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AVALIAÇÃO DA EFICIÊNCIA DA LIMPEZA E DESINFECÇÃO  
DE SUPERFÍCIES EM UMA UNIDADE BÁSICA DE SAÚDE

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## EFFICIENCY EVALUATION OF THE CLEANING AND DISINFECTION OF SURFACES IN A PRIMARY HEALTH CENTER

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### ABSTRACT

**Objective:** to evaluate the effect of educative interventions in the cleaning and disinfection of surfaces in a health center.

**Method:** this is a prospective analytical study with a quantitative approach, carried out in a health center where two *Estratégia Saúde da Família* teams work. The surfaces chosen to be evaluated for their cleaning and disinfection were from: the dressing trolleys; reception desks; gynecological examination tables; patient stretchers; and nursing consultation tables. The monitoring methods used were: visual evaluation; counting of colony-forming units; and measurement of adenosine triphosphate. The Wilcoxon test and the Mann-Whitney test were used for the statistical analysis, considering a significance level of 5% or ( $p < 0.05$ ).

**Results:** a total of 720 evaluations were performed at the end of all phases. In phase I, failure rates of 57.5%, 20.0%, and 90.0% were observed. After the educational intervention, the quantitative short-term disapprovals decreased to 0.0%, 2.5%, and 50.0% (data from phase III) and, in the long term, to 5.0%, 0.0%, and 65% (data from phase IV) for the visual, adenosine triphosphate, and culture methods, respectively. Visual inspection was the method that presented the highest frequency of disapproved surfaces in phases I and IV.

**Conclusion:** the microbial load and the values of the adenosine triphosphate readings were reduced. Although this reduction was not statistically significant for all surfaces. The educational intervention was considered efficient.

**DESCRIPTORS:** Primary health care. Patient safety. Quality management. Health education. Disinfection.

## AVALIAÇÃO DA EFICIÊNCIA DA LIMPEZA E DESINFECÇÃO DE SUPERFÍCIES EM UMA UNIDADE BÁSICA DE SAÚDE

### RESUMO

**Objetivo:** avaliar o efeito de intervenções educativas na limpeza e desinfecção de superfícies em uma unidade básica de saúde.

**Métodos:** trata-se de um estudo prospectivo, analítico com abordagem quantitativa. O estudo foi realizado em uma unidade básica de saúde, onde atuam duas equipes da Estratégia de Saúde da Família. Optou-se por avaliar a limpeza e desinfecção das superfícies: carrinho de curativo, balcão da recepção, mesa ginecológica, maca do paciente e mesa de consulta de enfermagem, utilizando-se dos métodos de monitoramento: avaliação visual, contagem de unidades formadoras de colônias e mensuração de adenosina trifosfato. Utilizaram-se, para a análise estatística, o teste de postos de Wilcoxon e o teste de Mann-Whitney, considerou-se nível de significância de 5% ou ( $p < 0,05$ ).

**Resultados:** obteve-se um total de 720 avaliações realizadas ao término de todas as fases. Observou-se na fase I uma taxa de reprovação de 57,5%, 20,0% e 90,0%; após a intervenção educativa, os quantitativos de reprovação em curto prazo diminuíram para 0,0%, 2,5,0% e 50,0% (dados da fase III) e, em longo prazo, para 5,0%, 0,0% e 65% (dados da fase IV) para os métodos visual, adenosina trifosfato e cultura, respectivamente. A inspeção visual foi o método que apresentou maior frequência de superfícies reprovadas nas fases I e IV.

**Conclusão:** houve redução da carga microbiana e valores das leituras de adenosina trifosfato; embora essa redução não tenha sido estatisticamente significativa em todas as superfícies. Constatou-se que a intervenção educativa foi eficiente.

**DESCRIPTORIOS:** Atenção primária à saúde. Segurança do paciente. Gestão da qualidade. Educação em saúde. Desinfecção.

# EVALUACIÓN DE LA EFICIENCIA DE LA LIMPIEZA Y DESINFECCIÓN DE SUPERFICIES EN UNA UNIDAD BÁSICA DE SALUD

## RESUMEN

**Objetivo:** evaluar el efecto de intervenciones educativa en la limpieza y desinfección de superficies en una unidad básica de salud.

