

ORIGINAL RESEARCH

Evaluation of a quality improvement program to prevent healthcare acquired infections in an acute care hospital

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ABSTRACT

Objective: The general purpose of the study was to evaluate a specific prevention program and its effects on infection prevention practices as part of continuous improvements in patient safety. Infection prevention is a global priority aimed at reducing mortality and morbidity rates related to infections acquired while under care.

Methods: A descriptive study was carried out through a documentation analysis and semi-structured interviews with 13 healthcare professionals working in a healthcare centre where the infection prevention program was developed and implemented.

Results: The thematic analysis identified three major axes: perceptions concerning audits and huddles strategies, the positive effects of the program on team building and, finally, its sustainability and continuous improvement.

Conclusions: Globally, program enhanced the habits of professionals by developing an accurate perception of infections and the way to manage the related risk. The program Controlling Specific Infections Successful Strategies (CSISS) is seen as effective and sustainable by the participants. It contributes to a collaborative safety culture to reduce nosocomial infection rates.

Key Words: Infection control, Quality improvement, Healthcare professionals, Prevention program, Patient safety

1. INTRODUCTION

Hospitals are places where patients are treated for their illnesses and hope to improve their health, but, unfortunately, many patients contract infections during their stay. Every year, more than 200,000 Canadians acquire infections related to their admission to the hospital, and 8,000 of them die as a result.^[1] “In the United States (US), an estimated 5% of patients develop hospital acquired infections (HAIs), at a cost of 4.5 billion USD per year”(p.2).^[2] HAIs include MRSA, VRE, and Clostridium difficile infections which can be transmitted to patients during care. Despite the fact that

hand hygiene is considered as the most effective strategy for reducing nosocomial infection rates, compliance remains poor.^[3,4] This reality has major consequences for patients, with longer hospitalization, higher mortality, and higher morbidity having a significant financial impact on the healthcare system.^[5]

A systematic review^[6] reports that multimodal interventions improve hand hygiene compliance in nurses. A multimodal intervention may include education, reminders, and feedback from a manager.^[7] Luangasanatip et al.^[3] underline the effectiveness of the World Health Organization’s 5 Moments for

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Hand Hygiene campaign (WHO-5).^[8] Therefore, WHO-5 should be promoted by managers and healthcare providers.^[6] Finally, cultural norms influence hand hygiene compliance for healthcare professionals.^[9]

Since Healthcare-acquired infections are a major problem, there must be constant vigilance in hospitals. Internationally, the prevalence of nosocomial infections in 27 hospitals around the Mediterranean was 10.5%.^[10] In Quebec, between 9.8% and 11% of patients fall victim to a nosocomial infection contracted while under care in a hospital and the mortality appears to be between 3,000 and 4,500 annually.^[11] Healthcare professionals have a key role to play in preventing nosocomial infections and continuous improvement development processes.^[12]

The World Health Organization considers two main effective ways to reduce HAIs: hand hygiene, to reduce 50% of infections, and infection prevention and control programs

and teams to reduce another 30%.^[13] In Quebec, infection prevention programs rarely include a continuous quality improvement approach of patient safety on organizational level.

With this in mind, the Nursing and Quality departments in a Quebec hospital developed a continuous improvement program entitled Controlling Specific Infections Successful Strategies (CSISS). This program aims to reduce nosocomial infections by improving infection control practices such as hand hygiene, appropriate use of gloves, appropriate use of personal protective equipment (PPE) and disinfecting the environment and healthcare equipment. The interventions were selected based on a systematic review of effective interventions for improving hand hygiene rates by team members.^[6]

More specifically, the systematic review by Doronina et al.^[6] and the study of Huis et al.^[7] were used to select the following interventions: training, tools and work processes, audits, and huddles, as described in Table 1.

