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Costs of topical treatment of pressure ulcer patients*

Custos do tratamento tópico de pacientes com úlcera por pressão

Costos del tratamiento tópico de pacientes con úlcera por presión

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ABSTRACT

Objective: To evaluate the costs of a topical treatment of pressure ulcer (PU) patients in a hospital unit for treatment of chronic patients in 2014. **Method:** This is an activity-based costing study. This method encompasses the identification, measurement and pricing of physical and human resources consumed for dressings. **Results:** Procedure costs varied between BRL 16.41 and BRL 260.18. For PUs of the same category, of near areas and with the same type of barrier/adjuvant, the cost varied between 3.5% and 614.6%. For most dressings, the cost increased proportionally to the increase of the area and to the development of PU category. The primary barrier accounted for a high percentage of costs among all items required to the application of dressings (human and material resources). Dressings applied in sacral PUs had longer application times. **Conclusion:** This study allowed us to understand the costs involved in the treatment of PUs, and it may support decision-makers and other cost-effectiveness studies.

DESCRIPTORS

Pressure Ulcer; Unified Health System; Hospital Costs; Therapeutics.

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INTRODUCTION

Skin changes are one of the most common consequences of long periods of hospitalization. Among these changes, pressure ulcers (PU) are the ones with the greatest impact, for both patients and their relatives and the health system, since they involve longer hospital stays, a risk of infections and other complications[1], in addition to high costs.

The WOCN (Wound, Ostomy and Continence Nurses Society) considers that most PUs can be avoided by means of preventive measures[2]. If the PU occurs despite the implementation of these measures, we can say that it was inevitable and did not happen as a result of care negligence, but rather because of its multiple causes[3]. This fact encouraged Medicare (American health insurance system) to refuse reimbursement of costs related to hospital-acquired PUs since 2008[4].

Although the evolution of health care is continuous, the occurrence of PUs remains high, especially in hospitalized patients[5]. In the international setting, the prevalence varies between 5.0 and 15%, and the incidence between 1.9 and 7%[3,6-9]. International studies show a prevalence of 11.1 to 23.2%, and an incidence of 22.5 to 66.6%[10-14].

Costs of PU management represent a constant challenge for health institutions, since the economic aspect is essential for making decisions related to the use of technologies[15]. The use of different barriers for treating PUs is common, although there is not a broad discussion concerning the comparative efficiency/effectiveness and costs related to treatment. There are few studies available in the literature that measure the economic impact of this disease, and these studies have countless limitations regarding their generalization[16].

In the United Kingdom, it was estimated that 412 thousand people develop a new PU every year and that the cost variation for PU healing is GBP 1.064 (Category I) up to GBP 10.551 (Category IV)[17]. In Portugal, EUR 9 million were allocated to PU treatment in Macaronesia (Azores, Madeira, Canary and Cape Verde archipelagos) in 2006. This cost corresponded to 4.5% of the public spending on health in Azores and 0.3% of its GDP that year[18]. Another study carried out in Ireland that evaluated the cost of PU in category IV showed that EUR 119 thousand per patient are spent over a period of five months. In this same study, the authors stated that EUR 250 million are spent every year to manage PUs in all places of care in Ireland[19]. In Brazil, eight studies on PU costs were found. In the first one, the average cost per patient varied between BRL 98.90 and BRL 180.00 per day, and it increased proportionally to the increase of the extent of tissue destruction[15]. The second, carried out in Minas Gerais, found a monthly spending that varied between BRL 915.75 and BRL 36,629.95. The estimated annual costs were BRL 445,664.38, excluding spendings with human and physical resources (such as water, electricity, telephone and others)[20].

Given the high costs involved, cost studies are relevant to support professionals in the development of strategies for the management of PUs[19]. In that sense, the objective of this study was to evaluate the costs of a topical treatment of pressure ulcer (PU) patients in a hospital unit for the treatment of chronic patients in 2014.

