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The monitoring system of surgical textile in health services

Sistema de monitoramento de têxteis cirúrgicos em serviços de saúde

Sistema de monitoreo de tejidos quirúrgicos en servicios sanitarios

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ABSTRACT

Objectives: to report the implementation of a monitoring system of the operative field, surgical gown, and utilized fields as sterile barrier system of products for health, manufactured from cotton fabrics. **Methods:** technological innovation report of a monitoring system of the use and processing of surgical textiles in a medium-size hospital. **Results:** steps: planning, confection, exchange of the surgical textiles, monitoring, and 12 months of supervision. The new pieces were silkscreened with a black indelible marker. **Final Considerations:** the implemented system is practical, low cost, and easily manageable for the team, it favored the work process management, contributing to the quality and security of the textile used in health care, and being able to be implemented in other health services.
Descriptors: Packaging; Surgical Gowns; Textile; Environmental Monitoring; Sterilization.

RESUMO

Objetivos: relatar a implementação de um sistema de monitoramento de campos operatórios, aventais cirúrgicos e campos utilizados como sistema de barreira estéril de produtos para a saúde confeccionados de tecidos de algodão. **Métodos:** relato de inovação tecnológica de um sistema de monitoramento do uso e processamento de têxteis cirúrgicos em um hospital de médio porte. **Resultados:** etapas percorridas: planejamento, confecção, troca dos têxteis cirúrgicos, monitoramento e acompanhamento por 12 meses. As novas peças foram serigrafadas com um quadro para o controle, no qual após cada ciclo de lavagem um espaço do quadro era pintado com um marcador indelével preto. **Considerações Finais:** o sistema implantado mostrou-se prático, de baixo custo e de fácil execução pela equipe, além de favorecer a gestão do processo de trabalho, contribuindo para a qualidade e segurança do uso dos têxteis na assistência à saúde, podendo ser reproduzido em outros serviços de saúde.
Descritores: Embalagem de Produtos; Vestimenta Cirúrgica; Têxteis; Monitoramento; Esterilização.

RESUMEN

Objetivos: informar sobre la aplicación de un sistema de monitoreo de campos operatorios, delantales y campos quirúrgicos utilizados como sistema de barrera estéril para productos sanitarios fabricados con tejidos de algodón **Métodos:** se trata de un informe de innovación tecnológica de un sistema de monitoreo de uso y procesamiento de tejidos quirúrgicos de un hospital de porte medio. **Resultados:** etapas realizadas: planificación, confección, cambio de los tejidos quirúrgicos, control y seguimiento durante 12 meses. Las nuevas prendas fueron serigrafiadas con un marco de control, en el que después de cada ciclo de lavado se pintaba, con un rotulador negro indeleble, un espacio del marco. **Consideraciones Finales:** el sistema implantado demostró ser práctico, de bajo costo y de fácil ejecución, además de facilitar la gestión del proceso de trabajo y contribuir con la calidad y la seguridad del uso de textiles en el cuidado de la salud, con la posibilidad de reproducirse en otros servicios sanitarios.
Descriptores: Embalaje de Productos; Vestimenta Quirúrgica; Textiles; Monitoreo; Esterilización.

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INTRODUCTION

We have utilized textiles in Health Services (HS) since the end of the 19th century, and its application in the confection of surgical gowns, operative fields, and fields as the Sterile Barrier System (SBS) for Health Products (HP) started in the year 1883[1].

In Brazil, for these aims, the 100% cotton textile is indicated, and its use must be according to the recommendations of the NBR 14.028 norm[2]. Its main function, when utilized on operative fields and surgical gowns, is to perform as a barrier and prevent or minimize the increase of microbial load for the surgical site, avoiding infectious grievances. It also protects the professionals from biological exposure[3]. When applied as SBS, it aims to pack, allow the sterilization, and the maintenance of sterility HP until its use, protecting them from possible contamination[4-5]. However, these properties must be accompanied and monitored.

Currently, we dispose of non-woven fabric and other technologies for use, such as the clothing and surgical fields and SBS, and these have been gradually incorporated into the routines of the HP and health care. However, textiles are still widely utilized in clinical practice.

