



Upper limb lymphedema treatment application

Aplicativo para tratamento do linfedema de membros superiores

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■ ABSTRACT

Introduction: Secondary lymphedema commonly develops due to trauma to the lymphatic system, and may occur after cancer surgery. The mobile application is an easily accessible and low-cost means of technical-scientific updating that can help the health professional to provide the best treatment for the patient. Thus, the objective of this study was to build an application for the treatment and prevention of upper limb lymphedema. **Methods:** The construction of the application took place in four stages: (1) Conception, involving the identification of application development needs; Content development, including an integrative literature review in the main databases; (3) Construction, consisting of structuring the database and developing the software; and (4) Transition, comprising carrying out functionality tests. **Results:** The developed application (Linfedema APP) consists of 31 screens, 4 figures and 3 videos. It was registered at the National Institute of Industrial Property (INPI) of the Ministry of Development, Industry and Foreign Trade, and is available for free on the Google Play Store. **Conclusion:** After an integrative review of the literature in the main databases, the “Lymphedema APP” application was developed, which constitutes a practical tool to qualify, direct and guide the physiotherapist in performing the exercises in post-mastectomized patients with lymphedema in the upper limbs.

Keywords: Lymphedema; Clinical protocols; Physical therapy modalities; Mobile applications; Breast cancer lymphedema.

■ RESUMO

Introdução: O linfedema secundário se desenvolve comumente devido a um trauma no sistema linfático, podendo ocorrer após cirurgia de câncer. O aplicativo móvel é um meio de atualização técnico-científica de fácil acesso e de baixo custo que pode auxiliar o profissional de saúde a proporcionar o melhor tratamento para o paciente. O objetivo desse estudo foi construir um aplicativo para tratamento de linfedema de membros superiores. **Método:** A construção do aplicativo ocorreu em quatro etapas: (1) Concepção, envolvendo a identificação das necessidades do desenvolvimento do aplicativo; (2) Elaboração do conteúdo, incluindo a revisão integrativa da literatura nas principais bases de dados; (3) Construção, consistindo na estruturação do banco de dados e desenvolvimento do *software*; e (4) Transição, compreendendo a realização de testes de funcionalidade. **Resultados:** O aplicativo desenvolvido (Linfedema APP) é composto por 31 telas, 4 figuras e 3 vídeos. Ele foi registrado no Instituto Nacional da Propriedade Industrial (INPI) do Ministério do Desenvolvimento, Indústria e Comércio Exterior e está disponível gratuitamente na Google Play Store. **Conclusão:** Após a revisão integrativa da literatura nas principais bases de dados, foi desenvolvido o aplicativo “Linfedema APP”, o qual se constitui em ferramenta prática para qualificar, direcionar e guiar o fisioterapeuta na realização dos exercícios nas pacientes pós- mastectomizadas com linfedema em membros superiores.

Descritores: Linfedema; Protocolos clínicos; Modalidades de fisioterapia; Aplicativos móveis; Linfedema relacionado a câncer de mama.

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INTRODUCTION

Lymphedema is one of the relevant complications that occur in the postoperative period of patients undergoing a surgical procedure for the treatment of cancer, resulting from the concentration of fluid in the interstitium, with a large protein cluster motivated by disorders of the lymphatic circulation that affects, above all, the upper limbs¹. Lymphedema in post-mastectomy patients occurs in around 20% to 30% of cases, with a prevalence rate of 15% to 30%¹⁻³.

Patients who undergo mastectomy must be treated postoperatively by a physiotherapist. This professional aims to control postoperative pain, prevent or treat lymphedema and postural changes, promote muscle relaxation, maintain the range of motion of the upper limb involved, and improve the appearance and malleability of the scar, preventing or treating adhesions^{1,4}. One of the physiotherapist's interventions is complex decongestive therapy, which consists of four approaches: guidance on skin care, manual lymphatic drainage, compressive bandaging, and lymphomyokinetic exercises - all to reduce lymphedema²⁻⁴.

For the physiotherapist to provide guidance, it is necessary to have technical-scientific knowledge and to develop educational resources and technologies (applications, electronic games, online courses, electronic medical records) with low cost, greater effectiveness, ease, and accessibility to the population^{5,6}.