METHOD

This is a cost study developed in a hospital unit of the Minas Gerais Hospital Foundation (FHEMIG, as per its acronym in Portuguese), which is responsible for care of patients who are mostly victims of trauma and who need long-term hospitalizations. We included in the study PUs of adult patients who had been hospitalized for more than 24 hours. Data were collected by a researcher, between June and December 2014.

The cost study was composed of five stages, as defined by the ABC methodology (Activity-Based Costing)[21]:

I. Identification and definition of macroprocesses, processes and activities related to PUs;

II. Creation of mapping of typical processes of patients who suffer from PU;

III. Identification of resources used in each activity, such as time spent with each activity, medical-hospital equipment and human resources;

IV. Construction of a database connected with the Hospital Management Integrated System (SIGH) linked with the ABC of FHEMIG, which consists of valuating the whole process according to the costs reported by FHEMIG;

V. Study validation by a board of experts.

The cost measurement methodology was based on the Activity-based costing – ABC, which seeks a more organic vision of the institution at the origin and pricing of events, procedures, packages, resources, allocations, transactions, and especially processes by means of a systemic view[21]. This methodology was previously applied to describe the costing of procedures and services, with the aim to ground the institution's managing development[22].

The process design (stage I) followed the interview model based on the method proposed by Gonçalves and Meireles (2004)[23] of critical success factors (Rockart). The interviews were conducted in the place of study, i.e. the hospital, with two nurses of the commission of prevention and treatment of injuries, and they included two phases: survey and confirmation.

In the stage of mapping typical processes (stage II), the application of 26 dressings by two nurses of the aforementioned commission were mapped on-site. Of these dressings, four corresponded to PU category II; one to category III; 13 to category IV and six to PUs that could not be classified. The number of mapped dressings was defined by data saturation, that is, time spent and the amount of inputs consumed to perform each activity began to present similar or approximate figures after the 26 dressings were mapped. During that stage, all inputs consumed in the process activities (dressing) were reported: medication (saline solution at 0.9%), medical-hospital equipment (such as needles, syringes, gloves, gauze compresses of 7.5 x 7.5 cm^2) and human resources (nursing professionals).

In the definition of activities that are part of the processes, drivers were established so as to adapt resources to

activities (Stage III). The activity drivers tracked the activity costs to the object of cost, thus allowing for a higher degree of certainty regarding its effectiveness in the activity allocation. To define these drivers, each resource was analyzed, and also the activities in which these resources were used. To identify the workforce, time spent (in minutes) was found for each activity, and to allocate consumable material, a direct identification of the amount used was performed (medication and medical equipment).

Stage IV consisted of the use of FHEMIG's SIGH-Costs to build the database, under direct allocation, tracking and distribution. Constitutive activity resources and costs were measured (stage V).

Personnel costs were obtained by means of information generated by SIGH-Costs. Data were based on the payroll of all employees involved by means of the Employees Time Clock System (SAPT, as per its acronym in Portuguese). Costs with consumable materials were obtained by means of reports from the storage of the Material Management Integrated System (SIAD), in addition to those generated by SIGH-Costs. The consumable materials group was in turn divided into medical-hospital materials, medication and barrier/adjuvants.

This study addresses the Unified Health System approach. Since the range of time variation and use of materials is wide, data were reported according to their minimum and maximum values. Therefore, it was possible to define a range of values in which each procedure had to be included. The values are expressed in local currency (Brazilian Real) for the year 2014.

This study complied with rules set out in Resolution 466, of December 2012, by the National Health Council for human research[24]. Interviews and procedures carried out by professionals regarding stages I and II of the ABC were monitored by the main researcher, after the Free and Informed Consent Form was signed by members of the nursing staff. The study was approved by the Research Ethics Committee under number 31711014.5.3001.5119.

For the purpose of understanding the terms used in this article, some definitions follow: *Barriers* are all material, substance or product applied on the wound which forms a physical barrier that is able to cover and protect the wound bed[25]. It is called primary when it is applied directly on the wound bed and/or surrounding skin, and secondary when placed onto a primary dressing. *Adjuvants* are auxiliary products used together with barriers or as a complement to wound healing. And *Category* refers to the translation of the classification used by the National Pressure Ulcer Advisory Panel (NPUAP)[26], which assesses the severity of PUs according to the loss and anatomical depth of the wounded tissue[27].