**Métodos:** se trata de un estudio prospectivo, analítico con abordaje cuantitativo. El estudio fue realizado en una Unidad Básica de Salud, donde actúan dos equipos de Estrategia de Saúde da Família. Se optó por evaluar la limpieza y desinfección de las superficies: carro de curado, mostrador de recepción, mesa ginecológica, maca del paciente y mesa de consulta de enfermería, utilizando los métodos de monitoreo: evaluación visual, conteo de unidades formadoras de colonias y la medición de adenosina trifosfato. Se utilizaron para el análisis estadístico la prueba de puestos de Wilcoxon y la prueba de Mann-Whitney, se consideró un nivel de significancia del 5% o ( $p < 0,05$ ).

**Resultados:** se obtuvo un total de 720 evaluaciones realizadas al término de todas las fases. En la fase I se obtuvo una tasa de reprobación del 57,5%, 20,0% y 90,0%; después de la intervención educativa, los cuantitativos de reprobación a corto plazo disminuyeron a 0,0%, 2,5,0% y 50,0% (datos de la fase III) y, a largo plazo, al 5,0%, 0, 0% y 65% (datos de la fase IV) para los métodos visual, Adenosina Trifosfato y cultivo, respectivamente. La inspección visual fue el método que presentó mayor frecuencia de superficies reprobadas en las fases I y IV.

**Conclusión:** hubo reducción de la carga microbiana y valores de las lecturas de adenosina trifosfato; aunque esta reducción no fue estadísticamente significativa a todas las superficies. Se constató que la intervención educativa fue eficiente.

**DESCRIPTORES:** Atención Primaria de Salud. Seguridad del Paciente. Gestión de la Calidad. Educación en Salud. Desinfección.

## INTRODUCTION

Contaminated environmental surfaces act as a reservoir for microorganisms that may come into contact with patients, directly or indirectly, from the hands of health professionals.<sup>1</sup> It is noteworthy that on these surfaces microorganisms of epidemiological relevance may be found, such as vancomycin-resistant *Enterococcus*, *Clostridium difficile*, *Acinetobacter spp.*, methicillin-resistant *Staphylococcus aureus*, and norovirus.<sup>2-4</sup>

Therefore, it is pertinent to develop actions with the goal of reducing the proliferation of these pathogens, considering that contaminated environments present a significant impact on the spread of these agents.<sup>5</sup> By virtue of the above, there is a growing concern about improving the cleaning and disinfection (C&D) of these surfaces, with a view to minimizing microbial transmission.<sup>6</sup>

It is observed that the performance of C&D of surfaces is an essential element for infection control programs, although often the main focus is on carrying out actions for adhesion to hand hygiene.<sup>7</sup> It is also corroborated that, in some places, the environmental C&D practices are below those recommended due to various aspects, including human resources, noncompliance with the manufacturer's standards and recommendations, and even the quality of the products used.<sup>8</sup>

It is also important to emphasize the need for a greater focus on the C&D of surfaces considered to have a high incidence of touch by either patients' or health professionals' hands: bedside tables; door handles; light switches; bed rails; toilet seats; and handrails, among others; especially those in close proximity to patients.<sup>9-10</sup> According to the United States Centers for Disease Control and Prevention, it

is important to extend cleaning performance to areas considered to be high-touch, in comparison to low-touch areas. In addition, it should be noted that all health services, regardless of their level of complexity, should seek the prevention of healthcare-associated infections (HAIs).<sup>11</sup> In the literature, a large number of publications in the hospital context are found; it is important to know which ones are performed in the C&D process in primary health care.

Based on this context, the goal of this study is to evaluate the effect of educational interventions on the cleaning and disinfection of surfaces in a primary health center (PHC).

## METHOD

This is a prospective analytical study with a quantitative approach, carried out in a PHC (Três Lagoas, MS, Brazil) where two family health strategy teams work. The teams are composed of different categories of professionals, among them physicians, nurses, nursing technicians/auxiliaries, community health agents, dentists and dental assistants; covering a total of 1,725 families registered. The study was conducted from July to November 2015.

The environments chosen were the riskiest ones for the acquisition of HAIs. Thus, a non-probabilistic intentional sampling was adopted. An intentional sample is one in which the researcher defines, based on pertinent criteria for the study purpose, the elements to be selected.<sup>12</sup> Thus, after this observation, the following surfaces were chosen: dressing trolley; reception desk; gynecological examination table; patient stretcher; and nursing consultation table.

