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Using the PDSA Cycle for the Evaluation of Pointing and Calling Implementation to Reduce the Rate of High-Alert Medication Administration Incidents in the United Christian Hospital of Hong Kong, China

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ABSTRACT

Introduction: The present study aimed to adopt a Plan-do-Study-Act (PDSA) cycle to monitor the implementation of Pointing and Calling (P&C) in the United Christian Hospital of Hong Kong, China.

Materials and Methods: A workgroup was formed to evaluate the approaches to apply P&C in high-alert medication administration using infusion and syringe devices. A series of promulgations and strategies were implemented to increase the probability of its success and sustainability. In addition, pretest and posttest evaluation was performed to monitor the incident rate associated with high-alert medication administration using infusion and syringe devices.

Results: Over 100 briefing sessions were conducted in the hospital wards, and 145 senior managers, ward managers, and advanced practice nurses completed the training and assessment. In total, 217 questionnaires, which were scored based on a six-point Likert scale, were collected from 21 wards, with the response rate estimated at 26.53%. Moreover, an audit was performed to obtain 98.1-100% of the compliance rate of using the P&C for evaluation. Since June 2016, the incident rate due to inaccurate device setting decreased from 0.21 to 0.13 after the P&C implementation.

Conclusion: According to the results, P&C is a simple method to facilitate the meticulous assessment of high-alert medication administration by nurses. It is recommended that further improvement be made in this regard in order to address the unidentified other areas. Of note, counter measures were proposed to strengthen P&C compliance.

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Introduction

Pointing and calling (P&C) originated from the Zero Accident Campaign in Japan in the early 1900s and has proven effective in reducing the human errors, which account for 88% of all occupational incidents (1, 2).

P&C was first used by train drivers and is widely used in the Japanese industries.

It is a method of occupational safety to prevent incidents by pointing at the important steps and calling out the status aloud. Therefore, it could enhance the alertness of individuals and increase the accuracy of operations, while maintaining the focus and attention during procedures.

P&C is a rule-based behavior composed of various aspects, including looking at the object (eyes), pointing (fingers), hearing (ears), and speaking out (mouth), which strengthens the effect of an action. Some of the positive effects of P&C include concentrating the awareness on an object actively and acquiring clear consciousness by pointing at the object, increasing the reliability of visual confirmation, auditory and kinesthetic stimulation, raising the cerebral neocortex activity by the kinesthetic stimulation of the muscles while stretching the arm and making loud statements,

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and preventing operational errors by enforcing the P&C between perception and reaction (3).

In a study in this regard, it was stated that the mechanism of finger pointing and calling (FPC) facilitates the cognitive control processes of the supervisory attentional system and is effective in the prevention of operational errors when cognitive control is requested (4). As such, this method could reduce the rate of the incidents caused by negligence, human errors or misunderstanding.

In Japan, incidents caused by human errors were reported to decrease by 84% after the implementation of P&C (1). In Hong Kong (China), P&C is commonly applied in industries such as construction and manufacturing, electrical and mechanical engineering, railway companies, and gas companies (5). Some researchers have recommended that the P&C could be applied in the healthcare industry for the prevention and management of the error systems similar to the other high-risk industries, such as aviation (6). However, evidence is scarce on the proper methods of P&C implementation in the healthcare setting and its effectiveness in the safety of medication administration.

The principle of 'five rights' has been shown to reduce the rate of medication-related incidents across the world. This principle holds nurses accountable for the administration of the right drug at the right dose to the right patient via the right route at the right time (7). This principle must be maintained in all drug administration procedures. Nevertheless, in the case infusion or syringe devices are needed for infusion medication, there is a lack of formal training on the proper monitoring of the implementation process.

In the past, high-alert medication administration incidents using infusion and syringe devices would lead to severe consequences, and the contributing factors were also highly associated with human errors. A retrospective cross-sectional study conducted in the United States reported that 1,487 (22.0%) of the high-alert medication administration incidents occurred in neonatal intensive care units (8).

Another retrospective case-control study reported that high-alert medication administration errors in three hospitals in the United States were an independent predictor of patient harm (OR: 4.00; 95% CI: 2.38-6.75) (9).

In the mentioned studies, evaluation of the reported incidents indicated a significant underestimation of the actual incidents (10).