Table 1. CSISS program strategies

Strategy 1: Training (Knowledge)
Interactive training sessions involving such things as presentations, stations, capsules and games are used to integrate the theory in a fun and interesting way. Online education modules on infection control are another option.
Strategy 2: Work tools and processes (Engagement)
Reference tools (list of tasks, algorithms, etc.) were developed to clarify roles related to the disinfection of equipment, and are set in place to facilitate sustainability.
Strategy 3: Audits (Measures)
Electronic tablets and software were provided to the healthcare teams for them to conduct their own audits of hand hygiene, additional precautions, glove use and disinfection of equipment and the environment.
Strategy 4: Huddles (Communication and sustainability)
Huddles are 15-minute interdisciplinary team meetings for sharing, analyzing and discussing results. Huddles take place once a week in the unit. The sharing of information increases staff awareness, which leads to better understanding and ownership, and to the development of champions. That brief encounter also provides a solution-based focus for quick responses in times of crisis management. Huddles take place in the hallway, where the public (patients, families and visitors) can witness the process and the results of the measures. The Plan-Do-Study-Act (PDSA) technique is used for change testing (rapid improvement cycles). During huddles, the interdisciplinary team analyzes the results and brainstorms. The resulting ideas are then transcribed into a test of change (PDSA) that is used to change practices and improve measurement results.

The general purpose of this study was to evaluate a specific prevention program and its effects on infections prevention practices as part of continuous improvements in patient safety. Since March 2016, the program has been implemented in 30 care units and four non-clinical services in the healthcare facility, and has touched approximately 1,000 people so far. Based on the plan that was developed, every inpatient unit and non-clinical services that involved contact with patients integrated the program by the end of 2019. In fact, the objective was to reduce nosocomial infections in order to achieve the provincial targets for *C. difficile* (adult), vancomycin-resistant *Enterococcus* (VRE) (adult), and upper respiratory

tract infections (pediatric).

This study attempted achieving the following targets:

- 80% hand hygiene compliance rate
- 90% appropriate glove use rate
- 90% appropriate use of additional precautions rate
- 100% disinfection of equipment at discharge rate
- 80% daily disinfection of equipment rate (routine)

An advisory committee and three sub-working groups on training development, work processes, reference tools and audit cycles oversaw the program. Before the program was implemented, the healthcare teams' environment and knowl-

edge were reviewed. The exercise revealed a knowledge gap in terms of the appropriate times for hand hygiene, that is to say the Five moments of hand hygiene (WHO-5) a) before touching a patient; b) before clean/aseptic procedures; c) after body fluid exposure/risk; d) after touching a patient, and e) after touching patient surroundings.^[14] That is how the healthcare and support teams (including healthcare professionals and non-clinical personnel) were trained on the chain of infection for interventions to break that cycle, and revised their practices in regard to hand hygiene, additional precautions, appropriate use of gloves, and disinfection of the environment and equipment.

Thus, inpatient units that implement the program went through the following stages: planning, implementation, performance and improvement evaluation, and sustainability. The unit's nursing care leadership team took part in two trainings: one on the audit cycle and how to conduct a huddle, and the other on the electronic applications and tools used to carry out the audits. The team and coaches decided on the appropriate day of the week and time for a 15-minute huddle on their unit. Before huddling, they carried out a few audits in order to have results to post on a large white board (the Quality Station) that all staff and patients/families can see.

Graphics were used to display the audit results sent to them by the Quality Department every two weeks. Staff used this real-time data to analyze and monitor results and identify tests of change (Plan-Do-Study-Act or PDSA, see table 1). Every unit needed someone in charge of nursing issues who would involve the interdisciplinary teams and non-clinical services. Then, someone in charge of medical issues was identified to work closely with the nursing care leadership team. The nursing care, interdisciplinary and interdepartmental teams gathered in front of the Quality Station for the weekly huddle to compare notes and discuss (brainstorm) their group's performance and generate PDSAs, which led to new collaborations and improvements.

The first huddles were facilitated by the coach, and the following ones by the person identified as being in charge of nursing issues. The unit's staff took part in training capsules during the huddles, and received CSISS training specific to their professions. All of these factors promoted commitment by the stakeholders and ownership of their care quality. Every stage included strategies for success for perpetuating the gains and the process, all at little cost. By the time the program coach left the unit, the latter had a solid grasp of the tools and process, and could continue to apply the acquired practices and results. The program team remained on hand to support the teams and continued in 2019 and 2020.

To date, the program results indicate a reduction in nosoco-

mial infections: *C. difficile* rate decreased from 13 to 6.8 per 10,000 patient days, VRE rate decreased from 26 to 12 per 10,000 patient days, and MRSA rate decreased from 8 to 4.5 per 10,000 patient days. Furthermore, the hand hygiene compliance for all staff increased from 37% to 67.2%.^[15]

To maintain the sustainability of this program, the perception of key strategies from an interdisciplinary point of view is very important. That is the context in which we propose this study, based on the Kirkpatrick and Kirkpatrick^[16] evaluation model and the Model of biological risks and safety perception.^[17]

The following were the specific objectives pursued:

- 1) Evaluate the effects of CSISS program on the perceptions of prevention practices of healthcare professionals and managers.
- 2) Describe the perceived effect of implementing the CSISS program according to the healthcare professionals and managers.

