

Medication Safety: A Need to Relook at Double-Checking Medicines?

Gek Phin Chua, Kim Hua Lee, Gemma Diente Peralta, John Heng Chi Lim

Cancer Education and Information Service Research and Data, National Cancer Centre Singapore, Singapore



Corresponding author: Gek Phin Chua, MN, RN

Project Director, CEIS (Research and Data), National Cancer Centre Singapore, Singapore

Tel: +65 6236 9448; Fax: +65 65365503

E-mail: ncccgpnccs.com.sg

Received: October 15, 2018, Accepted: January 03, 2019

ABSTRACT

Objective: To present a structured evaluation process that provides evidence that the single-checking (SC) system is not only a viable option in reducing medication errors, but also has the added advantage of increasing staff satisfaction.

Methods: The structured evaluation involved one work improvement process and conducting a survey establishing registered nurses' (RNs') attitude toward SC of medicines. The survey questionnaire included 12 questions with a 5-point Likert scale. **Results:** In spite of the increased number of patients, the number of medication errors actually reduced ($P < 0.001$; two-sample test of proportions) with the implementation of SC of medication for competent and experienced staff. A survey was conducted to establish RNs' attitudes toward SC of medicines 3 years post SC implementation. RNs viewed

the single-nurse checking protocol positively. In particular, the nurses considered single-nurse checking as an encouragement to update their drug knowledge and as a time-saving measure, enhancing the quality of patient care. Nonetheless, they also expressed concerns on single-nurse checking.

Conclusions: The findings provide evidence that SC system is a viable way to reducing medication errors and also confer the added advantage of staff satisfaction. Assuring quality and safety involves the need to challenge the *status quo* based on revealed evidence.

Key words: Accountability, cytotoxic drug, double checking, empowerment, medication safety, patient safety, quality improvement, staff satisfaction

Introduction

Medication errors account for 7000 deaths annually and are a major cause of morbidity.^[1] Estimating the prevalence of medication errors is difficult due to the: (1) varying definitions and classification system employed; (2) lack of national reporting system or systems that collect both errors and near misses; and (3) underreporting.^[2,3] As defined by

the National Coordinating Council for Medication Error and Prevention,^[2] medication error is "any preventable event that may cause or lead to inappropriate medication use of patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care

Access this article online

Quick Response Code:



Website: www.apjon.org

DOI:
10.4103/apjon.apjon_2_19

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Cite this article as: Chua GP, Lee KH, Peralta GD, Lim JH. Medication Safety: A Need to Relook at Double-Checking Medicines? *Asia Pac J Oncol Nurs* 2019;6:246-52.

products, procedures, and systems, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use.” This broad definition implies that medication errors are preventable at different levels. The main factors that may influence medication errors in an acute care setting are: (1) human factors; (2) environmental factors; and (3) computerized information system.^[2]

Patient safety is a universal and fundamental principle of health care^[4] and an important aspect of an effective and efficient health-care system. Providing patients with safe care is the responsibility of every health-care professional. As nurses make up the largest group of the health-care workforce and are the patients’ primary caregivers, their skills and availability can affect quality, safety, and efficiency.^[4]

The administration of intravenous medications, including high-alert medications (e.g., antineoplastic agents for the treatment of cancer), has been the role of nurses in many parts of the world. In the oncology setting, medication safety can also be compromised because of the complexities of the chemotherapy or clinical trial protocols, the changes in medication orders, and potential incompatibilities of intravenous medications. Medication errors relating to chemotherapy can compromise patient safety as well as the potential for cure. Other adverse effects of medication errors include increased medical complications, increased length of stay, increased treatment costs,^[5] loss of trust or reputation, civil liability, and criminal prosecution.^[6]