Several studies have shown that applications have been developed to provide care and guide clinical decisions. These are validated studies and results of research-based recommendations for practice⁵⁻⁷. Building an app for mobile devices offers professionals, caregivers, and patients a quick way to consult. It is easily transported to the various practice settings in healthcare facilities. It is hoped that doubts are resolved when accessing this tool and that there is more autonomy, both in the execution of physiotherapy exercises and in the control of clinical evolution⁸⁻¹⁴.

Developing an application aimed at post-mastectomized patients with upper limb lymphedema (UL) is unprecedented in Physiotherapy. It is an approach of great scientific and social relevance insofar as it provides accessibility to specific forms of care and ensures easy access to information and control of patients' evolution. The developed application is evident as a new therapeutic path in the area of rehabilitation of mastectomized patients.

OBJECTIVE

Therefore, this study aimed to build an application for preventing and treating upper limb lymphedema.

METHODS

The study applied the technological production modality of the methodological development research type to construct an application for the prevention and treatment of UL lymphedema in post-mastectomized patients, entitled "Linfedema APP."

As an application development methodology, Contextualized Instructional Design (CID) was chosen, which involves a constructivist proposal and consists of the intentional action of planning, developing, and applying specific didactic situations, incorporating mechanisms that favor contextualization¹⁵.

The construction of the application took place in four stages, including conception, elaboration of the content, construction of the application, and performance of functionality tests.

The study design involved understanding the educational problem and devising a related solution. A previous search was carried out to verify the existence of applications that guide the physiotherapist in evaluating, preventing, and treating upper limb lymphedema in post-mastectomized patients.

After verifying the problem's existence, an integrative literature review was carried out in the Health Sciences databases, including the Cochrane Library, SciELO, LILACS, and MEDLINE, using as descriptors lymphedema and physiotherapy.

For the selection of publications to be included in the review, two basic axes were adopted as inclusion criteria: only primary studies that were directly linked to the theme to be available in full and without proposed temporal delimitation, as the intention was to compile all studies that met the established criteria. Book chapters, theses, dissertations, monographs, technical reports, reference works, and articles that, after reading the abstract, did not converge with the proposed object of study, and publications that were repeated in the databases and virtual library were excluded.

After reading the abstracts, articles that described the descriptors lymphedema and physiotherapy were selected. Based on this survey, an application was created to treat and prevent post-mastectomized patients with upper limb lymphedema (Figure 1 and Chart 1).

The planning and production of didactic content included the definition of topics and the writing of subjects. For the construction of the application, the media were selected, as well as the design of the interface (layout). We opted for using texts, illustrations, and videos structured in topics and connected by hypertexts (links). The navigation structure was defined, and the environment configuration was planned.