The Model of biological risks and safety perception^[17] was used to meet the objectives by documenting different dimensions of the perceptions of healthcare professionals at the level of the individual, safety culture and social environment. This model served as a foundation for exploring the different types of safety cultures, as well as possible variations regarding the perceptions of healthcare professionals about risks, infectious diseases and professional infection prevention practices that were implemented through the CSISS program.

2. METHODS

Under this project, a descriptive study^[18] was used to explore the research objectives. A qualitative method was adopted in order to proceed with a post-intervention descriptive analysis of the CSISS program. This section provides an overview of the environment, the population, the data collection and analysis methods, and the ethical aspects.

2.1 Design

The general specification for this research is a descriptive study^[18,19] to give a voice to each participant and a space to express their perceptions on the CSISS program.

2.2 Population, milieu and sample

The target population consisted of the healthcare professionals at a university hospital in Quebec that is involved in the CSISS program. A non-probability/convenience sample was selected.^[20,21] A total of four inpatient units were targeted. These inpatient units were chosen based on the stage of sustainability that they had reached, as well as on their participation in CSISS for more than six months while

still performing their huddles and audits. These four units had different specialities: adult medicine, general surgery, transplants and ENT, and pediatric medicine.

In order to focus on a variety of participants, one to two healthcare professionals and one to two managers per unit were invited to participate in this study. The criteria for inclusion in the study were as follows: 1) healthcare professional or member of the leadership team; 2) acknowledged key informant who actively participated in the CSISS program, and 3) worked in the unit before the CSISS program was implemented. The top management key informant (contact) identified local key informants on each unit.

2.3 Conduct of collection in the healthcare facility

The contact met with the healthcare team managers and members during their team meetings or individually to introduce the study (September 2017). Summaries were provided to the other key informants to invite them to take part on a voluntary basis in an individual interview during work hours. Those who were interested replied to the contact. Once the participants got in touch with the contact, they were provided with a copy of the consent form, and a meeting was arranged based on the participant's availability, in collaboration with the assistant head nurse. For the managers, the contact sent an email to follow up on their interest in participating in the study.

2.4 Participant's description

Interviews were held with 13 participants in the fall of 2017. From the socio-demographic point of view, the participants were mostly women ($n = 9$), their average age was 42, and their work experience on their unit averaged 7.4 years. Participants held positions ranging from nurse clinician/physician ($n = 4$) to manager ($n = 7$).

2.5 Data collection and analysis process

The data collection included semi-structured individual interviews and documents publicly available on the units (e.g.: huddles and audits). The 13 interviews were done by a researcher with a post-doctoral degree, and were continued until data saturation.^[22]

The researchers and the participants had not met before the study. The interview guide was developed based on the Kirkpatrick and Kirkpatrick^[16] evaluation model, and the Model of biological risks and safety perception.^[17] The guide was tested for validation before initiating the data collection. The interviews, which lasted an average of 30 to 40 minutes, were recorded on a digital audio recorder, transcribed, and analyzed. The transcripts were not validated by the participants, but understanding of verbatim statements was confirmed

through iteration during the interviews.

Two researchers conducted a thematic analysis of the interviews in Word based on themes that emerged from the data.^[22] The documentary analysis included, for instance, the infection rates on the units, results of audits of hand hygiene and PDSAs. The descriptive analysis of the socio-demographic data was done in Excel to produce tables on frequency and averages.

2.6 Scientific rigour

In connection with these step-by-step descriptive specifications, several criteria related to research rigour were considered based on methodological works: substantial contribution toward the understanding of social life, aesthetic merit of the narrative structure, reflexivity of the author, impact of the narrative in terms of openness to other issues, and expression of a cultural reality.^[19,23] The question of voice is important in research: each person needs to be heard, and the reflections of certain participants must not be omitted.^[24]

2.7 Ethical considerations

This research was approved by the healthcare facility's research ethics committee. A consent form, provided in French and English, was filled out and signed prior to each interview, along with the socio-demographic questionnaire. Code identifiers were used to keep the interviews anonymous, and none of the participants refused to participate or withdrew from the study. The interviews took place in a closed office at the workplace, and to ensure confidentiality,^[25] non-participants were not present.

