# Electronic handoff instruments: a truly multidisciplinary tool?

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## ABSTRACT

The objective was to assess use of a physician handoff tool embedded in the electronic medical record by nurses and other non-physicians. We administered a survey to nurses, physical therapists, discharge planners, social workers, and others to assess integration into daily practice, usefulness, and accuracy of the handoff tool. 231 individuals (61% response) participated. 60% used the tool often or usually/always during a shift. Nurses (46%) used the tool for shift transitions and found it helpful for medical history (79%) but not for acquiring medication, allergy, and responsible physician information. Nurses (96%) and others (75%) rated the tool as accurate. Medical nurses rated the tool more useful than surgical nurses, and pediatric nurses rarely used the tool. The tool was integrated into the daily workflow of non-physicians despite being designed for physician use. Non-physicians should be included in the design and implementation of electronic patient handoff systems.

## BACKGROUND AND SIGNIFICANCE

As many as 80% of serious medical errors involve a breakdown of communication during transfer of patient care from one individual to another.[1] As a result, patient handoffs have become the focus of significant research efforts, quality improvement programs, and regulatory reviews.[1 2]

A number of interventions have been developed to improve the quality and safety of physician handoffs.[3–5] Yet unintended effects are often observed with quality improvement interventions. For example, computer physician order entry was intended to reduce the frequency of medical errors but in some cases increased them because of design flaws.[6 7] It is equally possible that effects of interventions to improve physician handoffs extend to other non-physician providers. Electronic sign-out notes for physician sign-out may unintentionally improve non-physician care through the diffusion of information to all members of the care team.[8 9]

We embedded a computerized physician sign-out note (CSON) into the electronic medical record (EMR) (Sunrise Acute Care, Allscripts Healthcare Solutions, Chicago, Illinois, USA) at Yale–New Haven Hospital (YNHH), a 966-bed, urban tertiary teaching institution, in 2008.[10] The EMR is used for all order entry and most documentation outside of the operating rooms and the emergency department. The CSON automatically imports patient demographics, hospital bed location, dietary status, selected laboratory values, and medications. Hospital course, physician care team, and code status are optional free text fields included in all sign-out notes. In addition, there are optional specialty-specific free text fields, such as operative procedures in surgery templates and chemotherapy history in oncology templates. Multiple specialties may each create a sign-out note for the same patient; all are visible to users (see online supplementary appendix 1).[10] All users of the EMR were granted read access to the CSON with write access restricted to physicians, advance practice nurses, and physician assistants. Read access includes all fields that are part of the CSON. Informal feedback from unintended (non-physician) users of the CSON indicated they often used the system as part of their daily workflow and prompted us to perform a formal evaluation.

## OBJECTIVE

We sought to identify and quantify the ways in which the CSON was being utilized by non-physicians, to describe which daily work functions were facilitated by the CSON, and to determine the perceived data quality of the CSON from a non-physician provider perspective.

## MATERIALS AND METHODS

### Survey sample population

We included nurses, unit secretaries, physical and occupational therapists, care coordinators/discharge planners, and social workers. Nursing and unit secretaries were limited to full time day staff from a broad base of selected units including general medicine, pediatrics, surgery and surgical specialties, surgical and neurologic intensive care units, neurosurgical general ward, obstetrics and gynecology, and orthopedics. Nursing leadership on selected units distributed and collected the surveys to nurses, and surveys were distributed to all discharge planners at a regularly scheduled meeting. Unit clerks, respiratory therapists, dietary consultants, and others on hospital wards were eligible to participate but were not systematically targeted for enrollment. We did not specifically include respiratory therapists or pharmacists, because the former have a very narrow interest in the patient and the latter do not provide direct patient care. The Human Investigations Committee of Yale School of Medicine determined this study to be exempt from review.

### Survey content

We developed a paper survey instrument including 10 questions (see online supplementary appendix 2). Demographics, type of profession, and primary medical specialty area were recorded. The instrument assessed the degree to which non-physician providers incorporated the CSON into their daily

practice, and examined which work functions were facilitated by the CSON. For the purposes of this study providers were defined as nurses (including charge nurses), physical therapists, discharge planners, and unit secretaries. We explored the frequency with which the CSON was used during handoffs and its perceived accuracy. Most of the questions regarding use and usefulness of the CSON used a 5-point Likert-type scale.

