Clinical Experience

Evaluating the Impact of Computer-Generated Rounding Reports on Physician Workflow in the Nursing Home: A Feasibility Time-Motion Study

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ABSTRACT

Objectives: To determine the feasibility and impact of a computer-generated rounding report on physician rounding time and perceived barriers to providing clinical care in the nursing home (NH) setting.

Setting: Three NHs located in Pittsburgh, PA.

Participants: Ten attending NH physicians.

Measurements: Time-motion method to record the time taken to gather data (pre-rounding), to evaluate patients (rounding), and document their findings/develop an assessment and plan (post-rounding). Additionally, surveys were used to determine the physicians’ perception of barriers to providing optimal clinical care, as well as physician satisfaction before and after the use of a computer-generated rounding report.

Results: Ten physicians were observed during half-day sessions both before and 4 weeks after they were introduced to a computer-generated rounding report. A total of 69 distinct patients were evaluated during the 20 physician observation sessions. Each physician evaluated, on average, four patients before implementation and three patients after implementation. The observations showed a significant increase ($P = .03$) in the pre-rounding time, and no significant difference in the rounding ($P = .09$) or post-rounding times ($P = .29$). Physicians reported that information was more accessible ($P = .03$) following the implementation of the computer-generated rounding report. Most (80%) physicians stated that they would prefer to use the computer-generated rounding report rather than the paper-based process.

Conclusions: The present study provides preliminary data suggesting that the use of a computer-generated rounding report can decrease some perceived barriers to providing optimal care in the NH. Although the rounding report did not improve rounding time efficiency, most NH physicians would prefer to use the computer-generated report rather than the current paper-based process. Improving the accuracy and harmonization of medication information with the electronic medication administration record and rounding reports, as well as improving facility network speeds might improve the effectiveness of this technology.

Most physicians who practice in nursing homes (NHs) spend an average of 2 hours or less per week caring for their patients.1 NH physicians need to gather patient data from various disparate sources that are primarily intended for nursing staff and are located throughout the facility so as to fully comprehend the clinical picture before evaluating a patient. A national survey of NH physicians suggests that actual time spent on 4 common types of NH visits (new admission for long term care, new admission for rehabilitation, 30/60-day review, and readmission to the NH) were significantly less than the perceived optimal visit times.2 This study found that the two most significant barriers to providing optimal visits were inaccessible and inaccurate data. Despite the concerns raised by this research, little empirical work has been done to characterize the actual amount of time spent to complete common NH visits, or the impact on efficiency when information is both potentially accessible and accurate.
The rounding process traditionally encompasses three distinct phases: pre-rounding, rounding, and post-rounding. Pre-rounding is the process of gathering, preparing, and analyzing information for the treatment and evaluation of patients before seeing the patient. Rounding is the process of evaluating those patients, and post-rounding is the process of writing a note or record of the encounter to document the history, physical examination, and assessment/plan in the medical record. Rounding reports contain the most relevant clinical and demographic patient data presented in a condensed format, and are typically used to simplify the rounding process for physicians in various clinical settings. Previous research has shown that the gathering and preparation of information necessary to see patients (i.e., pre-rounding) without a rounding report is a time-consuming and error-prone process.

We conducted this study as an initial step to determine the feasibility and impact of a computer-generated rounding report developed using a commercially available clinical surveillance system on physician rounding time and perceived barriers to providing clinical care in the NH setting. We selected this approach to data extraction and formatting because our NHs, similar to most US NHs, do not have an EMR (electronic medical record) system. Moreover, studies of EMRs in the NH have not shown a reduction in the proportion of time spent on clinical documentation and are associated with high costs of implementation and maintenance. To the best of our knowledge, there are no reports to date on the development, evaluation, or application of a computer-generated rounding report in the NH setting, which may represent a feasible alternative to electronic medical record systems used for clinical documentation.

Methods

Study Setting

We conducted physician observations at three University of Pittsburgh Medical Center (UPMC) NHs, which are considered nonchain and nonprofit and located in Pittsburgh, PA. The first, Seneca Place, is a suburban NH with 174 licensed beds, approximately 492 admissions per year, and 20 active attending physicians. The second, Heritage Place, is an urban NH with 145 licensed beds, approximately 542 admissions per year, and 26 active attending physicians. The third, Canterbury Place, is an urban NH with 80 licensed beds, approximately 232 admissions per year, and 16 active attending physicians.

Study Design

This was an observational pre-post time-motion study of NH physicians.

Recruitment

Attending physicians were e-mailed a brief description of the project from a member of the investigative team (S.M.H.) who had a preexisting working relationship. Physicians were subsequently contacted by phone, if they did not respond to three e-mail attempts.

