Original Study

Scalability of an IT Intervention to Prevent Pressure Ulcers in Nursing Homes

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Keywords:
Nursing homes
pressure ulcers
electronic medical records
patient safety

ABSTRACT

Background: Pressure ulcers pose an important quality-of-care challenge in nursing homes, with serious consequences for residents' health. We assessed the scalability of the On-Time Pressure Ulcer Prevention (On-Time) intervention strategy, developed by the Agency for Healthcare Research & Quality, in nursing homes nationwide.
Intervention: On-Time uses electronic health record reports to identify changes in resident pressure ulcer risk and facilitate multidisciplinary input into clinical decision making.
Objective: To assess the scalability and impact of On-Time on pressure ulcer incidence in nursing homes.
Design: We used quasi-experimental methods, employing a difference-in-differences design, to compare the pre-post trends in pressure ulcer incidence in the treatment and comparison homes.
Setting and participants: The study population included long-stay residents at high risk for developing pressure ulcers in 47 nursing homes and matched comparison homes in 17 states.
Measures: Stage 2 to 4 pressure ulcer incidence among long-stay residents who met the criteria for high risk, identified using an algorithm adapted from the Minimum Data Set 3.0 Percent of High-Risk Residents with Pressure Ulcers (Long Stay) measure.
Results: The overall decline in pressure ulcer rates for treatment relative to matched comparison homes was statistically insignificant ($P > .05$). A subgroup of heterogeneous homes experienced a statistically significant decline of 3.24 percentage points (61.0% relative decrease) in pressure ulcer rates relative to matched comparison homes, but no uniting characteristic common across homes readily explained their success.
Conclusions/Implications: Scalability of future health information technology—based quality improvement interventions in nursing home settings requires nuanced implementation support, particularly around electronic health record report accessibility and accuracy.

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Despite regulatory[1] and quality improvement efforts, pressure ulcers continue to be prevalent in nursing homes and have serious health[2] and financial[2,3] implications for nursing home residents. Most pressure ulcers are avoidable,[4] yet nursing home staff may lack timely information about residents' changes in risk, which limits prevention and early treatment. Electronic health records (EHRs) and clinical decision support systems can assist health care providers in more timely identification of residents at risk of forming pressure ulcers and interventions to address the risk factors, however, these systems are often underutilized in nursing home settings.[5]

The Agency for Healthcare Research and Quality developed the On-Time Pressure Ulcer Prevention (On-Time) intervention strategy to improve use of available health information technology to facilitate clinical intervention and prevent pressure ulcers in nursing homes.[6] In 2008, a pilot study of 12 nursing homes conducted with the New York

State Department of Health suggested that incorporating at least 2 On-Time reports during the intervention reduced the pressure ulcer rate among these residents by 53%; incorporating all 4 reports reduced the rate by 59%.[7] Building on the success of the pilot, this study sought to understand the scalability of On-Time within a diverse group of 47 nursing homes located across the United States.

Methods

The On-Time program aims to reduce the rates of pressure ulcers by generating 4 core reports via homes' EHR systems to identify residents with increased risk and monitor weekly changes in risk.[7,8] The reports serve as a form of Clinical Decision Support and profile resident risk factors,[*] including changes in meal intake (nutrition report), incontinence and catheter use (trigger summary report), weight loss (weight summary report), behavioral issues, and new or worsening pressure ulcers (priority report). The intervention relies on staff communication across disciplines and documentation by certified nursing assistants of standardized data elements within the On-Time reporting module. The On-Time intervention also employs a trained facilitator to assist nursing home staff who work in a "change team" to incorporate the reports into clinical workflow.[7] Working with a change team includes identifying weekly meetings and huddles where residents with new risk factors are discussed and changes in care are made when appropriate.

To assess scalability of the intervention beyond the initial pilot study, treatment nursing homes across the country were recruited, screened, scored, and selected based on predetermined eligibility criteria for inclusion. Minimum requirements included an overall 3- to 5-star Nursing Home Compare (NHC) rating[†] at the time of recruitment, an EHR system with access to the On-Time reports, and reporting of long-stay pressure ulcer scores to NHC during the baseline period. Several other criteria were combined into a "readiness" score[‡] to reflect an assessment by the study team of whether the nursing home was potentially capable of focusing on an intervention of this type. Eighty-five homes initially applied; of those, 50 were selected and 10 were retained as reserve homes to serve as replacements in case the study experienced a high attrition rate.[§] One facility with a 2-star NHC rating was eventually accepted because the facility seemed highly motivated and met other criteria. After attrition and replacement, 47 treatment homes from 17 states were included in the analysis.

