FINAL REPORT

Pain Assessment and Management in Residents with Dementia Using Web-Based Education and Informatics in Rural Nursing Homes

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Background and Goals

Unrelieved pain among nursing home (NH) residents is a well-documented problem that significantly decreases residents' quality of life, resulting in agitation, depression, behavior problems, and accelerated functional decline (American Geriatrics Society, 2002; American Medical Directors Association, 2009; Lapane et al., 2011). Residents with dementia are at highest risk for underestimated and undermanaged pain because they have more difficulties communicating their pain; research shows that under-assessment of pain by nursing staffs and families increases steadily with level of cognitive impairment (American Geriatrics Society, 2002; Won et al., 2004). Nearly 50 percent of NH residents have a diagnosis of dementia and almost 70 percent of persons with advanced dementia die in this setting (Mitchell et al., 2005). Estimates of pain prevalence in persons with dementia vary widely, from 20-83% depending on the sample and method of identifying pain. Thus, many nursing home residents with cognitive impairment experience unnecessary suffering as a result of pain.

Several evidence-based guidelines for evaluating treating pain in older persons, nursing home residents and persons with dementia have been published (American Geriatrics Society, 2002; American Medical Directors Association, 2009; Hadjistavropoulos et al., 2007 #780; Herr et al., 2006). However, often clinicians are unaware or fail to adhere to these recommended practices (Jablonski & Ersek, 2009). There are many challenges to implementing best clinical practices in nursing homes and other settings. These include: lack of clinician knowledge, misconceptions about pain in persons with dementia, low staffing ratios, limited physician involvement, and lack of resources and organization support to change practice (Tarzian & Hoffman, 2004; Jones et al., 2005).

Given the limited resources available at many nursing homes, online resources hold promise for disseminating best practices and supporting staff in adopting them in daily practices. However, there is scant empirical support for the effectiveness of internet-based tools targeted to nursing home staff. (Castle, 20110; Hobday et al.,2010).

The primary goal of this dementia grant project was to help a consortium of rural NHs improve assessment and management of pain in their residents with dementia through the use of readily accessible Web and computer-based education programs, evidence-based informatics reports, new assessment and care planning tools, and clinical support under the rubrics of a Web-based clearinghouse called *Stop Pain in Nursing Homes (SPiNH)* and a Web-based quality improvement program called *EQUIP for Quality*®(EQUIP). In line with the growing national focus on using technology to improve quality in healthcare, staffs had access to these resources without having to leave their NH. The intervention also incorporated several implementation strategies to increase adoption of the web-based tools. Other key goals were to:

- Update and improve the NHs' processes for assessing, documenting, and managing pain in residents with moderate to advanced dementia;
- Improve outcomes related to pain in these residents, including mood and behavior symptoms such as resisting care; depression; and functional decline;
- Demonstrate that Web-based education, consultation, informatics reports, tools, guidelines, and facilitation are cost-effective ways to help improve the quality of care of dementia residents, particularly in rural NHs where there are greater barriers to accessing education resources and slower adoption of technology to overcome geographical limitations;
- Demonstrate how the wealth of resident information already available in every NH's Minimum Data Set (MDS) data can be validated and used in decision-support software as an accurate informatics tool to prospectively identify cognitively impaired residents with high likelihood of suffering from undiagnosed pain, evaluate pain reduction efforts, and track improvements in outcomes related to pain.

Participating NHs received evidence- and research-based:

- pain assessment tools and education, tailored to appropriate NH staff (RNs/CNAs, nurse managers, physicians);
- pain management guidelines/protocols;
- facilitation to promote diffusion of the information within the NH; and
- resident-, unit and facility-level informatics reports to help staff identify cognitively impaired residents with high likelihood of undiagnosed pain for further assessment, and help staff monitor pain levels and pain-related outcomes.

We expected the benefits to go beyond having less pain—we expected to see less depression, fewer negative behaviors and moods, and slower functional decline in these residents—resulting in a better overall quality of life.

Methods

Project Personnel/Grant facilities

Sixteen rural nursing homes (NHs) in upstate New York agreed to participate in this project (Table 1), including two homes that merged prior to the start of the project (Katherine Luther and Martin Luther). The lead NH was Lutheran Home and Rehabilitation Center (LHRC), a 214 bed non-profit NH located in Jamestown (Chautauqua) NY. Participating NHs included a good representation by size, ownership (for-profit and not-for-profit), and region. As shown in Table 1, all NHs had a significant percentage of residents diagnosed with Alzheimer's disease and/or dementia, ranging from 39.5% to 79.3%. All NHs signed a letter of commitment

which indicated that they understood the requirements of the project which included: identifying key staff and allowing time for staff to participate in the project; providing computer and internet access; attending offsite and web-based meetings and education sessions; and participating in the evaluation. All but two NHs were regular users of the EQUIP software program, which was the program used to access key informatics reports. EQUIP is a proprietary MDS Analytics software program, developed over ten years ago by researchers at LeadingAge New York, that is used in hundreds of nursing homes throughout the country to assist staff in auditing and monitoring quality outcomes. EQUIP was provided to the two facilities that did not have access and EQUIP project staff conducted training to get these NHs up to speed on how to use the program.

The key project personnel were the Co-Principal Investigators, Senior Research Analyst, Nurse Educators, and Website developer. Dr. Christie Teigland, formerly the Director of Informatics and Research at LeadingAge New York, and Dr. Mary Ersek, Associate Professor at the University of Pennsylvania's School of Nursing were the named Co-Principal Investigators for this project. Upon Dr. Teigland's departure from LeadingAge New York in April 2011, Linda Spokane, Director of Research & Analytics, assumed the role of Co-Principal Investigator. From LeadingAge New York, Dr. Zulkarnain Pulungan was the Senior Research Analyst, Kathleen Pellatt, RN and Ann Marie Bradley, RN were the Nurse Educators and Tim Thate was the website developer/IT specialist.

Table 1: List of Participating Facilities

Facility	County	# Beds	# Residents w/Dementia	% Residents w/Dementia
ADIRONDACK TRI COUNTY NURSING & REHABILITATION CTR	Warren	82	51	54.3%
AUBURN NURSING HOME	Cayuga	92	58	54.7%
CATSKILL REGIONAL MEDICAL CTR SNF	Sullivan	64	32	39.5%
WAYNE HEALTH CARE (DeMay Living Center)	Wayne	180	109	60.2%
EVERGREEN VALLEY NURSING HOME	Clinton	89	73	79.3%
FORT HUDSON NURSING CENTER, INC	Washington	196	144	66.4%
KATHERINE AND MARTIN LUTHER HOME	Oneida	280	193	54.5%
LUTHERAN HOME & REHABILITATION CENTER	Chautauqua	214	107	52.5%
MICHAUD RESIDENTIAL HEALTH SERVICES INC	Oswego	89	41	44.6%
MM EWING CONTINUING CARE CTR	Ontario	188	121	59.3%
WESTERN N Y S VETERANS HOME (NYS Vets at Batavia)	Genesee	126	81	63.3%
ONEONTA NURSING AND REHABILITATION CENTER	Otsego	80	58	62.4%
ST JOSEPHS HOME	St. Lawrence	82	47	54.0%
ST LUKE HEALTH SERVICES	Oswego	200	151	60.9%
VESTAL REHABILITATION AND NURSING CENTER	Broome	180	114	55.1%
Total		**2142**	**1380**	

