Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: http://dx.doi.org/10.12957/reuerj.2020.42285

Cost-minimization of bandage for central venous catheter: sterile gauze versus transparent film

Custo-minimização de curativos para cateter venoso central: gaze estéril versus filme transparente

Minimización de costes del vendage para catéter venoso central: gasa estéril versus película transparente

Fernanda Oliveira Caló[I], Antônio Augusto de Freitas Peregrino[II], Andrezza Serpa Franco[III], Ronilson Gonçalves Rocha[IV], Flavia Giron Camerini[V], Cristiano Bertolossi Marta[VI]

ABSTRACT

Objective: to compare the cost of transparent film and sterile gauze fixed by microporous adhesive tape in central venous access dressings. **Method:** quantitative, prospective, observational, statistical study in the light of health economics. A total of 109 film and 168 gauze covers were evaluated for 27 days. Tree Age software was used to calculate the probability of each decision. **Results:** coverings used per day averaged 2.22 with transparent film-covered inserts and 3.43 with gauze. Additional changes were necessary in 38 (23%) coverings with gauze and 16 (15%) with transparent film. During the study period, the average final cost of gauze (R$ 389.44) was 3.7 times higher than transparent film (R$104.95). **Conclusion:** transparent film dressing is less expensive than sterile gauze covering.

Descriptors: Health Evaluation; Costs and Cost Analysis; Catheter-Related Infections.

RESUMO

Objetivo: comparar o custo entre coberturas com filme transparente versus gaze estéril e fita adesiva microporosa em curativos de acesso venoso central. **Método**: estudo estatístico, prospectivo, observacional, com abordagem quantitativa à luz da avaliação econômica de saúde. Foram avaliadas 109 coberturas com filme e 168 com gaze, durante 27 dias. Na análise utilizou-se o *Software Tree Age* para se calcular a probabilidade de cada decisão. **Resultado**: a média de uso das coberturas por dia foi de 2,22 inserções cobertas com filme e 3,43 com gaze. Houve necessidade de troca extra em 38 (23%) das coberturas com gaze e em 16 (15%) das coberturas com filme transparente. Observou-se custo final médio para gaze (R$389,44) 3,7 vezes maior que o filme transparente (R$104,95) durante o período estudado. **Conclusão**: cobertura com filme transparente tem menor custo quando comparado com cobertura com gaze estéril.

Descritores: Avaliação em Saúde; Custos e Análise de Custo; Infecções Relacionadas a Cateter.

RESUMEN

Objetivo: comparar el costo de la película transparente y la gasa estéril fijada con cinta adhesiva microporosa en apósitos de acceso venoso central. **Método:** estudio cuantitativo, prospectivo, observacional, estadístico a la luz de la economía de la salud. Se evaluaron un total de 109 películas y 168 cubiertas de gasa durante 27 días. Se utilizó el software Tree Age para calcular la probabilidad de cada decisión. **Resultados:** los recubrimientos utilizados por día promediaron 2,22 con inserciones transparentes recubiertas con película y 3,43 con gasas. Fueron necesarios cambios adicionales en 38 (23%) revestimientos con gasa y 16 (15%) con película transparente. Durante el período de estudio, el costo final promedio de la gasa (R $ 389,44) fue 3,7 veces superior al de la película transparente (R $ 104,95). **Conclusión:** el apósito de película transparente es menos costoso que el recubrimiento de gasa estéril.

Descriptores: Evaluación en Salud; Costos y Análisis de Costo; Infecciones Relacionadas con Catéteres.

INTRODUCTION

This study was developed from the concerns of care nurses about the best option for venous catheter covers from the perspective of costs. Therefore, a comparative assessment between the use of sterile gauze and transparent film in a central venous access dressing was conducted through an analysis of cost minimization from the perspective of infection prevention.

Health Care-Associated Infections (HAIs) refer to infections acquired and related to health care in any type of environment. Bloodstream Infections (BSI) stand out among the most frequent in critically ill patients[1].

