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An Analysis of Skin Integrity Alerts Used to Monitor Nursing Home Residents

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Abstract

Few computerized systems have been implemented and evaluated in nursing home systems. The purpose of this descriptive study is twofold: 1) assess the frequency of active alerts occurring in two nursing homes implementing an electronic health record (EHR) with a clinical decision support system; and 2) determine if clinical responses of health care workers are different when a clinical alert is active versus not active. A secondary analysis of de-identified data was performed to derive conclusions about use of alerts to monitor residents' skin conditions in the nursing homes. The percentage of residents who had active skin integrity alerts ranged from 8% to 52%. The majority of time resident skin integrity alerts were active for 1-3 consecutive days. In one facility, 6% of the residents had an active skin integrity alert for 20 or > consecutive days. A total of 118 alerts were analyzed from 59 residents in the analysis of documented clinical responsiveness. No significant difference was found in clinical documentation for responses when alerts were active versus when alerts were not active (N=59, p=1.00). There were just as many clinical responses documented to conditions when alerts were active than when they were not active.

Keywords:

decision support, clinical, computers, handheld, nursing home, information technology

Introduction

Continuing concerns about quality, costs, accessibility, adequacy of oversight, and regulation of nursing homes are driving the need to implement computerized clinical information systems in these settings. Key capabilities of clinical information systems recognized in nursing home settings include improved patient safety, more effective delivery of patient care services, better management of chronic conditions, and greater efficiency [1]. However, in order for nursing homes to adopt and invest in clinical information systems more research and dissemination is need to understand how electronic environments affect clinical processes in the nursing home [2]. This paper describes a secondary analysis of de-identified resident level data obtained from an electronic health record, called One Touch Technologies (OTT).

OTT had a clinical decision support system with an automated skin integrity alert system to alert nursing home staff of potential resident skin integrity problems and to facilitate clinical management. The purpose of this evaluation was to 1) describe the frequency of active skin integrity alerts occurring in two facilities during the seventh month (31 days) following implementation of the clinical information system; and 2) determine if significant differences existed between clinical actions documented by healthcare workers when alerts were active compared to when alerts were not active in the EHR.

Background

Technology is changing the way healthcare providers are performing clinical work [3]. Potential uses of computerized technologies in nursing homes include clinical decision support, improved financial analysis, and safety and quality improvement initiatives ([4;5]. Long term care strategists have placed a high priority on educating concerned citizens about the potential for nursing home technology and stimulating interest in the implementation of interoperable EHR's in long term care settings [6;7]. Historically, the process of adopting new technologies has been slow in long term care with as many as 14% of USA's 17,000 Medicare, Medicaid, and dually certified nursing facilities reporting having no computer system at all within the last decade [8;9]. However, this is changing as the benefits of computerization such as better recordkeeping and improved decision making are realized in other nursing systems [10;11].

Clinical Decision Support and Automated Alerts

A CDSS is a computer program that has the ability to facilitate a healthcare provider's clinical decisions. CDSS should aid in problem recognition and should lead to clinical actions that improve resident outcomes. In some cases, these mechanisms have shown to significantly improve clinical practice [12].

In nursing homes, resident assessment data usually associated with the long term care minimum data set is used to document resident conditions in the health record. Predetermined criteria or triggers within the resident assessment data can be used to build electronic decision support tools including alerting mechanisms. Few of these clinical information systems have been implemented in nursing homes.

Even fewer have been studied to determine there effectiveness to enhance clinical actions documented by nursing staff.

Nursing home technology

The OTT system uses wireless real time automated information processes at the point of care. This system incorporates electronic technologies not previously available to the nursing home industry, such as decision support. This new level of data manipulation should have positive effects on the quality of individual resident care by improving detection of potential resident problems through the automated alerts in the CDSS. Recently, evidence of the positive effects of CDSS has been found in healthcare practices using automated alerts to evaluate patient specific clinical variables and clinical decision making [12;13].

