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Original Article

Design and Implementation of a Competency-Based Training Framework for Home Health Aides in Community Settings

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ABSTRACT

Background: Home health aides provide essential support to patients receiving care in community and home-based settings, yet their training often varies across institutions and may lack structured competency validation. Competency-based training may improve practical performance, but implementation evidence in home health aide education remains limited. Objective: This study aimed to design and implement a competency-based training framework for home health aide trainees and evaluate its implementation outcomes, including adoption, feasibility, acceptability, fidelity, maintenance, and cost, alongside secondary caregiver and patient-related outcomes. Methods: A cluster-based hybrid effectiveness–implementation study was conducted across six healthcare training institutes in the United States. Three institutes implemented an 8-week competency-based training framework organized into basic, intermediate, and advanced skill levels, while three comparison institutes continued traditional training. The RE-AIM framework guided implementation evaluation. Outcomes included caregiver competency scores, patient satisfaction, infection incidence, medication errors, fall rates, readmissions, SF-36 quality-of-life scores, adoption, acceptability, fidelity, maintenance, and preliminary cost-offset estimates. Results: A total of 180 trainees participated, including 92 in the intervention group and 88 in the comparison group. Program completion was higher in the intervention group than in the comparison group (93.4% vs 81.8%). Fidelity was 91.0%, and 87.0% of trainees reported that the competency-based program was more useful than traditional training. Competency scores improved from 58.2 to 84.6 post-training in the intervention group and from 59.1 to 68.3 in the comparison group. At 6 months, scores remained higher in the intervention group than in the comparison group (78.9 vs 63.4). Patient-related indicators favored the intervention group, including satisfaction (88.5% vs 74.2%), infection incidence (6.8% vs 11.9%), medication errors (4.1 vs 9.3 per 100 cases), falls (5.7 vs 10.6 per 100 patients), readmissions (12.3% vs 18.8%), and SF-36 score (72.4 vs 61.7). The average training cost was USD 420 per caregiver, with an estimated annual cost offset of USD 950 per patient. Conclusion: The competency-based training framework was feasible, acceptable, adoptable, and deliverable with high reported fidelity across participating institutes. The findings suggest favorable early maintenance of caregiver competency and improved patient-related indicators, but larger cluster-adjusted studies with complete statistical and economic evaluation are needed before definitive effectiveness or cost-effectiveness conclusions can be made. Keywords: implementation science; competency-based training; home health aides; RE-AIM framework; feasibility; acceptability; adoption; fidelity; sustainability; home healthcare.

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INTRODUCTION

Home-based healthcare has become an increasingly important component of service delivery in the United States as population ageing, chronic disease burden, disability-related care needs, and patient preference for home-based support continue to increase. Within this model of care, home health aides play a central role in assisting patients with activities of daily living, mobility, hygiene, medication-related support, symptom observation, communication with families, and basic safety practices. Because these workers often provide care in unsupervised or semi-supervised community settings, their competence has direct implications for patient safety, continuity of care, caregiver confidence, and health-related quality of life. However, training systems for home health aides remain variable across institutions and jurisdictions, and many programs continue to emphasize didactic instruction rather than structured skill demonstration, supervised practice, and objective competency validation. This gap is clinically important because inadequate training may contribute to preventable adverse events, including infections, medication errors, falls, avoidable hospital readmissions, and inconsistent patient experiences (5,8,10,16).

Competency-based education offers a practical approach to addressing this workforce training gap because it shifts the emphasis from completion of instructional hours to demonstrable performance of defined skills. In competency-based models, learners are expected to show that they can perform essential tasks safely, consistently, and appropriately before progressing to independent practice. Evidence from nursing, long-term care, and healthcare workforce education suggests that competency-based training can improve technical performance, decision-making, confidence, and care quality when compared with traditional lecture-based approaches (6,7). For home health aides, this approach is particularly relevant because routine work requires practical application of infection control, safe transfer techniques, communication, medication assistance, monitoring, and emergency response within unpredictable household environments. Despite this theoretical and practical relevance, there remains limited implementation-focused evidence on how a structured competency-based framework can be introduced, delivered, monitored, and sustained within real-world home health aide training institutes.