Independent double checking (IDC) of medicines has been recommended as a way to reduce medication errors.^[7,8] Although this measure is meant to avoid “wrong patient” errors and to ensure the correct aspects of medicinal administration (e.g., dosage calculation), medication errors still occur. Studies have shown errors to occur despite DC,^[9] with nurses being unclear on its concept and practice.^[10-12] Armitage’s^[9] study revealed: (1) deference to authority, (2) reduction in responsibility, (3) autoprocessing, and (4) lack of time as the possible causative factors. Alsulami *et al.*’s^[12] study revealed that there was variation in nurses’ adherence to DC steps, and deviations from policy were observed. Grant’s^[10] qualitative exploration in the United States on 13 registered nurses’ (RNs’) understanding and practice of “independent double-checks” prior to administration of high-alert medications unraveled that, though IDC was accepted and promoted as the best practice, the definition and process are still unclear. Staffing and time to find another nurse to perform the DC were the major challenges the RNs experienced. Schwappach *et al.*’s^[11] cross-sectional survey on 274 oncology nurses working

in oncology wards and ambulatory units established that many nurses reported frequent interruptions caused by DC, particularly the nurses working in ambulatory infusion units. Almost all respondents (98%) cited busyness, in a hurry, interruptions, distractions, noise and poor illumination, problems with finding a colleague to countercheck, fatigue, and overcrowded rooms as factors that interfered with performing a good DC. The survey also unraveled the variability in interpretations and ideas of what constitutes a double check, the importance of independence of checks, and how it can be achieved. A considerable fraction of nurses also reported that they did not know the contents of medication administration guidelines at their unit well and some were even unaware that such guidelines existed.

Conversely, studies on the efficacy of single checking (SC) (one nurse checking that the correct medication is given) have found no significant differences in error rates.^[13] Although nurses may initially have a negative perception of SC,^[14] they have responded positively to its adoption post-implementation.^[13,14] In addition, the findings revealed that the majority of nurses appreciated the increased autonomy from single-person checking of medications and were more confident in their ability to assume this responsibility and to be accountable for their practice. Overall, they were highly satisfied with the change and had also identified several benefits to patients, including being more responsive to patient needs due to the additional time saved from having to perform DC.

In the largest ambulatory cancer center in Singapore, DC of chemotherapy drugs by two RNs with a checklist had been implemented since 2005. The auditors reported that it was just a ritualistic chant of repeating words. Even when it was changed to IDC, mistakes still occurred as staff would just tick the boxes in the checklist without checking the drugs in detail [Figure 1]. Based on the review of the incident reports, the mistakes were made by the more senior and experienced staff. This brought into question whether nurses had become complacent and if the practice of DC should be continued. In this structured evaluation process, it involved: (1) the removal of the need to double-check medication for trained and competent staff and (2) conducting a survey to establish RNs’ attitude toward SC of medicines. The goals were to address the potential cause of errors due to the aspect on complacency by encouraging staff accountability with the medication process and to establish the nurses’ perception with the SC process after its successful implementation. This article describes the two phases of the structured evaluation process and the resulting benefits and implications of the system.