Participants

We operationally defined active attending physicians as "providers that currently are considered the attending physician for one or more resident(s) in the selected NHs," were eligible for study participation. Attending physicians were enrolled following approval by the UPMC Total Quality Council as a quality improvement project without regard to gender, race, or ethnicity. The physicians in the study were presented with a written description of the study and were informed of their right to withdraw from the study without consequences. Each physician participant received a $25 gift card per observation (a total of $50 at the completion of the study) as a token of our appreciation.

Rounding Report Development

Before this study, a panel of 12 Division of Geriatric Medicine practitioners (10 MDs/DOs and two nurse practitioners) developed a list of 35 data elements that should be included as part of a NH-specific computer-generated rounding report (information available on request from the authors). The data elements available for inclusion in these reports were based on the types of information currently accessible in electronic format in the UPMC clinical and/or administrative systems, such as medication data, laboratory test results, vital signs, bowel and bladder function, microbiology and isolation precautions, and radiology reports. Using these data, a SOAP (subjective, objective, assessment, and plan)-formatted progress note template was developed, which will be referred to as the computer-generated rounding report.

The rounding report was developed by a member of our investigative team (C.M.C.), using the Rounds Assistant module in the Clinical Intelligence Platform of the TheraDoc Clinical Surveillance system (Hospira, Inc., Lake Forest, IL). The Rounds Assistant module enables end-users to create personalized views to display data within a customizable framework. These views can be shared among teams of practitioners within the TheraDoc system. These reports are available in online and printed formats enabling real-time integration of data from disparate systems to provide a customized snapshot of patient information formatted as a SOAP note. The computer-generated rounding report can be securely accessed and printed on demand through the TheraDoc system. The printed report can be used for notations and patient evaluation during rounds and then signed and placed in the medical record. A sample rounding report can be found online at www.jamda.com.

Observations (Time-Motion)

Time-motion is the analysis of specific jobs or tasks in order to determine and eliminate inefficient practices or to determine how time is allocated to various subtasks for a task of interest. Physician workflow can be evaluated via time-motion, which can be used to validate efficiency and the sources of delay in complex working environments. This technique has been previously used in NHs to evaluate staff-patient interaction of nursing assistants and other care processes, such as the application of wound care products. In this study, time-motion was defined as the real-time recording (by an external observer) of the time that it takes NH physicians to complete pre-rounding, rounding, and post-rounding, which encompasses the scope of NH physician rounding.

One observer (P.T.J.) used a Livescribe Echo smartpen (LiveScribe, Inc, Oakland, CA) to collect the time-motion data. The smartpen uses a built-in infrared camera reader that records motion, images, and coordinates on proprietary paper that is embedded with dots and stores this information on an internal 8 GB of storage. The camera tracks the pen’s movement while simultaneously recording audio with a precision to the second. Data were transferred to a computer using their proprietary software that can store, manage, and process data and export the files as a PDF. This smartpen was selected because it is easy to use, inexpensive, and available in most electronics retailers, and can collect accurate timed data with minimal interruption to physician workflow.

Each physician observation took place during a 4-hour interval equating to a half-day clinical session in the NH, both before and after
implementation of the computer-generated rounding report. The timed observations included measurement of the (1) pre-rounding time, (2) rounding time, and (3) post-rounding time. Additionally, select de-identified patient demographic information, including age, gender, number of medications, and number of comorbid conditions, were collected from the patient record to describe the patient population examined by the physician participants.

At the end of the initial (pre-implementation) observation, physicians were taught how to access, use, and print the computer-generated rounding reports. They were then given a 1-month period to become acclimated to using the rounding report and reach a new potential steady state in their workflow during which time physicians’ use of the system was captured. The same observer then returned to repeat timed observations and collect post-implementation data.

**Pre-Implementation Survey**

Following the pre-implementation physician observation, participants were asked to provide demographic information, describe the extent of their NH practice time, and complete a pre-implementation survey. The pre-implementation survey consisted of a previously published survey that evaluated perceived barriers (accessible information, accurate information, clerical support, nursing support, reimbursement, and scheduling) to providing care in the NH. The response options on a Likert scale ranged from “not at all (1)” to “very much (5)”, where the higher number indicated a more significant barrier.