The collections were carried out twice a week, always in the morning. Ten samples from each

surface were collected per day (five prior and five after the C&D process), twice a week, during four weeks, in phases I, III and IV, resulting in 80 samples per phase. This totaled 240 evaluations per each

monitoring method at the end of the three phases, as shown in Table 1. The definition of ward and days of the week for the collection was carried out by random sampling.

**Table 1 - Number of evaluations performed per method in each phase of the study. Três Lagoas, Mato Grosso do Sul, Brazil, 2016**

Method	Phase I (4 weeks)	Phase II (intervention)	Phase III (4 weeks)	Phase IV (4 weeks)	Total Evaluations
Visual Inspection	80	—	80	80	240
ATP	80	—	80	80	240
CFU	80	—	80	80	240
Total	240	—	240	240	720

This study was conducted in four phases. Phase I, characterized as diagnosis/observation, had a duration of one month. In this stage, the C&D process was evaluated, and was carried out by the nursing team (one nurse and two nursing techniques in each period) and the cleaning team (one collaborator).

Regarding the characterization of the C&D process carried out in the PHC before the implementation of the intervention program, it was observed that the unit already had a product indicated for fixed surface disinfection; however, spray bottles were not available for all rooms in the unit.

The responsibility for cleaning each of the studied surfaces varied. For example: the nursing professional (nurse or nursing technician) scaled for the procedure room was in charge of the dressing trolleys; the nursing professional (nurse or nursing technician) scaled for the vaccination room was in charge of the patient stretcher. Concerning the periodicity of the C&D of the surfaces, it was performed once a day, in the early morning or as needed.

It is important to note that the team was not informed of the true intent of the study; this decision was made in order to avoid the Hawthorne effect, that is, to avoid having the professionals modify their practices just because they were being observed. In this phase, when the question was raised about the purpose of the researcher during the collections in the PHC, the professionals were informed that it was an evaluation of the cleaning products used in the unit.<sup>13-15</sup>

With the results obtained in phase I, an educational intervention program was defined and developed within the team in phase II. The objectives of the study were then clarified to all the participants (nursing team, hygiene and cleaning

team, and coordination of the PHC).<sup>13-14</sup> The educational intervention consisted of a 60-minute lecture, a presentation of the results of phase I (diagnosis), standardization of C&D practices, and standardization of microfiber cloths.<sup>15</sup> With the standardization, surface C&D was established at a frequency of twice a day and whenever necessary. It was also decided to use microfiber cloths (80% viscose, 15% polypropylene, and 5% polyester) as, before the intervention program, cotton cloths or paper towels were used, depending on each professional's individual choice for how to carry out the C&D process. In addition, spray bottles containing the cleaning product were made available in all environments.<sup>13,15</sup>

In phase III, the immediate effect of the interventions developed in phase II (with the PHC nursing and hygiene teams) was analyzed. Its onset occurred immediately after phase II, based on the same actions that were developed in phase I (diagnosis); however, in this period, all participants were aware of the purpose of the study. Feedback to the team of the results and orientations was also offered in this phase, as requested by the professionals.<sup>15</sup>

In phase IV there was no intervention with the teams, only monitoring, which started two months after phase III and lasted for four weeks. The objective of this stage was to verify whether, in the long term, the team maintained the guidelines and behaviors that were implemented. That is, during this period, no feedback or orientation was offered to the teams.<sup>15-16</sup>

Although the visual method does not offer reliable criteria regarding the risk of HAIs, it is still used in studies together with other monitoring methods, with a view to evaluating the visible dirt present on surfaces, including the presence of spots, glue, dust, grease, fingerprints, and other residues (organic or inorganic matter). The presence of any

of these elements, for this investigation, was considered inadequacy of the surface C&D process.<sup>16-17</sup>

For over 30 years, surface adenosine triphosphate (ATP) detections have been used in the food and brewing industries to measure ATP, which indicates the presence of organic matter with great sensitivity.<sup>18</sup> It is important to highlight that the accomplishment of this monitoring method requires the acquisition of an apparatus, the luminometer, in addition to the use of swabs. The results of this measurement are defined in relative light units (RLUs). Because the data produced are quantitative, this method favors the provision of immediate feedback to the hygiene and nursing team.<sup>6</sup>