RESULTS

In stage I of the ABC methodology, the procedure *PU dressing* was mapped and resulted in a flowchart of the constitutive stages of the process (Figure 1).

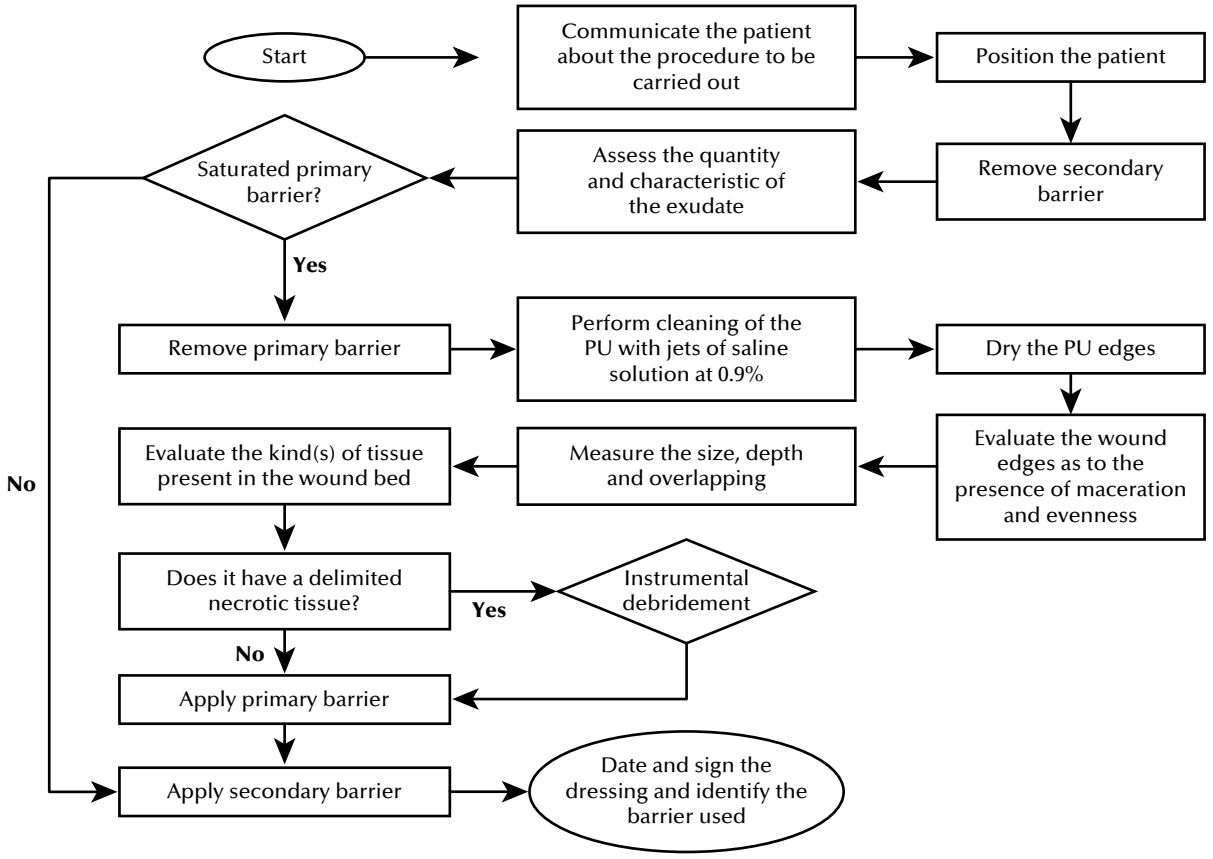

Figure 1 – Flowchart of the constitutive stages of the application process of a dressing in a public hospital of Minas Gerais – Belo Horizonte, MG, Brazil, 2014.

