https://doi.org/10.1590/ce.v30i0.98220 Cogitare Enferm. 2025, v30:e98220

Cogitare Enfermagem

EXPERIENCE REPORT

Low-cost simulators for assessing wounds and skin lesions: an experience report

HIGHLIGHTS

1. Simulators: artifacts used in health teaching.
2. Low-cost simulation: produced with inexpensive materials.
3. Low-cost simulation: teaching nursing skills.
4. Production of low-cost simulator models.

Milena Mendes Jorge[1]

Leticia de Souza Medeiros[2]

Cristian Jonas Mendonça Cartaxo[2]

Rute Rodrigues Justino[2]

Cristine Alves Costa de Jesus[3]

Fernanda Leticia Frates Cauduro[3]

ABSTRACT

Objective: to describe the production of low-cost simulators for teaching the assessment of wounds and skin lesions. **Method:** an experience report, guided by the precepts of technological production research, carried out at a public higher education institution in the Federal District - Brazil, between January 2022 and December 2023. To develop the study, we followed the step-by-step development of replicable low-cost simulator models for training skills in wound assessment and dressing technique. **Results:** three wound simulator models were produced, representing: lesions with granulation tissue and lesions with necrotic and infected tissue, both with regular and level edges, lesions with eschar and necrosis, and macerated, regular, and uneven edges. **Conclusion:** Products can be an option for developing skills such as creativity, adaptive capacity, and material handling.

DESCRIPTORS: Teaching Materials; Low-Cost Technology; Simulation Training; Nursing Education.

HOW TO REFERENCE THIS ARTICLE:
Jorge MM, Medeiros LS, Cartaxo CJM, Justino RR, de Jesus CA, Cauduro FLF. Low-cost simulators for assessing wounds and skin lesions: an experience report. Cogitare Enferm [Internet]. Ano [cited "insert year, month and day"];30. Available from: https://doi.org/10.1590/ce.v30i0.98220

[1]Universidade de Brasília, Programa de Pós-Graduação em Enfermagem, Brasília, DF, Brasil
[2]Universidade de Brasília, Brasília, DF, Brasil.
[3]Universidade de Brasília, Departamento de Enfermagem, Brasília, DF, Brasil.

INTRODUCTION

Wounds are classified according to their depth, shape, etiology, size, amount of exudate, odor, location, and appearance. By evaluating these points, it is possible to indicate the appropriate treatment and dressings for healing[1], and nurses are the key professionals in monitoring this process. During their training, nurses must develop skills to identify, assess, and treat wounds[2]. However, some studies have revealed gaps in nurses' knowledge about assessment, treatment, and types of dressings, which leads to difficulties in selecting technologies, especially for pain relief, and in characterizing the phases and stages of healing. This lack of knowledge compromises the quality of care and patient safety[1,3-4].

A study conducted with primary care nurses revealed that gaps in knowledge about the assessment and treatment of wounds begin at the undergraduate level, when nursing students find it difficult to relate coverings, materials, and other technologies to the characteristics of the injury to be treated, making this a factor that causes insecurity when faced with situations that require decisive positioning in wound treatment[4].

Given this, there is a need for investment in undergraduate nursing education through active methodologies that foster greater autonomy and confidence in performing dressings[1-2].

Among the various existing methodologies, realistic simulation has been used with positive results in terms of student learning, greater confidence, decision-making, and, consequently, an improvement in the quality of nursing care[5]. When applied to teaching wound assessment and treatment, it offers several benefits, such as improved assessment, use of dressings, and dressing techniques, and increased safety and confidence in carrying out procedures[2,5].

Dressing techniques require training on the part of students to gain confidence and there are educational resources, such as simulators, which can help them in this process. Simulators are technologies that represent individuals, complete anatomical parts or parts and are classified according to their complexity into low, medium, and high, to improve the traditional teaching offered to students[6]. In addition to these, there are also low-cost simulators which are generally made from easily accessible, less expensive materials with reasonable durability and good quality.

These simulators can be used to train specific skills, such as assessing wounds or injuries and even dressing techniques. To do this, there are various ways of creating wound models that resemble reality, such as the moulage technique, which consists of creating, imitating, or replicating something through the use of makeup[6].

The use of low-cost simulators in teaching environments for health professionals has numerous benefits, including increased self-confidence, learning, knowledge retention, and cognition[6]. With this in mind, this experience report aims to describe the production of low-cost simulators for teaching the assessment of wounds and skin lesions.