Rate of high-alert medication administration incidents using infusion/syringe devices has been estimated to be six and three cases in 2014 and 2015, respectively in the 1,400-bed United Christian Hospital (UCH) in Hong Kong, China. Among these incidents, three and two cases reported in the respective years were caused by the inaccurate infusion rate setting.

High-alert medications are the medications with the highest risk of injury in the case of misuse. Rate of the errors associated with the administration of these agents is not necessarily higher than the other drugs, while the consequences are clearly more devastating in comparison (11). In some countries, high-alert medications are the drugs that bear a heightened risk of causing significant patient harm in the case of erroneous administration (12).

Regardless of the mentioned definitions, the consequences of the improper administration of high-alert medications could substantially affect the patients, healthcare providers, and the healthcare system. As a result, senior management has decided to adopt the P&C method to enhance safe assessment behaviors in using high-alert medication administration by infusion and syringe devices. The present study was the first to determine the effectiveness of the P&C in reducing the rate of the incidents associated with the administration of high-alert medications while using infusion and syringe devices in Hong Kong.

The objectives of the study were to explicitly describe the application of the P&C in assessing high-alert medication using infusion and syringe devices, determine the effectiveness of the P&C in reducing the associated incidents, and review the obstacles and solutions after P&C implementation.

Materials and Methods

Pre- and post-evaluation were carried out to monitor the rate of the incidents caused by high-alert medication administration using infusion and syringe devices. The current research adopted a plan-do-study-act (PDSA) cycle to monitor the P&C implementation in the hospital wards.

The purpose of a PDSA cycle is to test the improvement ideas on a small scale before introducing the change. It is often used to help teams enhance the quality of care (13).

In addition, the authors intended to use an adapted post-implementation review method developed in the United Kingdom (14). The guide is composed of seven areas, including the objectives of the method, evidence on informing the review, extent of achieving the objectives, original assumptions, unintended consequences, evidence identifying the opportunities for reducing the burden on the implementation, and comparison of P&C implementation in one unit to the others.

Plan

A workgroup was formed for the present study, consisting of advanced practice nurses (APNs) from the nursing services division and ward managers (WMs) from the department of medicine and geriatrics in September 2015 to study the application of P&C in assessing the procedures of high-risk medication using infusion and syringe devices.

The workgroup identified five areas that are critical to induce serious consequences throughout the administration procedure (Figure 1).