[I]Nurse. Universidade do Estado do Rio de Janeiro. Rio de Janeiro, Brazil. E-mail: fcalo.enfermeira@gmail.com. ORCID: http://orcid.org/0000-0002-6735-8109
[II]Nurse. Postdoc. Universidade do Estado do Rio de Janeiro. Rio de Janeiro, Brazil. E-mail: antonio.peregrino@gmail.com. ORCID: http://orcid.org/0000-0002-6617-480X
[III]Nurse. PhD. Universidade do Estado do Rio de Janeiro. Rio de Janeiro, Brazil. E-mail: dezzafranco@gmail.com. ORCID: http://orcid.org/0000-0001-5008-1345
[IV]Nurse. PhD. Universidade do Estado do Rio de Janeiro. Rio de Janeiro, Brazil. E-mail: ronilsonprof@gmail.com. ORCID: http://orcid.org/0000-0003-4097-8786
[V]Nurse. PhD. Universidade do Estado do Rio de Janeiro. Rio de Janeiro, Brazil. E-mail: fcamerini@gmail.com. ORCID: http://orcid.org/0000-0002-4330-953X
[VI]Nurse. Postdoc. Universidade do Estado do Rio de Janeiro. Rio de Janeiro, Brazil. E-mail: cristianobertol2014@gmail.com. ORCID: http://orcid.org/0000-0002-0635-7970

Received: Apr 30th 2019 – Accepted: Aug 20th 2020

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: http://dx.doi.org/10.12957/reuerj.2020.42285

Mortality due to BSI is variable among patients and directly related to other risk factors, such as the length of stay in Intensive Care. According to The National Health Surveillance Agency (Portuguese acronym: ANVISA), results from compulsory notification with the incidence of BSI in Brazilian hospitals showed 18,370 cases of BSI per year, of which 60% occurred in adult intensive care units[1].

Bloodstream infections are multifactorial and depend on a series of conditions to guide diagnosis and the appropriate treatment. In practice, they are subdivided into: primary bloodstream infections (PBSI) and vascular access-associated infections (VAIs), which have a specific and distinct framework for prevention and diagnosis. Although VAIs are more frequent, they are considered less severe and have visible signs of infection at the catheter insertion site, such as purulent secretion and hyperemia[2].

Although central venous catheters (CVC) are widely used and have indisputable benefits for critically ill patients, the use of this device may increase the risk of complications such as BSI[3], which is of great concern, because this is the health care-associated infection with the greatest preventive potential. Studies estimate that 60-75% of cases could be prevented by optimizing the maintenance and handling practices of vascular devices[1,4].

Maintaining the use of CVC requires the use of appropriate covers to protect the puncture site and minimize the possibility of infection through the interface between the catheter surface and the skin, in addition to stabilizing the device in place and preventing its movement with potential damage to the vessel. The ideal cover must remain occlusive, dry and sterile for protection of the catheter insertion hole. To this end, the ANVISA suggests using a dressing with sterile gauze and fixative tape or with a sterile semipermeable transparent film, both with a moderate level of evidence[2].

In several hospital units, the current CVC care method includes daily occlusive dressings using aseptic technique with gauze and sterile gloves, microporous adhesive tape and 0.5% chlorhexidine alcohol solution or, in its absence, 70% alcohol. Alternatives such as sterile transparent film would replace the daily manipulation of the insertion site, although they involve the correct manipulation of the cover, skills and training of the team[5].

In a study assessing the effectiveness of preventing VAIs in CVC, similar probabilities of the occurrence of hole infection were found; 4% for gauze covers and 3% for sterile film. A statistically insignificant difference, that is, the cover options were equivalent in relation to the prevention of bloodstream infection. Therefore, the present study is based on analyzing the costs involved with the two methods of protecting the CVC hole[6].

Cost-minimization assessments consider the effectiveness of interventions compared as equivalent; the focus of the analysis are the costs involved in each of them, with indication of the one with the lowest cost[7].

Studies of this nature are infrequent in the field of nursing, although the category has a large representation in health services. As Nursing act in the process of purchasing, requesting and evaluating new materials, they exert influence on the economic aspect, because of their decision power to determine the destination of resources, in addition to having profound knowledge about the care needs of their sector. There is also the concept that BSI increases mortality as well as hospitalization length of stay and costs, therefore, this is a relevant matter in the management of financial resources[8].

