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Abstract

Background

The safety and effectiveness of same day discharge following percutaneous coronary intervention is well demonstrated; however, the uptake of this model of care is low.

Purpose

The aim was to examine the effectiveness of implementing same day discharge using a process evaluation methodology.

Methods

This study was undertaken in a cardiac services department of a tertiary teaching hospital in southeast Queensland, Australia. It was anticipated before the implementation that 120 patients could be discharged the same day in a 6 months' time. Patient flow and guideline adherence were assessed alongside patients' and relatives' satisfaction. Data were collected from onsite observation, field notes and surveys.

Results

During the 6 months of implementation, 22 patients were discharged home the same day. It was found that staff did not follow the guideline consistently with an overall adherence of 77.3%. Despite this, nearly all patients and relatives expressed high satisfaction with the discharge experience.

Conclusion

The uptake of same day discharge was low in this implementation. Although small sample was included, this study is important as it provides direction for future improvement both in the criteria and the implementation process.

MeSH terms

Percutaneous coronary intervention, patient discharge, length of stay, guideline adherence, patient satisfaction

INTRODUCTION

The introduction of new models of care within health care organizations involves multiple changes to care provision and organizational structures, which might be influenced by internal and external factors.¹ In cardiac services, same day discharge (SDD) following percutaneous coronary intervention (PCI) has emerged as a model of care to increase bed availability and hospital resource efficiency,² and consequently improve cost effectiveness^{3,4} and patient satisfaction.^{4,5} Traditionally patients undergoing PCI have been kept in hospital overnight for observation, therefore discharging patients home the same day of the PCI will offer an opportunity to reduce length of stay and improve patient throughput. Although SDD has been shown to be safe and feasible,⁵⁻⁷ its uptake within health services worldwide has been variable. While there is a growing body of literature describing the impact of SDD on patient and health service outcomes,⁵⁻⁸ the process of implementing SDD has not been well described in literature and there is little information available⁹ to inform clinicians wanting to implement this model of care. To address this gap in the literature, we undertook this process evaluation study aimed to evaluate the implementation of SDD as a new model of care in the cardiac service of an Australian tertiary teaching hospital.

METHODS

Design

This is a convergent parallel mixed-methods design study, in which quantitative and qualitative approaches are considered as equally important.¹⁰ This paper only reports on quantitative aspect of the study. A detailed analysis of qualitative data about what helps and hinders enactment of SDD will be reported elsewhere. The study was informed by the United Kingdom (UK) Medical Research Council (MRC) process evaluation of complex interventions.¹¹ The UK MRC defines complex interventions as comprising multiple and inter-linking strategies that endeavor to take a ‘whole of problem’ approach to health issues.¹²

Both the intervention (SDD) and strategies for its implementation were considered complex interventions because they required a range of interactive components to address factors such as individual level knowledge, attitudes and beliefs, organizational processes and resources.¹² While outcome evaluation is important as it can determine whether an intervention (SDD) succeeded or not, process evaluation can help understand what really contributed to outcomes and appropriately interpret findings as well as can facilitate to identify aspects of intervention that could be refined to optimize its effect.¹³

Setting

This study was conducted in an 18-bed short-stay unit in a cardiac catheterization laboratory of a 750-bed tertiary teaching hospital located in southeast Queensland, Australia. The SDD guideline was developed by nursing and medical leaders from the cardiac service and implemented by the senior nursing management team. The research team was responsible for conducting a process evaluation of the implementation. Ethical clearance was granted by the Human Research Ethics Committees (HREC) of the hospital (HREC/15/QGC/180) and the university (NRS/48/15/HREC). Written consent was given by participants who participated in surveys.

Participants

All outpatients who were scheduled for angiogram with or without planned PCI between June and December 2016 and assessed to have met eligibility of SDD before procedure were invited to participate in the study. Based on historical hospital record, it was estimated that 120 patients would be discharged home the same day of the procedure within 6 months. Patients' relatives were also invited to participate.