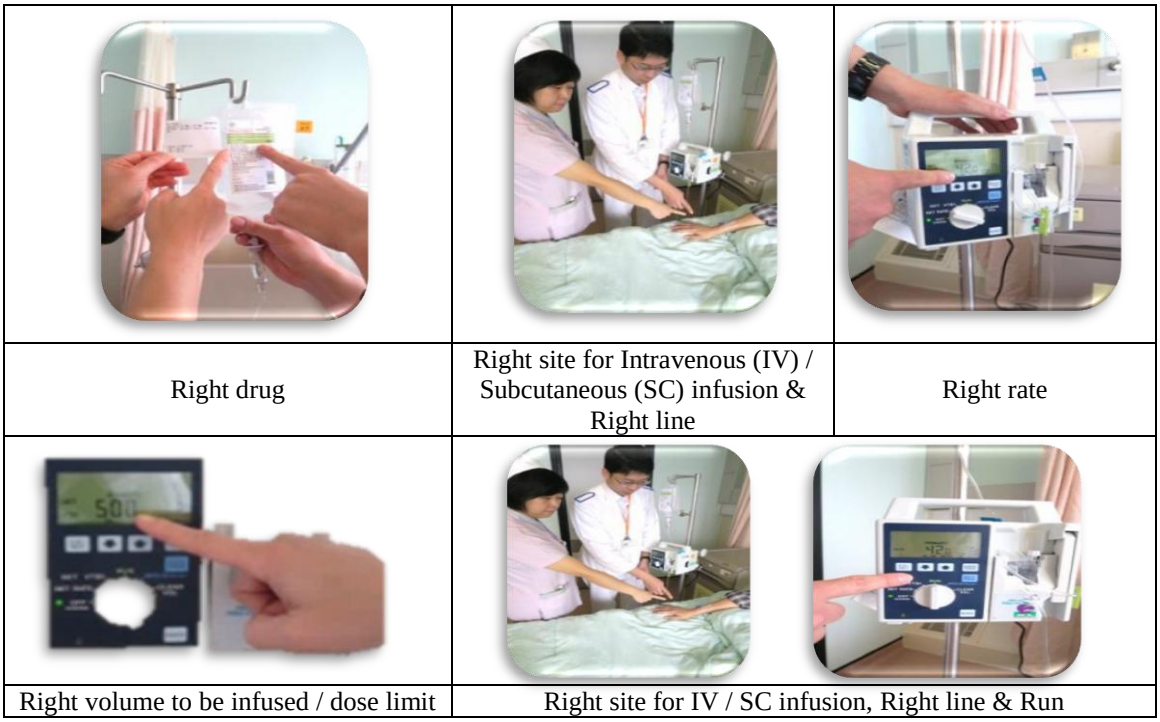

Figure1: The Application of the pointing and calling on checking high alert medication using infusion and syringe device

First and foremost, ensuring the right drug is the most important component throughout the assessment process. Nurses need to ensure that the dosage, name, time, and route are correct upon the administration of the drug to the right patient. Secondly, some critically ill patients may receive two or more infusion medications using infusion/syringe devices. Therefore, identifying the right infusion and syringe device for medication administration is of paramount importance. Thirdly, nurses should identify a dial of infusion rate and volume to be infused (clear dose limit) and prevent any mix-up. Error in identifying these two areas may lead to the vulnerability of the patient and pose life-threatening risks. Finally, nurses should confirm the right site for the catheter to be attached and ensure that the device is running properly. In some cases, although the nurses had prepared everything properly, they had forgotten to switch on the device. While applying the P&C, two nurses must use their eyes, fingers, mouths, and ears to reinforce the action's effect (Table 1).

Table1: P&C Evaluation Method Used by Nurses

Two nurses are essential to performing each step independently upon starting the next step.	
Eyes	Look at the confirmed target.
Fingers	Point at the target with the index finger
Mouth	Call out the slogan loudly and clearly as confirmation.
Ears	Listen to the confirmation slogan.
Okay!	

In order to incorporate the pointing and calling method into the existing practice of checking medication and infusion device using In-patient Medication Order Entry (IPMOE), the workgroup developed a comprehensive procedure based on the principle of "three-check five-right".

Meanwhile, the workgroup developed a promulgation package including training materials, cue card, clinical skills manual, instruction guide, imprinting flyer ball pen, videos and website. Different cue cards were designed for most models of infusion and syringe devices based on different checking procedures using the pointing and calling method. Wards are required to attach the cue cards to each device so that nurses can follow the checking steps in case they forget. An application manual of pointing and calling in clinical nursing skills and an instruction guide are made to provide more details to guide nurses using pointing and calling checking method on high alert medication using infusion and syringe device. At least one set of manual and some copies of instruction guides were distributed in each ward. In addition, an imprinting flyer ball pen is designed to increase awareness of nurses and to serve as a convenient reference in clinical setting. Videos based on different models of infusion and syringe devices are produced and uploaded at an internal nursing website for sharing.

Do

Such information prepared by the workgroup was brought to the senior nursing management for introduction and seeking for support. In order to test the viability of pointing and calling in clinical practice, it was pilot in two medical wards in December 2015 and January 2016 and four identical briefing sessions held in conjunction. Feedbacks were collected for improvement of the workflow of the pointing and

calling implementation. After that, over 100 briefing sessions were conducted in wards in addition to 4 open seminars and about 1100 nurses had been taught how to implement the pointing and calling method. As ward managers are the clinical leader to influence and supervise their subordinates to ensure the quality of the pointing and calling implementation in their workplace, repeated return demonstration sessions were arranged and finally one hundred and forty-five department operation manager (DOM), WM, APN and registered nurses completed the assessment and were nominated as an auditor. One hundred and fifty-eight preceptees received related training during this period. Since June 2016, the pointing and calling has been rollout in the department of Medicine and Geriatrics, Orthopaedics, Surgery, Obstetrics & Gynaecology, Ear, Nose & Throat, Psychiatrics, and Accident & Emergency to check high alert medication using infusion and syringe device after the nine-month preparation and promulgation. A staff satisfaction survey was conducted between January and June 2016.

Ethical consideration

Anonymity was assured throughout the study and the data collected were treated as confidential. Since this is a continuous quality improvement study, all qualified nurses were essential to participate in the study. Therefore, nurses had given agreement without written informed consent required. The study was approved by hospital general manager (nursing) who has rights to grant ethical approval in hospital.