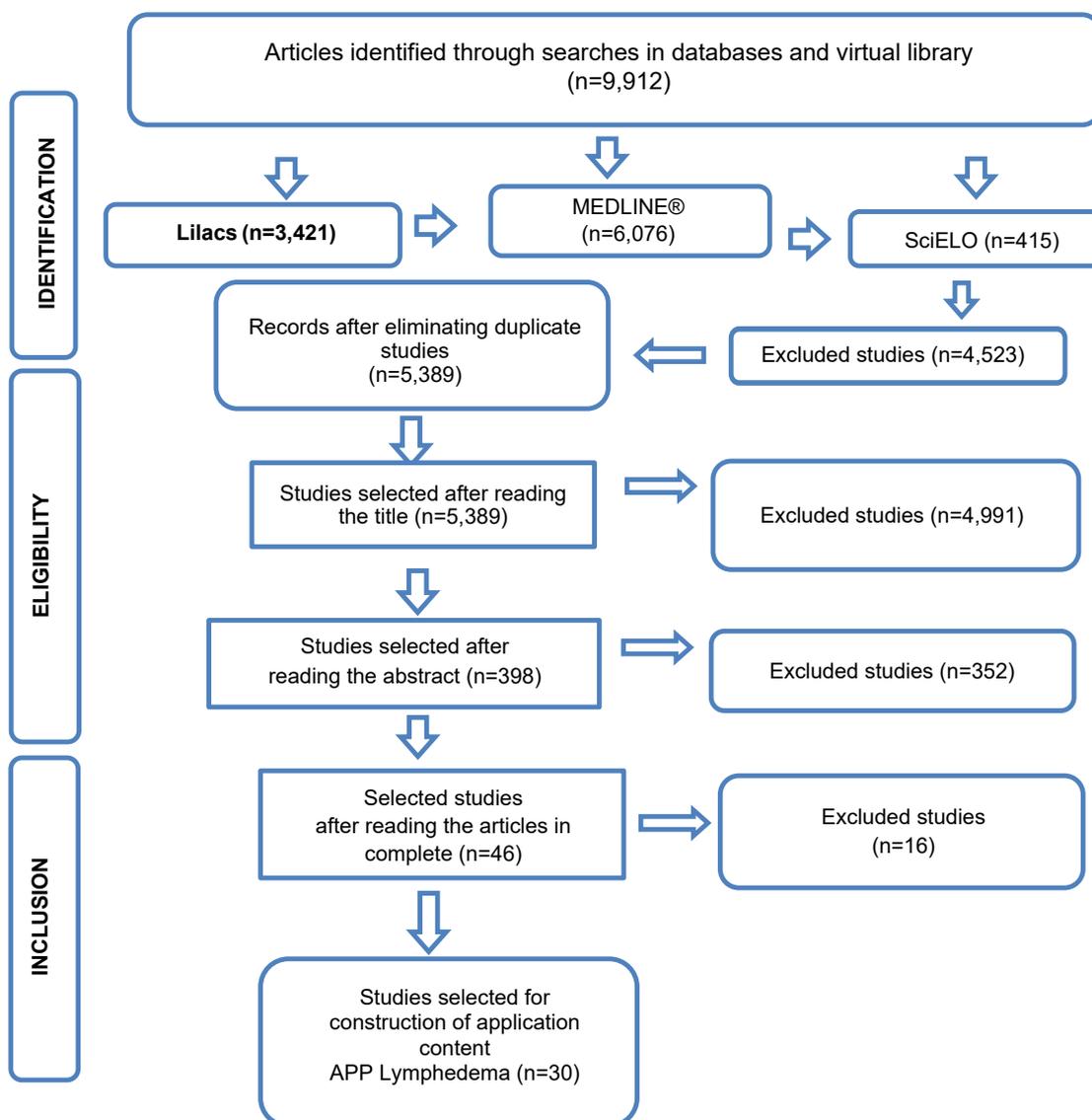


Figure 1. Flowchart of studies' identification, selection, and inclusion process, prepared based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendation.

The tools, educational, and technological resources were configured, as well as the construction of an environment to download the application on the Internet and install it on the mobile device.

Then, functionality tests were carried out (usability, performance, compatibility, and functionality). The testing process was carried out according to the steps described below:

- Usability testing: to verify that the user can intuitively use the application from the home screen to the final result. The project's authors used the application five times, registering the patient and verifying the physiotherapeutic treatment procedures in the patient with lymphedema.

- Performance test: The responsiveness after each command performed was evaluated. During

the use of the application, the systems analyst and the project authors checked the initialization time, screen changes, and application completion time. The access time to each screen, the time to register a new patient, and the reading of the physiotherapy treatment procedure were considered.

- The compatibility test with the theoretical framework was divided into two phases. First, the test verified information at the semantic and syntactic level of the application's content. In the second phase, functional or black-box testing was used to test the system. The systems analyst conducted this test.

For the functional test of the application, some devices were chosen that had Android technology as determinants, characterized by mobile equipment and with WiFi connectivity available for access to

Chart 1. Characteristics of the studies selected for the application for treating post-mastectomized patients with upper limb lymphedema.

