Multiple Levels of Impact of Nurse Consultant-Led Continuous Quality Improvement: The Experience of a Critical Care Nurse Consultant in Hong Kong

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Nurse consultants (NCs; intensive care) are actively involved in continuous quality improvement (CQI) projects, evidenced-based practice (EBP), and research to bring positive impact on patients, the nursing profession, and the healthcare institution. The clinical, professional, and leadership competencies of NC are essential elements for the successful initiation, implementation, and evaluation of CQI projects, EBP initiatives, and research. Dissemination and sharing of the evaluation results, via publications and presentations at conferences are of paramount importance to document the contribution of NC on improving the quality of patient care. This article reports on the experience of a NC with quality improvement projects spanning more than 10 years since introduction of the NC role. Quality improvement projects that are discussed include: prevention of ventilator-associated pneumonia, in-hospital follow-up of post-ICU discharge patients and prevention of venous thromboembolism with nonpharmacological measures.

Keywords: nurse consultant; intensive care unit; continuous quality improvement projects; Hong Kong

BACKGROUND

The establishment of nurse consultants (NCs) in Hong Kong started in 2009. Theirs roles encompass four core domains, including expert patient care practice and service development, leadership and consultancy, education, training, and staff development (So, 2019), and continuous quality improvement (CQI) initiatives and research on patient outcomes, which will be the focus of this article. The journey of initiation, promotion, implementation, and evaluation of CQI initiatives and research in an intensive care unit (ICU) will be outlined, and requirements for NC's clinical expertise, professional, and leadership essential for the successful conduct of patient-centered improvement projects will be discussed. Experiences of NC input at the unit, hospital, and health system level will be discussed.

CQI INITIATIVES AND RESEARCH

NCs work within the contextual environment aiming to align the goal of improving patients' health with that of the Hospital Authority (HA) and the healthcare system at large. Therefore, NCs are aware of the need to enable conditions for advocating the best practice in intensive nursing care and in general patient care.

For example, prior to the establishment of the NC role, eye care for critically ill patients in

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ICU was limited leading to risk of developing corneal abrasions. Furthermore, various eye care practices without evaluation of their effectiveness were noted in our unit causing staff confusion and ineffective care. Therefore, NCs took the lead to build systems in the ICU and exerted their influence by developing standards, guidelines, introducing evidence-based practice (EBP), participating, and conducting research to improve patient care. Therefore, NCs' contributions had a positive impact on patients' outcomes, nursing practice, and the organization, namely the ICU and hospital level. To allow better understanding of how NCs implement changes to improve patient care, the use of EBP models and research framework will be outlined.

Frameworks for EBP

EBP, being one type of CQI initiative, should be conducted with a team-based approach, as it demands commitment from a team, key stakeholders, and resources in terms of time, support from EBP experts, and a management team (Gallagher-Ford, Fineout-Overholt, Melnyk, & Stillwell, 2011). Two EBP models are discussed below.

The Iowa model of EBP (Iowa Model Collaborative, 2017) can guide the decision to initiate either an EBP project or conduct research. The key is to first identify the gap in the practice or services which are of the top priority from the unit and/or institutional perspective. Johns Hopkins Nursing PET model (practice question-evidence-translation model) (Dang & Dearholt, 2017) is another approach to guide the EBP process systemically and efficiently. A PICO format identifying the population, intervention, comparison group, and outcomes can be adopted to assist an effective search of evidence.

Subsequently, critical appraisal of the identified studies is crucial to determine the most credible evidence to support practice change. Once the pieces of evidence are identified, they are transformed and integrated into a practice guideline or protocol. Further, promotion of the evidence-based guideline or protocol through educational forums is essential to increase staff awareness and hence their engagement in implementation. Educational programs for the involved staff may be considered to empower them with the necessary competencies to implement practice change. Finally, evaluation of staff compliance to the EBP and related patient outcomes are required to confirm positive patient outcomes, sustainability of EBP and to address noncompliance if any.

Research Framework in the Context of EBP

A research question is set according to the gap identified in practice or service.