To evaluate success, this study used a difference-in-differences (DID) design—a quasi-experimental approach—to assess the change in pressure ulcer incidence attributable to the scaled-up intervention. The study population included long-stay residents[‖] at high risk for

developing pressure ulcers residing in nursing homes selected for participation in the intervention (henceforth referred to as the treatment nursing homes) and in propensity score–matched, nonparticipating nursing homes (henceforth referred to as the comparison nursing homes). Centers for Medicare & Medicaid Services' (CMS) Minimum Data Set (MDS) version 3.0 served as the data source for the nursing home resident-level information. Nursing home characteristics were derived from the NHC and Certification and Survey Provider Enhanced Reporting (CASPER) data sets.

Each treatment home was propensity score matched to 3 in-state comparison nursing homes on observable characteristics: profit status; chain ownership status; bed count; baseline pressure ulcer rate; and overall, survey, staffing, and quality ratings. We then selected the comparison nursing home among the 3 that exhibited preintervention trends most similar to trends for the matched treatment home, a key assumption of the DID model.[¶] After matching, the difference in means across both groups for all covariates except bed count[**] was negligible (standardized difference <0.1), lending credibility to the plausibility of the comparison group in controlling for secular trends (Table 1).

To compare the effects of the intervention across nursing homes with different start dates, we established "resident-quarters," successive 90-day periods occurring before and after the intervention start date, as the unit of analysis in the DID model. We pulled the last annual, quarterly, or significant change MDS assessment for each resident who resided in the nursing home for at least 1 day during a resident-quarter and met the high-risk criteria. The study population included 27,670 resident-quarters in the treatment group and 24,546 resident-quarters in the matched comparison homes.

The outcome measure for this study—high-risk pressure ulcer incidence—was defined as a dichotomous variable. If a resident had a new, post-admission stage 2 to 4 pressure ulcer recorded on the MDS assessment,[9] the resident-quarter during which the assessment was conducted was coded as 1 (presence of a new stage 2-4 pressure ulcer) or 0 otherwise. To measure the impact of the intervention on residents with the highest-risk pressure ulcers (ie, stage 3 and 4 pressure ulcers), a secondary outcome measure was specified to identify resident-quarters with a new, post-admission stage 3 or 4 pressure ulcer.

We used a nursing home–level random effects logistic regression model[††] with resident-quarter-level propensity weights,[‡‡] assuming a logit functional form for the dependent variable, to estimate the net effect of the On-Time intervention on stage 2 to 4 pressure ulcer incidence among high-risk residents at treatment homes after accounting for secular trends. For a description of the overall sample of residents during the 5 baseline resident-quarters, stratified by treatment and matched comparison homes, see Table 2.

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[*] Risk factors include changes in meal intake (nutrition report), incontinence and catheter use (trigger summary report), weight loss (weight summary report), behavioral issues, and new or worsening pressure ulcers (priority report).

[†] CMS's Five-Star Quality Rating System rates each nursing home on a scale of 1 to 5 stars. Nursing homes with 5 stars are considered to have "much above average quality." For more information, please see CMS's Nursing Home Compare website: https://www.cms.gov/medicare/provider-enrollment-and-certification/certification andcomplianc/fsqrs.html.

[‡] A readiness score of 3 (the highest) was given if the nursing home reported it had used its EHR for more than a year, if staff had experience pulling data reports from the EHR, and if staff regularly used the EHR for documentation. The score decreased to 2 if one of these items was not true, and to 1 if several were not true.

[§] Because the study was adequately powered for the overall effect, none of the reserve homes entered the study.

[‖] Long-stay (1 or more consecutive stays totaling more than 100 cumulative days in the facility) residents who met the criteria for high-risk (impaired self-performance bed mobility or transfer; comatose; or malnourished or at risk for malnutrition) were identified using an algorithm adapted from the MDS 3.0 Percent of High-Risk Residents with Pressure Ulcers (Long Stay) measure, effective April 1, 2016.