The Collegiate Board Resolution (CBR) #15[4] establishes that every Sterilization and Material Center (*CME*), when the textile use must establish an acquisition plan, traceability, and periodic substitution and evaluate the successive processes (washing and sterilization), through a system of monitoring of its useful life. It emphasizes that the textile and the cotton can't be utilized and present micro-holes, darned, and mended because that compromises its capability as a microbial barrier.

The monitoring constitutes a strategy of accompanying the natural wear of textiles and removal of those in unfavorable conditions once there is a disruption in the protection barrier and, consequently, the risk to the patient's security[3]. However, the process of implementation of this system is complex because it is not clearly instructed in the Brazilian norms, besides requiring the articulation and engagement of different sectors and actors. We add to that the lack of agreement in research regarding the maximum number of washes/processing that guarantees the property of the microbiological barrier of the textiles[6].

We highlight that the majority of the HS does not carry out this systematic monitoring and is limited to the visual inspection in the preparatory moment of the HP, being the textile indiscriminately utilized and despised when presenting tears and holes[7]. When investigating the use of the cotton textile as SBS, Freitas et al.[7] concluded that the majority of hospitals of large and medium-size from Goiânia - GO (14/16, 87,5%) did not carry out the systematic monitoring of the textile fields. Only one hospital declared empirical substitution of every layette every six months.

Facing the limited scientific production regarding textile monitoring, this report could contribute to the instrumentalization of responsible technicians of CME for the implementation of a textile control system utilized in HS in aseptic procedures, qualifying, thus, the care provided.

OBJECTIVES

To report the implementation of a monitoring system of operative field, surgical gown and utilized fields as sterile barrier system of products for health manufactured from cotton fabrics.

METHODS

Technological innovation report of a monitoring system of textiles in an HS of medium-size, philanthropic, in the Southeast of Goiania, carried out from February 2018 to February 2019.

The Surgical Center (SC) of the HS had three operating rooms, one post-anesthetic recovery room, and the CME was type II[4]. It carried out 170 surgeries/month on average, and the nurse team was composed of 10 collaborators, distributed among the units of the CC and CME, under the supervision of a nurse. It had its laundry, with three distinct areas: 1- reception and weighing, 2- separation and washing, and 3- drying, ironing, and folding. During the cycle of textile processing, the chemical products control was carried out through a metering panel.

The implementation of the monitoring system started through a step of Bouwman[8] study, in front of the necessity of monitoring and analyzing the changes of the physical properties and microbiological barrier of surgical gowns and operative fields and destined to SBS of HP, manufactured from cotton tissue in use in the clinical practice. After the acquiescence of the HS and the responsible technician of the units of SC and the CME, the study was submitted for approval on the Research Ethics Committee.

For the execution, we followed the following steps: planning, the confection of surgical gowns and operative fields and SBS, textiles exchange, monitoring, and accompanying. The entire nurse team of the SC and CME was involved and laundry professionals in the construction and implementation of the tracking system. All the steps were accompanied by researchers with the collaboration of two assistants, as well as the orientations, clarifications, and training with the team whenever necessary.

RESULTS

Planning

We initiated the implementation of the system with meetings with the hospital board, the coordination, and the nurse team of the SC and CME, aiming to present the importance of the implementation of the system to monitor the use and processing of operative fields, surgical gowns and fields destined for the packing of products for health, based in scientific evidence and with the experience of the team.

In this opportunity, we defined the size and type of the textile pieces to be manufactured, the placement of the figure that would be silkscreened for the registration of the use/washes and the HS' logo, the moment and sector where the marking would be carried out, as well as the use of the indelible ballpoint pen to this aim.

Confection of surgical gowns, operative fields and Sterile Barrier System

The chosen fabric for the confection follows the NBR 14.027 norm (for simple fields), which determines that the fabric must be 100% cotton, twill pattern 2/1 with 210 g/m² of rough texture, and with 40 to 56 wires per cm² of tissue[2].