The minimum and maximum costs were described according to PU category of barrier/adjuvants used for dressings and PU area (Table 1). For category II, smaller sized areas (5-8 cm²) had costs which ranged from BRL 67.69 to BRL 92.08; whereas larger areas (25-32 cm²) costs ranged from BRL 67.89 to BRL 172.32. The maximum cost varied up to 154.6% compared to the minimum cost for the same barrier (hydrocolloid) of different sizes.

For category III PUs, dressings applied with alginate had a variation between minimum and maximum costs of 76.1% Due to the impossibility of grouping the only PU in category III with the others done with hydrogel adjuvant, its cost was expressed in one single value.

For category IV PUs, it was seen that hydrofiber and silver dressings had minimum and maximum costs that varied 112.3% (from BRL 89.59 to BRL 190.24). With the hydrogel barrier, the variation was 3.5%. The variation observed between the minimum (BRL 20.04) and maximum (BRL 143.21) costs with alginate barrier was significant (614.6%). The difference between the costs of collagen and alginate was 67.8%.

For PUs that could not be classified, it was found that the minimum cost of dressings done with hydrogel varied up to 525.10% (BRL 16.41 to BRL 102.58) for different sizes. The cost variation with nanocrystalline silver was 35.1%.

Table 1 – Costs (minimum and maximum) according to the PU category, barrier/adjuvant used and PU area in a public hospital of Minas Gerais – Belo Horizonte, MG, Brazil, 2014.

Categories	Primary barrier/Adjuvant	PU area (cm²)	Minimum cost (BRL)	Maximum cost (BRL)
II	Hydrocolloid	5cm² to 8cm²	67.69	92.08
		25cm² to 32cm²	67.89	172.32
III	Alginate	87.5cm² to 130cm²	29.02	51.10
	Hydrogel	52.5cm²	96.38	
IV	Hydrofiber and silver	Up to 55cm²	93.31	133.71
		99cm² to 120cm²	89.59	190.24
	Hydrogel	190cm² to 234cm²	129.27	133.78
	Alginate	37.5cm² to 42.5cm²	20.04	143.21
	Collagen and alginate	98cm² to 102cm²	134.29	225.34
Could not be classified	Hydrogel	45.5cm²	28.20	51.59
		21cm² to 24.5cm²	16.41	102.58
	Nanocrystalline silver	96cm² to 120.5cm²	192.64	260.18

Of dressings that needed a secondary barrier, the primary barrier accounted for a greater percentage of costs, except for those in which hydrogel and alginate were used, and which the secondary barrier (hydrocolloid) and acrylic copolymer spray (Cavilon spray®) were used.

Considering the price per unit of barrier/adjuvant in relation with the total cost of PU treatment (human resources and medical-hospital material), it is seen that the variation ranges from 4.9% to 96.7% (Table 2). The barrier with the lowest cost per unit is alginate (BRL 7.02) and those with the highest costs are collagen with alginate (BRL 129.00) and nanocrystalline silver (BRL 160.00). The price of barriers in relation with the total cost varied between 4.9 and 35%, 57.2 and 96.1% and 61.5 and 83.1%, respectively. The price of calcium alginate accounted for a lower percentage in relation with total costs (4.9 to 35.0%). As for the price of hydrocolloid, it accounted for a higher percentage in relation with total costs (38.0 to 96.7%).

Table 2 – Price per unit of barriers/adjuvants and percentage of barrier price in relation with total cost in a public hospital of Minas Gerais – Belo Horizonte, MG, Brazil, 2014.

Barrier/adjuvant	Unit price (BRL)[a]	Percentage of (a) in relation with total costs (%)	
		Minimum	Maximum
Calcium alginate	7.02	35.0	4.9
Hydrogel	13.5	82.3	10.1
Hydrocolloid	65.48	96.7	38.0
Hydrofiber and silver	65.48	73.1	34.4
Collagen and alginate	129.00	96.1	57.2
Nanocrystalline silver	160.00	83.1	61.5

Table 3 presents the minimum and maximum times spent to apply dressings, according to the PU location. Dressings applied in intravertebral PUs were applied more quickly (5.8 to 10.7'), whereas sacral PUs took the longest to apply (14.8 to 33.7').