One of the defining features of the OTT clinical information systems is the ability to collect data at the patient's bedside using a handheld PDA at the point of care. The technology combines the use of magnetic technology located in the resident ID bracelet and caregiver ID badge to facilitate caregiver accountability for resident care and documentation while being alerted to individual resident needs. The PDA clinical modules provide a template for complete verifiable documentation and interactivity of specific items in the resident record.

The skin integrity alert in the OTT CDDS assists healthcare providers to identify when a resident may be experiencing a skin integrity problem. The skin integrity alerts have an electronic alert calculation that defines the triggers in the data that activate the alert. Alerts and triggers are incorporated into a relational database that uses detailed data elements to make an alert active or not active. Using the infrastructure of the OTT, the goal of this study was to describe the frequency of active skin integrity alerts during one month and to evaluate the skin integrity alert in the CDSS to determine if significant differences existed between clinical actions documented when alerts were active versus when they were not active.

Methods

Two nursing homes, A & B, participated in the study and ranged in size from 180 to 240 beds, respectively. Facility A was in a rural setting and was a government owned facility. Facility B was located in a urban setting and was a not for profit. Both nursing homes were participating in a larger federally sponsored research project designed to evaluate the use of bedside technology to improve quality of care [14]. According to the Centers for Medicaid and Medicare Nursing Home Compare database in February 2005, one month prior to the beginning date of collection, the lowest percentage of occupied beds was in facility A (72%) with the highest in facility B (95%). During this same time period as few as 40% (facility A) and as many as 80% (facility B) of the residents were categorized as having bowel and bladder control issues; these conditions could potentially predispose residents to an increased loss of skin integrity.

Data collection

De-identified data were collected for one month (31 days) following the 6 month post implementation date in both facilities. Data were provided by OTT after fictious, unique nursing home and patient identifiers were assigned in the data sets.

Data collection involved querying each facility EHR during the day at 0700 AM, the start of day shift, on the first day of the month and ending at 0700 AM on the last day of the month. Query data from the alerts was used to assess the average length of time that skin integrity alerts were active on consecutive days at 0700 AM. Finally, while controlling for periods when skin integrity alerts were active, time of day alert occurred, and resident, clinical actions documented in the EHR were counted. Six electronic administrative reports and clinical reports in the HER were used to determine clinical actions documented including: 1) care plan changes, 2) nurse assistant task lists, 3) skin and wound reports, 4) turning and repositioning reports, 5) toileting reports, and 6) progress notes.

Data analysis

To meet the goals of the research the analysis plan involved three steps. During the first step the average number of residents occupying the facility per day was determined, overall average frequency of active skin integrity alerts per day that were active at 0700 AM was calculated and the range of active skin alerts/day active at 0700 AM for all patients was recorded for each facility (Table 1).

Table 1. Frequency of active skin integrity alerts

Facility	Ave. Number of Residents	Ave. Frequency of Active Skin Integrity Alerts/day	Range of Active Skin Integrity Alerts/day
A	136	21	11 – 34
B	225	93	68 – 118

During step two the length of time skin integrity alerts were active on consecutive days at 0700 AM was tabulated. This step enabled us to calculate the number of residents in each facility that had no active alerts versus those that had 1 or more active alerts during the same period on consecutive days. Categories for active skin integrity alerts in consecutive days were operationalized by counting the number of days at 0700 AM when an alert was active; for example, if a resident had no active alert on

Monday, an active alert on Tuesday, and no active alert on Wednesday of the same week this episode was added to the 1-3 day category. Categories for length of time alerts were active were created where natural breaks appeared in the data. Categories included no alerts during the month, alerts that were active consecutively for 1-3 days, 4-9 days, 10-19 days, and 20 or greater days. The category no alerts, was an indicator of the number of residents who had no active alerts occurring during the 31 day period (Table 2).