For the acquisition and confection, we carried out four budgets with companies from the region, and we chose the one that had advantages regarding the price, quality, and recommendations. The selected fabric was from the Santista® brand, classified by Solasol, color Royal blue (518/193952TC D), 100% cotton, 260g/m² of weight, the texture of approximately 39.63 wires per cm² and ligament twill 3/1[2]. Although the referred norm indicates a ligament of 2/1, we opted by the presentation 3/1 to reach the recommended weight.

The calculation for the definition of the number of gowns and fields was based on specialist information of the field, based on the daily average of surgeries carried out in the hospital referring to the six months prior that was 6.5 surgeries/day. This number multiplied by four, considering the following path after the use of surgical textiles: 1st day - laundry, 2nd and 3rd day CME return (prepare, folding, sterilization, and store), and 4 - new use.

We manufactured fields with a single layer of fabric in three sizes: 156 surgical fields, 104 measuring 1.50 m x 1.70 m, 52 with 1.50 m x 1.20 m, and we utilized 104 fields for SBS having 1.50 m x 1.20 m. And, considering the removal of the samples in predetermined periods for the proposed study, a surplus of 30% for each piece.

Regarding the surgical gowns, we manufactured 36 with "type OPP" transpass and 42 simple, both with double frontal textile covering the chest and abdomen from the high of the waist to the cleavage (rest), with long sleeve and knitted cuffs (Figure 1) and the surplus of 30%.

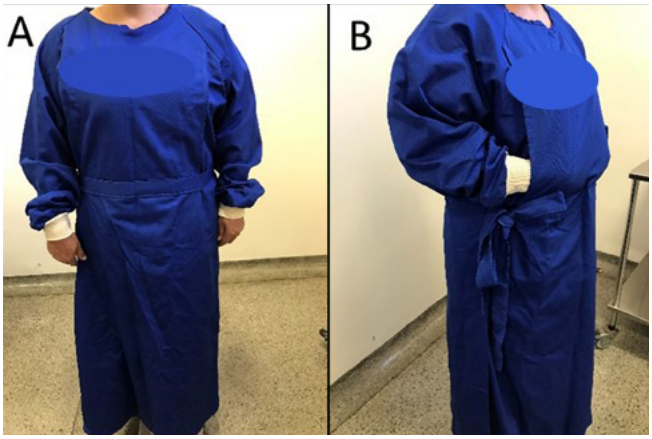

Figure 1 - Examples of the simple surgical gown (A) with "type OPP" transpass in a medium-sized hospital, Jataí, Goiás, Brazil, 2019

After the confection, all the pieces were silkscreened with the logo of the HS and with a figure for the washing control (Figure 2). We inserted the logo in the frontal part, and the figure for the washing control in the internal part of the front of the gown at waist height and in the lower-left corner of the fields.

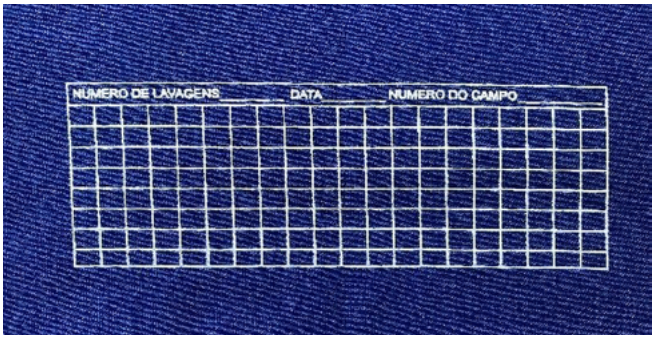

Figure 2 - Daily registry of the number of washes of surgical textile in a medium-sized hospital, Jataí, Goiás, Brazil, 2019

Exchange of the surgical textile, monitoring and accompaniment

We initiated this step with the washing of the field and gowns in the hospital's laundry. According to the recommendations of SOBECC[5], we washed the pieces (cleaning, centrifugation, and drying) for the removal of starch in the unit of clothing processing of the HS. We did not identify primary studies that indicated the safe number of washes preceding the first use, thus, we proceeded empirically to three previous washes.

