

# Integrated Electronic Discharge Summaries—Experience of a Tertiary Pediatric Institution

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## Abstract

**Objective** Succinct and timely discharge summaries (DSs) facilitate ongoing care for patients discharged from acute care settings. Many institutions have introduced electronic DS (eDS) templates to improve quality and timeliness of clinical correspondence. However, significant intrahospital and intraunit variability and application exists. A review of the literature and guidelines revealed 13 key elements that should be included in a best practice DS. This was compared against our pediatric institution's eDS template—housed within an integrated electronic medical record (EMR) and used across most inpatient hospital units.

**Methods** Uptake and adherence to the suggested key elements was measured by comparing all DSs for long stay inpatients (> 21-day admission) during the first year of the EMR eDS template's usage (May 2016–April 2017).

**Results** A total of 472 DSs were evaluated. Six of 13 key elements were completed in > 98.0% of DSs. Conversely, only < 5.0% included allergies or adverse reaction data, and < 11.0% included ceased medications or pending laboratory results. Inclusion of procedure information and pending laboratory results significantly improved with time ( $p = 0.05$  and  $p < 0.04$ , respectively), likely as doctors became more familiar with EMR and autopopulation functions. Inclusion of “discharge diagnosis” differed significantly between medical ( $n = 406/472$ ; 99.0%) and surgical ( $n = 32/472$ ; 51.6%) DSs.

**Conclusion** Uptake and adherence to an EMR eDS template designed to meet best practice guidelines in a pediatric institution was strong, although significant improvements in specific data elements are needed. Strategies can include a modification of existing eDS templates and junior medical staff education around best practice.

## Keywords

- ▶ best practice
- ▶ discharge summaries
- ▶ electronic medical records
- ▶ template

## Background and Significance

Effective ongoing management of patients discharged from acute care settings is facilitated via succinct and timely discharge summaries (DSs).<sup>1–3</sup> Transitions of care at points such as these have been identified as a time of increased risk for patient adverse events.<sup>4</sup> Thus, many health care institutions have introduced standardized electronic DS (eDS) not only to improve the quality and timeliness of clinical corre-

spondence, but also to prevent breakdown of communication between acute and primary care providers.<sup>5–7</sup>

The integration of technology with DS has been driven by clear enhancements in the quality and transmission of DS. These include improved legibility, consistency, accessibility, security, accuracy, and inclusion of key information and timeliness.<sup>2,8–13</sup> eDS are also more likely to include discussion of follow-up issues and pending test results compared with written DS.<sup>12</sup> In addition to the potential safety and quality

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benefits, there is evidence to suggest that eDS results in higher primary care clinician and patient satisfaction—not least because structured eDS organized by subheadings result in better readability compared with a lengthy narrative.<sup>1,14–19</sup>

eDSs are currently generated using a variety of technology options ranging from standalone rich text format solutions to modules within integrated electronic medical records (EMRs).<sup>20</sup> eDSs are then either physically or electronically dispatched to key stakeholders based on end user preference. However, significant intrahospital and intraunit variability in DS content still exists. To address this, some countries have released recommendations regarding health information transmission requirements, although these do not contain significant detail.<sup>21</sup> Others have gone one step further and created national guidelines for DS.<sup>22,23</sup>

Within the Australian context, there have been numerous strategies to address this at all levels—including national guidelines developed by the Australian Commission on Safety and Quality in Health Care (ACSQHC).<sup>7</sup> These aim to standardize content and structure of eDS across a variety of clinical settings, in anticipation of the expected increased availability of eDS within the national personalized medical record system (*My Health Record*) in the near future.<sup>24</sup>

The Royal Children's Hospital Melbourne (RCH), is an example of a local application of eDS templates as part of an integrated comprehensive EMR system (EpicCare, Madison, Wisconsin, United States)—which was launched in April 2016. Since the EMR went live, there has been a standardized template for eDS across most units and areas of the hospital. The template includes autopopulated patient demographic and care information, including diagnoses and procedures. Furthermore, it allows for the inclusion of automatic refreshing links, which pull key data elements from various sections of the patient's record (e.g., discharge medications and appointments), as well as free text (–Fig. 1). Although users can delete certain elements, sections, or even bypass the template and write free text only, this is strongly discouraged to encourage consistency of practice.

