

BMJ Open Quality Impact of customised ICU handover protocol on the quality of ICU discharge reports

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ABSTRACT

Background The aim of this investigation was to evaluate the impact of implementing a handover protocol, based on a standardised mnemonic tool specific for a cardiovascular intensive care unit (ICU), on the quality of information transferred during ICU discharge.

Methods In this prospective pre–post study, we evaluated the implementation of an ICU discharge handover protocol in 168 patients who underwent coronary artery bypass graft surgery. The primary outcome was the quality of the information. In the preintervention phase, 84 ICU standard discharge reports were evaluated. During the intervention period, a new handover protocol which included a written discharge report based on the I-PASS (illness severity, patient summary, action list, situation awareness and contingency plans, and synthesis by receiver) mnemonic tool was implemented. After the intervention, 84 new reports were assessed. The reports were evaluated by the ward physicians and by an external independent examiner using a standardised questionnaire. ICU discharge time and postoperative length of stay were also analysed.

Results The overall quality of the reports was evaluated as ‘completely understood’ by the ward physicians in 17 patients (21%) in the preintervention phase compared with 45 patients (54.9%) in the postintervention phase ($p<0.001$). The independent examiner classified one report (1.2% of the total number) as ‘excellent’ in the preintervention phase and 30 (35.7%) in the postintervention phase ($p<0.001$). After protocol implementation, patients were released from the ICU 58 min later ($p<0.001$). There was no difference in the length of postoperative hospital stay.

Conclusion Implementation of a customised handover protocol when discharging patients from the ICU was associated with improvement in the quality of the information transferred but also with ICU discharge occurring at a later time of day.

INTRODUCTION

Handover is one of the most important aspects of safe clinical care, particularly when discharging a patient from the intensive care unit (ICU) to the ward.^{1–3} Communication between ICU and ward physicians is often considered inadequate and of poor quality.⁴ At the time of ICU discharge, omission of important clinical data, transfer of erroneous

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Handover is an important aspect of safety care.
- ⇒ Handover program with mnemonic tools was associated with reductions in medical errors and in preventable adverse events in paediatric non-intensive care units (non-ICU) in the USA and Canada.

WHAT THIS STUDY ADDS

- ⇒ Implementation of a standardised handover protocol, customized for a cardiovascular ICU, during ICU discharge to the ward, in a developing country was related to better quality handovers of ICU discharge reports.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ Standard handover protocols on discharge from the ICU to the ward may be related to patient safety.
- ⇒ Custom and specific ICU forms using mnemonic tools may be appropriate in these circumstances.

information, passing of irrelevant details and lack of standardisation are common failings^{5–7} and are associated with adverse events and medical errors.^{8,9} Errors and lack of appropriate information on discharge reports are frequently reported by hospital quality offices and healthcare accreditation organisations as an important problem in safe patient care.

Standardisation of protocols during ICU discharge to the ward is an important quality improvement intervention.^{1,10} In developed countries, protocols for optimisation of handover on discharge from the ICU are employed habitually,¹ but in public health systems in developing countries such as Brazil these strategies have been little documented.

The objective of this study was to assess the effect of implementation of a systematised handover during ICU discharge to the ward, based on the I-PASS (illness severity, patient summary, action list, situation awareness and contingency plans, and synthesis by receiver) tool¹¹ and specific for a cardiovascular ICU,

on the quality of information on handover reports and on clinical and epidemiological outcomes.

METHODS

This is an exploratory prospective preintervention and postintervention study which evaluated the effects of implementation of a customised handover protocol, based on the I-PASS tool and created specifically for a cardiovascular ICU, on the quality of ICU discharge handover reports of patients submitted to coronary artery bypass graft (CABG) surgery. The study also analysed clinical and epidemiological outcomes.

The criteria for selection of patients whose handover reports were chosen for analysis were (1) age over 18 and (2) post-CABG patients who have been discharged from the ICU to the ward. Patients who did not have their handover report assessed for quality evaluation by the ward medical doctors were excluded.

Patient and public involvement

Patients were not involved in the development of the research. Patients' opinions were not considered in the design, recruitment and conduct of the study.

Setting

The study was carried out in a 1000-bed philanthropic hospital of Brazil's national health system (Sistema Único de Saúde), the public system for all Brazilian citizens financed by the Brazilian federal government. In this hospital there was no electronic system for medical records. The intervention took place in a 10-bed cardiovascular ICU which admits approximately 50 patients per month.