METHOD

This is an experience report in which the technology developed was guided by the precepts of technological production research[7]. The study was carried out at a public higher education institution in the Federal District, by teachers and students on the Nursing course from January 2022 to December 2023. In this context, the experience focused on the development of technology. To this end, the study followed the step-by-step development of replicable low-cost simulator models for training skills in wound assessment and dressing technique.

To develop the low-cost simulators, the steps defined by Knobel and Costa[8] were used as a reference: identifying the educational need, searching for ideas and inspiration, and pilot testing the material.

Identifying the educational need

Faced with the COVID-19 pandemic, the undergraduate nursing program has had to adapt the way it offers its courses, implementing hybrid teaching to enable the return of activities in the nursing laboratory. Given the restrictions imposed, such as the impossibility of sharing materials between students, and ensuring the safety of teachers and students, technological innovations for the teaching-learning process were required.

In this context, the teachers of the Fundamentals of Nursing course opted to use alternative educational resources to help with the learning process on content related to skin lesions, wound assessment, and treatment, realizing that the use of pictures, slides, or books alone is not enough to fix the content[9].

Search for ideas and inspiration

The search for inspiration took place through a literature review, in which publications were selected that addressed the production of low-cost simulators for health teaching[8,10]. A study whose aim was to present and evaluate, according to teachers' perceptions, a low-cost simulator for peripheral venipuncture, concluded that it was a successful teaching strategy since it contributed to increased learning and student self-confidence and the acquisition of technical skills related to the procedure[10]. In addition, the use of low-cost simulators, such as the childbirth, suturing, and medication administration simulator, encourages teamwork and provides an environment conducive to creativity and problem-solving[8].

Pilot test of the material

In terms of material resources, we used expanded polystyrene sheets (15mm and 20mm); smooth E.V.A. sheets in light pink and beige; moldable E.V.A. masses in white, brown, yellow, black, beige, red, orange, and pink; glue for E.V.A. and expanded polystyrene sheets; artificial blood in red and black; a palette of make-up shadows; a stylus; scissors. and expanded polystyrene sheets; red and black artificial blood; yellow coloring paint; latex sponges; a palette of make-up eyeshadows; a stylus; scissors; eyelash and eyebrow brushes; thin round brushes; black graphite pencils; a blue pen; a plastic spatula; absorbent cotton and a ruler (Figure 1).

Figure 1 - Materials for making the lesions. Brasília (DF), Brazil, 2023.

Source: The authors (2023).

Below are the steps involved in making the lesions on the expanded polystyrene sheet:

Step 1: the size and shape of the expanded polystyrene sheet (20cm x 20cm) was chosen, and marked with a pen and ruler, and the sheet was cut using a stylus (Figure 2);

Step 2: Using a pen and ruler, the flat sheets of E.V.A. were measured according to the size of the expanded polystyrene sheet that had been cut. The flat E.V.A. sheet was then cut out using a stylus or scissors and E.V.A. glue was used to glue the flat sheet to the expanded polystyrene sheet (Figure 2);