Data Source: Q3 2010 MDS data

Intervention

As discussed above, the primary objective of this project was to provide rural NYS NHs with web-based tools and resources to help staff better assess, identify, and treat pain in residents with dementia as well as to improve pain-related outcomes in residents with undetected and/or under-managed pain (i.e. depression, negative behaviors, functional decline). To accomplish this goal, facilities had access to two web-based resources:

1. Informatics Reports

   Participating facilities had access to EQUIP and to the 17 quality measures (QMs) developed by EQUIP research staff based specifically on chronic care residents with Alzheimer's/Dementia (AD) (see Appendix A for definitions). Several EQUIP AD QMs were derived from existing Centers for Medicare and Medicaid Services (CMS) Quality Measures[1]. The EQUIP AD QMs use the same QM definitions, but are based only on those residents with Alzheimer's/Dementia—all other residents are excluded. In addition, six new EQUIP AD QMs were developed through this project based on research identifying quality of care (QOC) and quality of life (QOL) issues for AD residents not addressed in existing CMS QMs, including a new "Indicator of Possible Undetected Pain" measure. The 17 QMs were integrated into EQUIP and made available via the "Dementia Suite" of reports. Resident-centered risk reports were generated from the QMs and provided staff with a list of modifiable and addressable risk factors related to pain that assisted them in improving care planning and to better target interventions aimed at reducing pain for persons with dementia. Facility staff downloaded the reports from a secure Internet site.

2. Stop Pain in Nursing Home (SPiNH) Website

   The SPiNH website (www.spinh.org) was designed to educate nursing home providers, including licensed nursing staff, prescribers, and nursing assistants about evidence-based strategies for assessing and treating pain, particularly in residents with cognitive impairment. Educational materials included both live and archived, on-demand webinars and downloadable slides. Resources available to staff included policies and procedures, clinical practice guidelines, algorithms, the SPiNH Pain Assessment Tool, information sheets, documentation forms, and various MDS regulatory documents. Specific nursing assistant-focused resources included webinars on observing pain behaviors, nondrug therapies and monitoring response to pain treatments; pain observation tools with instructions, and interactive

[1] The CMS QMs are used in nursing homes for quality improvement, in the survey process to identify quality problems and publicly reported on the Nursing Home Compare website through the Five Star Nursing Home Quality Rating System designed to help consumers select a nursing home.

learning exercises such as a Jeopardy-themed game. The website was redesigned and updated at regular intervals.

Several implementation strategies were employed to foster inter- and intra-facility collaboration and adoption of the informatics reports and SPINH resources. First, the project was initiated with two "kick-off meetings" to encourage collaboration and mutual understanding among the participating facilities. Because participating facilities were geographically dispersed, meetings were held in two upstate New York venues to facilitate attendance. A series of comprehensive web-based sessions detailing how to use the informatics reports and pain education resources to identify, assess, and treat pain in dementia residents, including recommendations on engaging leadership and forming an interdisciplinary team to support project goals (see Appendix B for the PowerPoint slides from these sessions) were conducted.

A key component of this project, especially at the beginning, was to educate NH staff about the importance of properly coding the MDS, specifically pain-related items such as arthritis, fractures, pressure ulcers, urinary tract infections, and other diseases and conditions known to increase the risk of having pain. Coding these items correctly improved the accuracy and reliability of the informatics reports which, in turn, assisted staff in identifying residents with pain or at risk of having pain. To this end, nurse educators conducted site visits at each participating facility in the summer of 2008 in order to validate MDS coding. Coding inaccuracies were noted and four web-based education programs were delivered by an AANAC-certified Master Trainer that provided valuable training on how to code pain-related MDS items.

Annual one-day workshops were conducted in each subsequent year of the project to re-energize facilities. As with the kick-off meeting, the workshops were held in two locations. They included a variety of activities, including review and updates on the goals of the project, "hands-on" practice with informatics reports and SPiNH site using real and constructed case studies, "scavenger hunts" to locate specific resources on the SPiNH site, one-on-one consulting for difficult pain cases, and sharing and discussion of pain policies. The project team also conducted periodic user group phone conferences to provide facility staff and administrators the opportunity to learn from each other and share success stories and strategies to improve pain care. Success stories were also shared on the SPiNH website.

Throughout the project period, participating facilities had access to sixteen (16) on-demand pain education webinars delivered by long-term care pain experts covering topics from the basics of pain management to the benefits and pitfalls of administering opioids and everything in between (see Appendix C for a complete list of education sessions offered and archived).

Timeline of Activities

The original project period was from January 1, 2008 through December 31, 2010; however a one year, no-cost extension extended the project until December 31, 2011. A brief summary of activities over the four year period is shown in Table 2.

Table 2 - Summary of activities by year

Year	Activity	When delivered
2008	In-person kick-off meeting	June
	MDS Coding Validation site visits	Jul - Aug
	MDS Coding Webinars	Sep-Dec
	SPiNH web-based training	Nov
	EQUIP web-based training	Nov
2009	Cont'd MDS Coding webinars	Jan
	Web-based on-demand educational programs	ongoing
	In-person Workshop	Sept
	User group phone calls	Oct - Dec
2010	Cont'd user group phone calls	Jan-Dec
	Cont'd web-based on-demand educational programs	Jan-Dec
	In-person Workshop	Nov
2011	SPiNH update webinar	Apr
	EQUIP MDS 3.0 web-based training session	May
	Cont'd web-based on-demand educational programs	Jan - June
	Focus group interviews	Sept-Oct

Facility and Staff Participation

At the beginning of the project, there was 100% involvement from all participating facilities. At least one and as many as five staff attended the kick-off meeting, were involved with the MDS validation site visits, and attended the SPiNH and EQUIP initial web-based training. However, involvement from several facilities dropped off in Year 2 mainly due to changes in staff, changes in leadership, and shifting priorities. Project staff attempted to re-engage these NHs throughout the remainder of the project with varying degrees of success. Three NHs either officially dropped out of the project or were not at all involved in project activities after Year 1 including Katherine & Martin Luther, NYS Veteran's Home in Batavia, and St. Joseph's Home.

Evaluation and Results

Both a qualitative and quantitative evaluation was conducted to determine the effectiveness of the intervention. The qualitative evaluation was conducted by project staff from the University of Pennsylvania's School of Nursing and was based on a number of focus group interviews conducted with staff from several "high

participating" NHs. The quantitative evaluation was conducted by project staff at LeadingAge New York and focused on analyzing changes over time in the primary outcomes of interest which included several AD-specific quality measures. Below are details of both evaluations.

Focus Group Interviews

In August 2011, fourteen of the original sixteen nursing homes that remained either very or somewhat active in the project until the end of the grant received an electronic solicitation letter inviting them to participate in its evaluation. The letter explained that the evaluation would consist of a one-hour focus group phone conference call and that each call would be audio-taped and transcribed to ensure accuracy of the data. In addition, investigators took extensive notes during the session. The letter also stated that the phone call was voluntary and that interviews would be transcribed and summarized with only aggregate data reported about the effectiveness of the intervention. Active solicitation of participants and subsequent scheduling occurred over one month. Human Subjects approval was obtained from the University of Pennsylvania Institutional Review Board.

