Health Information Technology Implementation: Implications for the Nursing Home Workforce

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Brief

Introduction/Background

Health Information Technology (HIT) has the potential to improve quality of care, resident quality of life, and health in nursing homes. Yet, HIT implementation in nursing homes may be delayed due to the new demands it places on nursing home staff. This study characterizes the effect of HIT on workforce perceptions and care processes, the training needs associated with HIT implementation, and the infrastructure needed for the workforce to effectively use HIT.

Methods

We used semi-structured interviews and small focus groups to gather information from key informants in nursing homes across the United States (n=15); and a systematic review of 46 research articles (31 US; 15 international).

Findings

Nursing homes lacked systematic processes for HIT implementation and underinvested in training, leading to slow integration or frank resistance from staff, especially among those with longer tenure. New staff took greater interest in learning new skills and served as point persons for on-the-job and technical assistance to other staff. Despite challenges posed by insufficient training, technology support, and workload changes, staff exhibited an overall interest in learning skills needed to navigate new HIT systems. Evidence for productivity gains due to HIT was inconclusive, and wireless connectivity was cited as the most frequent barrier to uptake. No study or interview revealed a direct relationship between HIT impact on the workforce and patient health outcomes or the delivery of care.

Conclusion

Nursing homes are unlikely to realize potential gains in productivity and quality of care without initial investment in implementation and training of their workforce. Future research should examine whether HIT, via impacts on nursing home workflows, lead to improved health and quality of life for residents.

Policy Implications

Our study findings support the following recommendations for nursing homes planning to implement HIT: 1) Development of a toolkit to prepare the nursing home workforce for HIT implementation, including both a facility and staff readiness assessment and guide for integration with quality improvement initiatives; 2) Development of training best practices, including increased time for training, systematic training for new hires, and ongoing training to account for technology updates; 3) Increase funding incentives for training and compensation for IT personnel and staff with advanced HIT skillsets.

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Background

Health information technology (HIT) is defined as the "electronic storage and retrieval systems that support financial, clinical, and operational needs" of a health care facility.[1] The implementation and use of HIT is associated with improved quality measures and resident care outcomes in nursing home settings. [2,3] HIT is also instrumental in preventing adverse drug events and identifying medication errors. [4,5] To date, however, little research has explored how the process of using HIT leads to better care outcomes, nor is there much evidence regarding how HIT can best support the care processes of nursing home staff, such as communication, documentation, work flow, and clinical decision-making.

Given numerous initiatives focused on developing a national infrastructure for HIT (2004 President's HIT Committee), the passage of the 2009 Federal HIT for Economic and Clinical Health Act (ARRA, 2009), and the National Quality Forum's commitment to incorporate HIT as a means to improve the quality of care, a growing number of nursing homes and skilled nursing facilities have implemented HIT. Key features of HIT in nursing homes have traditionally included the electronic health or medical record (EHR), computerized physician order entry of prescription medications and other orders, and decision support tools. In some systems, HIT also incorporates functional domain areas that focus on care-related processes as well as the use of technology to enhance the productivity of staff. [1]

In 2004, it was reported that nationally, 43% of nursing homes had some kind of electronic information system beyond that used to fulfill Centers for Medicare and Medicaid Services (CMS) Minimum Data Set requirements. [6] At that time, electronic information system use (broadly defined) ranged from a high of 79.6% for admission, transfer, and discharge to a low of 17.6% for daily care by certified nursing assistants (CNAs). A more recent survey of nursing homes in New York found that only 18% had fully implemented an EHR, and only 54% of these were exchanging information with other health care providers. [7] These data suggest that many nursing homes have some health information technology capacity, but that the use of EHRs is still not widespread.

Prior research on processes related to adoption of HIT in long-term care (LTC) facilities has reported that the need for training and the extensive culture change associated with HIT are important barriers to implementation. [8] Among early

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adopters, organizations have experienced positive outcomes after the multi-step process of implementation is finally complete.[9] Greater satisfaction with EHRs in nursing homes is associated with good training resources and effective implementation strategies, including carefully-planned change management procedures, hiring adequately-trained information technology staff, and offering a system support plan.[10,11] It is therefore critical to understand the experiences of frontline workers as the LTC industry continues to move toward more sophisticated uses of technology.[12,13]

The purpose of this study was to examine the processes of HIT implementation in nursing home facilities and HIT's relationship to the workforce. Through semi-structured interviews, focus groups, and a systematic review of the literature, we investigated perceptions of HIT, current workforce needs, and preparation and training for HIT implementation. We assessed the evidence for HIT's impact on the workforce and whether HIT translates into changes in productivity and quality of care in nursing homes.