Results

In total, 217 questionnaires, which were scored based on a six-point Likert scale, were collected from 21 wards, with the response rate estimated at 26.53%. The average mean of perception on learning pointing and calling, perception on using pointing and calling, support from management, and acceptance for using pointing and calling was 4.41, 4.25, 4.27, and 4.14 respectively (Table 2).

An audit was performed between September and November 2016 in the wards implementing the pointing and calling method. 709 nurses were audited and the compliance rate of using the pointing and calling for checking ranged from 98.1% to 100% for the 10 models of infusion or syringe device. One incident was reported as the high alert medication incident using infusion or syringe device accounting for wrong device setting between January and June 2016. There were four high alert medication incidents using infusion or syringe device, of which one incident accounted for wrong device setting, were reported from July 2016 to February 2017 (Figure 2). The remaining three incidents were associated with complicated medication administration procedure like diabetic ketoacidosis management, absence of mind to adjust infusion rate and non-compliant checking of a changed prescription. The incident rate due to wrong device setting decreased from 0.21 to 0.13 after the pointing and calling implementation.

Table 2: Perception of the pointing and calling implementation

Question	Mean	Median
I think learning how to use the pointing and calling is easy for me	4.50	5
I can easily use the pointing and calling in medication administration using infusion device	4.36	5
I can easily use the pointing and calling in medication administration using syringe device	4.38	5
I think using the pointing and calling is useful for medication administration using infusion device	4.26	4
I think using the pointing and calling is useful for medication administration using syringe device	4.28	4
I think using the pointing and calling can enhance my awareness on checking process	4.30	4
In general, I am satisfied to use the pointing and calling	4.13	4
I have the support to use the pointing and calling	4.22	4
I know where I can find assistance when I have problems in using the pointing and calling	4.33	5
I intend to use the pointing and calling for medication administration using infusion/ syringe device as often as needed	4.17	4
I prefer to use the pointing and calling on other steps through medication administration using infusion/ syringe device	4.08	4
I think I will use the pointing and calling on a regular basis	4.13	4
I think I will recommend my colleagues to use the pointing and calling	4.13	4
I think it is valuable to apply the pointing and calling on other high risk procedures	4.37	5
I am satisfied with the overall implementation of the pointing and calling	4.16	4

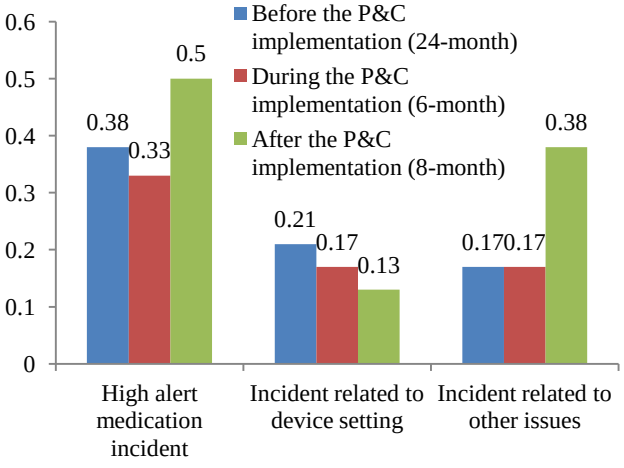

Figure2: High alert medication incident rate related to infusion and syringe devices before, during and after the pointing and calling implementation.

Discussion

A project leader is poised to play a pivotal role in recognizing the need to have subordinates who are psychologically connected to their work, or engaged in their work (15). Some evidences supported the correlation of work engagement of nursing colleagues with positive organizational outcomes including job performance (16) and productivity (17). It was a challenge to engage direct care nurses to perform a new checking method in their nursing practice by means of willingness to change practice and persistence, while maintaining their sense of significance, and keeping them fully concentrated and happily engrossed in their work (18). To achieve these goals, some successful factors should be identified whereas obstacles should be tackled.

Firstly, nurses might think that the pointing and calling is a new method that creates extra workload to them during medication administration. In fact, it is a simple way to draw one's awareness to the task. The pointing and calling method indeed was taught in traditional training schools of nursing sector a long time ago. On the other hand, no one had been taught on how to check with a standard procedure when using syringe and infusion device. Our nursing quality and safety team aimed to recapture the traditional checking method and make it more structural when applying it in checking infusion and syringe device despite device operation training. Therefore, the team did not intend to change practice but aimed to strengthen the checking practice.