Investigators collected data by asking participants on each call the same three open-ended questions to ascertain: 1) components of the intervention that were particularly helpful in changing practice as well as resources that were not helpful; 2) barriers to using the materials in practice; and 3) barriers to adopting evidence-based practices. Follow-up probes were used to assure that the participants addressed specific intervention components. Participants were asked to be candid; to provide examples of the extent of their involvement in the project; and to describe improvements in pain care processes and outcomes that they attributed to their involvement in the project. As a token of appreciation for their time, each participating facility selected a gift of either a pain management book or a dementia care pain management DVD.

Analysis

The audiotapes were transcribed by a research assistant and one of the investigators. The transcribed interviews served as the data source. Simple thematic content analysis was used to analyze the text from the structured focus calls. This conventional approach started with reading all of the transcripts to achieve immersion and obtain a sense of the whole. Next, transcripts were read word by word and then a systematic classification process of coding was created to identify first impressions, thoughts, and an initial analysis. From there, labels for the codes and themes emerged, reflecting linkages and meaningful clusters that supported the study questions and other information

elicited from the calls. A second investigator also reviewed and coded the transcripts to confirm themes.

Results

Of the 14 facilities invited to participate, one had merged with another nursing home and was no longer enrolled in the project. Seven of the remaining eligible 13 nursing homes that were still very or somewhat active with the project participated in the focus group conference calls. Three facilities had one representative participate while four others had from two to four nursing home staff on the conference call. The length of the conference calls ranged from 25 minutes to slightly over one hour. Nursing home staff included two Administrators, four Directors of Nursing, a Director of Health Information, four Nurse Managers, three MDS Coordinators, and one each from Social Services and Quality Assurance/Staff Education.

Intervention Components that were Most Useful

Several components of the intervention were mentioned by multiple respondents as being very useful. Every facility reported that nurses were the predominant users of the online materials, although three facilities stated that there was active engagement by other team members such as therapists, dieticians, and the medical provider team.

One of the most frequently mentioned resources was the pain policy which was developed by one of the investigators and presented at the second annual workshop. Later, the policy was made available on the SPiNH website as well. Three nursing homes did not have a pain policy before participating in the project but adopted the SPiNH pain policy. Two facilities adapted the policy to fit their setting.

Another SPiNH resource that was viewed as being valuable to enhancing clinical practices for pain was the SPiNH pain assessment instrument. This comprehensive tool included input from several team members including nursing assistants, primary care providers, and therapists. It was aligned with pain guidelines and MDS 3.0 items. One facility adapted the form and another integrated the entire tool into their new electronic medical record. Most commonly nursing homes used the instrument to establish, evaluate, and refine the pain treatment care plan.

All facilities reported that they participated in the synchronous and on-demand webinars. Most used the archived webinars for staff who were unable to attend the live sessions and also for ongoing staff education and orientation. Licensed nursing staff and certified nursing assistants were the most frequent webinar audiences, although other team members including physical therapists and nurse practitioners also attended webinars. One nursing home required all nursing assistants from every shift to complete the relevant webinars and learning modules on the website. In one facility, dietary and housekeeping personnel attended the pain assessment webinars that were designed for nursing assistants.

Another resource that facilities frequently applied in practice was the algorithms. These step-by-step decision aids focused on pain assessment, treatment and management of analgesic side effects. The online format allowed the project team to embed additional information to assist nurses and prescribers. For example, in the algorithm focused on pain evaluation and treatment for residents with advanced dementia, users could click on links to behavioral pain assessment tools and methods to maximize the ability of residents with dementia to self-report pain.

> *"We thought they were great because they are clear cut. It gives you suggestions on where to go. It's not just pulling something out of a hat, like hey let's try this. People don't stop and think sometimes, that less is more… I think they are useful."*

The EQUIP program reports were used by four facilities at some time during the project and three of these facilities routinely used EQUIP pain risk reports in care planning meetings. However, on closer analysis, it appears that the actual EQUIP pain risk reports, which calculated a pain risk score for individual residents using an empirically-derived algorithm were irregularly used. Two facilities that reported low or no usage of the EQUIP analytics program stated that they had challenges generating the pain risk reports and interpreting them, despite training to accomplish both these goals.

Although the intervention was designed to emphasize web-based resources, several respondents reported that the regularly scheduled user group calls and annual workshops augmented the use of the SPINH website and provided reinforcement of learned knowledge. In particular, case studies presented at the conferences were particularly helpful in "integrating information" and "enhancing problem solving skills."

Changes in Pain Assessment and Management Practice

All facilities reported that participating in the grant increased their awareness about pain, especially assessing and managing pain in residents with dementia. One respondent commented, "*We are constantly looking at pain now*." Specific changes in pain assessment practices included regular use of behavioral observation tools such as the Pain Assessment in Advanced Dementia (PAINAD) and incorporation of pain assessment tools and flow charts in electronic medical records.

Pain policies were instituted or enhanced by the majority of facilities, with accompanying changes in pain assessment practices. These changes were reflected by one respondent in her statement, "*Now we are doing the pain assessment every shift. Now the nurse manager audits the sheet to see if medication changes needed to be made*." Two facilities indicated that because of their participation in the project, involvement of team members such as nursing assistants and therapists in pain assessment and management increased. In particular, nursing assistants become empowered to report pain to the licensed nursing staff.

Participants reported several changes in pain management practices. Two facilities stated that they increased use of scheduled analgesics, particularly acetaminophen. Another respondent from a different facility commented that there was less use of antipsychotic agents for behavioral disturbances:

> *"I am more inclined to think it is pain. Is this person acting out because of their pain? So we are trying much more often to try two more Tylenol® to see what happens before other medications are used. Something as simple as the acetaminophen algorithm helped to see some behaviors disappear just with Tylenol®."*

Another facility reported better prevention of analgesic-induced constipation and three reported higher use of nondrug therapies.

The facilities that reported practice changes were able to provide some data to substantiate their improvement. Respondents from two facilities offered cases studies in which they described using what they learned in the project to relieve pain in specific residents. One facility attributed their participation as an important factor in helping them move off the list of Special Focus Facilities (i.e., a designation for nursing homes "with a recent history of persistent poor quality of care, as indicated by the findings of state or Federal inspection teams" http://www.medicare.gov/NHCompare/Static/). Finally, two facilities referenced actual MDS and pharmacy audit data such as decreased rates of pain, increased use of acetaminophen, and higher physical function among residents as evidence of practice change.

Barriers to Using Intervention Resources and to Changing Practice

The value of the study activities and resources was diminished by several barriers to accessing and using resources and to implementing practice changes. Several facilities described time constraints as a major barrier. Lack of time prevented facilities from both using the intervention resources and in changing practice. Staff turnover was noted by respondents at three facilities as a major impediment to reaching study goals. Turnover of nursing assistants and licensed nurses providing direct care increased the burden of training new staff about the project and use of resources. In one facility, the loss of the clinical champion led to gaps in programming and loss of momentum. Lack of a team leader or clinical champion also impeded changes in practice. One respondent noted, *"If you don't have that strong leadership on the nursing unit itself or you are not constantly harping on it, it is not going to happen."*

Technological problems caused some challenges to accessing the resources. All facilities had computers they could use to access the EQUIP program and SPiNH website. However, some facilities lacked the equipment to project webinars and other resources on a screen that was large enough for group viewing. Two respondents

noted that internet access was blocked for computers in clinical areas to prevent "web-surfing," which limited "real-time" use of resources.