Conceptual Framework / Theoretical Model

The conceptual framework used to evaluate the features to explore and examine for this study was developed by Liu and Castle.[14,15] The three concepts comprising the framework include: (1) general HIT systems; (2) Basic Minimum Data Set (MDS); and (3) Information system. HIT includes the use of EHRs, standardization of processes, and the interoperability of disparate systems (e.g., continuous monitoring systems and physician order entry systems). The basic MDS concept focuses on admission, discharge, and re-admission tracking as well as a comprehensive clinical assessment that is conducted on all residents. Finally, the information system concept encompasses registration, billing, payroll, human resources, and accounting. There are also two "Advanced Features" within the framework that overlap with the three main concepts. First, advanced HIT features include technologies that enhance use of narrative notes, track medications (electronic Medication Administration Records [eMAR]), provide point of care (POC) templates and MDS data entry, and allow for user-defined assessments. Advanced information system features include employee scheduling, bed control, planning, and facility-level information that is included in the Certification and Survey Provider Enhanced Reporting (CASPER) dataset maintained by CMS. *For this report, we focused our research on the HIT and Basic MDS concepts and their overlap with Advanced HIT features.*

Research Questions

To examine the relationships between HIT implementation and the nursing home workforce, we posed the following questions:

1) How do nursing homes prepare their workforce for HIT implementation?

2) How has HIT implementation changed staffing, roles, and teamwork?

3) How has HIT implementation changed workflows and productivity in nursing homes?

4) Have changes in staffing, workflow and/or productivity in nursing homes impacted quality of care?

Our findings may inform the Health Resources and Services Administration's (HRSA) training programs for occupations in nursing home settings, highlighting both current gaps and best practices.

Methods

We conducted both a comprehensive review of the peer-reviewed literature as well as qualitative key informant interviews and focus group meetings to understand both the evidence base and current experiences of HIT in nursing homes.

Literature Review

Search strategy

We identified search terms that pertained to HIT, such as "electronic health record," "computerized physician order entry," computerized patient record," and "health information management." These terms were then combined with terms related to the nursing home workforce, "nursing education," "personnel management," "job description," "turnover," and "staffing." (**See Appendix I for the detailed search strategy.**)

Given that adoption of HIT in nursing homes is a relatively new phenomenon, we did not include studies published prior to 2004. We focused on studies published in English; however, because we found that a substantial amount of the literature was from outside the U.S., we included studies from international settings as well as the U.S.

Data sources

We conducted searches in the following databases: PubMed, CINAHL, PsychINFO, Google Scholar, and Web of Science. We used major subject headings provided by each database, which were either identical or similar to our pre-identified search terms.

Eligibility criteria

We employed a number of inclusion and exclusion criteria to identify and select studies. We included only those studies that examined HIT in nursing homes or skilled nursing facilities, and excluded those in other settings, such as residential care facilities, assisted living, or home health. We included only peer-reviewed scientific literature published in English, and excluded reviews, commentaries, news articles, editorials, and unpublished reports. Lastly, we narrowed our search to studies that reported outcomes related to the implementation of HIT and impact on the nursing home workforce, such as staff productivity and quality of care.

Study selection

Our search of electronic literature databases yielded 246 non-duplicate records. (See Appendix, Figure 1, for flow diagram of records and selection.) We identified an additional two unique records of studies by using SCOPUS to identify references listed in literature reviews. Two reviewers (LW and MK) then independently screened titles and abstracts for inclusion based upon the study eligibility criteria. The two reviewers met and resolved discrepancies in selection, with refinement of the eligibility criteria. Following resolution, 103 records were selected for full text review. Of the 145 that were excluded, the major reasons were: records did not reference a research study; studies did not address HIT; and HIT was not implemented in a nursing home setting. Two reviewers (LW and MK) then independently reviewed full-text manuscripts. The reviewers again met to review selections and resolve discrepancies. Following resolution, 46 studies were selected for inclusion in the final literature review. Of the 57 studies excluded, the main reasons for exclusion included: absence of staffing or workforce outcomes; absence of outcomes secondary to implementation of HIT; and absence of nursing home outcomes.

Data abstraction

From the 46 studies, we collected descriptive information on: authors, date of publication, type of HIT studied, study design, setting, study population, workforce-related outcomes, and other outcomes.

Analysis

The majority of studies identified by the literature review (39 out of 46) employed non-experimental designs, and 3 of the 7 quasi-experimental designs did not employ statistical adjustment for non-equivalent comparison groups. Methods such as the GRADE system for evaluating literature quality were not applicable. [15] Also, many studies had employed qualitative methods such as focus groups, interviews, and direct observation. Therefore, we analyzed the literature findings for major themes related to each of the primary research questions. Detailed descriptions of study designs and findings from the literature review are summarized in Appendix Table 1.

