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Challenges and Facilitators to Adoption of a Point-of-Care Electronic Health Record in Home Care

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Abstract

Electronic health records (EHR), intended to improve the clinical process, are understudied in home care. The researchers assessed clinician satisfaction, informed by workflow and patient outcomes, to identify EHR adoption challenges. The mixed methods study setting was a Philadelphia agency with 137 clinicians. Adoption challenges included: (1) hardware problems coupled with lack of field support; (2) inadequate training; and (3) mismatch of EHR usability/ functionality and workflow resulting in decreased efficiency. Adoption facilitators were support for team communication and improved clinical data timeliness. Opportunities for improved adoption included sharing with front-line clinicians EHR data related to patient care and health outcomes.

Keywords

Evaluation studies; technology evaluation; clinical information systems; patient care team; aged; home care

Home care is an increasingly effective way of managing chronic illness using skilled nursing care. Point-of-care electronic health records (EHR) in home care, as in hospital and ambulatory settings, are intended to enable clinicians' access to the most current patient health information at the appropriate time in the clinical process. Multiple home care providers across clinical disciplines work together as a team in communicating as they provide care. Unlike hospitals and ambulatory settings, each clinician visits the patient in the home at different times independent of each other. While 29% of the 10,000 home care agencies in the United States have adopted EHRs at the point-of-care,(Resnick & Alwan,

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2010) relatively little is known about the challenges and facilitators to their growing use (Staggers, Weir, & Phansalkar, 2008).

In a recent literature review, the few empirical studies were qualitative involving home care clinicians focus groups (Stolee, 2010). The review identified the following most common barriers to adoption: implementation cost, training, and lack of user acceptance. Leading facilitators included “portable technology, strategies to decrease data entry errors, and managerial support and user incentives.” The top recommendations were mandatory training and real-time data entry and data viewing.

Due to knowledge gaps in home care studies, our understanding of home care EHR adoption is informed by what we have learned about adoption success factors in hospital and ambulatory settings which differ markedly from home care. EHR success is dependent on a smooth implementation process and is reflected in clinicians’ continuous EHR use. Clinician satisfaction is an important health information (HIT) success measure from both implementation and operational perspectives (Ash, Gorman, Lavelle, Payne et al., 2003; Berg M., 1999; Xiao & Dasgupta, 2002). Reported challenges to HIT use include workload, (Marr et al., 1993) cost, lost productivity,(Chalmers, 2006) and dissatisfaction (Handy, Hunter, & Whiddett, 2001; Jaspers et al., 2007; Joos, Chen, Jirjis, & Johnson, 2006; Melton et al., 2006). EHR adoption into practice is a necessary step toward ultimate impact on patient care. Clinicians strive to provide patients with the best quality of care. However, EHR implementation changes clinician patient care workflow. Frequently HIT dissatisfaction results from the system features (Balas, Weingarten, & Garb, 2000; Bobb et al., 2004; Chalmers, 2006; Marr et al., 1993; Melton et al., 2006; Saleem et al., 2005). When technology does not support work processes and expectations, clinicians will not use it (McDonald, 2006; Wideman, Whittler, & Anderson, 2005). EHRs can provide benefits to nurses such as improved nursing documentation completeness without a significant increase in time spent charting (Smith, Smith, Krugman, & Oman, 2005). EHRs can support providing better patient care through functionality such as standardized care plans, guidelines, and automated alerts (Bakken, 2006; Staggers et al., 2008). However, nurses tend to be frustrated with EHR inconveniences such as increased workload, and poor impact on nursing workflow (Sassen, 2009).

In addition to directly impacting clinical process, secondary EHR data can be used for quality assurance (Einbinder, Scully, Pates, Schubart, & Reynolds, 2001) and performance improvement (Grant et al., 2006). However, there are few publications about integration of feedback from secondary data into the clinical team’s practice (Neil & Nerenz, 2003). An exception is data use related to documentation timeliness to improve clinician performance, a finding from our larger study (Sokolow, Bowles, Adelsberger, Liao, & Chittams, In review). To inform EHR development and implementation in this unique and increasingly important setting as adoption increases, this study’s aim was to identify challenges and facilitators to EHR adoption.

METHODS

Challenges and facilitators to adoption and implementation were elicited from a mixed methods analysis. Analysis included assessing clinician satisfaction with EHR impact on clinical process with the unit of measure at the clinician level. Also included in the analysis was data related to clinician EHR usage and patient outcomes, to aid interpretation of clinician perception.