Author	Title	Periodic. Year; Volume (Number): Page
Howell DM, et al.	Complete decongestive therapy for lymphedema following breast cancer treatment (Protocol).	Cochrane Database Syst Rev. 2009
Carvalho APF & Azevedo EMM	Estudo comparativo entre a fisioterapia aquática e a convencional para reduzir linfedema pós-tratamento cirúrgico de câncer de mama: ensaio clínico randomizado / Comparative study between the aquatic physiotherapy and the conventional for lymphedema reduction after surgical treatment for breast cancer: randomized clinical trial	Rev Bras Mastologia. 2009;19(4):133-40
Forner-Cordero I, et al.	Predictive Factors of Response to Decongestive Therapy in Patients with Breast-Cancer-Related Lymphedem	Ann Surg Oncol. 2010;17(3):744-51
Soares HPS, et al.	Complex decongestant therapy with use of alternative material to reduce and control lymphedema in patients with endemic area of filariasis: a clinical trial	Fisioter Pesqui. 2016;23(3):268-77
Kim DS, et al.	Effect of active resistive exercise on breast cancer-related lymphedema: a randomized controlled trial	Arch Phys Med Rehabil. 2010;91(12):1844-8
Hacard F, et al.	Measurement of skin thickness and skin elasticity to evaluate the effectiveness of intensive decongestive treatment in patients with lymphoedema: a prospective study	Skin Res Technol. 2014;20(3):274-81
Kasseroller RG & Brenner E	A prospective randomised study of alginate-drenched low stretch bandages as an alternative to conventional lymphologic compression bandaging	Support Care Cancer. 2010;18(3):343-50
Karafa M, et al.	The effect of different compression pressure in therapy of secondary upper extremity lymphedema in women after breast cancer surgery	Lymphology. 2018;51(1):28-37
Melam GR, et al.	Effect of complete decongestive therapy and home program on health-related quality of life in post mastectomy lymphedema patients	BMC Womens Health. 2016;16(1):16-23
Bozkurt M, et al.	Effectiveness of Decongestive Lymphatic Therapy in Patients with Lymphedema Resulting from Breast Cancer Treatment Regardless of Previous Lymphedema Treatment	Breast J. 2017;23(2):154-8
Tambour M, et al.	Manual lymphatic drainage adds no further volume reduction to Complete Decongestive Therapy on breast cancer-related lymphoedema: a multicentre, randomised, single-blind trial	Br J Cancer. 2018;119(1):1215-22
Melgaard D	What is the effect of treating secondary lymphedema after breast cancer with complete decongestive physiotherapy when the bandage is replaced with Kinesio Textape? – A pilot study	Physiother Theory Pract. 2016;32(6):446-51
Dayes IS, et al.	Randomized Trial of Decongestive Lymphatic Therapy for the Treatment of Lymphedema in Women With Breast Cancer	J Clin Oncol. 2013;31(30):3758-63
Park JH	The effects of complex exercise on shoulder range of motion and pain for women with breast cancer-related lymphedema: a single-blind, randomized controlled trial	Breast Cancer. 2017;24(4):608-14
Oliveira MMF, et al.	Long term effects of manual lymphatic drainage and active exercises on physical morbidities, lymphoscintigraphy parameters and lymphedema formation in patients operated due to breast cancer: a clinical trial	PLoS One. 2018;13(1):e0189176
Haghighat S, et al.	Comparing two treatment methods for post mastectomy lymphedema: complex decongestive therapy alone and in combination with intermittent pneumatic compression	Lymphology. 2010;43(1):25-33
Gatt M, et al.	A meta-analysis of the effectiveness and safety of kinesiology taping in the management of cancer-related lymphoedema	Eur J Cancer Care (Engl). 2017;26(5):1-13

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Chart 1. Characteristics of the studies selected for the application for treating post-mastectomized patients with upper limb lymphedema.

