

The cost of medical supply waste: peripheral venipuncture and bed baths

Custo do desperdício de materiais: punção venosa periférica e banho no leito

Costo del desperdicio de materiales: venopunción periférica y baño en cama

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Abstract

Objective: To measure the costs of medical supply waste in two nursing procedures; to define waste into avoidable and unavoidable; to classify these materials according to the ABC classification and estimate the annual cost of these types of medical supply waste.

Methods: This was a quantitative, exploratory-descriptive single case study. Data were collected between March 2016 and February 2017 in two units of a university hospital in the city of São Paulo, Brazil. The following nursing procedures composed the sample: peripheral venipuncture and bed baths. Medical supply waste was calculated as the sum of the cost of each item of wasted materials. The data were analyzed descriptively in terms of absolute and relative frequencies, average, and standard deviation.

Result: The total of medical supply waste of peripheral venipuncture was R\$ 27.20 (US\$ 7.31) of which R\$ 3.50 (US\$ 0.94) were "avoidable", R\$ 23.70 (US\$ 6.37), "unavoidable". The total volume of waste for bed baths was R\$ 214,63 (US\$ 57.73), of which R\$ 149.59 (US\$ 40.24) were "avoidable" and R\$ 65.04 (US\$ 17.49) "unavoidable". More than 70% of the wasted supplies were class A materials in both procedures. The projected annual cost of medical supply waste was R\$ 83,858.53 (US\$ 22,557.94).

Conclusion: Medical supply waste presented a distinct behavior in the observed procedures, which points to the need for it to be identified, analyzed and calculated for nurses to make decisions efficiently.

Resumo

Objetivo: Mensurar o custo dos materiais desperdiçados em dois procedimentos de enfermagem; identificar o desperdício como evitável e não evitável; classificar esses materiais de acordo com a classificação ABC e estimar o custo anual com o desperdício desses materiais.

Métodos: Estudo quantitativo, exploratório-descritivo, do tipo estudo de caso único. Os dados foram coletados de março de 2016 a fevereiro de 2017 em duas unidades de um Hospital Universitário na cidade de São Paulo. Fizeram parte da amostra os procedimentos de enfermagem: Punção Venosa Periférica e Banho no Leito. O desperdício de materiais foi calculado pela soma do custo de cada item de material desperdiçado. Os dados foram analisados descritivamente quanto às frequências absolutas e relativas, por média e desvio padrão.

Resultados: O total com desperdício de materiais na Punção venosa periférica foi R\$ 27,20 (US\$ 7.31), sendo o custo "evitável" de R\$ 3,50 (US\$ 0.94) e R\$ 23,70 (US\$ 6.37) para o "não evitável". O total com desperdício de materiais no Banho no leito foi R\$ 214,63 (US\$ 57.73), sendo o custo de R\$ 149,59 (US\$ 40.24) para os materiais com classificação "evitável" e R\$ 65,04 (US\$ 17.49) para os "não evitável". A maioria dos materiais desperdiçados, acima de 70%, foram da classe A nos dois procedimentos. A projeção do custo anual com desperdício de materiais foi R\$ 83.858,53 (US\$ 22,557.94).

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Conflicts of interest: none to declare.

Conclusão: O desperdício de materiais mostrou comportamento distinto nos procedimentos observados, sinalizando a necessidade de serem identificados, analisados e calculados para que os enfermeiros tomem decisões com eficiência.

Resumen

Objetivo: Medir el costo de los materiales desperdiciados en dos procedimientos de enfermería, identificar el desperdicio evitable y no evitable, clasificar esos materiales de acuerdo con la clasificación ABC y estimar el costo anual del desperdicio de esos materiales.

Métodos: Estudio cuantitativo, exploratorio-descriptivo, tipo estudio de caso único. Los datos fueron recopilados de marzo de 2016 a febrero de 2017 en dos unidades de un hospital universitario en la ciudad de São Paulo. Los procedimientos de enfermería que formaron parte de la muestra fueron: venopunción periférica y baño en cama. El desperdicio de materiales fue calculado por la suma del costo de cada ítem de material desperdiciado. Los datos fueron analizados descriptivamente con relación a las frecuencias absolutas y relativas por promedio y desviación típica.

Resultados: El total del desperdicio de materiales en la venopunción periférica fue de R\$ 27,20 (USD 7,31), del cual el costo "evitable" fue de R\$ 3,50 (USD 6,37) y el "no evitable" de R\$ 23,70 (USD 6,37). El total del desperdicio de materiales en el baño en cama fue de R\$ 214,63 (USD 57,73), del cual el costo de R\$ 149,59 (USD 40,24) fue de material clasificado como "evitable" y R\$ 65,04 (USD 17,49) de "no evitable". La mayoría del material desperdiciado, más del 70 %, fue de clase A en los dos procedimientos. La proyección del costo anual del desperdicio de materiales fue de R\$ 83.858,53 (USD 22.557,94).