[¶] In the absence of treatment, preintervention trends should be parallel to produce valid findings.

[**] Extremely large homes (bed count >500) were excluded from the comparison pool; the largest treatment home had 460 beds.

[††] The model controlled for differences in selected characteristics associated with risk of pressure ulcer formation between resident-quarters in On-Time and matched comparison nursing homes, including BMI, physical restraints, functional limitations, bed mobility, transfer, comatose, malnutrition, and active diagnoses. Resident-level characteristics including demographics, functional status, and chronic conditions were included in the model as potential confounding variables.

[‡‡] The resident-quarter level propensity score model included the following covariates suggested in the literature: demographic characteristics (age, race/ethnicity, gender), functional status (restraints, activities of daily living, PPS stay, mobility limitation), chronic conditions (psychosis, Alzheimer's, gastroesophageal reflex disease, aphasia, anemia, hypertension, dehydration, Parkinson's, thyroid, hip fracture, arthritis, diabetes, cataracts, stroke, depression, HF, osteoporosis, dementia), and pressure ulcer risk factors (comatose, malnutrition, bed mobility).

Table 1
Balance of Nursing Home Covariates

Characteristic	Mean in Treatment	Mean in Comparison Pool	Standardized Difference	P Value of Difference
Profit status	2	1.98	0.039	.797
Chain ownership status	1.52	1.57	−0.097	.561
Total bed count	129.56	114.85	0.184	.329
Baseline pressure ulcer rate	4.77	4.59	0.054	.666
Overall NHC rating	4.25	4.23	0.018	.884
NHC survey rating	3.54	3.56	−0.018	.903
NHC staffing rating	4.08	4.04	0.045	.724
NHC quality rating	3.92	3.83	0.073	.642

The main analysis included all nursing homes that were selected to participate and began participation in the intervention, equivalent to an intent-to-treat approach. Because this approach potentially masks interesting heterogeneity, we also conducted subgroup analyses to assess the extent to which outcomes varied by implementation factors and nursing home–level factors. Implementation factors include characteristics associated with implementation fidelity, such as active engagement in the intervention (retained homes that demonstrated capacity to track MDS data), use of at least 3 On-Time reports homewide, and assigned facilitator. The statistical power for the subgroup analysis was significantly lower as a result of the smaller sample size, which limited our ability to detect program impact within subgroups.

Table 2
Select Characteristics of the Study Population (in Resident-Quarters)

Characteristic	Treatment, n (%)		Matched Comparison, n (%)	
	Pre	Post	Pre	Post
Age, y				
≤70	2079 (12.0)	1287 (12.5)	1621 (10.4)	956 (10.5)
71-80	2819 (16.3)	1724 (16.7)	2509 (16.2)	1551 (17.1)
81-90	7079 (40.8)	4156 (40.2)	6507 (42.1)	3716 (40.9)
≥91	5361 (30.9)	3165 (30.6)	4830 (31.2)	2856 (31.5)
Race/ethnicity				
Caucasian	16,376 (94.5)	9692 (93.8)	14,767 (95.5)	8677 (95.6)
African American	437 (2.5)	326 (3.2)	389 (2.5)	234 (2.6)
Hispanic/Latino	115 (0.7)	70 (0.7)	71 (0.5)	45 (0.5)
Other/ unknown	410 (2.4)	244 (2.4)	240 (1.6)	123 (1.4)
Sex				
Female	12,342 (71.2)	7216 (69.8)	11,092 (71.7)	6523 (71.85)
Male	4996 (28.8)	3116 (30.2)	4375 (28.3)	2556 (28.2)
Active diagnoses				
Stroke	2033 (6.2)	901 (4.6)	2054 (6.3)	965 (5.0)
Hip fracture	353 (1.1)	229 (1.2)	281 (0.9)	168 (0.9)
Hypertension	12,605 (38.4)	7575 (39.0)	11,066 (33.7)	6325 (32.6)
Heart failure	4106 (12.5)	2389 (12.3)	3629 (11.1)	2073 (10.7)
Diabetes mellitus	4734 (14.4)	2800 (14.4)	4383 (13.4)	2547 (13.1)
Urinary tract infection	975 (2.3)	523 (2.7)	857 (2.6)	435 (2.2)
Malnutrition	657 (2.0)	371 (1.9)	335 (1.0)	201 (1.0)
Urinary incontinence	13,944 (80.4)	8372 (81.0)	12,601 (81.5)	7530 (83.0)
Bowel incontinence	10,373 (59.8)	6223 (60.2)	9821 (63.5)	5810 (64.0)
Activities of daily living (ADL) requiring limited assistance or more				
Bed mobility	17,189 (52.4)	10,228 (52.7)	15,287 (46.6)	8989 (46.3)
Transfer	17,030 (51.9)	10,135 (52.2)	15,178 (46.3)	8923 (46.0)
Toileting	17,184 (52.4)	10,235 (52.7)	15,302 (46.7)	9009 (46.4)
Personal hygiene	16,968 (51.7)	10,079 (51.9)	15,068 (45.9)	8862 (45.7)
Bathing	17,199 (52.4)	10,243 (52.8)	15,416 (47.0)	9041 (46.6)

