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Evaluation of the Green Cross Method Regarding Patient Safety Culture and Incidence Reporting

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Objectives: The Green Cross (GC) method is a visual method for health service staff to recognize risks and preventable adverse events (PAEs) on a daily basis. The aim was to compare patient safety culture and the number of reported PAEs in units using the GC method with units that do not.

Methods: This study has a retrospective cross-sectional design in the setting of psychiatric and somatic care departments in a Swedish hospital. In total, 1476 staff members from 62 different units participate in the study.

Results: Units who had implemented the GC method scored higher than non-GC units in overall quality. The dimensions *Feedback and communication about error*, *Nonpunitive response to errors*, *Organizational learning-continuous improvement*, *Handoffs and transitions between units and shifts*, and *Teamwork within units* scored significantly higher in GC units. More risks were reported in the incident reporting system in GC units than in non-GC units, but the number of PAEs was similar. Units with nursing staff who used the GC method scored higher on patient safety culture than those who did not use the method. This difference was not seen in physician units.

Conclusions: The implementation of the GC method has a positive impact on patient safety culture and PAE reporting. However, the method does not seem to have the same impact in physician units as in units with nursing staff, which calls for further investigation.

Key Words: patient safety culture, incidence reporting, adverse event, Green Cross

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In recent decades, it has become clear that patient safety is an urgent issue, not only because of the high number of preventable adverse events (PAEs) but also because of high health care costs.¹ On average, 10% of in-hospital patients are affected by at least one adverse event, and between 34% and 83% of these are considered to be preventable.² Sweden is no exception; approximately 8% of somatic in-hospital patients are estimated to be affected annually by PAEs of varying severity.³

The main approach taken in Sweden, United States, and other countries for patient safety follow-up is the use of an incident reporting (IR) system where staff members are encouraged to report risks and adverse events.⁴ Ideally, the system provides information about risks so that organizations can implement interventions to reduce these risks.⁵ The use of IR systems has been criticized for failing to lead to meaningful change.⁶ Reported incidences

most commonly result in activities, such as informing the staff involved and arranging education or training^{7,8}; however, there is no clear evidence that IR systems improve patient safety.^{4,5} Studies reveal that the quality of the feedback given to those reporting the incidents is crucial for enabling learning, encouraging continued reporting, and developing trust in the system. This can be achieved by demonstrating that reported incidents are properly taken care of.^{9,10} If, however, the reported failures and misses lead to blame and shame and no change, the willingness to report incidences will likely decrease.¹⁰ These aspects are closely linked to existing patient safety culture. In a positive work culture, staff can safely speak up, discuss, and report incidences and the organization has at all levels a willingness to learn and act in a way that promotes patient safety.^{11,12} Measurement of patient safety culture has therefore been considered to be an important part in many patient safety programs.¹³ The measurements contribute to an understanding of shared values, behaviors, attitudes, and norms related to patient safety among the staff within a team, work unit, or organization. In Sweden, patient safety culture has been surveyed since 2011 as part of a quality and safety program.^{14,15}

Regarding IR systems, it is well known that the time it takes to investigate and take action on reported adverse events and risks is often long,⁸ which may contribute to the deterioration of efficacy. Therefore, methods that are more proactive, such as the Green Cross (GC) method, where adverse events are highlighted, discussed, and monitored in close connection to when it turned up, are advocated.⁶ The GC method is a visual method for health service staff to recognize risks and PAEs on a daily basis, thus creating a foundation for targeted, systematic improvement work. Contrary to traditional IR, the GC method is based on teamwork where risks and PAEs are discussed within the team at daily meetings. After the meeting, identified risks and PAEs are documented in a detailed report form, which in its turn forms the basis for systematic daily work on improvements. Every month is the events noted in the detailed report form summarized to visualize outcome and to identify problem areas. Based on these monthly summaries, long-term measures are taken to prevent events being repeated. The method was developed at the South Älvsborg Hospital in Sweden and is inspired by Safety Cross, a method used in industry to visualize occupational hazards and accidents (see Fig. 1 for an explanation). The Green color in the cross symbolizes the zero vision of PAEs and each box with numbers corresponds to the date of the current month.

The GC method has not yet been evaluated, hence the initiation of the GC Study (GCS). The present study is part of the GCS and has the specific aim of comparing patient safety culture and the number of reported PAEs in units using the GC with units that do not. The research question is: Does the GC method have any impact on patient safety culture and/or the number of adverse events reported?

METHODS

Design

The study had a retrospective cross-sectional design, based on data collected in 2017 in a hospital in the south of Sweden.