### Statistical analysis

We characterized frequency of CSON use, usefulness for various tasks, and accuracy of the CSON using descriptive statistics. For graphic presentation and statistical analysis we dichotomized outcomes by combining the first and second categories and the third through fifth categories. Our main predictor variable was professional role, dichotomized into nurses and others. We also conducted additional analyses of responses based on specialty area, age, and years of experience using $\chi^2$ tests. Analysis was performed using SPSS V.17.0, with $p<0.05$ considered significant.

## RESULTS

### Study sample

There were 231 total responses with an overall response rate of 61.0%. The majority of respondents were nurses (table 1).

**Table 1** Characteristics of respondents and response rates

| Role/status* | N or % in category | Response rate (%) |
|---|---|---|
| Nurse (n) | 153 | 62 |
| Medical | 45% | |
| Surgical | 43% | |
| Pediatric | 11% | |
| ICU | 11% | |
| Floor | 86% | |
| Age (years) | | |
| Less than 30 | 36% | |
| 30–50 | 46% | |
| 51–65 | 16% | |
| Over 65 | 0% | |
| Years of experience | | |
| Less than 2 | 24% | |
| 2–5 | 23% | |
| 6–10 | 16% | |
| More than 10 | 36% | |
| Gender | | |
| Female | 92% | |
| Male | 7% | |
| Others (n) | 73 | 55 |
| Medical | 17% | |
| Surgical | 44% | |
| Pediatric | 21% | |
| ICU | 7% | |
| Floor | 82% | |
| Age (years) | | |
| Less than 30 | 15% | |
| 30–50 | 38% | |
| 51–65 | 37% | |
| Over 65 | 6% | |
| Years of experience | | |
| Less than 2 | 10% | |
| 2–5 | 8% | |
| 6–10 | 10% | |
| More than 10 | 65% | |
| Gender | | |
| Female | 89% | |
| Male | 8% | |
| Job description | | |
| Charge nurse/manager | | 75 |
| Discharge planner | | 100 |
| Physical/occupation therapy | | 27 |
| Unit secretary | | 63 |

*Percentages do not sum to 100% due to missing data or in cases where the classification does not apply such as ICU versus floor for non-nurses.
ICU, intensive care unit.

### Use of the CSON

During a typical shift, the CSON was used often or usually/always by 136/221 (61.5%) survey respondents (figure 1). As an adjunct for the transition of care to the following shift, 62/135 (46%) nurses used the CSON, compared with 8/36 (22%) non-nurses ($p=0.010$) (figure 2). Nearly all (151, 94.7%) nurses reported usually or always conducting face-to-face sign-outs, most commonly at the bedside. Nurses with more than 5 years of experience were less likely to use a face-to-face or dictation-based sign-out but were similar with respect to CSON use. The CSON was used as the main method of sign-out or as an adjunct to face-to-face sign-outs by 77/151 (51.0%) nurses compared to other sign-out notes (63/151; 41.7%) and dictated sign-outs (40/151; 26.5%).

With respect to data retrieval, nurses found the CSON most helpful for obtaining medical history, current medications, allergies, potential problems, the responsible physician, and code status. Nearly one third of nurses also found it useful, very useful, or essential for completing daily tasks (figure 3). Nurses found the CSON significantly more useful than other providers for medical history (79% vs 57%, $p=0.011$), medications (45% vs 26%, $p=0.006$), and allergies (46% vs 26%, $p=0.004$). Only identification of the responsible physician was reported as very useful or essential by more than 25% of other providers.

### Quality of the CSON

There was a similar discrepancy between nurses and non-nurses with respect to CSON accuracy: 96% of nurses considered it accurate compared to 75% of non-nurses ($p<0.001$). Only lab/radiology reports, the nurses themselves, and nursing notes were considered more accurate (figure 4). There were no differences in perceived accuracy among various subgroups of nurses including intensive care unit nurses, pediatric nurses, surgical nurses, medical nurses, or obstetric nurses (table 2). Clinical experience affected perception, with 99% of nurses with 5 or less years of experience considering the CSON accurate compared to only 85% with more than 5 years of experience ($p=0.002$). The more experienced nurses also were less likely to rate the patient highly as an accurate source of information (79% vs 92%, $p=0.012$).