Outcomes Evaluation

The purpose of the outcomes or quantitative analysis was to test whether the interventions - including the use of readily accessible Web- and computer-based education programs, new assessment and care planning tools, clinical support under the rubric of SPiNH, a Web-based clearinghouse EQUIP, a Web-based quality improvement program - improved pain assessment and pain related outcomes in Alzheimer's/Dementia (AD) residents in rural facilities.

Outcomes were measured using 7 of the most relevant 17 EQUIP AD QMs defined in Appendix A:

1. Residents who have moderate pain daily or severe pain at any frequency
2. Residents who have moderate or severe pain less than daily or mild, moderate, or severe pain daily
3. Residents with high or very high risk of having pain
4. Use of 9 or more different medications
5. Prevalence of behavioral symptoms affecting others
6. Residents with decline of function from prior to target assessment
7. Prevalence of depression

Hypotheses

Since the main goal of this project was to improve pain assessment in AD residents, we hypothesized that the effect of the intervention would result in higher reported rates of pain (mild, moderate, and severe) and a lower rate of possible undetected pain in AD residents. We evaluated the impact of the intervention on the three pain measures described above.

To specifically address the critical problem of possible undetected pain in AD residents, a pain model was developed based on risk factors (conditions/diseases) that contribute most to reported pain in cognitively intact residents (using MDS assessment data). The pain model identified AD residents with a high likelihood of having pain. NH staff could use the EQUIP informatics report to drill down to a list of residents with a high likelihood of pain and resident-specific risk factors (painful conditions) that should be addressed to improve management and treatment of pain related to those factors. Examples of risk factors strongly related to the likelihood of having pain include:

- Being older - older residents are less likely to report pain.
- Being male - males are less likely than females to report pain.

- A higher body mass index (BMI); this increases the likelihood of having pain.
- Residents experiencing constipation or with an external, indwelling or intermittent catheter.
- Having diseases know to be painful including arthritis, hip fracture, osteoporosis, pathological bone fracture, asthma, anemia, cancer and others shown in the model.
- Having infections known to cause pain (e.g., urinary tract infections, viral hepatitis, wound infection).
- Having other problem conditions known to cause pain including dizziness/vertigo, edema, fever, and vomiting.
- Residents experiencing an acute episode or a flare-up of a recurrent or chronic problem or in end-stage disease.
- Pressure ulcers, skin conditions, and skin treatments.
- Residents who receive physical therapy.

AD residents at high risk of having pain based on the pain model but not coded for having pain on the MDS assessment were flagged for undetected pain. We hypothesized that staff at facilities participating in this project would improve detection of pain in AD residents with painful conditions, which would lower the prevalence of undetected pain.

As more residents were detected as having pain through this process, more AD residents would be treated appropriately for pain. Treatment of pain would require more pain medications and was expected to lower other outcomes caused by pain including negative behaviors and depression. We evaluated the impact of the intervention on four outcome measures including behavior symptoms, use of 9 or more different medications, functional decline or total functional dependence, and depression in AD residents.

Overall, the evaluation tested the following 7 hypotheses:

Hypothesis I	The intervention ***increases*** the rate of AD residents identified with moderate to severe pain
Hypothesis II	The intervention ***increases*** the rates of AD residents identified with having pain, including mild pain very day
Hypothesis III	The intervention ***lowers*** the rate of AD residents with undetected pain
Hypothesis IV	The intervention ***lowers*** the prevalence of AD residents with behavior symptoms affecting others
Hypothesis V	The intervention ***increases*** the rate of AD residents using 9 or more different medications
Hypothesis VI	The intervention ***lowers*** the rate of functional decline or total functional dependence in AD residents
Hypothesis VII	The intervention ***lowers*** the rate of AD residents with depression

Approach: The Difference-in-Differences Method

The "difference-in-differences" method is utilized to measure the effect of the intervention on these selected quality measures in participating nursing homes. In this evaluation, the difference-in-differences estimator is defined as the difference in the probability of a resident flagging for a QM in the intervention group before and after the intervention **minus** the difference in the probability of a resident flagging for the QM in the comparison group before and after intervention. This is a more rigorous evaluation of the impact of the intervention on outcomes as it evaluates the impact on outcomes *after* adjusting for (subtracting out) changes in the rates of the adverse outcome in similar residents due to other quality improvement initiatives that may have a broad impact, such as the national Advancing Excellence In America's Nursing Homes initiative, or the federal Nursing Home Compare website that encourages facilities to improve performance through the Five Star Nursing Home Quality Rating. In addition, this difference-in-differences method also could eliminate a selection bias related to time-invariant individual/facility characteristics.

In this evaluation, we estimate difference-in-differences parameters for two time periods, interim and post-intervention periods. The difference-in-differences rates of a resident flagging for a quality measure-*i* (QM^i) for the interim and post intervention periods are defined respectively as follows:

$$\hat{\delta}_1^i = \left(\overline{QM}_{P,1}^i - \overline{QM}_{P,0}^i\right) - \left(\overline{QM}_{N,1}^i - \overline{QM}_{N,0}^i\right)$$
$$\hat{\delta}_2^i = \left(\overline{QM}_{P,2}^i - \overline{QM}_{P,0}^i\right) - \left(\overline{QM}_{N,2}^i - \overline{QM}_{N,0}^i\right)$$

Where $\overline{QM}_{P,0}^i$, $\overline{QM}_{P,1}^i$ and $\overline{QM}_{P,2}^i$ are rates of residents flagging for QM^i in participating facilities, respectively for baseline, interim, and post-intervention periods; $\overline{QM}_{N,0}^i$, $\overline{QM}_{N,1}^i$ and $\overline{QM}_{N,2}^i$ are rates of residents flagging for a QM^i in non-participating facilities, respectively for baseline, interim, and post-intervention periods.

Resident and facility characteristics may also affect the outcomes being examined. Therefore, to measure the true effect of the intervention, the model for each QM also included facility and resident characteristics as control variables. Facility characteristics included in the model are facility size (total certified beds), type of sponsorship, and CNA and nursing staffing hours per resident day. Resident characteristics included in the model are age, gender, ADL score, and CPS score. A general difference-in-differences model for QM^i based on resident level data can be written as follows:

$$QM^i = \mu + \alpha D + \gamma_1 T_1 + \gamma_2 T_2 + \delta_1 (D \times T_1) + \delta_2 (D \times T_2) + X\beta + \varepsilon$$

Where QM^i *is* an indicator variable, which is equal to 1 if a resident flagged for QM^i and 0 otherwise; *D* is a dummy variable which is equal to 1 for residents from participating facilities (intervention group) and 0 for residents from non-participating facilities (comparison group); time period dummy 1, T_1, is equal to 1 for interim period and 0 for others; time period dummy 2, T_2, is equal to 1 for post-intervention period and 0 for others; *X* is a vector of facility and resident characteristic as control variables; μ is intercept. The model above is estimated using a linear probability model framework.

