



Hospital environment hygiene nurse: a key player to reduce healthcare associated infections by multi-resistant organisms

V. Paz*, M. Paniagua, A. Santillán, M. Alaniz, L. D'Agostino, R. Orellana, C. Rodríguez

Sanatorio de Los Arcos, Infectology and Infections Control Department, Verónica Paz, Av. Juan B. Justo 909, CABA, Argentina

ARTICLE INFO

Article history:

Received 15 October 2019
Accepted 3 December 2019
Available online 9 December 2019

Keywords:

Environment hygiene
Healthcare cleaning services
Infection control
Healthcare-associated infections
Multi-resistant microorganisms



SUMMARY

Background: Multi-Resistant Organisms (MRO) healthcare-associated infections (HAI) are closely associated with contamination of surfaces. Outsourced companies are usually in charge of both hospital hygiene and environmental hygiene personnel (EHP) supervision, which can result in bias.

Methods: A quasi-experimental study. The intervention was to add the "Hospital Environment Hygiene Nurse" (HEHN). MRO acquired infection rate and MRO acquired colonized rate were calculated, pre and post intervention. Confounding variables: MRO carriage rate upon admission and hospitalisation days median (HDM) were calculated.

Results: Median length of stay: 5 days ($p=0.85$, interquartile range=6 days). Carriage rate upon admission: 4.3% for pre-intervention vs 5.3% post-intervention, dif. (CI 95%): 1% (-1% to 2.9%) $p=0.33$. MRO acquired infection rate: 4.3% for pre-intervention vs. 2% post-intervention, Standardized Infection Ratio (SIR) (CI 95%): 0.47 (0.25 to 0.87). MRO acquired colonization rate: 10.4% for pre-intervention vs. 7.9% post-intervention, SIR (CI 95%): 0.75 (0.53 to 1.07).

Conclusions: As a reinforcement to standard infection control (IC) measures in place, the incorporation of an exclusive, full-time HEHN was significantly useful to reduce MRO HAI.

© 2019 The Authors. Published by Elsevier Ltd on behalf of The Healthcare Infection Society. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Contamination of environment surfaces in hospitals is a well-recognized cause of outbreaks of infection [1]. Scientific evidence has shown the close relation between such contamination and MRO transmission to patients [2]. As part of an improvement cleaning programme, we focused on hygiene

control. The objective of this work was to measure the impact of the addition of an innovative figure (HEHN) on the acquisition of MRO healthcare-associated infections in an adult ICU.

Methods

We describe a quasi-experimental study with an interrupted time-series design (before-after) in a 32-bed polyvalent (mixed medical and surgical) ICU. The regular IC scheme consisted of: 1) HAI surveillance and 2) antimicrobial stewardship programmes, 3) care bundle implementation, 4) hand-washing adherence, 5) admission and weekly MRO surveillance

* Corresponding author. Address: Sanatorio de Los Arcos, Infectology and Infections Control Department, Verónica Paz, Av. Juan B. Justo 909, CABA, Argentina. Fax: +541149170603.

E-mail address: maria.paz@swissmedical.com.ar (V. Paz).

programme, 6) exclusive cleaning staff for equipment, 7) "Link Nurse": ICU nurse, nexus between her department and the IC team, who works to improve prevention and IC related processes. Standard cleaning technique: accelerated peroxide hydrogen 1/64 dilution, microfiber cleaning cloth, disposable gloves.

The intervention was to add a HEHN, a full-time, exclusive professional for hospital hygiene control as part of the Infectology and Infection Control Department. She monitored daily and discharge cleaning through: direct observation of the technique; fluorescent marking with a checklist (known by the EHW), adapted from Centers for Disease Control and Prevention [3]; real-time feedback to cleaners; and environmental swabbing.

Two periods were compared: pre-intervention (January–December 2017) versus post-intervention (January–December 2018). Between pre-intervention and post-intervention periods, there were no changes in the cleaning technique. To measure the impact of intervention, MRO acquired infection rate and MRO acquired colonization rate were calculated for both periods. MRO acquired infection rate: number of patients with an infection diagnosis after 48 hours of admission every 1000 patient-days. Hospital infections collected using standardized definitions from Manual de Vigilancia de Infecciones Hospitalarias [4]. MRO acquired colonization rate: number of patients with positive weekly MRO vigilance swabbing after 48 hours of admission every 1000 patient-days. Potential confounding variables measured: MRO carriage rate upon admission and hospitalisation days median (HDM). MRO carriage rate upon admission: number of patients with positive vigilance swabbing and/or positive cultures within the first 48 hours every 100 admissions. Chi-square test (Diff; CI95%, P value) was used to compare rates of colonized/infected patients upon admission, standardized infection ratio (CI 95%) for acquired infection rates and Mann-Whitney U test to compare HDM, statistical computer package: BioEstat 5.3 and OpenEpi 3.01.

