



## Research Paper

## Impact of an integrated electronic handover tool on pediatric junior medical staff (JMS) handover

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## ABSTRACT

**Background:** Clinical medical handover between doctors forms a critical part of the patient care process. However, with the evolution of junior medical staff (JMS) working conditions, time pressure and increasing clinical and administrative loads mean that quality clinical handover is increasingly important yet more challenging to achieve.

This study evaluated the impact of a newly integrated electronic handover tool on JMS adoption and usage of the tool, as well as impacts on the quality (accuracy and redundancy) of handover data, JMS perceived workflow (time management and communication) and JMS satisfaction.

**Findings:** The majority of JMS surveyed used the tool at 1 (87.0%) and 3 (67.4%) months post implementation. After the introduction of the electronic handover tool, 67.5% of users spent less than 15 min updating handover data in the electronic handover tool, compared to just 6.7% prior to the introduction.

28.3% of respondents noted that there was > 25% redundant data, compared to more than half (52.2%) prior to introduction of the electronic tool. Overall JMS satisfaction with their handover process was significantly higher post implementation of the integrated electronic handover report (17.4% pre, 80.4% at 1 month, 67.4% at 3 months).

**Conclusion:** A newly introduced integrated electronic medical record handover tool had a high uptake amongst JMS, and resulted in improvement in perceived handover efficiency, a reduction in redundant data entry and improved JMS handover satisfaction.

## 1. Introduction

Clinical medical handover between doctors, also known as *signout* or *handoff*, forms a critical part of the patient care process. The quality of the passage of information between medical staff is paramount, as there is significant potential risk in patient care when one medical team who is familiar with the patient is handing over to one that is not [1].

In Australian hospitals, Junior Medical Staff (JMS), comprising interns, residents, registrars and fellows, provide the majority of on-site inpatient medical cover across any 24-h period. The number of JMS has increased with the introduction of safe working hour restrictions, with many working shifts that overlap [2]. Consequently, the number of episodes of clinical handover where the sharing of patient information between providers involved in a single patient's care has also increased.

Together with time pressures and increasing clinical and administrative loads amongst other training requirements, quality clinical handover is increasingly important yet more challenging to achieve.

Previous studies of JMS handover have shown significant variability in style, structure, quality and content [3,4]. Horwitz et al. have also identified cross-specialty gaps between JMS on various units, including poorly written documentation, lack of training and evaluation and an absence of standard handover policies [5]. This increases the risk for poor clinical communication and a subsequent well-established increased risk of patient care related adverse events [6].

Existing literature, including studies from Australasia, demonstrates that computer based handover systems assist in maintaining accurate patient care [7–10]. Starmer et al. have shown a significant reduction in both medical errors and preventable adverse events after the

**Abbreviations:** JMS, Junior Medical Staff; EMR, Electronic Medical Record; NSQHS, National Safety and Quality Health Service; ACSQHC, Australian Commission on Safety and Quality in Health Care; RCH, Royal Children's Hospital Melbourne; ISBAR Proforma, Identify, Situation, Background, Assessment, Recommendations

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introduction of a JMS handover package with three components – standardized handover training, a verbal mnemonic and redesign of the handover workflow structure amongst the junior medical staff team [11]. When the additional step of an unintegrated computerized handover was introduced, a resultant decrease in the omission of key handover data was also observed.

Thus, in an effort to standardize and improve both the standard and efficacy of clinical handover across Australia, the above processes have been adopted as a national quality assurance and improvement benchmark as part of the National Safety and Quality Health Service (NSQHS) Standards, developed by the Australian Commission on Safety and Quality in Health Care (ACSQHC) [12]. Similar efforts have been previously employed worldwide to tackle this problem [13].

The Royal Children's Hospital Melbourne (RCH) campus-wide introduction of an Electronic Medical Record (EMR) in April 2016, together with an EMR-integrated medical handover tool, provided an excellent opportunity to consider potential effects on current clinical handover practice amongst the JMS cohort.

This study evaluates the impact such a tool had on the adoption and usage of the EMR-handover tool, as well as impacts on quality (accuracy and redundancy) of handover data, JMS workflow (time management and communication) and JMS satisfaction.

## 2. Methods

### 2.1. Setting and participants

A cohort study was conducted at The Royal Children's Hospital Melbourne (RCH); a 315-bed pediatric quaternary referral and academic hospital in Melbourne, Australia.