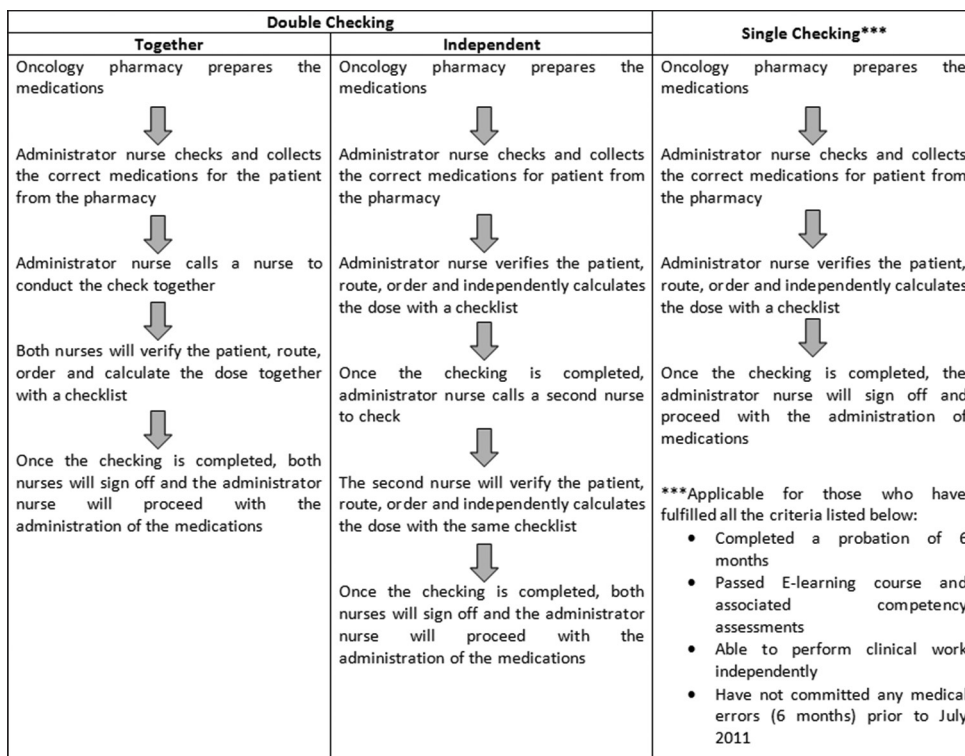


Figure 1: Process to check high-risk medications

Methods

Phase 1: Implementation of single checking

Prior to its implementation, nurses were consulted and, as the majority of nurses were keen, the process that required the DC of medications was removed from nurses who fulfilled the following conditions: (1) completed a probation period of 6 months; (2) passed the competency assessments associated with an E-learning course on chemotherapy; (3) able to perform their clinical work independently; and (4) had not committed any medical errors for a period of 6 months prior to July 2011 (implementation of SC). There was no restriction, and nurses could still ask another nurse to double-check if they were unfamiliar with the drugs or protocols. This was not only to create accountability and responsibility of the individual, but also to ensure safety for those who were new to and unfamiliar with the drugs.

During the implementation of the SC protocol, we closely monitored incidents of medication errors through incident reports and audits, paying particular attention to any change in trends. Over the years, the number of medication errors fluctuated and only stabilized with the implementation of SC for trained and experienced staff [Figure 2]. It demonstrated that, in spite of the increased number of patients, the number of medication errors had significantly reduced ($P < 0.001$; two-sample test of proportions).

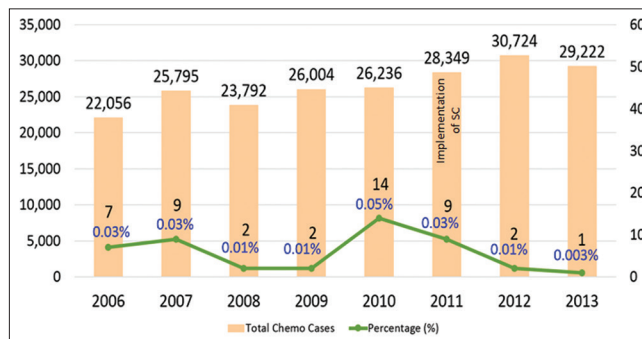


Figure 2: Number of chemo cases and medication errors

Phase 2: Evaluation of staff perception

Following the positive outcome, we investigated the perception and attitude of the RNs toward the SC system by conducting a survey 3 years after the removal of the DC system. The questionnaire was adapted from O’Connell et al.^[14] Two separate questionnaires for double- and single-checkers were presented. In each questionnaire, nurses were asked to respond to 12 statements, each presenting five response options to choose from. The wording of the statements differed slightly between both questionnaires to reflect the lack of SC experience encountered by double checkers (single checkers would have experienced both protocols).

The questionnaires were distributed at two points: August 2014 and January 2015. The latter was to ensure that

the RNs had at least been performing SC for a minimum of 3 months. Participation in this survey was purely voluntary. Return of questionnaires indicated consent to participate. Data were analyzed using STATA version 14.2 (StataCorp, College Station, TX).

Ethical approval for this evaluation was not obtained because the process represented a quality improvement initiative.