Prior to the commencement of the RCH EMR, medical staff were given standardized EMR training by two trainers, including orientation to the DS template. To improve usage and content reliability, two additional refresher sessions were offered to all trainees at 3 and 6 months posttemplate implementation. This was coupled with quick reference printed and electronic resource guides embedded within the EMR available at user discretion.

## Objective

Given many tertiary institutions are transitioning toward EMR, it is imperative that features within this process are revised, audited, and optimized. Thus, this study aims to determine best practice pediatric DS guidelines via a literature review and to then evaluate the existing RCH eDS template against these guidelines. The secondary aim is to assess the real-time uptake and use of DS templates by doctors within an Australian tertiary academic pediatric institution. By identifying potential barriers to both the

development and adherence to best practice templates, future areas for improvement and research could be identified for local, national, and international contexts.

## Methods

### Literature Review and Analysis

Suggested DS key elements from ACSQHC national guidelines are predominantly based on research and consultation within the adult population.<sup>7</sup> Thus, an additional literature review was performed to ensure that pertinent criteria relevant specific to the pediatric population were not excluded (e.g., immunizations given during hospitalization).<sup>18</sup>

This was conducted via a comprehensive search of Medline Ovid, EMBASE, and the Cochrane Library in April 2017 for articles relating to DS, with the search criteria limited to English language and human subjects (–Appendix A). The initial search identified 291 articles. Following removal of duplicates, screening of titles and abstracts, and review of full-length articles, 35 articles were analyzed by two authors (M.K. and D.C.) and included in our study (–Fig. 2).

Key elements across the 35 articles were compared and discussed with an institutional expert consultative committee. Their task was to use existing evidence to create best practice guidelines with particular focus on developing key inclusion elements. A list of 13 elements constituting a “best-practice” DS was developed, including: (1) patient details, (2) admission diagnosis, (3) discharge diagnosis, (4) investigations (e.g., laboratory tests, imaging tests), (5) procedures (surgical and other interventional procedures), (6) hospital course, (7) allergies, (8) adverse reactions, (9) ceased medications, (10) discharge medications, (11) pending laboratory results, (12) medical problems at discharge, and (13) follow-up details.

This was followed by a comparison against our institution's eDS practice, in the form of a retrospective cohort analysis assessing the DS of long stay patients (> 21-day inpatient stay) at RCH during the first year of its integrated EMR and eDS template (May 2016–April 2017) (–Fig. 3). Each eDS was analyzed and a comparison made between user-included and best-practice DS elements. The primary outcome measure was data available for each key criteria, whether auto- or manually populated.

Ethics approval was obtained from the RCH Human Research Ethics Committee (HREC #DA001–2017–102).

### Cohort Selection

Long stay inpatients were the target population selected for analysis. In pediatric settings, the bulk of inpatient encounters occur in otherwise well children with minimal comorbidities and only short admission periods. Thus, long stay patients are more likely to have multiple and complex comorbidities, medications, treatments, or follow-up—resulting in the need for a more detailed and robust DS which would include DS key elements. DS from units that do not use the standardized discharged-from-hospital eDS template were excluded (mental health unit). Furthermore, DS relating to day-stay patients were not generated. eDSs were

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### Royal Children's Hospital Inpatient Discharge Summary

**Patient Details**

UR# [1]  
Name: [1]  
DOB: [1] Sex: [1]  
Address: [1]  
Phone: [1]

**Discharge Details**

Adm. Date:	25/6/2017	Discharge Date:	***
Ward:	ROSELLA WARD	Discharged To:	(Discharged to 26209)
Unit:	Intensive Care Unit [111]	Consultant:	No att. clinicians found

