A SYSTEMATIC APPROACH FOR THE RATIONALIZATION OF SURGICAL TRAY INSTRUMENTS

Sistemática para racionalização de instrumentais de bandejas cirúrgicas

Sistemática para racionalización de instrumentales de bandejas quirúrgicas

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ABSTRACT: Objective: To report the experience of developing a systematic approach for the rationalization of instruments in surgical trays. **Method:** Study of the development of a systematic approach for the rationalization of instruments, carried out in 2015, using a qualitative method, in the Central Sterile Supply Department (CSSD) of a federal university hospital in Porto Alegre, Brazil. **Results:** There was a 10.92% average reduction in the number of instruments in institutional trays, a reduction in the number of trays owned by medical teams — 84.06% belonged to the otorhinolaryngology team — and a definitive inactivation of 369 orthopedic surgery instruments, which represented 72.84% of the total number of inactivated instruments. In addition, improvements were made to the management of instruments, the optimization of preparation time and the reduction of sterilization by expiration date. **Conclusion:** The relocation of instruments and the addition of items in specific trays allowed for the reappraisal of requests for purchase of instruments and the improvement of relationships between the teams. This systematic approach contributed significantly to the management of instruments, the optimizing processes and the involvement of the surgical teams in the work of the CSSD, thus demonstrating that it can be applied in other institutions.
Keywords: Surgical instruments. Organization and administration. Quality indicators in health care.

RESUMO: Objetivo: Relatar a experiência de desenvolver uma sistemática para racionalização de instrumentais em bandejas cirúrgicas. **Método:** Estudo de desenvolvimento de sistemática para racionalização de instrumentais, realizado em 2015, a partir do método qualitativo, em um centro de materiais e esterilização (CME) de um hospital universitário federal de Porto Alegre, Brasil. **Resultados:** Houve redução média do quantitativo de instrumentais em bandejas institucionais em 10,92%; diminuição de bandejas de propriedade das equipes médicas, sendo 84,06% pertencentes à equipe da otorrinolaringologia; e inativação definitiva de 369 instrumentais da cirurgia ortopédica, o que significou 72,84% do total dos instrumentais inativados. Além disso, houve condução de melhorias no gerenciamento de instrumentais, otimização do tempo de preparo e redução da esterilização por expiração do prazo de utilização. **Conclusão:** A realocação de instrumentais e o acréscimo de peças em bandejas específicas permitiu a reavaliação das solicitações de compras de instrumentais e a melhoria das relações entre as equipes. Essa sistemática contribuiu significativamente para o gerenciamento de instrumentais, otimizando processos e envolvendo as equipes cirúrgicas no trabalho do CME e evidenciou que pode ser aplicada em outras instituições.
Palavras-chave: Instrumentos cirúrgicos. Organização e administração. Indicadores de qualidade em assistência à saúde.

RESUMEN: Objetivo: Relatar la experiencia de desarrollar una sistemática para racionalización de instrumentales en bandejas quirúrgicas. **Método:** Estudio de desarrollo de sistemática para racionalización de instrumentales, realizado en 2015, desde el método cualitativo, en un centro de materiales y esterilización (CSSD) de un hospital universitario federal de Porto Alegre, Brasil. **Resultados:** Hubo reducción media del cuantitativo de instrumentales en bandejas institucionales en el 10,92%; disminución de bandejas de propiedad de los equipos médicos, siendo el 84,06% pertenecientes al equipo de la otorrinolaringología; e inactivación definitiva de 369 instrumentales de la cirugía ortopédica, lo que significó el 72,84% del total de los instrumentales

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inactivados. Además, hubo conducción de mejoras en el gerenciamiento de instrumentales, optimización del tiempo de preparo y reducción de la esterilización por expiración del plazo de utilización. **Conclusión:** La reubicación de instrumentales y el incremento de piezas en bandejas específicas permitió la reevaluación de las solicitaciones de compras de instrumentales y la mejora de las relaciones entre los equipos. Esa sistemática contribuyó significativamente para el gerenciamiento de instrumentales, perfeccionando procesos e involucrando a los equipos quirúrgicos en el trabajo de CSSD y evidenció que puede aplicarse en otras instituciones.