Conclusión: El desperdicio de materiales mostró diferentes comportamientos en los procedimientos observados, lo que indicó la necesidad de que sean identificados, analizados y calculados para que los enfermeros tomen decisiones con eficiencia.

Introduction

Waste in health care began to receive greater attention in the last two decades. According to the World Health Organization (WHO), in 2010, waste due to inefficiency varied between 20% and 40% of total health costs.⁽¹⁾

The United States has expressed concern about unsustainable health costs, emphasizing waste reduction as a less detrimental strategy than programs usually employed for cost containment. At the time, the authors estimated that approximately 34% of the country's healthcare spending was wasted.⁽²⁾ Despite efforts, a recent study showed that waste is still present in the US health care system, and measures to eliminate it represent opportunities to reduce the continuous increase in these expenditures.⁽³⁾

From this perspective, cost reduction alone has not been enough in the face of the economic crisis, which has been affecting several healthcare systems. Thus, in addition to traditional reforms aimed at cost reduction, complementary strategies include the identification and elimination of waste.^(2,4)

Studies about hospital waste have sought to identify the types of waste, its causes, and ways to reduce it.⁽⁵⁻⁹⁾ A pioneer study on the subject in Brazil highlighted the waste associated with material resources, human resources, working methods, equipment, the environment, and suppliers.⁽⁶⁾

Some studies in hospitals have shown that patient supplies are one of the main sources of waste.⁽⁵⁻¹³⁾ In

a surgical center, the study pointed to supply waste associated with packages, which was classified as unavoidable waste, in terms of the number of packages when these supplies were not fully used.⁽¹⁰⁾

Material resources are greatly used to provide health care and represent 35% to 45% of budgets, a percentage that can be higher depending on the system adopted, the methodology applied, and the complexity of the organization.⁽¹⁴⁾

Material resources take on greater proportions when it comes to university hospitals (UH). These are expensive structures, because they provide health care services, carry out academic teaching practices, and provide all levels of care, despite having a high-technology structure.⁽¹⁵⁾ University hospitals do not have complete control over their revenue, as the value of the services provided is defined by the Ministry of Health. Therefore, remuneration does not fully cover costs and it is a considerable challenge for these organizations to maintain financial balance.⁽¹⁶⁾

Nursing staff consumes many supplies as part of their practice^(17,18) and represent a considerable portion of human resources in health care.⁽¹⁹⁾ Therefore, information about the adequate use of these supplies and their costs are essential for their rationing, affecting the quality of care, user safety, and economic sustainability, especially in UH with high care demand and scarce resources.

The present study is justified when considering the above and the lack of research on the subject.

Therefore, the objectives were to measure the cost of medical supply waste in two nursing procedures; to identify which forms of waste are avoidable and unavoidable; to classify supplies according to the ABC classification and estimate the annual cost of medical supply waste related to these procedures.

Methods

This was an exploratory-descriptive quantitative single-case study,⁽²⁰⁾ based on STROBE guidelines.⁽²¹⁾ It was extracted from a thesis that analyzed medical supply waste in nursing procedures in a university hospital.

Data were collected between March 2016 and February 2017 in two units of a university hospital (UH) in the city of São Paulo, Brazil.

Medical supply waste (MSW) was defined as the action of using supplies differently from the recommendation and/or the action of using excessive supplies. MSW was also considered an avoidable action.

Unavoidable MSW was defined as leftover supplies in an open package.⁽¹⁰⁾

In this study materials or supplies are understood as those described in the university hospital's Standard Operating Procedures (SOP).

The materials were identified according to the ABC supplies classification used in the UH reports. This classification is based on the values of the items in the inventory as a function of their consumption, unit price, and average inventory. A-class supplies represent a substantial part of the total consumption value; B-class supplies represent intermediary values, and C-class, lower values.⁽²²⁾

The following nursing procedures were analyzed: peripheral venipuncture (PVP) and bed baths (BB). These were chosen because the institution's nursing staff indicated them as the greatest sources of waste. Convenience samples were used. The choice of the unit to collect PVP data was made after consulting the university hospital nursing care indicators system to identify the units with the highest number of patients with peripheral venous catheters-day. After interviewing the head nurses, a unit where BB

were carried out frequently was chosen to observe this procedure. The Male Clinical Unit was chosen for PVP and the adult ICU for BB.