All JMS who were eligible were invited to complete pre and post-intervention electronic surveys. Eligibility criteria included all JMS who were:

- Working at RCH across a range of specialties in which a formalized handover currently takes place and used the standardized EMR-integrated handover tool
- Working at RCH at ALL time points of the study
- Had completed the standardized EMR medical training package – provided by two trainers (DRC, JL) with a demonstration of the handover tool's capabilities and usability

Exclusion criteria include JMS rotating through critical care (PICU, NICU, ED and Anesthetics) and Mental Health units, as their handover process was unit specific and they did not uniformly adopt the new electronic handover tool during the go-live period.

### 2.2. Questionnaire

A 12-item multiple choice and free-text anonymous survey was distributed to participants one month prior to the implementation of the electronic handover tool and one and three months post the implementation of the handover tool. Surveys were electronically administered through Lime Survey, a secure survey delivery platform utilized across the RCH. The questionnaires (see appendix) were adapted from previously validated surveys used internationally [14,15].

### 2.3. Intervention

The new EMR-handover tool was a customized and integrated electronic solution housed within the hospital's commercial EMR system (Epic Electronic Medical Record, Wisconsin, USA). The entire EMR, including the handover tool, went live across the campus on 30th April 2016. The handover tool is visible and editable by all inpatient medical staff from any location (both on and off-campus) where logon

to the EMR system is possible.

The tool is based on NSQHS principles, and is based on the Identify, Situation, Background, Assessment, Recommendation (ISBAR) format for clinical handover [12]. It is patient specific and automatically populates and updates demographic and hospital location information, medications, laboratory data and latest vital signs. Users have the option to enter free text under four headings (Summary, Situational Awareness/Contingency, Key Meds/Labs, To Do List), as well as to utilize automatically refreshing links, which pull key data elements from various sections of the patient's record.

### 2.4. Statistical analysis

Descriptive summaries of data were compiled comprising percentages and mean and median values. Statistical analyses using Stata (Statacorp, TX) were performed, with Wilcoxon rank-sum test for ordinal variables and Fisher's exact test for categorical variables.

## 3. Results

46 out of 51 eligible JMS responded to all three surveys, with a response rate of 90.2%. The majority were female (71.2%), with a spread of resident seniority and specialty.

There was a significant uptake of the electronic handover tool after go-live, with 87.0% and 67.4% of JMS using the tool at 1 and 3 months post implementation respectively (Table 1). There was minimal change in concurrent use of verbal handovers for information transfer (76.1% pre vs 82.6% at 1 month and 78.3% at 3 months). Use of printed patient lists decreased slightly after the electronic handover tool was introduced, but still remained high (97.8% pre vs 93.5% at 1 month and 89.1% at 3 months). Use of alternative computer based tools virtually ceased after the introduction of the electronic handover tool.

After the introduction of the electronic handover tool, more than two thirds of users (67.5% at 1 month post) spent less than 15 min updating handover data in the electronic handover tool, compared to just 6.7% prior to the introduction. The median time was 11–15 min (post-intervention) compared to 21–25 min (pre-intervention) per day.

There was a marked decrease in user reported redundant data entry within the handover tool after the introduction of the electronic tool. 28.3% of respondents noted that there was > 25% redundant data entry at 1 month post implementation, compared to more than half (52.2%) prior to introduction of the electronic tool.

There was no statistically significant change in the perceived accuracy of data contained within the electronic tool after its introduction. Overall JMS satisfaction with their handover process was significantly higher post implementation of the integrated electronic handover report (17.4% pre, 80.4% at 1 month, 67.4% at 3 months).

## 4. Discussion

Our standardized and integrated electronic handover tool was designed to be a functional component of a systematic EMR rollout. Coupled with comprehensive end-user training, its introduction addressed key challenges across all medical specialties such as lack of training, standardization and poor written documentation [5]. To the authors' knowledge, this is the first Australasian study examining an electronic handover tool or initiative integrated with a fully electronic EMR system, which ultimately demonstrated widespread adoption and improvements in workflow efficiency and provider satisfaction.

The handover tool is structured to deliver handover information at a team rather than an individual clinician level. This better allows cross-covering JMS to understand the primary team's plans and make important decisions about patient care after hours [16]. This is particularly relevant in the pediatric setting where a significant proportion of presentations for emergency or inpatient care at our facility happen outside business hours.

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