



# Journal of Nursing

Revista de Enfermagem

UFPE On Line

ISSN: 1981-8963

## ORIGINAL ARTICLE

### ANALYSIS OF COST OF STERILIZATION PACKAGING USING COSTING BASED ACTIVITIES

#### ANÁLISE DE CUSTOS DE EMBALAGENS PARA ESTERILIZAÇÃO UTILIZANDO CUSTEIO BASEADO EM ATIVIDADES

#### ANÁLISIS DE COSTOS DE EMBALAJES PARA ESTERILIZACIÓN UTILIZANDO COSTOS BASADOS EN ACTIVIDADES

Jessica Santos Vital<sup>1</sup>, Lays Nogueira Miranda<sup>2</sup>, Patricia Carvalho Nagliate<sup>3</sup>, Eveline Lucena Vasconcelos<sup>4</sup>

#### ABSTRACT

**Objective:** to analyze the cost of packaging of a sterile processing center using the method of Activity Based Costing. **Method:** observational descriptive study conducted in a university hospital. The activities which comprise the step of packaging the sterilization process was observed. **Results:** it was found that a pack of dual field cotton fabric varies between R\$ 15.1 and R\$ 27.3; each washing cycle of 100 kg fabric is R\$ 23.5; while surgical grade paper packages cost were between R\$ 0.29 to R\$ 0.66 and the amount of dual packaging of surgical grade paper were between R\$ 1.32 and R\$ 1.45. **Conclusion:** it was evidenced that the cotton fabric had a high cost when compared to paper surgical grade; so the single-use packaging is more economical for the institution. **Descriptors:** Costs and Cost Analysis; Product Packaging; Sterilization.

#### RESUMO

**Objetivo:** analisar o custo das embalagens de um centro de material esterilizado utilizando o método de Custeio Baseado em Atividades. **Método:** estudo descritivo, observacional, realizado em um hospital escola. Observaram-se as atividades que compõem a etapa da embalagem do processo de esterilização. **Resultados:** constatou-se que uma embalagem de tecido de algodão de campo duplo varia entre R\$ 15,1 e R\$ 27,3; cada ciclo de lavagem de 100 kg de tecido custa R\$ 23,5; enquanto as embalagens de papel grau cirúrgico custam entre R\$ 0,29 a R\$ 0,66 e o valor de embalagens duplas de papel grau cirúrgico estavam entre R\$ 1,32 e R\$ 1,45. **Conclusão:** evidenciou-se que o tecido de algodão apresentou custo elevado quando comparado ao papel grau cirúrgico; assim as embalagens de uso único são mais econômicas para a instituição. **Descritores:** Custos e Análise de Custo; Embalagem de Produtos; Esterilização.

#### RESUMEN

**Objetivo:** analizar el costo de los embalajes de un centro de material esterilizado utilizando el método de Costeo Basado en Actividades. **Método:** estudio descriptivo observacional realizado en un hospital escuela. Se observaron las actividades que componen la etapa del embalaje del proceso de esterilización. **Resultados:** se constató que un embalaje de tejido de algodón de campo doble varia entre R\$ 15,1 y R\$ 27,3; cada ciclo de lavado de 100 kg de tejido cuesta R\$ 23,5; mientras los embalajes de papel grado quirúrgico cuestan entre R\$ 0,29 a R\$ 0,66 y el valor de embalajes dobles de papel grado quirúrgico estaban entre R\$ 1,32 y R\$ 1,45. **Conclusión:** se evidenció que el tejido de algodón presentó costo elevado cuando comparado al papel grado quirúrgico; así los embalajes de uso único son más económicos para la institución. **Descriptores:** Costos y Análisis de Costo; Embalaje de Productos; Esterilización.