Then a literature review aims to identify what is known about the topic and what is unknown. Research methodology is determined according to the objectives of the research. In this aspect, the NC at the advanced practice role should demonstrate her /his ability to gather, manage, analyze and report study findings, input for service plans, and communicate effectively with concerned stakeholders (Parker & Hill, 2017). Therefore, the NC being an Advanced Practice Nurse at senior level should start to engage all concerned stakeholders including patients, nurses, doctors, and management team in the research protocol.

CONTRIBUTION OF CRITICAL CARE NC AT ICU LEVEL

Identifying and Addressing the Stressors Perceived by Patients and Nurses in Critical Care Units

The frightening experience of admission to the ICU has been documented in several studies. Environmental stressors in the ICU have an important impact on patients' recovery and rehabilitation (Novaes et al., 1999). Therefore, a quantitative study with a comparative descriptive design was used. The study using the Intensive Care Unit Environmental Stressor Scale to assess the perception of stressors by patients and nurses in ICUs of two regional hospitals in Hong Kong has been conducted (Ballard, 1981). The top five stressors ranked by patients were listed in the

following descending priority (So & Chan, 2004). They are "being tied down by tubes," "not being in control of yourself," "not being able to sleep," "hearing the buzzers and alarms from the machinery," and "being thirsty." Except for the first and the fourth stressors, the rest of stressors were ranked similarly by the nurses working in two ICUs. "Being thirsty" was perceived to be a very low priority at the rank of 40th by nurses. The top five stressors perceived by ICU patients has provided directions for building improvement measures to promote sleep in stressful ICU environment, early weaning off mechanical ventilation, timely extubation, and oral care. Subsequently related improvement projects were carried out with positive patient outcomes.

Research on Prevention of Corneal Abrasions With the Use of Polyethylene Cover and a Standardized Eye Care Protocol

Variations in eye care practice and adverse effects of corneal abrasions in unconscious ICU patients were identified during patient care management rounds.

A literature review showed various eye care protocols and limited evaluation on their effectiveness. Only two randomized controlled studies were conducted, and a systematic review suggested superiority of polyethylene cover over eye medications to prevent corneal abrasions (Joyce, 2002). After these gaps were identified in the literature, a decision was made to conduct a randomized controlled trial (RCT) on eye care. An eye care team composing Critical Care NC and four ICU nurses was set up. The eye care team actively involved the initiation, promotion, implementation, and evaluation of the use of polyethylene covers (Gladwrap) which was compared with lanolin (Duratears) eye ointment to prevent corneal abrasions in critically ill patients. The team had received training on performing fluorescein stain test on recruited patients to detect any corneal abrasion. The study reported that there was no difference on incidences of corneal abrasions in the intervention group (n = 59) and control group (n = 57) (p = .519, So et al., 2008). Although the result was not statistically significant, this RCT concluded that polyethylene cover being cheaper and simple for fast application offers similar protection when compared with lanolin eye ointment in the prevention of corneal abrasion. Since then, a standardized eye care protocol with use of polyethylene has become the protective eye care to ICU patients with no or limited eye blinking. There was no adverse effect nor incidents of corneal abrasion noted after the implementation of the eye care protocol.

CQI Project to Reduce the Incidents of Ventilator-Associated Pneumonia With a Multipronged Strategic Approach

Ventilator-associated pneumonia (VAP) is the most common hospital acquired infection in ICU worldwide, leading to increased morbidity, mortality, and healthcare cost (Melsen et al., 2013). A local study (Kwan, 2011) revealed that the VAP rate was high at 70 cases per 1,000 ventilator days using the CDC VAP criteria (CDC, 2011). Recognizing this problem in our ICU, we initiated a quality improvement project with a multidisciplinary team and a multipronged strategic approach. The multidisciplinary team included Critical Care NC, eight ICU nurses, and three ICU doctors.