Results

For the intent-to-treat analysis, there was a marginal and statistically insignificant ($P > .05$) decline in pressure ulcer rates for both treatment (0.09 percentage point decrease) and matched comparison homes (0.25 percentage point decrease) between the baseline and intervention periods (Table 3), resulting in no significant change attributable to the intervention. Although there was no effect on average across the entire treatment group, there was considerable variation in impact among treatment nursing homes. We identified a subset of 13 treatment homes that achieved a statistically significant ($P < .01$) 3.2 percentage point decrease in pressure ulcer rates relative to their comparison homes. However, we found no common, uniting characteristic that readily explained their success (Table 4). In addition, there is no evidence that the intervention significantly reduced the highest-risk (stages 3 and 4) pressure ulcers. Treatment and matched comparison homes experienced an increase in stage 3 or 4 pressure ulcers (0.16 and 0.21 percentage points, respectively).

Table 5 presents results of the subgroup analyses. For each subgroup, we repeated the estimation strategy used in the main analysis. Although the results of the subgroup analyses are not statistically significant ($P > .05$), the analyses revealed findings that we believe are worthy of discussion and future examination. All results are presented relative to comparison homes. Homes that did not drop out as well as those using 3 reports experienced a similar decline in pressure ulcer rates as the broader group of homes that intended to participate. Actively engaged homes, or homes that demonstrated a capacity to share data during the intervention, experienced a statistically significant 0.72 percentage point decline in pressure ulcer rates. However, the matched comparison homes within the subset experienced a similar decrease (0.85 percentage point) in pressure ulcer rates between the baseline and intervention periods.

Nursing homes that utilized EHR vendors 2 and 3 experienced a 0.02 and 0.36 percentage point decrease in pressure ulcer incidence rates, respectively. Homes with lower readiness scores had better outcomes; homes with readiness scores of 1 and 2 (out of 3) experienced a 0.67 and 1.14 percentage point decrease, respectively, in pressure ulcer incidence rates. Homes in the highest tertile of baseline pressure ulcer rates (0.53 percentage point decrease), those with a star rating of 3 or more stars (0.24 percentage point decrease), homes not owned by chains (0.14 percentage point decrease), and government-owned homes (0.16 percentage point decrease) experienced a relative decrease in pressure ulcer incidence rates.

Discussion

In the intent-to-treat analysis (the base model), we are unable to attribute the observed decline in pressure ulcer rates among treatment homes to the On-Time intervention. The decrease in pressure ulcer rates among the matched comparison homes, possibly the result of other quality improvement initiatives, limits our ability to detect an overall impact of the intervention. Nineteen treatment homes were located in Minnesota; the remaining 28 homes were geographically dispersed. During the intervention period, 80% of Minnesota's nursing homes were participating in a nursing home quality care collaborative for which "pressure ulcer rate" was included as a targeted metric, possibly limiting the utility of those homes as a control.