Same day discharge process

Patient eligibility for SDD was assessed against the inclusion criteria by hospital staff at 3 points (before, during and after the procedure). These eligibility criteria guided the clinicians' decisions about whether a patient could be discharged the same day of the PCI procedure (Figure 1 as Supplemental Digital Content). Firstly, all outpatients were assessed for SDD eligibility in the pre-admission clinic before the procedure. Then during the procedure, the cardiologist needed to confirm that the procedure was successful and the procedure was performed via radial access as requested by the SDD guideline. After the procedure, patients were observed for 4 hours in the short-stay unit and sent home the same day if no complications arose during this observation period. As per SDD guideline, all SDD patients were to receive a follow-up phone call from a nursing staff working in the laboratory within 24 hours of discharge.

Modifications to the inclusion criteria and process were made 4 months after implementation commenced. These modifications included offering SDD to patients who were over the age of 80 years if considered appropriate, who had procedure performed on Fridays where an advanced trainee (senior medical officer) was responsible for conducting the next-day phone follow-up.

Data collection

Data collection techniques included onsite observation, field notes and surveys. During the 6-month implementation, the researcher (YC) made field notes through onsite observations and assessed eligibility for SDD of all patients undergoing PCI. The number of patients undergoing PCI was documented along with eligibility for SDD before, during and after the procedure. Importantly, staff's adherence to the guideline for those SDD patients was evaluated using pre-determined key performance indicators following discussions with

her supervisors. These 8 indicators included electrocardiography being attended, follow-up appointment with a cardiologist being made, being seen by a cardiac rehabilitation nurse and a pharmacist, discharge information given to patients, complete discharge paperwork given to patients, electronic medical record entry being by senior medical officer and next-day phone follow-up being conducted. Additionally, any variations to the guideline were recorded.

Phone surveys were used to evaluate patients' and relatives' experience of SDD. Patients and relatives were called by the researcher (YC) within 24 hours of discharge to ask about their satisfaction on SDD process when their memories of the SDD process were still fresh. The first section of the surveys included demographic information and simple questions such as preferences for SDD with "Yes" or "No" as answers. The second section was a 5-point Likert-type patients' and relatives' satisfaction scale towards SDD process when they responded the questions with "Yes". The full versions of satisfaction surveys can be obtained from the first author upon request.

Data analysis

Patient selection process diagram was developed starting from how many patients in total coming to the laboratory for the procedure to how many patients who were discharged the same day of the PCI. All other quantitative data including SDD compliance and survey data were analyzed using IBM SPSS Statistics for Windows (Version 22.0 Armonk, New York: IBM Corp). Data double entry was conducted for accuracy with an error rate of zero. Data were then analyzed descriptively, with continuous data as mean $\pm$ standard deviation (SD) if data were normally distributed and median $\pm$ interquartile range (IQR) if not normally distributed as well as categorical data as numbers (percentages).

RESULTS

Patient selection

During the 6-month implementation period, a total of 1,035 cardiac interventional procedures were performed on 1,000 patients (Figure 2 as Supplemental Digital Content). Of these, 342 PCIs were performed on 308 patients. Among 308 patients, 12 patients were admitted twice and had 1 PCI on each admission; 22 patients had 2 PCIs during the same hospital admission. Of the 308 patients who underwent PCI, 258 were ineligible for SDD prior to the procedure. The remaining 50 patients who had PCI were determined as eligible prior to the procedure including 47 patients who met the eligibility criteria and 3 patients who did not meet established eligibility criteria but considered eligible. Of these 50 patients, only 22 patients were sent home the same day of the procedure. The remaining 28 patients who were initially deemed eligible for SDD at the outpatient clinic were admitted for overnight stay (ONS).

SDD patients were slightly older than those who were admitted for ONS with mean age 65 ± 7.8 vs 62 ± 10.9 . A higher proportion of male patients in SDD group ($n=20$, 90.9%) were observed than in ONS group ($n=20$, 71.4%) and a higher percentage of patients were in a committed relationship in SDD group ($n=16$, 72.7%) than in ONS group ($n=19$, 67.9%).

Same day discharge guideline adherence

Adherence to the SDD guideline was assessed throughout the 6-month implementation period (Table 1). The areas of the guideline for which there were the highest rates of adherence for SDD patients included electrocardiography being attended to, follow-up appointments with a cardiologist being made and being seen by a cardiac rehabilitation nurse and a pharmacist prior to discharge. The areas of the guideline with poorer compliance were in discharge preparation and next-day phone follow-up. Guideline adherence was variable without signs of improvement during the 6-month evaluation period and ranged from 62.5-100.0%. The overall adherence rate for post PCI care was 77.3%.