The multipronged strategic approach included five key elements: training to increase staff awareness on VAP prevention, emphasis on compliance to basic infection control measures and ventilator bundle, trial use of automatic endotracheal tube cuff controller and microcuff endotracheal tube, clear documentation and departmental support, and finally report of monthly VAP rate. The successful experience of bringing down the VAP rate was shared at Hospital Authority Convention 2014 (So et al., 2014a), international conference (So et al., 2014b), and local journal (Lau et al., 2015). The VAP rate was reduced to < 10/1,000 ventilator days in 5 years' journey (So et al., 2016a). This quality improvement project was awarded with an Excellence Asian Hospital Management Award offered by Hospital Management Asia in 2014 and Outstanding Team Award by Hospital.

Research on Identifying and Addressing the Factors Affecting the Family Satisfaction With a Family Satisfaction Enhancement Program

A literature review shows that patient-centered healthcare delivery model is associated with improved clinical outcomes and may lessen potential complaints due to miscommunication (Lewin et al., 2001). One study reported that maintenance of longer periods of communication between families and healthcare providers was associated with lesser anxiety among family members (Rusinova, Kukal, Simek, Cerny, & DEPRESS Study Working Group, 2014). Families of patients admitted to ICU are at higher risk of facing uncertain outcome for their loved ones, leading to anxiety or development of postintensive care syndrome-family (PICS-F) (Schmidt & Azoulay, 2012). Evidence suggests that the manner that the healthcare providers communicate with the family may affect their risk of developing PICS-F. Therefore, the Family Satisfaction Enhancement program was initiated aiming to examine the level of family satisfaction in ICU, to compare the result with international standards, and to identify factors independently associated with higher satisfaction for future improvement. A family satisfaction questionnaire (FS-ICU) originally developed by an expert panel in Canada in 2003: the Canadian Researchers at the End of Life Network was used (Heyland et al., 2001). The questionnaire consists of 37 items which further divided into two sessions namely satisfaction with overall ICU care (FS-ICU/Care) with a linear score scale at 0–100; and the satisfaction with decision-making around the care of critically ill patients (FS-ICU/DM) with rating at dichotomous variables or a 3-point Likert scale. The score of 0 is considered as very poor or very dissatisfied and score of 100 as excellent or completely satisfied. Among 736 questionnaires returned (response rate: 76.6%), the mean (± standard deviation) total satisfaction score and subscores on satisfaction with overall ICU care and with decision-making were 78.1 ± 14.3, 78 ± 16.8, and 78.6 ± 13.6, respectively (Lam et al., 2015). The study also determined factors which independently affected family satisfaction. These factors included the ICU environment, agitation management, and communication between healthcare workers and families.

This first ICU family satisfaction survey published in Hong Kong sets the direction for future improvement (Lam et al., 2015). The report of family returned questionnaires would be discussed at weekly department meeting with subsequent enhancement in ICU environments to address family's concerns. These improvement initiatives included renovation of the visitor room with relaxing environment, provision of more chairs to visitors, discussing patient's progress with family during visiting hours, and involvement of family to make decision for patient care. Families showed trust to the healthcare team and were more satisfied with the care we offered to patients.

Reduction of Early ICU Readmission With a Post-ICU Discharge Follow-Up Program

A high ICU readmission rate at 6.7% was noted as compared to that of all ICUs (5%) in Hong Kong (Intensive Care National Audit & Research Centre, 2012). The ICU readmission rate within 72 hours post-ICU discharge was even higher at 9.5% in the subset of patients with respiratory problems. Therefore, the NC assumed a leading role in conducting a study to evaluate the effect of a post-ICU discharge in-hospital follow-up program on patient's health outcomes in 2015. When ICU patients were ready for transfer to general wards and met the study inclusion criteria, they received follow-up visits within 24 hours after transfer to general wards. The Critical Care Outreach Team (CCOT) consisting a Critical Care NC and one Advanced Practice Nurse offered follow-up visits to patients at ward once daily for the next 2 days. A total of three follow-up visits at ward. The service has been provided throughout the week with support from ICU senior doctors during unavailability of the nurse team members.