Design

We examined clinician satisfaction with point-of-care EHR impact on clinical process in home care using the mixed methods approach shown in Figure 1. In the quantitative component (QUAN) to assess clinician perceptions, satisfaction surveys were administered post-implementation. Responses were statistically analyzed for associations and trends. To better describe clinicians' actual EHR usage we used a pre/post study design embedded in a mixed methods study to measure EHR impact on documentation timeliness and patient outcomes and help explain findings. Quantitative data was statistically analyzed as discussed in greater detail elsewhere (Sokolow et al., In review). The embedded qualitative component (Qual) consisted of observation and interviews for one post-implementation observation to gain a rich description of clinician perspectives. Qualitative data was analyzed using thematic content analysis. Researchers (PS,KB) conducted mixed methods analysis by sorting results from each data source by theme, referring to the HIT Reference-based Evaluation Framework (HITREF),(Sokolow, Weiner, Bowles, Abbott, & Lehmann, 2011) and summarizing themes in a matrix. The HITREF, a comprehensive HIT evaluation framework firmly grounded in research evidence, was used to identify a range of HIT characteristics and dimensions to be measured. Institutional Review Boards approved the study.

Study Setting

The study site was a Medicare-certified, not-for-profit, skilled home care agency. As part of an academic, integrated health system, the agency provided home care services to 1,200 patients monthly who resided in a metropolitan area. Typical of home care operations, patient visits included developing care plans, performing interventions, and documenting outcomes against the care plan. Medicare reimbursed care based on the documentation of approximately 120 items in the Outcome and Assessment Information Set (OASIS) assessment instrument (Oasis.2011) and congruence with the care documentation. Agency staff were mostly women (90%) and mostly Caucasian (71%) with a minority who were African-American (20%).

EHR Implementation

The point-of-care EHR was implemented between February and August 2009. It was similar in functionality to other commercially available client-server home care EHRs. Eight HIT in-house staff members supported the EHR and other health system entities' HIT.

Intended clinician EHR use was as follows. Clinicians started their day at their own home by connecting the laptop to the server via a data card to view the patient schedule for the day,

access information about entering a patient's home or approaching a patient, and read messages from team members. The clinician traveled to the patient's home, found a space to set up the laptop, and documented patient care in the EHR. The clinician ended the day at home by connecting the laptop to the server to upload the information and check the next day's schedule and messages from the clinical care team. The point-of-care EHR replaced an office-based version that was updated via centralized clerical input from clinicians' paper records.

Data Collection

Here we present the three data collection methods used to assess clinician satisfaction with EHR impact on clinical process. The methods were: survey, observation, and interview.

Clinician Satisfaction.—Clinician satisfaction with EHR impact on clinical process was assessed using a validated survey instrument, the EHR Nurse Satisfaction (EHRNS) survey. Each item had a six-point Likert-type response indicating the magnitude of agreement or disagreement with 22 items (Sokolow, Weiner, Bowles, & Lehmann, 2011). Researchers distributed the EHRNS for self-administration to clinicians during staff meetings and via postal mail.

The researcher (PS) conducted observations during a patient visit while a clinician provided direct patient care. Clinicians selected to be observed were chosen using work sampling (Sittig, 1993), that is sorting clinicians into categories by role, to assure that there were observations on each clinical discipline from each geographic team. Clinicians who were observed were also interviewed. The open-ended interview questions embodied the major themes identified in previous clinician satisfaction interviews in a different setting (Sokolow, Weiner, Bowles, & Lehmann, 2011) and are shown in Figure 2. Responses were recorded and transcribed. Clinicians were interviewed until saturation, that is interview responses offered no new information or a functionality (i.e., the capability or feature of the software) was seen at least three times (Burns & Grove, 2013; Frattaroli, 2007)(personal communication).

EHR usage/clinician documentation completion—EHR usage data and documentation timeliness data were extracted from the EHR. Data was de-identified and extracted for all clinicians who documented direct patient care.

Assessed Patient Outcomes—Patient outcomes were assessed using the OASIS assessment instrument, which is mandated by the Centers for Medicare and Medicaid Services (CMS). The OASIS collects data on critical physiological, functional, cognitive, and emotional/behavioral indicators of health status (Schlenker, Powell, & Goodrich, 2005; Shaughnessy et al., 2002). Nurses or therapists used observation and information gathered directly from the patient or caregiver to collect OASIS data at admission, every 60 days, and at discharge for every user of Medicare home care services.