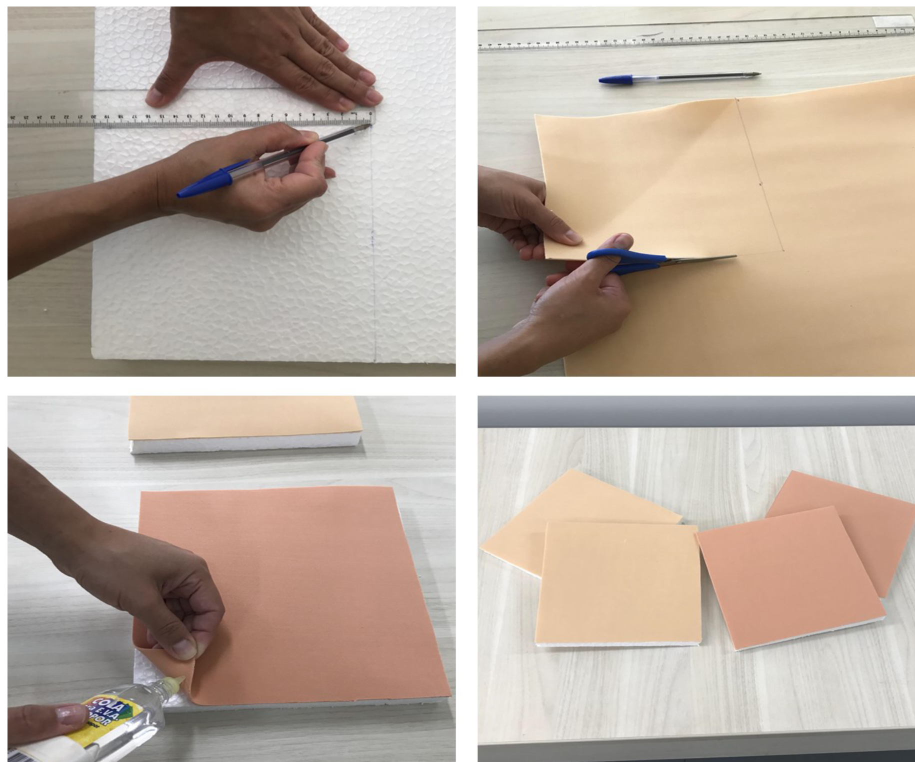

Figure 2 - Cut of expanded polystyrene board and E.V.A. sheets. Brasília (DF), Brazil, 2023.

Source: The authors (2023).

Step 3: the size and shape of the lesion to be simulated was defined on the smooth E.V.A. sheet using a pen (Figure 3);

Step 4: the moldable E.V.A. putty was applied in the desired color all over the bed and the edges of the drawing with the help of a spatula, leaving the elevations asymmetrical or symmetrical, according to the etiology of the lesion to be represented (Figure 3);

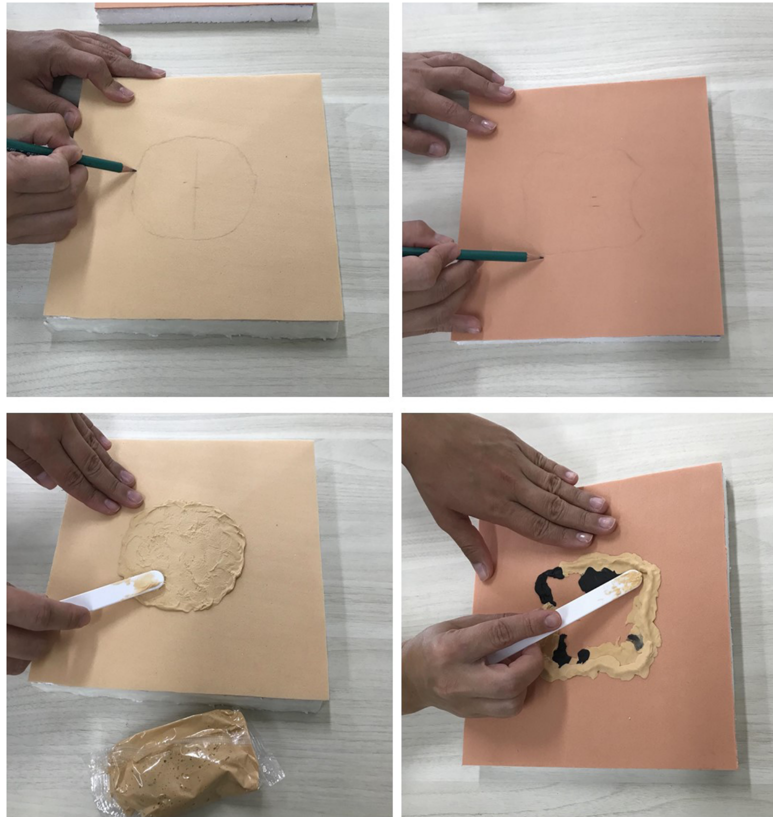

Figure 3 - Drawing of the shape of the desired lesion and application of moldable E.V.A. putty to the bed and edges. Brasília (DF), Brazil, 2023.
Source: The authors (2023).

Step 5: using a latex sponge, red, black, and yellow artificial blood, black E.V.A. putty, and other colors were applied to the wound bed to form the desired tissue. An eyelash and eyebrow brush was used to create a bead effect. On the edges, we used the eyeshadow palette for make-up and red artificial blood, for an effect of inflammation in the perilesional region (Figure 4).

Figure 4 - Making up the appearance of the bed and edges of the lesion. Brasília (DF), Brazil, 2023.
Source: The authors (2023).