Key Informant Interviews and Focus Groups

In April and May 2016, investigators conducted nationwide telephone and in-person interviews with 15 nursing home employees to examine how HIT impacts the nursing home workforce using a purposive sampling approach. Participants were interviewed from 5 different U.S. regions (West, Southwest, Midwest, Northeast, South). Inclusion criteria included employment as a staff member in a nursing home with HIT present. Employees of non-skilled nursing homes, such as assisted living facilities, were excluded. After deciding to participate, interviewees received an email with the interview guide and a consent form. Job titles included Administrators (2), Director of Nursing/Chief Nursing Officer (2), staff or charge nurse (5), Certified Nursing Assistant (3), Staff Development Coordinator (1), Infection Control Nurse (1), and a Director of Clinical Information Specialist (1). Years of nursing experience within their organization ranged from 1 month to 25 years. Education varied from a certificate program completion to a PhD.

Participants were interviewed individually, either in person (n=2) or by phone (n=13). Licensed nurses [Registered Nurses (RNs), Licensed Practical or Vocational Nurses (LPN/LVN)] or Certified Nursing Assistants (CNAs) were interviewed either individually or within a focus group conducted through an audio conference call. Each interview lasted 25 minutes to one hour. Focus Group A consisted of 3 CNAs, and Focus Group B was composed of 3 licensed nurses.

For all participants, interview questions were modified from the George Washington University HIT interview guide (See Appendix II for interview guides) and the literature review informed further modifications. We modified the interview guide for the CNA group given their role differences. Interviewees and focus group participants were asked to complete a 0-5 Likert scale to assess HIT quality in 5 areas – legibility, ease, accessibility, communication, and usability – with 0 indicating poor quality and 5 indicating high quality. One member of the study team recorded the responses while another team member conducted the interview. Participation indicated their consent. After interviewing participants, responses were compiled and analyzed. We identified main themes and triangulated the findings with those from the literature review. Ethics approval was received from UCSF's Institutional Review Board.

Table 1: Summary of main themes and synthesized findings from literature review and interviews

Theme	Main Finding
Implementation	
• Little to no systematic processes are used for implementation of HIT	
• Nursing home leadership is concerned about staff lack of computer skills, fear of technology, and limited English proficiency to use HIT	
• Initial training is inadequate and unmet need for ongoing training after implementation	
• Staff are frustrated because IT support is insufficient, rarely on-site, and after hours is slow or nonexistent	
• Staff are dissatisfied due to poor quality equipment, unreliable systems, and limited internet connectivity	
Staffing	
• Some staff assume new IT roles as "super-users" or mentors, but are not necessarily compensated for additional skills or responsibilities	
• Limited evidence that HIT replaces staff roles or increases staff turnover	
• High staff turnover in nursing home negatively impacts HIT implementation	
Productivity	
• Staff time and number of steps in workflow processes may increase initially due to HIT implementation but eventually return to baseline	
• Workflows should be redesigned with HIT in mind, prior to implementation	
• HIT implementation fosters staff communication and team cohesion	
Quality of Care	
• There is no direct evidence that HIT improves quality of care due to changes in staffing or productivity	
• Nursing home staff perceive that HIT improves quality of care through improvements in communication and documentation	

Results

Below we present the main themes that emerged for the primary research questions. For each theme we first present the findings from the literature review, and then further interpretation provided by our own qualitative work (interviews and focus groups).

1) How do nursing homes prepare their workforce for HIT implementation?

Planning

Literature Review. In order to understand how nursing homes prepare their workforce for HIT adoption, we examined the studies for what steps were taken to engage staff in the implementation process. We assessed for staff perceptions of these processes and to what extent, if any, best practices could be identified.

Four studies made note of the preparations for HIT adoption, although primarily to indicate that there was little or no systematic process for implementation.[16-19] Instead, staff described implementation as a "trial and error" process.[17] Staff reported communication prior to adoption as minimal [16,18] and the motivations for HIT implementation not well understood.[16,17,19] In a survey of Texas administrators and directors of nursing (DONs), those with higher leadership and employee readiness scores were more likely to have developed plans for implementation.[20] In one case, administrators and DONs reported using multiple means of communication to prepare staff for introduction of a new EHR, but the staff nurses and CNAs reported learning of the EHR through word-of-mouth or that they had no advance notification.[16,21] Only 2 studies described a deliberate effort to engage staff in selection of the HIT system or vendor [22] and another 2 described design and pilot testing of the software with feedback from nurses.[21,23] Two studies suggested that nursing homes have limited preparation for HIT implementation because leadership have poor understanding of HIT themselves.[17,20]

Interviews

Participants reported that HIT was relatively new, with many facilities slow to integrate the system. All participants but one reported their facility implemented some form of HIT less than 6 years ago. Across all interviews, there was a gradual phase-in of the HIT, rather than a complete system overhaul. There were no patterns of what type of HIT was implemented first. Some nursing homes

implemented the EHR first, whereas others implemented a treatment administration system (TARS) and medication administration system (MARS) before the EHR.