Table 3 – Minimum and maximum times to apply dressings, according to the PU anatomical location in a public hospital of Minas Gerais – Belo Horizonte, MG, Brazil, 2014.

Anatomical location	Minimum time (minutes)	Maximum time (minutes)
Intraparavertebral	5.8	10.7
Shoulder	7.9	8.8
Trochanteric	8.7	21.7
Sacral	14.8	33.7

DISCUSSION

Pressure ulcers are a serious public health issue, both for being often avoidable and the high costs related to their management. In this study, a wide variation of costs of primary barriers and adjuvants was observed in PU treatment. Considering the costs with barriers, medical-hospital material and human resources, they ranged from BRL 16.41 to BRL 260.18, depending on the type of barrier and PU size. The cost variation within the same category and type of barrier was large, from 3.5% to 614.6%.

For most dressings, the cost increased proportionally to the increase of the area and to the development of PU category. Studies carried out in 2004 and 2013 also showed a cost increase according to the PU category[15,17]. Larger areas clearly need more material resources and require more time for execution. Dressing costs are occasional measurements, and the variation according to the PU category could be better observed if spendings on PU treatment were accounted for from its outbreak until its healing, as time for healing tends to be longer for more severe PUs.

The primary barrier accounted for a high percentage of costs among all items required to the application of dressings (human and material resources), except for those in which hydrogel and calcium alginate were used. In that sense, cost comparisons are important since unit prices of barriers alone are not the best savings indicator in the consumption of resources. In addition to this, efficiency/effectiveness evaluations of these technologies must be carried out to assess the procedure efficiency.

In the unit where this study was carried out, all hydrocolloid plates used for dressings were 15cm x 15cm^2; however, in some cases, the whole plate was not used. The remaining hydrocolloid plate was left in patients' compartments in order to be used afterwards. However, it was noticed that sterility control and maintenance could be affected. This could have an influence on cost increase, in addition to impair patients' safety. Therefore, it is the institution's responsibility to provide different sizes of barrier/adjuvants, and it is up to nurses to anticipate the size of the adequate barrier for the PU location and/or depth. While the 15x15cm^2 hydrocolloid plate costs BRL 65.48, the 10x10 one costs only BRL 16.00. For dressings described in this study and done with hydrocolloid, the 10x10 plate would fit well, considering PU areas.

The 15x15cm^2 hydrocolloid plate (BRL 65.48 per unit), used as a secondary barrier, was the input that most increased the costs of dressings done with calcium alginate as a primary barrier. As this barrier and the hydrocolloid belong to different categories, with different mechanisms of action as well, the best option would be a different secondary barrier, such as the 10x12cm^2 transparent film, which costs BRL 10.00. In addition to leaving the primary barrier visible, the polyurethane film allows for savings of BRL 55.48 when it is used as a secondary barrier in this case. The product indication is associated with different factors, such as scarring, resource availability, cost-benefit and PU characteristics, but in this decision-making process, a trained professional makes all the difference[28]. Health professionals' knowledge and skill about indication and replacement frequency of barriers is essential for the choice of the most effective and economic treatment.

When compared to other dressings, those in which nanocrystalline silver and collagen and alginate were the most expensive, since barriers have higher costs, (BRL 160.00 and BRL 129.00 respectively). However, the secondary barrier (hydrocolloid plate) was the main responsible for the cost variation between dressings done with these two barriers. Both nanocrystalline silver and collagen-alginate belong to different categories of barriers and mechanism of action when compared to the hydrocolloid. Therefore, for these two cases it would be useful to have a traditional secondary barrier (sterile gauze and micropore surgical tape). The hydrocolloid plate unit costs BRL 65.48, and the traditional secondary barrier costs between BRL 1.12 and BRL 2.36. Once again, the choice of a more appropriate secondary barrier would result in savings of BRL 63.12 and BRL 64.36 respectively.

Comparing hydrocolloid and polyurethane film in this study, only the hydrocolloid was used as a primary barrier. However, a meta-analysis that compared these barriers showed that the polyurethane film is more likely to heal a PU[29].