Survey subjects

Twenty-six cardiology resident physicians answered a questionnaire on the quality of the ICU handover reports of patients whom they had admitted to the ward.

Study design

Preintervention collection of data began on 1 April 2015 and continued until 31 March 2016 (a control period of 12 months). In the preintervention phase, 160 patients were selected; of these, the ICU handover reports of 84 were evaluated by the ward doctors involved with the care of the patients, and as a result it was decided that the study population would be 84 patients in both phases (figure 1). There was a phase of intervention without data collection (April and May 2016) and a postintervention phase (from 1 June 2016 to 31 August 2017) where the handover reports of 84 patients were studied (figure 2).

Phase 1: routine prior to the intervention

Prior to the intervention, the handover reports were written by resident doctors under supervision or by the hospital's medical staff, in the morning, after a multidisciplinary round. ICU discharge reports were in a standard form used in all the ICUs of the hospital and not based on

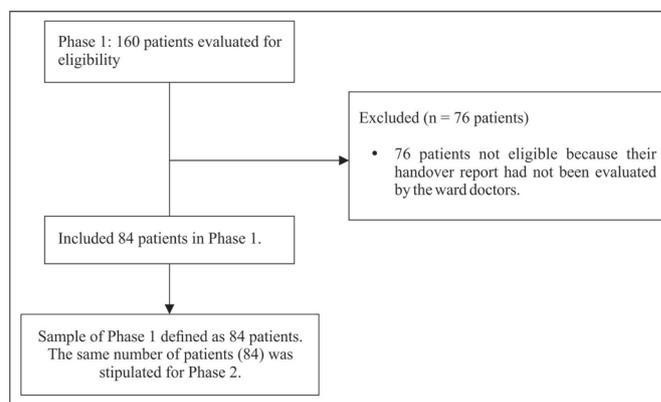


Figure 1 Size of the sample in phase 1 was used to decide the sample size in phase 2. In phase 1, of the 160 eligible patients, 84 were included in the study (ie, ward doctors carried out their evaluation in 52.5% of the cases).

any of the standardised 'mnemonic' tools. These forms had fields for identification data, reason for admission to the ICU, current and prior disease, evolution in the ICU, doctors' examination reports, diagnosis, care plan, antibiotics in use, previous antibiotics, medications list, laboratory examinations, culture results, and imaging results, in this order. There were no routines for sending other medical reports, such as description of the surgery, or copies of examinations as attachments.

Intervention

We developed and applied an adaptation of the I-PASS handover protocol,¹¹ which comprises *illness severity*, *patient summary*, *action list*, *situation awareness and contingency plans*, and *synthesis by receiver*, but the item 'Synthesis by receiver' was removed so that our mnemonic was I-PAS. This adaptation was designed to be used in patient transfers from the ICU to the ward in a situation where face-to-face verbal communication was not possible. The intervention also comprised a change in the form of the ICU discharge report, with fields for specific information on the postoperative phase following cardiac surgery. There was a period of 2 months of training for the medical teams of the ICU and of the cardiology ward

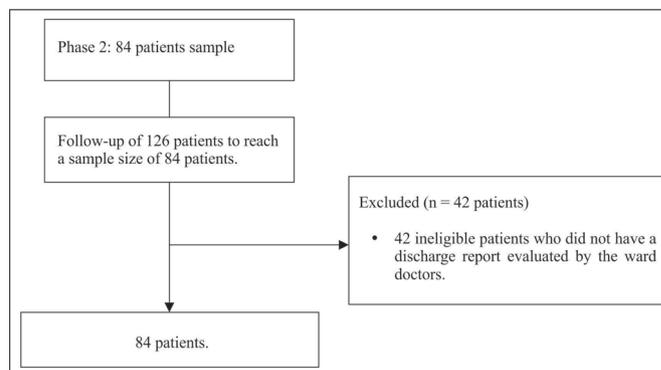


Figure 2 Phase 2 patient flow: stipulated sample size of 84 patients. In phase 2, ward doctors carried out their evaluation in 66.6% of the cases.

between phase 1 and phase 2, during which data were not collected. Training consisted of as two formal 1-hour meetings, informal discussions, display of information posters and individualised training.

The protocol was implemented with support from the hospital's patient safety team.

