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Using an interactive video simulator to improve certified nursing assistants' dressing assistance and nursing home residents' dressing performance: a pilot study

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Abstract

This pilot study examined the initial effects and estimated effect size of a computer-based simulation education program on certified nursing assistants' level of assistance when dressing nursing home residents with dementia, and on residents' dressing performance. Nine dyads, assigned to either the experimental or control group, completed the study. Both groups received a traditional 1-hour education module delivered by a research assistant. The experimental group was then instructed to undertake an additional 2-hour intervention using a video simulator that enabled

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Conflicts of Interest

We have no conflict of interest to declare.

nursing assistants to practice level of assistance skills. The appropriateness of dressing assistance from nursing assistants and residents' dressing performance were measured before and 6 weeks after the intervention. The results showed that the two groups did not significantly differ in either appropriate levels of dressing assistance ($p=.36$) or residents' dressing performance ($p=.25$). A lack of effort by some assistants to properly assist residents and low statistical power may explain the lack of significance. The effect sizes of the experimental intervention on appropriate levels of dressing assistance and resident dressing performance were .69 and .89, respectively. Incorporating a strategy to improve motivation should be considered in future studies.

Keywords

dressing performance; level of assistance; nursing home care; activities of daily living; simulation

Background

Cognitive impairment is prevalent in the elderly population, projected to increase significantly with the aging of the Baby Boomer generation.¹ Although there are many forms of dementia, Alzheimer's is by far the most common, making up approximately 60% to 80% of all dementia cases.² Currently, approximately 5.5 million Americans have Alzheimer's dementia, with 480,000 estimated new cases to be diagnosed in 2017 alone.² Cognition declines with Alzheimer's dementia, and when older persons lose some of their ability to perform activities of daily living (ADLs), caregivers, friends, and family tend to offer assistance. However, ADL skills deteriorate more quickly when caregivers, friends, and family do not allow or encourage persons to perform to the full extent of their abilities.³ This leads to reduced participation in ADLs, lower self-esteem, and less control over self and personal space.³ In addition, the inability to perform ADLs often hastens the move to a long-term care facility.^{4,5} Therefore, providing appropriate assistance is important to help persons with dementia retain ADL abilities as much as possible.

Dressing is the way we present who we are to others, and it is arguably one of our most personal and familiar ADLs. Through dressing, we demonstrate self-control, exert control over our personal space, and define who we are.⁴ As persons with dementia transition to institutional care, the percentage of residents who are dependent on others for dressing rises substantially – in one study to 91%.⁶ However, while a vast majority of nursing home residents need some level of dressing assistance, ranging from supervision to total dependence,⁷ research by Beck and others have shown that 75% of residents dressed by staff were able to dress more independently when staff used appropriate assistance strategies.⁸ With appropriate prompts and assistance during dressing, residents can overcome excess disability, express retained competencies, and experience success.^{3,4} Further, caregivers who use appropriate levels of assistance (LoA) strategies learn to view their work as maintaining the quality of life of able residents and they receive reinforcement from residents who are more confident and happy. Using an appropriate LoA also reduces safety issues for caregivers related to excessive bending, lifting, and other physical efforts.⁷

The LoA dressing strategy, developed by Beck and colleagues, is a structured, almost prescriptive approach to helping persons with dementia dress as independently as their ability allows.^{8,9} Indeed, it is one of the few strategies available to help persons with dementia perform ADLs independently. Other ADL interventions, such as mouth care without a battle, bathing without a battle and individualized feeding assistance have incorporated similar strategies to adjust the level of assistance to the ability of residents and promote self-care.⁹⁻¹² Although this strategy is effective, training caregivers to use it often meets resistance because of the misperception that supportive strategies will take much longer than providing complete assistance.⁸ Based on Bandura's social learning theory, behavior can be learned through modeling and observation, and the environment and a person's behavior influence each other.^{13,14} Thus a comprehensive training strategy is one that: (1) changes nursing home culture by switching from a "get the job done" ADL approach to a supportive approach that takes advantage of a person's retained abilities; (2) educates caregivers to determine a person's needs and implement the appropriate LoA; (3) teaches caregivers dressing strategies that promote independence; (4) enables caregivers to hone their newly-learned skills through modeling, reinforcement, and practice without risk to care recipients; and (5) is accessible to caregivers. There is a wealth of research-based evidence and clinical guidance for developing educational content and modules to address the first three of these.^{4, 8, 9, 15-18} Existing educational approaches were selected for delivery in a novel simulation approach, making the last two components the primary areas of inquiry for this pilot project.