Insert Table 1 here

Based on field notes taken during observation of clinical practice, it was observed that physician preference and individual clinical decision making contributed to variations on how the SDD guideline was enacted. One such example of guideline deviation was the offering of SDD to inpatients (n=11) although only 3 of 11 patients were discharged home the same day after the procedure. A total of 2 outpatients were discharged home the same day determined by physicians despite renal function being outside the established parameters for SDD eligibility.

Patients' and relatives' satisfaction towards same day discharge process

Of the 50 patients who received PCI and who were determined as eligible for SDD prior to the procedure, 44 consented to completing the survey on satisfaction. Patients were surveyed regardless of whether they continued to remain eligible for SDD (19 SDD patients and 20 ONS patients). Data for 5 patients were unavailable because they were either unable to be reached (n=3) or missed by the research team (n=2). Overall, 29 relatives consented to the study, with 27 completed surveys (16 SDD relatives and 11 ONS relatives); 2 relatives who were not contactable did not contribute data.

Although fewer than 2/3 of SDD patients and relatives received explanation of possibility of SDD prior to coming to the hospital and only half were involved in the decision to go home the same day of the procedure, they were satisfied with the SDD experience (Table 2 as Supplemental Digital Content).

DISCUSSION

To our knowledge, this is the first paper to report a process evaluation of SDD as a new model of care. Before the study it was estimated that approximately 120 patients would be discharged home the same day within a 6-month period. This process evaluation has demonstrated that far fewer patients met the SDD inclusion criteria and consequently there

was unlikely to be a substantive impact on anticipated outcomes such as reduced average hospital length of stay and decreased health care costs. The main reason for the reduction in the number of potentially eligible patients was that the criteria used in the guideline were more conservative compared to what is currently reported in the literature; as a result, many patients were excluded such as including those who were currently hospitalized, had an estimated glomerular filtration rate (eGFR) below 60 ml/min, or had the procedure performed via femoral access.

Of all patients undergoing PCI, 70.1% (216/308) were inpatients and were consequently deemed ineligible. Inpatients who had PCI often present with acute coronary syndrome (ACS).¹⁴ ACS describes a spectrum of clinical presentations ranging from unstable angina to myocardial infarction, with symptoms such as prolonged chest pain (> 20 minutes) which is almost always associated with a rupture of an atherosclerotic plaque leading to partial or complete thrombosis of the infarct-related coronary artery.¹⁵ These ACS patients are often loaded with aggressive antiplatelet and antithrombotic medications to avoid worsened ischemic outcomes¹⁵ and concerns about discharging these patients the same day of the procedure often relate to stent thrombosis and access site bleeding.^{6,7} However, advances in equipment design and procedural technique have significantly increased the safety and decreased complications associated with PCI.² Several studies have demonstrated the safety of SDD for most ACS patients.^{2,6,7} For instance, a recent analysis of PCI registry data showed that out of 1,530 patients who were SDD, 775 (50.7%) and 43 (2.8%) were presented with unstable angina and non-ST-elevation myocardial infarction respectively with a very low re-admission rate (0.9%) within 24 hours following discharge.² This suggested that SDD can be safely applied to many ACS patients.

An eGFR below 60 ml/min was the second most common reason patients were excluded from SDD in our study. This criterion is line with the recommendations from the

Society for Cardiovascular Angiography and Interventions/American College of Cardiology (SCAI/ACC) guidelines.¹⁶ The eGFR, used to indicate baseline renal function, is an important consideration for patients undergoing PCI, because of potential risk of contrast induced acute kidney injury.¹⁷ The incidence of contrast-induced acute renal injury ranges from 6% to 20% of patients undergoing PCI depending on the diagnostic criteria and cohort analyzed.¹⁸ However, this form of renal injury appears to be amenable to volume expansion and to measures to increase urine flow and removal of highly water-soluble contrast.¹⁷ Despite the SCAI/ACC guideline recommendations, the safety of SDD in patients with an eGFR lower than 60 ml/min, even down to < 15 ml/min, has been demonstrated in literature.^{2,7,19} For example, 20 patients (14.6% of all 149 SDD patients) who had an eGFR between 30 and 60 ml/min were discharged home the same day in an Australian study with no major event reported such as deaths, urgent target lesion revascularization, stroke, or bleeding within 48 hours after PCI or at 30 days.¹⁹ In this study,¹⁹ an eGFR < 30 ml/min was one of exclusion criteria. It must be noted that the above study did not reported renal-related post procedure outcomes.