As well as training of the medical teams and introduction of the new ICU discharge report, copies of reports of the most relevant cardiovascular examinations and medical descriptions were standardised to provide a more complete comprehension of the clinical cases.

Since the hospital did not have an electronic record system, sending of copies of cardiovascular test results and other medical reports was also standardised.

Phase 2: routine, postintervention

In the postintervention phase, all handover reports were made in the new, specific format for the cardiovascular ICU. As in the preintervention phase, the handover reports were made by resident physicians under supervision or by the hospital's medical staff shortly after a multidisciplinary round. All the documents, including surgery reports and copies of cardiovascular examinations, were transferred. Exactly as in the first phase of the study, all the handover reports were accompanied by a questionnaire for assessment of their quality (see online supplemental appendix).

The internship programme of the ward residents, the routine for admission of patients to the ICU and the ICU work team were the same during the studied phases.

Outcomes

The primary outcome was the quality of the information transmitted on the ICU discharge reports. The quality of the handover reports was assessed by the ward physicians involved with the care of the patient, using a specific questionnaire, as described in the following section. In the second step, the same handover reports were evaluated by an external physician who was neither involved in the patient's care nor related to the study. Clinical and epidemiological outcomes, such as time of day of the patient leaving the ICU, length of stay (LOS) after discharge from the ICU, readmission to the ICU after 48 hours and adverse events notified after discharge from the ICU, were analysed.

Evaluation of the handover reports

The ward physicians evaluated the quality of handover reports by responding to a standard questionnaire developed by the study team and validated using face validity (see 'Survey Questions Instrument' in online supplemental appendix). The ward doctors received formal training on the method of evaluation of the reports, to be carried out soon after admission of the patient to the ward. Their participation was voluntary and they were instructed not to identify themselves.

The questionnaire asked the physician to assess to what degree the information transmitted was

comprehensible for each of the following aspects: history, surgical strategy, clinical evolution in the ICU, nutritional aspects, analgesia, Deep vein thrombosis (DVT) prophylaxis, glycaemic profile, use of potentially dangerous medications and care plan, as well as a summary question on the overall quality of the information transmitted. The answers were classified into four levels: 'completely' (understood), 'partially' (understood), 'insufficiently' (understood) and 'not' (understood), plus two further options: 'These questions do not apply to the case' and 'I do not know how to answer the question'.

Independent assessment was performed by an external intensive care physician, evaluating the following topics: *illness severity*, *patient summary*, *action list*, *situation awareness and contingency plans*, *allergy*, and *list of medications*. The length of the report, the overall quality of the patient summary and the presence of wrong information were also assessed. Wrong information was identified by the examiner as inconsistencies, incompatibilities and controversial clinical data (see 'Handover Report Evaluation' in online supplemental appendix).

The process measure was the quality of the handover, the outcome measure was the LOS and the balancing measure was the ICU discharge time. I-PAS compliance was checked by independent assessment. Besides objective evaluation of allergies, medication list and clinical errors were established.

Statistical analysis

Statistical analysis was done using two software: SPSS V.20.0 and Minitab V.18.0. Since there were no previous studies related to this subject (quality of reports on ICU discharge to the ward), we had no previous data from which to calculate an estimated sample size. A convenience sample size was therefore used based on previous international studies with similar designs.

Quantitative variables were described as mean \pm SD when the variable had a normal distribution, verified by the Shapiro-Wilk test, and by median (25%–75% IQR) when the variable was not normally distributed. Nominal and ordinal categorical variables were described using absolute frequencies and percentages.

For comparison of the variables in the two phases, t-test (for variables with normal distribution) and Mann-Whitney test (for variables without normal distribution) were used for quantitative variables. For categorical variables, asymptotic Pearson's χ^2 test was used.

In the comparison of the clinical and epidemiological outcome variables between the two phases, asymptotic and exact Pearson's χ^2 tests were used for categorical variables and Mann-Whitney test was used for quantitative variables, as they were not normally distributed. CIs of 95% were constructed for the differences in proportions between the phases after and before the intervention.