Regarding the execution time of dressings, there was a variation of 5.75 to 33.73' in the application of all barriers. When comparing sacral PU dressings with other PUs, it was observed that the time to position patients and clean sacral PUs was longer. Sacral PUs had longer minimum and maximum times when compared to other PUs. Probably due to the proximity to anal and genital regions, sacral PU dressings took longer, since they require more care to avoid contamination of the PU barrier and bed by intestinal and bladder evacuation.

The cost estimates do not reflect prices paid for procedures. They include costs involved in the procedure (dressing) of each PU according to the chosen approach. Nonetheless, it is believed that the study achieved the intended goals and contributed to clinical practice, since the economic aspect is essential to decision making, both clinically and collectively, considering the input availability.

The use of economic grounds favors the rational use of resources and it is essential to the management of public health institutions in Brazil, considering that spendings on this field have been increasing, whereas resources available have not increased in the same proportion[17]. Economic matters must be considered when choosing the most appropriate treatment for patients, since this may provide nurses with arguments regarding the cost needs of different barriers, and allow them to decide together with the management upon the allocation of resources for different activities.

CONCLUSION

Pressure ulcers are considered as a public health issue and they affect mainly hospitalized individuals, impairing patients' safety. In addition, they result in high costs for the health system. Different barriers have costs that vary according to the area and severity of PUs. This study allowed us to understand the costs involved in the treatment of PUs, and it may support decision makers and other cost-effectiveness studies.

RESUMO

Objetivo: Realizar uma avaliação do custo do tratamento tópico de pacientes com úlceras por pressão (UP), em uma unidade hospitalar de atendimento a pacientes crônicos no ano de 2014. **Método:** Trata-se de um estudo de custos baseado no Sistema de custeio Baseado em Atividades. Este método contempla a identificação, mensuração e precificação dos recursos físicos e humanos consumidos para a realização de curativos. **Resultados:** Os custos dos procedimentos variaram de R$16,41 a R$260,18. Para UP de mesma categoria, de áreas aproximadas e mesmo tipo de cobertura/adjuvante, a variação entre os custos foi de 3,5% a 614,6%. Para a maioria dos curativos, o custo aumentou proporcionalmente ao aumento da área e à progressão da categoria das UP. A cobertura primária representou elevado percentual nos custos entre todos os itens necessários para realizar os curativos (recursos humanos e materiais). Os curativos realizados nas UP sacrais foram os que apresentaram maiores tempos para execução. **Conclusão:** Este estudo permitiu conhecer os custos envolvidos no tratamento das UP e pode fornecer subsídios para os tomadores de decisão, assim como para a realização de estudos de custo-efetividade.

DESCRITORES

Úlcera por Pressão; Sistema Único de Saúde; Custos Hospitalares; Terapêutica.

RESUMEN

Objetivo: Llevar a cabo una evaluación del costo del tratamiento tópico de pacientes con úlceras por presión (UP), en una unidad hospitalaria de atención a pacientes crónicos en el año de 2014. **Método:** Se trata de un estudio de costos basado en el Sistema de pago Basado en Actividades. Este método contempla la identificación, mensuración y precificación de los recursos físicos y humanos consumidos para la realización de apósitos. **Resultados:** Los costos de los procedimientos variaron de R$16,41 a R$260,18. Para UP de misma categoría, de áreas aproximadas y mismo tipo de cobertura/adyuvante, la variación entre los costos fue del 3,5% al 614,6%. Para la mayoría de los apósitos, el costo aumentó proporcionalmente al aumento del área y la progresión de la categoría de las UP. La cobertura primaria representó elevado porcentual en los costos entre todos los elementos necesarios para realizar los apósitos (recursos humanos y materiales). Los apósitos realizados en las UP sobre el sacro fueron los que presentaron mayores tiempos para ejecución. **Conclusión:** Este estudio permitió conocer los costos involucrados en el tratamiento de las UP y puede proporcionar subsidios para los tomadores de decisión, así como para la realización de estudios de costo-efectividad.