In our implementation of SDD, patients were only eligible if they received PCI via radial access. Consequently, a number of patients who required a femoral approach were excluded. A possible reason for excluding patients who underwent PCI via a femoral approach could be due to the concerns about access site complications. However, the safety of SDD in patients who had PCI via femoral approach has been demonstrated in the literature.^{4,5} A prospective analysis including 200 consecutive SDD patients from 2008 to 2011 showed that 151 (75.5%) had PCI via a femoral approach with no major bleeding or major adverse cardiovascular event was found within 24 hours of discharge.⁵ It must be noted that in this study⁵ nearly 80.0% of patients who had a femoral approach had a closure device used. A recent randomized controlled study showed that SDD after uncomplicated PCI with

stable and low-risk ACS was safe via the femoral approach when facilitated with a closure device.⁴

With an increasing demand for hospital resources, there is a trend moving toward the implementation of fast-track treatment pathways to reduce health care cost.²⁰ An evaluation of the current PCI care pathways in the United States (US) was conducted recently and it was found that SDD saved more than \$3000 per patient.³ In a recent randomized controlled study comparing SDD with overnight hospital stay, SDD was associated with US\$1200 savings per patient.⁴ In a Canadian study, SDD after transradial PCI was linked with 50% relative savings in health care cost which was approximate US\$1100.²¹ It was forecasted that there would be savings between \$200 and \$500 million annually if half of the average 1 million PCIs performed annually in the US are discharged the same day of the procedure.²² In our study, although 22 SDD patients would not make a significant impact on health care cost, it does save the cost by at least AUS\$24,200 equivalent to US\$19,592. If some of criteria were relaxed, many of patients could have been eligible for SDD, which would have led to cost-effectiveness to the organization.

The SDD criteria used in this implementation were more conservative than those reported in the literature. A conservative approach might have been applied because of different risk perceptions from the clinicians in this hospital. Risk perception is an individual's intuitive judgement or interpretation of risks in the context of limited and uncertain information.²³ It is common that people tend to be conservative and want to avoid disastrous consequences no matter how small the probability is predicted.²⁴ Since SDD was a new model of care being implemented that most clinicians had limited or no experience with, it was possible that they employed a more conservative approach in the initial implementation of SDD.

Clinical decisions about sending patients home the same day following PCI can be complex and individual clinicians' differing perceptions of risk might be influenced by a variety of factors including controllability, experiences, competence, perceived benefits and concerns.²⁵ It is possible that with modifications to the criteria, a greater number of patients would be eligible for SDD. Midway through the implementation period we achieved consensus among the clinicians to alter some inclusion criteria. SDD was offered to patients aged over 80 years if this was considered appropriate based on clinical judgement. Achieving consensus for other criteria such as a femoral approach, or a lower eGFR might be more challenging because of different risk perceptions held by physicians. Nevertheless, there is still the opportunity for ongoing refinement of the inclusion criteria and SDD guideline. Some strategies could be applied to help achieve maximal consensus. These may include the identification of the key concerns from the physicians following the alignment of them with the findings in the current literature and the local study as well as incorporating social influence via role-modelling from other physicians with prior SDD experience. Additionally, providing education sessions to clinicians about the current evidence related to the risks that they might have perceived may help persuade and reshape their personal beliefs about risks.

