Original Study

Implementing a Pilot Trial of an Infection Control Program in Nursing Homes: Results of a Matched Cluster Randomized Trial

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ABSTRACT

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Background: Hand hygiene is the single-most important nursing home (NH) infection control measure. We piloted a multifaceted hand-washing/surface cleaning intervention in 5 NHs. Our aims were to assess the feasibility of implementing this intervention by assessing staff participation, satisfaction, hand-washing compliance, and whether the intervention was associated with reductions in infection rates, new antimicrobial orders, or overall hospitalization rates.

Methods: We conducted a randomized, pair-matched pilot intervention in 10 Colorado NHs to reduce infections for all NH residents from October 1, 2015 through May 31, 2016. To evaluate process, we determined online education participation rates, recorded intervention fidelity through weekly reporting measures on microbial surface counts, hand-washing, and infection reporting, and conducted a survey of participating employees. To evaluate potential impacts on clinical outcomes, we collected information on monthly infection log data, new antibiotic orders, and hospitalizations.

Results: Three of 5 sites had education participation rates >90%, the other 2 were poor (13% and 23%). The majority of participation survey respondents (58%) were promoters of the intervention. Directors of nursing reported hygiene hand-washing data for 19.6/24 (81.8%) weeks and microbial surface count data for 20.4/24 (85.1%) weeks. For the first 4 weeks of the study, the bacterial counts averaged 351.4 ± 497.5 relative light units, the mean value for the last 4 weeks was 127.7 ± 85.1 (P value = .12). The number of hand-washing occasions per NH resident was steady over time but differed by treatment facility ($P = .03$). We observed nonsignificant reductions for total infections (6.7%) and lower respiratory tract infections (19.9%) vs control NHs. There were no significant differences in antimicrobial orders or hospitalization rates pre-post intervention.

Conclusions: This multifaceted hand-washing and surface cleaning intervention was designed to reduce infection rates among NH residents. In our 10-facility randomized, matched pair pilot study, we observed program compliance and satisfaction along with reductions in surface bacterial counts, but did not observe a statistically significant reduction in infection rates, antimicrobial use, or hospitalizations.

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Healthcare-associated infections (HAIs) are one of the leading sources of morbidity and mortality among the 1.4 million people who reside in, or are transitioning through, the 15,600 nursing homes (NHs) in the United States on any given day.[1] Experts estimate that 1.6 to 3.8 million infections and several thousand outbreaks occur annually in this setting.[2,3] Reducing HAIs has many benefits, including

fewer infection-related hospitalizations, prevention of *Clostridium difficile* infections, decreased antimicrobial use, and prevention of antimicrobial resistance.[4,5] Therefore, NH medical directors, clinicians, and policy-makers have a strong interest in infection control and prevention.[6]

A unique aspect of NHs is that they are residential: residents live and socialize in close proximity to one another and can be exposed to contaminated environmental surfaces during daily activities. Consequently, residents face significant risk of infection from person-person transmission of communicable disease; for example, lower respiratory tract infections (LRTIs) are the second-most common infection source in NHs.[7] Recommendations for the prevention of pneumonia include hand hygiene and surface cleaning to reduce exposure to the pathogen and person-person transmission, and both are included as elements in a model infection control program by the Society for Healthcare Epidemiology (SHEA).[7,8] In fact, SHEA emphasizes hand hygiene as the single-most important NH infection control measure. However, opportunities remain to improve compliance with hand hygiene and surface cleaning in the NH setting.[9,10]

To lay the groundwork for a large, pragmatic cluster randomized controlled trial and to demonstrate the feasibility of implementing a hand-washing/surface cleaning intervention to reduce NH HAIs, we piloted a multifaceted intervention in 5 NHs. Our primary objective was to report the feasibility of this intervention and to evaluate staff satisfaction and compliance with hand-washing. Our secondary objective was to assess whether introducing the intervention was associated with reductions in infection rates, new antimicrobial orders, and overall hospitalization rates.