For the detection of aerobic microorganisms, contact plates called Rodac Plate® were used, consisting of tryptone soy agar (24 cm<sup>2</sup>), each with an individual capacity between 15 ml and 20 ml. The plates were pressed against the surface for 10 seconds, and then introduced into an incubator at a temperature of 37°C for 48 hours. Afterwards, the plates were read in colony-forming units (CFU).<sup>19</sup>

In accordance with several studies, the surfaces were disapproved when the ATP measurement was greater than 250 RLUs, or when the amount of CFU was greater than 2.5 CFU/cm<sup>2</sup>.<sup>7,10,17,19-25</sup>

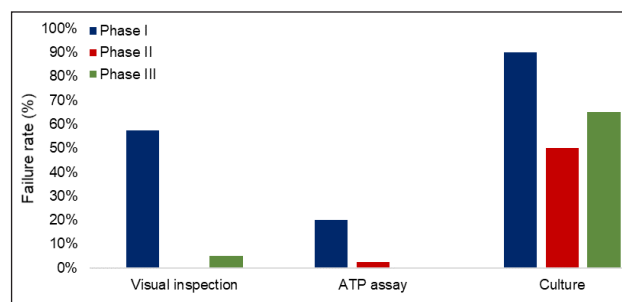
All statistical tests were applied with a significance level of 5% (or  $p < 0.05$ ). In the statistical analysis, the Wilcoxon test was applied in order to compare the results of ATP quantification and microbial counts before and after the intervention in each of the evaluated surfaces and phases, and the Mann-Whitney test was applied in order to compare the variation of the microbial count and the quantification of ATP in each of the evaluated surfaces and phases.

This study was approved by the human

ethics and research committee of the Federal University of Mato Grosso do Sul, Brazil (CAAE: 37896414.9.0000.0021). It is also worth noting that the national and international guidelines on research ethics were followed. Those who agreed to participate signed a free and informed consent form. An authorization from the manager was also obtained for the conduction of the study.

## RESULTS

At the end of this study, a total of 720 evaluations was performed. In phase I, a failure rate of 57.5%, 20.0%, and 90.0% was obtained. After the educational intervention, the quantitative short-term disapprovals decreased to 0.0%, 2.5%, and 50.0% and, in the long-term, to 5.0%, 0.0%, and 65.0%, for the visual, ATP, and culture methods, respectively (Figure 1).



**Figure 1 - Failure rate (comparison between methods). Três Lagoas, Mato Grosso do Sul, Brazil, 2015**

Table 2 shows the results of the proportions found on each of the surfaces according to visual inspection. It is important to mention that the proportions described refer to the surfaces disapproved in the visual test before and after the intervention.

**Table 2 - Proportions of surfaces with visual results disapproved before and after the intervention of cleaning and disinfection on the surfaces. Três Lagoas, Mato Grosso do Sul, Brazil, 2016**

Visual inspection		Intervention		P-value*
		Before	After	
Phase I (n=8)	Reception desk	0 (0.0%)	0 (0.0%)	1.000
	Patient stretcher	8 (100%)	8 (100%)	1.000
	Gynecological examination table	8 (100%)	8 (100%)	1.000
	Dressing trolley	7 (87.5%)	7 (87.5%)	1.000
	Nursing consultation table	0 (0.0%)	0 (0.0%)	1.000