<sup>1</sup>Nurse, Federal University of Alagoas/UFAL. Maceió (AL), Brazil. E-mail: [jessicasvital@hotmail.com](mailto:jessicasvital@hotmail.com); <sup>2</sup>Nurse, Master degree in Nursing, Graduate Program in Nursing, Federal University of Alagoas/PPGENF/UFAL. [laysnm@hotmail.com](mailto:laysnm@hotmail.com); <sup>3</sup>Nurse, Ph.D. Professor in Nursing, Federal University of Alagoas/UFAL. Maceió (AL), Brazil. E-mail: [nagliate@gmail.com](mailto:nagliate@gmail.com); <sup>4</sup>Nurse, Ph.D. Professor in Preventive Medicine and Public Health, Federal University of Alagoas/UFAL. Maceió (AL), Brazil. E-mail: [evelinelucena@gmail.com](mailto:evelinelucena@gmail.com)

INTRODUCTION

The packaging is the preparation of the article for sterilization, wrapping it in a compatible package both for the material and for the sterilization process,<sup>1</sup> aiming at maintaining the sterility of the article during storage and its transportations to its use.<sup>2</sup>

It is known that the packaging must be compatible with the particular sterilization method, as well as the article to be sterilized must be free of toxic ingredients, enabling penetration and removal of the sterilizing agent, working as an antimicrobial barrier and having a favorable cost-effective.<sup>3-4</sup>

The packaging used for sterilization of health products should be regulated by the National Health Surveillance Agency (ANVISA) for specific use in sterilization. According to the RDC 15/2012, the use of kraft paper packaging, paper towels, manila paper, newsprint and aluminum foil envelope type packaging transparent plastic are not allowed for sterilization equipment, as well as the use of metal boxes without holes.<sup>5</sup>

The main packages used in the market are the cotton fabric and surgical paper. The cotton fabric is one of the oldest packaging and still widely used for sterilization in saturated steam pressure sterilization centers in countries with low economic level. Of the advantages of using cotton fabric, there is the economy (often excluding indirect costs), the memory property and strength of the pack.<sup>6</sup> Its disadvantages are ease of contamination of the packaging, the low degree of efficiency as a microbial barrier (around 34%), not resistant to moisture and difficult to control the number of reprocessing.<sup>6-8</sup>

The surgical paper is found on the market in the form of envelopes or sheets of various measures, self-sealer. It is permeable to vapor and ethylene oxide, impervious to microorganisms, resistant to high temperatures, allowing seeing the article and regulated by the Ministry of Health since 1993.<sup>9</sup> Moreover, it has impregnated chemical indicator for easy viewing of the materials already processed.

In daily practice, the increased costs in health brought a constant challenge for the hospitals, becoming necessary to CME professionals to acquire knowledge about concepts and Cost Accounting techniques as a management tool for the control of resources, which allows to identify more effective strategic ways and give administrators the opportunity to identify more profitable activities as well as those whose cost needs to

be analyzed and monitored with greater care, or not economically viable.<sup>10</sup>

The method of the Activity Based Costing (ABC) has been suggested as suitable for hospital organizations, as this search tool monitors the expenses of a company to analyze and monitor the various consumption paths directly identifiable resources through the most relevant activities and those for goods and services.<sup>11</sup>

This study considered the activity as a set of actions necessary to achieve the goals and objectives of a function. Therefore, the activity is comprised of tasks or steps that are the combination of work elements and operations that represent how an activity is performed. The task is one of the basic elements of activity and consists of a set of operations.<sup>12</sup>

This study is relevant for providing subsidies to meet the cost-benefit of packaging for sterilization, used in a university hospital in northeastern Brazil, as well as support data to reduce costs of the institution. It is noted that the expenses arising from the packaging articles submitted to chemical disinfection, the cost of depreciation of hospital clothes washer, indirect costs (electricity, telephone, water) were not included, as they were considered inherent also to other sterilization process steps.

OBJECTIVES

- To analyze the cost of packaging used in CME by the Activity-Based Costing method.
- To calculate the costs of packaging used in the materials that have undergone the sterilization process in a hospital in northeastern Brazil.
- To establish what is the most economical packaging of articles for the sterilization of those used in the hospital setting of the study.

METHOD

Descriptive, observational study conducted at the CME and Hospital Laundry of a University Hospital in Northeast Brazil, beginning in September 2014 and ending in March 2015.

Data collection consisted of document analysis and direct observation of the activities performed during the articles packing process for the sterilization process. The staff was observed performing all steps involving the articles' packaging phase. It was clocked the time spent during the work on each packaging.

In the period of data collection, CME in that hospital had 12 employees in the nursing team, two nurses, one in the morning and another in the afternoon. Between five and six employees worked in the morning shift. In the evening, having more working hours in CME between seven or eight employees were scheduled and the night had two. On weekends, when there are no scheduled surgeries, the team was composed of three employees.

