solution planning, implementation, monitoring and evaluation. In this process, the change to improve practice is the tonic of movement, which seeks to build the solution based on the scientific method.[31]

For the development of the research, a market survey was carried out with the purpose of verifying which simulators the companies in this field recommend for use in the training of patients and/or caregivers for insulin administration, and their sales prices. The selection of companies was randomly made through the internet, in search engines. The quote request was made via e-mail or on the company's own website.

In the next step the simulators were evaluated by the researchers and participants based on the recommendations of the Brazilian Society of Diabetes on important aspects for safe management in the preparation and administration of insulin.[3] They were listed according to the characteristics expected in the simulators: 1) to allow recognition of all areas recommended for insulin administration, 2) to train skin antisepsis, use of skin fold, needle insertion into the subcutaneous tissue with 90° and 45° angulation, of the injection into the subcutaneous tissue, and the maintenance of the needle in the subcutaneous tissue for five seconds and 3) to plan injection site rotation.

The next phase consisted of the search and evaluation of materials for the development of a prototype at a low cost that would meet the expected results.

Afterwards, the proposal was presented to the technicians of the Precision Workshop of the University of São Paulo - Campus of the city of Ribeirão Preto, who proceeded with the development of the prototype.

Phase 2: Methodological study for simulator validation

For the development of the second phase of this study, e-mail invitations were sent to 14 experts working in the areas of assistance, teaching and management in the municipality where the study was carried out. The experts were selected through analysis of the Curriculum Lattes, according to the criteria adapted from Fehring.[32] Among the experts were representatives of the group of professionals who collaborated in the delimitation of the problem related to the administration of insulin in the municipality where the study was developed.

Professionals from health and education were selected, with at least one certificate of specialization in the area of study, and/or master's degree, and/or doctoral thesis, and/or practice of at least one year in the area, and/or research publication relevant to the area of interest of the study.

To evaluate the simulator, a sociometric scale developed by the researchers themselves was used, which evaluated the simulator in relation to the same items used for the evaluation of the simulators found in the market research.

This study was approved by the Research Ethics Committee of the Ribeirão Preto College of Nursing at the University of São Paulo with Consolidated Report no. 2.144.495, and by the Research Projects Evaluation Commission of the Municipal Health Secretariat of Ribeirão Preto with Letter No. 1447 of April 11, 2017. The participation of the subjects was formalized by the signing of a free and informed consent form.

RESULTS

Phase 1

Of the 17 companies consulted, only eight sent response letters, with one of them informing that it does not sell products that could be used to train patients and/or caregivers for insulin administration. Among the respondent companies, four whole-body simulators and three part simulators, such as anatomical parts, were indicated. For the creation of Chart 1, the lowest quote value per simulator was considered within the companies.

Chart 1 shows the prices, types, origins and evaluation based on the expected results of the simulators found in the market research.

Regarding the development of the prototype, in order to guarantee the vision and adaptation of all recommended areas for insulin administration, an adult-sized mannequin used for displaying clothes in stores, characterized as obese and female, was selected to be the simulator structure. The mannequin purchased was made of rigid, hollow plastic, with an iron support on the feet to ensure the orthostatic position, and it cost R$ 150.00 (US$ 47.51).

The structure selected to simulate the subcutaneous tissue was laminated foam of 8-cm thickness and 20-cm density, costing R$ 40.00 (US$ 12.67). Muscle tissue was not demonstrated in the structure of the simulator developed, because it is a dispensable structure, given the objectives of the study and the need to guarantee low cost.

A skin simulator was also developed with the use of liquid silicone, catalyst and water-based paint, which achieved good fidelity in relation to color, texture and skin thickness, compared to other materials tested. The cost of the skin simulator was R$ 15.50 (US $ 4.91). The materials used are shown in Figure 1.

The simulator was developed by the team of technicians from the Precision Workshop of the University of São Paulo, Campus of the city of Ribeirão Preto, with a labor cost of R$ 100.00 (US$ 31.57). The Precision Workshop has the mission to provide continuous benefits to society and technical support to teaching and research activities, being chosen for the development of the prototype.