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In what order?	When?	Example
Step 1. Identification		
<p>The staff at the unit/ward meets daily for a cross-disciplinary audit meeting. At the meeting, the following question is asked to all; has any employee discovered a patient PAE or a risk of one?</p>	Daily	<p>Manager*: Has anyone discovered a patient PAE or a risk of one? Staff A: Yes, this morning we found that patient X has developed a pressure ulcer</p> <p><i>*one from the staff group can also lead the meeting</i></p>
Step 2. Assessment of seriousness		
<p>General discussion of the events, risks and patient PAEs identified in <i>Step 1</i> takes place at the audit meeting and the degree of seriousness is assessed. The degree of seriousness is illustrated on the basic Green Cross template with the relevant color code for the date concerned; red for serious PAEs, orange for PAEs yellow for risk of PAEs, and green for no event or risk of event.</p> <p>Identified suggestions of improvements can also be captured at this meeting. An improvement note is then written and is taken care of in <i>Step 6</i>.</p>	Daily	<p>Manager: Was a risk assessment done at admission? What measures were taken? Was the pressure ulcer avoidable?</p> <p>Staff B: Yes, a risk assessment was done</p> <p>Staff C: but the turning schedule was not followed. I think the PU was avoidable but not a serious one</p> <p>Manager: Do you all agree? Ok, then we mark this day, the 25th, orange.</p>
Step 3. Data collection		
<p>A patient's PAE or risk of one is entered on an appropriate detailed report form, which also becomes part of the monthly summary (<i>step 6</i>).</p>	Daily	<p>Manager: Can you please write this in the detailed report form and register the PAE in the IR system?</p> <p>Staff A: Yes, I will do that right after this meeting</p> <p><i>Staff A describes shortly what has happened and categorize the type of PAE in the detailed form – in this case as PU</i></p>
Step 4. Non-conformance reporting		
<p>Occurred risk events and PAEs are entered into the hospital's incident reporting system the same day, before the end of the working day.</p>	Daily	
Step 5. Patient/relative involved		
<p>Patients/relatives are asked to contribute by making suggestions for improvements after red or orange events.</p>	Daily/Weekly	<p>Staff B (e.g.): "What could we have done differently?"</p> <p>Patient X: "At home, I use a gliding-sheet to more easily turn myself. Can I get such a sheet here?"</p> <p>Staff B: "Of course. And I will tell my colleagues that we should ask about this information at admission"</p>

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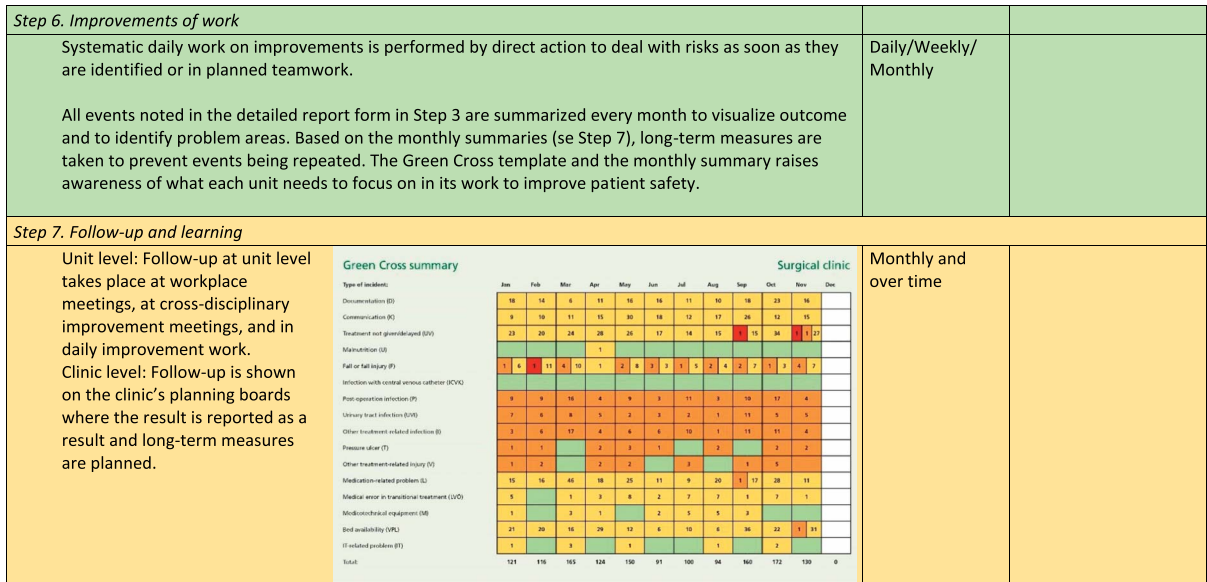


FIGURE 1. The working process of the GC method step by step.

