


# BMJ Open Quality **Implementing the patient care collaborative model in three general internal medicine units: a mixed-methods healthcare improvement initiative**

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## ABSTRACT

**Background** As part of the scale-up of the Patient Care Collaborative (PCC) at our institution, we explored staff perceptions and patient outcomes at different levels of model implementation in three general internal medicine units.

**Methods** We conducted a mixed-methods embedded experimental healthcare improvement initiative. In the qualitative strand, we conducted five focus group discussions. In the quantitative strand, we used hospital administrative data to compare outcomes (falls per 1000, median length of stay in days and resource use measured as resource intensity weights (RIW), before and after the implementation of the PCC, using  $\chi^2$  tests, Wilcoxon's rank sum tests and interrupted time series analyses.

**Results** Staff showed considerable knowledge and acceptance of the PCC but expressed mixed feelings with regards to patient safety, workload, communication and teamwork. Staff perceptions varied by level of implementation of the PCC. A number of falls (overall) in the full implementation phase were not significantly different from the preimplementation phase (227 per 1000 vs 200 per 1000;  $p=0.449$ ), but the number of moderate to severe falls dropped (12 vs 2 per 1000);  $p<0.001$ ). Median length of stay (5 vs 6 days;  $p<0.001$ ) and resource use were lower (0.1 vs 0.4;  $p<0.001$ ) in the full implementation phase compared with the preimplementation phase. The trend analyses showed differences across units.

**Conclusions** The PCC was moderately well adopted. Perceptions of the PCC among staff and patient outcomes are likely linked to the levels of implementation. The PCC resulted in improved safety, shorter hospital stays and lower costs of care.

## BACKGROUND

Organisation of nursing care or nursing care coordination is critical to improving quality of healthcare, and has been proposed as a solution to high costs of healthcare, uneven quality of care and suboptimal patient outcomes.<sup>1</sup> It depends on the availability of human resources, funding, leadership beliefs and evidence for the effectiveness of care models. Traditionally, four models have been used in inpatient hospital care:

functional nursing, team nursing, total patient care and primary nursing care. The first two use a mix of nursing personnel and are task oriented while the last two are patient oriented and rely only on registered nurses (RNs).<sup>2,3</sup> In recent years, more care delivery models have emerged using various combinations of licensed and unlicensed nursing personnel.<sup>4</sup>

The College of Nurses of Ontario (CNO) suggests a key priority in safe and effective care delivery is to ensure the nurse is practising within their legislated scope of practice. To achieve this, an established practice of appropriate assignment of patients to the appropriate category of nurse is required. The CNO RN/Registered Practical Nurse Utilisation Guideline describes a 'Three Factor Framework' which includes essential considerations to assignment determination: patient, nurse and environment.<sup>5</sup> The Canadian Nurses Association also provides similar guidance in skill mix decision making and care delivery models.<sup>6</sup>

In developing a model of care delivery, both regulatory and patient population needs must be considered. Considerations include the need to maximise the scope of practice of RNs and registered practical nurses (RPNs); reflect the need for careful assignment of patients based on acuity and predictability of patient outcomes; engage staff in the process; provide for adequate training and leadership involvement; and carefully monitor or evaluate the impact on nurse sensitive and other patient outcomes and resources.<sup>7-9</sup>

Previously, there was a paucity of evidence on which care models work best, notably due to the lack of rigour in their evaluation and the fact that they limit their outcomes to nurses perceptions, leaving out patient safety measures.<sup>4</sup> More recently, evidence from

randomised trials indicates that there are benefits in using patient care collaboratives (PCC).<sup>10</sup>

In 2014, the introduction of a new nursing model—The PCC model—across three general internal medicine (GIM) units at our institution, provided an opportunity to review the existing model of care delivery to reassure nursing staff that the skill mix was appropriate to meet the acuity and safety needs of patients and their caregivers.

We; therefore, sought to investigate nursing staff perceptions on the implementation of the PCC model, and patient safety and resource use outcomes. The purpose of this report is to inform decision making with regard to nursing care models by outlining nurse perceptions and patient outcomes in units implementing the PCC to various degrees.