DESCRIPTORES

Úlcera por Presión; Sistema Único de Salud; Costos de Hospital; Terapéutica.

REFERENCES

1. Brasil. Ministério da Saúde. Anexo 02: Protocolo para Prevenção de Úlcera por Pressão [Internet]. Brasília: MS/ANVISA/Fiocruz; 2013 [citado 2014 set. 12]. Disponível em: http://proqualis.net/sites/proqualis.net/files/000002429jFPtGg.pdf
2. Stevenson K. Pressure ulcer prevention: when are e negligent? Wound Care Canada. [Internet]. 2009 [cited 2013 June 20];7(2):30-32. Available from: http://cawc.net/images/uploads/wcc/7-2-stevenson.pdf
3. Costa IG. Incidência de úlcera por pressão em hospitais regionais do Mato Grosso, Brasil. Rev Gaúcha Enferm [Internet]. 2010 [citado 2013 out. 11];31(4):693-700. Disponível em: http://www.scielo.br/pdf/rgenf/v31n4/a12v31n4.pdf
4. Waters TM, Daniels MJ, Bazzoli GJ, Perencevich E, Dunton N, Staggs VS, et al.. Effect of Medicare's nonpayment for hospital-acquired conditions lessons for future policy. JAMA Intern Med. 2015;175(3):347-54.
5. Rocha JA, Miranda MJ, Andrade MJ. Abordagem terapêutica das úlceras de pressão: Intervenções baseadas na evidência. Acta Med Port [Internet]. 2006 [citado 2013 maio 4];28(19):29-38. Disponível em: http://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/908/581
6. Gardiner JC, Reed PL, Bonner JD, Haggerty DK, Hale DG. Incidence of hospital-acquired pressure ulcers – a population-based cohort study. Int Wound J. 2014 Dec 3. [Epub ahead of print]
7. Igarashi A, Yamamoto-Mitani N, Gushiken Y, Takai Y, Tanaka M, Okamoto Y. Prevalence and incidence of pressure ulcers in Japanese long-term-care hospitals. Arch Gerontol Geriatr. 2013;56(1):220-6.
8. Lahmann NA, Halfens RJ, Dassen T. Pressure ulcers in German nursing homes and acute care hospitals: prevalence, frequency and ulcer characteristics. Ostomy Wound Manage [Internet]. 2006 [cited 2014 Nov. 28];52(2):20-33. Available from: http://www.o-wm.com/content/pressure-ulcers-german-nursing-homes-and-acute-care-hospitals-prevalence-frequency-and-ulcer

9. Moore ZEH, Cowman S. Risk assessment tools for the prevention of pressure ulcers. Cochrane Database Syst Rev. 2008;(3):CD006471.

10. Moore Z. US Medicare data show incidence of hospital-acquired pressure ulcers is 4.5%, and they are associated with longer hospital stay and higher risk of death. Evid Based Nurs. 2013;16(4):118-9.

11. Queiroz ACCM, Mota DDCF, Bachion MM, Ferreira ACM. Pressure ulcers in palliative home care patients: prevalence and characteristics. Rev Esc Enferm USP [Internet]. 2014 Apr [cited 2015 Dec 09];48(2):264-71. Available from: http://www.scielo.br/pdf/reeusp/v48n2/0080-6234-reeusp-48-02-264.pdf

12. Freitas MC, Medeiros ABF, Guedes MVC, Almeida PC, Galiza FT, Nogueira JM. Úlcera por pressão em idosos institucionalizados: análise da prevalência e fatores de risco. Rev Gaúcha Enferm. [Internet]. 2011 [citado 2013 mar. 7];32(1):143-50. Disponível em: http://www.scielo.br/pdf/rgenf/v32n1/a19v32n1.pdf

13. Rogenski NMB, Kurcgant P. The incidence of pressure ulcers after the implementation of a prevention protocol. Rev Latino Am Enfermagem [Internet]. 2012 [cited 2015 Dec 13];20(2):333-9. Available from: http://www.scielo.br/pdf/rlae/v20n2/16.pdf