The recruited patients received structured vital signs monitoring and were assessed by CCOT accordingly. Furthermore, ward nurses could consult the CCOT when the modified early

warning scores (MEWS) were less than or equal to 3 which was set a point lower than the usual practice in general wards to trigger call for doctor. The MEWS is one of the track and trigger systems for using outside critical care areas to allow nurses to have timely recognition of patients with deteriorating conditions and then appropriate referral (NIHR, 2004). MEWS consists of five parameters, namely, pulse rate, respiratory rate, temperature, conscious state, and systolic blood pressure. The score ranges from 0 to 14 with high score showing patient in more serious condition. This practice change supported early tracking of patients at risk and trigger call for a doctor when patient's condition was showing signs of deterioration. The ICU readmission rate of the intervention group was then compared with that of the historical control group who did not receive post-ICU discharge follow-up visits.

A total of 185 patients were recruited after 13 months of implementation starting from October 2015. The historical control group was identified within 13 months before the implementation of the program and included 184 patients. So, Yan, and Chair (2018) reported that, after adjustment for confounders, a significant reduction in ICU readmission within 72 hours (1.6% vs. 9.2%, $p = .001$) and in total ICU readmission (9.7% vs. 23.9%, $p < .001$) were noted in the intervention group when compared to that of the control group. There was an estimated net saving of US$145,614. Furthermore, the program received high patient satisfaction score at 92 out of 100 among 91 returns.

An additional 2 years' data collection extending to November 2017 recruited a total of 286 patients in the intervention group and 326 patients in the historical control group. The study showed similar positive results (So et al., 2018). Therefore, the NC-led program helped to develop the foundation of ICU outreach service that serves as an integral part of ICU service in future.

Successful Implementation of the Post-Registration ICU Course Group Projects in ICU

Part of the NC role is to supervise and support the development and implementation of Post-registration ICU Course Group Projects yearly in the unit. Through the mentoring process, the NC supports the professional development and growth of staff. The following three projects have been successfully implemented with promising patient outcomes and staff satisfaction.

Early Resumption of Oral Feeding With a Nurse-Led Structured Swallowing Screening. Delayed resumption of oral feeding in patients postextubation was not uncommon due to waiting for a speech therapist assessment for exclusion of aspiration risk and fitness of oral feeding. The team's effort finally tailored the swallowing screening protocol in 2012 with training to enrich nurses' knowledge to detect early signs of dysphagia. The project aimed to establish a nurse-led protocol on swallowing screening for extubated or tracheostomized patients before resuming oral feeding. The eligible patients received structured swallowing screening (SSS) with drinking of 60 mL water with teaspoon. Aspiration risk is suspected if chocking signs, slowly swallowing, and/or incomplete swallowing are noted. Among 307 patients screened by ICU nurses using the SSS, 52 patients (16.9%) of the screened patients were detected to have signs of dysphagia and received further assessment by speech therapist. Those who passed SSS resumed oral intake uneventfully.

Most ICU nurses (86%, 48 out of 56 evaluations) showed confidence to perform SSS and agreed SSS was useful. The team was awarded with a Board of Study Award in 2014 by the Institute of Advance Nursing Studies of Hospital Authority for this excellent project linked to positive patient outcome.

Timely Extubation With a Mechanical Ventilation Weaning Protocol. Delayed weaning and extubation was noted due to uncoordinated care practices taking into accounts of different doctors' preference. Physician driven weaning may lead to unnecessary duration of mechanical ventilation, VAP, and prolonged ICU stay. Therefore, the team initiated a project to address this issue and a mechanical ventilation weaning protocol was developed in 2014. The team included Critical Care NC and four ICU nurses and was supported by ICU doctors. After implementation of the protocol, ICU nurses initiated the protocol-driven mechanical weaning once the patient was assessed as fit for weaning by ICU doctor. Then ICU nurse starts the ventilator weaning protocol by setting ventilator setting to pressure support mode at 10 cm H_2O and positive end-expiratory pressure at 5 cm H_2O. Patient's vital signs are monitored by ICU nurse for early detection of signs of intolerance to the weaning process. If there are no signs of intolerance to weaning and the patient exhibits good coughing effort or minimal amount of sputum aspirated, patient is ready for extubation. Evaluation of the project in 2016 after 3 years' implementation showed that the mean duration of weaning process to timely extubation was significantly reduced to 81 minutes in 2016 when compared to that of 134 minutes in 2014 ($p < .05$; Tang et al., 2016). The implementation of the protocol-driven mechanical ventilation weaning helped to reduce the duration of weaning from mechanical ventilation, to promote ICU nurses' participation in weaning process and ultimately to facilitate timely extubation.