Stage 6: the lesion was finalized in the desired manner (Figure 5).

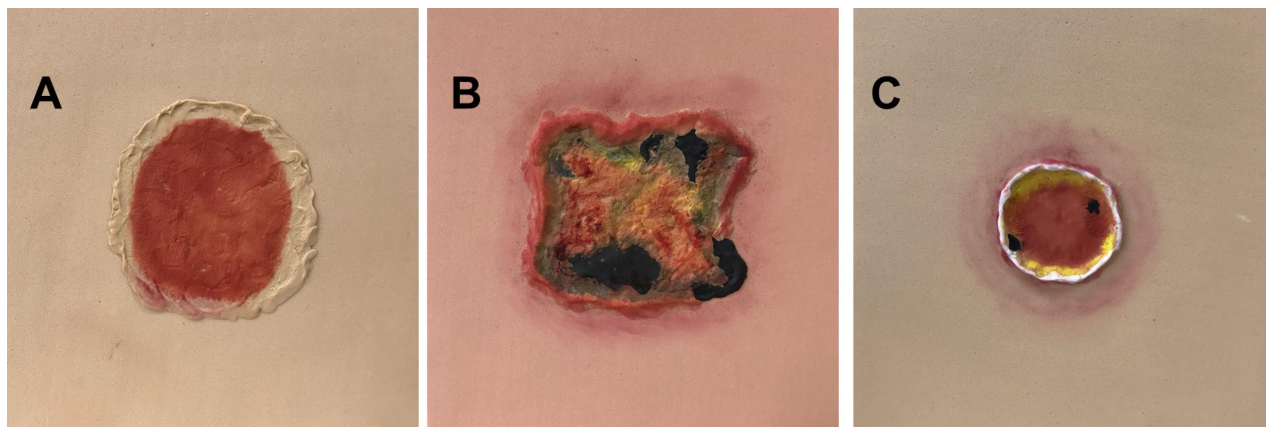

Figure 5 - Result of the lesion. Brasília (DF), Brazil, 2023.
Caption: **A** represents a model for the assessment and dressing of lesions with granulation tissue, regular, level edges and unaltered perilesional skin; **B** represents a model for the assessment and dressing of lesions with necrotic, infected tissue, regular, level edges and hyperemic perilesional skin; **C** represents a model for the assessment and dressing of lesions with a predominance of granulation tissue, sphacelage and necrosis near the edges, macerated, regular, uneven edges and hyperemic perilesional skin.
Source: The authors (2023).

Since the production of low-cost simulators for assessing wounds and dressings, the models have been used in the Fundamentals of Nursing subject as a technological resource in the teaching and learning process for students. In practical classes, workstations are set up with the various models of injuries and wounds created by the students, and tasks are carried out at each one. Examples include evaluation using the MEASURE[11] mnemonic, application of the TIMERS[12] acronym, and opening and handling sterile materials.

Regarding ethical aspects, the guidelines set out in National Health Council Resolution No. 510/2016 were followed.

RESULTS

The use of mannequins, low, medium, and high fidelity simulators, and the simulation strategy itself are gaining ground as teaching resources and methodology[8,10]. In the health sector, simulators can be found for training in draining ascitic fluid by catheter puncture[13], obstetric procedures such as simulating childbirth with a dummy, controlling postpartum hemorrhage, perineal suturing[14], administering medication to infants[15], assessing injuries and performing dressings[6,16], among others.

However, some technologies, especially medium- and high-fidelity ones, come at a high cost, as many are manufactured in other countries and need to be imported. It is therefore necessary to develop low-cost technologies to meet the diverse social contexts found in education[6,13,15].

As an option for low-cost simulators, the resource for assessing wounds described in this experience report makes it possible to insert it into different educational realities to contribute equally to the process of training health professionals. In addition, low-

cost technologies awaken the creativity of those who produce the material, thus favoring the development of clinical thinking at each stage of making the wounds, to meet the same objectives as high-cost technologies concerning wound content[6].

It is important to note that each student was instructed to make their own simulator, which already encouraged them to prepare for the subject (they needed to know the types of lesions, types of exudates, and viable and non-viable tissues in the wounds, for example), making it an important reinforcement in their studies and the acquisition of cognitive knowledge, and not just the training of psychomotor skills after making it[6,16].