Data Analysis

We analyzed all quantitative data, the primary data set, using SAS (SAS Institute Inc, 2008). Concurrently qualitative data from observations and interview responses were analyzed using NVivo (QSR International, 2008).

Clinician Satisfaction—Survey responses were analyzed for general associations and tests of trends between satisfaction and participant characteristics such as age, years of experience, and specific nursing profession. Specifically, cross-tabulations and odds ratios were generated followed by formal Chi-square or Fisher's Exact tests.

Data from observations and interviews were analyzed using thematic content analysis principles. Data about (i.e., observations) and from (i.e., interview responses) clinicians were analyzed inductively to identify descriptive or topical categories. The HITREF was used to sensitize the initial organization of the categories as well as their development, but HITREF use did not exclude possibilities for new organization. Two team members (PS, KB) met regularly to compare their application of the categories and resolve any differences in their analyses as well as code each interview independently.

EHR usage/clinician documentation completion—EHR data related to clinician note time-to-completion was computed as the time elapsed between the patient visit time and EHR note completion time. Statistical analysis entailed analyzing the proportion of clinicians who completed their documentation within guidelines.

Assessed Patient Outcomes—OASIS data was used to assess whether outcomes remained the same/improved, or declined comparing pre-implementation and post-implementation periods. The statistical analysis entailed dichotomizing the outcome data and applying logistic regression analysis.

Mixed Methods Analysis—Finally, mixed methods analysis was used to inform what clinicians said on the surveys and in interviews with what they did as indicated from findings related to actual usage, documentation timeliness, and patient outcomes. All data for each category were retrieved and summarized in a matrix of dimensions and sub-dimensions of EHR characteristics and data sources. Researchers used the matrix to integrate the results from the quantitative and qualitative segments and identify how the qualitative themes contributed to understanding the quantitative findings. The team considered the extent to which: (1) the inferences were consistent with each other and with the design; (2) there was agreement among researchers and clinicians on the conclusions; and (3) the interpretations were distinctive from other plausible explanations.

RESULTS

Each clinician was eligible to participate in the study with different participation levels in each method. For instance, all 137 clinicians were included in EHR documentation completion analysis, and of the 77 consented clinicians (56%), 6 were observed and interviewed (4%), and 71 responded to the survey (52%). All de-identified patient data from the study period was included in the patient outcome analysis.

Clinician Satisfaction

Survey respondents had a mean of 21 years work experience in health care, had a mean age of 49 years, 88% were women, and 53% were nurses. The balance of respondents were physical therapists (34%), occupational therapists (10%), social workers (1%), and speech pathologists (1%). Of respondents, 35% had previous EHR experience outside the research site, and of those with this experience, the average years of prior EHR experience was three years. Respondents self-rated their computer skills as average.

We purposefully selected 26 of the 77 clinicians (34%) who consented to be observed and interviewed until we met our goal of representing each team and clinical role, and reaching saturation. Eighteen clinicians did not reply to email requests or refused to be observed. The lead author observed and interviewed four home care nurses and two therapists. These clinicians were men and women who were in the clinical roles of occupational therapy, physical therapy, and nursing. They ranged from middle-aged with many years of experience to young with under five years of health care experience.

The HITREF evaluation criteria detailed below received survey scores indicating the most and the least satisfaction, were observed, and garnered the most responses on interviews. Criteria neither observed nor commented upon are not discussed. Evaluation criteria with findings related to EHR usage or patient outcomes are presented. Average survey scores, with the standard deviations (SD) are provided as mean scores where the distribution is normal, and as median scores otherwise. Within each section, criteria are listed in the order in which they appear in the HITREF.

Clinician satisfaction with EHR characteristics

Five criteria had survey scores indicating the greatest satisfaction reported – moderate, or close to moderate, clinician satisfaction where response choices ranged from Strongly Disagree (0) indicating most dissatisfied to Strongly Agree (5) indicating most satisfied. While all but one criterion, organizational support, elicited satisfactory responses on surveys and interviews, most criteria had some related issues as shown in Table 1.

The first criterion was the **EHR hardware** being consistently available (median 4.0, SD 1.2). However, clinicians indicated there were frequent system problems. While clinicians were also satisfied with the **organization's support for the EHR** (mean 3.8, SD 1.1), observation and interview responses indicated clinician frustration, including lack of support while in the field.