The method of sterilization was performed under saturated steam pressure, and the sterilization room had four autoclaves. In addition to this, the CME had a purge, chemical disinfection room, materials, and Arsenal preparation room, whose architectural structure respects the flowchart, so there is no intersection between contaminated and clean material.

Before being subjected to the sterilization process, the articles were sent to the preparation room to be packaged and labeled with packaging date, expiration of the sterilization process and destination sector. The preparation of the hospital room had a marble bench where used packaging was exposed and contained two thermos-sealers. There was a stainless table for the preparation of materials and chairs with suitable height for it. The windows remained closed, and the temperature was regulated by air conditioners.

To calculate the amount of packaging used, it was necessary to have knowledge in the warehouse sector, the values of the pieces of cotton fields of all sizes (40 cm x 40 cm, 50 cm x 50 cm, 80 cm x 80 cm; 1m x 1m and 1.4m x 1.4m) used in the institution; value by size, the rolls of surgical paper and available roll of tape used in packaging: masking tape and tape test for autoclaving.

For cotton fabric, the average value of the part of the wash cycle, the laundry hospital workpiece transport to the MEA and time of each size of packaging materials were calculated. For surgical paper, the value of packets from a roll of each size (10 cm x 200 m, 15 x 100 m; 20 x 100 and 30 x 10m) packaging time articles, as well as the time spent package sealing were calculated. In both types of packaging, we calculated the amount spent tape test and masking tape used in each package.

To know the cost of staff, it was performed Normal Hourly Compensation calculation ( a formula that calculates the value of the normal working time). The value of the normal working time is calculated  $(RB \times 12) / (52 \times N)$  and RB monthly basic pay and N

normal weekly working time (hours per week).<sup>13</sup>

Considering the Normal Hourly Compensation calculation for technical nursing professionals, the amount of time worked was calculated (with their basic monthly salary of R\$ 1,912.99 for 30 hours per week) which resulted in R\$ 14.71. The same calculation was performed for the employee of Hospital Laundry (with the monthly base salary of R\$ 745.00 for 36 hours per week) which resulted in R\$ 4.77 per hour worked.

To measure the value of the activity, the time the employee performs the packaging according to the value of time to work was timed. Working time is displayed in seconds. The value of household work in the packaging was changed from hours to seconds. The calculation of the packaging in seconds was obtained by dividing the value of the work, in seconds, the time in seconds spent in all stages of packaging comprising: choosing the size of packing, packaging, closing or sealing the package and article identification. Thus  $C = \text{value of work (seconds)} / \text{time (seconds)}$ ; C being the calculation of the packaging in seconds.

For packaging an article in cotton fabric two pieces of this type of tissue are used, masking tape used to: identify the article, the destination location (sector) of the sterile article, the validity of the sterility and seal the package; and tape test. Also, it was calculated the employee's labor value for each step involved in the packaging material.

The value of the employee's monthly salary was acquired with the purchase of the career plan provided by the Department of Personnel Administration (DAP) of the University which the hospital is linked. Since the values of the materials used in the packaging of articles were obtained by the quote reports provided by the warehouse of the hospital.

The research project was approved by the Research Ethics Committee (Brazil Platform) of the Federal University of Alagoas and has approval n° 817008.

RESULTS

To know the tape value used in each package, the tape roll in centimeters was divided to know the value of tape centimeter and then, the amount spent tape per package was calculated. The value of a roll of 50 meters of masking tape is R\$ 5.87, R\$ 0.001 per centimeter. A roll of 30 meters of tape test costs R\$ 14.89, R\$ 0.004 per centimeter.

Figure 1 shows the values of the cost of materials used on cotton fabric sterilization

packaging., Only the cost of packaging made in this CME was calculated.

Size	Unit value of (R\$)	Double value	Masking tape used (cm)	Masking tape value/cm (R\$)	Value masking tape used in the package (R\$)	Tape test used (cm)	Tape test /cm (R\$)	Value test tape used in the package (R\$)	Total (R\$)
40cm x 40cm	9.3	18.6	20	0.001	0.02	5	0.004	0.02	18.64
50cm x 50cm	9.6	19.2	20	0.001	0.02	5	0.004	0.02	19.24
80cm x 80 cm	7.4	14.8	20	0.001	0.02	5	0.004	0.02	14.84
1m x 1m	8.9	17.8	40	0.001	0.04	8	0.004	0.03	17.87
1,40m x 1,40m	13.4	26.8	50	0.001	0.05	8	0.004	0.03	26.87

Figure 1. Values of the costs of the materials used in the sterilization of packaging cotton fabric of a university hospital in northeastern Brazil. Maceió-AL, 2015.