For the construction of the simulator, the store mannequin was sent to the workshop, where the areas recommended for insulin administration were cut. For the delimitation of the areas, the recommendations of the Brazilian Society of Diabetes[5] were followed. The areas were cut using a manual saw blade, and the resulting edges were sanded with dry sandpaper.

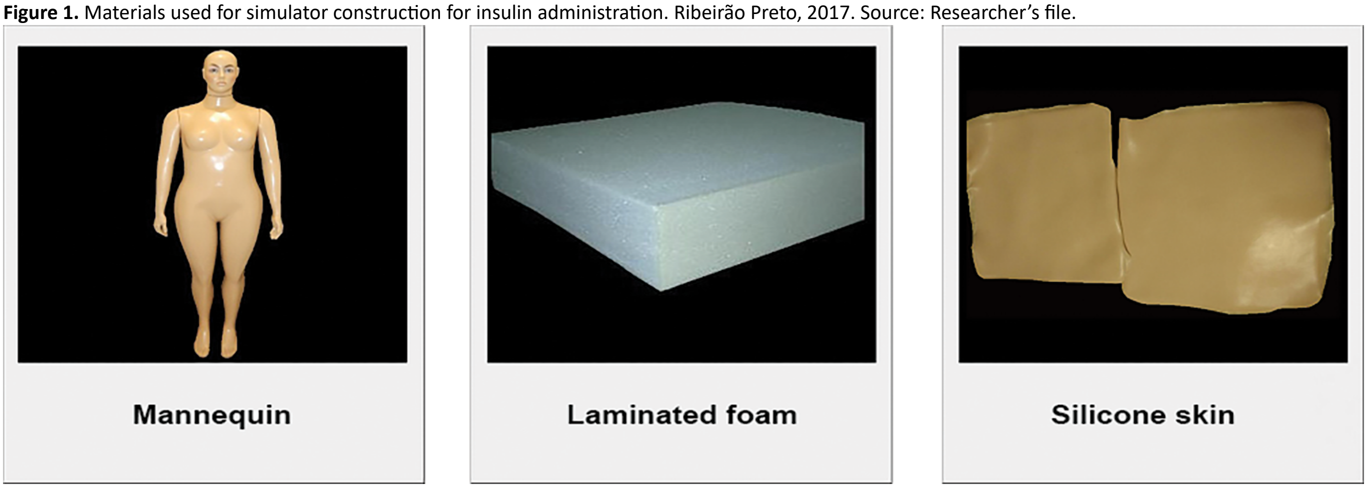
The resulting plastic bases from the cutout were fixed to the inner part of the mannequin about eight centimeters from the surface using metal rods and screws. The metal rods were internally fixed five centimeters from the cut edge to avoid decoupling of the subcutaneous tissue simulator when the fold

Chart 1. Evaluation of the patient simulators found in the market research in relation to the recommendations of the Brazilian Society of Diabetes (2016)[3], type, price and origin. Ribeirao Preto, 2017.

Simulator	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Type	Anatomic piece	Anatomic piece	Anatomic piece	Whole body	Whole body	Whole body	Whole body
Price *Dollar value in the Brazilian Central Bank on October 13, 2017, exchange rate US$ 1.00 = R$ 3.1572005.	R$ 460.00 US$ 145.69	R$ 608.00 US$ 192.57	R$ 1,210.00 US$ 383.25	R$ 1,940.00 US$ 614.46	R$ 2,498.00 US$ 791.20	R$ 4,480.00 US$1418.97	R$ 4,752.00 US$ 1505.13
Origin	Imported	Imported	Imported	Imported	Imported	Imported	Imported
Allows the recognition and delimitation of all areas recommended for insulin administration, and the understanding of its delimitation	No	No	No	No	No	No	No
Allows training for skin antisepsis	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Allows training for skin folding	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Allows training for needle insertion in the subcutaneous tissue with a 90° and 45° angulation	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Allows training for injection of liquid content in the subcutaneous tissue	Yes	Yes	No	Yes	Yes	Yes	Yes
Allows training for maintenance of needle in the subcutaneous tissue for five seconds	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Allows planning rotation of injection site	No	No	No	No	No	No	No

Source: Researcher's files

Figure 1. Materials used for simulator construction for insulin administration. Ribeirão Preto, 2017. Source: Researcher's file.



was performed. The cost with metal rods and screws was R$ 32.00 (US$ 10.14).