Author	Title	Periodic. Year; Volume (Number): Page
Uzkeser H, et al.	Efficacy of manual lymphatic drainage and intermittent pneumatic compression pump use in the treatment of lymphedema after mastectomy: a randomized controlled trial	Breast Cancer. 2015;22(3):300-7
Mestre S, et al.	Interest of an auto-adjustable nighttime compression sleeve (MOBIDERM® Autofit) in maintenance phase of upper limb lymphedema: the MARILYN pilot RC	Support Care Cancer. 2017;25(8):2455-62
Kizil R, et al.	Is Continuous Passive Motion Effective in Patients with Lymphedema? A Randomized Controlled Trial	Lymphat Res Biol. 2018;16(3):263-9
Szoinoky G, et al.	Intermittent pneumatic compression acts synergistically with manual lymphatic drainage in complex decongestive physiotherapy for breast cancer treatment-related lymphedema	Lymphology. 2009;42(4):188-94
Cacchio A, et al.	Effectiveness and safety of a product containing diosmin, coumarin, and arbutin (Linfadren®) in addition to complex decongestive therapy on management of breast cancer-related lymphedema	Support Care Cancer. 2019;27(4):1471-80
Gradalski T, et al.	Complex Decongestive Lymphatic Therapy With or Without Vodder II Manual Lymph Drainage in More Severe Chronic Postmastectomy Upper Limb Lymphedema: A Randomized Non-Inferiority Prospective Study	J Pain Symptom Manage. 2015;50(6):750-7
Do JH, et al.	Effects of a complex rehabilitation program on edema status, physical function, and quality of life in lower-limb lymphedema after gynecological cancer surgery	Gynecol Oncol. 2017;147(2):450-5
Abbasi B, et al.	The effect of relaxation techniques on edema, anxiety and depression in post-mastectomy lymphedema patients undergoing comprehensive decongestive therapy: A clinical trial	PLoS One. 2018;13(1):e0190231
Ergin G, et al.	Effects of Aqua-Lymphatic Therapy on Lower Extremity Lymphedema: A Randomized Controlled Study	Res Biol. 2017;15(3):284-91
Vignes S, et al.	Intensive complete decongestive physiotherapy for cancer-related upper-limb lymphedema: 11 days achieved greater volume reduction than 4	Gynecol Oncol. 2013;131(1):127-30
Pekyavaş NÖ, et al.	Complex decongestive therapy and taping for patients with postmastectomy lymphedema: A randomized controlled study	Eur J Oncol Nurs. 2014;18(6):585-90
Bok SK, et al.	Ultrasonographic Evaluation of the Effects of Progressive Resistive Exercise in Breast Cancer-Related Lymphedem	Lymphat Res Biol. 2016;14(1):18-24
Ha KJ, et al.	Synergistic effects of proprioceptive neuromuscular facilitation and manual lymphatic drainage in patients with mastectomy-related lymphedema	Front Physiol. 2017;8:959
Vakharia PP, et al.	Bibliometric analysis of breast cancer-related lymphoedema research published from 2007–2016	J Lymphoedema. 2017;12(1):16-8
Samuel SR, et al.	Exercise-based interventions for cancer survivors in India: a systematic review	Springerplus. 2015;4(1):655
Nicholson R, et al.	Understanding the acceptability and feasibility of a regional Lymphoedema surveillance programme: a pilot study	J Lymphoedema. 2019;14(1):32-6

the wireless network to carry out the usability and compatibility tests. The authors and the systems analyst conducted the entire testing process.

RESULTS

The application consists of 31 screens, 4 pictures, and 3 videos. The initial screen contains "Enter" icons for registered users or "Register" for new ones. When completing the registration (Figure 2a), the user will open the anamnesis screen by clicking "Next" (Figure 2b). After completing the anamnesis, the user will be directed to the physical examination screen (Figure 2c), where he can assess the range of motion with illustrations and instructions on performing the measurement technique.



Figure 2. Examples of screens from the Linfedema APP application. Screens for (a) user registration, (b) completion of anamnesis, and (c) physical examination.

Clicking "Next" will open the perimetry screen for the patient with UL lymphedema. After viewing the demonstrative video of the perimetry technique (Figure 3a), the user can fill in the data collected in the form fields (Figure 3b) according to the height and segment of the affected limb.

After carrying out the anamnesis, physical examination, and perimetry, and depending on the results obtained and the characteristics of the skin, the user will be automatically directed to the treatment indications according to the degree of clinical staging of the lymphedema (Figure 4). The application offers therapeutic management options for post-mastectomized patients with MMS lymphedema and indicates preventive care (Figure 4a, b, and c).

The application was registered at the National Institute of Industrial Property (INPI) of the Ministry of Development, Industry, and Foreign Trade and is available on the Google Play Store under the name "Linfedema APP."



Figure 3. Examples of screens from the Linfedema APP application. (a) Demonstration video of the perimetry technique and (b) form for data collection.

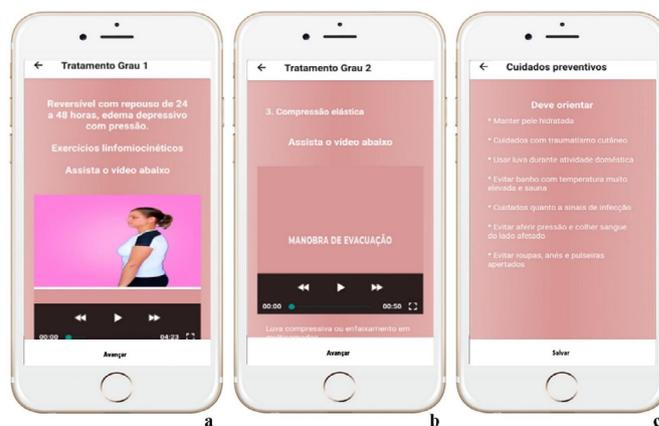


Figure 4. Examples of screens from the Linfedema APP application. Screens showing videos for (a) grade 1 treatment, (b) grade 2 treatment, and (c) preventive care indications for upper limb lymphedema.