Thus, the total value of each package, ready to be sterilized, respecting the size, it was the value found after adding the columns 3, 6 and 9 in Figure 1.

In addition to spending resources in packaging materials, the value of packaging activity through the time to perform all the steps that comprise this activity was calculated. For that, time in seconds and the worked value was clocked, changed from hours to seconds. In this sense, as seen above, the value of the hours worked in a nursing technician was R\$ 14.71, and a second working amounted to R\$ 0.004. Figure 2 shows the time and the amount spent on activities performed by employees in the packaging of articles with cotton fabric in various sizes.

Thus, the value of the cotton fabric packaging understood the value found related to expenses arising from material resources (field, masking tape, tape test) plus the employee's labor value. By combining the values, it was observed that a pack of cotton fabric sized 40 cm x 40 cm was R\$ 18.9; the 50 cm x 50 cm was R\$ 19.50; the 80 cm x 80 cm, R \$ 15.1; packing 1 m x1 m was R\$ 18.2 and packaging 1.4m x1,4m was R\$ 27.3.

Size	Time of packing (seconds)	Value according to work (R\$)	Value worked (R\$/seconds)
40cm x 40cm	64	0,004	0,25
50cm x 50cm	78	0,004	0,31
80cm x 80 cm	70	0,004	0,28
1m x 1m	95	0,004	0,38
1,40m x 1,40m	121	0,004	0,48

Figure 2. The value of the nursing technical manpower in packaging articles in cotton fabric packaging of a university hospital in northeastern Brazil. Maceió-AL, 2015.

It was noted that the total value shows a fabric made when the workpiece is acquired (used for the first time). After this first use, the expense arising with the washing process is added to the amount spent on the preparation, packaging of materials.

In the reality of the hospital studied, the number of reprocessing exceeds the number recommended by the literature, since each cotton fabric is reprocessed 130 times.

The amount spent in the hospital laundry was calculated according to the time consumed in processing the cotton fabric that includes washing, spinning and drying,

depending on the hourly wage value, calculated in seconds, of the Laundry employee (R\$ 4.77 per hour).

Figure 3 shows the time duration of each step of the washing of cotton process.



Activity	Time (seconds)
Loading the machine	65
Washing	3540
Loading the centrifugal	143
Centrifugation	780
Loading the dryer	74
Drying	2100
Transportation from the laundry to the hospital hotel	52
Transportation from the hospital hotel to the CME	58
Total time	6812

Figure 3. Time spent on reprocessing of cotton fabric in a Hospital Laundry of a university hospital in northeastern Brazil. Maceió-AL, 2015.

As is noted, the total cotton of washing cycle time is 6812/2 or 1 hour and 53 minutes, which is equivalent to a value of R\$ 9.02 of the employee's laundry activities. In calculating the wash cycle of the cotton fabric, it encompassed the amounts spent by the employee and the amount of spent material. Thus, for the 100kg cycle is spent: 800 ml liquid soap (R\$ 4.52); 1440 ml softener (R\$ 7.56) and 400 ml of hypochlorite (R\$ 2.4). Thus, the amount spent for the washing cycle of cotton is R\$ 23.50. The washing cotton is called heavy cycle and is carried out on machines which comprise 100 kg tissue.

The value of reprocessing a cotton of each size was calculated according to the weight. Considering that the value of reprocessing 100kg of cotton fabric is R\$ 23.50, the value for 1kg is R\$ 0.23. The cotton is washed before being used for the first time and always before each reuse.

Figure 4 shows the amount spent on the first use of the cotton (value + wash). It is noteworthy that this value (column 3) is the amount spent by washing it.

Size	Weight (Kg)	Value of reprocessing (R\$/Kg each)	Value of the piece (R\$)	Total value of one reprocessing (R\$)
40cm x 40cm	0.04	0.009	9.3	9.309
50cm x 50cm	0.05	0.011	9.6	9.611
80cm x 80 cm	0.15	0.035	7.4	7.435
1m x 1m	0.2	0.04	8.9	8.904
1,40m x 1,40m	0.5	0.117	13.4	13.517

Figure 4. The total value of the first use of a cotton fabric of each size available in a university hospital in northeastern Brazil. Maceió-AL, 2015.