The adopted strategy was different in the mannequin arms, because of the limited dimensions; the cut plastic base was resized and fixed with glue, 4 centimeters from the surface, and metal rods were not necessary. The glue cost R$ 2.00 ($ 0.63). Figure 2 shows the cut mannequin, the supporting structure developed, and the adaptation of the arm structure.

The simulator was developed using low-technology resources and had a total cost of R$ 339.50 (US$ 107.43). The final prototype of the low-cost simulator developed for the training of patients and/or their caregivers for the application of insulin is shown in Figure 3.

Phase 2

Of the 14 (100.0%) experts invited, only nine (64.3%) participated in the validation. Among them, one (11.1%) pharmacist, one (11.1%) dentist, one (11.1%) psychologist, three (33.3%) endocrinologists, one physician specialized in chronic diseases, and 22 (2%) nurses. All with proven expertise in the area of study. The validation was developed in a single meeting with duration of two hours, in which the research project was presented, followed by the exploration and discussion of the prototype.

The items evaluated by the experts in the validation process of the simulator prototype are described in Table 1.

DISCUSSION

In this study, a low-cost simulator for insulin administration was proposed and developed. The Federal Government aims to make Brazil independent regarding the foreign market in the development of equipment and technologies.[33] All the simulators found in the market research carried out in this study were imported.

Self-administration of insulin is a subject of great epidemiological relevance. In this context, according to the data found and described in Chart 1, the supply of simulators in the market, intended for the development of abilities related to the theme, still does not seem to contemplate some of the main critical points.

Figure 2. Simulator cutout structure for inclusion of subcutaneous tissue and simulated skin. Ribeirão Preto, 2017. Source: Researcher's file.

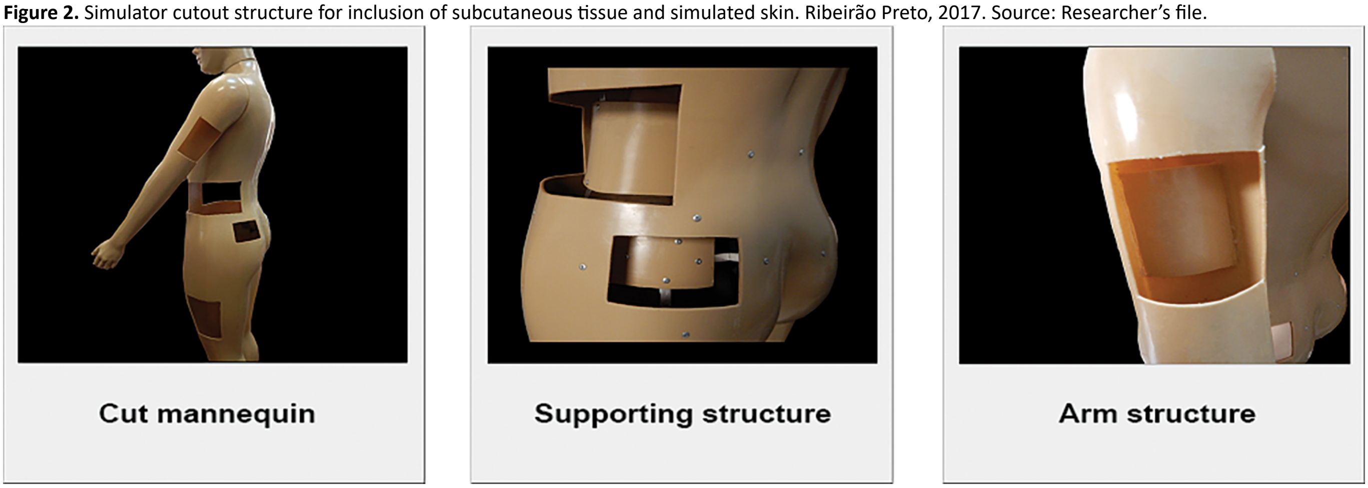


Figure 3. Prototype of a simulator for insulin administration in anterior, posterior and lateral view. Ribeirão Preto, 2017. Source: Researcher's file.