The study question of this work is: “What is the cost-minimization of doing a dressing with sterile transparent film, compared to daily sterile dressings with sterile gauze fixed with microporous adhesive tape in the central venous access of adult patients in intensive care units, within the scope of a university hospital, while using the device?”.

The hypothesis was that using sterile dressings with transparent film can reduce material expenditure and the working time of the nursing team in patients using vascular access in intensive care units, once there is less need for changes compared to the sterile gauze fixed with adhesive tape.

In view of the above, the objective was to compare the cost between covers with transparent film versus sterile gauze and microporous adhesive tape in dressings of central venous access.

METHOD

Statistical, prospective, observational, quantitative study in the light of economic evaluation in health. It is registered at the Plataforma Brasil (Brazilian database of research registration) and was approved by the Research Ethics Committee of the institution on 8 March, 2017 by Consubstantiated Opinion number 1.953.828. A waiver of Informed Consent form was granted.

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: http://dx.doi.org/10.12957/reuerj.2020.42285

Data related to covers and evaluation of the CVC insertion hole were collected in an adult intensive care unit at a university hospital. The research site has capacity for ten beds. The Standard Operating Protocol (SOP) of the unit was used to prepare the checklist of the studied practice. Together with the nursing team, it was determined that beds from one to five would use the cover with sterile transparent film and beds from six to ten would use the cover with sterile gauze fixed with microporous adhesive tape. The transparent film is part of the list of materials present in the unit, although it is used less often due to its high initial cost. The head of the unit directed the available amount of this material for use throughout the performance of this study.

The following were included: CVC covers with transparent film and sterile gauze fixed with microporous adhesive tape; CVC covers inserted in the internal jugular vein or subclavian vein of patients admitted to the adult intensive care unit studied, due to the possibility of daily monitoring and its frequency of installation in the unit. Hemodialysis catheters were excluded because of difficulties involving the monitoring of daily changes and the standardization of the team, as they are performed by the specific nephrology team; as well as peripheral catheters, because the sterile transparent film is not used in its dressing. Catheters inserted through the femoral vein were not used due to the higher possibility of change in the site for reasons outside the scope of the study that may cause confusion in the result.

Data collection occurred between April and July, 2017. Initially, the proposal was presented to the nursing staff of each shift, with emphasis on objectives of the study, method of collection, form of application of the film, correct assessment of maintenance and the importance of medical records. The researcher followed the daily change of dressings made with sterile gauze and sterile transparent film. Forty-nine collections were performed in 87 different days (14 weeks). In each collection, the number of patients using each cover, the characteristics of each one and the medical records related to the catheter and the dressing at that given moment were observed.

The record of the characteristics of the covers and evaluation of the hole were performed using a checklist created and completed by the researcher. The objective of this checklist was to quantify the number of patients using each cover and, among the covers, how many were appropriate (clean/dry, occlusive and appropriate date), and inappropriate with some condition that determined the performance of a new dressing (loosening, humidity/dirt or inappropriate/missing date), signs of local infection and space for extra observations. The signs of infection were viewed directly through covers with film or identified indirectly in the medical records (made by nursing staff) of patients using gauze covers.

The instrument allowed up to four daily collections during daytime service. Daytime service was chosen because this is a period of great activity of manipulation and/or mobilization of patients by professionals of the health team hence, it reflects the effectiveness of covers in daily procedures.

The collected data were inserted in a Microsoft Office Excel 2010® spreadsheet and separated by type of cover and characteristics observed. Afterwards, descriptive calculations of central tendency, probability and standard deviation by observed characteristic were performed.

For the calculation of costs, a micro-costing technique was used, including dressing with sterile gauze, dressing with transparent film, removal of CVC and puncture of new CVC. Information about the protocol used in the unit, the recent hospital purchase table and the amount paid by the remuneration table of the National Health System (Brazilian SUS) were used to survey the costs of materials needed. The following materials are used to do the dressing: glycerin alcohol, sterile procedure gloves, 0.9% saline tubes, sterile gauze, 0.5% alcoholic chlorhexidine, cap, surgical mask, goggles and the chosen cover[9,10].