Preceding the exchange of textile and the beginning of the monitoring system, we carried out a meeting with the team involved in the process (nurses and nursing technicians of the CME), aiming to reinforce the objectives and the importance of the daily systematic tagging of each piece. On this occasion, everyone received a pencil case containing a ballpoint pen and a black indelible marker for the tissue for the marking of the pieces.

To facilitate the marking in the proposed places, we carried out training with the laundry team, standardizing the folding, the way of reducing the handling of the textiles after the process of washing.

Considering the choice of confection, exclusively, of simple fields, we carried out an orientation of the surgical teams regarding the use of these fields, recommending the placement of two fields superimposed or using them folded.

On 02/19/2019, we withdrew from circulation all the textiles in use in the HS inserted in the routine. Since then, we submitted, subsequently, to the process of use, washing, folding, packages confection, packaging, and sterilization. We identified all packages through standardized labels containing the name of the product, batch number, sterilization date, expiration date (standardized in the HS for seven days), and the signature of the person who manufactured it.

In the HS, the sterilization was carried out by physical means, in a pressure saturated steam autoclave (Orthosynthesis®, prevacuum with capacity for 360 liters), at a temperature of 134ºC, for four minutes. For the control of the quality of the sterilization, in the first cycle, we daily carried out in the morning shift the Bowie & Dick test (chemical indicator type two, that evaluates the functioning of the pump vacuum), and in the second cycle, the challenge test with Biological Indicator of third generation and Chemical Integrator type five.

After the sterilization, we would store the textiles in the guard area, with restricted access and separated from the clean area of the CME by the autoclave barrier, it held artificial lighting and air conditioner equipment, two stainless cabinets with doors, seven stainless steel shelves (open mobile, composed by overlapping shelves) with a predominant distance between floor and roof over 20cm and 45cm and a stainless table.

A researcher and/or two assistants carried out the accompaniment of the monitoring system daily in a period of 12 months in the laundry and the CME, and in this period, whenever necessary, we carried out orientations to the team involved.

In the unit routine, daily, around 3 pm, the cleaned textiles were sent from the laundry to the CME in a closed cart, exclusive for this transport. In the CME, the researcher and/or the assistants of the research, in conjunction with the responsible workers, carried out through visual inspection the evaluation of the integrity of the pieces, regarding the presence of lint, rips, holes, or unraveling, and evaluation concerning the dirtiness.

In case the pieces presented damages, they would be removed from circulation, and those with dirtiness would be sent again to the laundry. Next, a space of the silkscreened figure would be painted with a black indelible marker for tissue, anticipating the folding, packing, and identification.

Following the normative orientations, every piece that presented holes or tears and abrasions was removed from circulation (Table 1), We verified that the majority of damages occurred after 50 washes, apparently related to the wear. We observed a few micro-holes that apparently may be attributed to the use of backaus tweezers for fixation during the procedure.

Table 1 – Distribution of the number of pieces of surgical clothing that showed damage from 2/19/2018 to 2/19/2019, in a medium-sized hospital, in the Midwest regions of Brazil, Jataí, Goiás, Brazil, 2019

Number of Washes	Items				
	Fields 1,70 m x 1,50 m (N 104)	Fields 1,50 m x 1,20 m (N 52)	Fields for packaging (N 104)	Simple surgical gown (N 42) *	Surgical gown with transpass (N 36) **
under 30	3 (2.9%)	-	1 (1.0%)	1 (2.4%)	2 (5.6%)
30 to 39	1 (1.0%)	1 (1.9%)	-	1 (2.4%)	1 (2.8%)
40 to 49	2 (1.9%)	-	-	2 (4.8%)	-
50 to 59	3 (2.9%)	-	-	3 (7.1%)	-
60 to 69	4 (3.8%)	1 (1.9%)	-	-	3 (8.3%)
Total	13 (12.5%)	2 (3.8%)	1 (1.0%)	7 (16.7%)	6 (16.7%)

**Gown with armrest, without oop and with lashing at the back; **Gown with armrest, with oop and lashing in the lateral and upper part*

DISCUSSION

For the confection of the fields and surgical gowns, we utilized a cotton tissue following the established guidelines by the Brazilian norms in a single layer. Although some institutions make the fields with double tissue darning both layers for the external part attending the *World Health Organization*[9] recommends two layers of fabric field to provide an efficient barrier.