A nurse leader's awareness of the need to implement change in practice entails knowledge of relationships, process and culture, supportive, reflective and culture-bearing leadership in addition to the use of guidelines (19). They are the key elements to achieve genuine and sustainable change and to ensure safe care (20). In addition, staff engagement is a crucial step to understand attitudinal constructs that represent employees' attitudes towards the change of practice: readiness for change, commitment to change, openness to change and cynicism about practice change (21). The team studied the feasible ways to implement the pointing and calling incorporating into daily practice of checking high alert medication using infusion and syringe device. We also invited a few direct care nurses to try out the procedures so as to mitigate the resistance to change. Training materials including presentation file, video and instruction guide were prepared to help them understand how the pointing and calling was applied. The use of manual can further reduce inappropriate variation in practice, thus, enhance quality and provide safe care as well as lower healthcare costs (22-23). It is particularly important for newly employed nurses and those who have not implemented the pointing and calling in previous unit. During the briefing sessions, nurses were invited to raise their concerns and questions. This is one of the strategies to engage their involvement as well as a good way to reduce self-doubt. Through the briefing sessions, an important message of ensuring medication safety using an evidence-based method was promulgated to direct care nurses. A staff satisfaction survey is another tool to understand the perception of the pointing and calling implementation. Cue card and imprinting flyer ball pen are a sort of gimmick to draw direct care nurses' attention. In addition, introduction and briefing sessions were delivered at different levels of nursing meetings to gain their support and foster a safe culture using the pointing and calling method.

Although a series of strategies had been developed and implemented, one high alert medication incident using infusion or syringe device was reported after rolling out of the pointing and calling. In the post-implementation review, the team intended to understand if the pointing and calling can mitigate the risk of checking issues caused by human errors. Apparently, the effectiveness of using pointing and calling method to reduce high alert medication incident is subject to several factors including the areas not being identified in the pointing and calling method, and compliance with the pointing and calling application. The main components of the pointing and calling method includes right drug exercising 5-right principle, right site, route and line, right rate, right dose limit, and right site, route, line and confirming the device is turned on. Nevertheless, two incidents were reported that nurses were not aware of adjusting infusion rate according to the different measuring readings of blood glucose level. In another incident, a nurse did not meticulously check the change of a patient's prescription via the IPMOE system and as a result, the infusion medication which had been discontinued by a physician was continuously administered. According to the incidents above, it raised two concerns on whether nurses understand the pointing and calling method for checking and whether nurses comply with the practice.

For the former, the team is going to work out a clinical nursing skills refresher and enhancement training (CNSRET) programme for nurses to refresh this practice periodically. The concept of refresher training is not commonly in place in UCH and limited to particular nursing skills. Healthcare providers queried the reason for not receiving any in-service training and refresher courses in specific area (24). Senior nurse managers need to identify the high risk areas which are worth taking the effort to organize refresher training to enhance patient safety and quality of nursing care. While striving for excellence of nursing care, we need to keep updating of basic care. In other words, it is the best to select the pointing and calling as a refresher topic for nurses to revise a basic checking principle of high alert medication using infusion and syringe device.

To address the issue of the pointing and calling checking compliance, it is of first and foremost importance to have a leadership and supervision

through ward manager and relevant levels of nurses, such as advanced practice nurse. Nurse leaders are a central component for achieving alignment and implementing change at ward level (25). Ward manager and advanced practice nurse can be very influential in developing a culture to perform a safe checking practice, especially with the high turnover rate of nurses that creates additional requirements of orientation and supervision of newly employed nurses, coupled with the winter surge that increases the demand in acute services annually. They obviously threaten the quality of the pointing and calling implementation.

No matter what measure is implemented to reinforce checking during medication administration, nurses' attitude towards patient safety is the most important component to make the pointing and calling implementation successful. Only if they believe the pointing and calling method is of the utmost importance throughout the process of the high alert medication administration, patient safety can be warranted.

Conclusion

The pointing and calling is a simple method to facilitate nurses checking high alert medication meticulously. Although the pointing and calling has been shown effective in improving the rate of incidents due to wrong device setting, there is room for improvement to address other areas that were not identified. The intrinsic factor including non-compliance with the pointing and calling implementation and the extrinsic factors including the areas not being identified in the pointing and calling method are influential in reducing high alert medication incidents. Counter measures were proposed to strengthen the compliance with the pointing and calling.

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