Palabras clave: Instrumentos quirúrgicos. Organización y administración. Indicadores de calidad de la atención de salud.

INTRODUCTION

With each new decade, the challenge increases for hospitals to improve the quality of their services offered to society, especially with regard to performing surgical procedures[1,2]. The quality of the cleaning, disinfection and sterilization processes is directly related to patient safety and the minimization of infection costs[3]. In this context, the Central Sterile Supply Department (CSSD) is responsible for the processing of health products (PHP), including the actions started immediately after direct patient care[4].

In addition to the PHP, the CSSD should manage the inventory of instruments, including registration, follow-up, and the handling and management of materials[5,6]. Such actions seek to reduce operational costs, providing adequate quantification for the surgical procedure and safety in the processing, functionality and durability of materials[5].

Due to the great demand of processed materials from the CSSD, a systematic and periodic review is needed to quantify the number of instruments used in surgical procedures, as a way to help improve the quality of the process, to reduce the time of returning the tray to the team, to reduce the weight of the trays (which may influence sterilization) and to reduce the costs for sterilization of unnecessary parts.

A study carried out in the United States at the Virginia Mason Medical Center (VMMC), in the city of Seattle, identified a reduction of approximately 2.8 million dollars after rationalizing the number of instruments available in surgical trays. This reduction was based on the observation of 20 surgical procedures of different specialties, where instruments were observed returning from operating rooms without having been used. This study demonstrated that the rationalization of instruments, using Lean methodology principles, improved the quality of the processing time at a lower cost, as well as the efficiency of the use of surgical rooms[7]. Similar actions at other heath institutions showed that the management of an instrument inventory from different specialties assists in the prevention of unnecessary sterilization of parts, the optimization of processing, and the considerable reduction of tray weight[8].

Other authors used grouping systematic approaches, based on the frequency of surgical procedures, when using instruments for the rationalization of trays[9]. Applying the algorithm proposed allowed for the identification of new options for the formation of trays, which in turn allowed for the optimization of sterilization processes. The literature shows that the use of clustering techniques, which consists of grouping observations (in this case, instrumental ones) with similar characteristics, and modeling, allows for the proposal of optimal groupings and solutions for the rationalization process[10,12].

OBJECTIVE

To report the experience of developing a systematic approach for the rationalization of surgical tray instruments with the aim of reducing the volume of unused material to be cleaned and sterilized, and to relocate instruments in the trays.

METHOD

A qualitative research method was developed[13], combining focus group approaches[14,15]. Exploratory and descriptive approaches were used in combination with intervention strategies in order to identify opportunities and propose alternatives for the improvement of surgical instrument management.

The systematic approach for the rationalization was conducted in the CSSD of a federal university hospital in the city of Porto Alegre, Brazil. This unit has approximately 80 thousand instruments. Of these, 19,476 pieces are allocated to 993 trays belonging to the institution, 78 belonging to surgeons, and 1,350 pieces are packed individually. These instruments may be used by 17 different specialties and in 38 different operating rooms.

The team responsible for the materials processing consists of 72 health professionals including nursing auxiliaries and technicians, 9 nurses (8 assistants and 1 coordinator of the unit), in addition to 1 administrative assistant. The department works 24 hours a day, 7 days a week. The study is part of a project to develop the follow-up and evaluation of managerial processes in health institutions. It was developed after being analyzed and approved by the Research Ethics Committee of the *Hospital de Clínicas de Porto Alegre*, under consubstantiated opinion number 33705014800005327/2014.

The development method was the one that was proposed and used for the rationalization of surgical trays and is based on seven steps:

- Prioritization: the revision of trays prioritized specialties whose procedures were characterized by greater complexity. In the sequence, specialties were prioritized according to greater surgical production and according to those that did not have the possibility of instrument rotation. Finally, specialties with a greater number of occurrences were reviewed, with regard to the dissatisfaction of the surgical team as well as their availability to perform the review;
- Contact with the specialist and the technician: from the definition of the specialty, an informal interview with specialists from the surgical block (SB) was performed in order to schedule a date and time for the analysis of the materials in each tray, the selection of technicians who would help in the process, and in order to contact the chief surgeon of the specialty;
- Tray revision and instrument selection: the revision of instruments and trays was performed at the CSSD and was accompanied by a nurse and a nursing technician, who belonged to the department, as well as other professionals of the specialty. Initially, the need for individually packed instruments was assessed and, later on, the opening of new trays was evaluated. The revision order of trays prioritized those that were considered basic, being used in all procedures of the specialty. Instruments were grouped according to their use in the surgical plan, with the aim of corresponding them to their sequence of use in the surgery. Next, professionals of the specialty were asked about the need for each material and their respective quantities. The process was repeated for special trays. For these, the head of the team and the technician were asked about the need for larger identical trays based on the demand of the surgical schedule. In the cases this increase in size was not necessary, as a new unit was put together with instruments left over from the trays that were already reviewed;
- Documentation of changes: in conjunction with step 3, a spreadsheet was built (hypothetical example in Chart 1) to record the quantitative and qualitative changes made to the instruments, in addition to register the instruments' reference, size, institutional code and photographs of the items withdrawn and the ones left in the trays. This spreadsheet also allowed for the tracking of materials allocated in new trays as well as their quantity. The records presented in Chart 1 were then forwarded, up to 24 hours after their review, to the CSSD and SB leaders for information, follow-up of alterations and to identify possible inconsistencies in the composition of the reviewed trays;
- Revision of surgical kits: after step 2, a revision of surgical kits was performed, which consisted in identifying the materials that must be sent to each procedure by the CSSD, according to the scheduled surgeries. In other words, in addition to the trays, individual mandatory instruments were also reviewed. The revision of the surgical kits of each specialty prioritized less complex procedures, due to the smaller number of instruments verified in this group. Professionals of the specialty were asked about the need and specificity of the trays and the individual instruments, in addition to the number of textiles to be sent to each surgical procedure. Based on the list of surgeries suitable for surgical scheduling in the institution's computerized system, groupings of the ones that used the same number trays and materials were conducted, as well as the updating of documents;
- Validation by the surgical team: immediately on the shift or the day after the revision, the updated surgical kit (with reviewed instruments and trays) was sent so that the procedure could be performed in the SB. In the moment, or immediately after the surgery, an interview was performed with technicians, surgeons and leaders of the SB, to evaluate and validate the changes made. From the feedback of the professionals, eventual corrections and/or reviews were made;
- Storage organization: subsequently, using a visual management tool, the CSSD stockpile was reorganized. To do this, the storage shelves of the trays were identified so that they were grouped according to specialty. Colors

were used to differentiate specialties with similar trays, according to preexisting records of the specialties.

To place the trays in storage, the amount and weight of trays was considered, so that heavier items were placed in positions to facilitate their handling.

RESULTS

The systematic approach proposed was applied in the 11 surgical specialties, presented in Chart 2, which contemplated instruments belonging to institutions and surgeons. The first column of the cart regards the order in which the revision procedure was carried out in relation to the specialties.

With regard to the results, there was a mean reduction of 10.92% (Chart 1) in the number of pieces belonging to the institution. This reduction was more representative in six specialties, emphasized in Table 1. Of the pieces removed, 841 instruments were reallocated to the CSSD warehouse, representing a storage return of 64.10% for the reallocation or for the making of future trays.

Another 498 pieces were permanently deactivated. This action is justified due to changes in surgical techniques or the loss of integrity of the pieces (Table 1). Such items will be forwarded for specific disposal, according to Brazilian legislation.

It should be noted that there was a quantitative increase of 8.17 and 12.00% in the total number of instruments in the trays for buccomaxillofacial and vascular surgeries, respectively (Table 1). This fact is due to the requests from teams

Chart 2. Surgical specialties reviewed.

Order of rationalization priority	Specialties
1	Neurosurgery
2	Cardiovascular surgery
3	Thoracic surgery
4	Vascular surgery
5	Urological surgery
6	Orthopedic surgery
7	Otorhinolaryngologic surgery
8	Plastic surgery
9	Proctological surgery
10	Pediatric surgery
11	Bucomaxillofacial surgery

Chart 1. A spreadsheet for the registration and control of altered instruments in the otorhinolaryngology tray.