A study co-author and colleagues developed a unique video-based computer simulator that incorporates effective instruction that may promote adoption of LoA. Development of the simulator was our response to strategy #4 and 5 (discussed in the previous paragraph), by providing training that both allows caregivers to hone their newly learned skills and is easily accessible. This simulator, in prototype form at the time of writing, allows caregivers to engage emotionally and practice recognition of subtle facial and body-language cues from videos of actors simulating persons with dementia and their caregivers. In addition, the simulator provides feedback to the caregiver to allow self-evaluation of performance. It also lets the caregiver experiment with LoA strategies to see what responses might typically occur. These approaches align with training strategies 2 through 4 (see previous paragraph). The pilot study examined the initial effect and estimated effect size of the simulator on caregivers' use of LoA and residents' dressing performance. We asked four questions:

1. Do certified nursing assistants (CNAs) in the experimental group show greater improvement in the appropriate use of LoA than CNAs in the control group?
2. Do residents in the experimental group increase their dressing performance more than residents in the control group?
3. Are CNAs' appropriate use of LoA associated with residents' dressing performance?
4. Are CNAs' appropriate use of LoA associated with time spent on the simulator, simulation runs, simulator score, and effort to assist?

Additionally, this pilot study served to identify key feasibility issues prior to conducting a larger study. Specifically, information about the use of the simulator, outcome measures, and recruitment and retention issues within the nursing home setting was gleaned.

Methods

Design

This was a pilot quasi-experimental design study. Data were collected between December 2012 and September 2013.

Ethics, consent, and permissions

With University of Arkansas for Medical Sciences Institutional Review Board approval, CNAs provided informed consent first, and they or administrators identified residents who might meet the study criteria. Since older persons with cognitive impairment are considered a vulnerable population, letters from nursing home administrators were sent to families of the residents explaining the study and asking for permission for the research team to contact them. If permission was granted, the research assistant (RA) contacted the family and obtained their consent for the resident to participate in the study. If the resident was able to consent his/herself, we obtained consent from both the resident and the family.

Sample

During the 6-month recruitment period, 12 dyads of CNAs and residents from two nursing homes in central Arkansas met eligibility criteria and participated, and 9 dyads completed the study (see Figure 1). Inclusion criteria for CNAs were that they (1) assisted residents with their ADLs; (2) had no LoA training in the past; and (3) provided physical guidance or complete dressing assistance (minimum Beck Dressing Performance Scale [BDPS] score = 5.5) for at least one resident. Caregivers were matched with residents who met the following study criteria: (1) a Mini-Mental State Examination (MMSE) score of 0-20 indicating severe/moderate dementia; (2) receipt of physical guidance or complete assistance for dressing based on caregiver report and chart review, and have BDPS ≥ 5.5 ; (3) no physical impairments that prevent dressing; and (4) no psychiatric disorders.

Intervention

We divided the CNAs into two groups, one that practiced with the simulator and one that did not. The CNA/resident dyads from the first nursing home were matched by resident MMSE score and randomly assigned to either the experimental group (educational module + simulator) or the control group (educational module only). That is, we conducted both control and experimental interventions in the first nursing home. Due to a high attrition rate in the experimental group in the first nursing home, CNA/resident dyads from the second nursing home were assigned to the experimental group (educational module + simulator) only (See Figure 1).

All CNAs attended an instructor-developed, three-part LoA education module, which lasted approximately 1 hour. This module, presented face-to-face at the nursing home facility, employed a group slide presentation and lecture format, and incorporated video illustrations

of residents and staff using LoA strategies, with multiple-choice questions to reinforce learning content. The content in Section One emphasized the effects of dependence on care recipients and the impact of the caregiver on independence. Section Two described methods to identify physical limitations of the resident, standard behavioral strategies for promoting independence, and application of LoA strategies. Upon successful completion of these two sections, as indicated by a minimum score of 80% on a quiz at the end, each CNA was assigned to one of the two groups. The CNAs in the control group were then excused and expected to begin implementing the LoA strategies with their participating residents. Section Three of the education module described the purpose of the simulator and steps for its use. The CNAs in the experimental group completed this section and then practiced LoA strategies using the video simulator on a tablet computer. They practiced for about 2 hours (total time) over a 3-day period at home or in a quiet room in the nursing home after their work hours. After practicing with the simulator, the CNAs in the experimental group were instructed to begin using LoA strategies with their residents.