Setting and Sample

The study encompassed hospital units with inpatient and outpatient care within somatic and psychiatric care, including operating department and prehospital care. The units were divided according to organizational leadership, meaning that staff within a unit had the same manager. Because of the limited number of units and clinics in the hospital, a sample size calculation was not performed. In total, 85 units were eligible for inclusion, 68 units with nursing staff and 17 units with physicians. The units with nursing staff, hereinafter called nursing units, included nurses, nurse assistants, and in some cases also allied health professionals or manager supporters. Physician units included physicians only. All units participated in the national patient safety culture survey conducted during the period of September 13 to October 4, 2017, on behalf of the County Council. The staff members at the units answered the survey questionnaires individually using a digital system that made personally identifying participants impossible. The employees were encouraged by their managers to answer the questionnaires and were allowed to do so on work time. Reminders were also sent out during the survey period by e-mail. The units were divided into two groups; units that had implemented the GC method and units that had not (non-GC) (Fig. 2). Units were excluded if less than 10 people per unit had participated in the patient safety

culture survey (n = 19 units) or if they had previously worked with the GC method but were not at the time of the study (n = 5 units). The final sample consisted of 62 units (Table 2): 46 GC units (n = 1221) and 16 non-GC units (n = 255).

Data Collection and Analysis

Patient Safety Culture Measurement

Patient safety culture was measured using a modified version of the Swedish adaptation¹⁴ of the Hospital Survey on Patient Safety Culture (S-HSOPSC).¹⁶ It consists of nine patient safety culture dimensions, encompassing 31 items with three to four items per dimension (Table 1). All items are based on a 5-point Likert scale of frequency (“never” to “always”) or agreement (“strongly disagree” to “strongly agree”).

The dimensions “staffing” and “teamwork within units” (Table 1) were not included in the modified S-HSOPSC. These dimensions were instead constructed on items collected from a coworker questionnaire about organizational and social work environment (OSA) that was distributed along with the modified S-HSOPSC. The OSA was developed by the Institute of Stress Medicine in Gothenburg, Sweden, and is based on selected validated questions from the Nordic Occupational Safety Climate questionnaire.¹⁷ In

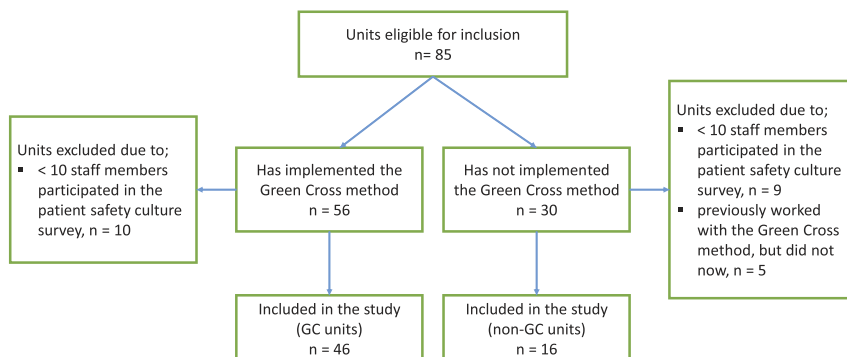


FIGURE 2. Schematic description of inclusion and exclusion strategy in the study.