**Problem List**

Principal Problem: [2]  
MVA (motor vehicle accident) [3]  
Active Problems:  
Fracture of humerus, right, closed [3]  
Fracture of distal end of left ulna [3]  
Fracture of rib of right side [3]  
Fracture subluxation of right sternoclavicular joint [3]  
Pulmonary contusion [3]  
Haemopneumothorax, right [3]  
Acetabulum fracture, left [3]  
Fracture of left femur [3]  
Resolved Problems: [12]  
\* No resolved hospital problems. \*

Principal Procedure [5]  
(N/A or comment:21418)

Presentation/Progress/Treatment [4] [6] [11]

Follow-up Plan [13]

Requested Action for GP:  
(RCH Discharge Summary GP Request 26545)

Discharge Weight: 82 kg

Medications at Discharge [10]  
No current outpatient prescriptions on file.

Medication comment:

Follow Up Appointments (scheduled at the time this document was signed) [13]  
No future appointments.  
No referral orders placed this visit

Appointment comment:

For access to Emergency Department, Specialist Clinics referral information, or Pathology & Radiology results please phone (03) 9345 7060 and for further resources go to [www.rch.org.au](http://www.rch.org.au)

**Fig. 1** Sample Royal Children's Hospital Melbourne electronic discharge summary template. Green numbers = autopopulated. Red numbers = no defined headings. Orange numbers = users were prompted to enter information. Users could enter free text information at their discretion.

reviewed and patient demographic data including age, sex, and inpatient unit was collected for each patient.

### Statistical Analysis

Descriptive statistics were used to summarize the inclusion of best-practice DS elements; this was recorded by frequency and percentage. *t*-Test and chi-squared tests were used to compare inclusion of best-practice DS elements over time, and between medical and surgical subgroups. A *p*-value of < 0.05 was considered significant.

## Results

### RCH eDS Template

Of the 13 best practice elements, 7 were autopopulated within the RCH DS template (→ Fig. 1, numbered in green). Four other elements had the potential to be autopopulated, but were not customized nor included in the template at the time of the study. There were no defined headings for 3 of the 13 elements (→ Fig. 1, numbered in red). Users were prompted to enter patient-specific information for a further