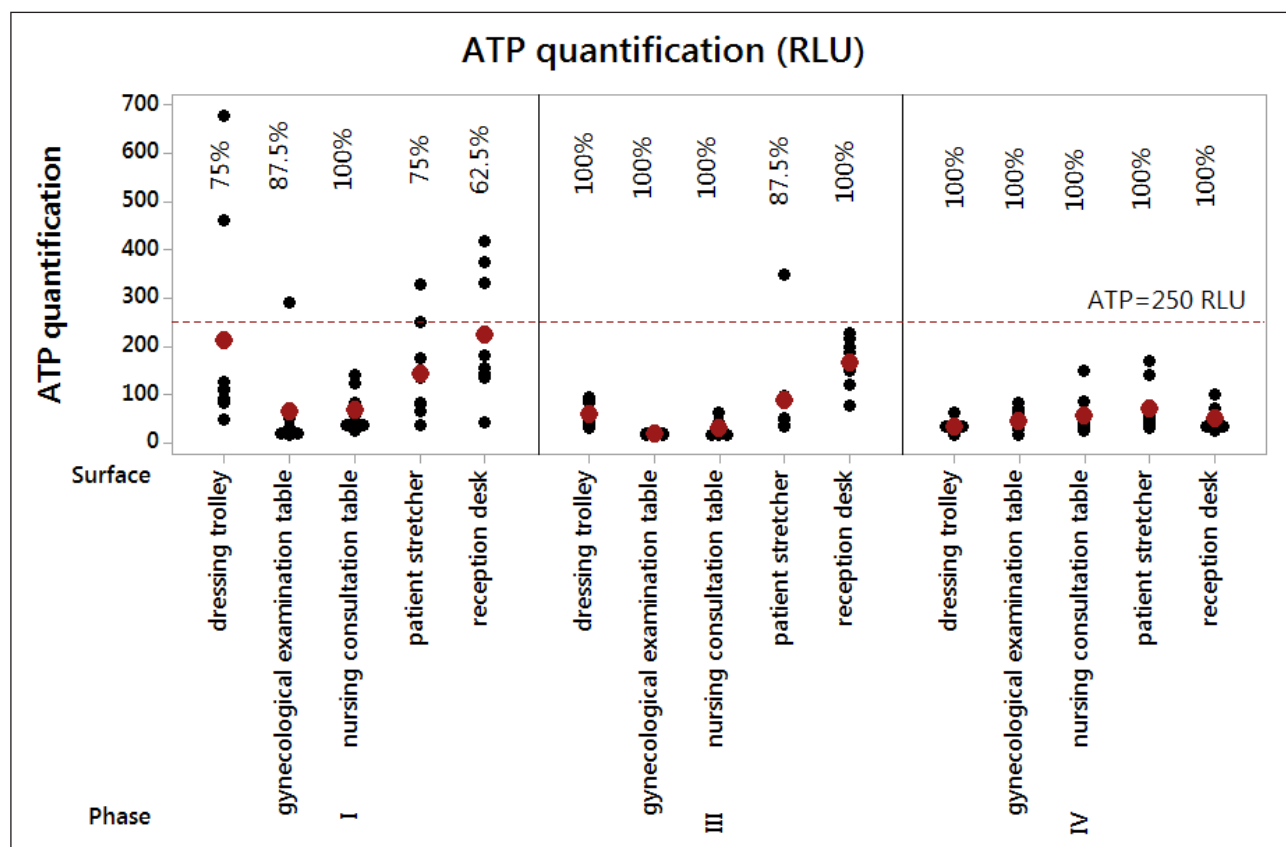
Phase III (n=8)	Reception desk	0 (0.0%)	0 (0.0%)	1.000
	Patient stretcher	0 (0.0%)	0 (0.0%)	1.000
	Gynecological examination table	0 (0.0%)	0 (0.0%)	1.000
	Dressing trolley	0 (0.0%)	0 (0.0%)	1.000
	Nursing consultation table	0 (0.0%)	0 (0.0%)	1.000
Phase IV (n=8)	Reception desk	0 (0.0%)	0 (0.0%)	1.000
	Patient stretcher	5 (62.5%)	0 (0.0%)	<b>0.026</b>
	Gynecological examination table	0 (0.0%)	0 (0.0%)	1.000
	Dressing trolley	3 (37.5%)	2 (25.0%)	1.000
	Nursing consultation table	2 (25.0%)	0 (0.0%)	0.467

\* P-value for Fisher's exact test for two proportions at  $p < 0.05$ .

The results show that the highest failure rates in phase I, regardless of the application of the intervention, were observed on patient stretchers, gynecological examination tables, and dressing trolleys, whereas the reception desk and the nursing consultation table did not present disapprovals. Phase III was characterized by the absence of disapprovals regarding the evaluation of visual inspection of all surfaces.

As to phase IV, there were disapprovals on the patient stretcher, the dressing trolley, and the nursing consultation table. A significant proportion of disapproval was shown for patient stretchers ( $p=0.026$ ); that is, the failure rate went from 62.5% before the intervention to 0.0% afterwards.

Figure 2 shows the graph for individual values of the ATP levels of the five surfaces in the three phases after the C&D intervention.