Results

There were 35 RNs from the ambulatory treatment unit who participated in this survey. Fifty-one percent (18) were Singaporeans or Singapore permanent residents. The sample consisted of relatively young, female dominated, educated workforce. Sixty-nine percent (24) were single checkers, of whom more than half had at least 3 years of experience as single checkers. Table 1 demonstrates the respondents' demographics.

Table 2 provides a descriptive summary of the double- and single-checkers' responses to the 12 statements. Eleven double checkers generally viewed the single-nurse checking protocol positively. Statements 1 through 9, which described the potential advantages of single-nurse checking, each drew more agreement than disagreement. In particular, the nurses were of the view that single-nurse checking would enhance the quality of patient care due to time savings (from statements 5, 6, and 7). Of the 11 nurses, 10 (90.9%) agreed with each of these three statements, and one nurse was neutral. The double checkers also expressed

some concerns on single-nurse checking – seven (63.6%) nurses agreed that they were worried that the number of medication errors would increase with single nurse checking.

Single checkers perceived the SC protocol more favorably than double checkers [Table 2]. Of the 24 nurses, 12 (50%) agreed that their stress level had increased with single-nurse checking and 10 (41.6%) agreed that they were worried that medication errors would increase with single-nurse checking.

Discussion

The perceptions of double checkers were less extreme than those of single checkers, as seen from the relatively lower proportions of “strongly agree” and “strongly disagree” indications and also relatively higher proportions of “neutral” indications. This was as expected because the double checkers had not experienced single-nurse checking and could only state their perceptions based merely on their anticipations or what they had heard from the single checkers. The single checkers, having experienced both protocols, generally indicated huge preferences toward single-nurse checking due to greater control, greater sense of responsibility, time saved, and also less interruption when focusing on their own work, but at the likely expense of an increased stress level.

The nurses' perception of SC showed that they welcomed the greater accountability associated with it compared to DC. This is particularly obvious in the SC group where

Table 1: Characteristics of the survey participants

Characteristics	Double-checker participants (n=11), n (%)	Single-checker participants (n=24), n (%)
Nationality		
Singaporean/PR	4 (36.4)	14 (58.3)
Foreigners	7 (63.6)	10 (41.7)
Gender		
Male	0	2 (8.3)
Female	11 (100.0)	22 (91.7)
Age (years)		
<25	7 (63.6)	4 (16.7)
25-30	2 (18.2)	5 (20.8)
31-40	2 (18.2)	10 (41.7)
41-50	0	5 (20.8)
Highest nursing education level		
Diploma in nursing	6 (54.5)	4 (16.7)
Degree in nursing	5 (45.5)	12 (50.0)
Advanced/postgraduate diploma	0	8 (33.3)
Length of time as a single checker in ATU		
4-6 months		4 (16.7)
7-12 months		1 (4.2)
1-2 years		1 (4.2)
2-3 years		4 (16.7)
3 years and above		14 (58.3)