As regards the preparation of articles in the surgical paper, it was identified as the material used in this type of packaging only paper and the tape test. Although the surgical paper contains the sterilization indicator, the institution also uses the test tape on the package; it is not always possible to identify the impregnated plant indicator in the

surgical paper, reading the article was subjected to the process of sterilization.

Figure 5 shows the values found for an article of packaging surgical paper available in the institution. It is noteworthy that for this type of packaging 5 cm tape test is used. The figure also shows the hand value of work already multiplied by seconds spent on packaging.

Size (cm)	Value/cm (R\$)	Test tape used (cm)	Value of test tape/5cm (R\$)	Time of packaging (seconds)	Value of work (R\$/seconds of the prior column)	Total (R\$)
10x20	0.16	5	0.02	27	0.11	0.29
15x20	0.24	5	0.02	26	0.10	0.36
20x40	0.53	5	0.02	29	0.11	0.66
30x30	0.43	5	0.02	38	0.15	0.60

Figure 5. The amount spent on materials and workmanship in a surgical paper packaging for each available size in a university hospital in northeastern Brazil. Maceió-AL, 2015.

The value of a surgical kraft paper, seen in Figure 5 was found after adding columns 2, 4 and 6.

Certain articles need to be prepared in double packages of surgical paper, as is the case of larger or pointed articles. Thus, it was necessary to calculate the amounts spent in pairs of surgical paper packaging. The value of the package, the value of tape to test autoclave used and the employee's labor value were added. Thus, the value found for a double pack size 20 cm x 40 cm, and 20 cm x 50 cm was R\$ 1.45 (R\$ 1.20 by adding the package, R\$ 0.02 and 0.23 of the tape test of the workforce). A double pack of surgical paper size 30 cm x 30 cm and 30 cm x 40 cm was R\$ 1.32 (totaling R\$ 1.0 Packing, R\$ 0.02 of the tape test and R\$ 0.30 of the workforce).

## DISCUSSION

The use of cotton to package articles shows some disadvantages as not being resistant to moisture and vulnerable to contamination, monitoring difficulty of life after repeated washed and low life by premature wear of tissues.<sup>7</sup> Such features are not observed when comparing the surgical paper, which besides being more efficient packaging and facilitate viewing the article, there is no reprocessing monitoring needs and life.

On lifetime monitoring control of tissues, it has been seen earlier that the literature suggests that the cotton fabrics are effective as microbial barrier up to 65 reprocessing.<sup>6,14</sup> In the hospital studied, it was observed that this number is exceeded, and a cotton fabric reprocessed 130 times, but no with a systematic control of that number.

Corroborating this study, a survey conducted in a university hospital in Paraná<sup>15</sup> found that the hospital has no control over the number of reuses of the cotton. A survey conducted in several hospitals in the state Goiás<sup>6</sup> noted that most of the object of study institutions was not done any monitoring of its useful life. In just one hospital had systematic control reuse of tissue, with the replacement of the trousseau every six months, a period corresponding to about 120 processing.

Analyzing the data in this study, it is confirmed that the use of the tissue without monitoring of life contradicts what is recommended by the Ministry of Health/MS, as this ensures that all CME that uses packaging cotton fabric, must have a plan containing criteria for the acquisition and replacement of tissue packaging Arsenal keeping records of this movement. The following criteria are not allowed to wear

cotton cloth packaging repaired with patches or amended, and whenever evidenced the presence of holes, tears, fraying of the fabric or impaired barrier function, the package must have its use suspended.<sup>5</sup> Without this control, it is not possible to observe whether the fabrics are wear in its fibers, which leads to questions about the effectiveness.

According to a study conducted in São Paulo,<sup>16</sup> reprocessing fields may cause some accidents with the pieces, which cause mechanical damage (tightness of tissue, tears, and micro-holes), physical (shrinkage by excess heat) and chemical (excess bleach and disinfectants, soaps and inadequate stains caused by contact colored clothing), which damage the part may preclude its use. Thus, the inventory control of cotton fabric pieces is a need. When there is any damage to the workpiece, it is discarded and replaced, and hence originates acquisition costs and washing processes.