Finally, in step 3 the frequency and types of clinical actions documented by staff during an active skin integrity alert versus when the alert was not active for the same resident was calculated. The day of the week and time of day alerts were active and not active was controlled for to offset any confounding affects of changing staff schedules during the week. For example, if an alert was active on Monday, a similar time period

Table 2: Length of time in consecutive days skin integrity alerts were active

Facility	Ave Number of residents	Total Number of Days in month	No Active Alerts	1-3 Days	4-9 Days	10-19 Days	20 or > Days
A	136	31	44	293	18	3	1
B	225	31	17	834	137	31	13

one week later when an alert was not active was selected to compare clinical responses documented on the same resident. Only alerts from facility B are analyzed here to minimize differences in documentation and clinical practices between homes. To test the hypothesis that there would be differences in the proportion of clinical actions during a period when a skin integrity alert was active versus not active a McNemars test was calculated. All statistical processes were performed using SPSS 13.0.

Results

Comparisons of the daily alert frequencies for home A and B were tabulated (Table 1). Facility A had fewer residents than facility B and also had few average active alerts during the day. The percentage of residents with an active skin integrity alert on their EHR at least once during the day ranged from 8% in facility A to 52% in facility B. The range of active alerts in facility B was also larger than facility A during the study period.

Results of the average length of time skin integrity alerts were active as measured by the number of consecutive days alerts were active in the EHR at the 0700 AM query are shown in Table 2. In facility A, 44 of 136 residents (32%) had no active skin integrity alerts during the month. Conversely, 78% of the residents had an active skin integrity alert in their record. The majority of those active akin integrity alerts in facility A occurred over 1-3 consecutive days. Only 1 resident had an active skin integrity alert for 20 or greater consecutive days at 0700 AM.

In contrast, only 8% (17/225) residents in facility B, which had a higher daily census, had no active skin integrity alerts during the month (Table 2). Ninety two percent of the residents had an active skin integrity alert; the majority of these were present for 1-3 consecutive days at 0700 AM. Thirteen residents (6%) had an active skin integrity alert over 20 or greater consecutive days. Skin integrity alerts had a very frequent change of status from active to not active with most lasting from 1-3 consecutive days.

The final analysis in this project compared clinical responses documented during periods when alerts were active and not active to determine if this could be a factor in the frequently changing status of the alerts activity. A total of 118 alerts were analyzed from 59 residents residing in facility B. Table 3 illustrates that there was no significant differences in clinical responses during periods when alerts were active versus when alerts were not active (N=59, p=1.00). There were just as many clinical responses documented to conditions when alerts were active than when they were not active.

However, further investigation using the administrative turning and repositioning reports in the EHR revealed that 39 out of 58 residents (67.2%) who had no documentation on the date a skin integrity alert became active had documentation on turning and repositioning when the alert was not active at the exact same time a week later. In comparison, electronic nurse assistant task lists,

Table 3: Analysis of Clinical Responsiveness to the Skin Integrity Alert

		Alert Active		Number residents	††Exact sig. *P*
		Clinical Response Absent	Clinical Response Present		
Alert Not Active	Clinical Response Absent	1	6	7	*1.00*
	Clinical Response Present	6	46	52	
Number of residents		7	52	59	

††McNemar's Test

used to communicate important resident tasks between nurses and nurse assistants, were used very little to delegate skin integrity care planning. Of 46 residents that had no documentation on the task list related to skin integrity when the alert became active, 100% had no documentation a week later when the alert was not active.

Discussion

The results of this study indicate there is substantial difference in the average daily frequencies of active alerts between the participating nursing homes. Even after adjusting for daily occupancy differences by calculating the average daily percentages of residents with active alerts, facility B had substantially more 41% than facility A (15%). One possible reason for the differences could be that 50% fewer residents had been reported nationally in NHC in facility A vs. facility B with bowel and bladder control issues [15]. Fewer residents with incontinence problems might reduce the frequency of skin integrity alerts that occurred in facility A. This makes intuitive sense since bowel and bladder voiding are two data triggers in the EHR relational database that can cause an alert to become active.

