

## Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study

Fernanda RE Gimenes<sup>1\*</sup>, PhD, RN, Patricia B Marck<sup>2</sup>, PhD, RN, Elisabeth Atila<sup>3</sup>, RN, Mayara Carvalho Godinho Rigobello<sup>1</sup>, Ms, RN, Ana Paula Gobbo Motta<sup>1</sup>, Ms Student, RN, Emanuel Nunes<sup>4</sup>, RN, Rosana Aparecida Pereira<sup>5</sup>, Ms student, RN

<sup>1</sup>University of São Paulo at Ribeirão Preto College of Nursing.

<sup>2</sup>Faculty of Human and Social Development, University of Victoria.

<sup>3</sup>Newcastle Private Hospital.

<sup>4</sup>Celso Pierro Hospital and Maternity.

*fregimenes@eerp.usp.br*

Received Date: May 19, 2017

Accepted Date: July 07, 2017

Published Date: July 11, 2017

### Abstract

**Objectives:** To gain a comprehensive understanding of medication safety and potential improvements in a Brazilian intensive care unit (ICU), we included an exploration of related workarounds.

**Methods:** We adapted participatory photographic research methods from the field of ecological restoration to study a Brazilian ICU. Using focus groups, nurse-led photo-narrated walkabouts, and photo elicitation in iterative phases of data collection and analysis, we identified a theme of 'living with workarounds on a day-to-day basis'.

**Results:** Participants recognized barriers within their work environment that might contribute to perpetuating medication workarounds, and the visual methods enabled them identify ideas to minimize workarounds related to these processes of care.

**Conclusions:** The participatory photo methods helped participants and researchers to develop in depth discussions to understand how nurses work around systemic vulnerabilities to optimize the delivery of patient care. The methods also increased participants' awareness of such behaviors and provided opportunities to identify ideas to reduce risk. We expect that similar methods could be successfully used in the future in a variety of practice settings to improve medication processes and other patient safety issues.

**Keywords:** Intensive care unit; complex health system; medication errors; photography; qualitative research; visual methods.

### INTRODUCTION

Unsafe medical care results in millions of people suffering serious or fatal harm in hospitals settings.<sup>1</sup> A major contributing factor to safety issues in these environments is the emergence of multiple barriers to carrying out work as prescribed within complex systems. Confronted with constrained resources and multiple competing priorities, stressed health care professionals often ignore policies and procedures and engage in workarounds to circumvent the shortcomings of their work environments in the process of providing care.<sup>2-4</sup>

Workarounds are described as "informal temporary practices for handling exceptions to normal workflow",<sup>5</sup> or "a creative, redesigned process that facilitates care to patients by providing opportunities for nurses, designers,

## **Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study**

---

regulators, and administrators to interact and produce novel patterns or knowledge<sup>7,6</sup> However, workarounds may result in information or work protocols that are unstable, unavailable, or unreliable.<sup>5</sup> People and organizations become accustomed to workarounds, which generates a false sense of confidence and safety that the shortcuts developed to circumvent system barriers are safe and sustainable. As workarounds become routine, they may transform some health care environments into less safe places within which to provide care because they merely transfer the problem to another location, resulting in little benefit for, if not inadvertent additional risks to, patient safety.<sup>7</sup>

Researchers have pointed to the development of medication workarounds by nurses in intensive care unit (ICU) that compromised patient safety.<sup>8,9</sup> Given the complexity of ICU environments, workarounds are thought to be common because a large number of diagnostic and therapeutic interventions are performed. Critically ill patients are more susceptible to medication errors because they often need high-risk medications.<sup>10</sup> The situation is similar in Brazilian ICU.<sup>11</sup>

If workarounds are a clue to system weaknesses, there is a need to understand how nurses work around systemic vulnerabilities to try to optimize the delivery of patient care. Examining workarounds help to increase staff awareness of such behaviors and provide opportunities for healthcare workers and facilities to transform from a state of tolerating unnecessary risks to one of more closely monitoring and reducing system-induced risks.<sup>12</sup>

Our aim, which was to gain a comprehensive understanding of medication safety and potential improvements in a Brazilian ICU,<sup>13</sup> included an exploration of related workarounds. Our work adds to the research to date by using a suite of participatory visual data collection methods to generate insights into workarounds related to medication preparation and administration in a Brazilian ICU.

