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Work Environment and Process in Intensive Care: Safety Risks for Professionals and Patients

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Abstract

Introduction: Risk situations are considered as being caused by the nature of the jobs and as the result of actions or external factors that increase the probability of changes in the workers' health.

Objective: To explore how healthcare professionals in an intensive care unit (ICU) experience safety issues and other safety concerns within their work environment.

Methods: The restorative approach in healthcare was used and involved joint identification of the problem and use of a set of visual methods: focus group; photo narration; and photo elicitation.

Results: A key finding was that the work conditions and processes pose threats to patients and professionals' safety. Participants discussed risks existing in their work environment and identified solutions to promote a safer workplace for medication management and for themselves.

Conclusions: The visual methods helped participants to develop in-depth discussions on the risk factors detected and engaged them in the proposition of solutions to the problems identified in this complex environment.

Keywords: Occupational health; Intensive care units; Photographic research methods; Nursing.

Introduction

Risk situations are considered as being caused by the nature of the jobs and as the result of actions or external factors that increase the probability of changes in the workers' health. Health work settings naturally concentrate a range of hazards that entail different health problems for the professionals working there.[1] The nursing workers are the largest workforce in hospitals and are therefore the professionals who are most

exposed to occupational hazards and accidents, factors that influence these workers' quality of life.[2] Among the major hazards at hospitals, nurses daily face lifting and moving patients, needle sticks, slips, trips, falls, and the agitated patients – along with a dynamic environment and a specific organizational culture.[3]

Intensive Care Units (ICU) are intended to provide high-complexity care to severe patients, which requires very specific facilities, equipment, devices and medications; therefore, ICU nurses are exposed to different occupational risks.[4]

In this study, the restorative research approach granted a better understanding of the existing hazards at an ICU according to healthcare professionals. This method permits studying the complex relationships in the health processes, furthering an understanding of how people interact with the environment they work in.[5]

The theoretical perspective used in this research rests in socio-ecological approach that is concerned with the complex interplay between individual, relationship, community, societal factors, and behaviors that stem from interactions between individuals and the environments in which they live and work.[5]

Researchers shown how the socio-ecological approach can be used in complex healthcare settings for developing practical guidance for designing, implementing, and evaluating quality improvement programs[5]. This approach has being used in Canada[5] and Brazil[6] to support the healthcare team to carry out best practices in order to improve patient safety and other quality issues. Thus, the principles of ecological restoration and its application to health care settings inspired us to engage nurses and decision-makers in the use of photo-methods to better understand the connections between people and nature.

Thus, the objective was to explore how healthcare professionals in an ICU experience safety issues and other safety concerns within their work environment.

Method

This qualitative research was conducted in the ICU of a general hospital in the State of São Paulo, Brazil. It is part of a research on safe medication in ICU; related publication detailed the methods used and a general view of the themes resulting from the interactive data collection and analysis.[6] In this article, we present the results and in-depth discussion on one of the emerging themes, which is the continuing need to cope with the threats in the ICU setting and in the work processes, which contribute to the risks for the patients and healthcare professionals.

The restorative approach in healthcare[7] involved collaborative work between the lead researcher and ICU professionals, joint identification of the research problem and use of a set of visual methods adapted from ecological restoration, which are: (1) focus group (FG); (2) photo narration; and (3) photo elicitation.

Institutional Review Board approval was obtained, in compliance with Brazilian requirements, under protocol 1096/2009. Before participating in any research phase, the ICU professionals received explanations on the objectives and methods used for data collection and analysis. After accepting to participate in the research voluntarily, each participant signed the informed consent form.

All nursing professionals, pharmacists and physicians active at the ICU were considered eligible. The exclusion criteria were: professionals on holiday, leave or dismissed from the hospital during the data collection period. Twenty-seven nursing professionals, one pharmacist and five intensive care physicians were invited to participate in the research; 19 nursing technicians, four nurses and one physician accepted the invitation. The participants' age ranged between 24 and 50 years and all of them had worked in the ICU between two and five years.