Although all nursing homes must contend with well-established barriers to implementation of quality improvement interventions, such as competing demands on staff time, resource scarcity, and frequent staff turnover, the implementation of EHR-based interventions in nursing homes presents unique challenges. During the current study, facilitators were asked to log implementation-related questions in a tracking system. Of the 51 total requests received by

Table 3
Unadjusted and Adjusted Differences in Long-Stay, High-Risk Pressure Ulcer Rate per Quarter Between Pre and Post Periods for On-Time and Matched Comparison Homes: Base Model

Analysis	Treatment Difference (Postintervention − Preintervention), % (95% CI)	Comparison Difference (Postintervention − Preintervention), % (95% CI)	Difference-in-Difference, % (95% CI)
Unadjusted, %	−0.28	−0.31	0.03
Adjusted (random effects DID model)	−0.09 (−0.68, 0.50)	−0.25 (−0.80, 0.30)	0.16 (−0.64, 0.96)
Adjusted (random effects DID model with resident-level propensity weighting)	−0.01 (−0.66, 0.64)	0.00 (−0.65, 0.65)	−0.01 (−0.93, 0.91)
Adjusted (stage 3 or 4 pressure ulcers)	0.16 (−0.10, 0.42)	0.21 (−0.14, 0.56)	−0.04 (−0.47, 0.39)

Average marginal effects computed from propensity weighted, random effects logistic regression models. The model controlled for demographic characteristics, functional status, and chronic condition status, and characteristics associated with risk of pressure ulcer formation, such as BMI, physical restraints, functional limitations, bed mobility, transfer, comatose, malnutrition, and active diagnoses.
Percentage (%) should be interpreted as percentage points, not relative percentage.

facilitators, 35 (69%) were related to technology (eg, software customization, reports not populating or sorting correctly, and access to reports). On-Time requires strong communication between each home and their EHR vendor. Nursing homes must work with their EHR vendor to learn which version of On-Time report specifications are embedded in the software; identify data fields that need to be documented to produce reports; and ensure that systematic, script-based testing has confirmed that reports are functioning "as designed." If reports are not ready, staff may become frustrated and lose interest in the effort. Considering the large number of problems with the

Table 4
Variation in Nursing Home Characteristics by Outcome

NH1	Pressure Ulcer Rate Decrease	Small Bed Size (≤90)	Located in Minnesota	Actively Engaged	Use of 3 Reports Homewide	EHR 3	High Baseline Pressure Ulcer Rate	Low Baseline Quality Rating	Readiness Score
NH1		●							
NH2	●	●	●				●		●
NH3	●		●		●				●
NH4	●	●	●	●	●				
NH5	●			●	●		●	●	
NH6	●	●	●	●			●	●	
NH7	●	●						●	
NH8	●	●	●	●	●	●			
NH9	●				●	●	●		
NH10	●				●		●		●
NH11	●			●				●	●
NH12	●		●					●	●
NH13	●			●	●				
NH14	●			●				●	
NH15	●		●				●		
NH16	●		●		●		●		
NH17	●	●			●				
NH18	●						●		●
NH19	●			●	●	●			
NH20	●		●	●	●				
NH21	●								
NH22	●			●	●	●			
NH23	●						●		
NH24	●	●	●	●			●	●	
NH25		●		●	●		●		
NH26		●		●	●				●
NH27			●	●			●	●	
NH28		●	●	●	●				
NH29							●		
NH30				●	●				
NH31		●	●	●	●				
NH32					●				●
NH33		●	●						
NH34			●						
NH35		●	●				●	●	●
NH36					●			●	
NH37				●	●			●	●
NH38				●	●	●			
NH39		●	●	●	●				
NH40				●	●		●		
NH41				●	●				
NH42		●		●	●	●			
NH43				●	●				
NH44			●						
NH45							●		●
NH46		●	●		●				
NH47				●				●	

Note. The dots here indicate that the home possessed the characteristic.