The ICU had 17 beds for both men and women, a nursing staff of 22 nurses, 25 nursing aides, and 21 nursing technicians. The nurses assessed the patients' clinical conditions before BB, and they were always carried out by two nursing professionals.

The Male Clinical Unit had 17 beds for men, a nursing staff of six nurses, five nursing technicians, and 11 nursing aides. PVP was carried out by the nursing staff.

The data were collected via non-participatory direct observation in order to record the supplies consumed and wasted. To this end, the nursing procedures were observed starting at the separation of the supplies until their conclusion.

Two different data collection instruments were developed considering the standardized supplies included in the institution's SOP. After conducting pre-tests, some adjustments were made to the instruments.

The cost of medical supply waste (CMSW) was calculated separately for each nursing procedure (NP) as the sum of the cost of waste of each supply item (CMSWi):

$$CMSW_{NP} = \sum_{i=1}^n CMSWi$$

The CMSWi was calculated as the product of the number of items of wasted supply (QMi) and the average unit price of the item (PMi):

$$CMSWi = \sum_{i=1}^n QMi \times PMi$$

The value of the supplies was obtained from the university hospital management system, using the average unit price of supplies of the last purchase.

The annual cost of MSW for PVP was calculated based on the annual total number of patients with peripheral catheter-day. The average MSW for BB was based on the number of ICU beds, multiplied by 12 months.

The current Brazilian currency, the Real (R\$), and the US dollar (US\$) were used to calculate based on the value announced by the Central Bank of Brazil on October 31, 2018, which was US\$ 0.269/ R\$ 1.⁽²³⁾

The data were analyzed descriptively in terms of absolute and relative frequencies and summary measures.

This study was approved by the Research Ethics Committee of the institution, with resolution no. 991.061.

Results

Peripheral venipuncture (PVP)

Over the course of 11 months, 66 PVP were observed. All 24 items included in the SOP were consumed. The most commonly used materials were: white surgical adhesive (25mm x10M), totaling 1,699 cm, with an average of 25.7 cm (SD=12.924 cm); 70% ethyl alcohol with 480 mL and an average of 7.2 mL (SD= 4.341 mL); 10 mL 0.9% physiological solution (ampoules) with 460 mL and an average of 6.9 mL (SD= 5.253 mL) and 100 ml (bag) 0.9% saline solution, with the consumption of 240 ml and an average of 3.6 ml (SD= 0.498 mL). Eleven (45.8%) items were discarded as MSW. Those with greater amounts wasted were: 0.9% saline solution 100 mL, with a total of 1,060 mL and an average of 16.06 mL (SD= 32.717 mL); sterile gauze compresses (7.5 x 7.5 13F) with 166 units and an average of 2.5 units (SD= 4.058 units); 0.9% saline solution 10 mL with 150 mL and an

average of 2.2 mL (SD= 1.368 ML) and hypoallergenic bandage tape (10 x 4.5 m) with 30 cm and an average of 0.45 cm (SD= 3.693 cm), according to Table 1.

The total cost of MSW for PVP was R\$ 27.20 (US\$ 7.31). The cost of the “avoidable” category of MSW was R\$ 3.50 (US\$ 0.94) and of the “unavoidable” category, R\$ 23.70 (US\$ 6.37). Most of the wasted supplies belonged in class A (72.7%) and the remainder in class B (27.3%). The items with the highest “unavoidable” waste costs were: 0.9% saline solution 100 ml R\$ 14.84 (US\$ 3.99), sterile gauze compress (7.5 x 7.5 13F) R\$ 6.47 (US\$ 1.74), and 0.9% saline solution 10 ml R\$ 2.25 (US\$ 0.60). The items with the highest “avoidable” waste costs were: Y extension 1.68 (US\$ 0.45), hypoallergenic tape for dressings (10 x 4.5M) R\$ 0.93 (US\$ 0.25), and procedure gloves R\$ 0.70 (US\$ 0.18), as shown in Table 2.

Bed Baths (BB)

A total of 84 BB were observed over the course of nine months. All 16 items included in the SOP were used, in addition to 13 extra items, for a total of 29 items. The most used materials were: white surgical tape (25mm x10M), totaling 7,680 cm, with an average of 91.4 cm (SD= 253.97 cm); sterile gauze compress (7.5 x 7.5 13F) with 3,650 units consumed and an average of 43.5 units (SD= 19.84 units); 0.9% saline solution 10 mL with 1,920 mL and an average of 22.8 mL (SD= 13,760 mL) and 70% ethyl alcohol with 820 mL consumed and an average of 9.7 mL (SD= 3,652 mL). Medical waste was observed in 25 items (86.2%) part of the SOP