The interactive data collection and analysis took place between January 2010 and October 2011, in three phases. In all phases, the lead researcher served as a facilitator for the discussions. In Phase 1, six FGs were held in Portuguese with the help of a semi-structured guide, aiming to understand the preparation and administration of the medicines present in the ICU, as well as the positive and negative aspects involved in the safety standards, routines and culture. The participants (n = 21) were encouraged to reflect not only on the problems, but also on the strengths of the medication system and existing resources in the work setting that positively affected safe medication preparation and administration. Two trained research assistants made notes in the field diary to enhance the rigor of the observations. The data from the FGs were recorded and later fully transcribed in rich text format. The transcriptions were compared with the notes in the field diary and content analysis was applied as described by Creswell.[8] The data analysis resulted in a list that covered positive and negative aspects of the processes to be captured in research Phase 2 (photo narration). This list was used as the starting point to conduct two photo narration sessions in the ICU. The lead nurse invited a nurse expert to conduct each session with a view to documenting safe and unsafe practices in the medication preparation and administration processes. The content of the recordings was literally transcribed in rich text format and the photos were numbered, labeled and stored in a computer protected with a password. These photos were transferred to Microsoft PowerPoint®; proceeding with the interactive data analysis, the narratives and photos were analyzed separately and in combination. Figure 1 exemplifies the coding process of the photographs.

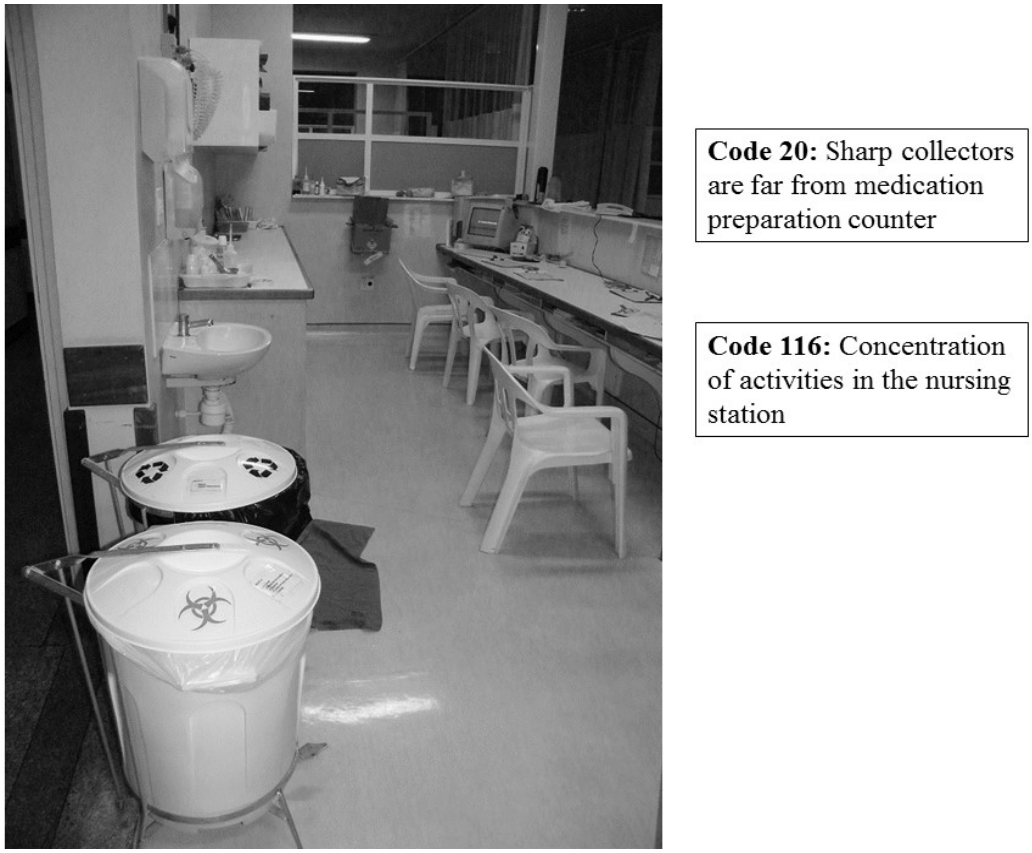

Figure1. *The process of photograph coding in Phase 2*

In Phase 3, the themes resulting from Phases 1 and 2 were presented to the participants during the photo elicitation. At that moment, the lead researcher selected 12 photos and presented them to the participants with

the help of Microsoft PowerPoint® (Figure 2). The purpose of this data collection method was to explore further details on the medication preparation and administration processes at the ICU and the strategies focused on the prevention of adverse events. All professionals (nurses, pharmacist and physicians) were invited to participate and seven accepted the invitation. In cooperation with the lead researcher, the participants reviewed the photos and shared their perceptions and histories on safe and unsafe medication–related practices in the work processes and in the ICU. To guarantee the rigor, critical discussions were held with the participants about the final theme and the categories that emerged from the interactive data analysis.