### Research paradigm

Pragmatism, a research paradigm in mixed-methods research that focuses on ‘what works’ is well adapted to this topic and very relevant to healthcare improvement, as it allows the researcher to incorporate diverse perspectives and link subjective and objective knowledge.<sup>11 12</sup>

### Why mixed methods

Mixed methods are an effective investigative approach for complex research questions and readily incorporate qualitative and quantitative data to offer a more complete picture. They are suited to research questions that cannot be addressed by either qualitative or quantitative approaches used singly.<sup>13 14</sup>

### Research questions

This report was guided by qualitative, quantitative and mixed research questions.

#### Qualitative research questions

1. How do nursing staff perceive the implementation of the PCC model?
2. How does the implementation of the PCC model affect perception of patient safety, workload, communication and teamwork?

#### Quantitative research questions

1. Does the implementation of the PCC model reduce patient falls, length of stay and resource utilisation?
2. Do outcomes vary by level of implementation?

#### Mixed research questions

1. What is the relationship between staff perceptions of the PCC model and patient outcomes?
2. What are the links between the qualitative and quantitative findings?

## METHODS

### Design and rationale for design

We employed an embedded experimental design. This design entails an experimental quantitative before–after phase, during which a qualitative phase is embedded. This is the design of choice for determining the mechanisms

involved in particular outcomes, for example, the failures or successes of the PCC model.<sup>12 15</sup> This work is reported using Standards for Quality Improvement Reporting Excellence guidance.<sup>16</sup>

Participants in the qualitative phase provided written informed consent prior to participation.

### Setting

#### Our institution

Our institution is a large multisite hospital. The campus where this study was conducted provides full-service emergency acute and surgical care in addition to inpatient and outpatient diagnostic services. This campus has over 700 staffed and operational beds and a work force comprising 64% of RNs who are full-time employees.

#### The current model

In the current all-RN care delivery model, staff were assigned total nursing care for a predetermined number of patients (ratio of 1:5 on day shifts and 1:5–1:7 on night shifts). Medical and therapeutic staff collaborated during transfer of information to nurses and change of shift which provided break relief. Nursing leadership of the units included a manager and charge nurse during daytime hours. However, there were limited leadership and mentoring opportunities. It is widely recognised as an efficient model given that one dedicated nurse can identify and resolve patient problems and improve health outcomes but can be financially limiting and resource intensive.

Based on the projected needs of the unit during this time of change, a new collaborative model of nursing care had the potential to:

- ▶ Support the implementation of skill mix.
- ▶ Provide an opportunity to maximise the leadership and mentoring skills of existing and new staff.
- ▶ Clarify roles and responsibilities.
- ▶ Provide opportunities for education and leadership for experienced nurses.
- ▶ Ensure that assignments were appropriate to the acuity and safety needs of patients.

#### The PCC model

The PCC model was implemented in three GIM units: Clinical Teaching Unit (CTU), CTU West (CTUW), CTU Central (CTUC) and Cardiology (DCD). It included groups of (RNs) and RPNs (four to five) each of whom were assigned patients based on their stability and the predictability of their outcomes. Each PCC had one assigned Collaborative Captain. The assessment of acuity that informs assignments was measured by a Collaborative Captain and the unit charge nurse before each change of shift using an adapted ‘Patient Care Needs Assessment Tool’.<sup>17</sup> In these three units, the levels of acuity were comparable.

Although the global staff-to-patient ratio did not change in this model, a redistribution of patient assignments reduced the number of patients assigned to the

**Table 1** PCC components implemented in each unit

PCC elements implemented	CTU-W	CTU-C	DCD
RNs and RPNs assigned a cluster of up to 18 patients	✓	✗	✓
A dedicated team RN Captain with less patient assignment	✓	✗	✗
Assignment of patients based on patient acuity	✓	✓	✗
Structured communication (planned huddles within PCCs and between PCCs)	✓	✗	✗
Review of roles and responsibilities—this should be first	✓	✗	✗
Coordinated meal and comfort rounds	✓	✓	✗
Dedicated staff break schedule	✓	✓	✓

CTU, clinical teaching unit; CTUC, CTU Central; CTUW, CTU West; DCD, CTU Central and Cardiology; PCC, patient care collaborative; RNs, registered nurses; RPNs, registered practical nurses.