One RN participant's employer failed to adopt HIT and thus we felt it was important to include her interview as part of the study. Her comments reflect an understanding that HIT decisions are derived from corporate leadership and not engaged with the staff in the nursing home:

 "with us being the nursing home [associated with a hospital chain], we get the last of everything. Goes down the hospitals first, we get the leftovers…We are still on paper with our charting."

Participants' knowledge of why the HIT was implemented focused around external pressures or policies. One Chief Nursing Officer at a multi-level health care system noted the importance of reimbursement as a justification for HIT implementation:

"We are driven by acute care policies. From what I remember, it was tied to reimbursement. I don't remember the year, but CMS had sent all acute care hospitals an initiative all hospital should be part of an EMR otherwise you will have a penalty in reimbursement…."

However, this type of response was espoused only by those employed by nursing homes within health systems. The issue of reimbursement penalties for lack of implementation was not mentioned by those employed in free-standing nursing homes.

Training

Literature Review. Across multiple studies, administrators and DONs reported concerns about staff lack of computer literacy, [8,16,17,19,24-26] fear of technology, [8,18,19,26] and limited English ability [19,25,27] as barriers to implementation. When interviewed or surveyed directly, nurses and CNAs reported trust in computer systems, [28] curiosity about new HIT, and enthusiasm for opportunities to learn new skills.[16]

Few studies described training efforts to address either leadership concerns or to meet staff preparation needs and interest in HIT implementation. Many found staff dissatisfaction due to insufficient time dedicated to training and that sessions were not tailored to staff needs.[12,16,18,24,25,27] Of the studies that described training, many reported single sessions for nursing staff ranging from 30 minutes to 1 day, and single sessions for CNAs or personal care assistants (PCAs) of only 20 to 30 minutes' duration.[12,16,22,24,29-31] In one of the few studies in which staff reported

satisfaction with training, they received more training than what was typically reported, such as multiple days for nurses and full days for CNAs.[11] For new hires, training was often described as *ad hoc*, provided by other staff when available.[24,30,32] Four studies described a "train-the-trainer" process, in which a few staff were identified as super-users; these individuals typically received a 1-week training with the software vendor and then provided additional support to staff during implementation.[16,22,24,33] Staff repeatedly identified the need for ongoing training and opportunities to practice.[16,19,25,34] Two studies noted difficulties because training sessions were optional, not mandatory.[18,32] All of the above studies emphasized that implementation challenges arose due to lack of sufficient investment in staff training. A few studies reported that inadequate investment in training programs and lack of clear expectations for staff training arose because nursing home leaders were unfamiliar with the technology and system capacities.[16,17,19] There were no studies that evaluated different training methods or quantified to what degree outcomes such as satisfaction or productivity were attributable to training or lack thereof.

Interviews. Our interviews revealed similar limited training experiences, although the sessions were slightly more extensive than what was reported in the literature. Nurses received 8 hours to 2 weeks of training, and CNAs, 30 minutes to 4 hours. One chief nursing officer reported that members failed the basic training and couldn't "even control the cursor," even though this nursing home provided staff with the most training, starting 90 days prior to implementation. The leaders of the seminars included IT personnel, unit managers, and even administrators. Few facilities offered 1:1 supplemental guidance from preceptors or super-users. If any new updates with the system occurred, staff may have been trained on major changes, but mostly received an email or endorsement about minor modifications. Consistent with the literature, newly hired nurses and CNAs received fewer hours or no orientation at all. Regardless of total hours of training, staff were dissatisfied with their orientation. One participant described the training as:

"Poor[ly]. I would rate it a 2."

Nurses with fewer years of nursing experience reportedly learned how to use new technology faster. However, nurses agreed that "not the experience years, but their age" determined nurses' ability to adapt to HIT.

Our interview and focus group participants also identified potential best practices. Computer simulation or 1:1 preceptor experience appeared to prepare staff better than traditional in-service education sessions. One participant noted the importance of involving clinical staff, and not only IT staff, in delivering training:

"We hired a program manager from IT driving the process. This person is not a nurse/clinician …Lesson learned, you really need to have a clinician as part of the program training otherwise I realize nurses will say ʼyesʼ and ʼyesʼ and not connect the dots. Non-clinicians don't talk our language to be able to train the nurses. They feel the nurses are learning a new language but in actuality they are not."