TABLE 1. Dimensions and Items of the Modified S-HSOPSC

Items	Cronbach α
Single-items “outcome” question*	
- How satisfied are you with the quality of the work done on your unit? (“very satisfied” to “very dissatisfied”)	
D1	
Feedback and communication about error	0.79
- We are given feedback about changes put into place based on event reports	
- We are informed about errors that happen in this unit	
- In this unit, we discuss ways to prevent errors from happening again	
D2	
Communication openness	0.76
- Staff will freely speak up if they see something that may negatively affect patient care	
- Staff feel free to question the decisions or actions of those with more authority	
- Staff are afraid to ask questions when something does not seem right	
D3	
Executive management support for patient safety	0.79
- Executive management provides a work climate that promotes patient safety	
- The actions of executive management show that patient safety is a top priority	
- Executive management seems interested in patient safety only after an adverse event happens	
D4	
Nonpunitive response to error	0.86
- Staff feel like their mistakes are held against them	
- When an event is reported, it feels like the person is being written up, not the problem	
- Staff worry that mistakes they make are kept in their personnel file	
D5	
Organizational learning—continuous improvement	0.68
- We are actively doing things to improve patient safety	
- Mistakes have led to positive changes here	
- After we make changes to improve patient safety, we evaluate their effectiveness	
D6	
Overall perceptions of safety	0.76
- Patient safety is never sacrificed to get more work done	
- Our procedures and systems are good at preventing errors from happening	
- It is just by chance that more serious mistakes do not happen around here	
-We have patient safety problems in this unit	
D7	
Supervisor/manager expectations and actions promoting safety	0.86
- My supervisor/manager says a good word when he/she sees a job done according to established safety procedures.	
- My supervisor/manager seriously considers staff suggestions for improving patient safety	
- Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	
- My supervisor/manager overlooks patient safety problems that happen over and over	
D8	
Handoffs and transitions between units and shifts	0.79
- Things “fall between the cracks” when transferring patients from one unit to another	
- Important patient care information is often lost during shift changes	
- Problems often occur in the exchange of information across units	
- Shift changes are problematic for patients in this unit	
D9	
Information and support to patients and family who have suffered an adverse event	0.90
- In this unit, apologies and regrets are given to patients and families who have suffered an adverse event	

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TABLE 1. (Continued)

Items	Cronbach α
- In this unit, patients and families who have suffered an adverse event are informed about the event, its causes and actions taken to prevent it from happening again	
- In this unit, patients and families who have suffered an adverse event, receive help and support to manage the situation	
- In this unit, patients and families who have suffered an adverse event, are informed about the possibility to apply for economic compensation from the Patient Insurance	
D10	
Staffing*	0.79
- My workload is reasonable	
- It is possible for me to fulfill my work within my work hours	
- In my workplace there are enough staff in terms of number and competence	
- In my work, reasonable demands are made for, for example, making quick decisions, solving demanding problems and/or retrieving new information	
D11	
Teamwork within units*	0.77
- In my work there are no cooperation problems	
- If necessary, I can get help from my colleagues to solve my duties	
- I feel comfortable and familiar with my colleagues	
- I have the opportunity to participate in the planning of how my work will be performed	

*Single-item question and dimensions constructed on items from the coworker questionnaire on organizational and social work environment distributed along with the modified S-HSOPSC.

addition, a single-item “outcome” question about quality within the unit was collected from the OSA (Table 1).

For each dimension, the answers of the included questions were converted into a value by dividing the total number of answers of the items (three or four items) by the number of total positive answers presented as a percentage [(n positive answers/n total answers] multiplied by 100). All dimensions included in this survey demonstrated acceptable internal consistency reliability with a Cronbach α of between 0.76 and 0.90 (Table 1), with the exception of the dimension “Organizational learning–continuous improvement,” which had a lower Cronbach α of (0.68), which was still close to the acceptable α level (≥ 0.70). The modified S-HSOPSC includes a number of descriptive data and the following data were used: sex, age (years), and staff position.

The modified S-HSOPSC and OSA were distributed and collected by an external organization (Institute of Quality Indicators, Gothenburg, Sweden).

Measurement of Incident Reporting

Data from reported incidents were collected from the county council’s Web-based IR system (MedControl PRO; Munkeby Systems AB, Malmö, Sweden). All staff members have access to the system and are liable to use it to report any incidents that occur. When entering data, the reporter gives a brief description and marks if the incident is a work-related injury, patient complaint, PAE, risk for PAE, or “other.” Most data are entered using multiple-choice responses.

All incidents reported as a PAE, risk for PAE, or “other” between January 1 and September 30, 2017, registered by the 62 included units in MedControl PRO, were selected, yielding a total of 2306 reports (356 PAEs, 1259 risk for PAEs, and 691 “other”). To validate the data, three authors of this article (U.K., S.N., and S.I.) reviewed all the cases to make sure that the reports were correctly categorized. During the reviewing process, it became clear that some reports concerned several events involving an unspecified number of patients. It was therefore decided that PAEs or identified

risks for PAEs would be connected to specific situations and individual patients; if this was not possible, the incident was categorized as “other.” If there was any uncertainty regarding the categorization process, the incident was discussed by the research group until agreement was reached, resulting in the figures: 357 PAEs, 1150 risks for PAEs, and 799 “other.” Because the units differed in size and type of care (24-hour care or outpatient care), the number of PAEs and risks for PAEs per unit were decided to be calculated per hundred employees rather than per patient care days.