Considering the variability between each patient, the time spent on procedures was timed randomly to determine the average time spent and the standard deviation in order to better reflect the reality of the sector and the variation in costs.

The costs related to professional time in minutes were calculated by using the average salary value and workload of each professional category (medical or nursing) with an employment contract in the public service, with data from the Secretariat of Finance and Planning of the city of Rio de Janeiro. The probability of occurring an infection with each cover was entered using as reference the probability published in a completed study[6].

The results of statistical calculations and costs involved were entered in the decision tree using the TreeAge® Software. The variable “loosening” of the film cover was removed, because no occurrences of loose cover were observed during data collections.

The need for a new dressing (more than one) at every 24 hours for the gauze and every seven days for the film cover was considered as an extra change.

DOI: http://dx.doi.org/10.12957/reuerj.2020.42285

The costs of inappropriate cover were inserted in the tree considering the sum of the cost of a dressing (with gauze or film) plus the cost of the daily dressing (in case of the film, this value was divided by seven). In the "appropriate cover" branch, only the costs of the daily dressing were included.

RESULTS

Using the probabilities mentioned in the method session and considering the number of covers observed, the probable number of catheter removal and puncture of new CVC was calculated and inserted into the cost calculation of the TreeAge® Software decision tree shown in Figure 1.

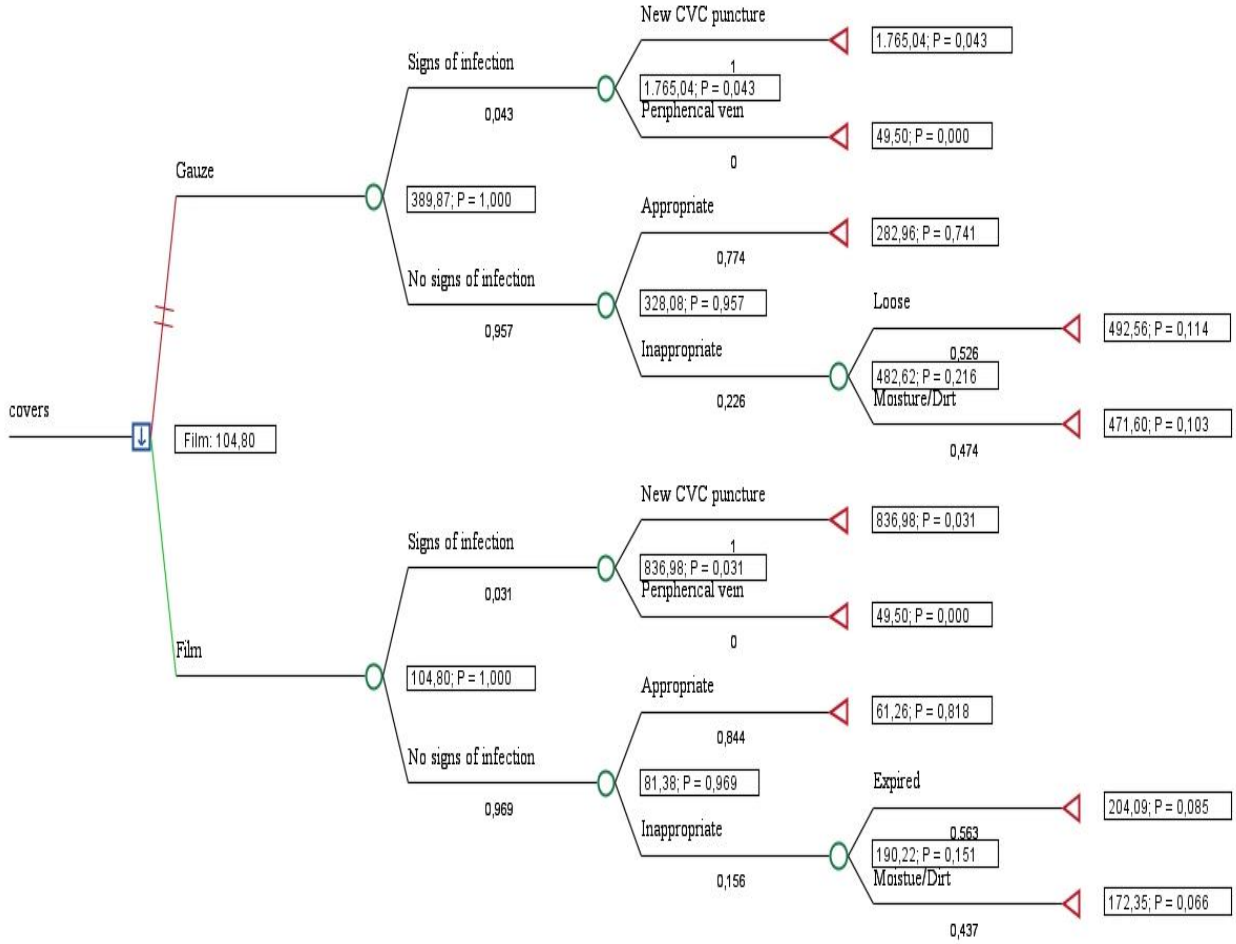

FIGURE 1: Decision tree including the probability and costs for each branch. Rio de Janeiro, Brazil, 2018.

In total, 168 covers with gauze and 109 covers with film were observed. The average use of covers per day was of 2.22 CVC insertions covered with film and 3.43 with gauze.

An extra change was necessary in 38 (23%) covers with gauze; in 20 (12%) because they were nonocclusive (loose dressings) and in 18 (11%) because of humidity/presence of dirt. Ten changes of cover without registered justification were identified.

In the case of covers with transparent film, 16 (15%) dressings had to be changed. Of these, in nine (8%) dressings, the application date was missing or the permanence was longer than seven days, followed by the presence of hole moisture/dirt in seven (6%) dressings.

The weekly average of extra changes of covers was 9.5 for gauze and 4 for transparent film. This average was calculated by dividing the total number of inappropriate covers by the time the catheter remained in weeks.

DOI: http://dx.doi.org/10.12957/reuerj.2020.42285

The cost obtained for the dressing procedure was R$ 10.48 for the cover with gauze and R$ 15.87 for film. These costs reflect the relationship between costs involved in each cover (considering the variations in professional time involved that may occur in each patient, the need for extra changes and the need for a new CVC puncture due to occurrence of infection) and the probability involved in each decision.

After insertion of these data into the Tree Age® Software, numerical data on the costs involved in each cover in the period were obtained, as shown in Figure 2.