The simulator is designed to encourage a caregiver (e.g., the CNA) to provide the least assistance necessary by moving up the hierarchy of assistance one level at a time. An actor portrays an elderly woman with moderate dementia needing some help with dressing (outerwear only). The simulator divides the outerwear dressing process into seven distinct and progressive tasks (e.g., put on pants; zip up pants; button pants; put on socks, shoes, and shirt; and button shirt). For each task, the actor portrays a typical elderly person who requires one of the five possible LoAs (verbal prompt, gesture/modeling, physical prompt, occasional physical guidance, complete physical guidance) for each dressing task.

The simulator pauses at the beginning of each of the seven tasks and the simulator user then chooses the LoA to perform by selecting one of six icons (ie, five LoAs and disengage) at the bottom of the screen (see Figure 2). In each scenario, the appropriate first step is always to modify the environment to minimize distractions, so the simulator user must choose to do this to begin the dressing process. Next, the simulator randomly chooses the LoA needed by the elder actor to complete the first task in the dressing activity and plays a video clip to initiate the dressing process. At this point, the simulator user has no idea what LoA is appropriate for the actor simulating the elder, so the simulator user should start with the least assistance possible (a verbal prompt) and systematically increase the amount of assistance given until the elder actor is able to complete the dressing task. The simulator then randomly assigns the appropriate LoA for the next task, using the rule that the appropriate LoA cannot drop by more than two levels from the previous appropriate LoA.

To simulate caregiver assistance, the user selects (by touch or mouse click) the appropriate icon on the bottom of the simulator. Selecting an icon starts a short video showing the caregiver actor performing the LoA, and the response of the elder actor. The elder actor will not perform the task until the correct LoA is selected. If the simulator user provides inappropriate (too little or too much) assistance, the actor simulating the elder responds with passive noncompliance or agitation (saying “what do you want from me?” or pushing away and saying, “I can do that”). When the elder actor portrays agitation, the only appropriate response for the simulator user is to disengage. The simulator also presents random outbursts that occur even if the LoA strategy is being applied correctly, simulating an elderly person

having a bad day or getting upset for a reason other than the dressing process. The goal of the simulator user is to minimize agitation, maximize independence, and enable the actor caregiver to complete the activity with minimal decision-making delays. When the simulator user is able to demonstrate the use of the appropriate LoA by clicking on the appropriate button assisting the elder actor with few errors, the simulator then randomizes the order of the icons. In this advanced level, the simulator user has to demonstrate that she or he knows the LoA sequence when they are not displayed in order at the bottom of the screen. When the simulator user completes this level with few errors, the simulator indicates that it has nothing more to teach.

The CNAs in both groups had 6 weeks after the training to hone their skills and practice with their residents. No additional training sessions or refreshers were offered. Rather, measurement of purely retained knowledge and skill of the LoA strategies were obtained. They received \$50 after completing the pretest and \$100 for completing the posttest at the end of the 6 weeks. No compensation was provided to residents for this project.

Measurement

Primary outcomes included the CNAs' provision of appropriate dressing LoA and residents' Beck Dressing Performance Score. They were measured both pre-intervention and 6 weeks post-intervention. An RA videotaped each CNA/resident pair during outerwear dressing, repeated over 4 days. These video series were obtained prior to and 6 weeks after the training program to (1) determine the extent to which CNAs were using the appropriate LoA; (2) measure residents' dressing performance using the BDPS; and (3) evaluate CNAs' efforts to assist during the task. A second RA blinded to group assignment coded the videotapes for the three measures.