Table 1. Distribution of the amounts of materials wasted in peripheral venipuncture

Items	Materials	Reference unit	Amount wasted	Average waste	Standard Deviation	Median	Minimum	Maximum
1	White surgical tape 25mm X 10m	Cm	21	0.318	1.915	0	0	14
2	70% ethyl alcohol 70% 100ml btl	mL	9	0.136	0.821	0	0	6
3	Hydrophilic cotton 500g	Grams	5.0	0.076	0.404	0	0	3.0
4	0.5% Chlorhexidine gluconate alcohol sol 1100 mL btl	mL	3	0.045	0.369	0	0	3
5	Gauze compress 7.5x7.5 cm 13F pkg with 10 sterile units	Units	166	2.515	4.058	0	0	18
6	Adhesive 25 mm x 10 M	Cm	3	0.045	0.369	0	0	3
7	2-way Y extension with clamp	Units	2	0.030	0.173	0	0	1
8	Hypoallergenic tape for dressing 10 x 4.5 M	Cm	30	0.455	3.693	0	0	30
9	Glove for non-sterile procedure	Units	5	0.076	0.267	0	0	1
10	0.9% saline solution 10mL amp	mL	150	2.273	1.368	0	0	10
11	0.9% saline solution 100mL bag	mL	1.060	16.061	32.717	0	0	90

Table 2. Distribution of the costs of medical supply waste, ABC classification and “unavoidable” waste in peripheral venipuncture

Items	Materials	ABC Classification ^(a)	“Unavoidable” waste	Reference Unit	Average unit cost (R\$)	Amount wasted	Cost of waste (R\$)	Cost of waste (US\$)
	TOTAL						27.20	7.31
1	White surgical tape 25mm X 10m	A		cm	0.003	21	0.06	0.01
2	70% ethyl alcohol 70% 100ml btl	A	x	mL	0.011	9	0.10	0.02
3	Hydrophilic cotton 500g	B		grams	0.022	5.0	0.11	0.03
4	0.5% Chlorhexidine gluconate alcohol sol 1100 mL btl	A	x	mL	0.014	3	0.04	0.01
5	Gauze compress 7.5x7.5 cm 13F pkg with 10 sterile units	A	x	units	0.039	166	6.47	1.74
6	Adhesive 25 mm x 10 M	A		cm	0.005	3	0.02	0.005
7	2-way Y extension with clamp	B		units	0.840	2	1.68	0.45
8	Hypoallergenic medical tape for dressings 10 x 4.5 M	B		cm	0.031	30	0.93	0.25
9	Glove for non-sterile procedure	A		units	0.140	5	0.70	0.19
10	0.9% saline solution 10mL amp	A	x	mL	0.015	150	2.25	0.61
11	0.9% saline solution 100mL bag	A	x	mL	0.014	1,060	14.84	4.00

^(a) Data from UH Administrative Board Report

and in 9 (69.2%) of the extra supplies. The most wasted supplies were: white surgical tape (25mm x10M), totaling 1,705 cm, with an average of 20.3 cm (SD= 18.504); sterile gauze compress (7.5 x 7.5 13F) with 1,076 units and an average of 12.8 units (SD= 14.208); 70% ethyl alcohol, having 1,000 mL of waste and 11.9 ML (SD= 21.772) and 2% chlorhexidine detergent with 300 ml and an average of 3.57 ML (SD= 15.101), according to Table 3.

The total cost of MSW for BB was R\$ 214.63 (US\$ 57.73). Of the total MSW, R\$ 170.24 (US\$ 45.79), 79.3%, was spent with materials described in the SOP and R\$ 44.39 (US\$ 11.94), 20.7%, with extra materials. The items with the highest waste costs were: a pad of sterile gauze (7.5 x 7.5 13F) R\$ 41.96 (US\$ 11.29), disposable diapers - R\$ 28.35 (US\$ 7.62), and faux-fabric disposable aprons R\$ 23.28 (US\$ 6.26). Most of the wasted materials (70.8%) were class A supplies, 25% were class B, and 4.2%, class C. The cost of “avoidable” items was R\$ 149.59 (US\$ 40.24) (69.7%) and of “unavoidable” items, R\$ 65.04 (US\$ 17.49) (30.3%). The items with the highest “unavoidable” waste costs were: sterile gauze compresses (7.5 x 7.5 13F) R\$ 41.96 (US\$ 11.29), 70% ethyl alcohol R\$ 11.30 (US\$ 3.03), and 2% chlorhexidine glucose detergent R\$ 5.55 (US\$ 1.50). Of these items, 71.4% were class A and 28.6%, class B. The items with the highest “avoidable” waste costs were: disposable diapers R\$ 28.35 (US\$ 7.63), disposable aprons R\$ 23.28 (US\$ 6.26), and disposable electrodes R\$ 17.28 (US\$ 4.65), of which 70.6% were

class A supplies, 23.5% were class B, and 5.9% were class C, as shown in Table 4.