Support Early Enteral Nutrition With an Evidence-Based Enteral Feeding Protocol. One of the NC roles is to uphold the quality of care to patients and support staff to adopt EBP. Previously, enteral feeding of critically ill patients was physician driven and the total energy intake was noted as unsatisfactory. Therefore, a protocol-guided early enteral feeding has been advocated since 2008, in which ICU nurses have been empowered to initiate and step up the volume of enteral feeding according to protocol. This practice can greatly enhance the delivery of early enteral feeding and achievement of target nutrition to ICU patients.

With reference to the European Society for Clinical Nutrition and Metabolism guideline 2018 (Singer et al., 2018) on enteral nutrition, a dedicated team was formed and initiated revision on the enteral feeding protocol. The team involved six ICU nurses and one ICU doctor. The project was supervised by the NC. The revised evidence-based protocol includes no regular gastric residue volume (GRV) aspirate and monitoring, allowance of refeeding GRV up to 500 mL and slowly titrating the feeding volume up to target at 8 hourly intervals. The updated protocol has been started since April 2019. The team conducted promotion, briefing, and monitoring the revised practice systemically. The preliminary evaluation showed that there was no adverse effect such as intolerance of feeding or increased incidents of vomiting.

CONTRIBUTION OF NC AT HOSPITAL AND HOSPITAL POLICY LEVEL

Formulation of Standards of Care to Guide Nursing Practice

NCs also have the role of ensuring that the nursing team is practicing using the best available evidence. Therefore, regular updates of policies and guidelines are critical to achieving these goals. Examples include contribution in setting and regularly updating ICU guidelines and advanced nursing standards. It was noted that a comprehensive guide on tracheostomy care was lacking, while sentinel events related with inappropriate management of tracheostomies were reported. A handbook on the care of patients with temporary tracheostomy was developed with a team of ICU expert nurses. The use of photos of tracheostomy tubes and the accessories helped in training to enhance staff competency. The handbook was then published in 2013 (Hospital Authority, 2013) and can be accessed by all nurses working in the Hospital Authority. Since then, training on tracheostomy care has been

widely promoted and conducted at organizational level yearly. With the success of this program, I was invited to make an impact at a higher system level and served as a working group member to prepare the Specialty Guideline on Tracheostomy Care (Hospital Authority, 2016).

Risk Mitigation Through a Cluster-Based Hospital Guideline on Tracheostomy Care

NCs need to expand successful local programs to impact care across the hospital and healthcare system. The Specialty Care Guideline on Tracheostomy Care prepared by HA (Hospital Authority, 2016) was then launched into a cluster-based guideline (Hospital Authority, 2018) to facilitate local use. To promulgate the implementation of the guideline and enhance nurses' competency in handling tracheostomy emergencies, an education forum and related simulation training sessions were arranged. This project was also shared at HA Convention 2019 (Leung et al., 2019). A total of 394 staff attended the forum and 76% of participants gave their feedback. Preliminary evaluation showed no adverse incidents related to tracheostomy care.

Timely Removal of Indwelling Urinary Catheter With a Nurse-Initiated Reminder to Wean Off Urinary Catheter

The literature suggests that nurse-initiated reminders help to shorten the duration of weaning off urinary catheters. Unnecessary duration of use of urinary catheters was also raised by EBP team members of different specialties. Therefore, an EBP project of implementing nurse-initiated reminder to wean off urinary catheter was initiated aiming at promoting timely removal of indwelling urinary catheter (IUC). The project included collaboration with NCs of different specialties to formulate evidence-based indications for continuing IUC use. A workflow diagram for weaning off IUC was developed. A simple and eye-catching written reminder was designed to alert the healthcare team to review patients for the indication of IUC. The EBP workgroup consisted of NCs from ICU, urology, stroke and oncology, and frontline nurses of related specialties. All team members were actively involved in development of the reminder, promotion, briefing, and monitoring the implementation process. Frontline nurses commented on the additional workload requirements as they had to review the appropriateness of urinary catheters daily. The team acknowledged the increased workload and emphasized the benefits to patient care. Evaluation of the project showed that the duration of IUC used was significantly reduced to a mean of 86 hours in the intervention group (n = 61) as compared to that of 140 hours in the historical control group (n = 76). The project was presented at the ninth ICN (So et al., 2016b). Subsequently, this EBP project was further elaborated by NC of urology and has been implemented fully within hospital.