The RAs determined CNAs' provision of appropriate LoA by ranking each dressing subtask as either appropriate or inappropriate, using the 22 subtask categories from the BDPS.^{8,9} The LoA used during each subtask was scored as appropriate if the CNA used the correct LoA protocol as outlined in the LoA training. For example, the LoA training recommended that a verbal prompt be used initially when starting the dressing sequence. If the CNA used a verbal prompt when initially dressing the client then this was scored as appropriate; if a higher-level prompt was used, it was scored as inappropriate. Likewise, the protocol called for the CNA to start each dressing subtask two levels below the previous subtask, in order to provide the minimal LoA needed to the client. The CNA was to progress through LoA strategies until the client was able to perform the dressing subtask. If the CNA followed this protocol, the dressing subtask was deemed appropriate. If, on the other hand, the CNA used a LoA strategy that was at the same level or higher than the previous subtask, then the use of LoA strategy for that subtask was scored as inappropriate. Each dressing subtask was scored as either appropriate or inappropriate individually. The CNAs' LoA appropriateness scores were determined by counting the amount of appropriate assistance provided and dividing that by the total amount of assistance provided. The 4-day average percentage of appropriateness served as the outcome measure. Higher percentages indicated that more appropriate assistance was provided. Both initial inter-rater agreement and agreement at follow up were 95.45%.

The original BDPS consists of 42 to 45 dressing component tasks that are individually rated for residents' levels of dressing performance. It provides a determination of the resident's capacity to perform dressing steps.¹⁷ For this project we only used the 22 items in the BDPS pertaining to outwear dressing. The RA scored each of 22 dressing component subtasks of the BDPS by rating, from 1 to 7 (independent, initial verbal prompt, repeated verbal prompt, gesture/modeling, occasional physical guidance, complete physical guidance, and complete dependence), with 1 being independent and 7 being completely dependent. For instance, if a resident was able to pick up his or her shirt with only the use of an initial verbal prompt, then this level of independence would be rated "initial verbal prompt," which is a score of 2 on the rating scale. Scores on the BDPS were obtained by summing ratings on each component, and dividing that number by the total number of components involved on each videotape. Four-day average BDPS scores served as the outcome measure. An earlier study had established the content validity and an inter-rater reliability of .80.¹⁶ Initial inter-rater agreement after training for the current study was 95%, and a follow up reliability check was 87.8% on average. Intra-rater agreement reached an average of 97.6%.

Other measures include the Dressing Assessment Guide (DAG), MMSE, time spent on simulation, number of simulation runs, simulation score and effort to assist. The DAG assesses cognitive function underlying the dressing task.¹⁸ The DAG items were developed by experts in geriatrics, including neuropsychologists, gero-psychiatric nurses, a nurse specialist, and a social worker specializing in gerontology. The DAG reveals residents' remaining functional capacities by identifying cognitive assets and deficits that involve attention, voluntary motor actions, motor skills, visual organization and perception, and language ability. Each function was scored as yes or no, with no indicating impaired and yes indicating intact cognition. Resident scores on the DAG were calculated by summing ratings on each function, and then dividing the sum by the total number of functions evaluated. Summary scores range between 0 and 1, with 0 being the most impaired and 1 being intact cognition.

A summary score on the 30-item MMSE was used as a measure of global cognitive function.^{19, 20} The MMSE has reported test-retest reliability of .83.¹⁹ Criterion validity is .83 with the Short Portable Mental Status Questionnaire, and .88 with the Cognitive Capacity Screening Examination.^{21, 22}

Time spent on simulation was measured via the simulator's internal clock, based on how long the CNAs worked on the simulator. A run was measured from one environmental modification (the first thing a person has to do when dressing someone) to the next, or until the CNA stopped using the simulator in the middle of dressing. Thus, a partial dressing run would be considered a run if the CNA stopped using the simulator afterwards, or if the dressing run had gone very poorly and the CNA needed to start over. If a CNA understood the LoA strategy, as little as four runs of practice might be sufficient; if the CNA struggled with the strategy, 10 runs might be needed to gain better understanding. The simulation score was determined by the number of correct LoA decisions for a given run ($score = \frac{(Total - Wrong)}{Total} * 100$). The score for each run by each CNA was calculated. No minimum score was required while practicing simulator runs. The final score was checked

against previous run scores achieved by the CNA to ensure that it was representative of individual achievement. Better simulation scores indicated better knowledge and skill in LoA.

Effort to assist was a 1-item scale designed specifically for this study to evaluate the caregiver's level of effort to provide proper assistance. The scale ranged from 0 to 10, with 0 being no effort provided and 10 being the maximum effort provided. Scoring was based on (1) was the resident given appropriate opportunity to begin the dressing task? (i.e., did the caregiver begin with a verbal prompt?); (2) did time, patience, or habit appear to affect the LoA provided?; and (3) was the resident given appropriate opportunity to respond to one LoA before the next level was attempted? The first two pretest videos and the last two posttest videos from each dyad were selected for coding CNA efforts to assist. The average inter-rater reliability for every 10 observations with the leading author was 96.9%.