The problem is therefore not only whether competency-based training can improve caregiver performance, but whether such a model can be implemented effectively within routine training systems. This distinction between the effectiveness gap and the implementation gap is central to the present study. The effectiveness gap concerns whether structured competency-based training is associated with improvements in caregiver skills and patient-related outcomes. The implementation gap concerns whether the program can reach the intended trainees, be adopted by institutes and trainers, be delivered with fidelity, be accepted by participants, remain feasible within existing schedules and resources, and maintain benefits over time. Many healthcare education interventions show short-term gains under controlled conditions but fail to achieve sustained use in ordinary service settings because of workflow constraints, trainer variability, limited organizational support, poor monitoring, inadequate adaptation, or low acceptability among users (11–13).

Implementation science provides a useful structure for evaluating these issues beyond simple pre-post outcome measurement. Frameworks such as RE-AIM allow investigators to examine Reach, Effectiveness, Adoption, Implementation, and Maintenance, thereby linking intervention impact with real-world uptake, delivery quality, and sustainability (3,4). This approach is especially appropriate for home health aide training because successful scale-up depends not only on improved competency scores but also on whether institutes can deliver the program consistently, whether trainees complete and value the program, whether trainers can maintain fidelity, and whether learned skills persist after the initial training period. Additional implementation outcomes such as feasibility, acceptability, fidelity, adoption, cost, and sustainability provide further insight into whether a training model is practical and transferable across settings (12,13).

Measurement quality is another important concern in this area. Many training evaluations rely heavily on self-report, supervisor impressions, or immediate post-training knowledge tests, which may not accurately reflect real caregiving performance. Objective and structured assessments, including direct observation checklists, standardized patient feedback, patient-reported outcome measures, and validated quality-of-life instruments, can provide stronger evidence of training impact and implementation quality (21,22). In home healthcare, patient satisfaction, infection rates, medication errors, fall incidents, hospital readmissions, and health-related quality of life are particularly relevant because they reflect both the technical and interpersonal dimensions of care. Similarly, follow-up assessment is necessary because immediate post-training improvement may decline if skills are not reinforced or integrated into routine practice.

Economic considerations are also relevant to implementation decisions. Competency-based training requires investment in trainer time, educational materials, simulation resources, assessment procedures, and monitoring systems. However, if such training reduces preventable complications, medication errors, falls, and readmissions, it may produce downstream savings for patients, agencies, and healthcare systems. Previous quality-improvement and home-care research suggests that investment in workforce training may be economically justified when it improves safety and reduces avoidable healthcare utilization (31). Nevertheless, economic evidence in home health aide training remains limited, and implementation studies should report both the cost of delivery and the potential cost implications of improved care processes.

The present study was therefore designed to address both the training-performance gap and the implementation gap in home health aide education. It developed and implemented a structured competency-based training framework organized into basic, intermediate, and advanced skill levels across selected healthcare training institutes in the United States. The study evaluated implementation outcomes, including reach, adoption, feasibility, acceptability, fidelity, maintenance, and cost, while also assessing secondary effectiveness outcomes related to caregiver competency, patient satisfaction, patient safety indicators, hospital readmissions, and quality of life. By using a cluster-based implementation approach with follow-up assessments at 3 and 6 months, the study aimed to determine whether a competency-based training framework could be delivered in real-world training settings and whether its effects on caregiver performance and patient-related outcomes could be sustained over time.

MATERIALS AND METHODS

This study was conducted as a cluster-based hybrid effectiveness–implementation study designed to evaluate the implementation of a competency-based training framework for home health aide trainees in community-based training institutes. The cluster design was selected to reduce contamination between trainees within the same institute, as learners trained in the same environment were likely to interact, share materials, and be exposed to similar instructional practices. The study had two linked aims: first, to evaluate implementation outcomes related to reach, adoption, feasibility, acceptability, fidelity, maintenance, and cost; and second, to assess secondary effectiveness outcomes related to caregiver competency, patient satisfaction, safety indicators, hospital readmissions, and health-related quality of life. The study was conducted across six healthcare training institutes in the United States that provided certification-oriented training for home health aides. Institutes were selected purposively to include both urban and semi-urban training environments and to capture variation in routine educational delivery, trainee background, and field-placement exposure. Three institutes implemented the competency-based training framework, while three institutes continued their usual traditional training model and served as comparison clusters. Allocation was performed at the institutional level rather than the individual level to preserve the integrity of the training model and reduce cross-group exposure within the same institute.