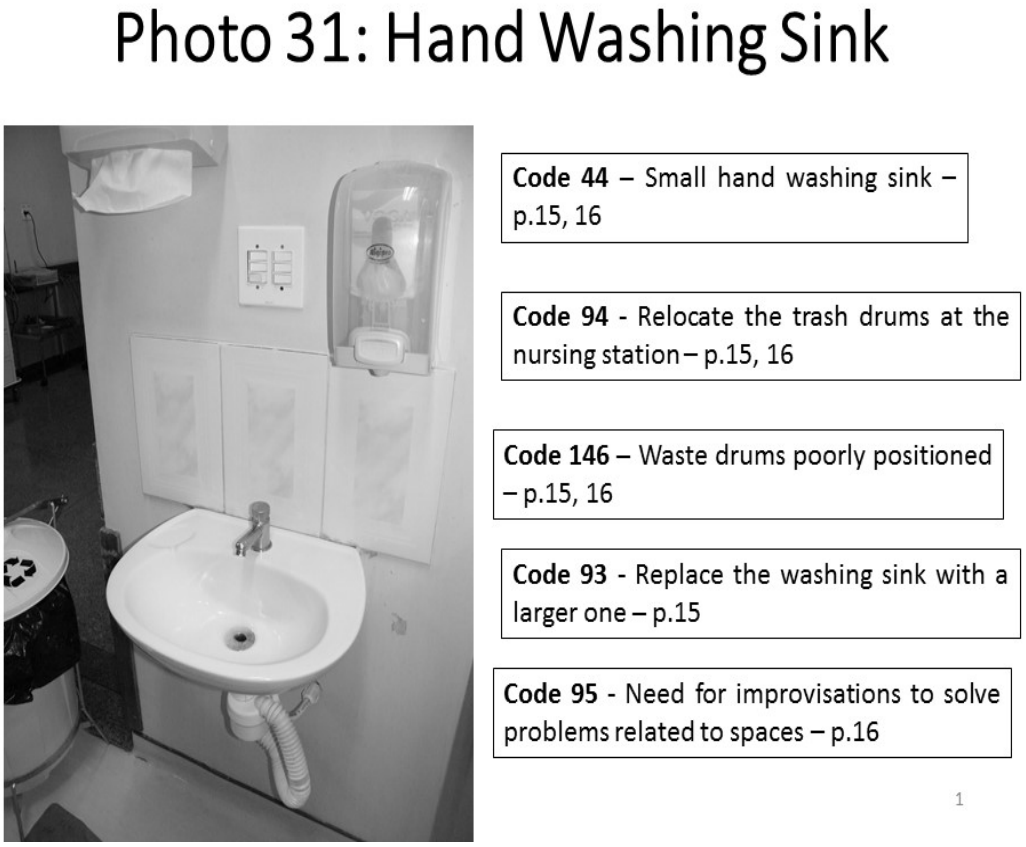

Figure2. *Process of concomitant analysis of photographs transcriptions in Phase 3*

Results

Through the content analysis, the theme "Work setting and processes represent threats to the patients and professionals' safety" was identified. This theme is detailed in two categories that illustrate the complex nature of this matter.