The visual methods employed in our study are derived from a restorative approach to health systems research initially developed in Canadian health care environments<sup>14</sup> and translated to other countries.<sup>15,16</sup> This innovative methodological approach adapts principles and methods from the field of ecological restoration to study safety issues in contemporary health systems from a socio-ecological perspective.<sup>14,17,18</sup>

The theoretical rationale for a restorative research approach in health care safety is the premise that today's health care systems are over-fragmented complex adaptive systems that lack systemic integrity due to an imbalance between increasing technology and neglected ecology.<sup>14,17</sup> While the socio-ecological foundations of our restorative research approach constitute a different theoretical base than the critical social theoretical foundations of participatory action research (PAR), both methodological approaches are concerned with empowering communities to generate collective action for positive change. In both health care safety research and restoration science, the need for methods which actively engage communities in the study and improvement of the places they share has been recognized.<sup>1,7,9,14,15,19-22</sup>

The goal of thinking restoratively is to study, understand, and manage systemic influences on safety and quality by examining a variety of relations, processes, and structures within health systems and health care environments.<sup>15</sup> By adopting a restorative approach to health systems research, people can capture the environmental and human context of workarounds and gain a deeper understanding of how nurses' work environments shape their thought processes and performance in relation to medication safety.

## **MATERIAL AND METHODS**

### **Study Design**

This qualitative study was part of a major investigation on medication safety conducted in a general hospital ICU in Brazil. Related publications detail the methods used<sup>13,21</sup> and an overview of the prevalent safety themes.<sup>21</sup>

The present article provides in depth findings and discussion on one of those six themes<sup>21</sup>

## **Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study**

---

### **Setting and Sample**

We conducted our research in a Brazilian ICU of a general hospital in São Paulo state; we invited all nurses and physicians to participate. The exclusion criteria included nurses and physicians on vacation, thus participants consisted of a convenient sample of 5 registered nurses, 18 nursing technicians, and one physician. Their ages ranged from 24 to 50 years, and they had a mean of 9.7 years of experience.

The study was approved by the Research Ethics Committee at University of São Paulo at Ribeirão Preto College of Nursing. The study was explained to all potential participants before seeking written informed consent.

### **Data Collection**

The suite of participatory photo methods adapted from previous restorative health systems research<sup>14, 22</sup> included initial focus group (FG) with nurses and subsequent nurse-led photo-narrated walkabouts of the ICU, followed by photo elicitation focus groups with participants. Iterative phases of data collection and analysis took place between January 2010 and October 2011 in three phases.

In Phase 1, six audiotaped FG were conducted using a semi-structured interview guide to determine the unit's current medication administration system and aspects of medication safety such as prescribed practices, rules and routines. Participants were encouraged to consider and relay not only problems, but also what they perceived to be the strengths and resources in their work environment related to medication management. Two trained research assistants took detailed field notes throughout the sessions.

In Phase 2, we used Phase 1 findings as a starting point to conduct two audiotaped photo walkabouts (PW). One experienced registered nurse was invited to lead each walkabout to capture and narrate photos of the unit in relation to the process of medication and identified safety issues. A trained research assistant recorded field notes to enhance the rigor of the observations.

To complete Phase 3, the themes generated from Phase 2 analysis were used to develop questions for 12 select photos to discuss with participants in an audiotaped photo elicitation FG. Using a semi-structured interview guide developed from the Phase 2 preliminary narrative themes, the images were displayed and participants were probed for further feedback and ideas about medication safety. Participants viewed the photographs and shared their perceptions and stories of medication safety issues in relation to what they saw in the images. A trained research assistant took field notes to observe group dynamics and critical discussions about these data were held with participants.

### **Data Analysis**

In Phase 1, the audiotaped FG data were transcribed verbatim, comparing the transcripts with the assistants' detailed field notes to ensure accuracy and note group dynamics. Content analysis<sup>23</sup> was conducted to identify preliminary codes and categories, which enabled us to develop a list of medication safety issues to be captured during narrated PW in the second phase.

Proceeding with Phase 2 data analysis in an iterative process, the digital recordings were transcribed verbatim in rich text format and stored numbered, labelled photographs in a Microsoft Power Point® format. The photographs and transcripts of digital recordings were initially analyzed separately and then concurrently. The Phase 1 FG analysis and Phase 2 PW narratives enriched how we viewed the photographed areas, and revealed how nurses employed a variety of workarounds in their practice to manage medications within the ICU.