Table 5
Adjusted Differences in Subgroup Analyses: Treatment and Matched Comparison Homes

Subgroup	Treatment Home Postintervention − Preintervention, % (95% CI)	Selected Comparison Postintervention − Preintervention, % (95% CI)	Difference-in-Differences, % (95% CI)
Active homes during the intervention	−0.17 (−0.76, 0.42)	−0.52 (−1.09, 0.05)	0.35 (−0.46, 1.16)
Actively-engaged homes	−0.72 (−1.36, −0.08)	−0.85 (−1.50, −0.20)	0.13 (−0.78, 1.04)
Homes using 3 on-time reports	−0.13 (−0.70, 0.44)	−0.48 (−1.11, 0.15)	0.35 (−0.48, 1.18)
Homes with significant decline in pressure ulcer rates (n = 13)	−2.41 (−3.07, −1.75)	0.83 (0.06, 1.60)	−3.24 (−4.25, −2.23)
EHR vendor			
1	0.11 (−2.17, 2.39)	−0.29 (−1.30, 0.72)	0.40 (−2.12, 2.92)
2	0.27 (−1.21, 1.75)	0.29 (−1.19, 1.77)	−0.02 (−2.17, 2.13)
3	−0.36 (−0.97, 0.25)	0.26 (−0.77, 1.29)	−0.62 (−1.78, 0.54)
4	−0.23 (−0.93, 0.47)	−0.68 (−1.63, 0.27)	0.45 (−0.74, 1.64)
Readiness score			
3	0.07 (−0.48, 0.62)	−0.66 (−1.24, −0.08)	0.72 (−0.07, 1.51)
2	−0.80 (−2.35, 0.75)	−0.13 (−1.37, 1.11)	−0.67 (−2.72, 1.38)
1	0.51 (−1.55, 2.57)	1.64 (0.24, 3.04)	−1.14 (−3.68, 1.40)
Baseline pressure ulcer score (tertiles)			
First tertile	0.16 (−0.56, 0.88)	−0.04 (−0.85, 0.77)	0.20 (−0.88, 1.28)
Second tertile	−0.07 (−0.87, 0.73)	−0.90 (−1.73, −0.07)	0.83 (−0.32, 1.98)
Third tertile	−0.43 (−1.58, 0.72)	0.10 (−0.86, 1.06)	−0.53 (−2.03, 0.97)
Baseline star rating			
3 stars	−0.61 (−1.69, 0.47)	−0.37 (−1.62, 0.88)	−0.24 (−1.89, 1.41)
4 stars	0.05 (−0.84, 0.94)	−0.27 (−1.16, 0.62)	0.33 (−0.93, 1.59)
5 stars	0.03 (−0.74, 0.80)	−0.21 (−0.90, 0.48)	0.24 (−0.79, 1.27)
Corporation (chain) status			
No	−0.44 (−1.14, 0.26)	−0.31 (−1.01, 0.39)	−0.14 (−1.13, 0.85)
Yes	0.29 (−0.45, 1.03)	−0.19 (−0.88, 0.50)	0.48 (−0.53, 1.49)
Ownership type			
For profit	1.36 (−0.66, 3.38)	−0.40 (−2.27, 1.47)	1.76 (−0.97, 4.49)
Not for profit	−0.30 (−0.87, 0.27)	−0.37 (−0.92, 0.18)	0.07 (−0.72, 0.86)

Average marginal effects computed from propensity score−weighted, random effects logistic regression models. The model controlled for demographic characteristics, functional status, and chronic condition status, and characteristics associated with risk of pressure ulcer formation, such as BMI, physical restraints, functional limitations, bed mobility, transfer, comatose, malnutrition, and active diagnoses.
Percentage (%) should be interpreted as percentage points, not relative percentage.

electronic reports, it appears that many treatment homes underestimate the amount of time and resources that were needed to ensure that staff had access to valid On-Time reports. This may have made it difficult for staff to use the reports in a timely manner to make changes in care plans to prevent pressure ulcers from forming. In the On-Time pilot study in New York, which showed a positive impact of the intervention, nursing homes received funds from the New York Department of Health to help defray the cost of developing the software for the electronic reports.[7] This arrangement may have made the validation of the reports more of a priority for the venders and helped facilitate the incorporation of the report information into day-to-day care planning.

Despite the increasing placement of EHRs in nursing homes, the full potential of these systems to improve the quality of patient care is seldom realized. Research demonstrates that nursing homes often underestimate the cost of EHR adoption, especially related to access to Internet-connected equipment and the need to customize and update software.[10,11] Nursing homes often run on tight margins and rarely have adequate technical support to sustain these needs. In addition, truly utilizing an EHR requires continued staff buy-in. Recent studies have highlighted the need for consistent, ongoing staff training on EHR.[12,13] Staff must also ensure a careful and accurate assessment of the documentation of changes in residents' risk for pressure ulcer formation.