The cost projection of one year of MSW related to PVP was R\$ 27,401.53 (US\$ 7,371.01), and to BB, R\$ 56,457.00 (US\$ 15,186.93), for a total of R\$ 83,858.53 (US\$ 22,557.94).

Discussion

All the materials described in the SOP for PVP were used and 45.8% were wasted. The highest MSW costs in PVP were associated with “unavoidable” waste (86.9%), because the quantity of packages was greater than that necessary for PVP.

A study that analyzed MSW in a surgical center of a university hospital also observed greater waste of “unavoidable” items, resulting in a loss for hospital institutions, because industries are responsible for the number of packages, with a strong correlation between total waste and “unavoidable” waste, especially with gauze compresses.⁽¹⁰⁾

The items with the highest waste costs in PVP were: 0.9% saline solution (100ml bag) and sterile gauze compresses (10 units), both “unavoidable” items. Most of the time, the leftovers of the contents of these packages are discarded or used improperly, compromising the quality and safety of care. It is a topic that needs to be discussed using a consumer-based rather than a manufacturer-based approach in order to make adaptations, reduce waste, and meet care needs.

Table 3. Distribution of the amounts of supplies wasted in bed baths

Items	Materials	Reference unit	Amount wasted	Average waste	Standard Deviation	Median	Minimum	Maximum
SOP materials								
1	Wooden tongue depressor	units	11	0.13	0.373	0	0	2
2	White surgical tape 25mm X 10m	cm	1,705	20.30	18.504	15	0	80
3	70% ethyl alcohol 100 mL btl	mL	1,000	11.90	21.772	0	0	75
4	Disposable long-sleeved faux fabric apron	units	24	0.29	0.785	0	0	5
5	Twill shoelace 10m x 10mm	cm	90	1.07	3.112	0	0	10
6	0.12% chlorhexidine glucose w/o alcohol 250 mL btl	mL	22	0.26	1.424	0	0	10
7	Gauze compress 7.5x7.5 cm 13F pkg with 10 sterile units	units	1,076	12.81	14.208	10	0	60
8	Gauze compress 7.5x7.5 cm 13F pkg with 500 non-sterile units	units	2	0.02	0.153	0	0	1
9	Disp plastic cup 120 ml	units	9	0.11	0.311	0	0	1
10	Adhesive 25 mm x 10 M	cm	120	1.43	11.101	0	0	100
11	Geriatric disposable diaper w/ gel	units	35	0.42	0.779	0	0	4
12	Fabric sheet	units	34	0.40	0.494	0	0	1
13	Glove for non-sterile procedure	units	69	0.82	2.095	0	0	16
14	Dispo rectang triple mask with BFE filter and cords	units	1	0.01	0.109	0	0	1
15	Garbage bag thickness 0.07 - 200 L capacity l red	units	1	0.01	0.109	0	0	1
16	Saline solution (sodium cl) 0.9% 10 ml amp	mL	100	1.19	0.476	0	0	20
Extra materials								
1	Crepe bandage 13 strands 20 comx 4.5 M	units	2	0.02	0.153	0	0	1
2	2% chlorhexidine glucose detergent 100 ml btl	mL	300	3.57	15.101	0	0	100
3	Intravenous device no. 21	units	5	0.06	0.324	0	0	2
4	Adult disposable electrode	units	54	0.64	1.189	0	0	5
5	Adhesive tape crepe 19 x 50m	cm	21	0.25	0.890	0	0	100
6	Sterile surgical glove	units	4	0.05	0.214	0	0	1
7	PPF mask-Biohazards	units	1	0.01	0.109	0	0	1
8	3 way disposable faucet with Luer lok	units	22	0.26	0.679	0	0	2
9	Disposable hair cap	units	21	0.25	0.955	0	0	5

Table 4. Distribution of the cost of medical supply waste, ABC classification, and “unavoidable” waste in peripheral venipuncture