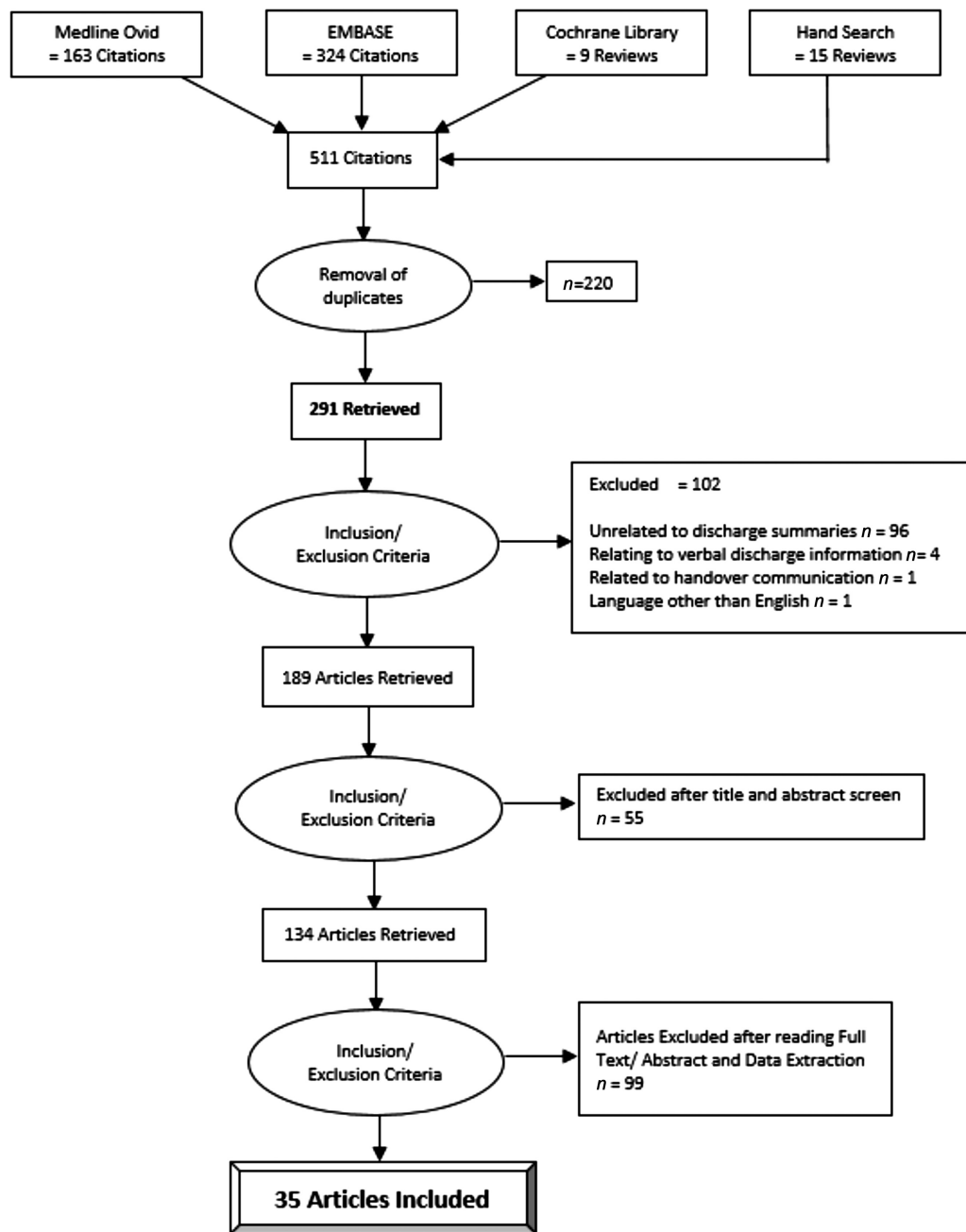


Fig. 2 Literature review algorithm.

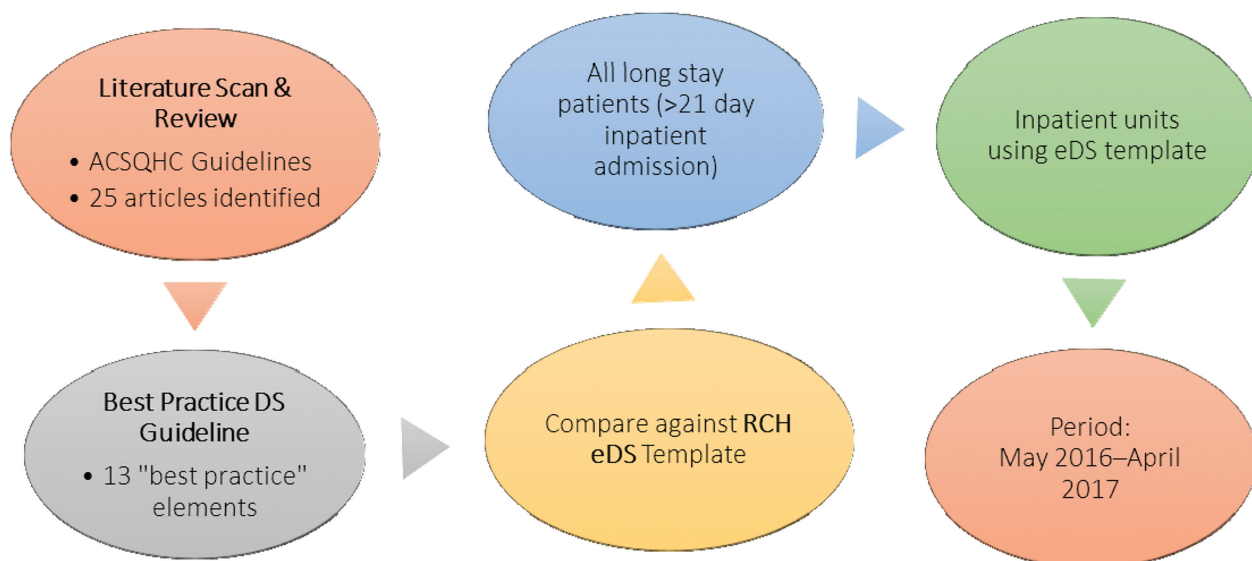
3 elements (→ Fig. 1, numbered in yellow) and they could enter free-text information for any other key elements at their discretion.