Participants were home health aide trainees enrolled in certification programs during the study period. Eligible participants were adults aged 18 years or above who were enrolled in a recognized home health aide training program and were willing to participate in baseline, post-training, and follow-up assessments. Trainees were excluded if they had already completed advanced clinical certifications or had more than five years of professional caregiving experience, because the study was designed to evaluate the framework among entry-level and early-career home health aide trainees rather than experienced care professionals. A total of 180 trainees were enrolled across the six institutes, with approximately 30 trainees per cluster. Of these, 92 trainees were included in the intervention clusters and 88 in the comparison clusters. Participants were further categorized according to prior caregiving experience, educational level, and intended work setting to support stratified analysis. Experience was classified as less than six months or more than two years, education as high-school level or college-level education, and work-setting preference as rural or urban. These categories were selected because prior experience, educational background, and expected care context may influence training uptake, competency acquisition, digital-tool use, and skill retention.

The intervention being implemented was a structured competency-based training framework for home health aides. The framework was developed using competency-based education principles and literature on caregiver training, patient safety, and healthcare workforce development. It was organized into three progressive levels. The basic level focused on fundamental caregiving competencies, including hygiene assistance, communication, patient dignity, basic mobility support, and safety practices. The intermediate level addressed medication assistance, infection prevention, patient monitoring, documentation, and recognition of common care-related risks. The advanced level focused on emergency response, care coordination, decision-making, escalation of concerns, and application of skills in more complex home-care scenarios. Each level included defined competencies, observable performance indicators, assessment criteria, and progression benchmarks. Certification within the framework was linked to successful demonstration of practical competence rather than attendance or theoretical knowledge alone. Before full implementation, the training content was reviewed by an expert panel consisting of nursing educators, home-care supervisors, and public health professionals. Minor revisions were made following pilot testing in one institute to improve clarity of checklists, sequencing of modules, and feasibility of delivery within existing training schedules.

The implementation strategy was distinct from the training framework itself. The training framework represented the educational intervention, whereas the implementation strategy consisted of the procedures used to integrate the framework into routine institute-based training. The strategy included trainer orientation, structured educational materials, standardized competency checklists, simulation-based practice, supervised skill demonstration, digital logs for task tracking, structured feedback, and fidelity monitoring. Trainers in the intervention institutes were oriented to the competency framework before delivery and were provided with standardized teaching guides, demonstration checklists, assessment forms, and feedback templates. Training was delivered over eight weeks through a combination of classroom sessions, trainer-led demonstrations, supervised hands-on practice, simulation exercises, digital checklist completion, and formative feedback. Trainees received feedback after practical sessions to reinforce skill acquisition and correct unsafe or inconsistent performance. Digital logs were used by trainees in the intervention group to record daily caregiving tasks and checklist completion during practice and field-placement activities. Initial difficulty with digital logs was managed through additional orientation and trainer support, and this adaptation was documented as part of the implementation process.

The comparison clusters continued with their usual traditional training approach, which mainly consisted of lecture-based instruction and limited practical assessment. These institutes did not receive the structured competency levels, digital task logs, standardized simulation sequence, or formal competency-linked certification criteria during the study period. This comparison condition was retained to reflect routine training practice and to allow evaluation of whether the competency-based framework was associated with improved implementation and effectiveness outcomes compared with usual training.

The RE-AIM framework was used as the primary implementation framework to guide study design, outcome selection, data collection, analysis, and interpretation. Reach was defined as the number and proportion of eligible trainees and institutes participating in the study. Effectiveness was assessed through caregiver competency scores and secondary patient-related outcomes. Adoption was defined as the proportion of trainees and institutes initiating and completing the competency-based program.