Regarding the **completeness and correctness of the data** (mean 3.7, SD 1.1), clinicians were observed recording the majority of EHR data as discrete data elements in pull-down menus and entry of numbers (e.g., blood pressure) with free text input limited to the narrative visit note. Interview responses mostly expressed satisfaction, with some areas of incomplete data noted and observed. Data timeliness is related to completeness. Delayed input (e.g., not available for next patient visit) negatively impacts data completeness. Some clinicians documented on paper and later updated the EHR. Clinicians were satisfied with data timeliness in interview responses.

EHR impact on **appropriateness of patient care** (median 4.0, SD 1.1) was observed when clinicians accessed EHR information for incorporation in a care decision (e.g., previous blood pressure) and to facilitate a dialog with the patient. However, some clinicians believed that having the laptop between them and the patient disrupted establishing rapport, impacting patient care plan adherence and effecting outcomes.

Team communication solely via EHR (median 4.0, SD 1.0) was observed among and between clinical roles as nurses and therapists documented in separate areas of the EHR. However, clinicians noted that team communication was negatively impacted by team members who did not have laptops with which to document (e.g., per diem nurses, home health aides).

Clinician neutral perception of EHR characteristics

Three notable HITREF criteria garnered responses that indicated neither clinician satisfaction nor dissatisfaction on survey responses as indicated with responses between 2.5 and 3.5. However clinicians remarked on their dissatisfaction related to these criteria during observation and in their interview responses.

The first criteria was software **usability** (i.e, user-friendly) (mean 2.8, SD 1.3). The software was reliable with timely screen changes. However, screen flow and information display was poor. Clinician concerns included navigation, finding information, and entering data.

Clinicians used EHR **functionality** (mean 3.0, SD 1.3) to document both the start of care and routine visits and comply with reimbursement requirements such as checking allowable visits. Clinicians found the care plan functionality cumbersome and redundant. Clinicians identified needed functionality that was not available including structured fields for two addresses, and capability for physicians to view the scanned laboratory test results.

Clinician **efficiency** (mean 3.2, SD 1.1) was reduced due to redundant EHR documentation, the large amount of data to be documented especially during assessments, and duplication of administrative information. Clinicians also reported spending additional time at home completing documentation. The most frequent theme among interview responses concerned negative impact of EHR usability on efficiency.

A fourth theme, **patient outcome** (mean 3.4, SD 1.1), acknowledged to be important to clinicians, garnered neither high satisfaction/dissatisfaction survey scores nor many interview responses. While active advice, such as clinical decision support, was not observed, ‘memory jogs’ were seen. The few interview comments expressed either satisfaction or dissatisfaction.

EHR usage/clinician documentation completion

Every clinical discipline and every staff clinician who provided and documented patient care used the point-of-care EHR during the post-periods. In the 14-month pre-period, 14,563 notes were documented on a census of 500 Medicare patients. Following implementation, 56,702 notes were completed in the 7-month first post-period and 168,782 notes completed in the 14-month second post-period as the census rose toward 700 Medicare patients.

Clinicians completed their notes sooner relative to the patient visit during the post-periods as compared to the pre-period: The proportion of documents completed within 1 day (compliance guideline) rose from 50% to above 90% (Sockolow et al., In review).

Assessed Patient Outcomes

OASIS assessment records for 31,363 patients and 69,932 assessments (78% of the data) were included in the analysis. Briefly, for most of the selected physiological conditions, the assessed patient population was neither more nor less likely to retain the same or improve in health outcome in the post period as compared to the pre period (e.g., odds ratio near 1.0). Patients assessed for dyspnea (shortness of breath) ($n = 1419$) had an odds ratio of 1.2 (95% CI 1.02, 1.36; $p=0.03$) (Sockolow et al., In review). Patients assessed for the selected behavioral conditions were more likely to improve in health outcome, with the exception of behavioral conditions (i.e., cognitive, behavioral, and psychiatric symptoms). The populations with assessments for anxiety ($n = 1955$) (OR 1.6; CI: 1.4–1.8; $p<0.0001$), awareness ($n = 938$) (OR 2.1; CI 1.7–2.6; $p<0.0001$), or confusion ($n = 1141$) (OR 1.9; CI: 1.6–2.3; $p<0.0001$) improved in health outcomes.