Inappropriate physical layout and organization of the setting are risk factors for medication-related adverse events

According to the participants, the inappropriate physical layout of the ICU and the hospital as a whole represents a risk factor for medication-related adverse events because the nursing team walks long distances throughout the day and in different situations to deliver care to the patients. The ICU has no satellite pharmacy, so that the professionals need to leave the unit and go to the pharmacy (which is far from the ICU) to get the medication needed for care:

. . . Can you believe it! The technicians have to leave the ICU and go there [to the pharmacy] *to pick them up* [the medicines] . . . (Focus Group 2)

The following excerpts reveal that the frequent movements are tiresome and cause delays in care provision:

But it's far [the pharmacy], *I get here tired.* (Focus Group 2)

It's tiresome, it takes time, you have to keep on waiting! (Focus Group 3)

The participants reported that the organization of the setting is another factor that contributes to the team's frequent movements during care delivery:

There was a garbage bin there, so we opened a syringe and cast the paper in the garbage. Now they [the nurses] *have put the bins distant. Sometimes you're gonna throw it* [the paper] *there but you need to go to the other side . . .* (Focus Group 4)

Another problem that contributes to the team's frequent movements refers to the place where the saline solution bottles are stored. These bottles are stored in a room next to the nursing station. Hence, while preparing solution, the professionals need to go from the nursing station to the room to have access to the bottle, and then return to the nursing station to prepare it and install it on the patient.

The arrangement of the nursing station was another negative aspect of the ICU's physical layout. According to the participants, the arrangement of the nursing station can contribute to medication-related adverse events because it does not permit seeing the ten ICU beds, negatively affecting the patient monitoring:

. . . the station is next to the beds; it would need to be central because you lose the entire visibility of the beds. (Photo Narration)

Many of the problems at the ICU were related to the nursing station where the medicines are prepared. Participants found the space turbulent because the area concentrated not only the medication preparation material, but also the medical records, waste disposal bins, hand washing sink, computer and telephone. In addition, the multidisciplinary team uses the site to discuss patients' clinical cases and the medical and nursing shift transfer. According to one participant, this multipurpose area is not ideal for medication preparation:

It does not only serve to prepare the medication, so the site is small, uncomfortable to prepare [the medicines], *it's tight . . . So I think the medicines should not be stored inside the nursing station because it's a bit bothersome*. . . (Focus Group 5)

According to one participant, the ventilation in the site is another problem:

. . . on top there are the medical records, so it gives that feeling of suffocation because there's no window, it's not expansive . . . (Focus Group 6)

Sources of distraction were identified and considered as risk factors for safe medication preparation and administration. The excessive movements at the nursing station and the noise from electronic equipment, such as infusion pump alarms, heart monitors and mechanical ventilators distract the professional.

During the FG with photo elicitation, however, the participants suggested possible improvements, mainly to reduce frequent movements: reorganizing the spaces inside the ICU, repositioning the waste disposal bins at the nursing station and having a satellite pharmacy inside the ICU. The latter would be possible through the better use of existing but underused spaces at the unit:

. . . They do not use the countertop there because it's bad for them to sit, there's no chair, they end up adapting and stay here [at the nursing station]. (Photo Narration)

Work setting as a risk factor for healthcare-associated infections and occupational accidents

According to the participants' testimonies during the FG, the ICU setting presents risk factors for healthcare-associated infections (HAI). To give an example, the research participants considered the coating material of the medication preparation counter inappropriate due to the lack of a tiled wall and the wooden counter, impeding its effective cleaning:

I think that the counter is horrible. Mainly to clean . . . Because it is made of wood. (Focus Group 4)

Without mentioning that it's horrible, the people do not take care, they don't clean medication that splashes, the place is horrible. (Focus Group 4)

Another problem appointed was the size of the sink for hand washing. According to the participants, it is small for the effective and safe accomplishment of the procedure:

In fact, the sink is a problem because it's something small. It's something for restrooms, not for an ICU, where there can be two, three, you know? . . . So it's something very small really. You are washing your hands and they hit the bottom of the sink or the tap. (Focus Group 1)

. . . the sink where we wash our hands all the water falls onto the floor, because it's that small . . . You take a bath instead of washing your hands. (Focus Group 3)

In the second phase of the research, it was observed that the recycle waste disposal bin did not comply with the standards of the National Health Surveillance Agency (ANVISA), Brazil. According to the participants that not only is the recipient improper for the hospital environment, but it is also placed inappropriately. The area makes it impossible to satisfactorily open the lid and occupies space that could be used for other ends.