Implementation was assessed through fidelity to planned training delivery, use of digital logs, completion of competency assessments, dose delivered, and consistency of program delivery across institutes. Maintenance was assessed through skill retention and continued performance at 3-month and 6-month follow-up. Additional implementation outcomes, including feasibility, acceptability, fidelity, sustainability, and cost, were interpreted alongside RE-AIM domains using implementation-outcome concepts described in implementation research literature. This combined approach was selected because RE-AIM provided the overall structure for real-world evaluation, while feasibility, acceptability, and fidelity provided more specific information about implementation quality and practicality.

Data were collected at baseline, immediately after the eight-week training period, and at 3-month and 6-month follow-up. Baseline data included trainee age category, educational level, prior caregiving experience, intended work setting, and institute allocation. Caregiver competency was assessed using direct observation scoring. A structured checklist based on the competency benchmarks was used to assess practical performance during key tasks, including patient transfer, hygiene care, infection prevention procedures, medication handling support, patient communication, and response to safety scenarios. Scores were recorded at baseline, immediately after training, and during follow-up assessments. To strengthen objectivity, assessors used the same structured scoring checklist across assessment points. Where more than one assessor was involved, trainers and observers were oriented to the checklist before scoring to improve consistency. The manuscript should report the final checklist score range, scoring anchors, assessor qualifications, and inter-rater reliability if these data are available.

Patient-related outcomes were collected during field-placement or supervised care exposure and were treated as secondary effectiveness outcomes. These included patient satisfaction, infection incidence, medication errors, fall rates, hospital readmission rates, and health-related quality of life. Patient satisfaction was assessed using standardized survey methods, while health-related quality of life was assessed using the SF-36. Infection incidence was defined as reported infection events during the relevant care-observation period. Medication errors were defined as documented medication-related incidents or near-miss events associated with caregiver support activities. Fall rate was defined as the number of reported falls per relevant patient denominator during the observation period. Hospital readmission rate was defined as the proportion of patients requiring hospital readmission during the follow-up observation period. Because these outcomes may be influenced by patient case mix, supervision level, reporting systems, and institutional procedures, they were interpreted as service and patient-safety indicators rather than direct causal measures of trainee performance alone. For publication, each patient outcome should be reported with its exact denominator, data source, observation period, and method of verification.

Implementation outcomes were assessed using training records, completion logs, trainer reports, observation forms, and trainee feedback. Feasibility was defined as the extent to which the program could be delivered within existing institute schedules, staffing arrangements, and training resources. Acceptability was assessed through trainee feedback regarding perceived usefulness, clarity, relevance, workload, and satisfaction with the competency-based model. Adoption was measured as the proportion of intervention trainees who initiated and completed the full competency-based program. Fidelity was defined as the proportion of planned training components delivered according to the standardized structure, including classroom teaching, demonstrations, supervised practice, simulation, checklist-based assessment, and structured feedback. Sustainability or maintenance was assessed through retention of competency scores and continued application of skills at 3 and 6 months. Cost was assessed through training-related costs, including trainer time, training materials, simulation resources, and time spent per trainee. Potential cost savings were estimated descriptively by comparing reductions in medication errors, readmissions, and complications. Because a full economic evaluation was not conducted, the cost component was treated as a basic cost-offset analysis rather than a formal cost-effectiveness analysis.

Fidelity and process evaluation were integrated into implementation monitoring. Trainers recorded whether planned sessions were delivered, whether competency checklists were completed, whether simulation exercises were conducted, and whether structured feedback was provided. Dose delivered was defined as the number and proportion of planned training components delivered by trainers. Dose received was reflected by trainee attendance, completion of practical tasks, use of digital logs, and completion of competency assessments. Adaptations were documented when they occurred, including additional support for digital-log use, modifications in scheduling, or minor adjustments to the sequence of practical activities. These adaptations were reviewed to determine whether they supported implementation while preserving the core components of the competency-based framework. Core components included the three-level competency structure, direct observation assessment, simulation-based skill practice, standardized checklists, and feedback-linked progression. Adaptations that did not alter these core components were considered pragmatic implementation modifications rather than deviations from the intervention.