### User Uptake and Usage

Following review of EMR for long stay patients, 564 patient episodes were identified. Note that 472 had DS available for evaluation. Of the DS available, 86.86% ( $n = 410/472$ ) were medical patients. Ninety-two DS were not generated as these related to administrative long stay patients and were appropriately excluded—continuous multi-day visit patients who were receiving outpatient-based treatments such as chemotherapy or rehabilitation.

Six of 13 best practice elements were completed in > 98.0% of DS: patient details ( $N = 472/472$ , 100%), admission diagnosis ( $N = 472/472$ , 100%), hospital course ( $N = 472/472$ , 100%), discharge medications ( $N = 463/472$ , 98.09%), medical problems at discharge ( $N = 468/472$ , 99.15%), and follow-up details ( $N = 472/472$ , 100%). The 7th autopopulated element—principal procedure—required users to enter N/A or comment on the procedure and was included in 92.37% of DS ( $N = 436/472$ ). DS infrequently included allergies, adverse reaction data, ceased medications, and pending laboratory results (→ Table 1).

Inclusion of procedure information and pending laboratory results improved with time, that is, from the first



**Fig. 3** Study methods algorithm. ACSQHC: Australian Commission on Safety and Quality in Health Care.

3-month period, May to July 2016, to the final 3-month period, February to April 2017 ( $n = 77/86$ , 89.53% to  $n = 142/148$ , 95.95%,  $p = 0.05$  and  $n = 4/86$ , 4.65% to  $n = 24/148$ , 16.22%,  $p = 0.04$ , respectively) (→Fig. 4). Though not statistically significant, there was an overall numerical improvement in inclusion of the pending investigations over time. Information around immunizations administered during a hospital stay was not included in DS unless specifically entered by end users.

Medical DS were significantly more likely to include a discharge diagnosis compared with surgical DS ( $n = 406/410$ , 99.02% vs.  $n = 32/62$ , 51.61%, respectively). Furthermore, the discharge weight, an autopopulated feature spe-

cific to the RCH DS, was included in  $n = 403/410$ , 98.29%, of medical DS and  $n = 62/62$ , 100%, of surgical DS.