Collaborative Captain, thus facilitating their availability to support other members of each PCC. Communication among the PCC about changing patient care needs and system challenges was a key priority for the Captain throughout the shift. Different aspects of the model were employed at the different units. [Table 1](#) outlines the key features of the model as deployed in the three GIM units.

### Sampling

Qualitative data were collected from administrative hospital records. In the qualitative strand, participants were purposefully selected from the three GIM units. The number of groups and participants per group was determined by the number of available staff in the GIM units. In order to allow for a variety of perspectives, the different professions, units in the GIM and the number of staff on each unit were considered. For good productive sessions, groups were limited to two to six participants and a few one-on-one in-depth interviews.

### Data collection

#### Quantitative data

Hospital records were drawn from the three GIM unit for three periods: 4 months before the introduction of the PCC model, 3 months of introduction of the model and then for 15 months of implementation (22 months in total). Sociodemographic data such as age and gender of the patients in the units, safety data (falls), length of stay and resource intensity weights (RIW) were collected.

#### Qualitative data

Focus group discussions (FGDs) were conducted for about an hour each. Refreshments were provided. Two moderators led the FGDs, with one taking notes.<sup>18</sup> The questions, which were the same for each professional group, were open ended permitting the participants to explore the topics in question.<sup>19</sup> There were slight changes to wording for questions to apply across all disciplines. The order of questions remained the same for all focus groups to allow for comparability across all groups.<sup>20</sup>

### Data analysis

#### Quantitative data

Baseline characteristics are reported as counts (%), mean (SD or median (minimum; maximum (min; max))). We made direct comparisons of outcomes between periods 1 (preimplementation) and 3 (full implementation) using  $\chi^2$  tests for categorical variables and the Wilcoxon rank sum test for continuous variables. The variables of interest were falls (calculated as the number of patient falls divided by the number of patients at risk  $\times$  1000), length of stay and (RIW; a Canadian system for measuring hospital resources consumption).<sup>21</sup> We performed interrupted time series analysis using autoregressive integrated moving average models to evaluate changes over time that were attributable to the intervention. The models included terms to evaluate the following variables: a constant to represent level of outcome at baseline (before the intervention), a term for linear trend before the intervention, a term for change in level of the outcome after the intervention and a term for change in trend after the intervention. We used the Ljung-Box Q test to assess autocorrelation, where p values of less than 0.05 indicate the presence of autocorrelation. We report Beta ( $\beta$ ) coefficients, SEs, the t-test statistic and p values. Negative  $\beta$  coefficients indicate reductions over time. Model fit was assessed using the  $R^2$  statistic. We plotted graphs of the outcomes over time to illustrate trends. Statistical significance was set at  $\alpha < 0.05$  for all analyses. Statistics were conducted using SPSS V.25 (IBM).

#### Qualitative data

Qualitative data analysis was conducted using an open coding method.<sup>22</sup> Similar phrases and words were categorised under more abstract concepts or categories.<sup>22</sup> Transcripts were typed, then open coding began for each focus group. Once the open coding was complete, the data were placed into categories from all the focus groups achieving intergroup comparisons. This was done using a computer word processor that could change font colour of text and allowed for copying and pasting to move data under the categories.

### Validation checks

In the qualitative strand, member checking was used to verify the accuracy of the data. Coding was done in duplicate and revised by several coders. In the quantitative strand, data were collected from hospital administrative records, precluding selection bias, refusal to participate, drop-outs and recall bias.

## RESULTS

### Qualitative results

#### Participants

Each focus group varied in size and composition. A total of five focus groups (37 participants) ranging from two to six participants were conducted. All the participants were female. The majority were RNs (n=21), followed by unit communication clerks (UCC; n=7), RPNs (n=5), physical therapists (n=3) and occupational therapists (n=1). Although most participants were fully invested, some needed to be encouraged by the moderator to engage in discussions. However, the in-depth interviews were very successful. The strongest themes that emerged from these discussions were: model components and implementation, collaboration, staff mix, captain guilt, communication and acceptance.