### Service specific CSON use

There was less use of the CSON by pediatric nurses for their daily work compared with adult nurses ($p=0.014$). Compared to medical nurses, surgical nurses felt the CSON performed less well for identifying potential patient problems ($p=0.024$), patient medications ($p=0.028$), allergies ($p=0.050$), primary care physician and other consultants ($p=0.036$), prioritizing daily work ($p=0.002$), family contact information ($p<0.001$), planning staffing assignments ($p=0.049$), and code status

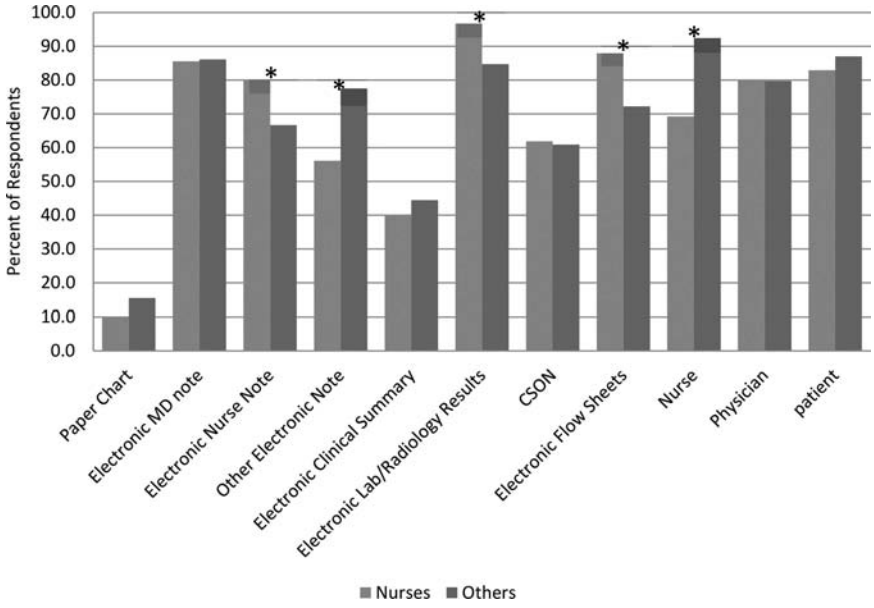


**Figure 1** Frequency with which various methods for gathering patient data are used comparing nurses and other healthcare professionals. Bars represent percentage responding often/usually/always. CSON, computerized physician sign-out note; *difference significant ($p<0.05$).

($p=0.027$) (table 2). There were no additional differences beyond those documented above with respect to age, sex, or clinical experience among respondents.

## DISCUSSION

We found that use of the physician computerized sign-out note by professionals other than physicians and their surrogates was an unintended positive consequence of a hospital-wide physician handoff system. Nearly half of nurses incorporated the CSON into their own handoff process, and over 60% often used the CSON during the workday.

Survey respondents reported gathering patient information from a wide variety of sources. We therefore do not know if the CSON was used as a primary or complementary source. However, given its common but not universal use it likely serves to complement other sources of data or it is not well known to all staff members. Some disciplines, such as discharge planning and physical/occupational therapy, do not staff a night shift and therefore have little need for shift-to-shift communication except on weekends. Only about 20% of these professionals used the CSON. By contrast, of nurses, 40% used the CSON as an adjunct to sign-out, and this appeared random, not related to unit, unit type, or specialty. This relatively common use of a system for an unintended purpose suggests either a lack of other appropriate tool or perhaps that the CSON could serve a role in nursing sign-out with or without modification. Although a number of studies have been published about nursing handovers,[11] only one small pilot asked nurses to review physician handoff information during the nursing change of shift report. In that study, nurses felt better informed about basic patient information and more able to anticipate changes in clinical status.[12] Another study found that 46% of information in nursing and physician handoffs overlap.[13] Together with our study, these results suggest that integrating physician and nursing handoff materials may be a useful strategy.