Interpretation of Coefficients: α represents the difference in the rate of residents flagging for QM^i between the intervention and comparison groups at baseline after controlling for other characteristics; γ_1 represents the difference in the aggregate rate of residents flagging for QM^i between the interim and baseline periods after controlling for other characteristics; γ_2 represents the difference in the aggregate rate of residents flagging for QM^i between the post-intervention and baseline periods after controlling for other characteristics; β represents the coefficients of the control variables; and ε is a random unobserved error term which represents other factors impacting the quality measure not captured in the model.

The main parameters to be estimated and tested are δ_1 and δ_2 which represent the effect of the intervention on the probability of a resident flagging for a QM in the participating facilities ***after*** subtracting out the change in the probability of a resident flagging for the QM in the comparison group and other characteristics influencing the outcome over that same time period. Parameter δ_1 is interpreted as the difference in the rate of residents flagging for QM^i in the intervention group between baseline and interim periods **minus** the difference in the rate of residents flagging for QM^i in the comparison group between the baseline and interim periods after controlling for other characteristics. Parameter δ_2 measures the effect between the post-intervention and baseline periods after controlling for other factors.

Data

Data used in this evaluation comes from MDS 2.0 assessments for quarter 1, 2007 through quarter 3, 2010 (January 1, 2007 – September 30, 2010) and from the Online Survey, Certification and Reporting (OSCAR) 2007-2010 data for staffing measures. This 15 quarter period was divided into three timeframes: the baseline period defined as Q1 2007 through Q2 2008 (January 1, 2007 – June 30, 2008); the interim period defined as Q3 2008 through Q2 2009 (July 1, 2008 – June 30, 2009), and the post intervention period defined as Q3 2009 through Q3 2010 (July 1, 2009 – September 30, 2010). All quality measures included in this evaluation are calculated based on residents with Alzheimer's/dementia.

Originally there were a total of 16 rural New York State NHs recruited to participate in this grant. However, over time, four nursing homes withdrew or did not actively participate in the study for a variety of reasons including staff turnover, lack of buy-in from leadership, and other competing priorities. After removing those non-active facilities, 12 nursing homes were included as the intervention group in this evaluation. These 12 facilities represent about 940 dementia residents in each quarter. All participating facilities are non-public and located in rural areas of New York State.

Nursing homes in the comparison group were selected from all New York State facilities with exclusion criteria as follows:

- Facilities that originally agreed to participate in the project but dropped out.
- Facilities located in the 5 boroughs of New York City, Albany, Buffalo, Rochester, and Syracuse.
- Specialty facilities (e.g. pediatric nursing homes).
- Transitional Care Unit (TCU) facilities.
- Facilities that participated in a similar research project awarded to LeadingAge New York's research foundation and funded by the Alzheimer's Association during 2007-2010.
- Public facilities.

The next step in the selection of the comparison group was to match the facilities in the intervention group based on several characteristics including facility size, staffing levels, average ADL score, average CPS score, percent males, average age, and percent of dementia residents. Facilities included in the comparison group are those with characteristics that fall within the range of 90% to 110% of each criterion. For example, the number of total certified beds in the intervention group ranges from 64 to 242; facilities included in the comparison group had to have certified beds between 58 (90% of 64) and 266 (110% of 242) beds. After accounting for the exclusions and matching criteria there are 97 facilities in the comparison group. These 97 facilities represent about 7,690 dementia residents in each quarter.

Table 3 presents the summary of facility characteristics for the intervention and comparison groups. On average, facilities in the intervention group are similar to those in the comparison group. One significant difference, however, is sponsorship type; two thirds of facilities in the intervention group are not-for-profit compared to only 39 percent in the comparison group. Both groups, on average, have the same resident characteristics and staffing rates. Facility characteristics in Table 3 are included in the difference-in-differences estimation in the linear probability model as control variables.

Table 3. Characteristics of facilities included in the analyses

	Intervention Group	Matched Comparison Group
Number of facilities	12	97
Average facility size (number of beds)	141	143
Percent not-for-profit facilities	67%	39%
Average percent dementia residents	64%	67%
Average resident age (years)	84	85
Average percent males	21%	22%
Average ADL score	13.1	12.9
Average CPS score	3.7	3.6
Average RN hours per resident per day	0.54	0.53
Average LPN/LVN hours per resident per day	0.98	0.92
Average CNA hours per resident per day	2.25	2.27

Results

We tested and measured the impact of the intervention on 7 QMs based on the difference-in-differences model. The model was estimated using a linear probability framework with the indicator of a resident flagging on a QM as the dependent variable. All three pain measures were found to be statistically affected by the intervention in both interim and post-intervention periods:

- The intervention statistically significantly ***increased*** the rate of AD residents identified with moderate to severe pain by 45% and 82%, respectively in the interim and post-intervention periods;
- The intervention statistically significantly ***increased*** the rate of AD residents identified with pain, including mild pain every day by 15% and 27%, respectively in the interim and post-intervention periods;
- The intervention statistically significantly ***decreased*** the rate of AD residents with undetected pain by 1.8% and 3.2%, respectively in the interim and post-intervention periods.

Two of the non-pain measures were found to be significantly affected by the intervention:

- The intervention statistically significantly ***decreased*** the rate of AD residents with behavior symptoms affecting others by 12.5% in the post-intervention period;

- The intervention ***increased*** the rate of the use of 9 or more different medications by 3.3% in the post-intervention period;

Two measures were found to be not significantly affected by the intervention:

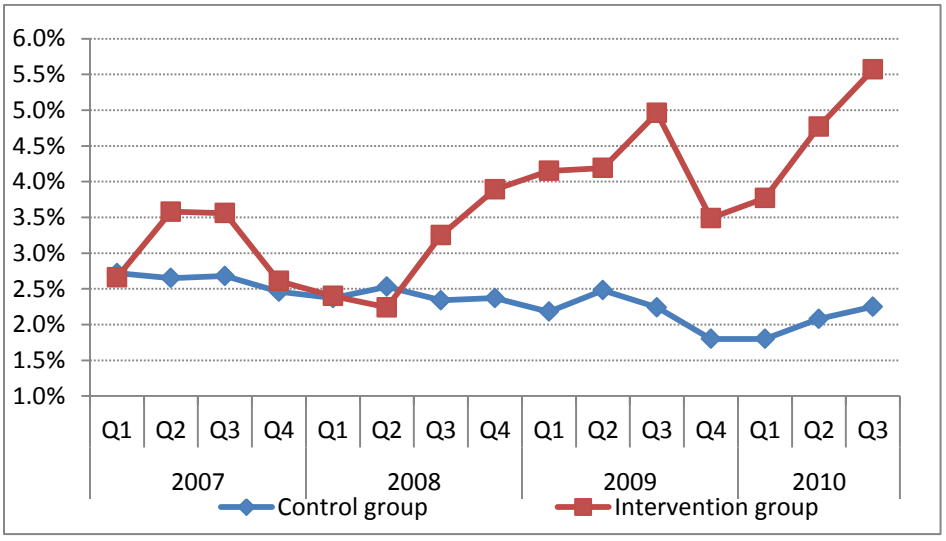
- The rate of AD residents with a decline in function or with total functional dependence;
- The rate of AD residents with depression.

Detailed analysis of the results from the estimation of each of the quality measures above are presented in the following sections.