Clinician dissatisfaction with EHR characteristics

Clinicians were particularly dissatisfied with two aspects of EHR impact on clinical process as indicted on both surveys and interviews. These criteria were neither observed nor commented upon by clinicians during observation. One criterion was **clinician involvement** with system selection/ development/ implementation/ training (median 0.0, SD 1.3). Clinicians were dissatisfied with the inadequate initial and on-going training.

The second criteria was **unintended consequences** of interfering with patient care (mean 2.3, SD 1.6) which included the negative impact on patient rapport mentioned above as well as the benefit of the EHR providing transparency which increased the thoroughness of clinical documentation. However, clinicians were not satisfied with the unintended consequences of patient admissions taking longer, too much information stifling decision-making, and possession of a laptop which made clinicians feel unsafe.

Propensity analysis of survey responses

A component of the survey analysis was to assess whether survey responses were confounded by demographic variables. Our analysis indicated three demographic characteristics had statistically significant relationships with survey responses when the survey responses were dichotomized as either agree or disagree to increase power. Clinicians who were 47 years (average age) or older as compared to younger clinicians were more likely to be dissatisfied with EHR characteristics. In addition, clinicians who did not have previous EHR experience were 4 times more likely to disagree that the EHR had a positive impact on patient care services being provided in a timely manner (Item 8) as compared to clinicians who had prior EHR experience ($\chi^2=0.02$). Lastly, nurses were 3.7 times more likely to be satisfied overall compared to physical therapists (Fisher's Exact $p=0.05$).

In summary, 11 important themes related to clinician satisfaction with EHR impact on the clinical process emerged from the mixed methods analyses. Clinicians expressed satisfaction

across all assessment methods with: (1) hardware availability; (2) EHR data completeness/ correctness/ timeliness; (3) appropriateness of patient care; and (4) team communication. Clinicians expressed satisfaction on surveys and dissatisfaction in interviews with: (1) organizational support; (2) software usability; (3) software functionality; and (4) efficiency. Also, clinicians expressed dissatisfaction across all assessment methods with: training and unintended consequences. Lastly, clinicians had neutral perceptions of the EHR impact on patient outcomes while the EHR had minimal impact on patient outcomes.

Quality Assurance And Performance Improvement

In addition to EHR impact on clinical process, the use of secondary data from the EHR was observed. Management used EHR data to improve clinicians' compliance with documentation timeliness guidelines. Clinicians were observed acting to comply with these guidelines. Not observed was management feedback from EHR clinical data analysis to improve care management or patient outcomes.

DISCUSSION

This paper describes the first known evaluation of a point-of-care home care EHR's impact on clinician satisfaction. The analysis explored clinician satisfaction with EHR impact on clinical process while looking at actual EHR usage and patient outcomes and how that affects adoption.

We have confidence in the methods used in this study as the research team has previously used these methods in another community health care setting (Sockolow, Weiner, Bowles, Abbott et al., 2011). The validated satisfaction survey, EHRNS, had a slightly lower than expected return rate. There may be participant bias in the survey responses that were returned. We did not have access to any non-respondent clinicians' demographic characteristics for comparison. Despite using random sampling among roles and teams in the work sampling approach, there may be participant bias in the selection of the pool of interviewees. Although we reached saturation with only 6 interviewees, there may be participant bias in the responses due to the non-participation rate which was higher than expected. The lack of consistency in the results from the surveys and from the interviews may also indicate participant bias among the interview and survey groups. However, a similar effect was noted in the previous study with approximately 90% survey response (Sockolow, Weiner, Bowles, & Lehmann, 2011).

We assessed clinician satisfaction over a relatively brief time period, following the agency's management changes. There were no major hardware changes or software updates during the post-implementation study period. We do not expect that the low rate of clinician staff changes or minor software functionality changes had a strong influence on satisfaction results.

As with all studies, evaluation results are limited to evaluation time and place (Ammenwerth, Mansmann, Iller, & Eichstadter, 2003). We expect that our findings are generalizable to other point-of-care EHR systems and other home care agencies. We think the EHR has functionality that is typical of other such systems and would expect similar

results with other point-of-care EHR software. However, proof would come from other studies. Compared with other home care agencies, the study agency clinicians seem to be representative in regard to age, gender, health care experience, and computer expertise. The patient population may be younger than agencies that care for older homebound people with many chronic conditions. However, one agency cannot demonstrate all possible combination of factors. For example, the study agency's younger patient population may necessitate workflow that differs from agencies with older patient populations. Whether the results can be transferred to other agencies cannot be proved without further studies.