#### Model components and implementation

Certain components of the model were identified in the focus groups: captain or team leader, huddle, UCC, PCC or pod, partner or buddy, comfort rounds, medicine rounds, break times and binders for the information about the PCC. However, knowledge about these components was not uniform, with some units being able to identify different sets of components. These differences reflected the different levels of implementation across units. At least one person in one unit did not even know the PCC model had been implemented. Another participant (MD) acknowledged the model but did not notice any major changes in care delivery. This happened in the units where the PCC was not fully implemented.

Details regarding the daily set up of the PCC model were reported uniformly among the RNs and RPNs across units. However, the team captain roles and responsibilities varied across units and could involve running a morning huddle with the pod, reviewed the patients on the floor, supporting patient flow, mentoring and supporting new staff, helping pod members complete comfort rounds, assisting with higher acuity patients and discussing safety issues. Thus, it was generally perceived as 'assistance' rather than 'taking over' the patient. The staff on one unit felt the staff/patient ratio did not work for their unit and worked in pairs. Break time was taken in turns between the RPNs and the captain.

Terminology relating to the PCC model came up often. Some teams exercised caution with regards to the terms used. For example, in some units the term 'team leader' was used as opposed to 'Captain'. Likewise, some units preferred 'partner', 'buddy' or pod to refer to colleagues.

### Collaboration

A common theme across most focus groups although in different contexts was collaboration, teamwork and support. The PCC allowed staff to take breaks. In the DCD unit, some staff thought collaboration led to too many people working on the same patient, dissatisfaction of patients who liked familiar faces, uncertainty with which patient orders had been met and some staff not getting breaks. They felt the model had a negative impact on patients and that their unit (DCD) was too small to use it.

The CTUC staff feel that there was no teamwork between the RNs and RPNs. The RPNs feel '...silly...' asking for help from an RN and patient load was not balanced.

In the third unit CTUW, where all key elements were implemented successfully, there was a feeling of understanding patients better, thus facilitating discharges and patient care, with better organised breaks. The captain was an extra pair of hands and there were fewer call bells. The non-nursing groups also recognised more teamwork and knowledge of patient need. There was a perception of more nursing presence during rounds and family meetings and higher patient satisfaction.

'... I see CTU West staff at the desk more, whereas CTU Central and DCD are always all over the unit, I see this as the patients on CTU West have their needs met...'

### Staff mix

This theme was prominent in all the focus groups. The nursing staff felt that the younger staff socialise more and are less likely to assist pod members, requiring the captain role to rotate for efficiency, as opposed to a fixed captain being chosen. The success of the model was dependent on the captain, as the captain influences breaks, assistance, communication, completing orders and level of engagement. The model is also dependent on the nurse in the pod who may or may not delegate tasks. Some units acknowledged that a highly acute pod prevented the model from working effectively since the captain cannot assist if they have an acute patient. The decision of UCCs to either identify and page staff if urgent or leave the chart flagged affected workflow.

### Captain guilt

In some instance, the captains missed breaks to ensure the model worked and other pod members could have breaks. Some described it as a form of mentorship with the captain always feeling responsible for all the patients in a pod.

'...a very overwhelming position to be in, and it is often a role that is taken advantage of...'