Moderate to severe pain

This quality measure was derived from the MDS 2.0 Centers for Medicare and Medicaid Services (CMS) Quality Measures, but calculated based on AD residents (see Appendix A for the detailed measure specifications). Figure 1 illustrates the rate of AD residents who have moderate to severe pain in the intervention and comparison groups. There is a slight decrease in the comparison group's rate over time from quarter 1 2007 through quarter 3 2010. However, the intervention group's pain rate increased from quarter 3 2008, when the intervention started, through quarter 3 2010. These results suggest that as participating facilities improved their pain assessment process, there was a corresponding increase in residents being correctly coded for pain on their MDS assessment. The statistical test and the size of the effect of the intervention can be seen from the results of the difference-in-differences model estimation (see Table 4).

Figure 1. Rate of AD residents identified with moderate to severe pain



As shown in Table 4, the coefficient estimates of $D \times T_1$ and $D \times T_2$ are both positive and statistically significant meaning that the intervention increased the probability of identifying moderate to severe pain in AD residents. These coefficient estimates can be translated as follows: the rate in the intervention facilities increased by 1.3 percentage points during the interim period and 2.3 percentage points during the post-intervention period from the baseline rate. These changes are the effects of the intervention after taking into account components including the aggregate trend, the difference in the baseline rate between the two groups, and the effects of other factors, such as total certified beds (facility size), type of sponsorship, and CNA and nursing staffing hours, resident age, gender, ADL score, and CPS score. Given that the baseline rate is 2.8% in the intervention group, these results indicate that the intervention group's pain rate is 45% higher in the interim period and 82% higher in the post-intervention period than the baseline rate.

Table 4. Difference-in-differences estimates: moderate to severe pain

Variable	Coefficient/Interpretive Description	Coefficient Estimate	p-Value
	μ=intercept term	0.0982	<.0001
D	α=avg. baseline probability diff intervention vs. comparison	0.0007	0.7691
T_1	γ_1=diff in avg. probability all residents between interim vs. baseline	-0.0036	0.0018
T_2	γ_2=diff in avg. probability all residents between post-intervention vs. baseline	-0.0079	<.0001
$D \times T_1$	δ_1=effect of intervention at interim after subtracting change in probability in comparison group and controlling for other characteristics	0.0128	0.0002
$D \times T_2$	δ_2= effect of intervention at interim after subtracting change in probability in comparison group and controlling for other characteristics	0.0233	<.0001

Pain - including mild pain every day

This QM was developed by research staff for this project and expands on the CMS pain measure definition to include residents with mild pain every day and residents with moderate pain less than daily (see Appendix A for the detailed measure specifications). Figure2 presents the rate of AD residents identified with pain including mild pain every day in the intervention and comparison groups. Similar to the CMS pain measure for moderate to severe pain, these results suggest that as participating facilities improved their pain assessment process, there was a corresponding increase in residents being correctly coded for all types of pain on their MDS assessment.

Figure 2. Rate of AD residents identified with pain-including mild pain every day

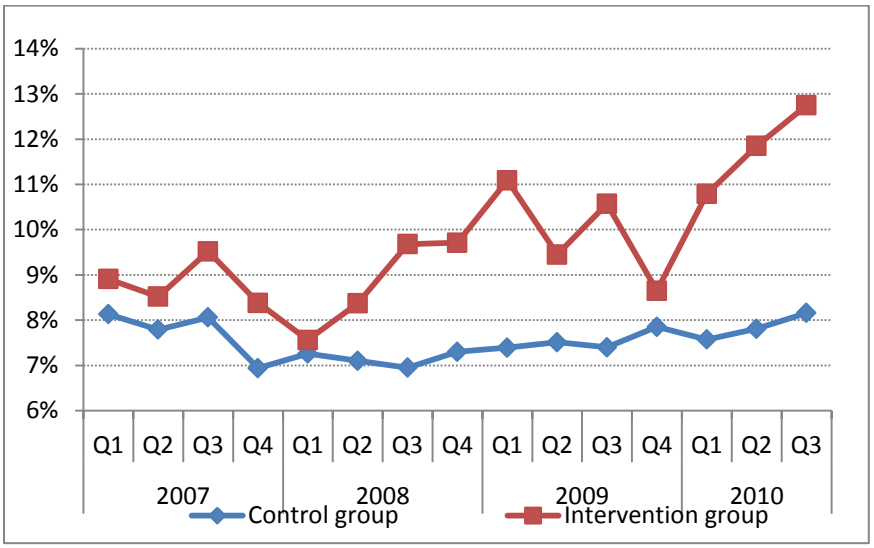


Table 5 presents the coefficient estimates of the difference-in- differences model. Again, the coefficient estimates of $D \times T_1$ and $D \times T_2$ are both positive and statistically significant meaning that the intervention increased the probability of identifying pain including mild pain every day among AD residents. These coefficient estimates indicate that the pain rate in the facilities participating in this program increased by 1.9 percentage points in the interim period and 2.4 percentage points in the post-intervention period from the baseline rate after controlling for other factors. Given that the baseline rate is 8.5% in the intervention group, these results indicate that the intervention group's pain rate is 15% higher in the interim period and 27% higher in the post-intervention period than the baseline rate.

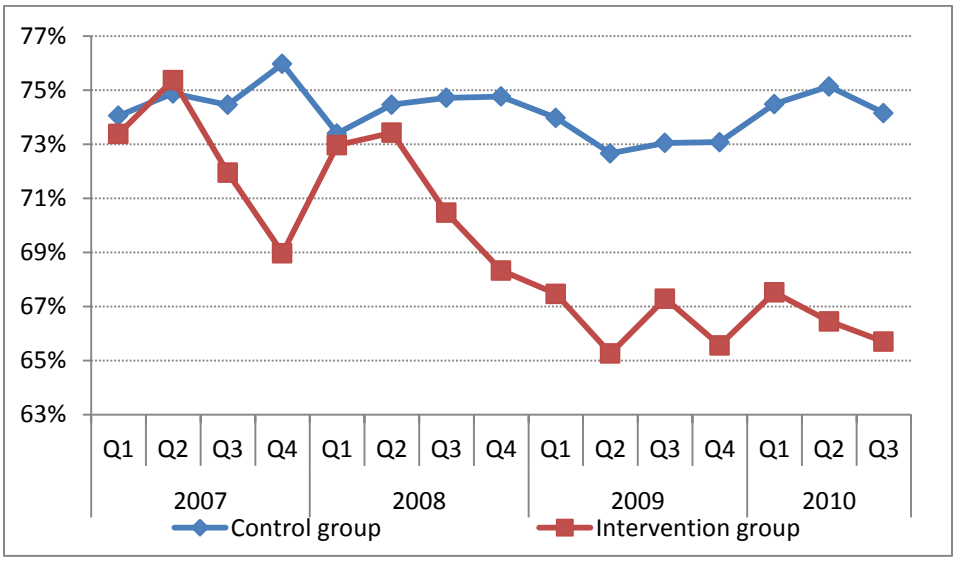
Table 5. Difference-in-differences estimates: pain-including mild pain everyday

Variable	Coefficient/Interpretive Description	Coefficient Estimate	p-Value
	μ=intercept term	0.2684	<.0001
D	α=avg. baseline probability diff intervention vs. comparison	0.0066	0.0858
T_1	γ_1=diff in avg. probability all residents between interim vs. baseline	-0.0065	0.0012
T_2	γ_2=diff in avg. probability all residents between post-intervention vs. baseline	-0.0045	0.0161
$D \times T_1$	δ_1=effect of intervention at interim after subtracting change in probability in comparison group and controlling for other characteristics	0.0187	0.0017
$D \times T_2$	δ_2= effect of intervention at interim after subtracting change in probability in comparison group and controlling for other characteristics	0.0241	<.0001

Undetected pain

Figure 3 illustrates the rate of AD residents with undetected pain in the intervention and comparison groups over time. In the comparison group, the trend is almost flat from quarter 1 2007 through quarter 3 2010. However, in the intervention group, there is a sharp downward trend from quarter 3 2008, when the intervention began, through quarter 3 2010. These results again demonstrate that intervention facilities improved their pain assessment process over the course of this project. The statistical test and the size of the effect of the intervention can be seen from the results of difference-in-differences model estimation (see Table 6).