Technology Support

Literature Review. In conjunction with insufficient training, most studies found that nursing homes did not adequately invest in technology infrastructure or support personnel, and these deficiencies led to staff frustration. Staff frequently reported difficulties with HIT adoption due to too few computers, limited and/or slow internet access, lack of wireless connectivity, and poor integration of systems. [21,25,26,34-38] In multiple studies, staff also reported a need for greater IT support, ideally on-site.[12,19,25-27,34,39] Several studies described a help line that staff could contact, but most of these were not available after hours and staff frequently encountered slow response times.[12,24,25,27] Only 1 study described IT support available on site; [2] others reported that on-site and intensive IT support available 24/7 were instrumental to HIT implementation.[2,16]

Interviews. Our interviews provided greater detail into consequences of inadequate technology infrastructure and IT support. Participants most frequently identified connectivity, and specifically wireless internet, as the most frequent barrier to successful uptake of HIT. Participants noted that if problems arose, a 24-hour support system was available, but response time varied by when the service was called. During business hours, a reply was returned within "a few minutes," but at off-hours, such as the weekend or holidays, staff could expect to wait 24 hours or receive no assistance until regular office hours. Only Administrators and DONs had staff access health records information off-site, and sometimes they assisted staff with technology concerns. Staff reported considerable frustration because technical difficulties arose often (and without sufficient support):

 "In a 5-day work week, 3 days we have issues."

2) How has HIT implementation changed staffing, roles, and teamwork?

In order to assess the impact of HIT adoption on staffing, we explored changes in staff roles, staffing models, and whether HIT systems affected turnover or recruitment of new staff.

Staff Roles

Literature Review. We found studies describing one change in staff roles, that of the super users noted above. In some cases, super users were selected based upon the results of an initial computer skills test;[33] in others, the process was not well described and lack of transparency in the selection of super users fostered resentment.[16,34] Staff members, and occasionally the super users themselves, did not know who was a designated super user.[16] In all studies, super users were expected to assume the responsibility of training and assisting other staff without a change in their other work roles; they were compensated for extra hours but did not receive higher pay or other accommodation in recognition of their added skills or responsibilities.[16] Two studies also referenced the use of "nurse mentors," but there was no description of the selection, training, or deployment of mentors (Alexander 2007, Rantz 2006).[25,34] On occasion, super users and mentors expressed frustration with their additional responsibilities and said they would prefer that colleagues use IT support.[12] Three studies described positive benefits by engaging quality improvement nurses and teams with the HIT implementation process.[23,25,40]

Interviews. We found no evidence that new HIT system capabilities reduced the need for personnel. In most cases, interview participants noted no changes in their roles, although super users were identified as part of the implementation process. One chief nursing officer noted that a super user staff nurse's role changed over time into a full-time equivalent specialist because, as noted above, IT consultants were not as effective in training the staff:

"Nurses can tell when the person isn't clinician. I identified a 'super super user' who sat in on all the meetings. I said to myself 'I will do this for 1 year' and now it's been 5 years with this person as a full time quality improvement support IT nurse."

Staff Turnover and Recruitment

Literature Review. We identified few studies that reported an increase in staff turnover as a result of HIT adoption. In interviews with DONs in Texas nursing homes, Cherry et al. reported that staff quit due to "information overload" and difficulty using computers.[9] One study described increased absences due to staff dissatisfaction with the new HIT system.[21] Another described high staff resistance, including pulling out cables and turning off systems, but not turnover.[17]

Across the studies, the findings on staff satisfaction with HIT were both positive[8,11,12,18,41,42] and negative.[11,17,19,24,34] This is consistent with findings from the one quasi-experimental study that examined turnover and found no significant differences in turnover between intervention and comparison sites.[3]

A few studies described how high turnover and use of intermittent staff in nursing homes created barriers to implementation, as changing staff and leadership required repeat training.[12,21,38] Administrators expected that adoption of HIT would be helpful in recruiting new and younger staff to their facilities but offered no evidence to support this expectation.[9]

Interviews. Our interviews also revealed that, despite the difficulty with the new technology, few instances of technology-associated staff turnover occurred. In one case, employers hired more staff to accommodate the extra time the new system required. One nurse remarked:

 "We had one or two CNAs who were resistant to change so those who were able to retire, retired. However, nurses did not quit. Even the nurses who were here over 20 years stayed with the facility."

Teamwork

Literature Review. In most studies, administrators and staff reported that HIT improved communication;[16,21,24,25,27] however, a few concluded HIT had no impact on communication.[33,42] In one study, nurses and managers described how EHR systems improved communication with CNAs and PCAs by providing a consistent framework for alerts on resident care needs.[42] When examined by direct observation, staff had fewer in-person or verbal interactions but used a greater variety of communication methods after adoption of HIT.[29,30,39,43,44] Others found that staff expressed a continued preference for verbal communication on issues deemed important, and felt the new HIT system did not impact these interactions.[30,45,46]

Some studies reported that HIT implementation fostered team cohesion.[25,40,43] CNAs and PCAs reported mixed perceptions of the impact of HIT on their relationships with supervisors: on one hand, the value of their work may be more appreciated when it is visible in HIT;[9] on the other hand, electronic tracking can convey a "Big Brother" impression of close monitoring.[25,27]

Interviews. Our interviews offered a richer picture of how HIT can impact teamwork within nursing homes. Participants described that HIT inadvertently enhanced team composition. Teams worked better because both new and experienced nurses

learned from each other. Seasoned staff shared their clinical expertise with newer employees, while newer personnel assisted experienced workers with technology support. A chief nursing officer explained:

"The older season nurses did not feel intimidated because they got to share expertise and skills and that's exactly why we were so successful."