The participants affirmed that occupational accidents also happen as a result of existing risks in the ICU work setting. The inappropriate positioning of the waste disposal bins and sharps collector was mentioned several times during the FG:

The doctor almost fell here the other day. It [waste disposal bin] *stands in the way*. *We're always hitting it, I've got a bruise on my leg, huge* [showing the hematoma on her leg]. *I hit the bin while rushing*. (Focus Group 6)

The disposal bins were located next to the medication preparation counter, in between the nursing station and the patient reception room. The same room contained the refrigerator, two armchairs, one table for occasional use and the corridor that gave access to the coffee room, the physicians' room, the bathrooms and the linen room, hindering the professionals' safe circulation.

The sharps collector was located at the distal end of the nursing station, exposing the professionals to accidents involving this material. During the medication preparation, the professional needs to move from the preparation counter to the collector to dispose off the sharps. While moving, the professional is at risk of hitting another person in view of the small space.

Another aspect of the work setting discussed during the FG was the inappropriate arrangement of the furniture, which favored occupational accidents. To give an example, the shelf with the medical records are located on top of the medication preparation counter, without any type of protection (Figure 3). This problem may have contributed to the accident one participant mentioned:

Medical records, they've fallen on my head once. (Focus Group 5)

Figure3. *Shelf with patient charts at the head level of the professional*

The arrangement of the medication preparation counter drawers was another problem mentioned during the FG, which was related with the workers' health:

Yes, they are very low [the drawers] . . . *there's one here, then there's another downward, so it's very uncomfortable to get the medicines*. (Photo Narration)

It is not something that stands in front of them, that is easy to access. So let's say that, in terms of ergonomics, it's very bad, right? (Focus Group 1).

The emergency cart was a problem mentioned during the FG as a risk factor for occupational accidents. According to the participants, the cart is heavy and demands excessive strength and a non-ergonomic posture from the professionals to transport it to the patient's bed.

During the FG with photo elicitation, the participants were asked about possible changes to be implemented in the work setting to avoid the risks identified in this research. The suggestions included the repositioning of the disposal bins and the sharps collector in the nursing station, the replacement of the recyclable waste bin by another that complies with ANVISA standards for biological waste, replacement of the hand washing sinks by other larger ones, tiling the wall of the medication preparation counter and separating the medication preparation counter from the nursing station.

Discussion

Inappropriate physical layout and organization of the setting are risk factors for medication-related adverse events because they contribute to excessive movements throughout the working day. These movements can entail harmful consequences for the participants in two senses: the professional's absence from the unit can negatively affect the quality of care in emergency situations and the need to walk long distances can physically

wear out the professional. In the first situation, the absence of the professional responsible for the patient will cause a work and stress burden for the other team members[9].

In an earlier study at a Brazilian ICU, it was identified that one of the main difficulties nursing professionals experience in the workplace was the need to move frequently inside and beyond the unit. These moves resulted in high levels of fatigue and stress, demanding the reconsideration of the physical layout and organization of work for the benefit of the patients and professionals' safety[10].

ICU nurses are exposed to different occupational risks, such as the risk of developing musculoskeletal disorders (MSD) due to the performance of heavy physical activities, such as handling loads – lifting and transferring patients; working in inadequate postures – bending and twisting the vertebral column; standing for long hours[11,12]. Related to biomechanical and postural elements, one of the most frequent MSD among nursing professionals is low back pain (LBP).

About the mental dimension of work, the ICU nursing staff performs complex tasks in critical situations, frequently facing unpredictable events and making decisions under time pressure. These situations of job strain and stress in health care settings represent a high mental load and suggest the occurrence of mental and physical fatigue among nursing professionals.[4]

What low drawers are concerned, the problem makes the professional adopt an inadequate posture while executing the activities, which is considered a predisposing factor of back pain, contributing to the increase in absenteeism rates[4]. The institutions need to adopt strategies to prevent occupational health damage by reviewing the organization of the work processes and the physical and cultural environment the healthcare activities are performed in, with a view to achieving safety in the care environments for professionals and patients.[9]

The concentration of activities at the nursing station was another problem the participants appointed, because it contributes to reduce the space for medication administration. Researchers have pointed to the organization of the medication preparation site as a risk factor for patient safety because it represents a source of distraction and stress in the nursing team.[13] As one participant mentioned, the medication preparation counter should not be located inside the nursing station, as the area is turbulent and, consequently, favors the professional's distraction while preparing the doses.