Methods

Design and Setting

We conducted a randomized, pair-matched pilot of an intervention to reduce NH infections from October 1, 2015 through May 31, 2016. Study personnel implemented and oversaw a facility-level quality improvement intervention with staff from 5 facilities from a multi-facility corporation in Colorado. Five additional NHs from the same corporation served as pair-matched controls. We began training in October 2015 and, to allow a phase-in our outcome analyses, include all NH residents in the facilities at any time during the study period [January 1, 2016 through May 31, 2016 (last period of primary data collection)].

Selection of Treatment and Control NHs

To assess potential research sites and pair-match facilities, we used publicly available 2014 NH Compare data and 2013 data from a Brown University database that links resident Minimum Data Set (MDS) and facility Online Survey, Certification and Reporting (OSCAR) data.[11] The MDS is a federally mandated assessment completed by clinicians at regular intervals for all short- and long-stay NH residents. The resulting data include residents' diagnoses, treatments, symptoms, and medications. OSCAR data are administrative data collected by state surveyors during regular inspections. These data include organizational characteristics, staffing levels, and aggregate resident characteristics. Brown University's Center for Long-Term Care Quality and Innovation Center, which tests interventions to improve postacute and long-term care, has access to the MDS and OSCAR data under a Centers for Medicare and Medicaid Services data use agreement to evaluate quality improvement projects.

A Colorado-based NH corporation provided a list of 11 NHs and investigators manually paired 10 of the 11 facilities based on bed size, occupancy rate, the proportion of Medicare enrollees, the number of admissions per bed, registered nurse and licensed practical nurse staffing rates per 100 beds, hospitalization rate, urinary tract infection rate, and Medicare 5-star rating. Urinary tract infection rates and 5-star ratings came from NH Compare; all other measures, from the Brown University MDS and OSCAR database. The corporate leader affirmed that each pair was logically matched and then we used a random number generator to assign one facility from each pair to the intervention.

After being randomized to participate, administrators at pilot sites were required to identify an Heroes In Prevention champion and team, allow all staff to participate in education, allow staff in each floor or community to use an iPad, and ask staff to incorporate the intervention into workflow.

Description of the Intervention

The intervention included 3 components: education, cleaning products, and audit of compliance and feedback.

Educational component

Study personnel aimed to equip staff with the knowledge and tools necessary to protect residents from infections, while helping them to incorporate the intervention into the "culture" of care. The intervention launched in October 2015 with 1-hour events for all staff at each site, to publicize the program ahead of a full November 2015 implementation and to help staff understand their roles in preventing infection transmission. A smaller group of facility staff comprised a team that received more intensive education: study personnel taught 1 or 2 "hygiene monitors" at each site to collect and enter data into a Health Insurance Portability and Accountability-compliant audit and feedback tool, and a site champion and select group of certified nursing assistants independently completed a 1-hour online educational module focused on how to prevent infections, monitor product use, and monitor data.

Product component

Before the intervention's launch, study personnel conducted a review of each facility's existing products and protocols, to identify gaps in product selection and compliance and to suggest changes. NHs were provided with an "essential bundle" of 7 products, ranging from hand sanitizer gel and foam to antiviral facial tissues, disinfecting spray, and hand and face wipes (Appendix A). We also recommended an additional 4 skin cream and wipe products. Facilities could receive these 11 products at no cost for the duration of the intervention; but if a site already using 1 or more comparable products from another vendor before the intervention, staff could elect to continue using those products and to fill in any gaps with products from the study list.

Audit and feedback

Facilities began using the cloud-based audit and feedback system in November 2015. The system was accessible by secure login via web browsers on NHs' existing computers or via iPads provided to each community or floor by study personnel. It was preloaded with secondary data from the NHs' electronic health record (EHR); each week, hygiene monitors submitted primary data on product consumption and surface cultures collected using a surface hygiene monitor device. All audit and feedback system users had access to a data dashboard, reports, and resident-level infection data for their individual communities (example screenshots included in Appendix A). A subset of users also had access to a facility-level data dashboard and to benchmarking data comparing their performance to other users' performance. Each week, communities within each facility competed against one another in a data-driven "team challenge" to earn recognition for their achievements.

Study personnel provided ongoing support throughout the intervention. This included a newsletter with best practices from the