3. RESULTS

The thematic analysis revealed three main axes: the perception of successful strategies, the impact of the program and, finally, its sustainability and options for continuous improvement.

3.1 Axis 1: Perception of successful strategies

The program is perceived by participants as a set of strategies inscribed in a preventive process to control infections in the healthcare facility: "We apply processes for prevention, hand hygiene, cleaning of the environment and equipment" (participant 1).

Two major strategies were detailed by the participants: audits (measures) and huddles (communication and sustainability). The other two program strategies were less often mentioned by participants: training (knowledge) and tools and process (engagement).

3.1.1 Perceptions of audits

Audits were led by the assistant nurse manager or by a clinical nurse specialist directly on the unit. An audit is a good way to provide visibility for prevention measures like hand hygiene, as are glow germ audits on hands, in the environment, as well as, and mostly on, equipment. A glow germ audit is a technique where you apply a lotion that glows under UV light to show whether the cleaning result is appropriate or not. Participant 2 said “They are doing studies to kind of see how well people are washing their hands, cleaning the equipment on the floor, and they’re doing per–, like, they’re checking the percentages”. Audits clearly assess the efforts made by the team to prevent infection and apply the infection prevention and control measures.

3.1.2 Perceptions of huddles

Huddles provide a physical and psychological space for setting common goals to reduce infection rates. They are embedded in the cultural shift of the unit to value collaboration, transparency and patient safety. Huddles became routine for the healthcare professionals, and became ingrained in the culture of units. They serve as reminders to apply the basic and additional precautions to prevent infections. Huddles are perceived as a core strategy of the CSISS program that must continue in the future.

3.1.3 Perceptions of training

Initial training was provided by CSISS coaches, but some participants expressed the wish for continuous training on a regular basis, and to not limit training to transport staff or patient care attendants. Participants indicated that it takes time for the culture to shift, and for infection prevention and control to be seen as a key target in day-to-day practice: it takes continuous repetition to develop a prevention reflex.

3.1.4 Perceptions of tools and processes

Most of the participants were able to talk about the sustainability of the program, but the majority of them did not explicitly mention tools or program processes.

3.2 Axis 2: Impact of the program

The CSISS program has a positive impact on patient safety which, according to the participants, has improved. They

believe that the program is part of a more global approach to quality management promoted by senior management in the facility. Huddles improve patient safety and quality on the unit through collaborative teamwork. Globally, the program enhanced the habits of professionals by developing an accurate perception of infections and the way to manage the related risk.

While the program was being implemented, infection rates dropped, but after 18 months of routinization, some of the units saw a rise in their infection rates. Nonetheless, overall healthcare professionals and managers who participated to this study saw this program as reducing the costs associated with infections in the healthcare facility. However, the hand hygiene audits have a negative effect on the workload of nursing managers, who have to make time during the day for hand hygiene audits for the next huddle. According to the participants, the CSISS program has a major positive impact on teambuilding and teamwork. It also identified which staff will clean the equipment, the frequency of cleaning and how.

3.3 Axis 3: Sustainability and continuous improvement of the program

According to participants, sustainability could be ensured through new challenges proposed to the healthcare professionals. New challenges can be specific activities related to infection control and new team’s goals to maintain attractiveness for the program. Participants presented options for improvement as a way to further advance the infection control measures by adding new components to the program, for instance, adding another target such as new infections to control. These options for improvement have the potential to keep the team motivated and involved with the program.

As shown in Table 2, participants also proposed some options for improvement, one of them being to develop a competition perspective to enhance patient safety. In conclusion, the CSISS program was highly appreciated by participants because they perceived that it improved patient safety and controls infection rates and costs. Its sustainability was ensured, and it helped achieve a culture switch leading to a collaborative safety mentality within a global quality approach to patient care.