In Phase 3, data were coded, categorized and new themes were identified; during the discussions, the principal investigator questioned whether the themes derived from the data accurately reflected what participants

## Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study

perceived. To ensure rigor, the final themes were developed by consensus from joint discussions by the research team and study participants.

### RESULTS

This article focuses on one of six central findings from our analysis, as captured in the theme: “Living with workarounds on a day-to-day basis”. This theme is detailed within two main categories that illustrate the complex nature of workarounds related to medication within the ICU.

#### Lack of Space Contributing to Workarounds

Spatial barriers presented challenges to medication safety in a variety of ways. According to one participant, the size of the patient’s bedside cabinet was insufficient. The nurse argued that it was necessary to work around this deficit by balancing the medication tray on top of the patient during medication administration (Figure 1):



**Fig1.** *Patient’s bedside cabinet*

I think it’s more like a small cabinet next to each bed. Sometimes there is not enough space and we end up putting the medication tray on top of the patient because sometimes there are a couple of things on the bedside cabinet. So we don’t have anywhere to put it. (P17)

During the provision of care, nurses frequently needed to leave instruments and supplies over the bedside cabinet, resulting in lack of sufficient space to manage the tray used during medications administration. Because of this, nurses used the bed or the patient as a workaround to support the medication tray.

Another issue related to improper packaging of the supplies in the medication preparation counter. To keep IV catheters more organized and accessible, nurses wrapped them with an elastic band to keep them grouped together and easy-to-reach (Figure 2); as one participant noted, “it is improvised”. Another participant argued that the problematic IV workaround was related to the lack of existing space inside the drawers for the volume of supplies needed for patient care:

## Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study

I guess the space is small for all materials they have there, so they end up storing the wrong way. That elastic band, I've talked about it many times in all units. Because it tightens and contaminates the whole material. It is because of the space and tying them the drawer becomes more organized. (P2)



**Fig2.** Keeping IV catheters tight with an elastic band

When we asked participants their ideas about potential improvements from these workarounds, some creative and simple solutions emerged, including keeping the patient's bedside cabinet free of unnecessary devices; adding partitions within the drawers; removing the elastic bands from the IV catheters; reorganizing the drawers and utilizing existing but idle spaces within the ICU.

### Organizational Factors Contributing to Workarounds

Participants shared with us the need to keep stocks of medications on the unit that were frequently prescribed. These medications required unit storage because of the relatively long distance between the ICU and the hospital pharmacy. Nurses reported that they often needed to leave their patients to walk to the distant hospital pharmacy to pick up new medications that were ordered during their shift. As one participant stated: "Can you believe it? The nurses have to leave the ICU and go there [to the pharmacy] to pick up the medications . . ." (P5).

To circumvent this problem of leaving their patients unattended, nurses chose to maintain stock medications such as potassium chloride in the ICU, as one nurse explained:

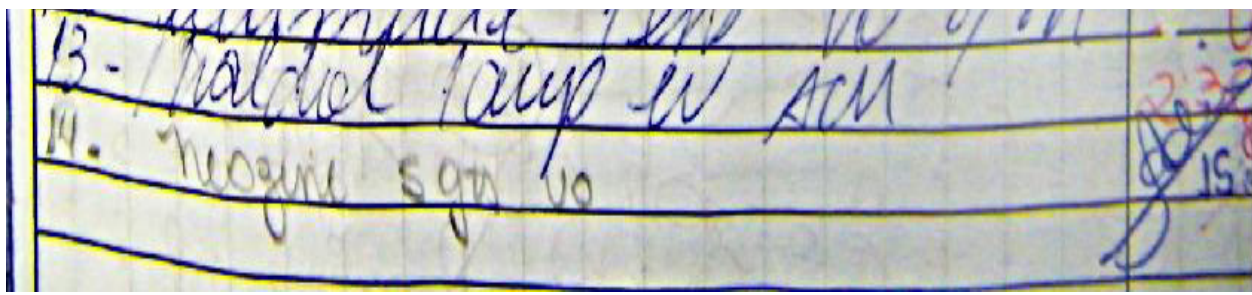
Our number of cardiac arrest patients is very high, and the physicians ask to initiate the infusion of potassium chloride. It is sort of a routine for all physicians . . . So that is why we end up keeping the stock.(P2)

Another type of organizational workaround that participants discussed was nurses' insertion of new medication orders in the prescription sheet using a pencil (Figure 3), especially at night when the physicians were resting and such as potassium chloride in the ICU, as one nurse explained:

Our number of cardiac arrest patients is very high, and the physicians ask to initiate the infusion of potassium chloride. It is sort of a routine for all physicians . . . So that is why we end up keeping the stock.(P2)

Another type of organizational workaround that participants discussed was nurses' insertion of new medication orders in the prescription sheet using a pencil (Figure 3), especially at night when the physicians were resting and medication orders were given verbally over the phone.

## Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study



**Figure 3.** *Using a pencil to introduce a new medication on medical order sheet*

However, this practice is not allowed in the institution; only physicians were supposed to insert new medications in the prescription sheet. As a participant noted, a written pencil order was their effort to ensure that the patient received the medication necessary: "Sometimes it happens at night, when physicians ask to administer a medication. Nurses transcribe it and check it. Early in the morning, the physician re-writes the order by pen." (P24).

Although nurses perpetuated this practice of transcribing phone orders for new medications, they knew this practice put them at risk: "During the training that we had, they told us that we could not do it. That it was forbidden. Whereas the physician says to do it, then he says it was not. The responsibility will be ours." (P16).

Participants discussed the workarounds they needed to employ to ensure medications were available in deliverable form for patients. For example, nurses talked about how they opened capsules or crush different tablets during medication preparation to be administered via enteral tubes because appropriate forms and doses of medications were not provided by their pharmacy. Participants recognized that these workarounds resulted in waste and increased costs for the institution, and increased the risk of medication errors: "That happens a lot. They prescribe some milligrams, but the pharmacy does not have that dosage and they will send a larger amount to us. A larger dosage." (P7).

Some of the drugs were purchased in only one pharmaceutical form by the hospital pharmacy. Nurses needed to crush the tablets to give through the enteral tube: "The pharmacy does not offer all doses, and then we end up having to, you know, workaround." (P9).

Again, nurses pointed to the need for a pharmacy satellite in the ICU to solve these problems. However, we asked participants about potential changes in their work environment and work processes that could avert the need for the workarounds identified. Participants recommended that their organization institute a satellite (decentralized) pharmacy in the ICU and implement the computerized physician order entry system.

## DISCUSSION

Our findings offer insights into how nurses of a Brazilian ICU worked to assess their practice and surroundings and to navigate medication safety barriers for patients. Several barriers were identified which gave rise to the development of workarounds to overcome what participants viewed as obstacles to good practice. Some of these barriers, such as the frequent inability to access physicians for new orders, difficulties with leaving one's patients to reach a distant pharmacy, or having to prepare enteral medications on the unit, could fit to a greater or lesser extent with the information exchange block (physician access) or the internal supply chain block.<sup>2</sup> Other barriers, such as the space limitations, do not appear in previous study,<sup>2</sup> but are outlined in other non-ICU contexts.<sup>14</sup> The fact that a number of barriers or blocks that encourage workarounds cross studies in different contexts and different countries strengthens the argument that the focus for reducing workarounds needs to be at the system level.

## **Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study**

---

Throughout data collection and analysis, participants were eager to identify problems in their work environment that contributed to medication workarounds. They readily shared their perspectives, promoting a common understanding of their work context, and becoming more engaged in examining the safety of their own practices and their surroundings. People who work in complex systems are very adaptable and develop habits and practices in accordance with the organizational culture.<sup>24</sup> In this context, workarounds are a common procedure adopted to deal with the inherent uncertainty of highly strained health care environments. Although workarounds may save time, they create other safety concerns, which can have detrimental consequences.<sup>2, 25, 26</sup> Our findings reinforce that open discussions of the barriers that lead to workarounds allows health care professionals to identify the threats they pose to patient safety.<sup>27</sup>

We found that a hospital's physical structure may encourage workarounds. Participants found workarounds necessary to administer medications because of the lack of sufficient space for the placement of the medication tray. Placing the tray over the patient, however, is an unsafe practice because it breaches infection control principles. The medication tray is a vehicle of transmission of pathogenic microorganisms, which contribute to hospital-acquired infections with significant risk to patient safety.<sup>28, 29</sup>

Our findings are possibly related to limited resources, physical structure and organization of the work environment, and are engendered by system design deficiencies which pose additional risks to medication safety. For example, the use of elastic bands to keep IV devices grouped together should be viewed as an unsafe practice, has the potential to compromise the integrity of the packaging and contaminate the IV catheter. Nurses should inspect the packaging material to ensure the protective barrier is not breached and, in the presence of breaks or tampering, the device should be discarded.<sup>30</sup> The redesigning of the work process may alleviate some of these issues.<sup>2, 27, 31</sup>