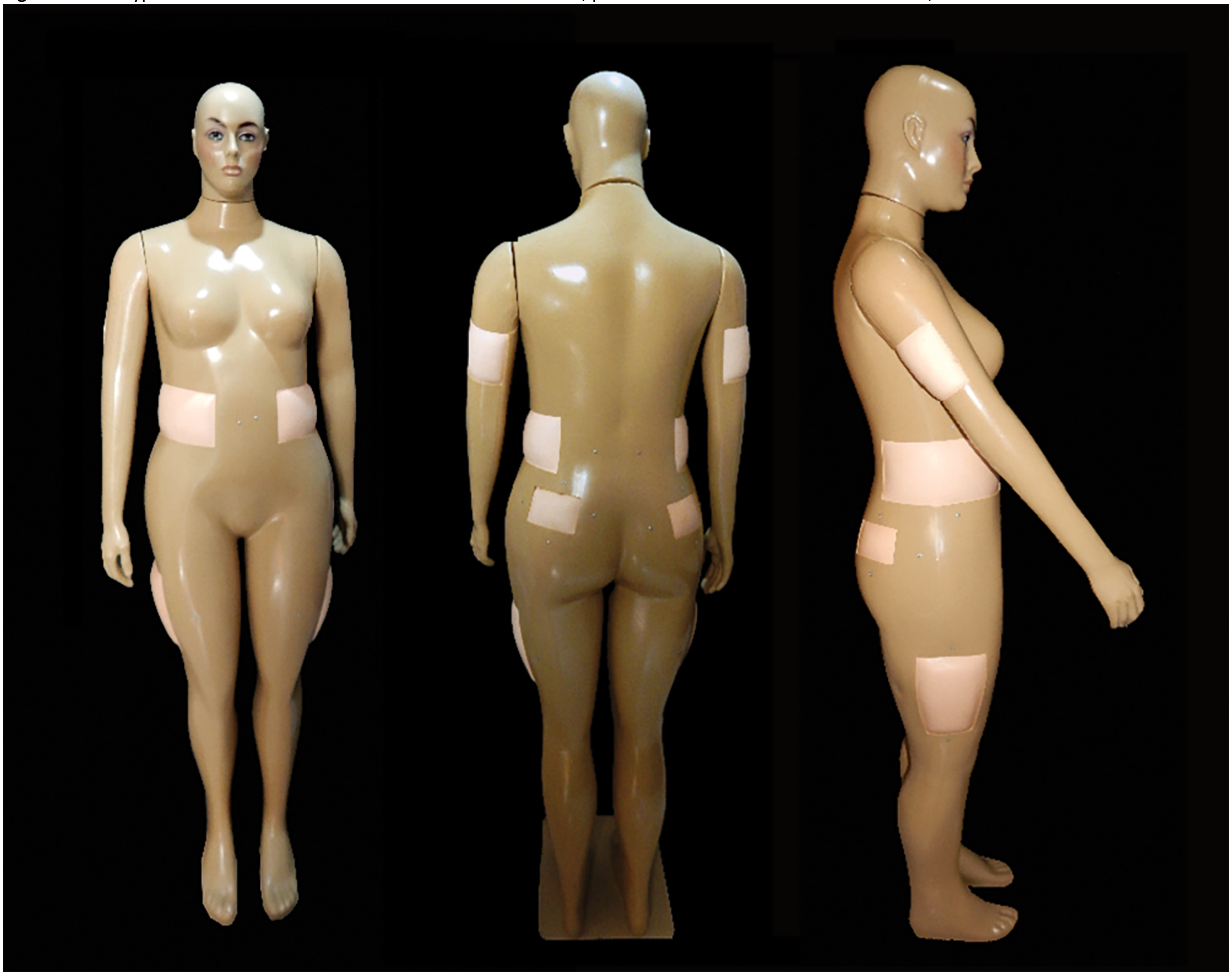


Table 1. Items evaluated by the experts for validation of a low-cost simulator for the training of diabetes mellitus patients and their caregivers in insulin administration. Ribeirão Preto, 2017.