This article's objective was to identify challenges and facilitators to EHR adoption. Our motivation was the evidence in the literature suggesting that user satisfaction is an indicator for system use in hospitals, (Ash, Gorman, Lavelle, Stavri et al., 2003; Berg, 2003) an essential step toward impacting patient care. Because EHR functionality can impact clinical workflow and patient care decisions, (Staggers et al., 2008) we assessed user satisfaction with EHR characteristics using the HITREF evaluation framework.

In summary, the findings related to EHR impact on aspects of the clinical process related to documentation were mixed. Overall, older clinicians and those with less previous EHR experience were more likely to be dissatisfied with EHR impact. This finding is consistent with findings related to nurse satisfaction with nurse information systems in hospitals abroad (Ammenwerth, Mansmann, Iller, & Eichstadter, 2003; Lee, Mills, Bausell, & Lu, 2008), although not consistent with the authors' previous study (Sokolow, Bowles, Abbott, Lehmann, & Weiner, 2012). Clinicians were satisfied with the hardware availability and dissatisfied with frequent system problems and field support. Overall clinicians were satisfied with the EHR data availability which supported providing care and team communication, and dissatisfied with EHR functionality. Clinicians were neither satisfied nor dissatisfied with EHR usability or EHR impact on efficiency in survey responses but reported dissatisfaction in interviews.

Based on the survey responses, observation, and interviews, we identified important EHR characteristics influencing user satisfaction, such as hardware field support and software usability. The findings regarding hardware availability are similar to findings from studies in the hospital environment where unavailable or non-functioning computers reduced nurses' ability to efficiently manage their time (Kossmann, 2006; Lee, Mills, Bausell, & Lu, 2008). Because home care clinicians travel with their laptop to the patient's home, they do not have access to either backup hardware or on-site technical support. Without dependable hardware and field support, when the hardware is unusable, clinicians' workload increases (e.g., transcribing paper notes and driving their laptop to the tech support site) and their efficiency decreases causing dissatisfaction with the EHR. Where we expected the portable technology to be a facilitator to adoption, (Stolee, 2010) we found that less than reliable hardware coupled with needed but unavailable field support resulted in the hardware being an EHR adoption challenge.

Another aspect of organizational support for the EHR implementation was training, which was consistent with Stolee's literature review findings (Stolee, 2010). Adequate staff training and support in hospital settings enabled users to gain proficiency with the system often

resulting in improved productivity (Campbell, Hong, Mori, Osterweil, & Guise, 2008). However, home care clinicians were dissatisfied with the training they received. On-going training on better ways to document could instruct clinicians in eliminating redundant documentation and improving efficiency. Effective initial and on-going training is especially important for these clinicians who practice independently in the home. Home care clinicians have few opportunities to learn from their colleagues about new and faster ways to use the EHR to get their work done. Consistent with Stolee's recommendations, on-going mandatory training would benefit the clinicians using the EHR (Stolee, 2010).

User satisfaction was also influenced by the EHR's usability and functionality that decreased clinician efficiency. Older clinicians were particularly dissatisfied with EHR functionality. EHR Introduction can improve practice efficiency by reducing time spent locating and collating information, as Campbell (Campbell et al., 2008) found in a study among labor and delivery nurses. However, where the EHR does not support the interdisciplinary care team clinical workflow in a community setting, clinicians' efficiency is reduced and they are dissatisfied with the EHR (McGurkin, Hart, & Millinghausen, 2006; Sokolow, et al, 2012). Although clinicians increased their documentation use and timeliness, (Sokolow et al., In review) they perceived the EHR did not well support some clinical process documentation. These findings concerning the mismatch between the task requirements and the software functionality are consistent with findings from information systems evaluations in hospitals (Campbell, Guappone, Sittig, Dykstra, & Ash, 2009) and a community setting (Sokolow et al., 2012).

In addition, as observed in this study, an EHR designed for one clinical discipline may introduce inefficiency in another clinical discipline's clinical process. For example, this study's EHR, designed for nurses, organized information as a review of body systems. However, physical therapists tend to assess the patient and organize information by the patient's position: e.g., prone, sitting, standing. Documenting according to the EHR's assessment template guided physical therapists to have the patient change posture more frequently than if the assessment was organized by patient position. This particular mismatch between physical therapists' task requirements and EHR design may have contributed to physical therapists being more dissatisfied with the EHR as compared to nurses.