Figure 3. Rate of AD residents with undetected pain



As shown in Table 6, the coefficient estimates of $D \times T_1$ and $D \times T_2$ are both negative and statistically significant meaning that the intervention lowered the probability of possible undetected pain among AD residents. These coefficient estimates can be translated as follows: the rate of undetected pain in the intervention facilities decreased by 4.3 percentage points in the interim period and 6.2 percentage points in the post-intervention period from the baseline rate. These changes are the effects of the intervention after taking out other components including overall trend in the rate, difference in the baseline rate between the two groups, and the effect of other factors. With a baseline undetected pain rate of 72.7% in the intervention group, these results indicate that the intervention group's undetected pain rate is 1.8% lower in the interim period and 3.2% lower in the post-intervention period than the baseline rate.

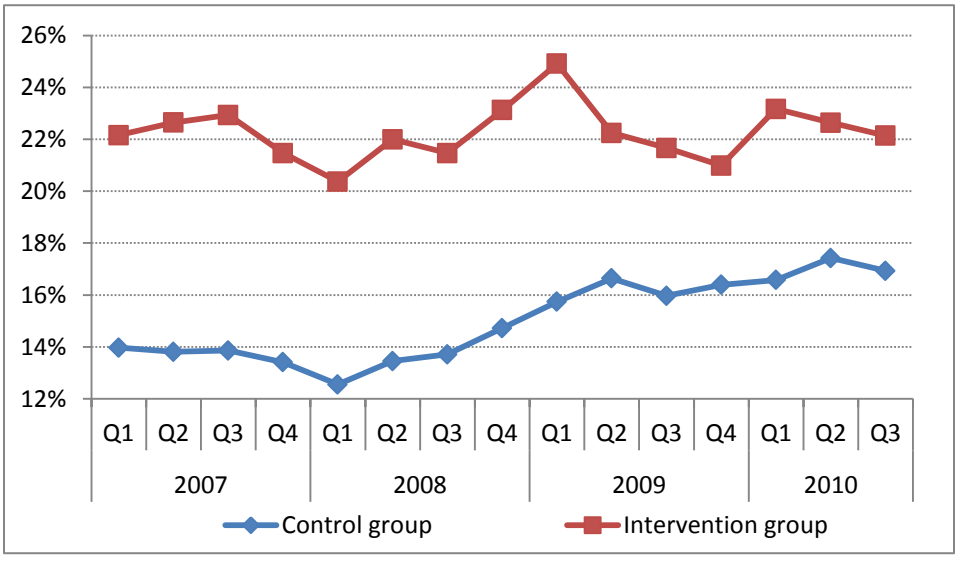
Table 6. Difference-in-differences estimates: undetected pain

Variable	Coefficient/Interpretive Description	Coefficient Estimate	p-Value
	μ=intercept term	0.6532	<.0001
D	α=avg. baseline probability diff intervention vs. comparison	-0.0110	0.2778
T_1	γ_1=diff in avg. probability all residents between interim vs. baseline	0.0039	0.4685
T_2	γ_2=diff in avg. probability all residents between post-intervention vs. baseline	0.0097	0.0506
$D \times T_1$	δ_1=effect of intervention at interim after subtracting change in probability in comparison group and controlling for other characteristics	-0.0491	0.0012
$D \times T_2$	δ_2= effect of intervention at interim after subtracting change in probability in comparison group and controlling for other characteristics	-0.0615	<.0001

Behavior symptoms affecting others

One possible consequence of a high prevalence of untreated pain in AD residents is a corresponding increase in behavior symptoms affecting others. Figure 4 presents the rate of AD residents with behavior symptoms affecting others for the intervention and comparison groups. The rate is higher in the intervention group than in the comparison group over time. In the comparison group, the trend increases slightly. However, in the intervention group, the trend is almost flat. To test the significance and to measure the effect of the intervention, a difference-in-differences model was estimated and is presented in Table 7.

Figure 4. Rate of behavior symptoms affecting others



After controlling for other factors, the baseline rate is about 7.2 percentage points higher in the intervention group than in the comparison group. After taking out the effects of other factors including the intervention, aggregate rates are statistically higher in both the interim and post-intervention periods than in the baseline period as indicated by the coefficient estimates of variables T_1 and T_2. The coefficient estimates of $\boldsymbol{D \times T_2}$ are negative and statistically significant meaning that the intervention is associated with a lower rate of behavior symptoms affecting others among AD residents. The coefficient estimate of $\boldsymbol{D \times T_2}$ can be translated as follows: the rate of behavior symptoms affecting others in the intervention facilities decreased by 2.8 percentage points in the post-intervention period from the baseline rate. With a baseline rate of 21.9% in the intervention group, the intervention is associated with a decrease of 12.5% in the rate for the post-intervention period compared to the baseline rate. The effect of the intervention is not significant in the interim period.

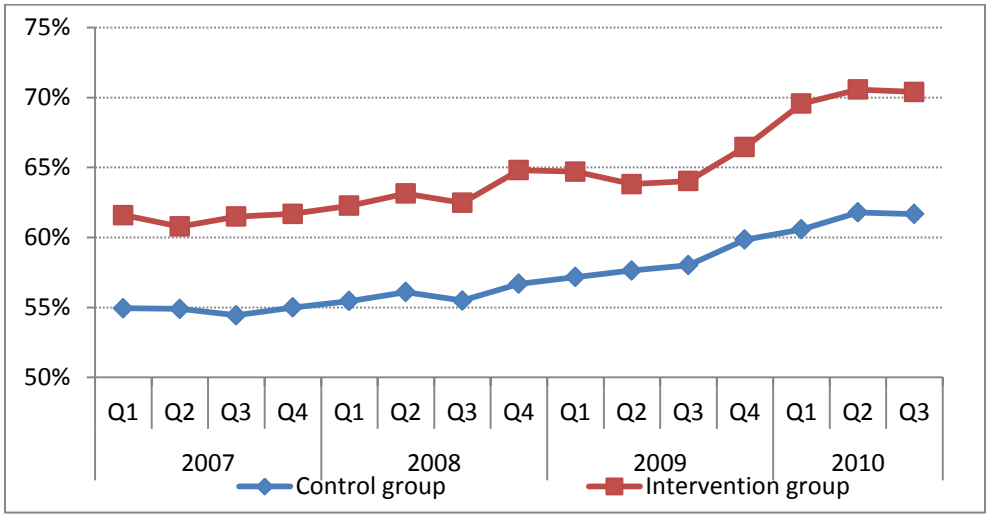
Table 7. Difference-in-differences estimates: Behavior symptoms affecting others