Finally, a post-evaluation survey was completed by the CNAs. This evaluation included four questions about ease of use, satisfaction, self-rated LoA competence after training, and perceived simulator value. Answers were provided on a Likert scale ranging from 1 (extremely negative) to 5 (extremely positive). Open-ended questions inquired about features that were liked least and best, and suggested changes to be made.

Statistical analysis

We summarized continuous variables using means, standard deviations, medians and quartiles and categorical variables using frequency and percent. Demographic characteristics and other variables were compared between the control (n=3) and treatment (n=6) using Mann-Whitney U test and Fisher's exact test.

Median differences in BDPS scores and LoA scores were compared between the two groups using a Mann-Whitney U test. Spearman's rho correlation coefficient was used to test the association between two quantitative variables. An analysis of covariance model was used to test for associations between differences in BDPS scores and differences in LoA scores within each group, using an interaction effect between group and differences in LoA score. All tests conducted were two-sided, assuming a significance level of 5%. The data analysis was generated using JMP Pro v 12 for Windows (SAS Institute, Cary, NC). All plots were done using the ggplot2 package in R (R Foundation for Statistical Computing, Vienna, Austria).

Results

Among the residents who completed the study, the median age was 87 years. The majority of participants were female (78%) and all were Caucasian. The CNAs who completed the study had a median age of 42 years and the majority was African American (89%). All were female. They had a median of 13 years of education, 9 years of working experience, 36 months working in the current facility, and 9 months working with the current resident. Summary statistics for demographics, outcomes, and predictors for the two treatment groups are presented in Table 1. No statistically significant differences on these variables between

intervention and control groups were found except for the effort to assist score, which approached significance ($p=0.06$).

The median difference [experimental group: 33%; control group: 14.3%] in appropriate LoA from baseline to post intervention between the two groups was 18.7% ($p=0.42$) (Table 2). The median difference [experimental group: 1.87; control group: 0.28] in residents' BDPS scores from baseline to post intervention between the two groups was 1.59 ($p=0.38$) (Table 2). Differences in the appropriateness of LoA was a significant predictor of differences in BDPS scores ($\rho=.95$, $p<0.0001$). However, this association did not differ by groups ($p=.76$).

For the experimental group, the number of simulator rounds completed by the CNAs was positively associated with difference in appropriateness of LoA scores ($\rho=0.82$, $p=0.046$). There were no associations between difference in LoA scores and the simulation score ($\rho=-0.03$; $p=0.96$), or time spent on the simulator ($\rho=0.54$; $P=0.27$). The nine CNAs' efforts to assist and the dressing assistance skills were not associated at pretest ($\rho=0.19$; $p=.621$). However, they were positively associated at post intervention ($\rho=0.83$; $p=.0061$).

The study showed that the experimental group's improvement in the provision of appropriate LoA was more than double that of the control group (37.41% vs. 17.60%) (Table 2), which indicates an observed effect size of 0.69. Residents' mean BDPS scores improved more than three times as much as control residents' scores (1.87 vs. 0.59) after the intervention, indicating an observed effect size of 0.89.

In addition to tentatively promising statistical findings, the pilot study provided valuable feasibility information. Regarding recruitment, retention, and adherence issues, two nursing homes were recruited easily (Figure 1). However, recruitment and retention of the dyads, as well as CNAs' adherence to the study protocol in the first nursing home, were difficult compared to the second nursing home. The reasons for successful completion of the study in the second nursing home include (1) a culture of openness from the nursing home to research, (2) excellent administrative support, (3) working with staff instead of administrators to recruit residents, (4) use of a structural method to engage CNAs in practicing with the simulator, and (5) consistent staff assignments to allow CNAs opportunities to practice LoA with their residents.

Working with the CNAs provided both challenges and valuable insights into the feasibility of our interventional approach. The methods of collecting data and scheduling data collection were unique learning opportunities for this pilot study. Allowing CNA feedback provided additional insight into the feasibility of the intervention within a nursing home setting.