The lack of control in the number of reprocessing cotton fabric also interferes with the microbial barrier packaging increasing the cost, since the fabric laundering activity includes steps that require spending cleaning materials. Furthermore, it increases the cost of packaging, since CME employee spends more time before performing packet, performs the inspection of the tissue, to detect the presence of faults due to wear that can occur during washing.

Between the cost of activities in the packaging step articles with a cotton cloth and surgical paper, it is noticed that the packaging of articles with cotton fabric includes more steps packaging with surgical paper and more time-consuming employee to use double field and still use more resource materials such as masking tape. Moreover, being reusable increases the costs in their use and reuse in the washing process. The present study shows that the use of surgical packaging requires a lower cost of manpower since there is no washing process of the paper.

Regarding surgical paper, it is known that it has on its face the chemical indicator class I. However, in the research institution, the tape test is sticking writing the date of packaging and validity of sterilization, the sector the article belongs and the name of the employee who prepared the material. These details were also observed by the researchers of the study in Paraná,<sup>15</sup> in which the use of the process indicator tape (class I) is also stuck around package that will be autoclaved. This is because it is not always possible to identify only the indicator contained in a surgical paper that the paper was submitted to the

sterilization process. When using the tape test for spare autoclave, submission of viewing the sterilization process is facilitated. Although even a little increase, the cost of surgical kraft paper is even less costly to the packaging of cotton fabric.

When comparing the values found in this study with one in Bahia,<sup>1</sup> it is confirmed that although one of the arguments against the use of cotton fabric as packaging is that it has lower cost compared to other wrappers on the market, it is observed that within the CMEs, the tissue is the enclosure with greater cost, as the use of this non-dispensing washing and the tape used.

All kinds of hospital packaging material must maintain the sterile material to the validity of sterilization.<sup>17</sup> The validity of the product is the term adopted by each institution, according to the different types of packaging and submission of products to the sterilization process respecting the following criteria: package integrity assessment and strength of packaging; events related to handling/storage (in drawers, stacked with folds and elastic involving the sterile package); humidity and temperature; security sealing and turnover of stored stock.<sup>18</sup>

In the studied institution, the validity time of an article with cotton fabric is 07 days, while the articles packaged in sterilization wraps have a time of 90 days. In a study conducted in Minas Gerais,<sup>18</sup> the period of validity of articles packed in cotton fabric was seven to ten days. When questioned the use of surgical paper, the institutions responded the expiration date varied for up to one year.

It is evident that the shorter validity of the sterilization of materials packed in cotton fabric about the validity of packed in the surgical paper is charged with the first type of packaging because the fact that there reprocessing of cotton and, of course, same washing process increases the value of this container. It is worth mentioning that the cotton fabric has a higher probability of occurrence of incidents in the wash and consequently wear it, reducing its life and making every reprocessing, less efficient as a microbial barrier.

Furthermore, the articles to be sterilized should be packed to ensure the quality of the entire sterilization process. Tailoring the package to the type of article and the sterilization method to which they submit is important,<sup>19</sup> because not every package is compatible with all sterilization technologies available in the market.<sup>3</sup> While the use of cotton fabric is only compatible with moist heat, the surgical paper is compatible with

the moist heat, ethylene oxide, ionizing radiation, plasma hydrogen peroxide and low-temperature steam and formaldehyde.<sup>20</sup> Thus, if the institution will use some of these technologies, it must dispose of its inventory of cotton fabric.

The current study agreed with that achieved in the state of São Paulo<sup>16</sup> when suggests replacing the cotton fabric 100% by non-woven (such as surgical), since the acquisition of the surgical eliminates some disadvantages (accidents may occur during washing) and expenses relating to reprocessing and incompatibility with some sterilization types, low validity time of the sterilization process, inspection before packaging material and low microbial barrier.

## CONCLUSION

It was possible to observe the importance of analyzing the cost-effectiveness of packaging for sterilization because the cotton fabric, despite being reused and appear to be more economical, actually showing a higher cost when the expenses involved are known in reprocessing.

The use of surgical packaging becomes a more economic measure for the institution because there is no spending reprocessing; packaging demands less professional working time, and are compatible with various existing sterilization technologies in the market and have a good microbial barrier. It is suggested that the institution considers replacing the cotton fabric for single-use packaging, as well as less expensive, they are more efficient, satisfying the rigorous principles of the sterilization process.