Home care clinicians were satisfied with the EHR's impact on the documentation completeness and timeliness. This finding was consistent with findings from hospital settings (Daly, Buckwalter, & Maas, 2002; Helleso, Lorensen, Sorensen, Norman, & Bang, 2006; Kossman, 2006; Maekawa & Majima, 2006; Moody, Slocumb, Berg, & Jackson, 2004; Smith et al., 2005). The improved documentation completeness may be attributed to clinician use of formatted screens which provided clinical documentation cues and prompts (Smith et al., 2005). EHR data indicated that documentation timeliness improved post-implementation. This improvement was attributable to the agency's performance improvement efforts focused on documentation timeliness (Sokolow, et al., In review). This real time EHR data availability coupled with EHR functionality supported home care clinicians providing care and communicating among team members, consistent with hospital

study findings (Maekawa & Majima, 2006; Moller-Jensen, Lund Pedersen, & Simonsen, 2006).

Enabling clinician access to the most current patient information at the appropriate time in the clinical process was expected to be a facilitator to adoption, (Stolee, 2010) to improve quality of care, and hence improve patient outcomes (Committee on Quality of Health Care in America, Institute of Medicine, 2001; Institute of Medicine, 2000). However, study findings indicated the EHR had minimal impact on patient outcomes which is consistent with the hospital literature (Black et al., 2011; DesRoches et al., 2010; Lau, Kuziemy, Price, & Gardner, 2010).

We suggest that the EHR in the study, with its current functionality, has untapped potential to provide clinicians with quality assurance and care management feedback. The EHR was able to be queried by management to produce reports to improve performance related to timely clinical documentation completion (Sokolow et al., In review). Similarly, we suggest information from the EHR can be presented to clinicians to support the agency's clinical quality assurance efforts, such as identifying diabetics or patients due for seasonal vaccinations. We also suggest that redundant clinician documentation can be reduced when EHR administrative reports, such as daily activity reports, replace paper-based reporting. Consistent with this finding, Stolee notes the absence of any mention of using HIT for care management, quality control, or decision making (Stolee, 2010).

In addition, the documentation quality efforts incurred a cost to clinicians with little benefit. We suggest that since clinicians are motivated to improve patient care and patient safety, sharing patient care process or health outcome data with clinicians may motivate clinicians to use the EHR as intended. This approach has been successful in community hospital settings where sharing patient care data with nurses improved HIT use as intended and quality of care (Shaw, 2012).

In the absence of providing clinicians with data from the EHR to help them improve patient care and safety, clinicians may not have perceived the EHR as providing value to them in their workday. Clinicians become frustrated, perceive the system is forced on them, (Sassen, 2009) and do not fully engage with the system (Darbyshire, 2004). Clinicians are more likely to use the system as intended if they value the information received from the system because it helps improve the care they provide and they understand that the source is the system into which they document.

These evaluation results can inform EHR development and implementation in long term care settings as EHR adoption increases to better meet the needs of the growing population of older people with chronic health conditions.

CONCLUSION

This evaluation of a leading commercial point-of-care EHR in a home care agency adds to our understanding of EHR use in the care of the growing aging population. Clinician access to accurate and timely documentation, which supported team communication, was an incentive to use the EHR at the point of care. However, not all clinicians used the EHR as

intended. Related factors that are addressable by the agency include improved hardware, training and support, and working with the HER vendor to address functionality and software usability issues both for all clinical disciplines on the care team. Lastly, presenting information from the EHR in support of patient quality and safety efforts could improve clinicians' perception of the EHR's value and increase adoption.

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Figure 1.
Mixed Methods Research Study Design

Question: What works well or what are your concerns related to the EHR's (topic):

Topics:

Functionality

Usability

Completeness/correctness of information

Impact on efficiency

Support (to use the EHR),

Impact on team communication

Impact on patient outcomes

Figure 2.