For example, there were both positive and negative aspects to the use of a video recorder for data collection. Videotaping for obtaining primary outcome measures (appropriateness of LoA and BDPS) did not seem to bother residents or CNAs, which allowed data to be captured and subsequently coded systematically. Simple observation could have made it difficult to accurately capture performance of the CNAs in real time. However, the videotaping procedure, coding, and reliability checking for these two measures were labor-

intensive. In addition, we had to revise the videotaping protocol from 5 to 4 times a week because CNAs generally did not work 5 days in a row. Therefore, although videotaping was feasible, it is possible that alternative data collection methods may be more efficient.

Additionally, all CNA participants in the experimental arm were able to successfully use and practice with the simulator. The average scores for the post-evaluation survey ranged from 4.5 to 5, indicating an extremely positive experience. The least liked features of the simulator included slow progress, and talking about or learning the steps. The features that CNAs liked the best included being told their actions were right or wrong, learning to work with a resident, being shown step-by-step how to help, being shown a different way to help, and ways to remember the process, and not being allowed to give up until complete. The only recommended change was to load the program faster.

Discussion

As indicated above, there was a comparative difference in change in the provision of appropriate LoA between groups. Other studies promoting ADL independence in nursing home residents have not examined staff outcomes, with one exception. A one-group pre- and post-implementation design study investigating the effect of mouth care training on six CNAs showed that the training improved thoroughness of care on 88 residents' inner tooth surfaces but not on outer tooth surfaces.²³ However, there are no data regarding percentage of improvement for comparison with the current study.

Despite demonstrating a grasp of the LoA techniques, this did not always translate into a change in clinical behavior. This is a longstanding struggle in all levels of nursing.²⁴ In our study, not all CNAs in the experimental group improved on provision of appropriate LoA. Two of six participants in the experimental group improved only 10% or less in provision of appropriate LoA, while the rest of the group improved between 36.4% to 81.80%. One of these two CNAs also had the lowest simulation score. Thus, even if CNAs are equipped with knowledge and skills, they might still perform poorly on the provision of appropriate LoA. A detailed analysis showed that these two CNAs spent the least amount of time on the simulator and completed the fewest simulation runs, and their effort to assist was also scored lowest. To illustrate, one CNA appeared to become impatient and then took over the task, unrelated to the resident's capabilities. A similar but opposite phenomenon was also observed in one of three CNAs in the control group. She scored 38.50% on provision of appropriate LoA, which was better than her peers in the control group (who scored 0% and 14%) and her score was comparable to some CNAs in the experimental group. We suspected that this was related to her high effort to assist score. Indeed, her effort to assist score was the highest among all CNAs in both groups. These findings indicate that knowledge and skills obtained from an intervention with simulator usage may be outweighed by lack of motivation or willingness to learn and help, as indicated by less practice on the simulator and/or less effort spent on providing assistance to residents. Even without simulator training, if a CNA is willing to assist and makes an effort on the task, he or she can improve the provision of appropriate LoA. This conclusion is congruent with various behavioral theoretical frameworks. Specifically, the theory of planned behavior proposes that behavioral intention is most influential in determining adoption of a specific behavior.²⁵ Bandura also

proposed that motivation is one of the mediating processes.^{13, 14} That is, before a CNA shows the learned behavior, important mental processes, including motivation, need to occur.

After the intervention, experimental group residents' dressing performance scores improved more than three times as much as control group residents' scores. The improvement on BDPS with this pilot study was similar to or better than in Beck's earlier work,⁸ where nursing home residents' dressing behaviors and average BDPS score improved only about 1.11 after an education program.⁸ The program on the simulator can be reproduced on a smartphone, tablet, computer, or the Internet, as compared to other studies using extensive or lengthy training workshops to improve CNA skills in caring for residents.^{8, 29} Thus, if the results of this pilot study can be reproduced in a larger study, using the simulator to improve the provision of appropriate LoA and residents' BDPS, the costs of caregiver training over time could be reduced. Indeed, for the new generation of healthcare workers, this format may be preferable to more traditional, non-electronic formats. In addition, the simulator requires little or no personnel assistance, while other programs require heavy involvement of skilled and knowledgeable instructors.