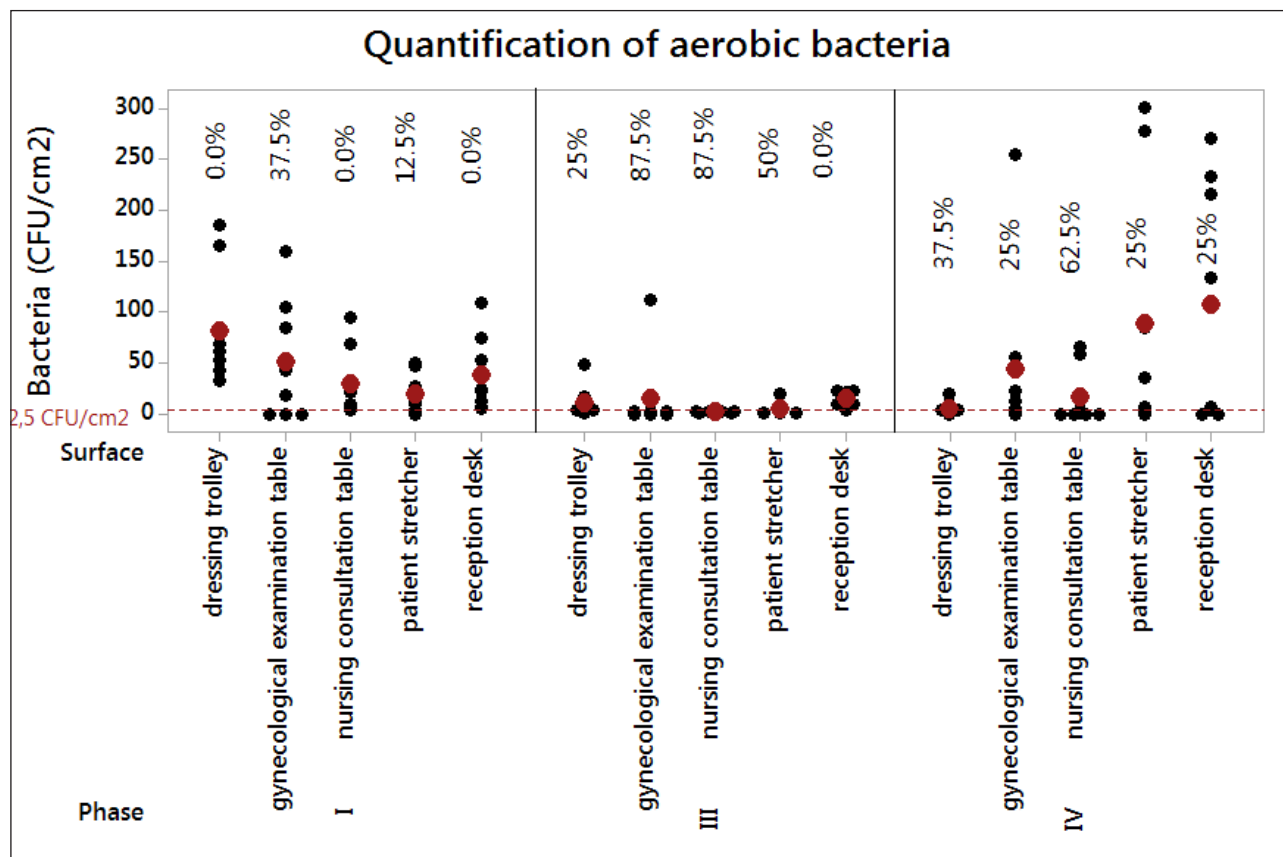
Note: Percentages are related to approval ratings. Black dots indicate the individual ATP values and red dots indicate the medians of the distributions.

**Figure 2 - RLU values for the five surfaces in the three phases evaluated after the cleaning and disinfection intervention. Três Lagoas, Mato Grosso do Sul, Brazil, 2016.**

The data in Figure 2 show that all surfaces presented failures in the ATP test in phase I, except for the nursing consultation table. A significant improvement was observed in the approval of the surfaces regarding the ATP test in phase III, with an only disapproval on the dressing trolley, which

presented a quantification of ATP greater than 250 RLUs. In phase IV there were no disapprovals.

The quantification of aerobic bacteria (CFU/cm<sup>2</sup>) was also evaluated, according to the cutoff point of 2.5 CFU/cm<sup>2</sup> (Figure 3).