Items	Materials	ABC Classification ^(a)	“Unavoidable” waste	Reference unit	Average unit cost (R\$)	Amount wasted	Cost of waste (R\$)	Cost of waste (US\$)
TOTAL							214.63	57.73
Standard material							170.24	45.79
1	Wooden tongue depressor	C		units	0.020	11	0.22	0.06
2	White surgical tape 25mm X 10m	A		cm	0.003	1,705	5.22	1.40
3	70% ethyl alcohol 100 mL btl	A	x	mL	0.011	1,000	11.30	3.03
4	Disposable long-sleeved faux fabric apron	A		units	0.970	24	23.28	6.26
5	Twill shoelace 10m x 10mm	B		cm	0.0002	90	0.02	0.005
6	0.12% chlorhexidine glucose w/o alcohol 250 mL btl	B	x	mL	0.025	22	0.55	0.15
7	Gauze compress 7.5x7.5 cm 13F pkg with 10 sterile units	A	x	units	0.039	1,076	41.96	11.29
8	Gauze compress 7.5x7.5 cm 13F pkg with 500 non-sterile units	A	x	units	0.030	2	0.06	0.02
9	Disp plastic cup 50 ml	A		units	0.010	9	0.09	0.02
10	Adhesive 25 mm x 10 M	A		cm	0.005	120	0.56	0.15
11	Geriatric disposable diaper w/ gel	A		units	0.810	35	28.35	7.63
12	Fabric sheet ^(b)	-		units	1.370	34	46.58	12.53
13	Glove for non-sterile procedure	A		units	0.140	69	9.66	2.60
14	Dispo rectang triple mask with BFE filter and cords	A		units	0.100	1	0.10	0.03
15	Garbage bag thickness 0.07 - 200 L capacity l red	A		units	0.790	1	0.79	0.21
16	Saline solution (sodium cl) 0.9% 10 ml amp	A	x	mL	0.015	100	1.50	0.40
Extra materials							44.39	11.94
1	Crepe bandage 13 strands 20 comx 4.5 M	B		units	0.800	2	1.60	0.43
2	2% chlorhexidine glucose detergent 100 ml btl	A	x	mL	0.019	300	5.55	1.50
3	Intravenous device no. 21	B		units	0.150	5	0.75	0.20
4	Adult disposable electrode	A		units	0.32	54	17.28	4.65
5	Adhesive tape crepe 19 x 50m	B		cm	0.00052	21	0.01	0.002
6	Sterile surgical glove	A		units	1.04	4	4.16	1.12
7	PPF mask-Biohazards	B		units	1.89	1	1.89	0.51
8	3 way disposable faucet with Luer lok	A		units	0.55	22	12.10	3.25
9	Disposable hair cap	A		units	0.05	21	1.05	0.28

^(a) Data from UH Administrative Board Report; ^(b) item of clothing

In BB, MSW was produced for 86.2% of the items and all the materials described in the SOP for BB were used, in addition to several extra items. A study that measured the costs of body hygiene care also identified the use of extra materials in BB, indicating the need to review the SOP.⁽²⁴⁾ The goal of standardization is to organize nursing work and it is an opportunity for cost reduction and for optimizing resources.⁽²⁵⁾

Most of the costs with waste in BB were: sterile gauze compress, disposable diapers, and disposable aprons. A study in a university hospital analyzed different types of waste and showed that disposable aprons were items of waste in clinical care, and gauze in surgical care.⁽¹³⁾ Gauze waste was also shown in a study that quantified the undue use of supplies in a neonatal ICU.⁽¹²⁾ Gauze compresses were identified as one of the most wasted supplies in a study carried out in a surgical center in a university hospital.⁽¹⁰⁾

Regarding BB, the greatest cost of MSW was with “avoidable” supplies (R\$ 149.59/US\$ 40.24), because this type of supply was misused or excessively used. The study identified situations when professionals improvised the use of the material, highlighting that these practices are already part of the routine or arise from the need to adapt what is available for use.⁽¹²⁾ Another study that analyzed the adaptations and improvisations with supplies found that these actions aimed to ensure patient care and facilitate the nursing work process. This practice arises from the precariousness of the job, due to qualitative and quantitative lack of supplies.⁽²⁶⁾ The adaptation of supplies carried out by most of the participants included substituting materials every day because of lack of supplies to perform patient procedures. Most found problems caused by substitution in nursing work dynamics, with emphasis to harm to patient care and safety of care of the given procedure, in addition to supply waste.⁽²⁷⁾

One study about MSW emphasized the importance of integrating the acquisitions staff and front line staff in order to acquire supplies that contribute to quality of care.⁽⁹⁾

Both the substitution of materials and lack of knowledge of materials by those responsible for purchases are complex problems present in most

public hospitals. In traditional supply management models, most problems among care units and hospital supply sector occur because they do not see themselves as part of an integrated system. There is also lack of credibility among units and supply sectors due to the irregularity of supply given frequent budgetary problems, resulting in lack of materials. The low qualification of sector professionals, poor use of materials, waste, and little attention of managers contribute to increasing these problems.⁽²⁸⁾