Results

In the pre-intervention period, 861 admissions and 6798 patient-days were analyzed. In the post-intervention period, 930 admissions and 7468 patient-days were analyzed. The median length of stay for both periods was 5 days ($p=0.85$, interquartile range=6 days). Carriage rate upon admission was 4.3% (37/861) for pre-intervention vs 5.3% (49/930) for post-intervention, dif. (CI 95%): 1% (-1% to 2.9%) $p=0.33$, statistically not significant. MRO acquired infection rate was 4.3% (29/6798) for pre-intervention vs. 2% (15/7468) for post-intervention, SIR (CI 95%): 0.47 (0.25 to 0.87), statistically significant. MRO acquired colonization rate was 10.4% (71/6798) for pre-intervention vs. 7.9% (59/7468) for post-intervention, SIR (CI 95%): 0.75 (0.53 to 1.07), statistically not significant.

Discussion

There is no doubt about the fundamental role of cleaning in healthcare. More specifically, hospital environmental contamination is considered an important part of nosocomial transmission of MROs [2,5,6]. These microorganisms, constantly shed by patients, are difficult to eliminate precisely

because they can survive in the environment for a long time [2], even in water, air and on surfaces [7]. Hence, cleaning is essential in order to reduce surface contamination, and therefore, HAI [6]. There exists a "clear correlation between 'cleaning hygiene failures' and the number of intensive care unit-acquired infections" [5], as a patient is very likely to acquire certain microorganisms when occupying a room which previously hosted a colonized or infected patient [8]. This connection reinforces the notion that cleaning is not a mere aesthetic requirement. On the contrary, it is intimately related to patient safety during hospitalization. Peters *et al.* [9] refer to Albretch's description of five key variables that define the cleaning process: "what product or intervention is applied, the technique and equipment used to apply the product, the type of surface, the level of contamination of the environment, and last but not least, the environmental hygiene personnel doing the cleaning. If any one of these elements is lacking, the cleaning will by definition be suboptimal". Our careful consideration of such variables within our hospital raised the following question: How do we know that what seems to be clean actually *is* clean? To answer this question, we focused on fluorescent marking: to our surprise, only around 15% of surfaces were clean. Our findings, then, determined the necessity to generate an exclusive control mechanism that would ensure constant effectiveness in cleaning procedures.

However, the mere existence of protocols and personnel dedicated to this work is not tantamount to effectiveness. Because cleaning is a "complex and multi-faceted process", Han *et al.* propose monitoring strategies to guarantee an appropriate cleaning practice [6]. In our healthcare system, lack of awareness of the key role of environment hygiene personnel is a pervasive problem. Their task is deemed aesthetic, and there is no real understanding of the impact that the environment has as a reservoir of MROs. This explains the low qualification standards for environment hygiene personnel, who Peters *et al.* describe as "not sufficiently trained" [9]. In our hospital, consequently, it becomes our IC personnel's responsibility to (re)train the environmental hygiene workers, which implies a work overload. This situation worsens due to the high staff turnover typical of this sector. A third problem regarding hospital hygiene personnel is that "the amount of work that they are expected to do is not always in accordance with the time assigned to the task" [9]. Our hospital is not indifferent to this reality. Our staff works against the clock to comply with terminal cleaning while ER patients wait to be admitted. In consequence, and in order to sustain such a demanding pace, the work is usually done quickly and, often, inefficiently. Ultimately, these problems shape personnel idiosyncrasy and the work itself, and result in the detriment of outcomes. A new and exclusive professional, then, is essential to ensure efficient environment hospital cleaning control.

This challenge results in an innovative idea: appointing a graduate nurse that is part of the Infectology and Infection Control Service of the hospital (HEHN), with exclusive, full time dedication to hospital cleaning control. This appointment has a double purpose: that the HEHN should be trained by suitable personnel, i.e., IC nurses (ICNs); and, at the same time, that this cleaning control should be internal to the hospital and external to outsourced cleaning services. Regarding the first purpose, both the training and the activities of the HEHN are planned and managed by ICNs because of the close relation between cleaning and transmission of infections. Zoutman [10]

explains that the more cooperation and collaboration between infection control and cleaning personnel the lower rates of MROs. In this sense, the HEHN emerges as the evident and vital link between these two participants. Before the HEHN, because hygiene workers are supervised by the outsourced cleaning company themselves, the ICNs have the task to perform their own control to ensure high cleaning standards. However, this intervention is not fully satisfactory, since it implies a significant overload to their daily work. In other words, ICNs' time is not enough for the appropriate control of this process. Besides, if the audit is external to the outsourced company, a superficial or biased view will be avoided. Hence the necessity and thus our decision that this professional must be exclusive and full time: only this leads to a qualitative improvement of the cleaning process and the descent of HAI rates.