Note: Percentages related to approval ratings. Black dots indicate the individual ATP values and red dots indicate the medians of the distributions.

**Figure 3 – Microbial count values for the five surfaces in the three phases evaluated after the cleaning and disinfection intervention. Três Lagoas, Mato Grosso do Sul, Brazil, 2015.**

Analysis of the results from Figure 3 suggests that most of the surfaces evaluated in phase I were disapproved, with failure rates in the range of 62.5% to 100%. Improvements were observed in phase III. However, there was a maximum failure rate for two surfaces: the reception desk and the dressing trolley. In phase IV, there was a decrease in approvals in relation to phase III for the patient stretcher, the nursing consultation table, and the gynecological examination table, along with an increase in the number of approvals for the reception desk and the dressing trolley, these being the ones with the highest failure rates in phase III.

## DISCUSSION

Several strategies known and implemented in hospital care for patient safety can be optimized in primary health care, as long as the particularities and characteristics of each service are considered.<sup>26</sup> However, there are few studies on the impact of healthcare-associated infections (HAIs) on services outside the hospital context.<sup>27</sup> Yet, there is a growing concern about the risk of acquiring HAIs in non-hospital health centers. A recent study carried out in five primary healthcare units in Portugal identified important C&D failures, by both the visual inspection analysis and by ATP bioluminescence.<sup>28</sup>

Regarding the inadequacies of the C&D process, an evaluation of 85 surfaces from a 2,200-bed hospital in Taiwan showed a general decrease in cleaning inadequacies of 60.2%, 70.5%, and 58.1% % for the visual evaluation, CFU, and ATP, respectively.<sup>10</sup> These data are different from the ones obtained in this study, according to Figure 1, which shows a failure rate in phase I; a decrease in the quantitative short-term disapprovals after the educational intervention (phase III); and, in the long-term (phase IV). Then, the results demonstrate the assertive impact of the educational intervention on the team, obtained by means of this work.

A study<sup>14</sup> indicates that, among the factors related to the positive performance of the intervention in monitoring the cleaning by measuring the ATP, is the fact that the nursing team showed interest in improving the C&D process of the surfaces. It is worth mentioning that the HC team also showed great interest in the development of the study, adherence to the participation of the educational activity, interest in clarifying doubts, and improving the cleaning process carried out in the unit.

Also in corroboration is the importance of the impact of aligning clear competences for the teams, concerning the responsibility for each item of furniture, equipment, or material. In a study carried out in a hospital institution, the authors assert that the construction of clear delineations for the team, together with the monitoring of C&D, can favor the achievement of improved results.<sup>29</sup>

Multifaceted aspects may be correlated to the impacts of interventions. Several facets may be related to the non-success of the post-cleaning results, ranging from non-adherence to the protocol to inadequate performance of the procedures, and/or use of contaminated materials, utensils, or equipment.<sup>28</sup> Another factor associated with the quality of the C&D process is the feedback to the team. In a study carried out in an inpatient unit where feedback was given to the team through the results of the ATP method in order to improve the quality of the environmental cleaning, a mean proportion of significant improvement in cleaning was obtained ( $p=0.012$ ). The conclusion was that the feedback to the team directly responsible for the cleaning and the adoption of an objective method was a useful element for the improvement of the process.<sup>30</sup>

The data in Table 2 show the absence of disapprovals for the visual method immediately after the educational intervention but, in the long term, disapprovals are observed. It is important to mention that in the PHC there was no formal periodic con-

tinuing education program for the team regarding environmental C&D. This was a different scenario from that found by other researchers, in which even checklists (with items related to the presence of dust, residues, stains, blood, grease, fingerprints) were used to evaluate the visual inspection, composing a constant program of hospital cleaning.

When analyzing the visual assessment separately, one study<sup>32</sup> identified higher percentages of surfaces considered approved by the visual method even before undergoing the C&D process, implying that visual inspection used alone is a poor indicator regarding the rigor of the cleaning. In this same study, the authors point to fluorescent markers and evaluation of ATP as methods with better diagnosis in comparison to visual evaluation.