## Discussion

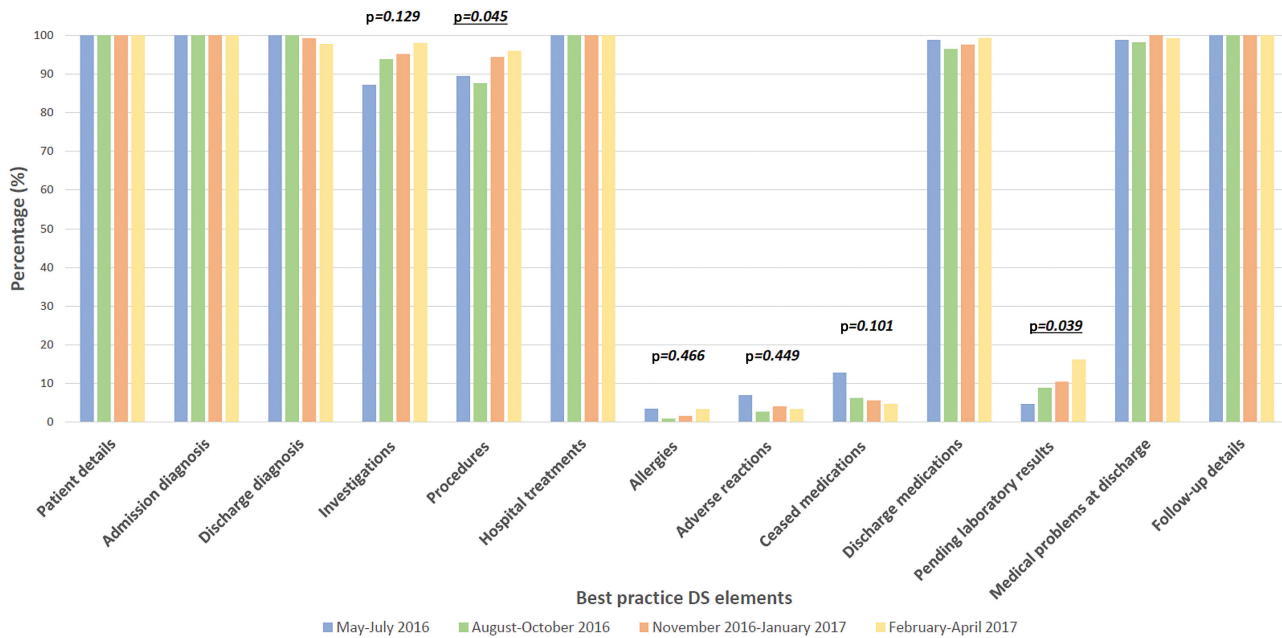
This study looked at best practice guidelines for DS and its implementation and uptake in a single tertiary pediatric institution. To the authors' knowledge, this study is the first of its kind within an Australasian context.

There is unequivocal existing recognition that variability and inconsistencies among DS content may be a barrier to efficient patient care.<sup>19</sup> Even with existing standardized guidelines, it is important to consider pediatric nuances

**Table 1** Best practice DS elements and inclusions

Best practice DS elements	RCH DSs with included best practice elements N (%)	Autopopulated
<b>Total, n = 472</b>		
[1] Patient details	472 (100)	Yes
[2] Admission diagnosis	472 (100)	Yes
[3] Discharge diagnosis	438 (92.80)	Yes
[4] Investigations	439 (93.01)	Yes
[5] Procedures	436 (92.37)	Yes
[6] Hospital course	472 (100)	No
[7] Allergies	11 (2.33)	Potentially Yes – but not currently included in template
[8] Adverse reactions	19 (4.04)	Potentially Yes – but not currently included in template
[9] Ceased medications	19 (4.04)	Potentially Yes – but not currently included in template
[10] Discharge medications	463 (98.09)	Yes
[11] Pending laboratory results	51 (10.81)	Potentially Yes – but not currently included in template
[12] Medical problems at discharge	468 (99.15)	Yes
[13] Follow-up details	472 (100)	No

Abbreviations: DS, discharge summary; RCH, Royal Children's Hospital Melbourne.



**Fig. 4** Best practice elements included in Royal Children's Hospital Melbourne discharge summary (DS) (stratified by quarter).

including preventative measures and pediatric-specific information such as developmental history or social or schooling factors that may contribute to creating effective eDS and assist patient care for this cohort.

Examples of key elements relevant to both adult and pediatric population groups include patient demographics, admission and discharge diagnoses, hospital management, and treatment. Utilization of the autopopulation function in the design of our eDS templates was shown to significantly increase the likelihood of inclusion of these elements within each DS; consistent with previous studies.<sup>25-27</sup> This is further evidenced by the poor uptake of best practice elements which were not autopopulated but only available for inclusion at the author's discretion—for example, allergies or adverse reaction data, ceased medications, or pending laboratory results.

Similar trends have been seen previously, with multiple studies finding diagnostic test results (33–63%), hospital course (7–22%), discharge medications (2–40%), pending test results (65%), patient or family counseling (90–92%), and follow-up plans (2–43%) are variable and often omitted elements in adult DS.<sup>9</sup> This suggests that similar deficiencies in meeting best practice DS guidelines are likely present among other institutions, both adult and pediatric, within Australia.