Table 2. Options for improvement proposed by participants

Huddles should be adapted to the reality of the healthcare professional, particularly when it takes place at the beginning of a shift for the nurses.	To mobilize the doctor’s top managers and organize big meetings for doctors to enhance awareness of the infection issues and the positive impact of CSISS on infection and costs reduction
Huddles should be more interdisciplinary and attract doctors	To add a dimension of infection control to the evaluation of the medical students and residents
To improve engagement, compliance and presence by doctors during the huddles by establishing healthy competition	To externalize the audits to reduce managers’ workload and avoid the Hawthorne effect

4. DISCUSSION

Discussion will focus on four main points regarding the results on successful strategies: the adaptation of the Model of safety perception, the routinization of the processes in the healthcare professional's practices to prevent infections, the need for infection prevention continuous training and the notion of competition within a clinical collaborative culture.

4.1 Collaborative safety culture

A collaborative safety culture was documented within the research milieu in previous studies.^[17,26]

As shown in Figure 1, The model of biological risks and safety perception was used as a theoretical framework for this study, to describe the healthcare professional's perception of the CSISS program and its outcomes. The results helped to refine this nursing model by describing major successful strategies linked to participants' perceptions, and

by giving new examples of a collaborative culture with this program evaluation that could guide clinical nurses in their nursing practices.

4.2 Routinization of safety processes

Participants mentioned sustainability through process routinization in their clinical practices: successful strategies like huddles are integrated into the safety culture on a daily basis. Fleiszer, Semenic, Ritchie, Richer and Denis^[27] assert that routinization is a major characteristic of sustainability, and that it takes time to achieve. They described routinization as an "embeddedness of structures and processes of the innovation into the habitual practices of individuals, organizations and systems" (p.1495).^[27] Routinization also implies training that should be further developed to meet participants and the healthcare center's needs in terms of infection prevention practices.

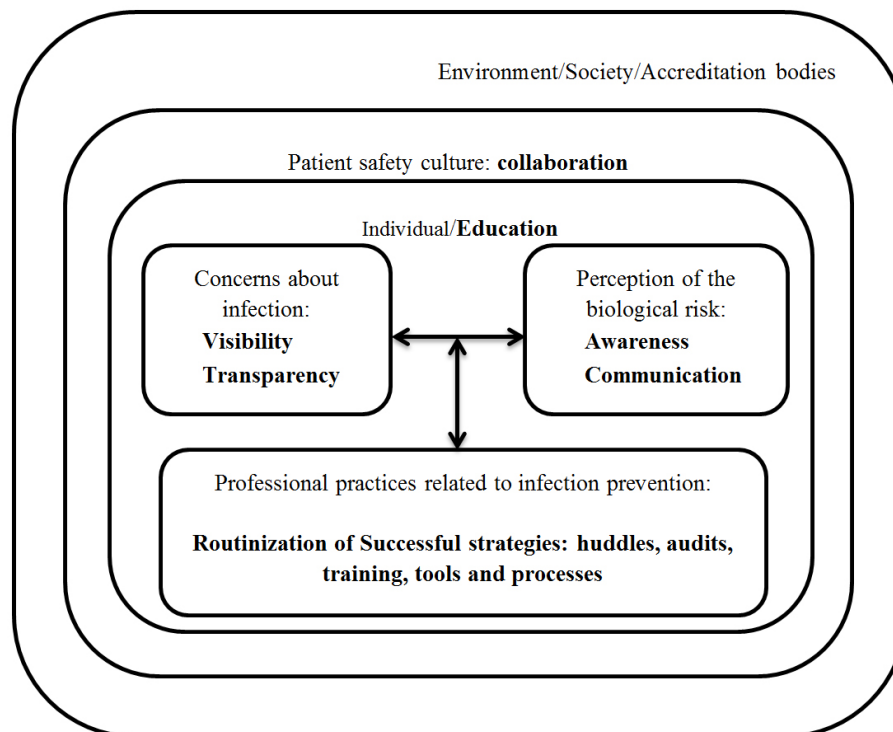


Figure 1. The Model of biological risks and safety perception, adapted with authorization, Source: Bernard et al.^[17]

4.3 Perception of the training to prevent infection

Participants expressed the wish for continuous training on patient safety and infection control on regular basis to prevent infection. This need is documented in the literature also for undergraduate staff during their academic training,^[28] because the future healthcare professionals should develop patient safety competencies during their curricula. When they graduate, they face new infections realities in the healthcare facility. Active methods, like e-learning or interactive

learning, used for continuous training to prevent HAI are important, because the sustainability of practices changes constitutes a challenge.^[29]

4.4 Competition within a collaborative safety culture

A paradoxical term that deserves elaboration concerns the issue of "healthy competition" or "good competition" requested by doctors to improve infection rates and hand hygiene observance (see Table 2). Some might argue that com-

petition can lead to better results because “competitive forces shape strategy” (p.137),^[30] or that “collaboration is the new competition”,^[31] but competition is traditionally seen as the opposite of collaboration, or as “polar opposites” (p.288).^[32] It is unclear how competition could impact the collaborative practices and safety culture over time. Therefore, this recommendation from participants should be taken cautiously. If we want to develop a collaborative culture, competition should be avoided.