Several procedures were used to reduce bias and improve data integrity. Cluster-level allocation reduced contamination between trainees within the same institute. Standardized checklists were used to reduce variability in competency assessment. The same core assessment tools were used at baseline, post-training, and follow-up to support comparability over time. Data collectors and trainers were oriented to study procedures before implementation. Digital logs reduced reliance on memory-based reporting for task completion. Participant characteristics were summarized at baseline to assess comparability between study groups. Stratified analyses were planned for experience level, education level, age category, and intended rural or urban work setting. Missing data were reviewed by assessment point and group; where outcome data were unavailable, analyses were based on available cases without imputation unless missingness was sufficient to require sensitivity analysis. In a full statistical revision, the manuscript should report the amount and pattern of missing data and should avoid complete-case analysis without justification if attrition is substantial.

The sample size was determined pragmatically according to the number of participating institutes and the expected number of trainees enrolled in each certification cycle. Six institutes were included, with approximately 30 trainees per institute, producing a total sample of 180 trainees. This sample was considered adequate for estimating implementation outcomes such as adoption, feasibility, acceptability, fidelity, and short-term maintenance across multiple training clusters. Because the study used a cluster-based design, the sample size should be interpreted in relation to both the number of trainees and the number of clusters. For inferential effectiveness testing, the limited number of clusters may reduce statistical power and precision. Therefore, findings from group comparisons should be interpreted cautiously and supported by cluster-adjusted analysis where possible.

Data were analyzed using descriptive and comparative statistical methods. Participant and institute characteristics were summarized using frequencies and percentages for categorical variables and means with standard deviations or medians with interquartile ranges for continuous variables, depending on distribution. Implementation outcomes were summarized as proportions, percentages, and mean scores where applicable. Adoption was calculated as the proportion of enrolled intervention trainees completing the program. Fidelity was calculated as the proportion of planned training components delivered as intended. Acceptability and feasibility were summarized from trainee and trainer feedback. Competency scores were compared between groups across baseline, post-training, 3-month follow-up, and 6-month follow-up. Patient-related outcomes were compared descriptively between intervention and comparison groups. Where inferential testing was performed, continuous outcomes were compared using appropriate parametric or non-parametric tests, and categorical outcomes were compared using chi-square or Fisher's exact tests. Because the design involved clustering by institute and repeated assessments over time, the preferred analytic approach for revised analysis is mixed-effects regression or generalized estimating equations, with study group, time, and group-by-time interaction as fixed effects and institute as a clustering variable. For binary or count-based patient safety outcomes, generalized mixed models with appropriate link functions should be used. Stratified analyses were conducted by experience level, education level, and intended work setting to explore variation in training response across participant subgroups.

Ethical and governance procedures were applied to protect trainee and patient-related data. Participation required voluntary agreement from trainees, and trainee-level data were handled confidentially. Patient-related outcomes were collected in aggregate or de-identified form during field-placement or supervised care exposure to protect privacy. Data were stored securely and accessed only by the research team. The manuscript should include the name of the ethics committee or institutional review board, approval number, approval date, consent procedure, and whether patient-level consent or a waiver of consent was obtained for use of de-identified patient outcome data. Funding, conflicts of interest, protocol availability, and data availability should also be reported in the final manuscript to meet transparency expectations for implementation research.

RESULTS

A total of 180 home health aide trainees were enrolled from six healthcare training institutes, with three institutes assigned to the competency-based training intervention and three institutes continuing traditional training as comparison clusters. Of the total sample, 92 trainees were included in the intervention group and 88 trainees were included in the comparison group. Completion of the assigned training program was higher in the intervention group, where 86 of 92 trainees completed the full competency-based program, corresponding to an adoption/completion rate of 93.4%. In the comparison group, 72 of 88 trainees completed traditional training, corresponding to a completion rate of 81.8%. Baseline characteristics were reported as broadly comparable between groups in terms of age, education, and prior caregiving experience; however, detailed baseline distributions, p-values, and cluster-level characteristics were not available in the manuscript and therefore are not presented here. Approximately 54% of participants had less than six months of caregiving experience, while the remaining participants had more than two years of prior caregiving exposure.