Effectively developing or redesigning an eDS template could contribute to a significant improvement in the documentation of key information; including patient allergies, changes to medications, and specific requests of primary care providers or general practitioners on discharge. One way this can be achieved is by allowing for autopopulation or customization of suggested phrases and links.<sup>25,28</sup> This reduces the need for double documentation and may have the flow on effect of increasing efficiency and timely delivery of DS to primary care providers.<sup>28-30</sup> Ultimately, this may contribute to both referring provider satisfaction and improved patient outcomes as pertinent information is disseminated.

Movement into or out of hospital is a particularly vulnerable period for medication safety and potential prescribing errors.<sup>4,31</sup> These are especially important in pediatrics where dose calculations are complicated and weight-based, and small errors can cause significant harm.<sup>32</sup> Medicines administered during an inpatient stay including immunizations, adverse reactions, and ceased medications, either by autopopulation or manual user-entry, were sparsely included in DS that were evaluated. Besides a discharge medication list, selective auto-inclusion of inpatient medications in eDS which are relevant to ongoing patient care could be beneficial for patient primary care providers. More importantly, ensuring these data are synchronized with other repositories or centralized databases (e.g., Australian Immunisation Register for immunization) will ensure seamless transition and recording of key patient information beyond the hospital stay.

Importantly, however, although these strategies may all lead to improvement in the inclusion of information within an eDS, the accuracy and validity of the information remains an arguably greater consideration and may have potential impact on patient care. Gattari et al have demonstrated that the introduction of EMRs along with eDS may unwittingly result in multiple sources of the same information within a patient's record—which in turn creates discrepancies between medication lists housed within an EMR and a similar list autopopulated to a DS.<sup>33</sup> Others have also shown that 36.4% of DS in their health service contained some information errors.<sup>10</sup> Errors in patients' DS have been correlated with increased rates of readmission to hospital and adverse patient outcomes.<sup>9,34-37</sup>

Among the features that EMR bring, comes the “copy and paste” or copy forward functionality. While this feature may support efficiency during clinical documentation, there is also the potential to promote inaccurate documentation that poses risks to patient safety. Tsou et al found that 66 to 90% of clinicians routinely use the copy and paste function.<sup>37</sup> In

cases where erroneous discharge information does not immediately impact patients, it may subsequently be detrimental to a patient at a later date—as incomplete and inaccurate information about a patient's hospitalization remains in their medical record and is rarely questioned once documented.<sup>38</sup> To improve documentation reliability within EMRs, it is essential that documentation practices are monitored and routinely evaluated and assessed.<sup>39</sup>

Content reliability is also challenging because of interuser variability; even within our pediatric tertiary center where the implementation of eDS templates is almost universal. In most cases, it is the responsibility of junior medical staff to complete DS. There remained significant variability between various medical and surgical teams and departments. For example, surgical DSs would often use autopopulated procedure or operation names as a surrogate for discharge diagnoses, which was not always accurate. Inclusion of certain elements improved over time as clinicians presumably became more familiar with the integrated eDS/EMR system and also likely due to effects of education and familiarization sessions. Other contributing factors toward variability could include completion of DS by a clinical team rather than an individual clinician, time pressures associated with DS generation, and lack of clinical experience by junior doctors completing the DS.<sup>5</sup>

### Future Direction

We propose several strategies to improve the quality of DS in the future. Our study targeted DS for long stay patients only, and within this cohort, deficiencies in meeting best practice standards were identified. Future research should include all inpatient units and patients (short or long stay) at the RCH to ensure best practice across all areas, departments, and patients is evaluated. More importantly, comprehensive future studies evaluating the accuracy of included eDS content are currently under way.

Work to optimize eDS templates has already begun, which involves modification of existing eDS templates to autopopulate best practice features, particularly around current deficit areas. Suggestions and prompts to enhance and simplify eDS completion are also being considered based on our findings. Guides around completing narrative portions of the DS are also being developed. Other principles useful in the implementation of an eDS are being considered, including the juxtaposition of allowing flexibility while ensuring key criteria are included.<sup>40</sup> If found to improve the quality of eDS, these enhancements could be implemented within eDS across EMRs within Australia.