The workarounds to accumulate stock medications raise concern. A previous study points to a high numbers of medication errors as a direct result of keeping unnecessary stocks of medications on the wards.<sup>32</sup> For instance, concentrated electrolyte solutions are deadly when not prepared and administered properly, and should be removed from patient care units.<sup>28, 33</sup> The removal of these agents has a positive impact on the reduction of death and disabling injury.<sup>28, 34</sup>

Our finding that ICU nurses needed to either prepare partial doses, work with larger doses than ordered, or with different drug formulations reflects the fact that many Brazilian hospitals still lack a unit-dose dispensing system, a situation that requires the nursing staff to be responsible for drug reconstitution prior to administration, especially via the enteral tube route. Most of the medication errors which occurred within three Brazilian ICU were related to the pharmaceutical form.<sup>35</sup> It is important to remember that incorrect methods of medication preparation and administration through enteral tubes can result in obstruction, reduce the effectiveness of drug therapy, or promote the incompatibility between drugs and increase the risk for adverse events.<sup>36, 37</sup>

Like Halbesleben and colleagues,<sup>2</sup> Kane-Gill and colleagues<sup>10</sup> recommend the establishment of a satellite (decentralized) pharmacy service staffed by pharmacists and pharmacy technicians to improve medication safety. This innovation would ensure that properly dispensed medications, medication safety advice, and clinical resources were all available to ICU professionals in a more accessible location.

DeBono and colleagues<sup>26</sup> concludes that workarounds have the potential for either short-term positive but more often longer term negative consequences for patient safety. In our research, nurses transcribed new medications ordered by phone on the prescription sheet using a pencil. Essentially, participants violated

## **Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study**

---

hospital policy, because only physicians are allowed to prescribe medications in Brazil, and bypassed the system to accommodate a patient's immediate needs, use their time more efficiently, and get their work done. The potential positive consequence of this occurs when the patient receives the medication they need for their treatment. The potential negative consequence is the risk for medication errors if the nurse misunderstands the verbal phone order. Several medication errors are related to verbal telephone orders, especially those which concern sound-alike medications. Nurses should avoid verbal orders unless it is an emergency situation. If verbal orders are permitted for use in an emergency, the hospital should develop policies and procedures for these orders.<sup>38</sup>

There is a need to recognize that nurses and other healthcare providers tolerate unsafe conditions because they have become accustomed to the hazards existing in their work environment and practices. They are confident in their ability to continue to navigate unsafe conditions without any failures.<sup>39</sup> For these reasons, workarounds present an opportunity to analyze and learn from system vulnerabilities to create more effective processes for clinical excellence.<sup>6</sup> Continuous monitoring and discussions of barriers can help practitioners and organizational leaders identify potential threats of where workarounds signal risks for patient safety.<sup>27</sup>

Nurses have used workarounds successfully in the past to overcome temporary obstacles and pressures. However, there is a growing trend for nurses to increasingly resort to using workarounds to replace preferred practice as they contend with stressful work environments. This trend may negatively influence patient outcomes as well as expose practitioners to more risk.

The participatory photo methods adapted from the field of ecological restoration were used in this research because this approach allows people to work together in order to make the health care environment more ethical, effective, and safe. Therefore, there is a need for further investigation of the workaround phenomenon in health care to ensure the safety of the critically ill patients, to track specific safety outcomes over time, and to assess the cost-benefit of the adoption of such management models.

### **CONCLUSION**

Our data represent settings specific to the study hospital, and the findings may not be transferrable to every ICU context. Furthermore, there was no involvement of the pharmacy staff and organizational leaders in our research, limiting our findings to our observations and the perspectives of nurses and one physician. Despite these limitations, our study contributes to a growing body of knowledge on the phenomenon of workarounds in health care.

This is the first study using restorative research methods to explore the complex nature of workarounds related to medication preparation and administration in a critical care setting. The participatory photo methods helped participants and researchers to develop in depth discussions about current medication management practices and to understand how nurses work around systemic vulnerabilities to optimize the delivery of patient care. The methods also increased participants' awareness of such behaviors and provided opportunities to identify ideas to reduce risk. We expect that similar methods could be successfully used in the future in a variety of practice settings to improve medication processes and other patient safety issues.