To take advantage of quality improvement opportunities like On-Time, homes must have the IT infrastructure, staff capacity, and EHR vendor support to ensure reports are correctly programmed and to enable faithful intervention execution. Vendors reported that they typically require a year to plan and implement new software or software functionality. In future efforts, homes interested in implementing On-Time should conduct a preemptive comprehensive assessment with their EHR vendor up to a year in advance to ensure reports are available and accurate.

Conclusions and Implications

Despite the lack of an overall effect, the study was able to increase understanding of the scalability and associated challenges of this EHR-based intervention in nursing homes. Specifically, this study shows that nursing home readiness to undertake EHR-dependent quality improvement is a function of staff commitment and preparation, and EHR vendor engagement. In the case of On-Time, the intervention really begins when the reports are accessible to staff to use within the change teams, something that is not easily achieved. Additional research is needed to understand how best to reduce the investment required to prepare (both for the facility and for the EHR vendor) so that the promise of EHR-based interventions to reduce the incidence of adverse effects can be realized.

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Online Appendix

AHRQ offers a set of materials, including 16 Implementation Steps, Self-Assessment Worksheet, and a Menu of Implementation Strategies on their website to help nursing homes understand the intended flow of On-Time and how to incorporate report use as part of their day-to-day prevention activities. For additional information, please visit https://www.ahrq.gov/professionals/systems/long-term-care/resources/ontime/pruprev/pruprev-intro.html.

The goal of On-Time is to incorporate the On-Time reports into day-to-day prevention activities and to ensure multidisciplinary input into clinical intervention decisions. The Implementation Steps document was created to help nursing homes understand the implementation steps for carrying out On-Time and the likely timeline to make the reports part of daily practice. It is intended to be used by the team champion and the change team members to help keep the effort on track and methodical.

Step 1: Verify Nursing Home Readiness

The facilitator meets with nursing home leadership to confirm willingness to implement the On-Time Pressure Ulcer Prevention Program. Leadership agrees to identify a change team champion and establish a multidisciplinary change team to lead the project. The facilitator develops a plan with the change team on how they work together.

Step 2: Confirm Access to Electronic Reports

The change team champion or information technology (IT) representative contacts the facility's electronic medical record (EMR) vendor to confirm that On-Time pressure ulcer prevention reports are in the system and takes appropriate steps at the facility to provide frontline staff with access to prevention reports.

Step 3: Identify Multidisciplinary Team Members To Serve on the Change Team

The change team consists of a change team champion, nurse managers from each nursing unit, a dietitian, and certified nursing assistants (CNAs). The champion advocates and supports the project and ensures that project activities are sustained during turnover of key staff. Nursing leadership may assume this role or delegate the responsibility. Two team leaders may co-lead project activities; one is a nurse and the second can be from nursing or another discipline.

Team leaders share responsibilities to coordinate and implement activities and coordinate calls with an On-Time facilitator. The director of nursing (DON) determines his or her level of involvement. Ad hoc team members include wound care staff, staff educator, physicians, nurses, and rehabilitation staff.

Step 4: Provide Overview of On-Time Pressure Ulcer Prevention

The On-Time facilitator provides an overview on the On-Time Pressure Ulcer Prevention Program to the change team. The facilitator answers questions and confirms that the facility team members understand how to access reports and tools.

Step 5: Review On-Time Pressure Ulcer Prevention Reports

The team reviews reports with the facilitator to understand the purpose, content, potential uses, and likely users of the reports.

Step 6: Complete Pressure Ulcer Prevention Self-Assessment

The facilitator meets with the champion to fill out the worksheet and helps the team review findings. The team completes the self-assessment worksheet that identifies details about the current processes at the facility to identify residents at risk for pressure ulcers. They also identify prevention practices and processes for root cause review. The review includes identification of existing team meetings, huddles, and other communication structures at the facility.

The facilitator reviews ways risk information is transmitted to clinical staff and ways care plans are updated and interventions are determined. The facilitator guides the team to identify gaps and begin to think about ways they can use On-Time reports to help prevent pressure ulcers.

Step 7: Pilot a Report with Data

The On-Time facilitator guides the team in generating and reviewing a report with actual resident data on one unit. The facilitator works with the team to understand the report and answers questions, as needed.