Concerning the noise from electronic equipment the professionals at the ICU perceived, studies involving nurses have demonstrated that interruptions and distractions during medication preparation and administration are important risk factors for the occurrence of medication-related adverse events. At ICU, noise control is a challenge as the technological devices are necessary to diagnose and treat diseases and to monitor the critical patients' clinical evolution.[14]

Another problem in the ICU environment was the existence of idle spaces, showing the need to reform and adapt the unit. It was also verified during photo narration that the unit is large but its space is badly used, as detected in an earlier study on the theme[6]. Therefore, the nursing station in the ICU should offer a safe environment and wellbeing to the professionals and patients, with a view to facilitating the care activities, reducing the physical and mental efforts and stress of the nursing team.[15]

Participants also considered the work setting as a risk factor for HAI and occupational accidents. The coating of the medication preparation counter was considered inappropriate due to the lack of a tiled wall and the wooden counter. According to the ICU professionals, the coating material of the medication preparation

countertop does not permit effective cleaning. According to the Brazilian Standards for Physical Projects for Healthcare Establishments, proper material to coat floors, walls, countertops should be washable and resistant to disinfectant agents.[16]

Another aspect at the ICU and which the participants found important refers to the hand washing sink. According to studies, the sink can be considered a reservoir for gram-negative bacteria. The fact that all professionals share the environment can increase the disease transmission potential. Therefore, structural changes are needed for the sake of greater practicality for the health workers and to decrease the contamination.[17] The health institutions should take into account the sink size before it is purchased as, during the hand washing, the professionals can touch the rims, reducing the efficacy of the procedure to prevent infections. In addition, the sink type should not require contact with contaminated hands.[16]

Concerning the waste recycling bin in the ICU, it is improper and is placed in an improper location. According to Regulatory Standard 32 (NR – 32), the biohazards correspond to the probability of occupational exposure to biological agents, represented by microorganisms genetically modified or not, to cell cultures, parasites, fungi, viruses, protozoa, toxins and prions.[18] All hospital waste should be stored in washable bins resistant to puncture, rupture and leakage, with a manual contact-free opening system, the type driven by a footswitch being the most indicated.[19]

The erroneous distribution of the physical space, insufficient order and cleaning, the risk of falls for the professionals, hits against material/equipment, risk of tripping over objects, excessive physical effort, exposure to biological material, among others, are common problems in the nursing work environment, which compromise the workers' safety.[20]

At the ICU, the professionals need to rethink how the organization of the care environment is managed, including the physical resources and material available at that moment. In that sense, the team, together with the service manager and the administrative sphere, needs to reconsider and analyze the existing risks in the care environment, with a view to avoiding damage to the workers' physical, psychological and moral integrity.

Despite numerous attempts to include the multidisciplinary team in FG and photo elicitation, there was no involvement of the hospital pharmacist, which limited discussions to the view of nurses and physician. Further research is needed to gather a wider range of opinions of those healthcare professionals. Nevertheless, the contribution of the nurse manager was critical to understand the organizational context of the medication system.

Restorative methods suggest the potential merits of hospitals adopting more participatory forms of management, where frontline professionals and organizational leaders are encouraged to collectively build shared knowledge of the weaknesses and potentials in their complex care environments. If we can learn how to use restorative methods to open up further dialogue and transparency about our current practices and workplace conditions, perhaps we can also use them to re-imagine and achieve safer, more effective systems of care. To pursue that hypothesis, it will be important in future restorative research to track specific safety outcomes over time to assess the cost-benefit of adopting such management models.

Conclusion

This is the first Brazilian research to use ecological restoration method in order to explore the risks of the work setting in an intensive care environment. The visual methods helped the research participants and the researchers to develop in-depth discussions on the risk factors detected and engaged them in the proposition of solutions to the problems identified in this complex environment.

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Author Contribution Statement

Gimenes F.R.E. contributed to the project design, development of research, data collection, analysis and interpretation of data, writing, critical review of the relevant intellectual content and final approval of the version to be published. Motta A.P.G., Nunes E., Rocha F.L.R., Miasso A.I., Rigobello M.C.G. contributed to the writing, critical review of the relevant intellectual content and final approval of the version to be published. Robazzi M.L.C.C. made substantial contributions to drafting of the article, and revised the article for important intellectual content.

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