Items evaluated	Strongly agree	Agree	Partially agree	Disagree	I don't know
Allows the recognition of all areas recommended for insulin injection and comprehension of its delimitation	8 (89.0%)	1 (11.0%)	-	-	-
Allows training for skin antisepsis	9 (100.0%)	-	-	-	-
Allows training for skin folding	9 (100.0%)	-	-	-	-
Allows training for needle insertion in the subcutaneous tissue with 90° and 45° angulation	9 (100.0%)	-	-	-	-
Allows training for injection in the subcutaneous tissue	8 (89.0%)	1 (11.0%)	-	-	-
Allows training for maintenance of needle in the subcutaneous tissue for five seconds	9 (100.0%)	-	-	-	-
Allows planning for injection site rotation	6 (67.0%)	3 (33.0%)	-	-	-
It is useful in the training of diabetes mellitus patients using insulin and/or their caregivers for administering insulin	9 (100.0%)	-	-	-	-

According to the Brazilian Society of Diabetes,[3] insulin should be applied to the arms, abdomen, thighs or buttocks. In relation to the delimitation of injection sites, the following anatomical parameters are recommended: 1) in the arms, the posterior aspect can be used, three to four finger breadths below the axilla, and three to four finger breadths above the elbow; 2) the lateral regions can be used in the abdomen, from three to four finger breadths from the umbilical scar; 3) on the thighs, the anterior and external lateral aspects can be used, four finger breadths below the groin, and four finger breadths above the knee, and 4) on the buttocks, the upper external lateral quadrant can be used. All these areas were adapted on the mannequin to allow recognition and understanding.

The simulators suggested by the companies consulted in this study were mostly of whole body; however, they did not show all the areas recommended for insulin application adapted for this purpose, a fact that impairs the recognition of the areas, their delimitation and the planning of injection site rotation. In addition, all whole-body simulators found had the deltoid region adapted for injectable administration, and this is not a recommended area for the administration of insulin. Insulin administration in the deltoid region may result in administration in the intramuscular tissue, which increases the rate of insulin absorption and may cause serious harm to the patient's health.

Another type of simulator found in the market research is the anatomical pieces, part simulators, which, despite being considered practical due to the ease of transportation and manipulation, do not favor the understanding of the delimitation of the areas recommended for the administration of insulin, since they do not allow the proper visualization of the reference points.

The step-by-step construction of a high-fidelity, low-cost simulator for the training of the ability to check blood glucose was described in a study conducted in Australia.[34]

The development of a simulator requires the understanding and description of the results expected from its use. When this development occurs along with the team that will make use of this new resource, the chances of success increase.[35] In this study, the experts' opinions show that the proposed simulator can be a useful tool for patients' and/or caregivers' education.

Investments in innovative strategies for education in diabetes mellitus have higher efficacy compared to traditional education.[36] A study showed that the majority of patients with diabetes mellitus treated with insulin have a lack of knowledge about the administration procedure and, therefore, investing in education about administration techniques can result in better results.[37]

The use of insulin administration devices with a high degree of integrated technology, such as insulin pumps and application pens have increased; however, in the absence of a structured education program, despite technology and costs involved, the results can still be unsatisfactory.[38]

The use of the prototype allows learners that is, patients and/or their caregivers, to understand the proposed system of rotation. Correct rotation of insulin injection sites seems to be a critical factor in the prevention of lipohypertrophy, a common complication related to the variability of glycemic levels and episodes of hypoglycaemia.[13]