Training and education is a key plank in optimizing end-user usage of eDS technology and also best practice in DS completion.<sup>23</sup> This helps to ensure that accurate and succinct patient data are first entered into the medical record, which is then autopopulated in eDS. Thus, when pertinent information is included, it is able to be utilized effectively by all clinicians involved in the patient's care.

Finally, strategies to develop eDS into a dynamic patient care tool should also be explored. Work in enabling two-way synchronization of key discharge information with national

health records, health databases, disease registries, or other repositories will increase currency and accuracy of data across multiple information sources.

### Limitations

This study examines inclusion of key data within eDS; however, it does not evaluate the accuracy of the information included as part of the autopopulation feature. Assessment of this is both user- and unit-dependent and is beyond the scope of this study. Nonetheless, it is a crucial piece for future research. Furthermore, our sample included long stay patients only and thus it is uncertain whether the deficits identified within DS are generalizable to short stay DS too.

### Conclusion

DSs serve an important purpose of being the primary mode of communication between the inpatient and outpatient setting. Review of the literature revealed that variability and inconsistency exist within DS, and furthermore, that incomplete and erroneous completion can compromise patient care, safety, and follow-up. There is room for improvement in the completion of DSs across all specialties.

### Clinical Relevance Statement

Discharge summaries remain the primary mode of communication between the inpatient and outpatient setting. Variability and inconsistency within discharge summaries, along with omitted key details and erroneous completion, can compromise patient care, safety, and follow-up. Regular optimization of electronic templates along with user training and education as well as synchronization with other dynamic databases can enhance effectiveness and reliability.

### Multiple Choice Questions

- Which key criteria is often omitted from pediatric discharge summaries?
  - Admission diagnosis.
  - Discharge medications.
  - Pending laboratory results.
  - Follow-up results.

**Correct Answer:** The correct answer is option c. Pending laboratory results and details around altered medications were included in < 10% of all discharge summaries. This creates a potential medication safety risk and/or duplication of therapy. By including them in discharge summaries, prevention of potential errors is maximized.

- Which of these has been identified as a key issue with electronic discharge summary content?
  - Autopopulation of data.
  - Accuracy of content.

- c. Not including family details.
- d. Inclusion of doctors' signature.

**Correct Answer:** The correct answer is option b. Accuracy of content has been identified as a major challenge in electronic discharge summaries, even in scenarios and contexts where a current template exists. Much of it depends on end-user data entry, review, and validation. The other options are minor challenges compared with accuracy of content.

#### Protection of Human and Animal Subjects

This study was performed in compliance with the World Medical Association Declaration of Helsinki on Ethical Principles for Medical Research Involving Human Subjects and was reviewed by RCH Human Research Ethics Committee (HREC #DA001-2017-102).

#### Conflict of Interest

None.

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### Appendix A Literature review search terms

<b>Medline Ovid</b>
“Discharge Summary” and “Gold Standard” = 9
“Discharge Summary” and “Variability OR Inconsistency” = 6
“Discharge Summary” and “Template” = 12
“Handwritten” and “Discharge Summary” = 8
“Electronic” and “Discharge Summary” = 128
<b>Cochrane Library</b>
“Discharge Summary” and “Gold Standard” = 0
“Discharge Summary” and “Variability OR Inconsistency” = 1
“Discharge Summary” and “Template” = 2
“Handwritten” and “Discharge Summary” = 0
“Electronic” and “Discharge Summary” = 6
<b>EMBASE</b>
“Discharge Summary” and “Gold Standard” = 19
“Discharge Summary” and “Variability OR Inconsistency” = 16
“Discharge Summary” and “Template” = 39
“Handwritten” and “Discharge Summary” = 20
“Electronic” and “Discharge Summary” = 230

Note: Keyword terms: Discharge Summary, Gold Standard, Template, Variability, Inconsistency.