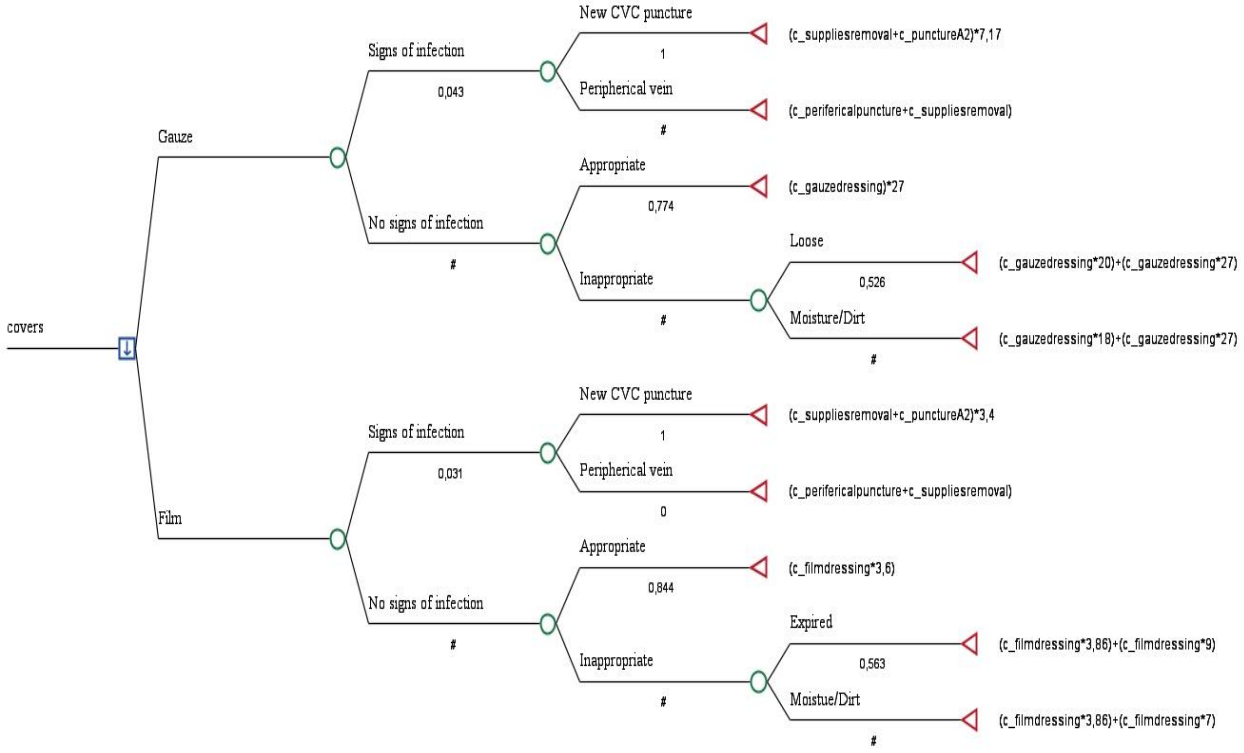

Figure 2. Decision tree with cost x probability for each decision. Rio de Janeiro, Brazil, 2018.

DISCUSSION

By applying statistical tools that allow the use of data contained in the indexed literature and collected in loco, it is possible to better integrate and discuss from an economic perspective and contribute to replicate the findings in different scenarios. In practice, the increase in costs between one technology and the other requires knowledge for a better management of materials used in the hospital[7,11].

In a study published in 2015, the durability and costs related to the cover with films of different brands on 590 catheters were evaluated. It was found that 28% of film covers needed replacement because of loss of skin adhesion. These results differ from data collected, in which no loose film cover was observed[12].

In a step performed before data collection, professionals were explained about the importance to avoid tensioning the film during application, and making sure that the patient's skin is clean and dry before applying the transparent film cover. Some authors argue that the loss of adherence of this technology may be more related to the lack of training of the team, which can lead to a higher frequency of change and its decreased cost-effectiveness[10,12].

Regarding gauze covers, a randomized trial showed that it has 0.1 probability of non-adherence. In the present study, the probability of non-adherence of gauze fixation with microporous tape was 0.12%, corroborating the findings

DOI: http://dx.doi.org/10.12957/reuerj.2020.42285

of the trial. Note that the CVC puncture site strongly influences the fixation of the dressing and that catheters placed in the jugular vein have a greater chance of non-adherence of the cover, regardless of the type of material[10,13-14].

Economically, at first glance, the transparent film may be seen with reservations regarding financial benefits because of the price difference between the unit and the sterile gauze package. While the gauze cover costs R$ 0.39, the transparent film unit costs R$ 5.50. However, when considering the seven days of stay, there is an inversion of the difference. The cost of the gauze dressing (considering the use of sterile glove and microporous tape) is now R$ 73.34 while the cost of the film remains (considering the transparent film and the sterile glove) R$ 15.87 weekly. Considering the weekly average of 4 extra changes of cover with film and 9.5 with gauze, plus the number of minimum changes required, we have an average weekly expense of R$ 79.35 for the film and R$ 177.92 for the gauze.

After the information about costs and probabilities was inserted in the decision tree and values related to each intervention were calculated, the cost of using sterile gauze observed during the collection period was R$ 389.44, which is 3.7 times greater than the film, which cost R$ 104.95 for a 30-day period. These values increase progressively and a simple calculation illustrates how far this progression can go.