A study evaluating skin thickness in adults using insulin concluded that it rarely exceeds 3 mm, regardless of the application site, gender, body mass index, age and ethnicity.[39] The skin developed for the construction of the prototype is 3 mm thick, but despite having good fidelity regarding color, thickness and texture, it needs investments to improve its resistance, because although it is resistant to multiple perforations with an insulin needle, its manipulation, necessary when the prototype is cleaned, has sometimes resulted in damage to its structure. A study evaluated the thickness of the subcutaneous tissue in patients who administer insulin, and concluded that there is great variability, with it being thicker in the gluteal region and in the abdomen.[38] In the construction of the prototype, the laminated foam was selected to simulate adipose tissue, since it is a soft structure, with a capacity of absorption and retention of small volumes of liquids. The viscoelastic foam was tested, but presented slow recovery time to the baseline shape, being distant from the desired functional fidelity.

Muscle tissue was not presented in the simulator structure, because self-administration of insulin in home environments should be done only in the subcutaneous tissue, due to its absorption characteristics. Insulin administration in the muscle tissue by the patient usually results from an error related to needle size selection, the angulation adopted for the injection, and failure to perform a skin fold, leading to glycemic variability. The non-visualization of muscle tissue in the developed simulator can be considered another limitation of the study, because if demonstrated, muscle tissue could be used to work on aspects related to prevention of administration in deeper regions that would change absorption rate. However, in this simulator, this aspect was not prioritized so low cost could be kept.

The prototype was built using a store mannequin used for clothing display as the main structure, which is classified as obese by the manufacturer. It is 1.70 meters (m) high, and the estimated weight of an individual with the same physical biotype is about 80 kilograms (kg), which would result in a body mass index of 27.6 kg/m^2, which is considered overweight in the classification of nutritional status. For developing other prototypes, other mannequin biotypes, representing eutrophic individuals with grade 1, 2 and 3 obesity, could be adopted.

Due to its size and possibility of disarticulation only of the head and upper limbs, one of the limitations of the prototype produced is transportation. Despite its volume, its final weight was 6.8 kg.

The experts suggested the construction of a pediatric mannequin prototype to reach this population and to facilitate the transportation of this teaching tool due to its small size.

The simulator that was built was cheaper than the cheapest anatomical part found in the market research.

The prototype was validated by nine experts, who were selected by convenience from the analysis of their Lattes Curriculum, and the adequacy of the domain area of the invited professionals to the objectives of the study; the reduced number of experts in that phase can be one of the limitations of this study.

It may be relatively simple for a healthcare professional to apply an injection into the subcutaneous tissue; however, for a patient and/or caregiver, to carry out the technique of administrating a potentially dangerous medication at home without first having the opportunity to practice it under the supervision of a professional in a controlled environment can be an important stressor and jeopardize the results.

CONCLUSIONS

The low-fidelity simulator presented in this study is a tool that can facilitate the training process for self-care. It is low-cost and has greater anatomical functional fidelity than the models available in the market.

Because it was constructed in a collective way, considering the observations of all participants, it is more likely to be incorporated as educational material in the process of patient training, a benefit that can be clearly attributed to the action research process.

The Brazilian Society of Diabetes recommends that the appropriate technique of insulin administration be demonstrated to patients and caregivers, and that these subsequently demonstrate the performance of the technique to the professional. The simulator developed makes it possible to comply with this recommendation safely.

CONTRIBUTIONS

The simulator developed can be used by health professionals as a tool for training patients with diabetes mellitus and their caregivers for insulin administration. Its use may favor the identification of critical points related to the administration technique, thus allowing the planning of more directive and effective educational interventions.

It is an innovation that allows complying with the recommendation of the Brazilian Society of Diabetes regarding the approach of this technique with the lowest level of abstraction possible.

Due to its low cost and easy manipulation, it can be adopted by health teams as a tool to train patients, reducing the gap between knowledge and practice, and collaborating to solve the problem presented by patients in understanding fundamentally verbal orientations.

ACKNOWLEDGMENTS

The authors thank the professionals of the Precision Workshop of the University of São Paulo, Campus of the city of Ribeirão Preto for their effort and dedication in the development of this prototype.

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