Otorhinolaryngology	Tray for sinusotomy with septoplasty 1 Pieces: 30						
Instrument	Size	Ref.	HC Code	Quantity until 04/16	Withdrawn/ inserted	Current quantity	Destination/source
Curved vacuum	13 cm	STORZ 586030		1		1	
Franck-Pasquini vacuum 20.5 cm	2.5 FR	STORZ 662825	285915	0	1	1	new piece
Thick vacuum	11FR 19 cm	701102		1		1	Source: sinusotomy test
Round tanks	10 cm			2	2		disabled
Round tanks	8 cm			2	2		disabled
Scalpel cord	Nº 3			1	1		disabled
Cottle double stripper	22.5 cm	STORZ 479200		0	1	1	Source: sinusotomy test
Freer stripper		330020		1		1	
Ritter front dilator No. 1	14.5 cm	STORZ 641525	216151	1		1	
Double lift	22.5 cm	STORZ 479000	215970	1		1	
Beckmann nasal speculum (curved)	15 cm	STORZ 400520	282205	0	1	1	new piece
Large nasal speculum 55 mm	13.5 cm	STORZ 403565	285937	0	1	1	new piece
Medium nasal speculum 55 mm	13.5 cm	STORZ 403555	285938	0	1	1	new piece

demanding the inclusion of pieces in the trays, as well as an increase in the quantities of identical trays. There was also the deactivation of other little used pieces in these specialties.

Regarding trays belonging to the doctors, they represented, before rationalization, 26.86% of the total of pieces in the CSSD. After this process, there was a reduction of approximately 10.00%. The results obtained for the otorhinolaryngology specialty are highlighted here, in which a reduction of 84.06% was observed in the delivery and circulation of instruments belonging to medical teams (Table 2).

The rationalization also allowed for the detection of unused medical instruments, which belonged to the arsenal of instruments available and required re-sterilization due to the expiration date. In this inactivation, the specialty of orthopedic surgery, in which a definite idleness of 369 instruments was verified, corresponds to 72.84% of the total unused instruments (Table 2).

Requests for the purchasing of new trays were reevaluated from the rationalization. Of those, we highlight the urology specialty, in which there was a need for the acquisition of 38 instruments to put together a new tray to meet surgical demands. However, from the review of three other specialties (neurology, thoracic and cardiac) and the inclusion of five instruments available in the CSSD warehouse, is was possible to provide the urology team with a new tray containing identical instruments to the ones requested for purchase. This action was responsible for a savings of approximately, R$14.000.00 in the purchase of these instruments. A similar situation occurred in the other ten specialties that had their requested purchase lists reviewed.

DISCUSSION

In addition to the benefits resulting from the reduction indicators presented, the rationalization of tray instruments belonging to 11 specialties also resulted in the improved relation between surgical teams and the CSSD. This is due to the sharing of responsibility in relation to the choice of instruments that should remain in the trays, and the number of identical sets available for procedure schedules, in addition to visitations of the CSSD and the explanation of each step and the time necessary for the processing of materials. This knowledge, held by surgeons and technicians, helped planning the quantity, the order of surgeries to be performed, and the priority of forwarding the materials to the CSSD. Furthermore, it improved confidence in the work performed by professionals of the department. This aspect was verbalized by the feedback provided by the teams.

Table 1. Results of the rationalization of instruments and institutional trays.

Specialty	Rationalization of trays			Rationalization of pieces					
	Before	After	Reduction	Before	After	Reduction	Deactivated	Reallocated	Included
	n	n	%	n	n	%	n	n	n
Neurosurgery	58	44	-24.14	812	648	-20.20	2	141	3
Cardiovascular surgery	32	31	-3.13	862	816	-5.34	20	48	48
Thoracic surgery	21	18	-14.29	769	583	-24.19	25	136	22
Vascular surgery	28	28	–	901	1,016	12.76	1	10	56
Urological surgery	34	31	-8.82	689	625	-9.29	1	75	52
Orthopedic surgery	89	68	-23.60	1,969	1,666	-15.39	263	62	65
Otorhinolaryngologic surgery	31	26	-16.13	1,315	1,171	-10.95	18	198	181
Plastic surgery	25	23	-8.00	1,042	849	-18.52	129	67	41
Proctological surgery	12	11	-8.33	138	113	-18.12	18	–	–
Pediatric surgery	21	19	-9.52	807	752	-6.82	–	11	32
Bucomaxillofacial surgery	10	10	–	257	278	8.17	21	93	138
Total	361	309	-14.40	9,561	8517	-10.92	498	841	638

Table 2. Results of the rationalization of instruments and trays belonging to surgeons.