Table 1. Participant Flow and Training Completion

Indicator	Intervention Group	Comparison Group
Number of institutes/clusters	3	3
Trainees enrolled	92	88
Trainees completing assigned training	86	72
Completion/adoption rate	93.4%	81.8%
Trainees not completing assigned training	6	16
Non-completion rate	6.6%	18.2%

Table 1 shows that the competency-based training framework achieved a higher completion rate than the traditional training model. The absolute difference in completion was 11.6 percentage points in favor of the intervention group. This finding supports stronger adoption of the competency-based model among enrolled trainees, although reasons for non-completion and cluster-level variation were not reported. Because completion was measured at the trainee level within clustered institutes, future reporting should include institute-wise completion rates and reasons for attrition to clarify whether adoption was consistent across all intervention sites.

Implementation outcomes were favorable across the competency-based training institutes. Feasibility was described as acceptable by trainers, who reported that the program could be delivered within existing training schedules. Acceptability was also high, with 87% of trainees reporting that the competency-based training felt more useful than traditional methods. Fidelity monitoring showed that 91% of planned sessions were delivered according to the intended structure. The intervention group also demonstrated high adoption, reflected by the 93.4% program completion rate. Sustainability was evaluated indirectly through skill-retention scores at 3 and 6 months after training completion.

Table 2. Implementation Outcomes of the Competency-Based Training Framework

Implementation Outcome	Reported Indicator	Result
Adoption	Intervention trainees completing full program	86/92, 93.4%
Feasibility	Trainer-reported ability to deliver program within existing schedules	Reported as feasible
Acceptability	Trainees reporting the program was more useful than traditional training	87%
Fidelity	Planned sessions delivered according to structure	91%
Maintenance/sustainability	Skill retention at 3 and 6 months	Maintained above comparison group
Digital-tool implementation	Initial difficulty with digital logs	Improved over time
Cost of delivery	Average training cost per caregiver	USD 420
Estimated economic impact	Estimated annual cost reduction per patient	USD 950

Table 2 summarizes the implementation outcomes. Adoption was high, with 93.4% of intervention trainees completing the full program. Acceptability was also favorable, as 87% of trainees considered the competency-based model more useful than traditional training. Fidelity was reported at 91%, suggesting that most planned training components were delivered as intended. However, the manuscript does not provide denominators for fidelity monitoring, details of the fidelity checklist, site-wise fidelity variation, or predefined feasibility and acceptability thresholds. Therefore, these findings should be interpreted as encouraging but incompletely specified implementation indicators. The cost findings suggest that the program required an average investment of USD 420 per caregiver and was associated with an estimated USD 950 annual cost reduction per patient, but the manuscript does not provide the cost perspective, time horizon, costing assumptions, or sensitivity analysis. For this reason, the economic component is best described as a basic cost-offset estimate rather than a formal cost-effectiveness analysis.

Caregiver competency improved more substantially in the intervention group than in the comparison group. At baseline, competency scores were similar between groups, with a mean score of 58.2 in the intervention group and 59.1 in the comparison group. Immediately after training, the intervention group improved to 84.6, while the comparison group improved to 68.3. At 3-month follow-up, the intervention group maintained a mean score of 81.2 compared with 65.1 in the comparison group. At 6-month follow-up, the intervention group maintained a score of 78.9 compared with 63.4 in the comparison group.