Table 1 Number and proportion of highest quality evaluations of information transfer of ICU handover reports before and after implementation of the protocol

Rated items	Preintervention phase: 84 patients n (%)	Postintervention phase: 84 patients n (%)	CI of the difference between proportions	P value
History	40 (47.6)	44 (53.7)	6.0 (−9.1 to 21.2)	0.436
Surgical strategy	47 (56.6)	60 (73.2)	16.6 (2.2 to 30.9)	0.026
Evolution in ICU	49 (58.3)	69 (83.1)	24.8 (11.5 to 38.1)	<0.001
Nutrition	16 (19.3)	62 (74.7)	55.4 (42.8 to 68.1)	<0.001
DVT prophylaxis	24 (29.6)	76 (95.0)	65.4 (54.3 to 76.4)	<0.001
Analgesia	18 (22.0)	53 (67.9)	46.0 (32.3 to 59.7)	<0.001
Glycaemic profile	19 (26.4)	61 (79.2)	52.8 (39.2 to 66.5)	<0.001
Dangerous medications	27 (38.6)	52 (78.8)	40.2 (25.1 to 55.3)	<0.001
Care plan	37 (46.2)	60 (71.4)	25.2 (10.6 to 39.8)	<0.001

DVT, Deep vein thrombosis; ICU, intensive care unit.

RESULTS

The general characteristics of the 168 patients included in the preintervention and postintervention phases were analysed. No differences were observed between patients' data in the two phases, for example in the following: male: 61 patients (72.6%) vs 54 patients (64.2%) ($p=0.245$); age (years): median 65.0 (25%–75% IQR: 59.0–70.0) vs median 63.0 (25%–75% IQR: 57.0–74.0) ($p=0.300$); LOS in ICU (days): median 5 (25%–75% IQR: 2–6) vs median 4 (25%–75% IQR: 3–6) ($p=0.953$); Euroscore 2: median 1.29 (25%–75% IQR: 1.18–1.62) vs median 1.42 (25%–75% IQR: 1.19–1.89) ($p=0.159$).

Evaluation of handover reports

The quality of the ICU handover reports as perceived by the ward doctors was reported as the proportion of responses attributing the highest quality (level I of the choice of answers: 'completely understood') compared with the other responses (partially understood, insufficiently understood or not understood) and is shown in [table 1](#). The overall information on ICU discharge was considered to be 'completely understood' by the resident doctors in 17 patients (21%) in the control phase compared with 45 patients (54.9%) in the postintervention phase ($p<0.001$), an absolute difference of 33.9 percentage points (pp) (95% CI 19.9 to 47.8). Also, there was a significantly higher proportion of optimal evaluations in phase 2 than in phase 1 in eight of the nine specific items ([table 1](#)).

The differences between the percentages of high-quality assessments of handover reports by the ward doctors, for eight of the nine categories, in phase 1 and phase 2, expressed in percentage points (pp), were 16.6 pp (95% CI 2.2 to 30.9) for *surgical strategy*, 24.8 pp (95% CI 11.5 to 38.1) for *evolution in the ICU*, 55.4 pp (95% CI 42.8 to 68.1) for *nutrition*, 65.4 pp (95% CI 54.3 to 76.4) for *DVT prophylaxis strategy*, 46.0 pp (95% CI 32.3 to 59.7) for *analgesia*, 52.8 pp (95% CI 39.2 to 66.5) for *glycaemic profile*, 40.2 pp (95% CI 25.1 to 55.3) for *use of potentially*

dangerous medications and 25.2 pp (95% CI 10.6 to 39.8) for *care plan*. In all these items, the improvement in evaluations during the postintervention phase was significant ($p<0.05$). On the other hand, no significant difference was observed in the proportion of 'excellent' evaluations of information transfer in the *history* category: the difference was 6.0 pp (95% CI −9.1 to −21.2, $p=0.436$).

Separate examination of the quality of information transfer, under six separate aspects for each report, was carried out by an independent physician for 84 patients of phase 1 and 81 patients of phase 2 (handover reports of three patients were not evaluated because they were not available for this separate examination). The quality of information transfer was judged to be 'adequate' by the independent examiner in the following total number of reports in phase 1 and phase 2, respectively: 0 report vs 81 reports (100%) for the aspect *illness severity*; 77 reports (91.7%) vs 81 reports (100%) ($p=0.014$) for *patient summary*; 29 (34.5%) vs 75 (92.6%) ($p<0.001$) for *action list*; 0 vs 49 (60.5%) ($p<0.001$) for *situation awareness*; 2 (2.4%) vs 81 (100%) ($p<0.001$) for *allergies*; and 34 (41.0%) vs 78 (92.9%) ($p<0.001$) for *medications list*.