A one-year projection indicated there would be at least 365 changes of cover with gauze and 52.14 changes of film. When multiplying these numbers of changes by the value of the dressing with each cover, the dressing with film would cost R$ 827.46 and with gauze it would cost R$ 3,825.20, which is 4.62 times higher, without even considering the need for extra changes. When these values are inserted in national scenarios from the perspective of SUS, even higher financial figures are reached, which could be saved and directed to other practices[10,15].

Thus, the evaluation of costs of a given practice presents other realities not seen previously. Clearly, the use of transparent film in an average period of time can reduce costs with the CVC cover by reducing the use of materials and the exposure and manipulation of the hole, practices that prevent the occurrence of BSI and consequently, favor the reduction of hospital length of stay and its associated costs.

Study limitations

The study had some limitations related to the existence and quality of records made by professionals in the medical records regarding the execution of dressings, although there is a Nursing Care Systematization (SAE) in the sector for the registration of characteristics of the dressing. In addition, the daily sequence of observations of executions of dressings by the researcher was limited because of restricted access to the hospital due to a strike.

CONCLUSION

After data analysis, it was possible to compare the costs of using CVC dressings with transparent film cover and with fixed sterile gauze and prove the initial hypothesis that the film has a lower cost compared to gauze. In addition, it remains appropriate for a longer time, which reflects on a shorter time of nurse's care.

Clinical trials have shown a slightly lower probability of occurrence of PBSI when using the film, although without statistical significance. Note that the possibility of seeing the hole without removing the cover allows interventions in less time. In this study, only one hole with signs of local infection was identified in a dressing made with sterile gauze. Part of this result was because of the difficulty in obtaining reliable data from medical records.

The results of this study demonstrate the importance of economic evaluation in the nursing field, even in the most everyday activities. A critical look enables professionals to rethink their concepts and actions in the financial sense associated with a better care and work process. This analysis should not be based on external pressures to have a new technology, or even on the resistance to adapt to novelties, but on the search for the best result at a lower cost, thereby qualifying and evolving the health system as a whole.

In view of this, we suggest the replication of this study in other units that use such products to cover Central Venous Catheter dressings in order to expand the analysis of studies on costs and the scientific evidence on the subject, thereby helping in the decision-making process for incorporating a certain technology.