4.5 Limits

The study’s main limitation stems from the choice of the qualitative specification. This means that the results cannot be generalized to other contexts.^[22] A convenience sample was chosen for this qualitative study, which tend to be small.

Nonetheless, the qualitative assessment of this prevention program provides a point of reference for stakeholders regarding the sustainability of the program.

5. CONCLUSION

Infection control and prevention are global challenges to which there can be local answers through the implementation and sustainability of a strategic program aimed at improv-

ing patient safety. The general purpose of this study was to evaluate a specific prevention program and its effects on infection prevention practices as part of continuous improvements in patient safety. Few initiatives involve the entire organization in integrated programs that mobilize healthcare professionals to target global quality improvement in patient safety and infection control. The collaborative safety culture is everyone’s responsibility, and this type of program seeks to empower healthcare professionals and managers for its sustainability.

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CONFLICTS OF INTEREST DISCLOSURE

No conflict of interest known.

REFERENCES

- [1] Public Health Agency of Canada. The chief public health officer’s report on the state of public health in Canada 2013 – Healthcare-associated infections – Due diligence. [Internet]. 2013. Available from: <https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/chief-public-health-officer-report-on-state-public-health-canada-2013-infectious-disease-never-ending-threat/healthcare-associated-infections-due-diligence.html>
- [2] Gould DJ, Moralejo D, Drey N, et al. Interventions to improve hand hygiene compliance in patient care. *Cochrane Database of Systematic Reviews*, 9. 2010;
- [3] Luangasanatip N, Hongsuwan M, Limmathurotsakul D, et al. Comparative efficacy of interventions to promote hand hygiene in hospital: Systematic review and network meta-analysis. *BMJ (Online)*. 2015; 351. PMID:26220070 <https://doi.org/10.1136/bmj.h3728>
- [4] Sharma R, Sharma M, Koushal V. Hand washing compliance among Healthcare staff in Intensive Care Unit (ICU) of a Multispecialty Hospital of North India. *Journal of Hospital Administration*. 2012; 1(2). <https://doi.org/10.5430/jha.v1n2p27>
- [5] Levchenko AI, Boscart VM, Fernie GR. The feasibility of an automated monitoring system to improve nurses’ hand hygiene. *International Journal of Medical Informatics*. 2011; 80(8): 596-603. PMID:21600842 <https://doi.org/10.1016/j.ijmedinf.2011.04.002>
- [6] Doronina O, Jones D, Martello M, et al. A systematic review on the effectiveness of interventions to improve hand hygiene compliance of nurses in hospital setting. *Journal of Nursing Scholarship*. 2017; 49(2): 143-52. PMID:28114724 <https://doi.org/10.1111/jnu.12274>
- [7] Huis A, Schoonhoven L, Grol R, et al. Impact of a team and leaders-directed strategy to improve nurses’ adherence to hand hygiene guidelines: A cluster randomised trial. *International Journal of Nursing Studies*. 2013; 50(4): 464-74. PMID:22939048 <https://doi.org/10.1016/j.ijnurstu.2012.08.004>
- [8] World Health Organization. My 5 moments for hand hygiene [Internet]. 2019. Available from: <https://www.who.int/infection-prevention/campaigns/clean-hands/5moments/en/>
- [9] Barrett R, Randle J. Hand hygiene practices: Nursing students’ perceptions. *Journal of Clinical Nursing*. 2008; 17(14): 1851-7. PMID:18578759 <https://doi.org/10.1111/j.1365-2702.2007.02215.x>
- [10] Amazian K, Rossello J, Castella A, et al. Prevalence of nosocomial infections in 27 hospitals in the Mediterranean region. *Eastern Mediterranean Health Journal*. 2010; 16(10): 1070-8. PMID:21226344 <https://doi.org/10.26719/2010.16.10.1070>
- [11] Phaneuf M, Gadbois C. Les infections nosocomiales - Agir ensemble pour des milieux cliniques sains et sécuritaires [Internet]. 2010. Available from: http://www.infiressources.ca/fer/depotdocuments/Les_infections_nosocomiales-Agir_ensemble_pour_milieux_cliniques_securitaires.pdf
- [12] Langley GJ. The improvement guide: A practical approach to enhancing organizational performance. San Francisco: Jossey-Bass; 2009.