**Post-Implementation Survey**

This survey reassessed the same aforementioned perceived barriers to providing care in the NH following the use of the computer-generated report. The survey also had one three-part question regarding satisfaction with the accuracy, timeliness (eg, most recent medication information), and completeness (eg, comprehensive list of laboratory results) of the information contained within the report with response options on a Likert response scale that ranged from “not at all satisfied (1)” to “extremely satisfied (5).” Another set of questions using a Likert scale ranging from “much less efficient (1)” to “much more efficient (5),” was used to determine the perceived impact of the computer-generated rounding report on 3 aspects of physician efficiency (information abstraction and formatting, number of residents seen, and time spent with each resident). Physicians were also asked to give their preference for using the paper-based process or the computer-generated rounding report at the completion of the study.

**Statistical Analysis**

Appropriate descriptive statistics (percentages, means, and SDs) were used to characterize the physician and patient demographic variables as well as to summarize the time taken for data gathering, to provide patient care, and to write the progress note for each physician pre- and post-implementation with each physician serving as his or her own control. The pre- and post-implementation time means were then compared using the Wilcoxon signed rank test to determine statistical significance. For comparison with previously reported data, the section of the survey containing the Likert scale responses was summarized as means with the Wilcoxon signed rank test to determine statistical significance. A significance level of .05 was used in each test. IBM SPSS Statistics version 19 (IBM Corporation, Somers, NY) was used for all statistical analyses.

We planned a priori to enroll a minimum of 5 physicians, as other pilot time-in-motion studies also included similar numbers. We are cognizant of the small sample size and the limitations it imposes on statistical hypothesis testing in this initial investigation, and draw our conclusions based on magnitude of descriptive statistics in addition to P values.

**Results**

**Participant Characteristics**

Five female and five male physicians comprised the 10 attending NH physicians who participated in the study. Seven worked at Seneca Place NH, two at Heritage Place NH, and one at Canterbury Place NH. All participants were attending physicians trained in internal (40%) or family medicine (60%), and completed a fellowship in geriatric medicine (60%). Three (30%) of the physicians recently (<5 years) completed their training, three (30%) completed their training in the past 11 to 15 years, and four (40%) completed training more than 16 years ago. Most (60%) of the physicians spent less than 5 years providing care in the NH where the study was conducted. Six (60%) of the physicians provide care in three or more NHs and six (60%) provided care for more than 20 patients in the study facility. Physicians reported spending an average 54 hours per month in the NH setting.

A total of 69 distinct patients were evaluated over the 20-physician observation sessions. Each physician evaluated, on average, four patients pre-implementation and three patients post-implementation. The (mean ± SD) age of the patients was 81.29 ± 13.76 years and 36% were male. The number of scheduled medications listed in patient charts was 12.12 ± 5.59. The number of co-morbid medical conditions based on chart review was 18.51 ± 7.39.

**Time-motion**

The observations showed a significant increase (mean difference = 3.61 minutes, P = .03) in the pre-rounding time (Figure 1A), and no significant difference in the rounding (mean difference = 1.54 minutes, P = .09; Figure 1B) or post-rounding times (mean difference = 0.23 minute, P = .29, Figure 1C) following the introduction of the computer-generated rounding reports.

**Perceived Barriers to Providing Optimal Care**

The most notable perceived barriers to providing optimal clinical care in the NH before using the rounding report were inaccurate and inaccessible information. Following implementation of the rounding report, statistically significant improvements were noted in both accessible information (P = .03) and scheduling (P = .04) (Table 1).

**Rounding Report Satisfaction Feedback**

All participants completed the rounding report feedback Likert scale survey questions. When asked to compare the computer-generated rounding report with the manual paper-based process, the participants were generally satisfied with the computer-generated rounding report’s accuracy (3.6), timeliness (3.6), and completeness (3.7). The participants were also satisfied with the computer-generated rounding report’s impact on efficiency, including information abstraction and formatting (4.4), number of residents seen (3.5), and time spent with each resident (3.9). Finally, 8 of the 10 physicians reported that they would prefer to use the computer-generated rounding report rather than the paper-based process.
In this feasibility study, we found that almost all of the physician’s perceptions of barriers to providing optimal clinical care in the NH decreased following the implementation of a computer-generated rounding report. Consistent with previous studies, physicians ranked the lack of accurate and accessible information as the most significant barrier to providing optimum care in the NH before the use of a computer-generated rounding report. Following the implementation of the computer-generated rounding report, accessible information was the barrier with the most significant decrease or improvement.