The values found in this study are characteristic of the hospital, but the economy found in the use of surgical packaging compared to cotton, is very considerable and valid for any sterilization center.

## REFERENCES

1. Costa EAM. Estudo de custo-benefício de embalagens para esterilização. Rev SOBECC [Internet]. 2004 Oct/Dec [cited 2015 Apr 20];9(4):38-43. Available from: <http://bases.bireme.br/cgi-bin/wxislind.exe/iah/online/?IisScript=iah/iah.xis&src=google&base=LILACS&lang=p&nextAction=lnk&exprSearch=403462&indexSearch=ID>
2. Levif P, S'eguín J, Moisan M et al. Packaging materials for plasma sterilization with the flowing afterglow of an N<sub>2</sub>-O<sub>2</sub> discharge: damage assessment and inactivation efficiency of enclosed bacterial

spores. J Phys D Appl Phys. 2011;44(40):2-14. (PRINTED)

3. Morton PJ, Conner R. Implementing AORN recommended practices for selection and use of packaging systems for sterilization. AORN J. 2014 Apr; 99(4):495-505. (PRINTED)

4. Knudson L. New recommended practices for selecting and use packaging systems for sterilization. AORN C. 2013;98(5):5-6. (PRINTED).

5. Ministério da Saúde (BR), Agência Nacional de Vigilância Sanitária. Resolução - RDC nº 15, de 15 de março de 2012. Dispõe sobre requisitos de boas práticas para o processamento de produtos para saúde e dá outras providências [Internet]. Brasília: ANVISA, 2012 [cited 2015 Aug 23]. Available from:

[http://bvsms.saude.gov.br/bvs/saudelegis/anvisa/2012/rdc0015\\_15\\_03\\_2012.html](http://bvsms.saude.gov.br/bvs/saudelegis/anvisa/2012/rdc0015_15_03_2012.html)

6. Freitas LR, Tipple AFV, Felipe DP, Rodrigues NSR, Melo DS. Embalagem de tecido de algodão: análise do uso em hospitais de médio e grande porte. Rev Eletronica Enferm [Internet]. 2012 Oct/Dec [cited 2015 Apr 20];14(4):811-20. Available from: [https://www.fen.ufg.br/fen\\_revista/v14/n4/pdf/v14n4a09.pdf](https://www.fen.ufg.br/fen_revista/v14/n4/pdf/v14n4a09.pdf)

7. Souza AS, Sória DAC, Araújo JO, Silva MT, Andrade NC. Embalagens para esterilização: suas aplicações e recomendações na prática hospitalar. R Pesq Cuid Fundam [Internet]. 2010 Oct/Dec [cited 2015 May 25];2(Supl.):316-9. Available from: [http://www.seer.unirio.br/index.php/cuidadofundamental/article/view/931/pdf\\_139](http://www.seer.unirio.br/index.php/cuidadofundamental/article/view/931/pdf_139)

8. Maldaner C, Berlet LJ, Ascari RA, Klein ML, Savian BA, Silva OM. Invólucros para esterilização de materiais odonto-médico-hospitalares. Rev Saúde Públ Santa Cat [Internet]. 2013 July/Sept [cited 2015 June 14];6(3):61-70. Available from: <http://esp.saude.sc.gov.br/sistemas/revista/index.php/inicio/article/viewFile/180/223>

9. Perozini C, Jorge AOC, Santos SSF. Tempo de manutenção da esterilidade de materiais armazenados em diversas embalagens. Rev Bras Odontol. 2010 July/Dec; 12;67(1):44-8. (PRINTED).

10. Oliveira WT, Rodrigues AVD, Haddad MCL, Vannuch MTO, Taldivo MA. Concepções de enfermeiros de um hospital universitário público sobre o relatório gerencial de custos. Rev Esc Enferm USP [Internet]. 2012 Oct [cited 2015 Oct 25];46(5):1184-91. Available from: <http://www.scielo.br/pdf/reeusp/v46n5/21.pdf>

11. Jericó MC, Castilho V. Gerenciamento de custos: aplicação do método de custeio baseado em atividades em Centro de Material Esterilizado. Rev Esc Enferm USP [Internet]. 2010 Sept [cited 2015 June 24]; 44(3):745-52. Available from: <http://www.scielo.br/pdf/reeusp/v44n3/28.pdf>