- [13] World Health Organization. The main ways to prevent infections. [Internet]. 2018. Available from: http://www.who.int/gpsc/information_centre/en/
- [14] Shekelle PG, Wachter RM, Pronovost PJ, et al. Making healthcare safer II: An updated critical analysis of the evidence for patient safety practices. *Evidence report/technology Assessment*. 2013; 211: 1-945.
- [15] GESTRED. Système d'indicateurs de suivi de gestion et de reddition de comptes. Ministère de santé et de services sociaux du Québec; 2017.
- [16] Kirkpatrick DL, Kirkpatrick JD. *Implementing the four levels*. Berrett-Koehler Publishers. San Francisco; 2007.
- [17] Bernard L, Bernard A, Biron A, et al. Exploring Canadians' and Europeans' healthcare professionals' perception of biological risks, patient safety, and professionals' safety practices. *Health Care Manager*. 2017; 36(2): 129-39. PMID:28375944 <https://doi.org/10.1097/HCM.0000000000000152>
- [18] Denzin NK, Lincoln YS. *The Sage handbook of qualitative research*. Thousand Oaks: Sage; 2011.
- [19] Patton MQ. *Qualitative Research & Evaluation Methods*. 4th ed. Thousand Oaks: Sage; 2014.
- [20] Fortin MF, Gagnon J. *Fondements et étapes du processus de recherche: méthodes quantitatives et qualitatives*. Montreal: Chenelière; 2016.
- [21] Loiselle CG, Profetto-McGrath J, Polit DF, et al. *Méthodes de recherche en sciences infirmières: approches quantitatives et qualitatives*. Montreal: ERPI; 2007.
- [22] Paillé P, Muchielli A. *L'analyse qualitative en sciences humaines et sociales*. 4e ed. Montreal: Armand Colin; 2016.
- [23] Richardson L. *Writing: A method of inquiry*. Thousand Oaks: Sage; 2000.
- [24] Guba EG, Lincoln YS. *Paradigmatic controversies, contradictions and emerging confluences*. Thousand Oaks: Sage; 2005.
- [25] Madison DS. *Critical ethnography: Method, ethics, and performance*. Thousand Oaks: Sage; 2005.
- [26] Bernard L, Biron A, Lavigne G, et al. Exploratory study on safety culture, biological risk management and hand hygiene of healthcare professionals. *Journal of Advanced Nursing*. 2018; 74(4): 827-37. PMID:29117448 <https://doi.org/10.1111/jan.13500>
- [27] Fleischer AR, Semenic SE, Ritchie JA, et al. The sustainability of healthcare innovations: a concept analysis. *J Adv Nurs*. 2015 Jul; 71(7): 1484-98. PMID:25708256 <https://doi.org/10.1111/jan.12633>
- [28] Canadian Association of Schools of Nursing. Learning outcomes for patient safety in undergraduate nursing curricula [Internet]. 2018. Available from: <https://www.casn.ca/wp-content/uploads/2018/08/Patient-Safety-LO-EN-FINAL-2018.pdf>
- [29] Aucamp MC. Best practices for teaching healthcare workers about infection prevention and control: a systematic review. [South Africa]: Stellenbosch University; 2016.
- [30] Porter ME. How competitive forces shape strategy. *Harvard Business Review*. 1979; 137-45.
- [31] Hecht B. Collaboration is the new competition. *Harvard Business Review* [Internet]. 2013; Available from: <https://hbr.org/2013/01/collaboration-is-the-new-compe>
- [32] Cox JRW, Mann L, Samson D. Benchmarking as a mixed metaphor: disentangling assumptions of competition and collaboration. *Journal of Management Studies*. 1997; 34(2): 285-314. <https://doi.org/10.1111/1467-6486.00052>