ATU: Ambulatory treatment unit, PR: Permanent resident

Table 2: Responses from double and single checkers

Questions	Double checker (n=11), n (%)					Single checker (n=24), n (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. I would enjoy having more control using a single-nurse checking drug administration system	0	4 (36.4)	7 (63.6)	0	0	10 (41.7)	10 (41.7)	3 (12.5)	0	1 (4.2)
2. Single-nurse checking would allow me greater accountability as a professional nurse	3 (27.3)	6 (54.5)	2 (18.2)	0	0	14 (58.3)	7 (29.2)	1 (4.2)	1 (4.2)	1 (4.2)
3. Single-nurse checking would encourage me to keep updating my drug knowledge	3 (27.3)	3 (27.3)	5 (45.5)	0	0	13 (54.2)	8 (33.3)	3 (12.5)	0	0
4. Single-nurse checking would allow me to be more meticulous in patient care, thereby improving patient safety	3 (27.3)	6 (54.5)	1 (9.1)	1 (9.1)	0	15 (62.5)	6 (25)	1 (4.2)	2 (8.3)	0
5. I would welcome the time saved using single-nurse checking	5 (45.5)	5 (45.5)	1 (9.1)	0	0	13 (54.2)	9 (37.5)	2 (8.3)	0	0
6. The time saved from single-nurse checking would allow me to spend more quality time with the patients	3 (27.3)	7 (63.6)	1 (9.1)	0	0	10 (41.7)	10 (41.7)	4 (16.7)	0	0
7. I would enjoy not being interrupted to check medications for others, thereby allowing me to be more focused on my work	1 (9.1)	4 (36.4)	5 (45.5)	1 (9.1)	0	13 (54.2)	7 (29.2)	4 (16.7)	0	0
8. Single-nurse checking would reduce my frustration by not having to always look for another nurse	5 (45.5)	4 (36.4)	2 (18.2)	0	0	13 (54.2)	9 (37.5)	1 (4.2)	0	1 (4.2)
9. The patient's waiting time for medication would be reduced with single-nurse checking	4 (36.4)	6 (54.5)	1 (9.1)	0	0	15 (62.5)	7 (29.2)	2 (8.3)	0	0
10. Single-nurse checking would increase my stress level due to added responsibility and the need to multitask	2 (18.2)	2 (18.2)	6 (54.5)	1 (9.1)	0	8 (33.3)	4 (16.7)	9 (37.5)	3 (12.5)	0
11. I am worried that medication errors will increase with single-nurse checking	1 (9.1)	6 (54.5)	3 (27.3)	1 (9.1)	0	3 (12.5)	7 (29.2)	8 (33.3)	5 (20.8)	1 (4.2)
12. If a drug error was made with single-nurse checking, it would be easier for it to go unnoticed	0	4 (36.4)	1 (9.1)	3 (27.3)	3 (27.3)	4 (16.7)	5 (20.8)	6 (25)	6 (25)	3 (12.5)

they enjoyed more sense of control. Unanimously, the RNs perceived SC helped them save time, which in turn translated to more quality time with patients. SC also reduced their frustration having to look for another RN to check the medications as well as their ability to concentrate on their work as there would be less interruption. The time saved through the process can be better utilized to provide quality care to the patients resulting in: (1) higher level of patient safety, (2) lesser medication errors, (3) increase patient satisfaction, (4) lower job strain, and (5) staff retention.^[15-18]

Another advantage of SC would be a shorter waiting time for the patients. Lesser waiting time for patients is an important component of quality care and has been associated with: (1) increased patient satisfaction; (2) perceived quality of care received; (3) better compete, manage cost, and retain clientele; (4) better utilization of facilities; (5) more likely to adhere to scheduled appointment and treatment schedules; and (6) more likely to recommend the institution.^[15,19-24]

Even the double checkers were highly supportive of the SC method. While they scored lower for more control, encouragement to update their knowledge, and enjoying less interruption, they scored high in other aspects of benefits. Although 49% (17) of the nurses surveyed were concerned with an increase in medication errors with SC, such concerns may be viewed positively as fear of the negative consequences that may impact both patients and

self,^[25,26] and may spur them to be more vigilant with the checking process.

The results of our survey are consistent with previous studies.^[7,13,14] We postulate that using a SC procedure might have encouraged nurses to be more vigilant in administering medications, thereby potentially improving patient safety. In addition, Westbrook *et al's*.^[27] study found a significant dose-response relationship between interruptions and procedural failures and clinical errors in medication administration. This indicated that, with fewer interruptions, nurses were able to concentrate on the checking and administration process of medicines.