Statistics

Descriptive statistics were used to describe background data and study variables. Categorical data are presented as number and percentage and continuous data are presented as mean (SD) and median (min–max). Pearson χ^2 test was used to compare descriptive data and Mann-Whitney U test was used for pairwise comparisons between the units. The comparison between GC units and non-GC units was performed for both the whole sample and for nursing units and physician units separately. The latter were performed as previous research indicates that patient safety culture and adverse event reporting may differ between different groups of health care professionals.^{18,19} All data were analyzed with SAS/STAT 9.4 software and P values of 0.05 or less were considered significant.

Ethics

The study follows common ethical principles for clinical research regulated by the World Medical Association Declaration of Helsinki (WMA, 2018) and was approved by the ethical review board in Gothenburg, Sweden (Number 069-18).

RESULTS

The data from the 62 units consisted of answers from 1476 staff members. The response rate was 67.4%. Most participants were nursing staff ($n = 1266$, 85.8%). Sex and professions differed between the GC units and the non-GC units (Table 2).

TABLE 2. Comparison Between Units That Work With the GC Method (GC Units) and Units That Do Not (Non-GC Units) of Descriptive Data, Rated Quality and Positive Dimensional Scores From the Patient Safety Culture Measurement Using the Modified S-HSOPSC

Variable	All Units		P	Nursing Units		P	Physician Units		P
	GC Units (n = 46)	Non-GC Units (n = 16)		GC Units (n = 40)	Non-GC Units (n = 10)		GC Units (n = 6)	Non-GC Units (n = 6)	
Staff, n (%)	1221 (82.7)	255 (17.3)	NA	1103 (87.1)	163 (12.9)	NA	111 (55.5)	89 (45.5)	NA
Sex, n (%)			<0.001			<0.001			0.50
Female	1003 (82.6)	176 (70.1)		953 (86.2)	131 (80.4)		50 (46.3)	45 (51.1)	
Male	203 (16.7)	72 (28.7)		145 (13.1)	29 (17.8)		58 (53.7)	43 (48.9)	
Other	8 (0.7)	3 (1.2)		8 (0.7)	3 (1.8)		—	—	
Age, n (%)			0.12			0.57			0.12
≤29 y	145 (12.0)	24 (9.7)		143 (13.0)	22 (13.7)		2 (1.9)	2 (2.3)	
30–39 y	253 (21.0)	53 (21.4)		215 (19.6)	30 (18.6)		38 (35.2)	23 (26.4)	
40–49 y	344 (28.5)	65 (26.2)		303 (27.6)	38 (23.6)		41 (38.0)	27 (31.0)	
50–59 y	317 (26.3)	61 (24.6)		299 (27.3)	44 (27.3)		18 (16.7)	17 (19.5)	
≥60 y	146 (12.1)	45 (18.1)		137 (12.5)	27 (16.8)		9 (8.3)	18 (20.7)	
Staff group, n (%)			<0.001			<0.001			
Nursing staff	1074 (88.5)	134 (53.2)		1074 (97.4)	134 (82.2)		—	—	
Physicians	111 (9.1)	89 (35.3)		—	—		111 (55.5)	89 (45.5)	NA
Other	17 (1.4)	22 (8.7)		17 (1.5)	22 (13.5)		—	—	
Manager supporter/administrator	12 (1.0)	7 (2.8)		12 (1.1)	7 (4.3)		—	—	
Quality on the ward, mean (SD)	78.0 (14.5)	63.7 (25.1)	0.039	77.8 (15.0)	57.6 (28.5)	0.031	79.5 (9.4)	73.8 (15.1)	0.58
Patient safety culture dimensions, mean (SD)									
D1									
Feedback and communication about error	69.6 (17.9)	50.0 (16.9)	<0.001	72.0 (17.1)	44.6 (16.7)	<0.001	52.7 (13.7)	59.1 (14.0)	0.58
D2									
Communication openness	71.2 (10.7)	64.2 (11.2)	0.06	72.2 (10.6)	64.8 (12.3)	0.14	64.6 (8.9)	63.2 (10.1)	0.94
D3									
Executive management support for patient safety	25.7 (11.6)	23.2 (13.4)	0.44	24.8 (10.3)	18.6 (14.3)	0.051	31.9 (18.3)	30.9 (7.6)	0.69
D4									
Nonpunitive response to errors	61.3 (14.5)	50.4 (18.4)	0.04	63.1 (14.0)	56.2 (18.2)	0.31	49.8 (13.8)	40.6 (15.4)	0.23
D5									
Organizational learning-continuous improvement	65.1 (14.5)	48.4 (18.7)	0.002	65.5 (14.6)	38.6 (15.0)	<0.001	62.0 (15.2)	64.7 (11.7)	0.57
D6									
Overall perception of patient safety	52.4 (17.5)	47.3 (15.4)	0.35	54.4 (17.4)	45.1 (18.1)	0.17	38.8 (12.1)	50.9 (9.8)	0.09
D7									
Supervisor/manager expectations and actions promoting safety	64.3 (17.5)	50.9 (23.0)	0.056	66.3 (17.1)	47.4 (27.6)	0.059	50.6 (14.7)	56.7 (12.0)	0.47
D8									
Handoffs and transitions between units and shifts	42.6 (13.1)	28.9 (12.5)	<0.001	44.3 (12.8)	27.8 (9.8)	<0.001	30.7 (8.7)	30.7 (17.1)	0.47
D9									
Information and support to patient/family in case of adverse event	56.3 (15.8)	56.3 (18.3)	0.96	55.2 (15.4)	50.4 (21.0)	0.38	64.1 (18.1)	66.0 (5.3)	0.69
D10									
Staffing	47.6 (18.1)	42.5 (20.5)	0.35	49.4 (17.3)	50.1 (20.9)	0.75	35.5 (20.0)	29.7 (12.9)	0.42
D11									
Teamwork within units	87.7 (8.4)	79.4 (12.4)	0.005	88.4 (8.3)	78.6 (15.3)	0.032	83.7 (8.4)	80.8 (5.9)	0.23