We expected that the rounding report would decrease the total rounding time because it provides relevant patient data in a structured SOAP-note format; however, what we observed was that there was an increase in the amount of time that the physician took to complete the pre-rounding, rounding, and post-rounding phases following implementation of the computer-generated rounding report. There are several likely explanations for this. The pre-rounding process took longer largely because of the amount of time that it took the computer-generated rounding reports to print. The printing delays were caused by slow network speeds at the NHs, which were resolved following the completion of the study. It is less clear why the rounding process took longer; however, most of the physicians spent more time speaking with and examining their patients. Perhaps, because information was more accessible and structured as SOAP notes from the pre-rounding process, they could spend more time addressing the patient’s individual concerns and physical examination findings. Unfortunately, we will not know the answer to this because our data collection did not include accompanying the physician into the patient’s room because we did not obtain informed consent of patients, only the physicians. The post-rounding process may have taken longer because physicians could now concentrate on writing a more detailed note, as all of the supporting data was already pre-printed. It is also possible that this finding was observed because the 1-month period that we allowed for each physician to become acclimated to using the rounding report and reach a new potential steady state in their workflow was insufficient. However, the timing of our post-implementation evaluation is consistent with previous studies of EMR systems, where the follow-up assessment of workflow is conducted within 3 months of implementation.

Physicians were generally satisfied with the computer-generated rounding report’s accuracy, timeliness, and completeness. Their concerns about these factors were primarily linked to medication data discrepancies between the electronic medication administration record and the computer-generated rounding report. For example, the medications listed in the rounding report represent medications ordered and not medications administered. Consequently, if a medication order is changed by the nurse for whatever reason, this information would not be listed on the rounding report in a timely fashion. We have implemented a process to address this problem following the conclusion of this study. Physicians were also satisfied with the computer-generated rounding report’s impact on efficiency, including information abstraction and formatting, number of residents seen, and time spent with each resident. Finally, it is important to note that 8 of the 10 physicians reported that they would prefer to use the computer-generated rounding report rather than the paper-based process.

### Limitations

Although the findings of this study provide the basis for future work, we acknowledge that there are important limitations. The small physician sample size and number of observations limits the ability to determine whether the rounding report itself led to the changes in the rounding process. However, the number of subjects and observations is comparable with other time-motion studies. Another possible limitation was the use of one observer, which has been reported to decrease data reliability. Nevertheless, one observer has been used for practical purposes and to decrease variability of the time measurements in previous research. We used
a convenience sample of physicians because recruitment has been shown to be a major obstacle to physician participation in health services research and that personal contact improves participation. It is possible that other factors, such as temporal/secure factors or specific clinical issues that arose during the days when physicians were being observed, affected the changes found. Another potential limitation of this study was that the physicians’ behavior and workflow during the study may have been affected by the presence of an observer, known as the Hawthorne effect. Finally, the system that generates the rounding reports relies on accurate information being extracted from other electronic sources (eg, medication data, vitals, laboratory data). If these upstream systems do not have accurate or complete data, then the rounding report will contain the same inaccuracies. We believe that like any other information technology system, continued coordination with laboratory, pharmacy, and Minimum Data Set service providers will be necessary to ensure that we continue to receive accurate and complete information.

Future Directions

Similar to other quality improvement projects, continuous feedback can be used to develop and refine the computer-generated rounding report, which may ultimately improve physician rounding time, further reduce perceived barriers, and improve satisfaction to physicians providing clinical care in the NH. Any further improvement of the computer-generated rounding report should include the input of the target users (ie, physicians). Focus groups and increased observations of physician workflows can be used to gain direct input into the rounding report information content, abstraction, and formatting, whereas heuristic analysis can be used to evaluate the usability of the rounding report itself or the computer interface used to print the reports. Ultimately, we intend to develop other computer-generated rounding reports to support the needs of advanced practitioners, nurses, and consultant pharmacists. The development and availability of additional rounding reports customized for different clinical purposes or provider groups may represent a feasible alternative to an EMR system used for clinical documentation in the NH. We also envision the rounding report being used to enhance communication during transitional care from the NH to emergency department/hospital because of the detailed information that it contains (eg, medication, allergy, laboratory, and radiology). The rounding report can be printed on demand and provides pertinent information that would be difficult to collect and aggregate manually in a timely fashion and send to the emergency department/hospital. This process may be able to facilitate medication reconciliation and reduce redundant lab or radiology testing.

Conclusions

The present study provides preliminary data suggesting that the use of a computer-generated rounding report can decrease most perceived barriers to providing optimal care in the NH. Although the rounding report did not improve rounding time efficiency, most NH physicians would prefer to use it rather than the current paper-based process. Improving the accuracy and harmonization of medication information with the electronic medication administration record and rounding reports, as well as improving facility network speeds, might improve the effectiveness of this technology. The data obtained from conducting this quality improvement project will ultimately inform our physician practices and directly guide the future advancement and modification of the computer-based rounding report, which may further benefit physicians and other clinicians.

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Supplementary Data

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