For simulators to achieve their objectives, it is of the utmost importance to use techniques that provide a minimum of fidelity to what is being studied. Moulage is a technique that can be used to develop low-cost simulators, especially when it comes to making different types of injuries with different fidelity perspectives. It is through moulage that different models of wounds can be created, which makes it possible, during a simulated teaching activity, to come into contact with wounds of different etiologies, which have different aspects of the wound bed and the peri-injured skin, contributing to the development of skills for assessing the injury[6,16].

A quick search for customizable portable wound simulators on the Internet revealed considerably high prices, compared to the cost of producing the material presented in this experience report. Some models can cost more than a thousand reais. The cost of the materials used to build the simulator did not exceed fifty reais. The main potential of the material is its accessibility, which enables students to exercise the skills expected when studying skin lesions, as well as encourages them to develop their learning beyond the university campus, as it is an activity that can easily be carried out at home.

CONCLUSION

The production of low-cost simulators, described in this article, can be a successful option as a teaching strategy for assessing wounds and skin lesions, but also for performing dressings, since it is an easily executable practice that, when associated with theoretical and practical classes, can help develop skills for performing the procedure in question.

Limitations include the fact that although the materials used to develop the wound models are easily accessible and inexpensive, they are sensitive and have variable durability, which means that they have a finite period of usability. In addition, during skills training, such as dressing, it is advisable not to rub and clean the models with aqueous solutions, such as saline solution, as the materials can break down. However, it is possible to apply coverings and adhesive tape. Another aspect is that it is impossible to reproduce all the wound models in Styrofoam, especially the more complex and deeper ones.

This method provides students with an alternative way of studying and enables them to develop other important skills, such as creativity and adaptability, in addition to the experience of handling materials and memorizing the stages of dressing. In this way, this material can be an ally for both teachers and students in the area of teaching the practice of dressings for nursing.

Regarding the contributions of the experience described, the models produced and customized are easily reproducible and accessible, so they can be made by

purchasing the materials listed. The innovation was an opportunity for the partner teachers and students to have contact with the various types of lesions, to produce lesions and wounds of different etiologies and characteristics, to train their practical skills in cleaning and debridement, as well as have contact with the handling of the materials for the procedure.

REFERENCES

1. de Sousa MBV, Bezerra AMF, Costa CV, Gomes EB, da Fonseca HTA, Quaresma OB, et al. Assistência de enfermagem no cuidado de feridas na atenção primária em saúde: revisão integrativa. Rev Eletrônica Acervo Saúde [Internet]. 2013 [cited 2023 May 26];(Suppl 48):e3303. Available from: https://doi.org/10.25248/reas.e3303.2020

2. dos Santos BRF, Guimarães RS, Nascimento MHM, Henriques KGG, Miranda SVRS, Cervantes SWC, et al. Realistic simulation training in wound and dressing care: an experience report. Res Soc and Dev [Internet]. 2022 [cited 2023 May 26];11(12):e96111232992. Available from: https://doi.org/10.33448/rsd-v11i12.32992

3. de Lima BR, Silva GO, Galdino-Júnior H. Avaliação das prescrições de enfermagem e médicas para curativos em um hospital universitário: implicações éticas. Enferm Foco [Internet]. 2020 [cited 2023 May 27];11(5):67-72. Available from: https://doi.org/10.21675/2357-707X.2020.v11.n4.3334

4. Vieira CCO. Avaliação e tratamento de feridas: conhecimento de enfermeiros da Unidade Básica de Saúde em técnicas de curativo [[thesis on the Internet]. Sinop: Instituto de Ciências da Saúde, Universidade Federal de Mato Grosso; 2017 [cited 2023 May 27]. 74 p. Available from: http://bdm.ufmt.br/handle/1/1952

5. Chícharo SCR, Silva RMCR, Pereira ER, Nogueira LRD, Prado LDSR, da Silva MRB, et al. Realistic simulation in teaching nursing practices in wound care: account of experiences. Res Soc Dev [Internet]. 2021 [cited 2023 May 27];10(9):e29010918180. Available from: https://doi.org/10.33448/rsd-v10i9.18180

6. Pereira GA Jr, Guedes HTV, organizators. Simulação em saúde para ensino e avaliação: conceitos e práticas. São Carlos: Cubo Multimídia; 2021. 261 p.

7. Polit DF, Beck CT. Fundamentos de pesquisa em enfermagem: avaliação de evidências para a prática da enfermagem. 7. ed. Brasil: Artmed Editora; 2017. 658 p.