All units and nursing and physician units separately.

Bold data indicates statistically significant.

D, dimension 1–11; NA, not applicable.

Patient Safety Culture

The rated quality satisfaction, based on the single-item question, was significantly higher among staff working in GC units than staff working in non-GC units, 78.0% positive answers compared with 63.7%. When nursing units were analyzed separately, this difference was even more pronounced ($P = 0.031$) (Table 2).

The units that had implemented the GC method rated five patient safety culture dimensions higher than units that had not implemented the method. These dimensions were Feedback and communication about error (D1), Nonpunitive response to errors (D4), Organizational learning-continuous improvement (D5), Handoffs and transitions between units and shifts (D8), and Teamwork within units (D11) (Table 2).

Among the nursing units, the same dimensions were rated higher by the GC units than the non-GC units with the exception of Nonpunitive response to errors (D4). Instead, the dimension Executive management support for patient safety (D3) was rated significantly higher (Table 2). There were no differences between the GC units and the non-GC units among the physician units.

Number of Reported PAEs and Risks of PAEs

The GC units reported risks of PAEs to a larger extent than non-GC units; a mean of 108.5 risks of PAEs per 100 employees was reported in GC units compared with 59.1 risks of PAEs in non-GC units ($P = 0.02$) (Table 3).

When analyzing nursing and physician units separately, the number of risks of PAEs reported in nursing GC units was significantly higher than in non-GC units, whereas there was no difference in the physician units. There was no significant difference in the number of PAEs reported between GC units and non-GC units in the entire sample, nor for the separate professions.

DISCUSSION

This study demonstrates that the implementation of the GC method has had an impact on patient safety culture. The overall patient safety culture quality was rated higher in units that had implemented the GC method than in units that had not. Furthermore, several safety culture dimensions were scored significantly higher by units using the GC method. The frequency of IRs being submitted for risks of PAEs was also higher among these units, which might indicate that the method contributes to a raised perception and increased overall awareness of patient safety. Though not causal, the findings are interesting.

Daily meetings where team members are asked if they have discovered a PAE or risk of a PAE are an essential part of the GC method. These meetings provide an opportunity to mention and discuss incidents that have occurred, but a culture of openness and trust is required for team members to dare to raise them.^{11,13} Several dimensions in the modified S-HSOPSC survey significantly supported that such a culture was more often present in GC units than in non-GC units; Feedback and communication about error (D1), Teamwork within units (D11), and, arguably the most important, Nonpunitive response to errors (D4). A possible explanation for these findings could be that patient safety is on the agenda every day on these units, which both dedramatizes it and encourages team members to speak up about incidents.

The dimension Organizational learning-continuous improvement (D5) was interestingly rated significantly higher in GC units than non-GC units, suggesting that the use of IR systems used outside the GC method do not generate experience from lessons learned in the same way as when they are used together with the GC method. The importance of collecting data in near real time and by the team who knows its context has previously been highlighted.⁶ The GC method incorporates both these factors, which might contribute to this finding. This is in contrast to events reported in the IR system that often are handled by managers or administrative staff at a later time. Visualization of PAEs and risks in the GC template itself (step 2 in Fig. 1) might also call for action to a larger extent than if the event is solely reported in a computer system.²⁰

Organizational learning, together with feedback and communication, is of substantial importance for patient safety improvement (Reason 1997). Although no conclusions can be drawn from this study about improvements at the GC units, it indicates that these units have a higher risk awareness than non-GC units; the number of risks reported into the IR system was significantly higher in GC units.