DISCUSSION

The choice of theme for the "Linfedema APP" application arose because of the difficulties observed by researchers during their clinical practices, in the sense that some professionals have difficulty in assessing, prescribing preventive measures and therapeutic management for post-mastectomized patients with upper limb lymphedema. A previous search was then carried out, which showed that no application helps or guides the physiotherapist in an evaluation. Because of this fact, it was decided to develop the "Linfedema APP" application, which, after evaluating the patient, will provide professionals with indications of preventive measures and physiotherapeutic exercises.

In Brazil, the use of management software has grown exponentially in different areas. In the work process of health professionals, information technology is increasingly improving through the development and

evaluation of tools, processes, and structures that help these professionals manage care, whether preventive or therapeutic^{7,16-18}.

Professionals who deal with post-mastectomized patients with upper limb lymphedema, when using the application developed in this study, will be acquiring and developing clinical skills, as they will assist with the lowest possible risk, without damage and adverse events, in short, assistance with security for post-mastectomized individuals, since this technological instrument was developed with a scientific basis, through an integrative review of the literature found in the main databases.

The more clinical information an application provides, the better the decision-making process. Thus, it is essential to develop technological tools that make clinical management related to people with post-mastectomy lymphedema more efficient and minimize the difficulties and deficiencies of health professionals in clinical practice^{5,19}.

The "Linfedema APP" application allows physiotherapists, through smartphones, notebooks, and tablets, quick access to information during the consultation and clinical evaluation, helping the professional collect data, as the application provides a report of the entire evaluation and procedures performed. It also provides videos demonstrating the technique of physiotherapeutic exercises.

An application must have a social impact, offer health professionals theoretical and practical foundations, as well as standardization of assessment, preventive measures, therapeutic approaches, and instructions for self-care, which result in improved care provided to patients, individualized and systematized care, greater safety for health professionals and patients^{5,12,20}.

With technological advances, mainly in telephone devices, the use of applications is becoming more and more common; in this way, professionals will make more informed decisions, following clinical protocols that will be evolutionarily more effective, providing less chance of error during the clinical procedure^{12,20}.

CONCLUSION

After an integrative review of the literature in the main databases, the "Linfedema APP" application was developed, which constitutes a practical tool to qualify, direct, and guide the physiotherapist in performing the exercises in post-mastectomized patients with lymphedema in the upper limbs.

COLLABORATIONS

- GMS** Analysis and/or data interpretation, Conception and design study, Conceptualization, Final manuscript approval, Formal Analysis, Investigation, Methodology, Project Administration, Software, Supervision, Validation, Writing - Review & Editing.
- JIR** Conception and design study, Data Curation, Final manuscript approval, Investigation, Software, Validation.
- GCMR** Software, Validation, Visualization, Writing - Original Draft Preparation, Writing - Review & Editing.