Step 8: Validate Data

This step helps the team gain confidence in the validity of the data in the reports. The team discusses residents populated on the report to ensure that data on the report agree with staff knowledge of residents' health/risks. Staff may choose to go back to the medical record to confirm that data on the report are consistent.

In completing this task, the team may identify problems in, for example, CNA documentation completeness, and may find it necessary to have the nurse educator retrain CNAs, to improve report validity. In addition, the facilitator can clarify any normal but potentially confusing data situations and how to interpret them. Each report the team uses should go through this process so the team is confident in the information being produced on the reports.

Step 9: Have Team Choose To Use At Least 3 Core Reports

With the help of the facilitator, the change team uses the Pressure Ulcer Prevention Menu of Implementation Strategies. The facilitator helps the team determine which reports may help them given the list of existing meetings from the Self-Assessment Worksheet (Step 6). The team can use 1 report more than 1 way and in multiple meetings, but is required to implement at least 3 Pressure Ulcer Prevention reports.

Step 10: Decide on Meetings to Incorporate Reports

With the help of the facilitator, the change team decides which meetings/huddles will incorporate reports. Some new meeting/huddles may be created or existing meetings may be altered to accommodate report discussions.

The facilitator helps the team initiate the first report meeting and provides advice on how to structure existing meetings or create new meetings to best incorporate report discussions. Advice includes who should attend the meeting, what their roles are, who is responsible for the reports, and who will lead the discussion.

Step 11: Pilot All Reports/Meetings in 1 Unit

The team pilots each report in a designated meeting. The facilitator helps with implementation issues. This is an iterative process that should be repeated until the process is smooth and effective.

Once new reports are incorporated into meetings, the champion decides on role changes for staff to ensure that reports are used at designated meetings with appropriate clinical and CNA input. It is important for the champion to have supervisory responsibility so these changes can be informed and enforced.

Step 12: Implement All Reports in All Units

The facilitator, champion, or unit representative introduces the On-Time Pressure Ulcer Prevention Program to other units. The facilitator will help the team during the next 3 months to train staff and to problem-solve implementation issues until all reports and all units are implementing the reports as planned and the team becomes more independent. The timeline depends on leadership commitment, stability of staff, how familiar the facility is with using computerized reports, and quality improvement (QI) experience of staff.

Step 13: Monitor Facility Implementation Progress Monthly

After about 6 months, the facilitator's role is to check in to identify obstacles that could occur and to troubleshoot issues as needed, such as turnover of key staff, computer glitches, and implementation issues. The expectation is that reports will be used on a weekly basis except for meetings that occur less frequently (eg, monthly). The Implementation Steps provide a basis for monitoring implementation progress.

Step 14: Review Pressure Ulcer Incidence

The facilitator works with the team to generate QI monitoring reports that identify pressure ulcer rates to provide feedback to the change team and to support reporting requirements.

Step 15: Use Optional Reports

In 2014, 2 new reports were added. The first report, Intervention History for Nutrition Risk Reports: High Risk and Medium Risk, focuses on the intervention history of residents with nutrition risks. The second report, Resident Clinical, Functional, and Intervention Profile Report, focuses on detailed information for any resident and can be used to provide a clinical history for residents with new pressure ulcers. Because the evaluation results were based only on the original reports, use of new reports is optional, but these reports provide more insight on the clinical and intervention history of residents and may help in developing better care plans that can improve pressure ulcer prevention practices in the nursing home.

The vendor needs to program these new reports; all data elements for this report are currently available and new programming is expected to be a low effort by the participating vendor. The team implements reports into current practice as above.

Step 16: Sustain the Effort

After 9 months, the nursing home change team develops a plan to incorporate implementation strategies for report use into facility policies and procedures. The plan includes incorporating educational in-service for new hires and training material for temporary employees. The facility needs to establish a permanent champion for this QI effort and champions on units.

Likely champions for each nursing unit are the nurse managers, with backup support by the QI department, who may be assigned to conduct periodic monitoring of implementation strategies to ensure they are sustained. But on a weekly basis, the DON is responsible for ensuring that On-Time process improvements are carried out on each nursing unit and holds each nurse manager accountable.