All organizations are considered to have subcultures and the view of patient safety can vary between them. Shared values, beliefs, norms, and procedures can differ between departments, specialties, and professional groups.^{12,21} When analyzing nursing and physician units separately, it becomes evident that the GC method seems to have had impact on the patient safety culture and IR among staff at nursing units, however, not among physicians. It is possible that different professional subcultures are behind this finding and this would be an interesting subject for further research.

The dimension Executive management support for patient safety (D3) was rated very low by both GC units and non-GC units. This was slightly surprising since the GC method includes steps for follow-up at system level. Previous studies demonstrate that frontline

TABLE 3. Comparison Between Units That Work With the GC Method (GC Units) and Those That Do Not (Non-GC Units) Regarding the Number of PAEs and Risks for PAE Per 100 Employees/Unit, Described for the Whole Sample and Nursing and Physician Units Separately

	Units, n	No. Reported PAE		No. Reported Risks	
		Mean (SD)	P	Mean (SD)	P
Whole sample					
GC units	46	25.6 (30.6)	0.12	108.5 (98.9)	0.007
Non-GC units	16	12.5 (19.2)		59.1 (84.8)	
Nursing units					
GC units	40	27.4 (32.2)	0.36	114.1 (100.2)	0.02
Non-GC units	10	16.7 (23.2)		54.3 (70.2)	
Physician units					
GC units	6	13.5 (12.1)	0.19	33.8 (10.7)	1.00
Non-GC units	6	5.43 (6.49)		82.4 (143.6)	

Bold data indicates statistically significant.

staff are quite aware of what is currently dealt with at the ward level but believe that top-level managers can do more to support patient safety.¹⁹ The GC method does not seem to have an impact here. Though not significant, the trend was that GC units rated the dimension Manager expectations and actions promoting safety (D7) higher than non-GC units did. Managers paying attention to staff perceptions and showing that patient safety is a priority is of importance,²² and the GC method can perhaps support managers in this work. The staff and managers' experiences of the GC method will be addressed in further studies within the GCS.

This study was not without limitations. As the study has a retrospective design, we cannot be sure that the existing differences between GC units and non-GC units may not have a plausible alternative explanation than the GC method.²³ An already strong culture of safety, differences in leadership, or workload might influence results.^{24,25} However, the fact that the dimension Staffing (D10) did not differ significantly between the groups and that all included units operate under one and the same top-level management, and thus, work toward the same patient safety goals is a strength of the study. Another limitation may be the number of units excluded, which might affect the results. The largest reason for exclusion was that less than 10 people per unit had participated in the patient safety culture survey. This exclusion criterion was set to guarantee that no individual answers in the modified S-HSOPSC could be connected to a certain person.

A final limitation is that the PAEs or risks for PAEs reported in the IR system are based on self-reporting. Therefore, it cannot be said with certainty that all incidents occurring during the selected period have been included in the study. Although the GC method is based on a willingness to report incidents, it is an interesting question to ask whether staff record more incidents in the GC system than they later report in the IR system. This will be analyzed further within the framework of the GCS.

CONCLUSIONS

This study demonstrates that the implementation of the GC method has a positive impact on patient safety culture and IR. Units using the GC method scored several safety culture dimensions higher, reported more risks for PAEs, and valued overall patient safety quality higher than non-GC units. However, the method does not seem to have the same impact in physician units as in nursing units, which calls for further investigation.