The frequent change of status in the alerting mechanism from active to not active could not be explained by the clinical responses documented by staff in the EHR. Documentation of clinical responses in care plans, skin and wound reports, toileting, and information in progress notes were not significantly affected by active alerts in the HER. Finding indicate a uniformity in clinical interventions whether alerts were active or not. Such consistency can contribute to quality assurance and prevention. It also raises questions about responsiveness to new clinical information generated by a CDSS.

An exception is seen in the administrative turning and repositioning reports. In more than half the cases where active alerts existed, it appeared that documentation on turning and repositioning residents occurred during a one week period starting with an alert being active and ending with the alert being not active. This is a positive finding because another trigger which can active a skin integrity alert in this specific EHR relates to the frequency of occurrence of turning and repositioning. Although there was not significance found between the clinical responses documented and active/not active clinical alerts, there was increased documentation on turning and repositioning following an active alert. However, interventions for skin integrity following an active alert, such as turning and repositioning, do not appear to be carried through on documentation contained in automated nurse task lists. This raises the question whether, ideally, alerts should automatically generate selected, evidenced based nurse aide tasks such as more frequent turning and repositioning for residents for which this is authorized by a nurse.

Prevention of skin ulcers is a central goal of nursing homes. This study contributes to knowledge about the potential role of CDSS technology in effectively pursuing this goal. Limitations of this study include the small sample size, small time frame for gathering alert data, and reliance on secondary data analysis to confirm clinical responsiveness.

Application

Widespread adoption of CDSSs such as OTT will largely depend on how much they contribute to effectiveness and efficiency of nursing care. Staffing levels in nursing homes make it challenging to meet all of the physical needs of residents. As compared to acute care, there is a higher proportion of nurse aides to licensed nurses and onsite physician visits are less frequent. CDSSs have potential to contribute to effectiveness in care by identifying and alerting nurses to patterns in EHR data that indicate possible resident problems, thus facilitating earlier interventions. They could contribute to efficiency by reducing nurse time in assessment and detection of some problems and by recommending and possibly even facilitating some interventions.

As an active [16] CDSS, the OTT alerts nurses to potential skin breakdown based on underlying risk factors. Such risk scenarios may sometimes otherwise be missed, leading to development or worsening of pressure ulcers. In this way, the CDSS functions as an additional intelligent processor of otherwise discrete data inputs in the EHR. Ideally, CDSSs are supplemental in assisting nursing home staff in delivering care.

In addition to assisting in assessment, CDSSs like OTT recommend and can even facilitate associated interventions. For pressure ulcers, more frequent turning and repositioning is one recommendation. This can be automatically added to nurse aide task lists, thus increasing efficiency for nurse case managers and possibly facilitating more timely response by aides. Other tasks that might be automated include ordering and increasing inventory levels of associated supplies. Furthermore, CDSS alerts may influence staffing assignments and allocation.

CDSS information, including alerts and associated responses, can potentially enhance a facilities quality assurance oversight and quality improvement analyses. CDSSs and other electronic documentation should reduce time otherwise involved in manually compiling summary information form chart reviews. In addition to improving quality, this may be helpful in meeting facility licensure and other regulatory requirements. To the extent that CDSSs contribute to quality, they may contribute to market demand for a facility and thus to its occupancy level and associated financial viability. Word of mouth about quality is the most important factor in nursing home selection [17].

Lastly, CDSSs may contribute to research-based knowledge of nursing home performance. Electronic documentation facilitates faster tabulation of data than manual chart review. This could contribute to research

with larger samples, thus allowing generalization and associated advancement of theory. CDSSs in particular allow for examination of process responses to alerts and recommended interventions, and their differential effects on clinical outcomes.

Conclusion

This study does not conclusively show that a CDSS with alerts is beneficial to nursing home residents and staff who care for them. Further research is needed to evaluate these types of electronic tools in nursing homes to determine effectiveness. Important considerations for future research using CDSSs for skin integrity include association of alerts and evidenced based clinical process responses with skin integrity outcomes.

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