DOI: http://dx.doi.org/10.12957/reuerj.2020.42285

REFERENCES

1. Agência Nacional de Vigilância Sanitária. Medidas de prevenção de Infecção Relacionada à Assistência à Saúde. Segurança do Paciente e Qualidade em Serviços de Saúde. 2017 [cited 2020 Jun 6]. Available from: http://portal.anvisa.gov.br/documents/33852/3507912/Caderno+4+-+Medidas+de+Preven%C3%A7%C3%A3o+de+Infec%C3%A7%C3%A3o+Relacionada+%C3%A0+Assist%C3%AAncia+%C3%A0+Sa%C3%BAde/a3f23dfb-2c54-4e64-881c-fccf9220c373
2. Agência Nacional de Vigilância Sanitária. Critérios Diagnósticos de Infecção Relacionada à Assistência à Saúde. Segurança do Paciente e Qualidade em Serviços de Saúde. Brasília: Agência Nacional de Vigilância Sanitária; 2013 [cited 2020 Jun 6]. Available from: http://portal.anvisa.gov.br/documents/33852/3507912/Caderno+2+-+Crit%C3%A9rios+Diagn%C3%B3sticos+de+Infec%C3%A7%C3%A3o+Relacionada+%C3%A0+Assist%C3%AAncia+%C3%A0+Sa%C3%BAde/7485b45a-074f-4b34-8868-61f1e5724501
3. Mendonça KM, Neves HCC, Barbosa DFS, Souza ACS, Tipple AFV, Prado MA. Nursing care in the prevention and control of catheter-related bloodstream infections. Rev. enferm. UERJ. [Internet], 2011 [cited 2020 Jun 5]; 19(2):330-3. Available from: http://www.revenf.bvs.br/pdf/reuerj/v19n2/v19n2a26.pdf
4. Andrade AM, Borges KS, Lima HO. Cost analysis and evaluation of covers fora central venous catheter insertionsite in BMT. REME Rev. Min. Enferm. [Internet], 2011 [cited 2020 Aug 17]; 15(2):233-41. Available from: https://cdn.publisher.gn1.link/reme.org.br/pdf/v15n2a11.pdf
5. Agência Nacional de Vigilância Sanitária. Medidas de prevenção de Infecção Relacionada à Assistência à Saúde. Segurança do Paciente e Qualidade em Serviços de Saúde. 2017 [cited 2018 Jun 6]. Available from: http://portal.anvisa.gov.br/documents/33852/3507912/Caderno+4+-+Medidas+de+Preven%C3%A7%C3%A3o+de+Infec%C3%A7%C3%A3o+Relacionada+%C3%A0+Assist%C3%AAncia+%C3%A0+Sa%C3%BAde/a3f23dfb-2c54-4e64-881c-fccf9220c373
6. Pedrolo E. Custo-efetividade das coberturas para cateter venoso central de curta permanência. [Doctoral dissertation]. Curitiba: Universidade Federal do Paraná; 2017 [cited 2018 Jun 6]. Available from: https://acervodigital.ufpr.br/handle/1884/51269
7. Ministério da Saúde. Diretrizes metodológicas: Diretriz de Avaliação Econômica. Brasília: Ministério da Saúde; 2014 [cited 2018 Sep 27]. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/diretrizes_metodologicas_diretriz_avaliacao_economica.pdf
8. Borgert E, Gasparetto V. Factors that influence costs, in the approach of strategic cost management: empirical analysis in municipal health centers. Cuadernos de Contabilidad [Internet]. 2019 [cited 2020 jul 27]; 20(49):1-7. DOI: https://doi.org/10.11144/Javeriana.cc20-49.fica
9. Oliveira BCC, Silva JA, Pontes RL, Barbosa MGA, Silva EI, Silva BM, Lins SRO. The knowledge of the professionals of nursing about infections related to the use of central venous cateter of double lumen in dialytic patients in a nephrological clinic of the agreste of Pernambuco. Braz. J. of Develop. [Internet], 2020 [cited 2020 jul 27]; 6(7):44436-50. DOI: https://doi.org/10.34117/bjdv6n7-166
10. Paz A, Maciel R, Alves P, Souza RM. Elaboração do Procedimento Operacional Padrão de Enfermagem sobre Curativo de Cateter Venoso Central – CVC. [tese] Rio de Janeiro: Hospital Universitário Pedro Ernesto; 2014.
11. Azevedo LF, Sousa-Pinto B. Critical Appraisal of Economic Evaluation Studies (Part II): Cost-effectiveness and cost-utility analyses. Rev. Soc. Port. Anestesiol. [Internet], 2020 [cited 2020 Jul 18]; 29(1):18-21. DOI: https://doi.org/10.25751/rspa.19778
12. Richardson A, Melling A, Straughan C, Simms L, Coulter C, Elliot Y, et al. Central venous catheter dressing durability: an evaluation. J. Infect. Prev. [Internet], 2015 [cited 2020 May 3]; 16(6):256-61. DOI: https://doi.org/10.1177/1757177415594246
13. Pedrolo E, Danski MTR, Vayego AS, Oliveira GLR, Boostel R. Infection, local reaction and poor fixation of dressings for central venous cateter. Acta Paul. Enferm. [Internet], 2014 [cited 2020 Feb 17]; 27(1):63-8. DOI: https://doi.org/10.1590/1982-0194201400013
14. Gomes MLS, Aquino GAA, Barros LM, Queiroz PA, Oliveira FJG, Caetano JA. Assessment of short-term central venous catheter dressing practices. Rev. enferm. UERJ. [Internet], 2017 [cited 2020 Jul 10]; 25:e18196. DOI: http://dx.doi.org/10.12957/reuerj.2017.18196
15. Costa TC, Peregrino AAF, Rocha RG, Franco AS, Camerini F, Marta CB. Cost minimization analysis: use of dual and triple lumen central venous catheter. R. pesq.: cuid. fundam. online [Internet], 2020 [cited 2020 Jul 10]; 12:622-8. DOI: https://doi.org/10.9789/2175-5361.rpcfo.v12.8992