Specialty	Rationalization of trays			Rationalization of pieces					
	Before	After	Reduction	Before	After	Reduction	Deactivated	Reallocated	Included
	n	n	%	n	n	%	n	n	n
Neurosurgery	7	5	-29	74	61	-17.57	13	–	–
Cardiovascular surgery	37	32	-14	192	182	-5.21	3	-	–
Thoracic surgery	4	4	–	43	42	-2.33	1	–	–
Vascular surgery	5	5	–	13	13	–	–	–	–
Orthopedic surgery	26	6	-77	473	104	-78.01	369	–	–
Otorhinolaryngologic surgery	17	9	-47	138	22	-84.06	116	–	–
Total	96	61	-36	933	424	-54.53	474	–	–

In financial terms, the rationalization of the trays may lead to a reduction in the number of autoclave cycles needed for (re)sterilization, i.e., the need to (re)process trays that are not used and are expired.

Another optimization result is the reduction of preparation time of the trays, which was approximately 28% less (difference between preparation time and packaging of the revised trays), given the chronoanalysis performed before the rationalization and published in another study of the institution[16]. Such results confirm the findings of the literature[7-10,12].

It should also be noted that the reallocation of instruments due to the rationalization procedure and the inclusion of other pieces in specific trays allowed for the scheduling of more subsequent surgeries. From this process, we observed a need to anticipate the step regarding the process of receiving instruments by the CSSD in the SB unit as a way to confirm the instruments, immediately identify the maintenance of them, improve the relationship between perioperative surgical and nursing teams, and optimize processing time.

There were reduced amounts of trays belonging to doctors due, mainly, to the readjustments in institutional trays, which started to better supply the demands of the surgeons. Thus, a reduction was verified in the number of events in which medical instruments were received with little or no time for sterilization.

FINAL CONSIDERATIONS

In this study, the use of a systematic approach developed for the rationalization of instruments in surgical trays helped to improve CSSD management and the relationships among surgical teams. There was a quantitative reduction in the number of instruments, an improvement of work processes and also advances regarding the management of purchase orders for instruments.

Among the positive aspects of the study, it should also be noted that it subsidized planning process for the purchase of surgical instruments.

From the results obtained with the rationalization of instruments of 11 specialties, it is observed that it is essential to extend rationalization to all other surgical specialties with instruments in hospitalization units of the institution. After the conclusion of this step, we propose that a study estimating the costs allocated in the CSSD should be carried out, addressing the number of pieces in the warehouse and the financial investment needed. This could project the creation of new institutional facilities and the consequent increase in surgical production capacity.

These data support the implementation of a computerized instrument management system, including the traceability of the steps in the process, the control of inputs, the costs and the instruments' maintenance records, assisting in the planning of investments for the acquisition of new instruments. Therefore, the systematic approach of the rationalization of instruments contributes to the research and teaching of managerial and assistance aspects, especially because the study directly impacts the safety of the patient that undergoes an anesthetic-surgical procedure.

The exclusive use of the opinion of specialists may be understood as a limitation of the systematic approach proposed in this study. Another limitation could be the lack of continuation with all surgical specialties and the fact that it was carried out in an educational institution.

We propose future studies to be based on field observations and the use of programming tools to be applied in production engineering in the various specialties and in other institutions.

We concluded that this systematics approach contributed significantly to the management of instruments, the optimizing of processes and the involvement of surgical teams in the work of the CSSD. It was demonstrated that this method should be enhanced, and could possibly be used in other institutions, since it contributes directly to the improvement of the work process, which has a positive impact on the care of patients submitted to surgeries in various specialties.

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