However, this occurred in the unit that did not review roles and responsibilities or implement the lesser patient



**Table 2** Summary of quantitative data

GIM ward	Preimplementation	Introduction	Full implementation	Total	Test statistic	P value*
Falls (rate per 1000 patients at risk)						
CTUC	51	66	53	170	0.006	0.937
CTUW	51	102	108	261	8.220	0.004
DCD	98	221	66	385	1.699	0.192
Total	200	390	227	817	0.573	0.449
Moderate to severe injury falls (rate per 1000 patients at risk)						
CTUC	21	0	2	22	14.119	<0.001
CTUW	7	0	4	11	0.594	0.441
DCD	8	8	0	15	44.871	<0.001
Total	12	1	2	15	52.262	<0.001
Length of stay (days): median (min, max)						
CTUC†	6 (1, 74)	6 (1, 115)	5 (1, 128)	5 (1, 128)	214260	<0.001
CTUW	6 (1, 61)	5 (1, 102)	5 (1, 173)	5 (1, 173)	319460	<0.001
DCD†	6 (1, 87)	6 (1, 124)	5 (1, 91)	6 (1, 124)	90035	<0.001
Total	6 (1, 87)	6 (1, 124)	5 (1, 173)	.	1770300	<0.001
Resources intensity weights (per month): median (min, max)						
CTUC†	0.4 (0.1, 4.3)	0.4 (0.1, 8.1)	0.1 (0.01, 3.9)	0.1 (0, 8.1)	224750	<0.001
CTUW	0.4 (0.1, 2.1)	0.3 (0.1, 4.7)	0.1 (0.01, 2.8)	0.1 (0, 4.7)	335570	<0.001
DCD†	0.4 (0.1, 5.7)	0.4 (0.1, 4.4)	0.1 (0.01, 2.4)	0.1 (0, 5.7)	93532	<0.001
Total	0.4 (0.1, 5.7)	0.3 (0.1, 8.1)	0.1 (0.01, 3.9)	.	1854400	<0.001

\*P value for comparison between period 3 and 1.

†Missing data  $\leq 5$ .

CTUC, clinical teaching unit central; CTUW, clinical teaching unit west; DCD, CTU Central and Cardiology; GIM, general internal medicine.

assignment for the captain, making it closer to the team nursing model.

### Communication

There were different views on communication. The RNs on CTUW felt that Kardex's were not updated properly and led to miscommunication. RPNs in one unit thought the communication was stronger between the PCC group, the captain and rounds. Some felt the strong communication was inherent to the unit and not directly related to the PCC model. In all the units, the RNs did not think it was appropriate to tell an RPN a patient was not appropriate for them, especially if the RPN did not seek assistance. Some nurses (UCCs) noted improvements in communication with regards to diagnostics (one call after the huddle for all patients) and shared information (they start the day knowing who will be discharged). Allied nurses, who were not involved in huddles did not notice any changes on communication and felt that instead of paging the Medical Doctors (MDs), problem lists should be used during rounds.

### Acceptance

The RNs one unit (CTUW) felt that they were asked to be part of a working group and readily embraced the new model.

In another unit (CTUC), the staff admitted reluctance to accepting the PCC model but later accepted it with a modified version of the Captain role.

In the third unit (DCD), despite accepting the model, they felt their unit was too small to fully implement the model. Some RPNs were interested in participating in further development of the PCC model. MDs accepted the model and wanted to be involved in the communication component, but not the other parts. UCCs wanted to be involved in the huddles.