The report was considered to be of highest quality by the external examiner in 1 (1.2%) case in phase 1 and in 30 (35.7%) cases in phase 2, an absolute difference of 34.5 pp (95% CI 24.0 to 45.0, $p<0.001$). Errors were identified in eight (9.5%) reports in phase 1 and in six (7.7%) reports in phase 2 ($p=0.678$). The reports were considered to be of appropriate length in 46 (54.8%) cases in phase 1 and 67 (79.8%) cases in phase 2, an absolute difference of 25.0 pp (95% CI 11.3 to 38.7, $p=0.001$).

Clinical and epidemiological outcomes

In phase 1 (the control period), the median time of day of discharge from the ICU was 11:26 (10:58–12:11), and in phase 2 (postintervention) it was 12:24 (11:35–13:35). Thus, the mean time of day of discharge from the ICU was 58 min later in the day in phase 2 than in phase 1 ($p<0.001$). There was no reduction in LOS after ICU

discharge: 7 days (6–8) for the preintervention phase and 7 days (5–10) for the postintervention phase ($p=0.29$). There was no reduction in readmissions to the ICU after 48 hours (0% vs 1.2%, $p=0.32$). We found no internal notification of any adverse event or death after discharge from the ICU in either of the phases.

DISCUSSION

In this study we found that implementation of a systematised information transfer protocol, adapted for use specifically in the cardiovascular ICU of a hospital of the Brazilian public health system and based on the I-PASS mnemonic tool, was associated with better quality of handover reports. However, the implementation of this systematic transfer protocol resulted in patients being released from the ICU, on average, later in the day. To our knowledge this is the first investigation related to the implementation of strategies of optimisation of ICU handover in Brazil.

Transmission of information is essential to ensuring adequate healthcare, particularly in the context of complex surgical cases transferred from the ICU to the ward. Inadequate transfer of information may lead to serious adverse events, such as inappropriate medicine dosage or pharmacological interactions, both of which may be associated with postoperative clinical complications.¹¹

The landmark article *To Err is Human* in 1999¹² indicated that there were as many as 98 000 deaths on an average year from medical errors in hospitals in the USA. This problem is likely to be even more serious in low-resource hospitals that do not have electronic medical records (EMR) and lack operational handover protocols. In the present study, we aimed to improve the quality of patient handover by developing, implementing and providing training for a specifically designed protocol to transfer information from the ICU to the ward, based on the I-PASS tool,¹¹ in a low-resource setting of a publicly funded philanthropic hospital in a developing country.

The I-PASS mnemonic tool was used because it was related to 23% reduction in medical errors and 30% reduction in adverse events in an emblematic study.¹¹ In our opinion it is the best mnemonic tool for this type of handover characterised by complex situation. In contrast to the initial proposal of the I-PASS project, which was developed for use in paediatric non-ICUs, we adopted an ICU discharge protocol requiring that ICU discharge reports for post-CABG patients should be made in writing. In our study, only CABG patients were included. We chose a closed and specific sample with less heterogeneity to avoid research bias. We observed better handover in general and also in topics related to patient safety. Thus, we believe that this tool and the procedure developed and implemented can be applied to other types of cardiovascular surgeries. The quality of the handover was assessed in two different ways, namely the perception of the physician actually responsible for the patient's care

and the objective assessment of the external examiner, to reduce bias. We used understandability perception to measure the quality of handover as an assessment of how the information reaches the receiver and how the receiver considers it. According to the perception of the ward doctors responsible for patient care and the assessment of an external intensive care specialist, there was a significant improvement in the quality of the information transmitted.

In an investigation similar to ours, Sheth *et al*,¹³ after implementing an I-PASS tool for discharge from a paediatric cardiovascular ICU in the USA, reported a higher percentage of health professionals stating 'satisfaction' with (1) the amount of information transmitted, from 34% prior to introduction of the protocol to 41% after its implementation ($p=0.03$); and (2) the overall transfer process, from 3% before intervention to 24% after ($p<0.01$).

In another study related to discharge from the ICU to the internal medicine ward in Canada, Bodley *et al*¹⁰ reported a higher percentage of doctors' responses evaluating the information transfer process as 'adequate' (48.8% in the preintervention phase vs 93.3% in the postintervention phase, $p=0.03$). In this same investigation, the doctors reported a better understanding of medication use (29.1% preintervention vs 69.0% postintervention, $p<0.01$), a higher prevalence of adequate information for possible discharge home (31.0% preintervention vs 69.2% postintervention, $p=0.01$) and easier identification of which consulting services were involved in the patient's care (38.8% preintervention vs 76.9% postintervention, $p=0.01$).