This study showed the feasibility of using the newly developed simulator in CNA training, and provided pilot data for estimating sample sizes for a larger study on efficacy of the simulator-based intervention for improving the CNAs' provision of appropriate LoA and residents' BDPS. A future study could be adequately powered to detect these differences based on information gained here. A sample size of 30 dyads per group for a total of 60 dyads would be needed to detect a difference of 19.82% between the two groups in changes from baseline appropriateness of LoA with 80% power. Similarly, we found that 21 dyads per group for a total of 42 dyads would be required to detect a difference of 1.28 in BDPS changes from baseline with 80% power.

Limitations

Although this study provides promising preliminary results, there are a number of limitations that need to be considered. First, a small sample size limits the identification of significant findings in this pilot study. Despite this limitation, it is encouraging that dressing capabilities can be improved or preserved with appropriate LoA. Findings from the study were also useful in determining the sample size necessary for a future study.

It is possible that CNAs, because of familiarity with their assigned elder, preemptively assumed how much assistance the elder would require. This is a limitation of using existing CNA-client dyads. However, for clients with dementia, providing a consistent routine is paramount to reducing unnecessary negative emotions and distress.²⁷ This includes both consistent schedules and familiar caregivers. Despite posing a limitation, using existing CNA-client dyads was appropriate for the clients' emotional wellbeing throughout the study.

There are many existing simulation techniques available to aid in knowledge development. For this particular study, use of a tablet simulation program was strategically selected. Specifically, the tablet is portable, making it easier for caregivers to practice at a convenient time and location. Additionally, the simulation program can be installed on other tablets, computers, or devices. This may be a vehicle to provide training and practice to caregivers

without time- and labor-intensive training sessions. However, because caregivers have individual learning styles, using the selected approach may have dampened some participants' ability to learn as effectively as others. Therefore, alternative simulation approaches and/or teaching strategies may be considered in a future study.

It is possible that being videotaped may have influenced caregivers' awareness and performance of the LoA process.²⁸ However, video recording may feel less imposing and obtrusive than a live observer, and has been found to not significantly change behavior in other settings.²⁹ In addition, recording the interactions between the CNA and resident was pertinent to recording and scoring the complex, detailed LoA process. Furthermore, video records allowed for (1) a blinded RA to independently score the videos, and (2) inter-rater reliability to be established.

Lessons Learned and Recommendations

There are several lessons learned from this pilot study. Using a simulator to teach CNAs the LoA approach is feasible, although the loading speed needs improvement. In the experimental group, CNAs' provision of appropriate LoA scores and residents' BDPS scores increased in a desired direction compared to the control group. Overall, the CNAs' ability to provide appropriate LoA was associated with residents' dressing independence scores. However, after examining an individual CNA's LoA performance, it was found that a greater level of effort or motivation played a key role, leading to higher score for provision of appropriate LoA. Identifying nursing homes with administrative support, openness to research, and consistent resident assignment, and use of a structured schedule for CNAs to practice on the simulator, are important to ensure successful recruitment, retention, and adherence. Measurement of major variables, such as CNA provision of appropriate LoA and residents' BDPS, are feasible, though labor intensive.

Therefore, an adequately powered sample, improvement of the simulator's loading speed, and identifying nursing homes with adequate administrative support, should be addressed in a future study testing the simulator. Dedicated administrative support would help foster a culture change in nursing homes, so that assisting in ADL would be viewed as a caring means for individuals to retain their own abilities and dignity rather than a quick task to be accomplished. Additionally, future studies should ensure that CNAs achieve a certain degree of skill and knowledge after training as we have done in this pilot study, as well as incorporate strategies to improve CNAs' motivation for behavior change and/or consider motivation as a confounder. The current study addressed LoA as demonstrated by CNAs in a nursing home. However, future studies may incorporate simulation and training for caregivers at home, including both hired caregivers and family members/unpaid caregivers. When applied within a community context, caregivers who employ LoA techniques may assist their loved ones to remain at home longer. Likewise, it could be tested for effectiveness in adults with other forms of dementia in various caregiving settings.

Although this program of study is in a pilot stage and no definitive conclusions can be made, we cannot rule out that perhaps the computer simulation is not the best typology of simulation to achieve the goal of improving CNAs' LoA skill and dressing performance in elders with dementia. Alternative teaching and simulation methods, including simulation

with standardized patients, may encourage learners to incorporate knowledge into daily practice. Recalling and retaining LoA steps may be difficult for some caregivers. It may be beneficial to provide caregiver participants with a visual reminder or “cheat sheet,” such as a pocket card or badge attachment of the steps and strategy to employ. Additionally, hands-on demonstration and practice during the training session(s) may be useful to caregivers with kinesthetic learning needs.