## Quantitative results

### Participants

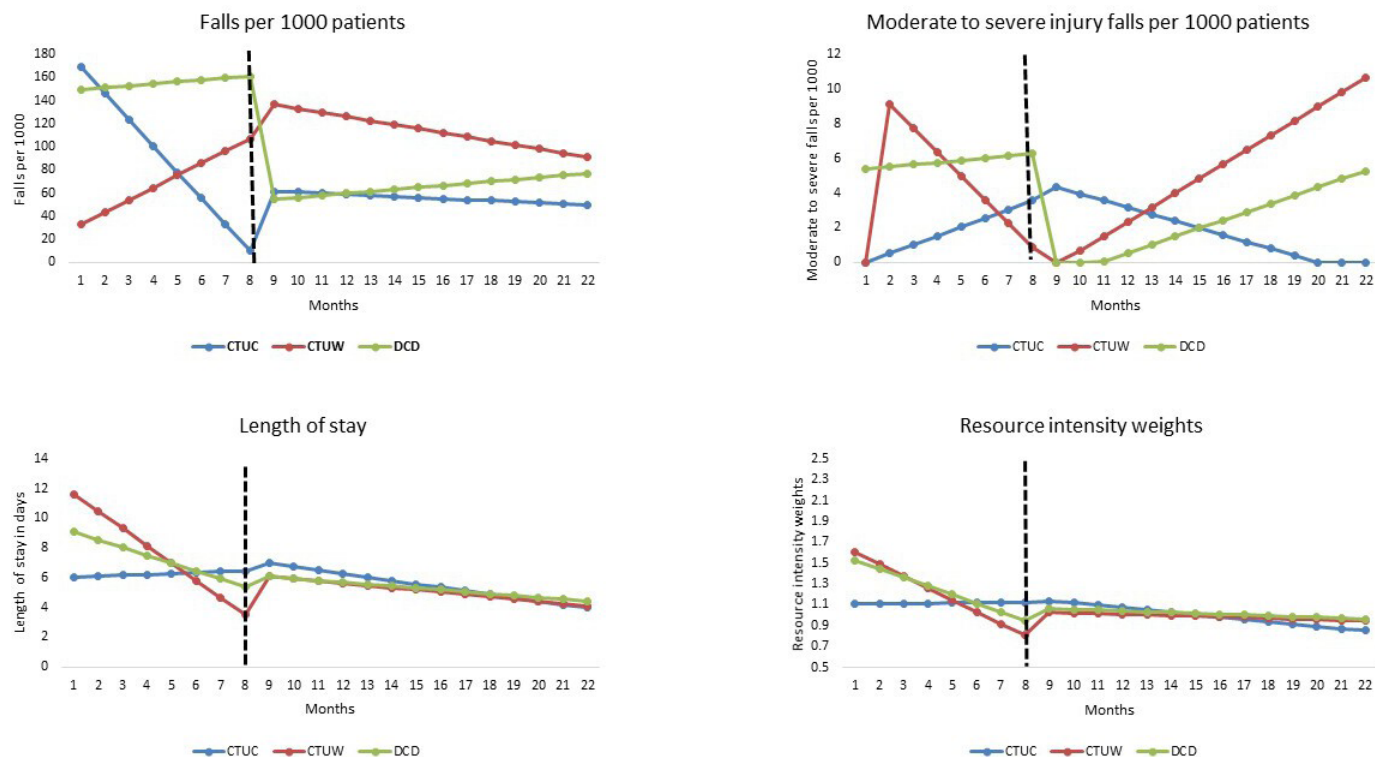
A total of 3246 patients were admitted in the three GIM units during the study period (CTUC: 1667; CTUW: 1848; DCD: 1004). The age and sex distributions were similar and reported in online supplementary file.

### Falls

There was no difference in all falls, between the full implementation and preimplementation phase ( $\chi^2=0.573$ ;  $p=0.449$ ). However, the number of moderate to severe falls reduced across all units dropped from 12 to 2 per 1000 ( $\chi^2=52.262$ ;  $p<0.001$ ). The interrupted time series revealed a postintervention drop in all falls in the DCD unit ( $p=0.002$ ) (see online supplementary material).

### Patient flow and resource utilisation

Median length of stay per patient was shorter in the full implementation phase for all GIM wards ( $W=1770300$ ;  $p=0.002$ ). Median RIWs per month were also lower in the full implementation phase overall ( $W=1854400$ ;



**Figure 1** Trends in outcomes in three general internal medicine units after implementation of the PCC model. CTUC, clinical teaching unit central; CTUW, clinical teaching unit west; DCD, Cardiology; PCC, patient care collaborative.

$p < 0.001$ ). The interrupted time series revealed a drop in median length of stay in the CTUW ( $p = 0.003$ ) and DCD ( $p < 0.014$ ) units but no postintervention trend. We also found a drop in resource use (RIW) in the CTUW ( $p = 0.004$ ) and DCD units ( $p < 0.001$ ). Direct comparison outcome data are presented in [table 2](#).

The full interrupted time series models are reported as online supplementary material. The predicted values for all outcomes are shown in [figure 1](#).