### **Funding Statement**

The source of funding for the study was the Government of Canada International Scholarships Program – Graduate Students' Exchange Program - Department of Foreign Affairs & International Trade Graduate Student Exchange Program, Canada.



## Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study

---

### REFERENCES

1. World Health Organization., WHO Patient Safety. WHO patient safety research : better knowledge for safer care. Geneva: World Health Organization; 2009. 12 p. p.
2. Halbesleben JR, Savage GT, Wakefield DS, Wakefield BJ. Rework and workarounds in nurse medication administration process: implications for work processes and patient safety. *Health Care Manage Rev.* 2010;35(2):124-33.
3. Jha AK, Prasopa-Plaizier N, Larizgoitia I, Bates DW. Patient safety research: an overview of the global evidence. *Qual Saf Health Care.* 2010;19(1):42-7.
4. Rack LL, Dudjak LA, Wolf GA. Study of nurse workarounds in a hospital using bar code medication administration system. *J Nurs Care Qual.* 2012;27(3):232-9.
5. Niazkhani Z, Pirnejad H, van der Sijs H, Aarts J. Evaluating the medication process in the context of CPOE use: the significance of working around the system. *Int J Med Inform.* 2011;80(7):490-506.
6. Lalley C, Malloch K. Workarounds: The Hidden Pathway to Excellence. *Nurse Leader.* 2010;8(4):29-32.
7. Halbesleben JR, Rathert C, Bennett SF. Measuring nursing workarounds: tests of the reliability and validity of a tool. *J Nurs Adm.* 2013;43(1):50-5.
8. Eisenhauer LA, Hurley AC, Dolan N. Nurses' reported thinking during medication administration. *J Nurs Scholarsh.* 2007;39(1):82-7.
9. Wulff K, Cummings GG, Marck P, Yurtseven O. Medication administration technologies and patient safety: a mixed-method systematic review. *J Adv Nurs.* 2011;67(10):2080-95.
10. Kane-Gill SL, LeBlanc JM, Dasta JF, Devabhakthuni S. A multicenter study of the point prevalence of drug-induced hypotension in the ICU. *Crit Care Med.* 2014;42(10):2197-203.
11. Azevedo Filho FMd, Pinho DLM, Bezerra ALQ, Amaral RT, Silva MEd. Prevalência de incidentes relacionados à medicação em unidade de terapia intensiva. *Acta Paulista de Enfermagem.* 2015;28:331-6.
12. Rathert C, Williams ES, Lawrence ER, Halbesleben JR. Emotional exhaustion and workarounds in acute care: cross sectional tests of a theoretical framework. *Int J Nurs Stud.* 2012;49(8):969-77.
13. Gimenes FR, Marck PB, Atila EG, Cassiani SH. Engaging nurses to strengthen medication safety: Fostering and capturing change with restorative photographic research methods. *Int J Nurs Pract.* 2015;21(6):741-8
14. Marck PB, Kwan JA, Preville B, Reynes M, Morgan-Eckley W, Versluys R, et al. Building safer systems by ecological design: using restoration science to develop a medication safety intervention. *Qual Saf Health Care.* 2006;15(2):92-7.
15. Backman C, Marck PB, Krogman N, Taylor G, Sales A, Bonten MJ, et al. Barriers and bridges to infection prevention and control: results of a qualitative case study of a Netherlands' surgical unit. *BMJ Open.* 2. England. 2012;2(2): e000511.
16. Gimenes FRE, Torrieri MCGR, Gabriel CS, Rocha FLR, Silva AEBdC, Shasanmi RO, et al. Applying an ecological restoration approach to study patient safety culture in an intensive care unit. *Journal of Clinical Nursing.* 2016;25(7-8):1073-85.