Interestingly, use of the CSON by nurses was widespread despite the fact that most also reported frequently referring to physician progress notes during daily activities. The CSON must therefore serve a different function for nurses, perhaps as a more concise synopsis of the medical history and hospital course than can be found elsewhere. Indeed, about 80% of nurses reported that they found the CSON very useful or essential for information about the patient's medical history and most also felt it helpful for responsible physicians and potential

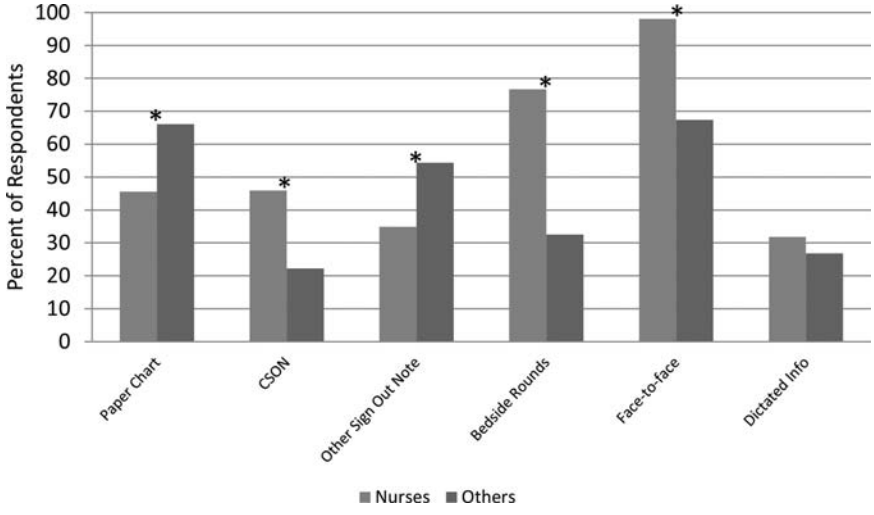


**Figure 2** Frequency with which various methods for transferring patient data to the next shift are used comparing nurses and other healthcare professionals. Bars represent percentage responding often/usually/always. CSON, computerized physician sign-out note; *difference significant ($p<0.05$).

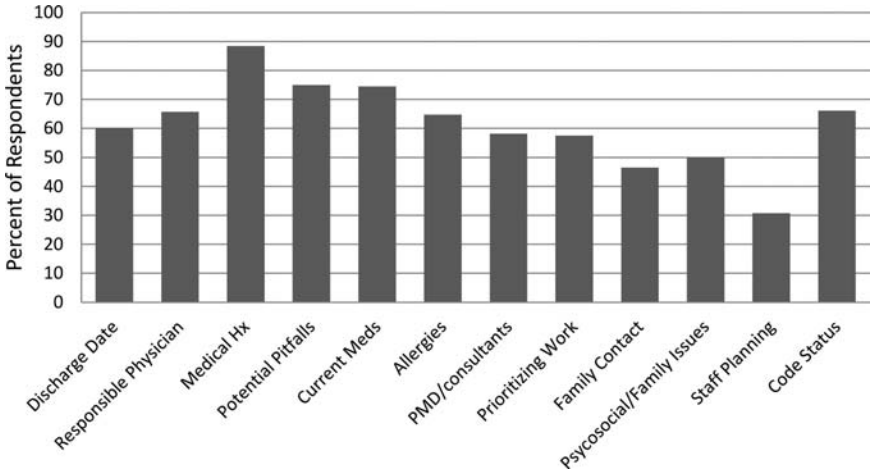


**Figure 3** Nursing use of the computerized physician sign-out note (CSON) for various tasks. Bars indicate percentage of respondents who identified the CSON as moderately useful, very useful, or essential for each specific task.

pitfalls, which are important components of the physician handoff. Equally surprising was the fact that nurses reported relying on the CSON for allergies and medications, which auto-populate from other areas of the EMR. Using the CSON to obtain these data suggests that the EMR is not optimally designed for rapid access of information in a central location. The same might be argued of the medical history—this information should be readily visible in the daily progress note or elsewhere, yet the 'essential' nature of CSON for staff for this information suggest progress notes are also not optimally designed. In fact EMR based notes have become longer and more likely to include outdated or copy/pasted information with loss of the 'narrative function'.[14–16] Perhaps a model will arise where the CSON will serve the intersection of information necessary for cross covering physicians and nurses providing routine care.