It is observed in health services that visual inspection is often the most chosen method to evaluate the C&D process.<sup>6</sup> However, visual evaluation has not presented itself as an accurate tool to measure the quality of cleaning when compared to other monitoring methods.<sup>6,19</sup> Also, the visual method can demonstrate "coarse" results in the evaluation of cleaning efficiency.<sup>18</sup>

The results of a study conducted in northern Taiwan, which aimed to evaluate and compare ATP bioluminescence with visual inspection, showed a lower sensitivity of the ATP method for cleaning evaluation when compared to visual evaluation and total aerobic colony counts. Thus, the authors concurred on the importance of using quantitative methods in the evaluation of C&D.

Visual inspection, in the present study, varied in its failure rate, presenting a higher frequency of failures in phases I and IV; whereas in phase III there was no disapproval of any surface. It is inferred that, in this study, right after the educational intervention, the results were positive for this method of evaluating the C&D of the surfaces.

Considering the effects of short-term educational intervention observed in a study,<sup>33</sup> it was noted that 43.9% presented values within the acceptable limit of cleanliness (less than 250 RLUs). This phase was carried out from April to June 2013. After the educational intervention, there was an improvement, increasing to 88.1%. The evaluation performed in phase II occurred right after the intervention, from July to September 2013. Comparing these data with the present study (Figure 2), it can be noted that, prior to the intervention of five evaluated surfaces, four were disapproved. After the short term intervention, only one was disapproved; and, in the long term, none were disapproved ac-



cording to the ATP method. This suggested that, for this method, the C&D practices performed by the team were more efficient. It is not possible to affirm that the team adhered better to this or any other method, because there is no way to measure adherence to methods.

It is also worth noting that the intervention itself, when added to the team qualification and modification or updating of the C&D practices, favors the improvement of the results previously obtained by the team. A study<sup>34</sup> in a hospital environment showed that the implementation of a program (such as modifications in the cleaning process) reached results close to 90% of adequacy through the evaluation of ATP.

Another aspect to be considered pervades the issue of the amount of friction to be exerted during the surface cleaning process.<sup>35</sup> Considering that the quality of the cleaning process can be influenced by the pressure exerted by the professionals during its execution (and in spite of this friction activity being an action practically impossible to measure for each individual), during phase II this issue was intensely stressed, and during phase III, in practice, it was again intensified with feedback.<sup>36</sup> Moreover, the inadequacy of the cleaning process can often be related to the fact that the team does not actually remove the dirt, but redistributes the microorganisms on the surface.<sup>37</sup>

Although the evaluation of ATP favors the rapid efficiency definition of the cleaning process, there are still divergences regarding the specification of organic matter regarding the identification of microorganisms of epidemiological relevance that cause infections.<sup>38</sup> However, it can be said that the bioluminescence technique allows a rapid quantitative identification of the organic matter present on the surfaces.<sup>10</sup>

As to the quantification of total aerobic bacteria, this study presented a failure rate of 62.5% to 100% (Figure 3), suggesting that most of the surfaces monitored in phase I were disapproved; however, in phase III, after the intervention, this quantitative went down to 50%. One of the advantages of the microbiological method is the ability to quantify the hospital pathogens.<sup>31</sup>

It is important to highlight that evaluation with the use of cultures can be carried out using swabs or glass slides coated with agar, with swabs being more frequently used for the specific identification of pathogens, such as outbreak situations. Agar plates allow measuring the microbial load expressed in aerobic colonies/cm<sup>2</sup>. However, both techniques have, as limitations, the cost and time spent in processing.<sup>18</sup> For this study, Rodac® type

plates with disinfectant inhibitor were chosen, which represents an advantage when compared to other methods of microbiological collection from flat and rigid surfaces.

This study presents, as a limitation, the choice of only one HC, in addition to the non-identification of the microorganism species and possible resistance profiles in the cultures found in the CFU. However, these limitations are correlated with the financial limitations of the conduction of the study.

## CONCLUSION

With this investigation it is possible to identify microbial load reduction by CFU and ATP readings, mainly in phases III and IV, on all surfaces evaluated, comparing the before and after of the C&D process, although this reduction was not statistically significant in all surfaces evaluated. Visual inspection was the method that presented the highest frequency of surfaces disapproved in phases I and IV.

It was found that the educational intervention performed had a positive impact on the process of C&D of the surfaces in phases III and IV, in comparison to phase I, for the visual, ATP and culture methods, respectively.

Further studies are suggested, especially in a non-hospital setting, in order to define acceptable values and limits of C&D evaluation methods, considering the level of health care.

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