3) How has HIT implementation changed workflows and productivity in nursing homes?

Workflow

Literature Review. Staff perceptions of the influence of HIT on workflow were mixed: in some studies, staff described processes as more streamlined[8,12,16,24,47,48] and in others, processes were more cumbersome.[17,19,25,27,30,32,34,42,45,49] In the quasi-experimental studies, staff in the intervention groups were more likely to report that documentation times and completeness improved.[11,42,48] In the studies that used direct observations and process mapping of workflows, the number of steps and the time to complete tasks were either reduced or the same with the new HIT system.[24,29-31,47] A few noted that careful evaluation and redesign of workflows should occur in the planning phase, prior to HIT implementation.[19,37]

The studies with longer follow-up periods noted that staff efficiency increased in the initial months following adoption; however by 12 to 24 months, most processes had returned to baseline efficiency.[25,27,29,30] In some cases this reflected greater familiarity with the HIT system[3], and in others workflows were no more efficient because the staff had developed workarounds or reverted to paper.[24]

Interviews. In our interviews, participants were asked to rate HIT in terms of 5 levels of quality: usability, legibility, communication, accessibility, and ease. On average, participants rated usability at 5, legibility at 4.5, communication at 3.27, and accessibility at 3.67. Ease was initially asked but discontinued due to clarity issues. HIT is an integral part of the staff's role, with approximately half of the shift spent using technology. With regard to impact on workflows, some participants reported that HIT shortened the time to complete a cycle of medication administration. Difficulties adapting to the new HIT system were reported infrequently in the interviews.

4) Have changes in staffing, workflow and/or productivity in nursing homes impacted quality of care?

Literature Review. We attempted to investigate whether the impacts of HIT on nursing home staffing and productivity led to subsequent changes in quality of care. We identified no studies that examined this relationship directly. We found one study that attempted to quantify the interrelationships between staffing, use of HIT for MDS, and quality of care.[14] In this analysis of nursing home data, the authors concluded that the positive association between staffing and quality was both partly accounted for (mediated) by the higher use of IT by more highly staffed nursing homes, and potentially amplified (moderated) by HIT. Thus, the study addressed the way in which staffing levels affect HIT use in nursing homes, rather than the impacts of HIT on staffing.

In the quasi-experimental study by Rantz et al, the intervention group with both EHR implementation and a quality improvement nurse expert experienced the most improvement in quality outcomes, compared with the groups with only the EHR, only the nurse expert, or neither.[3,25] Again, the study suggests that quality gains from HIT are synergistic with staffing rather than via a pathway in which staff are changed by HIT.

The remaining literature described staff perceptions of how HIT implementation may have impacted quality of care. Administrators and nurse managers believed HIT improved quality of care due to the capacity to monitor resident conditions, conduct oversight of care practices by frontline staff, and facilitate continuity of care.[2,24,25,27,33,42,43,50,51] Nurses and CNAs reported that HIT improved the legibility of documentation and ease of access to needed information, and as a result they could deliver better quality of care to residents.[12,30,33,34] However, CNAs and PCAs also expressed concern that use of HIT came at the expense of time spent on direct resident care, and some direct observation studies found that resident care time declined following HIT implementation.[9,16,25,27,30,34] Both nursing and direct care staff perceived that HIT did not impact clinical decision-making, another potential influence on quality of care.[24,33]

A few studies assessed documentation as an intermediate step in improving quality of care. Some found that introduction of HIT led to improved accuracy and completeness of documentation, [9,48] whereas others found the opposite.[25] Direct observation studies described ways in which the HIT system or consequent workarounds could contribute to both better and worse quality of care. Studies of electronic medication administration records found alerts fostered proactive correction of medications.[23,36] Others described workaround strategies that could

negatively impact of quality of care, including skipping fields, "clicking" through fields to check vital signs prior to medication administration,[37] documenting care before it was given,[25] using paper documentation that was inconsistently entered in the EHR,[25,46] and avoiding checks of the EHR due to log-on difficulties.[45]