## **Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study**

---

17. Marck P, Molzahn A, Berry-Hauf R, Hutchings LG, Hughes S. Exploring safety and quality in a hemodialysis environment with participatory photographic methods: a restorative approach. *Nephrol Nurs J*. 2014;41(1):25-35.
18. Lang A, Macdonald M, Marck P, Toon L, Griffin M, Easty T, et al. Seniors managing multiple medications: using mixed methods to view the home care safety lens. *BMC Health Serv Res*. 2015;15:548.
19. Smeulders M, Onderwater AT, van Zwieten MC, Vermeulen H. Nurses' experiences and perspectives on medication safety practices: an explorative qualitative study. *J Nurs Manag*. 2014;22(3):276-85.
20. Higgs ES. *Nature by Design: People, Natural Process, and Ecological Design*: Mit Press; 2003.
21. Gimenes FRE, Cassiani SHDB. Safety in medication preparation and administration, in light of restorative health care research. *Revista Mineira de Enfermagem*. 2013;17(4):966-83.
22. Marck PB, Lang A, Macdonald M, Griffin M, Easty A, Corsini-Munt S. Safety in home care: A research protocol for studying medication management. *Implement Sci*. 2010;5:43.
23. Creswell JW. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*: SAGE Publications; 2009.
24. Vincent C. *Patient Safety*: John Wiley & Sons; 2010.
25. Seaman JB, Erlen JA. Workarounds in the Workplace: A Second Look. *Orthop Nurs*. 2015;34(4):235-40; quiz 41-2.
26. Debono DS, Greenfield D, Travaglia JF, Long JC, Black D, Johnson J, et al. Nurses' workarounds in acute healthcare settings: a scoping review. *BMC Health Serv Res*. 13. England2013. p. 175.
27. Vogelsmeier AA, Halbesleben JR, Scott-Cawiezell JR. Technology implementation and workarounds in the nursing home. *J Am Med Inform Assoc*. 15. United States2008. p. 114-9.
28. World Health Organization. Director-General's Office. Communications Office. WHO launches "nine patient safety solutions" to save lives and avoid harm. Geneva: World Health Organization; 2007.
29. Mehta Y, Gupta A, Todi S, Myatra SN, Samaddar DP, Patil V, et al. Guidelines for prevention of hospital acquired infections. *Indian Journal of Critical Care Medicine* : Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine. 2014;18(3):149-63.
30. World Health Organization. Regional Office for Europe. A brief synopsis on patient safety. Copenhagen: WHO Regional Office for Europe; 2010. 55 p. p.
31. Carayon P, Wood KE. *Patient Safety: The Role of Human Factors and Systems Engineering*. Studies in health technology and informatics. 2010;153:23-46.
32. Miasso AI, Silva AE, Cassiani SH, Grou CR, de Oliveira RC, Fakh FT. [The medication preparation and administration process: problem identification in order to propose improvements and prevent medication errors]. *Rev Lat Am Enfermagem*. 2006;14(3):354-63.
33. Quattrin R, Zanin S, Londero C, Troncon MG, Cecchi A, Brusaferrero S, et al. Evaluation of the adherence to a new potassium chloride storage and handling hospital protocol: an observational study. *Ann Ig*. 2011;23(1):63-70.

## Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study

---

34. Leape LL. Errors in medicine. *Clin Chim Acta*. 2009;404(1):2-5.
35. Pelliciotti Jda S, Kimura M. Medications errors and health-related quality of life of nursing professionals in intensive care units. *Rev Lat Am Enfermagem*. 2010;18(6):1062-9.
36. Williams NT. Medication administration through enteral feeding tubes. *Am J Health Syst Pharm*. 65. United States 2008. p. 2347-57.
37. Stegemann S. Drug administration via enteral tubing: an unresolved but increasing challenge. *Expert Opin Drug Deliv*. 2015;12(2):159-61.
38. Commission TJ. Look-alike, sound-alike drug names 2001 [Sentinel Event Alert, Issue 19]. Available from: [http://www.jointcommission.org/sentinel\\_event\\_alert\\_issue\\_19\\_look-alike\\_sound-alike\\_drug\\_names/](http://www.jointcommission.org/sentinel_event_alert_issue_19_look-alike_sound-alike_drug_names/).
39. Kosnik LK, Brown J, Maund T. Patient safety: learning from the aviation industry. *Nurs Manage*. 2007 38(1):25-30.

**Citation:** Fernanda RE Gimenes, Patricia B Marck, Elisabeth Atila, Mayara Carvalho Godinho Rigobello, Ana Paula Gobbo Motta, Emanuel Nunes, Rosana Aparecida Pereira, "Workarounds to Medication Preparation and Administration within an Intensive Care Unit: A Qualitative Study". *American Research Journal of Nursing*; V3, I1; pp:1-11.

**Copyright** © 2017 Fernanda RE Gimenes, Patricia B Marck, Elisabeth Atila, Mayara Carvalho Godinho Rigobello, Ana Paula Gobbo Motta, Emanuel Nunes, Rosana Aparecida Pereira, *This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.*