The relevance of HEHNs is revealed by their contributions, which change daily cleaning practices qualitatively. One of the first adjustments implemented by the HEHN in our hospital is enforcing predefined cleaning times, which enable appropriate standards of safety. In addition, this new participant mediates between cleaners and the admission personnel so that these times are respected. Another contribution is to define the surfaces that the cleaning staff is responsible for cleaning. For instance, hygiene workers do not often clean bed rails for fear of disconnecting devices, and nursing assistants neither, because they believe that this is done by hygiene workers. The consequence is the lack of cleaning of high touch surfaces. The intervention of the HEHN is to appoint nursing assistants as responsible for the cleaning of these surfaces. Another contribution of the HEHN is related to the previously mentioned unmodifiable variable: high cleaning staff turnover, which demands that the HEHN must be dedicated to the constant training of cleaning personnel. Although the cleaning company is supposed to offer qualified personnel, this is often not the case. Nevertheless, because of the exclusiveness of the position, the HEHN can compensate this lack, adopting, in this sense, a teaching role. Finally, and transversely to the aforementioned contributions, the HEHN works to foster empowerment, reevaluation and understanding for the hygiene workers themselves, especially in terms of the importance of their work within a health institution. Peters *et al.* [9] recognize the importance of these three aspects because "[w]ithin the hospital hierarchy, environmental hygiene personnel are on one of the lowest rungs, and often credit is not given to them, especially considering the importance of their work. There is a major problem with how "cleaners" are often perceived as menial and uneducated by the rest of the hospital staff" and, because of that, they recommend that: "Leaders and trainers must be seen as legitimate by staff, and need to ensure their understanding in training can quality become routine; an informed person tends to be more compliant, and a compliant person is more motivated." [9]. The HEHN's work has certainly contributed to the motivation of the EHP as well as their feeling of belonging to the hospital.

Conclusions

Since vast scientific evidence shows the close relation between contamination of surfaces and transmission of MROs to patients, a "HEHN" is introduced as a potential enhancement to the multifaceted process of hospital cleaning. As an exclusive and full-time professional in constant interaction

with the Infectology and IC Service, the HEHN proves to be significantly useful to reduce MRO HAI. Also, the HEHN ensures unbiased supervision of outsourced cleaning services. Other significant contributions include raising awareness of the relevance of hospital cleaning practices, and cleaning staff empowerment. Consequently, and as a reinforcement to standard IC measures in place, the Hospital Environment Hygiene Nurse must be part of an institutional infection control program for the systematic reduction of HAI rates.

Acknowledgement

We would like to thank Dr. Jorge Lantos for his contribution in this project.

Conflict of interest statement

None.

Financial support

None.

References

- [1] Dancer SJ. The role of environmental cleaning in the control of hospital-acquired infection. *J. Hosp. Infect.* 2009;73:378–85. <https://doi.org/10.1016/j.jhin.2009.03.030>.
- [2] Otter JA, Yesli S, Salkeld JAG, French G. Evidence that contaminated surfaces contribute to the transmission of hospital pathogens and an overview of strategies to address contaminated surfaces in hospital settings. *Am. J. Infect. Control.* 2013;41(5):6–11. <https://doi.org/10.1016/j.ajic.2012.12.004>.
- [3] CDC. Environmental checklist for monitoring terminal cleaning. 2010. <https://www.cdc.gov/hai/pdfs/toolkits/Environmental-Cleaning-Checklist>.
- [4] *Manual de Vigilancia de Infecciones Hospitalarias, Programa VIHDA. Ministerio de Salud de la Nación, Secretaría de Políticas, Regulación e Institutos A.N.L.I.S.. Argentina: Instituto Nacional de Epidemiología Mar del Plata;* 2015. p. 1–186.
- [5] Dancer SJ. Controlling Hospital-Acquired Infection: Focus on the Role of the Environment and New Technologies for Decontamination. *Clin. Microbiol. Rev.* 2014;27(4):665–90. <https://doi.org/10.1128/CMR.00020-14>.
- [6] Han JH, Sullivan N, Leas BF, Pegues D, Kaczmarek J, Umscheid C. Cleaning Hospital Room Surfaces to Prevent Health Care-Associated Infections. *Ann. Intern. Med.* 2015;163(8):598–607. <https://doi.org/10.7326/M15-1192>.
- [7] Provincial Infectious Diseases Advisory Committee (PIDAC). *Best practices for environmental cleaning for prevention and control of infections.* 2012.
- [8] Huang SS, Datta R, Platt R. Risk of Acquiring Antibiotic Resistant Bacteria From Prior Room Occupants. *Arch. Intern. Med.* 2006;166(18):1945–51. <https://doi.org/10.1001/archinte.166.18.1945>.
- [9] Peters A, Otter J, Moldovan A, Parneix P, Voss A, Pittet D. Keeping hospitals clean and safe without breaking the bank; summary of the Healthcare Cleaning Forum 2018. *Antimicrob. Resist. Infect. Control.* 2018;7:2–12. <https://doi.org/10.1186/s13756-018-0420-3>.
- [10] Zoutman DE, Douglas Ford B, Sopha K. Working relationship of infection prevention and control programs and environmental services and associations with antibiotic-resistant organisms in Canadian acute care hospitals. *Am. J. Infect. Control.* 2014;42:349–52. <https://doi.org/10.1016/j.ajic.2013.11.020>.