## DISCUSSION

In this healthcare improvement initiative, we found considerable knowledge among staff about the PCC and the various model components, and the interplay between allocated tasks and roles as part of the team. Staff recognised enhanced collaboration and support, alleviating some burdens, but there were also disruptions in perceived hierarchies between RPs and RNs where roles and responsibilities were not redefined. Staff mix was an important component for success with younger staff appearing to socialise more and being less supportive of the group. However, the captain held the reigns of the team and fewer patients assigned determined success. Captains with fewer patients assigned were able to coordinate, mentor and facilitate collaborative work and communication. Adequate communication was perceived to be critical, but not necessarily related to the PCC, rather inherent to the unit—some units had a strong communication culture. The PCC was widely accepted and there

was collective willingness to work towards improving the model.

Overall, during the implementation of the PCC model, there was no difference in the number of falls (overall), but a reduction in moderate to severe falls, shorter hospitalisations and less resources used. There were differences across units which reflect the number and type of model components implemented, the staff mix and the unit culture. These issues were raised in the qualitative phase.

PCC models have been used extensively to care for patients with depression and have led to improved outcomes in the long and short term.<sup>23</sup> They have also been shown to reduce cardiovascular risk in patients with diabetes,<sup>24</sup> and to improve satisfaction and access to care in patients with kidney disease. These improvements in outcomes are often accompanied by reduced costs.<sup>25</sup> In this study of GIM units, we noted significant reductions in resource use and length of stay.

The PCC model combines the strengths of individual and team models and allows for the use of both categories of nurses and retains the assigned nurse's accountability to address problems throughout the continuum of care. The level of collaboration in the provision of each patient's care may vary based on changing patient needs and staff experience based on the CNO Three Factor Framework.<sup>5</sup>

However, the suitability of this model to other units with higher acuity or institutions with a different staff mix cannot be ascertained from this work. As noted above, the PCC model blends group and individual strengths in

patient care but how it is implemented depends on staff experience, institutional culture and patient needs. There may be barriers to implementing the PCC model. In our case, we estimated that it took 3 months of introduction for any of the components to be fully implemented. These barriers stemmed from difficulties in understanding the model components and how to implement them; navigating staff mix issues (based on level of experience or age), higher levels of responsibility for the team captain, the need for more communication and staff reluctance to accept a new model of care.

This study is not without limitations. Given the observational nature of the study and the use of administrative data, we were unable to control for potential confounders related to seasonal variation, unit workload and staff composition. Noteworthy, is the fact that administrative records do not often capture quantitative details on certain PCC model outcomes such as huddles, mentoring and assistance provided. Future research may address some of these limitations by using trial-based research designs to explore the effects of the PCC model.

However, using each unit as its own control makes the comparisons more consistent. In addition, the adoption of a mixed-methods design blends the depth of qualitative information with the quantitative findings and gives better understand of the PCC model. The consistency of some findings between the direct comparisons and time series analyses lend more credibility to these findings.

## CONCLUSIONS

The PCC was well received and adopted by nurses in GIM units to varying degrees. There were mixed feelings regarding patient safety, workload, communication and teamwork, dependent on the levels of implementation and team dynamics. The implementation of the PCC model reduced moderate to severe patient falls, reduced length of stay and resource utilisation in all units. The PCC led to better care and lower costs during its implementation.

**Contributors** KL, EB, CG and DJ conceived of the study. LM, EB, CG, GA and JN supported the design of the study. JC collected qualitative data. GA and JN collected quantitative data. JC and MM analysed qualitative data. TV and LM analysed quantitative data. JC wrote the first draft of the qualitative data; revised by MM. LM wrote the first draft. KL, JN, MM and DJ reviewed several versions of the manuscript. All authors (KL, JC, EB, CG, DJ, GA, JN, MM, TV and LM) reviewed and approved the final version. LM and KL are the guarantors and are responsible for overall content.

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**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

**Patient consent for publication** Not required.

**Ethics approval** This work was conducted as a quality improvement initiative as per our ethics review board and is therefore considered exempt from ethics review.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data may be obtained from a third party and are not publicly available.

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