12. Carmo LPF, Silva LM. Custeio baseado em atividades (ABC) aplicado ao setor público: estudo de caso no Colégio Militar do Rio de Janeiro (CMRJ). Rev UNIABEU [Internet]. 2011 Jan/Apr [cited 2015 July 21];4(6):161-81. Available from: <http://www.uniabeu.edu.br/publica/index.php/RU/article/view/120/186>

13. Ministério das Finanças (PT), Direção-geral da administração e do emprego público. Lei 12-A/2008. Estabelece os regimes de vinculação de carreiras e de remunerações dos trabalhadores que exercem funções públicas. Lisboa: Ministério das Finanças, 2008 [cited 2015 Mar 17]. Available from: [http://www.dgaep.gov.pt/stap/infoPage.cfm?objid=6c1a9b1b-14c5-4dde-9e4f-2dceda7359f0&KeepThis=true&TB\\_iframe=true&height=580&width=520](http://www.dgaep.gov.pt/stap/infoPage.cfm?objid=6c1a9b1b-14c5-4dde-9e4f-2dceda7359f0&KeepThis=true&TB_iframe=true&height=580&width=520)

14. Rodrigues E, Levin AS, Sinto SI, Mendes CF, Barbosa B, Graziano KU. Evaluation of the use and re - use of cotton f Aprics as medical and hospital wraps. Braz J Microbiol [Internet]. 2006 Apr/June [cited 2015 Sept 24];37(2):113-6. Available from: <http://www.scielo.br/pdf/bjm/v37n2/arg03.pdf>

15. Tillvitz LR, Nascimento LA do, Ribeiro RP, Fonseca LF. Quality evaluation of a central supply unit at a university hospital. J Nurs UFPE on line [Internet]. 2012 Sept [cited 2015 Oct 24]; 6(9):2077-85. Available from: [http://www.revista.ufpe.br/revistaenfermage/index.php/revista/article/view/2719/pdf\\_1434](http://www.revista.ufpe.br/revistaenfermage/index.php/revista/article/view/2719/pdf_1434)

16. Mizusaki T, Possari JF, Araújo CC. Avaliação dos custos referentes ao reprocessamento dos campos cirúrgicos simples feitos de 100% de algodão e aos campos descartáveis (não tecido). Rev SOBECC [Internet]. 2004 Dec [cited 2015 Nov 12];9(4):27-36. Available from: [http://novo.sobecc.org.br/artigo/artigo\\_95.pdf](http://novo.sobecc.org.br/artigo/artigo_95.pdf)

17. Association of Operating Room Nurses (AORN). RP Summary: Recommended Practices for Selection and Use of Packaging Systems for Sterilization. AORN J. 2014 Apr; 99(4):506-8. (PRINTED)

18. Oliveira AC, Mussel IC, Paula AO. Armazenamento dos produtos para saúde



Vital JS, Miranda LN, Nagliate PC et al.

Analysis of cost of sterilization packaging...

estéreis em unidades assistenciais: estudo descritivo. Rev SOBECC [Internet]. 2014 Oct/Dec [cited 2015 Mar 24];19(4):188-94. Available from: [http://sobecc.org.br/arquivos/artigos/2015/pdfs/v19n4/SOBECC\\_v19n4\\_188-194.pdf](http://sobecc.org.br/arquivos/artigos/2015/pdfs/v19n4/SOBECC_v19n4_188-194.pdf)

19. Graybill-D'ercole P. Implementing AORN Recommended Practices for Sterilization. AORN J. 2013 May;97(5):521-33. (PRINTED)

20. Ascari RA, Vidori J, Moretti CA, Peri EMF, Silva OM, Buss E. O processo de esterilização de materiais em serviços de saúde: uma revisão integrativa. BJSCR [Internet]. 2013 Sept/Nov [cited 2015 Apr 29];4(2):33-8. Available from: [http://www.mastereditora.com.br/periodico/20130831\\_181149.pdf](http://www.mastereditora.com.br/periodico/20130831_181149.pdf)

Submission: 2015/10/11

Accepted: 2016/05/27

Publishing: 2016/08/01

#### **Corresponding Address**

Lays Nogueira Miranda  
Av. Lourival de Melo Mota, S/N  
Tabuleiro dos Martins  
CEP 57072-900 – Maceió (AL), Brazil