EBP Project on Nonpharmacological Measures for Prevention of Venous Thromboembolism in Surgical Patients

Although pharmacological prophylaxis for prevention of venous thromboembolism (VTE) is considered as the gold standard (Schunemann et al., 2018), use of nonpharmacological measures is also recommended especially in postoperative patients who are at risk for bleeding. However, variations in the use of mechanical devices were noted. Therefore, the EBP workgroup led by the NC started to review the VTE prophylaxis practice. A review of evidence on the use of graduated compression stockings (GCS) confirmed its effectiveness, and was successfully adopted in 2015 in one specialty unit which did not use GCS before. A review of evidence was conducted again in 2017. The project was then stepped up to a hospital-based project and a hospital guideline was developed.

With the collaboration of physiotherapists, an education forum was held to promote evidence on prevention of VTE and the dissemination of the EBP guideline. In addition, thigh-length GCS did not show statistical benefit over the knee-length GCS (Ayhan et al., 2015; Wade et al., 2016). Promotion of early ambulation, adequate hydration, education to nurses, and team approach were

essential elements for effective VTE prevention (Liew et al., 2017). Therefore, a standardized nursing care plan including these essential elements and the nursing prescription for VTE prevention were designed for clear instruction, documentation, and handover.

Additionally, a user-friendly tailor-made measuring tape prepared by the Department of Physiotherapy was also introduced for quick calf measurement and selection of an appropriate size of GCS. A designated measuring tape prepared by the ICU team for measurement and selection of appropriate size of GCS and pneumatic compression sleeves in one step was also shared.

Overall, 114 participants (105 nurses and 9 physiotherapists) joined the forum and most of them (>90%) gave positive feedback. This EBP project significantly helped to build collaboration among healthcare providers on VTE alertness and preventive measures. Consequently, the quality of patient care and professional practice was improved. This project was presented at the First Cochrane Symposium held in Hong Kong (So et al., 2019).

DISCUSSION

The four core pillars of the NC role include expertise and service development, leadership and consultancy, education, training, and staff development, research and CQI initiatives (Hospital Authority, 2011). To maximize the impact of NC roles on patients' health outcomes/care givers' satisfaction, the organization and the profession, a NC must have a high profile demonstrating sound research skills, leadership skills, collaborating in the multidisciplinary team and leadership competencies to negotiate the necessary resources for successful conduct, and implementation of CQI projects and research (Wong et al., 2017).

The process of implementing EBP projects and research is always challenging and calls for precise planning from the very beginning. Forming a dedicated team is essential to ensure contributions from different levels of staff and perspectives. Limitations include time and workload constraints, but they can be managed with planning and protected time for team meetings. Celebrations of successes are crucial to maintain the momentum of efforts and show appreciation of team's commitment. In summary, the NC being an Advanced Practice Nurse at senior level should take the lead to engage all concerned stakeholders including patients, nurses, doctors, and management team for quality improvement initiatives to maintain quality patient care.

CONCLUSIONS

The examples outlined above demonstrate the contribution of NC in achieving high quality CQI projects and research that impact patient outcomes at the unit, hospital, and system level. NCs contribute to the modernizing of the service delivery through undertaking research and EBP. They shape the future nursing career pathways by getting frontline staff engaged in the journey of clinical inquiry and EBP, which strongly promotes the professional image of nursing. Therefore, dissemination via publications and conference presentations is crucial for articulating the contribution of NCs in improving the quality of patient care not only to nursing professionals, but also other healthcare professionals and healthcare policy makers.

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