8. Knobel R, Costa RRO. Confecção e uso de simuladores de baixo custo: experiências da Medicina e Enfermagem. In: Pereira GA Jr, Guedes HTV, organizators. Simulação em saúde para ensino e avaliação: conceitos e práticas. São Carlos: Cubo Multimídia; 2021 [cited 2023 Aug 16]. 24 p. Available from: https://website.abem-educmed.org.br/wp-content/uploads/2022/03/LIVRO-Simulacao-em-saude-para-ensino-e-avaliacao.pdf

9. Molonha A, Fakhr BO, Custódio FA, Lopes TP, Roecker S, Araujo JP. Simulation as a teaching-learning strategy in wound treatment: experience report. Rev Baiana Enferm [Internet]. 2020 [cited 2023 May 28];34:e37039. Available from: https://doi.org/10.18471/rbe.v34.37039

10. de Oliveira SN, Canever BP, da Silveira NI, Fernandes SR, Martini JG, Lino MM. Low cost peripheral venipuncture simulator: from confection to evaluation. Rev Enferm UERJ [Internet]. 2024 [cited 2024 Aug 17];27:e45584. Available from: http://dx.doi.org/10.12957/reuerj.2019.45584

11. Keast DH, Bowering K, Evans AW, Mackean GL, Burrows C, D'Sousa L. Measure: a proposed assessment framework for developing best practice recommendations for wound assessment. Wound Repair Regen [Internet]. 2004 [cited 2024 Jan 23];12(1):1-17. Available from: https://doi.org/10.1111/j.1067-1927.2004.0123S1.x

12. Atkin L, Bućko Z, Montero EC, Cutting K, Moffatt C, Probst A, et al. Implementing TIMERS: the race against hard-to-heal wounds. J Wound Care [Internet]. 2019 [cited 2024 Jan. 23];28(Suppl 3a):1-52. Available from: https://doi.org/10.12968/jowc.2019.28.Sup3a.S1

13. Silveira BWM, Araújo LAA, Albuquerque LS, Vasconcelos FO, Lima EBM, Góes AC, et al. Assembly and use of a low-cost paracentesis simulator for the teaching of puncture and drainage of ascites. Rev Col Bras Cir [Internet]. 2022 [cited 2024 Oct 10];49:e20223099. Available from: https://doi.org/10.1590/0100-6991e-20223099

14. Knobel R, Menezes MO, Santos DS, Takemoto MLS. Planning, construction and use of handmade simulators to enhance the teaching and learning in Obstetrics. Rev Latino-Am Enfermagem [Internet]. 2020 [cited 2024 Oct 11];28:e3302. Available from: https://doi.org/10.1590/1518-8345.3684.3302

15. de Araújo MS. Construction, validation and evaluation of the effectiveness of a low-cost simulator aimed at teaching medication administration to infants [thesis]. Natal: Centro de Ciências da Saúde, Universidade Federal do Rio Grande do Norte; 2023 [cited 2024 Oct 10]. Available from: https://repositorio.ufrn.br/handle/123456789/57627

16. da Silva BMS, Dutra LN, Dias LO, Goulart MCL, Góes FGB, Ávila FMVP. Use of moulagein the clinical simulation of dressings among nursing students: an experience repor. Rev Enferm UFSM [Internet]. 2024 [cited 2024 Oct 10];14:e8. Available from: https://doi.org/10.5902/2179769284878

Received: 26/01/2024
Approved: 06/12/2024
Associate editor: Dra. Luciana de Alcantara Nogueira

Corresponding author:
Milena Mendes Jorge
Universidade de Brasília
Campus Universitário Darcy Ribeiro, s/n, CEP 70910-900, Asa Norte, Brasília, DF, Brasil
E-mail: milenamendes.jorge@gmail.com

Role of Authors:
Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work - **Jorge MM, Medeiros LS, Cartaxo CJM, Justino RR, de Jesus CA, Cauduro FLF;** Drafting the work or revising it critically for important intellectual content - **Jorge MM, Medeiros LS, Cartaxo CJM, Justino RR, de Jesus CA, Cauduro FLF**; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved - **Jorge MM, Medeiros LS, Cartaxo CJM, Justino RR, de Jesus CA, Cauduro FLF.** All authors approved the final version of the text.

ISSN 2176-9133

This work is licensed under a *Creative Commons Attribution 4.0 International License*.