14. Borghardt AT, Prado TN, Araújo TM, Rogenski NMB, Bringuente MEO. Evaluation of the pressure ulcers risk scales with critically ill patients: a prospective cohort study. Rev Latino Am Enfermagem [Internet]. 2015 [cited 2015 Dec 8];23(1):28-35. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4376028/

15. Lima ACB, Guerra DM. Avaliação do custo do tratamento de úlceras por pressão em pacientes hospitalizados usando curativos industrializados. Ciênc.saúde coletiva [Internet]. 2011 Jan [cited 2013 Jan 11];16(1):267-77.

16. Silva AJ, Pereira SM, Rodrigues A, Rocha AP, Varela J, Gomes LM, et al. Custo econômico do tratamento das úlceras por pressão: uma abordagem teórica. Rev Esc Enferm USP. 2013;47(4):971-6.

17. Bennett G, Dealey C, Posnett J. The cost of pressure ulcers in the UK. J Woundcare. 2004;33(3):230-5.

18. Grupo Investigação Científica em Enfermagem. Enfermagem e úlceras por pressão: da reflexão sobre a disciplina às evidências nos cuidados: colectânia [Internet]. Angra do Heroísmo, PT; 2008 [citado 2014 dez. 1]. Disponível em: http://sociedadeferidas.pt/documentos/Enfermagem_e_ulceras_por_Pressao_-_Colectanea.pdf

19. Gethin G, Jordan-O'Brien J, Moore Z. Estimating costs of pressure area management based on a survey of ulcer care in one Irish hospital. J Wound Care. 2005;14(4):162-5.

20. Costa AM, Matozinhos ACS, Trigueiro PS, Cunha RCG, Moreira LR. Custos do tratamento de úlceras por pressão em unidade de cuidados prolongados em uma instituição hospitalar de Minas Gerais. Enferm Rev [Internet]. 2015 [citado 2015 jun. 8]; 18(1): 58-74. Disponível em: http://periodicos.pucminas.br/index.php/enfermagemrevista/article/view/9378

21. Nakagawa M. ABC: custeio baseado em atividades. São Paulo: Atlas; 1994.

22. Brandão CMR, Machado GPM, Mascarenhas MA, Drumond HA, Acurcio FA. Custos de fraturas relacionadas à osteoporose no Sistema Único de Saúde. J Bras Econ Saúde. [Internet]. 2014 [citado 2015 dez. 14];6(1):2-8. Disponível em: http://www.jbes.com.br/images/v6n1/v6n1.pdf

23. Gonçalves CA, Meirelles AM. Projetos e relatórios de pesquisa em administração. São Paulo: Atlas; 2004.

24. Brasil. Ministério da Saúde; Conselho Nacional de Saúde. Resolução n. 466, de 12 de dezembro de 2012. Dispõe sobre diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos [Internet]. Brasília; 2012 [citado 2013 mar. 25]. Disponível em: http://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf.

25. Borges EL, Saar SRC, Magalhães MBB, Gomes FSL, Lima VLAN. Feridas: como tratar. 2ª ed. Belo Horizonte: COOPMED; 2010.

26. Santos VLCG, Caliri MHL. Conceito e classificação de úlcera por pressão: atualização do NPUAP. Rev Estima 2007;5(3):43-4.

27. Marques LG, Vieira MLC, Pereira SRM. A Construção dos conhecimentos dos enfermeiros perante a nova classificação da úlcera por pressão. Rev Estima. 2013;11(1):13-21.

28. Melo EM, Fernandes VS. Avaliação do conhecimento do enfermeiro acerca das coberturas de última geração. Rev Estima. 2011;9(4):12-20.

29. Pott FS, Meier MJ, Stocco JG, Crozeta K, Ribas JD. The effectiveness of hydrocolloid dressings versus other dressings in the healing of pressure ulcers in adults and older adults: a systematic review and meta-analysis. Rev Latino Am Enfermagem [Internet]. 2014 [cited 2015 Dec 15];22(3):511-20. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4292618/

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