Opinions regarding accuracy of the CSON were troubling. However, because nurses were more likely to find it accurate than other care providers were, we suspect this relates to differences in the elements nurses use compared to others. For example, sign-outs typically lack elements that might be useful to non-nursing staff, such as care coordination needs, dietary requirements, or family contacts. The decreased use by pediatric nurses was not surprising as system data has documented less use by pediatric physicians.[10] The discrepancy between surgical and medical nurses likely reflects the data entered by surgical house staff. Surgical house staff at our institution use the CSON mostly to log background medical information and daily work plan but do not typically record the other items queried.[17] It is possible this reflects differences in nurses, not authors of the CSON; this is however unlikely. Nurses rarely care for patients outside of their primary specialty.

We obtained a broad view of which groups use the CSON, what functions are aided, and the perceived accuracy of the CSON. There are some limitations in the design and execution of the study. There was no previously validated survey instrument and although comprehensive and straightforward, our instrument has not been validated. For some types of respondents, we did not know the denominator to which the survey was distributed and could not determine response rate; furthermore, we had few responses from staff outside nurses and care coordinators. Nonetheless, our response rates from nurses and care coordinators were high and these are the two groups likely to use the CSON. We only included day shift nurses; night shift staff might have had different views. We surveyed only nurses from select units; however, they represented a diversity of practice. We felt the logistical challenge of an institution-wide survey would likely have lowered response rates. There is some potential for bias associated with distribution by a supervisor; however, we feel this risk was mitigated by the anonymous completion of the instrument. This is a single institution study with its attendant limitations, however it provides a framework by which future studies of single author/

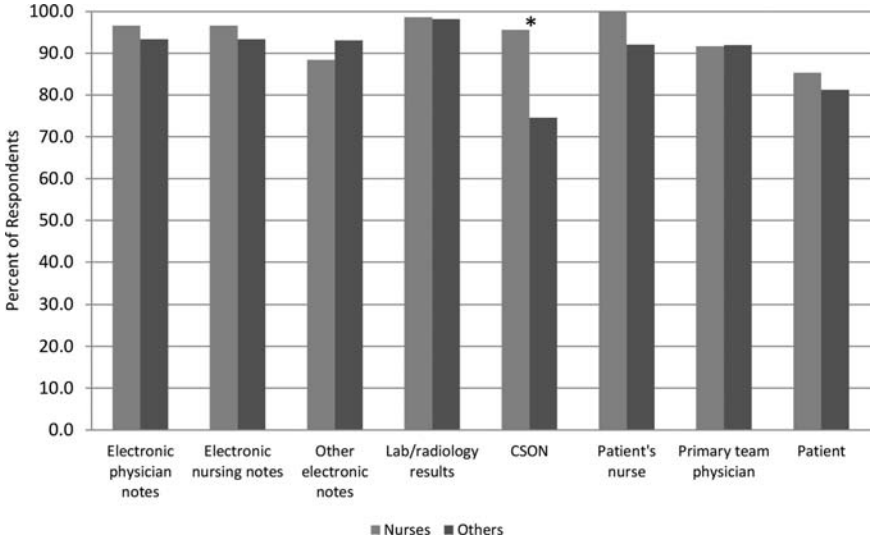


**Figure 4** Perceived accuracy of various patient data sources. CSON, computerized physician sign-out note; *difference significant ($p<0.05$).

**Table 2** Breakdown of categories of nurses and their assessment of the CSON for accuracy and usefulness in various tasks (all data reported as percentages between dichotomized responses)