However, the double-stitched fabrics can present some disadvantages, such as difficulty the washing, once they cause the detachment of fibers that may accumulate in the internal faces of the field. Furthermore, CDR 15[4] considers that the stitches in the middle of the fields favor the passage of microorganisms, decreasing the quality of the barrier. Hence, we manufactured every new field with only one layer of fabric, and for the utilization of an SBS, we utilized two fields, and as an aseptic barrier in surgeries, we placed two fields or one folded over the patient.

After the beginning of the monitoring process, we identified some problems that we discussed among the team of researchers and professionals from the HS. We verified that after the marking, folding, and packing of the surgical pieces that came from the laundry, at times, a few remained with marks, and these were not in a sufficient number to close the package of fields and gowns. Hence, so that the pieces already marked were not mixed with those coming from the laundry the next day, we provided a container identified as "marked pieces" and standardized that they would be the first to be used the following day.

We observed that after some washes (around four or five), the quality of the serigraphy of the wash control figure had lost its color. Hence, we included in the routine of the piece's evaluation the enhancement of the lines of the figure with a paintbrush and white paint for tissue. This experience alerted the necessity of assuring the quality of the figure print with the company of serigraphy.

Another problem that we detected was that many gowns unraveled in the place of insertion of the lashing, probably because during the process of washing they rolled up in other pieces, thus when removed from the machines they were pulled. These pieces were identified and sent for sewing and the next day sent again to the laundry. This was the only acceptable reason for sewing the piece and continuing to use it. The constant problem of unraveling of the gowns in the place of lashing presumes the necessity of a proposition for a new format for the lashing for surgical gowns.

The care regarding the inspection of the pieces was reinforced, and we removed from circulation every piece that presented holes or tears and abrasions. Because the use of damaged pieces may facilitate tears in the fabric during the use and allow the passage of microorganisms, particles, and fluids between the aseptic and non-sterile areas, exposing patients and the team to bacterial contamination and contributing to the loss of effectiveness of the microbiological barrier[4-5,10].

The monitoring system of textiles was well accepted by the involved team that demonstrated interest in carrying out the entire process correctly and performed collaboratively in the period of the study. Also, they manifested interest in giving continuity to the monitoring process after the conclusion of the study. Similarly, the laundry team joined the new folding method of fields and gowns to facilitate the marking in the wash control figure.

The number of operative fields and SBS and surgical gowns manufactured was enough to supply the necessary demand because there was not a day where there was a lack of textiles for use in the surgeries. Additionally, a package rarely surpassed the deadline of use of SBS adopted by the HS (seven days), needing to submit them to a new cycle of washing and processing. Although the calculus for the confection of the amount of clothing had been based on 6, 5 surgeries, even with the increase of the average of daily surgeries to 8, 7, during the period of study, the number of manufactured pieces supplied the demand.

Study limitations

The system was implemented in a medium-size hospital, hence, it is not possible to presume potential difficulties in services with a high demand for textiles. Yet, the implementation was directly dependent on the articulation of the work process among the units of CME and laundry, which requires shared management of these units, which is not always an easy task.

Contributions to the field

The implemented system represented a simple and successful innovation on monitoring the utilized textiles in health services, it undertook quality to the CME nurse manager job, consequently, security to the patients. Contributions that may be extended to other health services, especially those with low financial resources.

FINAL CONSIDERATIONS

The implemented system of surgical textiles monitoring proved to be easily manageable, low cost, allowing the control of the number of washes. Moreover, it favored the management of the work process by involving the team in every step, contributing to the quality and security in the use of textiles in health care, allowing the mapping of accompaniment sub-processes of the useful life, characterizing as an important component in the quality control.

Although the challenges for the implementation of a monitoring system, as the RDC 15/ 2012[4] recommends, the adopted system that counted with an engagement and involvement of all sectors and actors necessary to its operationalization, proved itself to be effective, being able to be reproduced in other health services.

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