In our study, there is room for improvement even after a standardised handover tool. We can imagine that aspects of culture, individual conceptions, human factors or the process of evaluation may be related to non-excellence. Also, no reductions were observed in (1) the frequency of adverse events, (2) the rate of readmission to the ICU after 48 hours, (3) LOS nor (4) mortality after ICU discharge. The data used for adverse events were the figures provided by the hospital's notification system and there may have been undernotification. The rates of hospital readmission and death were low, possibly due to the low degree of severity in the population studied (median Euroscore 2: 1.34 (1.19–1.70)).

Implementation of quality improvement protocols for transfer of information may be considered to provide a fundamental benefit. In the great majority of other studies on this subject, no reduction in clinical outcomes was reported; this effect has been attributed to methodological difficulties.^{14 15} Certainly, a larger sample would have enabled a more accurate estimate of the impact of the handover protocol on adverse events and on other clinical outcomes in our specific setting.

We also observed a later time of day for discharge after the intervention than in the control phase. The hospital where the study was carried out had no EMR system. We consider that typing of data and sending



of copies of examinations and reports may have contributed to the longer time taken to discharge the patient from the ICU. Further studies on the use of these protocols associated with electronic information transfer forms could provide clarification on the effect of this new handover protocol on time to ICU discharge. New protocols involving multidisciplinary teams, now with EMR, are ongoing in our ICU. We are preparing a plan–do–study–act (PDSA) cycle with the quality department and safe team to implement our handover protocol, now in the EMR system, as part of a quality process to obtain quality certification.

This study was on a strategy for improvement of patient safety. As well as the doctors dealing with each case, the hospital's patient safety team was also involved. We improved the discharge handover process of our cardiovascular ICU. The new protocol resulted in better quality written communication. Implementation of this standardised protocol in an institution of the Brazilian public health system improved the quality of the handover reports, although it also resulted in the time of day of ICU discharge occurring approximately 1 hour later.

Our study has some significant limitations that require careful interpretation. It is a study done in a single hospital and the improvement in the quality of reports could have been influenced by local aspects. One limitation of our method was that our protocol did not include oral communication, as closed-loop oral communication should, in our opinion, always be a pillar of the handover process.

The questionnaire was validated using face validity. Other more objective validation methods include content validation, criterion validation and construct validation. We reported improvement in a number of parameters; however, the reliability of the measurement cannot be fully demonstrated. Other limitations are related to the measurement tool applied. In our study, the questionnaires were applied to respondents of the same profile (first-year and second-year cardiology residents). However, as the answers were not identified, there was no way to control respondents' relationship with each case studied. Furthermore, it was not possible to know if the sample of the included cases was systematically equal to that of the population that did not have their reports evaluated (excluded cases). Analysis of the complete sample of patients, including non-respondents, has not been established. In the same way we cannot answer why some handover forms were not evaluated. The reasons for not evaluating handovers could be related to the doctors, for instance busy doctors, or other aspects related to patients, such as severity, as well as poor handovers or due to plenty of complex information.

The quality of the handover assessed according to the perception of the physician actually responsible for the care of the patient was subjective in essence and can be influenced by personal reasons.

The data on the adverse events were provided by the hospital's adverse events notification system, which may have been under-reported.

The mean time of day of discharge from the ICU was 58 min later after protocol implementation. The findings in relation to the later time of discharge are interpreted to mean that the process of discharge took 58 min longer, but it may be that the process started later, for example. A different study design, for example observing and timing the process, would be needed to draw conclusions about the duration of the discharge process.

In conclusion, creation and implementation of a customised handover protocol when discharging patients from a cardiovascular ICU in Brazil were associated with better quality of handover reports, while after the intervention discharge of patients from the ICU took place later in the day.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval This study involves human participants and was approved by the Ethics Committee of the Santa Casa de Belo Horizonte Hospital (under proposal number (CAAE) 42065115.6.0000.5138) and the School of Medicine of São Paulo University (FM-USP) (CAAE: 57798816.9.0000.0065). Consent form was not required by the Ethics Committee. The data are part of the unit's overall improvement strategy and reflect the care improvement strategy.

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