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REFERENCES

1. Agbabiaka TB, Lietz M, Mira JJ, et al. A literature-based economic evaluation of healthcare preventable adverse events in Europe. *Int J Qual Health Care*. 2017;29:9–18.
2. Schwendimann R, Blatter C, Dhaini S, et al. The occurrence, types, consequences and preventability of in-hospital adverse events - a scoping review. *BMC Health Serv Res*. 2018;18:521.
3. Swedish Association of Local Authorities and Regions (SALAR), Stockholm, Sweden. Skador i vården, 2013-2016. Available at: <https://webbutik.skl.se/sv/artiklar/skador-i-varden-2013-2016>. Accessed August 13, 2019.
4. Stavropoulou C, Doherty C, Tosey P. How effective are incident-reporting systems for improving patient safety? A systematic literature review. *Milbank Q*. 2015;93:826–866.
5. Pham JC, Girard T, Pronovost PJ. What to do with healthcare incident reporting systems. *J Public Health Res*. 2013;2:e27.
6. Vincent C. Incident reporting and patient safety. *BMJ*. 2007;334:51.
7. Latif A, Rawat N, Pustavoitau A, et al. National study on the distribution, causes, and consequences of voluntarily reported medication errors between the ICU and non-ICU settings. *Crit Care Med*. 2013;41:389–398.
8. Ahlberg EL, Elfström J, Borgstedt MR, et al. Learning from incident reporting? Analysis of incidents resulting in patient injuries in a web-based system in Swedish health care. *J Patient Saf*. 2017. doi: 10.1097/PTS.0000000000000343. [Epub ahead of print].
9. Waring JJ. A qualitative study of the intra-hospital variations in incident reporting. *International J Qual Health Care*. 2004;16:347–352.
10. Anderson JE, Kodate N, Walters R, et al. Can incident reporting improve safety? Healthcare practitioners' views of the effectiveness of incident reporting. *International J Qual Health Care*. 2013;25:141–150.
11. Reason J. *Managing the Risks of Organizational Accidents*. New York: Routledge; 1997.
12. Flin R. Measuring safety culture in healthcare. A case for accurate diagnosis. *Saf Sci* 2007;45:653–67.
13. Nieva VF, Sorra J. Safety culture assessment: a tool for improving patient safety in healthcare organizations. *Qual Saf Health Care*. 2003;12(suppl 2):ii17–ii23.
14. Hedskold M, Pukk-Harenstam K, Berg E, et al. Psychometric properties of the hospital survey on patient safety culture, HSOPSC, applied on a large Swedish health care sample. *BMC Health Serv Res*. 2013;13:332.
15. Swedish Association of Local Authorities and Regions (SALAR), Stockholm, Sweden. Att mäta patientsäkerhetskulturen. *Handbok för patientsäkerhetsarbete*. Available at: <https://webbutik.skl.se/sv/artiklar/att-mata-patientsakerhetskulturen-2> Accessed August 13, 2019.
16. Sorra JS, Dyer N. Multilevel psychometric properties of the AHRQ hospital survey on patient safety culture. *BMC Health Serv Res*. 2010;10:199.
17. Kines P, Lappalainen J, Lyngby Mikkelsen K, et al. Nordic Safety Climate Questionnaire (NOSACQ-50): a new tool for diagnosing occupational safety climate. *Int J Ind Ergon*. 2011;41:634–646.
18. Tricarico P, Castriotta L, Battistella C, et al. Professional attitudes toward incident reporting: can we measure and compare improvements in patient safety culture? *International J Qual Health Care*. 2017;29:243–249.
19. Danielsson M, Nilsson P, Rutberg H, et al. A national study of patient safety culture in hospitals in Sweden. *J Patient Saf*. 2019;15:328–333.
20. Nakagawa Y. Importance of standard operating procedure documents and visualization to implement lean construction. In: *13th Annual Conference of the International Group for Lean Construction (IGLC Conference)*. Sydney, Australia; 2005:207–215. Available at: <https://iglcstorage.blob.core.windows.net/papers/attachment-dec14734-5a6b-45b4-90f1-5e35e9535e98.pdf>. Accessed Aug 13, 2019.
21. Vlayen A, Hellings J, Claes N, et al. Measuring safety culture in Belgian psychiatric hospitals: validation of the Dutch and French translations of the hospital survey on patient safety culture. *J Psychiatr Pract*. 2015;21:124–139.
22. Richter JP, McAlearney AS, Pennell ML. Evaluating the effect of safety culture on error reporting: a comparison of managerial and staff perspectives. *Am J Med Qual*. 2015;30:550–558.
23. Polit DF, Beck CT. *Essentials of Nursing Research: Appraising Evidence for Nursing Practice*. 7th ed. Philadelphia: Wolters Kluwer Health/Lippincott; 2010.
24. Gambashidze N, Hammer A, Wagner A, et al. Influence of gender, profession, and managerial function on clinicians' perceptions of patient safety culture: a cross-national cross-sectional study. *J Patient Saf*. 2019. doi: 10.1097/PTS.0000000000000585. [Epub ahead of print].
25. Pousette A, Larsman P, Eklof M, et al. The relationship between patient safety climate and occupational safety climate in healthcare - a multi-level investigation. *J Safety Res*. 2017;61:187–198.