In quasi-experimental studies, staff in intervention groups tended to perceive improved documentation and other aspects of workflows following HIT adoption, but the relationship to quality of care was unclear.[22,25,42] In the one experimental study, a randomized controlled trial of a menu-driven incident reporting system for falls, the authors found that documentation of near falls and fall circumstances in the intervention sites improved significantly relative to the control sites after 4 months.[21]

Interviews. In our interviews, compromised bedside care was not commonly cited as a consequence of HIT. Participants noted that HIT allowed them to view patients more holistically by making it easier to see medications and treatments. A charge nurse reported that she felt quality of care improved after HIT implementation:

"Yes, I am able to reorder meds faster, I am able to document and chart things as I come. If someone refuses their meds, I can do it as the incident is happening, I don't have to wait until the end of the shift. It has helped. Nurses' notes are more legible. Orders are more legible, We can [write] notes to team members and they can see our notes. Communication is faster in the event of a situation. My work does go by faster."

Differences across types of HIT

Lastly, we explored whether there were differences in staff preparation, experiences, or required skillsets, depending on the type of technology being introduced into the nursing home. We did not identify any studies that addressed these questions directly. Occasionally the literature described systems or processes in which the technology was adapted to the (real or perceived) technology skills of the staff: for example, RNs/LVNs used a text-based EHR, whereas CNAs/PCAs used a touch-screen point-of-care system[9] or continued to use paper.[33] In case studies on health information exchanges (HIEs), challenges arose due to the lack of integration with other systems. In one HIE with a hospital, the nursing home staff did not have access to the hospital EHR and continued to use paper.[35] In another HIE with an emergency department, nursing home staff printed and scanned documents, again due to lack of systems integration, occupying both time and available computers.[32] In this same study, the nursing home staff schedule was

deemed "too difficult" to work with, and thus training sessions were provided on a mandatory, rather than optional basis.

Conclusions

Over the past decade, the adoption of HIT in nursing home settings is rapidly occurring,[52] yet there has been a limited focus on the impacts of this implementation on the nursing home workforce. We assert that a greater understanding of how HIT affects the workforce is imperative in order to maximize a successful uptake. Greater satisfaction is associated with complete training resources and effective implementation strategies, including carefully planned change management procedures, hiring adequately trained information technology staff that understand the needs of frontline nursing home staff, and offering a system support plan.[11,34] Understanding the experiences of frontline workers as the nursing home industry continues to move towards more sophisticated uses of technology is essential to ultimately impact the quality of care that is provided.[12,13]

However, **despite over 10 years of research documenting implementation needs, training of nursing home staff remains underinvested and inadequate**. Staff are motivated to learn how to use new HIT systems, but training is often minimal and primarily occurs during the initial implementation period. Failures in successful implementation can lead to staff dissatisfaction, ultimately resulting in reduced or strained uptake. Our findings identified that limited access or availability of the technology (e.g., one computer or device on each unit), limited IT support for staff to troubleshoot problems, and limitations in the facility's technology interface (e.g., slow wireless internet) were significant issues that precluded successful implementation.

There was limited evidence that HIT adoption leads to staff turnover or elimination of workforce roles. Instead, we identified changes to staff roles through the development of "super users" who are identified as champions to assist with successful implementation. Furthermore, existing high turnover in the nursing home workforce may be raising barriers to adoption of new HIT system. As HIT becomes more common in nursing homes, and within large healthcare systems that use common vendors, workforce transitions may be less consequential or, as expressed by administrators, HIT may reduce turnover and enhance recruitment.

As identified by interview participants where HIT had been adopted over a long period of time, HIT can reduce documentation needs and improve efficiency. However, this is true only if there is not ongoing double-documentation with paper, which still occurs in many cases. **Workflow processes need to be re-**

engineered prior to adoption to avoid redundancies in care. In this study, perceptions of workflow changes were varied, despite observational analysis that suggests little real change in time or steps. This indicates that more time dedicated to training, re-engineering of flows, and removing paper documentation could all lead to greater perceived improvements in workflows at the start of HIT implementation.

While our interview participants provided anecdotes that HIT adoption led to improvements in efficiency and quality of care, there is no clear evidence that the impact of HIT on staffing, workflows, or productivity leads to changes in quality of care. HIT should theoretically improve quality of care via several mechanisms, from clinical alerts, decision support systems, and ease of accessing information – but proving this pathway is hard. Alexander et al. found higher IT sophistication is associated with improved quality of resident care (Alexander et al 2016), but it is not clear if HIT led to improvements, or the type of nursing home that would invest in more sophisticated IT is also more likely to have higher quality of care. Furthermore, without the initial investment in implementation – in engaging staff with selection of the product, the capacity to customize the system to the actual needs of the facility, and to invest in adequate equipment and connectivity so staff can have reliable access – as well as investment in initial and ongoing training, facilities are unlikely to realize potential gains in productivity and quality of care.