REFERENCES

- Cendron SW, Paiva LL, Darski CC, Colla C. Complex decongestive physiotherapy associated compression therapy in the treatment of secondary lymphedema in breast cancer: A systematic review. *Rev Bras Cancerol.* 2015;61(1):49-58. DOI: 10.32635/2176-9745.RBC.2015v61n1.773
- Luz ND, Lima ACG. Physical therapy resource in post-mastectomy lymphedema: a review of the literature. *Fisioter Mov.* 2011;24(1):191-200. DOI: 10.1590/S0103-51502011000100022
- Tacani PM, Camargo RAL, Silva G, Moreira BC, Batista PAN, Montezello D, et al. Decongestive physiotherapy on upper limb lymphedema post mastectomy: Retrospective study. *Rev Bras Ciênc Saúde.* 2013;11(37):17-23. DOI: 10.13037/rbcs.vol11n37.1884
- Tavares AC, Velar CM, Bueno CS, Bazan M, Brito CMM, Toscano JL, et al. Grupo de monitoramento do linfedema: Cuidados pós-alta de um programa de reabilitação nos pacientes com câncer de mama. In: *Anais do Congresso Internacional de Humanidades & Humanização em Saúde.* São Paulo: Blucher; 2014. DOI: 10.5151/medpro-cihhs-10703
- Salomé GM, Ferreira LM. Developing a mobile app for prevention and treatment of pressure injuries. *Adv Skin Wound Care.* 2018;31(2):1-6. DOI: 10.1097/01.ASW.0000529693.60680.5e
- Mendes B, Salomé GM, Pinheiro FAM, Massahud Júnior MR, Cunha DR, Ferreira LM. Preventing and treating trench foot: Validation of an educational manual for military personnel. *J Wound Care.* 2018;27(Sup10):S33-8. DOI: 10.12968/jowc.2018.27.sup10.s33
- Cunha DR, Dutra RAA, Salomé GM, Ferreira LM. Construction of a multimedia application in a mobile platform for wound treatment with laser therapy. *J Nurs UFPE On Line.* 2018;12(5):1241-9. DOI: 10.5205/1981-8963-v12i5a230676p1241-1249-2018
- Galvão ECF, Püschel VAA. Multimedia application in mobile platform for teaching the measurement of central venous pressure. *Rev Esc Enferm USP.* 2012;46(Esp):107-15. DOI: 10.1590/S0080-62342012000700016
- Rezende LCM, Santos SR, Medeiros AL. Assessment of a prototype for the Systemization of Nursing Care on a mobile device. *Rev Latino-Am Enferm.* 2016;24:e2714. DOI: 10.1590/1518-8345.0898.2714
- Pereira FGF, Silva DV, Sousa LMO, Frota NM. Building a digital application for teaching vital signs. *Rev Gaucha Enferm.* 2016;37(2):e59015. DOI: 10.5935/1415-2762.20170044.

11. Webb R. The 3D future of wound healing. *J Wound Care*. 2016;25(10):559. DOI: 10.12968/jowc.2016.25.10.559
12. Salomé GM, Bueno JC, Ferreira LM. Multimedia application in a mobile platform for wound treatment using herbal and medicinal plants. *J Nurs UFPE On Line*. 2017;11(Suppl.11):4579-88. DOI: 10.5205/reuol.11138-99362-1-SM.1111sup201706
13. Santos AC, Dutra RAA, Salomé GM, Ferreira LM. Construction and internal reliability of an algorithm for choice cleaning and topical therapy on wounds. *J Nurs UFPE On Line*. 2018;12(5):1250-62. DOI: 10.5205/1981-8963-v12i5a230676p1241-1249-2018
14. Cunha DR, Salomé GM, Massahud Junior MR, Mendes B, Ferreira LM. Development and validation of an algorithm for laser application in wound treatment. *Rev Latino-Am Enferm*. 2017;25:e2955. DOI: 10.1590/1518-8345.1998.2955
15. Filatro AC. Learning design como fundamentação teórico-prática para o design instrucional contextualizado [Tese de doutorado]. São Paulo: Universidade de São Paulo; 2008 [acesso 2020 Set 8]. Disponível em: <https://www.teses.usp.br/teses/disponiveis/48/48134/tde-12062008-142556/pt-br.php>
16. Kelechi TJ, Johnson JJ; WOCN Society. Guideline for the management of wounds in patients with lower-extremity venous disease: an executive summary. *J Wound Ostomy Continence Nurs*. 2012;39(6):598-606. DOI: 10.1097/WON.0b013e31827179e9
17. Salomé GM, Cunha AL, Pereira AP, Miranda FD, Alves JR. Educational handbook for healthcare professionals: Preventing complications and treating peristomal skin. *J Coloproctol*. 2019;39(4):332-8. DOI: 10.1016/j.jcol.2019.07.005
18. Pegoraro LGO, Gvozđ R, Haddad MCFL, Vannuchi MTO, Silva LGC, Rossaneis MA. Validation of instrument to assess software of patients' risk classification. *Rev Bras Enferm*. 2018;71(3):975-82. DOI: 10.1590/0034-7167-2017-0053
19. Cardoso IA, Salomé GM, Miranda FD, Alves JR, Leão J, Leão AS, et al. A new APP for prevention and treatment of complications of intestinal peristomal skin. *J Coloproctol*. 2020;40(2):120-8. DOI: 10.1016/j.jcol.2019.10.0.11
20. Vitoriano AM, Dell'Acqua MCQ, Silva CPC, Oliveira JS, Castro MCN. Software evaluation to pressure ulcer risk and evolution in intensive therapeutic care. *J Nurs UFPE On Line*. 2016;10(7):2369-75. DOI: 10.5205/reuol.9106-80230-1-SM1007201610

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