In the present study, most of the materials were classified as belonging to class A, with 72.7% in PVP and 70.8% in BB. This points to the great responsibility of nursing professionals and the impact they can have on organizations. This situation was shown in a study that identified that approximately 80% of class A hospital supplies were used by nursing staff.⁽²⁹⁾ Class A regards priority items, the main ones that are part of the inventory, which are few in number and represent a substantial part of the total value. These are items that systematically receive more attention, via more rigorous planning and control.⁽²²⁾ A study aimed at verifying consumption and the costs of supplies used in ICU and semi-intensive nursing care showed different ABC classifications for materials, depending on the number of beds and supply consumption.⁽³⁰⁾

Nurses are responsible for daily process management and adequate resource allocation; thus, they can contribute substantially to reducing the occurrence of waste at the local level.⁽⁸⁾ They are centrally positioned in the care delivery process, with an important role in reducing waste and improving patient experience. Reducing and eliminating waste increases efficiency and allows more time for patient care,⁽⁴⁾ in addition to attributing to nursing a leading role.

The projection of annual MSW cost associated with PVP and BB represented 6.5%, when compared to the monthly spending of the institution with the materials used to deliver care (R\$ 1,300,000/US\$ 349,700). Similar results were observed in a study on MSW in a surgical center,⁽¹⁰⁾ however it is worth noting that these expenditures do not add value to the processes and if they were avoided, could benefit other patients.

Limitations of the present study include the fact that the observation of PVP and BB procedures in one unit each hindered the calculation of total waste in the organization. In addition, there were few articles to compare the findings and discuss the topic.

This study contributed to the proposal of using a supply waste calculation method, pointing to the need for greater reflection about the topic of material resource management. More in-depth studies should be conducted to increase knowledge on the topic and guide strategies to eliminate the waste of material resources.

Conclusion

The present study showed that there was MSW in the two procedures observed, even in different units. These presented opposite behaviors, with “unavoidable” waste being predominant in PVP, and “avoidable” waste in BB. However, in both procedures, most of the waste materials were in class A, those with higher inventory costs for the university hospital. The total cost of MSW associated with PVP was R\$ 27.20 (US\$ 7.31), and with BB, R\$ 214.63 (US\$ 57.73). The projected annual cost was R\$ 83,858.53 (US\$ 22,557.94). Material resources need to be analyzed in more depth in order to identify, analyze, and reduce the cost of MSW, as they represent costs that should be used for the benefit of other patients. The values found may vary as more data is collected and all units of the university hospital are included, in addition to other procedures shown to generate MSW. Nursing professionals play a prominent role in health care and therefore must be familiar with MSW and its costs, underpinning nursing decision making that will contribute to the efficiency of these processes. As nurses learn about MSW they can adopt measures to prevent this practice, which has harmful consequences for patient and professional safety and affects the financial sustainability of organizations.

Collaborations

Reichert MCF and D’innocenzo M contributed with the creation of the study, data analysis and in-

terpretation, drafting of the article, relevant critical review of the intellectual content, and final approval of the version to be published.