| | CSON Never/ sometimes accurate | CSON Often/ usually/ always accurate | Information on discharge date | | Identifying hospital contact physician | | Finding medical history, current issues, and care plan | | Understanding what to watch for | | Finding a list of current medications | | Checking allergies | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Not or somewhat useful | Moderate, very useful or essential | Not or Somewhat useful | Moderate, very useful or essential | Not or somewhat useful | Moderate, very useful or essential | Not or somewhat useful | Moderate, very useful or essential | Not or somewhat useful | Moderate, very useful or essential | Not or Somewhat Useful | Moderate, very useful or essential |
| Adult nurses | 3.3 | 96.7 | 38.1 | 61.9 | 32.8 | 67.2 | 10.6 | 89.4 | 25.2 | 74.8 | 26.2 | 73.8 | 34.5 | 65.5 |
| Pediatric nurses | 7.7 | 92.3 | 50.0 | 50.0 | 42.9 | 57.1 | 14.3 | 85.7 | 18.8 | 81.3 | 14.3 | 85.7 | 37.5 | 62.5 |
| Medical nurses | 3.4 | 96.6 | 35.0 | 65.0 | 32.2 | 67.8 | 8.3 | 91.7 | 16.1 | 83.9 | 16.7 | 83.3 | 26.2 | 73.8 |
| Surgical nurses | 5.2 | 94.8 | 45.1 | 54.9 | 36.8 | 63.2 | 14.5 | 85.5 | 32.9 | 67.1 | 33.3 | 66.7 | 42.5 | 57.5 |
| ICU nurses | 0.0 | 100.0 | 73.3 | 26.7 | 31.3 | 68.8 | 12.5 | 87.5 | 43.8 | 56.3 | 37.5 | 62.5 | 50.0 | 50.0 |
| Ward nurses | 4.2 | 95.8 | 35.0 | 65.0 | 34.2 | 65.8 | 10.7 | 89.3 | 22.0 | 78.0 | 23.3 | 76.7 | 32.8 | 67.2 |

| | Contacting consultants and the primary medical doctor | | Prioritizing daily work and/or early discharges | | Finding family contact information | | Identifying psychosocial/family issues | | Planning staffing assignments | | Identifying code status | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Not or somewhat useful | Moderate, very useful or essential | Not or somewhat useful | Moderate, very useful or essential | Not or somewhat useful | Moderate, very useful or essential | Not or somewhat useful | Moderate, very useful or essential | Not or somewhat useful | Moderate, very useful or essential | Not or somewhat useful | Moderate, very useful or essential |
| Adult nurses | 43.0 | 57.0 | 39.3 | 60.7 | 52.6 | 47.4 | 46.7 | 53.3 | 69.6 | 30.4 | 30.6 | 69.4 |
| Pediatric nurses | 28.6 | 71.4 | 64.3 | 35.7 | 57.1 | 42.9 | 73.3 | 26.7 | 63.6 | 36.4 | 57.1 | 42.9 |
| Medical nurses | 32.1 | 67.9 | 28.8 | 71.2 | 35.1 | 64.9 | 40.7 | 59.3 | 58.7 | 41.3 | 23.7 | 76.3 |
| Surgical nurses | 50.7 | 49.3 | 56.1 | 43.9 | 70.0 | 30.0 | 57.3 | 42.7 | 76.1 | 23.9 | 42.4 | 57.6 |
| ICU nurses | 62.5 | 37.5 | 64.3 | 35.7 | 81.3 | 18.8 | 75.0 | 25.0 | 86.7 | 13.3 | 43.8 | 56.3 |
| Ward nurses | 38.4 | 61.6 | 39.3 | 60.7 | 49.1 | 50.9 | 46.2 | 53.8 | 66.3 | 33.7 | 32.1 | 67.9 |

CSON, computerized physician sign-out note; ICU, intensive care unit.



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multiple user sign-out systems can and should be completed. In addition to confirmation of our findings, an area that was not investigated in this study is which data may have augmented the CSON to achieve maximal usefulness for all providers and the value of other providers having write access to the CSON.

## CONCLUSION

Non-physician care providers, most commonly nurses, used the CSON for multiple tasks despite availability of the full EMR. Nurses also most commonly identified the CSON as accurate. A physician CSON may be incorporated into the workflow of other care providers in an EMR which may provide a useful mechanism to improve communication of important information. Similarly, involving all care providers in the design of sign-out systems should be considered to improve both efficiency and patient care. Further evaluation of which types of care providers should be given write access and the data fields that are appropriate for such a tool will be essential.

**Contributors** KMS and LIH: design, data acquisition, data analysis, drafting of manuscript, critical revision, final approval. GYJ, SFT, DCH, JN, and DGS: design, data acquisition, critical revision, final approval

**Competing interests** None.

**Ethics approval** The study was determined to be exempt by the Yale Human Investigations Committee.

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