Variable	Coefficient/Interpretive Description	Coefficient Estimate	p-Value
	μ=intercept term	0.1591	<.0001
D	α=avg. baseline probability diff intervention vs. comparison	0.0723	<.0001
T_1	γ_1=diff in avg. probability all residents between interim vs. baseline	0.0166	<.0001
T_2	γ_2=diff in avg. probability all residents between post-intervention vs. baseline	0.0312	<.0001
$\boldsymbol{D \times T_1}$	δ_1=effect of intervention at interim after subtracting change in probability in comparison group and controlling for other characteristics	-0.0063	0.4387
$\boldsymbol{D \times T_2}$	δ_2= effect of intervention at interim after subtracting change in probability in comparison group and controlling for other characteristics	-0.0275	0.0003

Use of 9 or more different medications

One important element of treating pain is the use of pain medications. As a result of improved pain assessment and treatment protocols, it is logical to deduce that the rate of residents receiving pain medication would increase. Because we don't have access to number of pain medications used in the NHs, in this evaluation we measure and test the effect of the intervention on the rate of the use of 9 or more different medications. Over time, the rate of this measure is higher for both the intervention and comparison groups; however, the rate is consistently higher in the intervention group than in the comparison group over time. Table 8 presents the coefficient estimates of the difference-in-differences model.

Figure 5. Rate of use of 9 or more different medications



Importantly, the intervention is statistically associated with a 2 percentage point increase in the post intervention group's use of 9 or more different medications rate compared to the baseline rate as indicated by the coefficient estimate of $\boldsymbol{D \times T_2}$ (p-value=0.04). Given the baseline rate of 61.8%, the intervention is associated with an increase of 3.3% in the rate for the post-intervention period compared to the baseline rate. It is important to note that we did not have information on the types of medications used in the NHs. The increase in number of medications could be due to an increase in use of pain medications or it could be due to other types of medications. In addition, we also did not have information on the effectiveness of the pain medications. Therefore, there are two possible interpretations of the increase in the rate of residents with use of 9 or more medications. First, if the increase is due to an increase in the use of pain medications and those medications were effective then the effect of this intervention is a positive outcome on improving pain management in AD residents. Otherwise, the increase is considered to be a negative outcome of the intervention. One needs to be cautious interpreting these results because we are reporting the **net** effect of the intervention; the intervention could have also resulted in the reduction of administering other types of medications due, for example, to less behavior symptoms. Furthermore, as this study is not a case/control study, the effect could be attributed to other factors not included in the model.

Table 8. Difference-in-differences estimates: Use of nine or more medications

Variable	Coefficient/Interpretive Description	Coefficient Estimate	p-Value
	μ=intercept term	0.9192	<.0001
D	α=avg. baseline probability diff intervention vs. comparison	0.0595	<.0001
T_1	γ_1=diff in avg. probability all residents between interim vs. baseline	0.0041	0.2539
T_2	γ_2=diff in avg. probability all residents between post-intervention vs. baseline	0.0306	<.0001
$D \times T_1$	δ_1=effect of intervention at interim after subtracting change in probability in comparison group and controlling for other characteristics	0.0137	0.2020
$D \times T_2$	δ_2= effect of intervention at interim after subtracting change in probability in comparison group and controlling for other characteristics	0.0204	0.0422

Quality Measures NOT Showing Significant Improvement in Intervention Nursing Homes

The results from the difference-in-differences estimation indicate that the intervention was not statistically associated with changes in the rates of functional decline and depression for both interim and post-intervention periods. This could be due to the fact that identifying and treating pain in AD residents alone, as the main goal of this project, was not enough to slow down functional decline; further interventions designed to specifically address functional decline, especially those related to activity of daily living (ADL) such as therapy, may need to be implemented. In this case, none of the interventions included in this project were directly related to ADLs. Similarly, identifying and treating pain itself was not enough to lower the depression rates in AD residents.

Conclusions and Limitations

Residents with dementia are at highest risk for underestimated and undermanaged pain because they have more difficulties communicating their pain. The primary goal of this dementia grant project was to help a consortium of primarily rural NYS NHs improve assessment and treatment of pain in their residents with dementia through the use of readily accessible Web and computer-based education programs, informatics reports, assessment and care planning tools, and clinical support. As the evaluation indicated, NHs that participated in this project benefited a great deal from having access to these types of resources, especially the educational modules, pain policies, pain assessment tools and algorithms. In addition to the online resources, NH staff reported that the regularly scheduled user group calls and annual workshops were equally important to augment the use of the online tools and provided reinforcement of learned knowledge. As the outcomes

evaluation confirmed, NHs that participated in the project improved their pain assessment of AD residents as indicated by higher reported rates of pain and lower rates of undetected pain. Behavior symptoms affecting others were also less prevalent in the intervention groups after the intervention. It is important to note that NHs that most actively participated in the project cited buy-in from leadership and a commitment on the part of the direct care staff as reasons for their success.

There are limitations inherent in all research projects. Since this was not a rigorous case/control study, caution is recommended when interpreting the results from the outcomes evaluation since some effects might be partially related to other factors not included in the models due to lack of available information. Also, due to the small sample size and self-selection of NHs into this project, results cannot be generalizable to a larger population. However, based on our findings, we conclude that NHs can improve their assessment and treatment of pain in one of their most vulnerable populations – residents with Alzheimer's disease and/or dementia - through the use of online resources and the adoption of overall better pain practices, policies and processes.

Deliverables

To date, a CD-ROM has been sent to all 630+ nursing homes in New York State which consists of all the educational modules provided to participating homes, along with tools and tips, pain documentation and assessment forms and links to a variety of helpful pain-related resources. In addition, a final Dementia Pain Grant Wrap-Up newsletter was sent to all participating facilities thanking them for their participation and providing a summary of activities and accomplishments (see Appendix D).

Dissemination

There have been several statewide and national dissemination presentations on the interim results of this project:

1. Spokane, L "*"Identifying Undetected Pain in Residents with Dementia Using MDS Data,"* GSA Annual Meeting, National Harbor, MD, November 2008.
2. Teigland, C, Spokane, L, Reude, B, and Rice, C. "*Targeting Undetected Pain in Residents with Dementia,*" American Association of Homes and Services for the Aging 2009 Annual Meeting, Chicago, IL, November 2009.
3. Ersek, M and Spokane, L. *"Stop Pain in Nursing Homes (SPiNH): Improving Pain Assessment and Management in Residents with Dementia through Web-based Education and Support",* GSA Annual Meeting, Atlanta GA, November 2009.

4. Spokane, L, Reude, B, and Nordin, P. "*Stop Undetected Pain in Residents with Dementia: An Interactive Web-based Tool Kit*", New York Association of Homes and Services for the Aging Annual Conference, Saratoga Springs, NY, June 2011.

In addition, the research and findings from the project formed the basis for a published abstract and a manuscript currently being developed by project staff:

1. Ersek M. (2009). Stop Pain In Nursing Homes (SPiNH): Improving pain assessment and management in residents with dementia through web-based education and support. Gerontologist, 49 (Suppl 2), 291.(abstract)
2. Long CO, Spokane LS, Ersek M. (in process). Evaluating the effectiveness of web-based pain education and informatics tools in rural nursing homes. J Gerontological Nursing.

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