Finally, as is common in published research on nursing homes, there were temporal delays in the literature results compared with what is occurring "on the ground" in real time. This was the rationale behind our approach to include staff interviews to explore issues that may not be evident yet in the research. At the same time, in this 10-year period of rapid innovation and adoption, the challenges remain consistent.

Limitations

A few limitations were noted from this research. First, the extant peer-reviewed research on the impact of HIT among the nursing home workforce is limited, especially in the United States. We thus included international literature that directly addressed our research questions. Second, most studies, including our own interviews, utilized staff members' self-reported experiences. The findings are subject to selection bias from voluntary participation, and staff may not be willing to disclose perspectives such as resistance to using technology. However, our interviews identified numerous barriers to HIT implementation and the participants did not voice any concerns about participation, as confidentiality was assured. Third, given the lack of a systematic approach towards implementation across

nursing homes, there was a vast heterogeneity in the types of HIT implemented, and thus it was not possible to fully compare the implementation's impact on the nursing home workforce.

Recommendations

Based on our two-pronged approach of a comprehensive literature review and key informant interviews, we developed the following recommendations to engage and prepare the nursing home workforce for HIT:

1. **Development of a toolkit to prepare the nursing home workforce for HIT implementation**. Such a toolkit would include:

   - a facility and staff readiness assessment (for example, as developed by Cherry et al)[20];

   - a technical needs assessment, given the numerous issues with WiFi connectivity and technical support that negatively impact staff ability to use HIT successfully;

     - a process guide to engage all levels of staff, not just management, in the selection of the HIT products and vendors. Early engagement not only fosters staff buy-in, but also increases the likelihood that the HIT systems will be best tailored to the nursing home care needs and workflows;

     - a framework to integrate quality improvement initiatives with HIT implementation. Although leadership and staff perceive quality of care can be improved with HIT, we identified few formal efforts to systematically include HIT as part of quality improvement in nursing homes. The findings by Rantz et al. suggest that planning and implementation of HIT may show the greatest promise when jointly conducted with a quality improvement team.[3]

2. **Development of "best practices" for training the nursing home workforce in HIT implementation.** Through the literature and interviews, we identified several potential best practices:

     - Mandatory, rather than optional, training. Gaps in trained staff hinder implementation for the entire nursing home, not only those workers.

- Dedicated time and space for training, rather than ad hoc sessions.

- Increased time for training. Although our interview findings suggest nursing homes are increasing training time relative to prior years, staff nevertheless report current practices are still inadequate.

- Provide the same amount of training for new hires. Better training may foster staff retention; conversely, with a high turnover rate and no training for new hires, nursing homes will be faced with a preponderance of inadequately trained staff regardless of initial investments in training.

- Involvement of nursing home leadership and staff of all levels in the training process. This ensures understanding throughout the nursing home of HIT applications and challenges.

- Inclusion of individualized examples common in the specific nursing home during training sessions rather than a "one size fits all" approach, facilitated by an instructor with clinical experience. Training solely with IT personnel does not ensure that staff are trained to use HIT applications for their specific work tasks.

- Provision of ongoing training. Staff would be better supported by having continued opportunities to practice outside of care duties. Ongoing training also creates opportunities for staff to provide feedback on their HIT experience and identify solutions to problems rather than workarounds, e.g. paper documentation and skipping steps. In addition, nursing home leadership should anticipate ongoing updates in the technology such that training is not a one-time event but a continuous process integral to staff development.

3. **Increase funding incentives for training and compensation for IT personnel and staff with advanced HIT skillsets.** Successful strategies include both consistent, readily available IT support, on-site if possible or at minimum available 24 hours by phone, and dedicated staff with additional HIT training, e.g. super users. We recommend that these staff members be appropriately compensated either through a reduction in workload or increased wages in recognition of their added skillsets. In many cases, this was not an embedded practice. Furthermore, the selection of super-users should be transparent and systematic.

Related Resources

Technical Appendix: Literature search strategy and detailed list of studies.

Research Brief

Acronyms Used in this Report

Health Information Technology (HIT)

EHR: Electronic health record

HIE: Health information exchange

eMAR: Electronic Medication Administration Record

CDSS: Clinical Decision Support System

POC: Point-of-Care documentation system

CPOE: Computerized order entry

MDS: Electronic Minimum Data Set entry system

Long-Term Care Facilities:

RACH: Residential Aged Care Home

Workforce Roles:

PCA/PCA: Personal Care Assistant/Personal Care Worker

CNA: Certified Nursing Assistant

AIN: Assistant in Nursing

LVN/LPN: Licensed Vocational Nurse/Licensed Practical Nurse

EEN: Enrolled Employed Nurse

RN: Registered Nurse

DON: Director of Nursing

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