Patient safety is the critical element of health-care delivery. While DC may be seen as integral to medication safety in nursing, however, evidence from literature and our work improvement process cum climate survey of RNs showed otherwise. The number of medication errors had significantly reduced with the implementation of SC of medication for competent and experienced staff. This demonstrates that with careful training,^[14] SC is a viable option, and selective DC may be only for those RNs who are unfamiliar with the process or medications. Double checks should only be applied strategically to situations that most warrant their use. Insisting that DC medicines will help reduce errors without first determining how the process is being done may inadvertently provide false assurance.^[9]

Our survey on the nurses' perceptions revealed that the RNs perceived having greater accountability for medication

administration using SC than they did when using DC. Accountability and workplace empowerment are some of the variables associated with job satisfaction.^[16,28,29] Evidence is also prevalent that staff satisfaction is also associated with the provision of safe care. Nurses who are satisfied with their jobs exhibit higher levels of patient safety and less medication errors which help increase patient satisfaction^[15,16,30,31] and staff retention.^[15-17]

Even the Institute of Safe Medication Practices (ISMP) advocates the use of independent double checks judiciously and should only be used for very selective high-alert medicines (not all) that warrant their use. They caution the use of double checks as a means of fixing problems.^[32] Our result shows that, even with high-alert medication such as cytotoxic drugs, the process of administration is more critical than the drug *per se*. The double check system should be regarded as an independent cognitive task, not as a superficial routine task.^[33]

Implementing system changes and practices is often a challenging process. However, they are crucial in improving safety in health care. DC of medicines was introduced into nursing practice as it is assumed to reduce medication errors. However, it is very labor intensive as it involves two qualified health-care professionals. There is little evidence to support or refute such a practice. Evidence indicates that, with DC, errors still occur and, unless the process of DC is being carefully studied, errors will still continue to occur as there are various factors that can influence the effective checking of medications.^[9,12] Critics are also concerned that the double check process might create a false sense of security. Given an ever-increasing workload of nurses, performing DC can not only be laborious and waste valuable resources, but also create a false sense of security. Based on our evidence, accountability and empowerment is a promising approach. SC for trained and competent nurses is a viable option as it does not expose patients to undue risk compared to DC. In fact, the benefits offered to both nurses and patients are invaluable and may have influenced the reduction of medication errors. Besides, individual accountability, where the full responsibility for the correct administration of medicine lies wholly with the administering nurse, may be more effective. This is also the view of the ISMP, where full accountability for the correct administration of the medicine should lie wholly with the administering nurse. DC should only be applied strategically to situations that most warrant their use such as new, inexperienced, and untrained staff.

Limitations

This study on the staff perception was conducted in a single center with a small sample size; hence, the findings

may not be generalizable. Nevertheless, as more than half of the single checkers had more than 3 years of SC experience, it strengthened the outcome of our findings. In addition, this project was based on a work evaluation process that involved one quality improvement process and one climate survey and provides evidence of its effectiveness and benefits. Thus, in our opinion, it can be transferred to other settings.

Conclusion

Ensuring medication safety can be extremely challenging. DC of medications prior to administration is a feature of day-to-day clinical practice. Although DC should and will catch errors, it is not supported by sound empirical evidence and errors still occur with DC. Quality improvement is a critical aspect of safety and all efforts should not be spared to prevent or lessen the possibility of errors occurring. Although assuring quality and safety involves more than individual accountability, the results of our structured evaluation process indicate that a SC system for trained and competent staff can be a viable option in reducing medication errors and also confer the added advantage of staff satisfaction. Increased patient safety and level of care is the benefit of satisfied staff.

Implications

This structured evaluation process contributed to nursing knowledge in regard to the administration of intravenous medications. It reinforces that quality improvement requires constant and vigilant monitoring of data to solve problems, and assuring quality and safety involves the need to challenge the *status quo* based on revealed evidence.

To our knowledge, this is the first work improvement project to focus on the administration of high-alert medication with single checker. The climate survey on the RNs (single and double checkers) indicated the perceived benefits of SC by trained and experienced staff. Another climate survey of previous double checkers that have now progressed to SC would be beneficial to provide evidence whether there is any change in their attitudes to SC. It could encompass perceived benefits or concerns that were not addressed in the current survey, including measuring the time saved for the DC process. This would assist in strengthening the benefits of a single checker of medications including high-alert medications such as chemotherapy drugs.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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