Open-ended Clinician Interview Questions Related to Clinician Satisfaction with EHR

TABLE 1

Open-Ended Clinician Interview Questions Related to Clinician Satisfaction With EHR

Theme (Ordered by HITREF)	EHRNS Survey (Dissatisfaction: 0–2.5; Satisfaction: 3.5–5)	Observation	Interview (% of all responses)
Computer hardware	Available (Item 1): median 4.0, SD 1.2 Frequent problems (Item 2): mean 3.1, SD 1.4	Inadequate battery power caused clinicians to note on paper; (2) a clinician remarked that screen was small	1%. “There are certain homes, in all honesty, where it’s really difficult to use because there’s no safe [place] or you sort of maybe would want to minimize time in there”
Usability	(Item 3) mean 2.8, SD 1.3	Reliable, timely screen changes. Difficulty logging on, opening patient records, poor information display (i.e., care plan), poor screen flow for documenting routine care, especially by non-nursing disciplines and documenting phone calls	21%: mostly dissatisfaction: syncing with the database, navigation, finding information, and entering data
Functionality	(Item 5) mean 3.0, SD 1.3	Start of care, routine visits, allowable visits, insurance authorization.	10%: dissatisfaction: care plan documentation cumbersome and redundant: “Sometimes you get something that doesn’t fit in there or sometimes you have too many care plans and there seems to be a lot of stuff in the care plans that’s conflicting”. Missing functionality: 2 address, physician view scanned lab results
Clinician involvement in implementation	(Item 18) median 0.0, SD 1.3	Not observed	4%: dissatisfaction: initial preceptor training during orientation, lack of on-going training: “we just should have had more time and I think you need to do it after your...I think they put a lot on the preceptors to teach us and I would have rather done mostly preceptor but then kind of fill in the gaps with maybe after the end, you do another [software name] session.”
Organizational support	Sufficient resources to operate the EHR (Item 4): mean 3.8, SD 1.1 Sufficient resources to learn the EHR (Item 21): mean 3.5, SD 1.2	Lack of support while in the field	8%: dissatisfaction
Quality of data	Complete/Correct Data (Item 6): mean 3.7, SD 1.1	Documented as discrete data elements with some free text input; incomplete start of care documentation; timely input	5%: satisfaction: incomplete data: medication, hospital stay, home health aide care provided, physician contact;; satisfied with data timelines
Efficiency	Patient care services being provided in a timely manner (Item 8) mean 3.2, SD 1.1	Redundant documentation of discrete data and text in the narrative visit note; paper report on daily activity and visit schedule in EHR; document 120 OASIS assessment data elements; Extra time at home to complete assessment, discharges, revisits	23%: dissatisfaction: The EHR has made my days much, much longer because it takes me longer to put in all the information in the computer so an 8-hour day typically is now almost like a 9 to 9 ½ hour day ... and since you don’t want anything to impact on patient care, all these things are done at your time.”
Team communication	(Item 11) median 4.0, SD 1.0	Team communication via EHR	22%: satisfaction: EHR facilitated communication, similar to in-person communication; negatively impacted by team members without laptops
Impact on clinical process	(Item 9: “patient care orders in the EHR are appropriate”):	Used EHR data in clinical decision making; Clinicians perceived laptop interfered with patient rapport, “I try to keep it [laptop] away from them so we can still look at each other but	12%: satisfaction; Facilitate dialog about previous visit: “if you don’t know the patient, you can say, ‘I see we ordered physical therapy. How’s that going?’”

Theme (Ordered by HITREF)	EHRNS Survey (Dissatisfaction: 0–2.5; Satisfaction: 3.5–5)	Observation	Interview (% of all responses)
		I'm not giving them my undivided attention"	
Impact on patient outcomes	Patient safety (Item 10) mean 3.4, SD 1.1; Patient outcome (Item 12) mean 3.4, SD 1.2	Memory jogs: body systems presented in a 'tree' for datainput, input screen window 1%: neutral display of most recent blood pressure reading	1%: neutral: dissatisfaction about EHR use taking time away from patient care; satisfaction with the access to clinical information related to patient care.
Barriers or Facilitators to Clinicians' Adoption	(Item 19) mean 2.8, SD 1.5		Unable to access laboratory results from sources external to the health system
Unintended consequence of interfering with	(Item 18) mean 2.3, SD 1.6		2%: dissatisfaction: interferes with patient rapport: "I agree with the patients who feel that it takes away from them because when I'm putting stuff in, I try to make eye contact;" patient admissions taking longer, too much information impacting decision making, feeling unsafe with a laptop.

Open-ended Clinician Interview Questions Open-ended Clinician Interview Questions:

Question: What works well or what are your concerns related to the EHR's (topic):

Topics:

Functionality

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Impact on efficiency

Support (to use the EHR),

Impact on team communication

Impact on patient outcomes

Figure.