Clinicians' risk perceptions might have impacted on whether they adhered to the SDD guideline. Although there is no established benchmark for adherence to post procedure care for SDD patients in literature, we set the benchmark of over 90.0%. However, the adherence rate for post procedure care in this study was 77.3%. Possible reasons for this suboptimal result include knowledge related factors such as lack of awareness or familiarity due to insufficient education and training, attitude related factors such as lack of agreement on SDD inclusion criteria and process as well as the patient related factors such as patients not answering the follow-up phone call. In this study, staff adhered to task oriented components of the guideline strictly such as attending electrocardiography, which could be due to staff

being familiar with these processes and perceiving the tasks as important. However, there is an opportunity to improve other components of the guideline adherence such as ensuring patients to receive next-day phone follow-up, which could be due to clinicians' perceiving low-risk for patients not receiving phone follow-up. Staff's guideline adherence did not improve over the implementation period, which could be due to no self-monitoring being in place. This could suggest that a weekly or monthly audit and feedback might be useful to monitor the implementation, as it provides staff with an objective summary of their clinical performance typically on a set of quality indicators over a specific period and has been demonstrated to improve clinician performance.²⁶

Although patients did not receive all care components from the clinicians in some instances according to the SDD guideline, the patients expressed high satisfaction in this study suggesting that they were willing to be discharged the same day and preferred SDD. This was consistent with prior studies which demonstrated that 73%-96% patients overwhelmingly preferred to be sent home the same day, if it could be offered safely.^{4,5,27} In addition, SDD relatives were also satisfied with the experience, which was the first study that explored the satisfaction from the relatives. In this implementation, patients and relatives would not understand how the new model of care process was supposed to be followed in the hospital. They also did not experience serious adverse event during the SDD process but rather enjoying its convenience and comfort. These could explain why there was no direct relationship between their satisfaction and the clinicians' guideline adherence.

In undertaking this process evaluation, separation between the implementation and evaluation team was critical to minimize evaluation bias. In addition, the voices of patients and relatives were also included by assessing their satisfaction towards the SDD process in the process evaluation. These are both important strengths of this work. However, this study is limited by the small number of patients who were discharged the same day of the PCI and

consequently this may have limited our understanding of these complex processes in practice change. Data were gleaned from a single center which limits the generalizability of the study findings, particularly given the importance of context in change process. It is possible that improvement in the guideline adherence rates and survey results might have been observed if more SDD patients were involved.

CONCLUSION

The results of this process evaluation study suggest that SDD criteria were conservative in comparison with the ones described in the literature, which has contributed to only a small proportion of patients being discharged home same day. There is also an opportunity to improve guideline adherence. However, the evaluation showed high satisfaction from the patients and relatives. Although small sample was included, this study is important as it offers directions for future improvement of SDD. Improvements in both the intervention designs (SDD criteria should become less conservative) and the implementation process (implementation needs to be planned systematically) would have been beneficial and could have resulted in a positive impact of the implementation.

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Abbreviations: CR, cardiac rehabilitation; ECG, electrocardiography; eGFR, estimated glomerular filtration rate; ONS, overnight stay; PCI, percutaneous coronary intervention; SDD, same day discharge; TIMI, thrombolysis in myocardial infarction.

Figure 1. Same day discharge criteria and screening process

An * indicates that some patients met more than 1 exclusion criterion.

An ** indicates that patients had been chest pain free for the last 24 hours before the procedure.

Abbreviations: eGFR, estimated glomerular filtration rate; PCI, percutaneous coronary intervention; ONS, overnight stay; SDD, same day discharge; STEMI, ST-elevation myocardial infarction.

Figure 2. Patient flow

Table 1. Same Day Discharge Guideline Adherence Following Procedure

Guideline Items	n (%)
Post-procedure care (n=22)	
*ECG performed	22 (100.0)
*F/U with cardiologist made	22 (100.0)
*S/B a CR nurse	22 (100.0)
*S/B a pharmacist	22 (100.0)
*Discharge information given to patients	22 (100.0)
*Complete discharge paperwork given to patients	7 (31.8)
*EMR entry by senior medical officer	3 (13.6)
*Attempted next-day phone F/U by hospital staff	16 (72.7)
*Received F/U call by patients (didn't contribute to adherence)	15 (68.2)
Overall guideline adherence post procedure (A total of 176 items on 22 SDD)	136 (77.3)

An * indicates that item did not contribute to adherence

Superscripts of * indicate the key indicators that contributed to overall adherence post PCI.

Abbreviations: CR, cardiac rehabilitation; ECG, electrocardiography; EMR, electronic medical record; F/U, follow up; S/B, seen by; SDD, same day discharge.

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