References

1. Organização Mundial de Saúde (OMS). Relatório mundial da saúde: financiamento dos serviços de saúde: o caminho para a cobertura universal. Geneva: OMS; 2010 [citado 2020 Nov 12]. Disponível em: http://www.who.int/whr/2010/whr10_pt.pdf?ua=1
2. Berwick DM, Hackbarth AD. Eliminating waste in US healthcare JAMA. 2012;307(14):1513-6.
3. Shrank WH, Rogstad TL, Parekh N. Waste in the US Health Care System Estimated Costs and Potential for Savings JAMA. 2019;322(15):1501-9.
4. Minogue V, Wells B. Managing resources and reducing waste in healthcare settings. Nurs Stand. 2016;30(38):52-60.
5. Sacramento F. Desperdícios em instituições hospitalares. Rev Iberoam Estratégia. 2002;1(1):15-26.
6. Aranha GT, Vieira RW. Estudo de um dos indicadores de custo da qualidade: resíduos. Rev Adm Saúde. 2004;6(23):43-55.
7. Goff SL, Kleppel R, Lindenauer PK, Rothberg MB. Hospital workers’ perceptions of waste: a qualitative study involving photo-elicitation. BMJ Qual Saf. 2013;22(10):826-35.
8. Dante A, Marega M, Peteani A, Checchi A, Lancia L. [What nurses see? Occurrence and typology of wastes in medical and surgical wards: a cross-sectional study]. Prof Inferm. 2016;69(4):225-36. Italian.
9. Vaghetti HH, Roehrs M, Pires AC, Rodriguez C. Desperdício de material de assistência ao paciente na percepção de profissionais de enfermagem de um hospital universitário. Rev Enferm UERJ. 2011;19(3):369-74.
10. Castro LC, Castilho V. The cost of waste of consumable materials in a surgical center. Rev Lat Am Enfermagem. 2013;21(6):1228-34.
11. Morrow J, Hunt S, Rogan V, Cowie K, Kopacz J, Keeler C, et al. Reducing waste in the critical care setting. Nurs Leadersh (Tor Ont). 2013;26 Spec No 2013:17-26.
12. Lopes LA, Dyniewicz AM, Kalinowski LC. Gerenciamento de materiais e custos hospitalares em UTI neonatal. Cogitare Enferm. 2010;15(2):278-85.
13. Castilho V, Castro LC, Couto AT, Maia FO, Sasaki NY, Nomura FH, et al. Survey of the major sources of waste in the health care units of a teaching hospital. Rev Esc Enferm USP. 2011;45 Spec No:1613-20.
14. Reinhard Filho W. Gestão de suprimentos e medicamentos. In: Vecina Neto G, Malik AM, editors. Gestão em saúde. Rio de Janeiro: Guanabara Koogan; 2011. p. 191-202.
15. Medici AC. Hospitais universitários: passado, presente e futuro. Rev Assoc Med Bras. 2001;47(2):149-56.
16. Dallora ME, Forster AC. Gerenciamento de custos de material de consumo em um hospital de ensino. Rev Adm Saúde. 2013;15(59):46-52.
17. Ruiz PB, Nobrega CR, Vigna CP, Lima AF. Custos de procedimentos/intervenções de enfermagem: revisão integrativa da literatura. Rev Bras Enferm. 2020;73(Suppl 6):e20190351.

18. Andrade RG, Bogo PC, Tonini NS, Matos FG, Alves DC. Inserção dos profissionais de enfermagem no gerenciamento de materiais em hospital universitário do Paraná. *Rev Gaúcha Enferm.* 2021;42:e20200069.
19. Souza e Souza LP, Souza AG. Enfermagem brasileira na linha de frente contra o novo Coronavírus: quem cuidará de quem cuida? *J Nurs Health.* 2020;10:e20104005.
20. Yin RK. Estudo de caso: planejamento e métodos. 5a ed. Porto Alegre: Bookman; 2015. 212 p.
21. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *BMJ.* 2007;335(7624):806-8.
22. Barbieri JC, Machline C. Logística hospitalar: teoria e prática. 2a ed. São Paulo: Saraiva; 2011. 325 p.
23. Brasil. Ministério da Economia. Receita Federal. Taxas de câmbio, incluindo valor em dólar para fins fiscais. Anos anteriores. Brasília (DF): Ministério da Economia; 2021 [citado 2021 Fev 16]. Disponível em: <https://www.gov.br/receitafederal/pt-br/assuntos/orientacao-tributaria/declaracoes-e-demonstrativos/ecf/taxas-de-cambio-incluindo-valor-do-dolar-para-fins-fiscais-irpj>
24. Lima AF, Fugulin FM, Castilho V, Nomura FH, Gaidzinski RR. Contribuição da documentação eletrônica de enfermagem para mensuração dos custos do organismo de saúde. *J Health Inform.* 2012;4(Spec Pt I):108-13.
25. Jerico MC, Peres AM, Kurcgant P. Organizational structure of nursing services: reflections on the influence of the organizational power and culture. *Rev Esc Enferm USP.* 2008;42(3):569-77.
26. Souza NV, Santos DM, Anunciação CT, Thiengo PC. O trabalho da enfermagem e a criatividade: adaptações e improvisações nosocômias. *Rev Enferm UERJ.* 2009;17(3):356-61.
27. Grossi MG, Bittar E. A reposição de insumos de consumo na dinâmica de trabalho da enfermagem em um hospital cardiológico. *Rev Adm Hosp Inov Saúde.* 2012;8(8):44-53.
28. Infante M, Santos MA. Infante M, Santos MA. A organização do abastecimento do hospital público a partir da cadeia produtiva: uma abordagem logística para a área de saúde. *Cien Saude Colet.* 2007;12(4):945-54.
29. Lourenco KG, Castilho V. Classificação ABC dos materiais: uma ferramenta gerencial de custos em enfermagem. *Rev Bras Enferm.* 2006;59(1):52-5.
30. Zuliani LL, Jericó MC, Castro LC, Soler ZA. Consumo e custo de recursos materiais em unidades pediátricas de terapia intensiva e semi-intensiva. *Rev Bras Enferm.* 2012;65(6):969-76.