If effective, the intervention can easily be replicated in various electronic formats for training caregivers to improve dressing performance and thus independence for patients with dementia. Finally, LoA skills learned from this program may enable caregivers to expand their LoA skill to other ADLs, such as grooming and self-feeding, which can be further verified by a future study. In a clinical setting, this type of training could be offered as initial certification training and/or when CNAs are initially hired, so it will be a habitual behavior throughout employment.

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Figure 1.
Flowchart

Figure 2.
Snapshot of simulator process

Table 1

Summary statistics for the two treatment groups

Variable	Median (Q1, Q3) or n (%)			P value ^a
	Total (N=9)	Control (N=3)	Treatment (N=6)	
Resident				
Age	87 (83.5, 89.5)	87 (87, 90)	85.5 (82.75, 89.5)	0.52
Female Gender	7 (78%)	2 (66.7%)	5 (83.3%)	1.00
Caucasian	9 (100%)	3 (100%)	6(100%)	NA ^b
MMSE	10 (7, 17)	10 (0, 16)	11 (7.5, 18)	0.63
DAG	0.94 (0.26, 0.99)	0.94 (0, 0.97)	0.90 (0.29, 1)	0.77
BDPS at pretest	6.89 (6.79, 6.94)	6.93 (6.88, 6.99)	6.87 (6.67, 6.93)	0.26
CNA				
Age	42 (33, 46.5)	44 (42, 49)	36 (32, 46.3)	0.19
Female Gender	9 (100%)	3 (100%)	6 (100%)	NA ^b
African American	8 (89%)	2 (67%)	6 (100%)	.33
Years of Education	13 (11.5, 14)	13 (11, 13)	13 (11.5, 14)	0.73
Years of Working Experience	9 (1.25, 16)	0.5 (0.4, 22)	9.5 (4.25, 14)	0.55
Months of Working in Current Facility	36 (5.5, 72)	6 (5, 12)	36 (28, 141)	0.17
Months of Working with Current Resident	9 (4.5, 15)	6 (5, 12)	10.5 (3.75, 28.5)	0.76
Time Spent on Simulator (Minutes)	NA	NA	84.39 (44.55, 99.54)	NA
Number of Runs Played on Simulator	NA	NA	8 (4.75, 8.75)	NA
Simulation Score	NA	NA	78.9 (61.3, 94.38)	NA
Appropriateness LoA at pretest	0% (0%, 3.15%)	0% (0%, 0%)	0 % (0%, 7%)	.50
Effort to Assist at pretest	1 (0.5, 1.75)	0 (0, 1)	1.25 (1, 2.13)	.06

Note.

^a p value obtained from fisher exact test or Mann-Whitney U test;^b p value is not available since race or gender is a constant

NA: Not Applicable

MMSE: Mini Mental State Exam

DAG: Dressing Assessment Guide

BDPS: Beck Dressing Performance Scale

LoA: Level of Assistance

Table 2

Summary statistics for major outcomes

Variable	Control (n=3)			Treatment (n=6)			P
	Pre	Post	Post-Pre	Pre	Post	Post-Pre	
Residents' BDPS							
Median (Q1, Q3)	6.93 (6.88, 6.99)	6.6 (5.43, 7)	-0.28 (-1.5, 0.01)	6.87 (6.67, 6.93)	5 (3.80, 6.37)	-1.87 (-3.10, 0.22)	0.38 ^a
Mean (SD)	6.93 (0.06)	6.34 (0.82)	-0.59 (-0.80)	6.80 (0.19)	4.93 (1.59)	-1.87 (-1.62)	
CNAs' Appropriateness LoA							
Median (Q1, Q3)	0% (0%, 0%)	14.3% (0%, 38.5%)	14.3% (0%, 38.5%)	0% (0%, 7%)	40.7% (7.5%, 70.5%)	33% (7.5%, 70.5%)	0.42 ^a
Mean (SD)	0% (0)	17.60% (19.46%)	17.6% (19.46%)	2.57 % (4.07%)	39.98% (31.62%)	37.41% (31.88%)	

BDPS: Beck Dressing Performance Scale

LoA: Level of Assistance

^a p value obtained from Mann-Whitney U test