Table 3. Caregiver Competency Scores Over Time

Assessment Time Point	Intervention Group Mean Score	Comparison Group Mean Score	Between-Group Difference
Baseline	58.2	59.1	-0.9
Post-training	84.6	68.3	16.3
3-month follow-up	81.2	65.1	16.1
6-month follow-up	78.9	63.4	15.5
Change from baseline to post-training	+26.4	+9.2	—
Change from baseline to 6 months	+20.7	+4.3	—

Table 3 demonstrates a clear and sustained pattern of competency improvement in the intervention group. The intervention group improved by 26.4 points from baseline to post-training, compared with a 9.2-point improvement in the comparison group. Although scores declined slightly after training, the intervention group retained most of the improvement at both follow-up points. By 6 months, the intervention group remained 20.7 points above baseline, while the comparison group was only 4.3 points above baseline. The between-group difference was 16.3 points immediately after training, 16.1 points at 3 months, and 15.5 points at 6 months, indicating sustained separation between groups. Standard deviations, confidence intervals, p-values, effect sizes, and cluster-adjusted estimates were not available in the manuscript; therefore, statistical significance cannot be claimed from the currently reported data.

Patient-related outcomes also favored the intervention group after training. Patient satisfaction was higher in the intervention group at 88.5% compared with 74.2% in the comparison group. Infection incidence was lower in the intervention group at 6.8% compared with 11.9% in the comparison group.

Medication errors were reported at 4.1 per 100 cases in the intervention group and 9.3 per 100 cases in the comparison group. Fall rates were 5.7 per 100 patients in the intervention group and 10.6 per 100 patients in the comparison group. Hospital readmission was reported at 12.3% in the intervention group and 18.8% in the comparison group. Mean SF-36 quality-of-life score was 72.4 in the intervention group and 61.7 in the comparison group.

Table 4. Patient-Related Outcomes After Training

Outcome Indicator	Intervention Group	Comparison Group	Absolute Difference
Patient satisfaction	88.5%	74.2%	+14.3 percentage points
Infection incidence	6.8%	11.9%	-5.1 percentage points
Medication errors	4.1 per 100 cases	9.3 per 100 cases	-5.2 per 100 cases
Fall rate	5.7 per 100 patients	10.6 per 100 patients	-4.9 per 100 patients
Hospital readmission rate	12.3%	18.8%	-6.5 percentage points
Quality of life score, SF-36	72.4	61.7	+10.7 points

Table 4 shows that patient-related outcomes were consistently more favorable in the intervention group. Patient satisfaction was 14.3 percentage points higher among patients exposed to intervention-trained aides. Safety-related indicators were lower in the intervention group, including infection incidence by 5.1 percentage points, medication errors by 5.2 per 100 cases, fall rate by 4.9 per 100 patients, and hospital readmission by 6.5 percentage points. SF-36 quality-of-life score was 10.7 points higher in the intervention group. These findings suggest clinically and operationally meaningful differences in patient-facing outcomes. However, denominators, observation periods, case-mix characteristics, standard deviations, p-values, confidence intervals, and adjusted analyses were not provided. Therefore, these results should be presented as descriptive patient-safety and service-outcome indicators rather than definitive causal effects. Skill retention was assessed immediately after training and again at 3 and 6 months. The intervention group showed a gradual decline from 84.6 post-training to 81.2 at 3 months and 78.9 at 6 months. The comparison group showed a smaller post-training improvement and also declined over time, from 68.3 post-training to 65.1 at 3 months and 63.4 at 6 months.

Table 5. Skill Retention After Training

Time Point	Intervention Group Score	Change From Post-Training	Comparison Group Score	Change From Post-Training
Post-training	84.6	Reference	68.3	Reference
3-month follow-up	81.2	-3.4	65.1	-3.2
6-month follow-up	78.9	-5.7	63.4	-4.9

Table 5 indicates that both groups experienced some decline in performance after the immediate post-training assessment, but the intervention group maintained substantially higher scores throughout follow-up. The intervention group declined by 3.4 points at 3 months and 5.7 points at 6 months from its post-training score, while the comparison group declined by 3.2 and 4.9 points, respectively. Although the magnitude of post-training decline was similar across groups, the intervention group retained a much higher absolute level of competency at every assessment point. This pattern suggests that the competency-based framework produced greater initial skill acquisition and maintained higher performance over time, although formal repeated-measures analysis is needed to confirm the statistical robustness of this finding. Stratified findings were reported narratively. Trainees with less than six months of prior caregiving experience showed the greatest improvement, suggesting that the framework may be particularly useful for early-career trainees. Participants with higher educational levels adapted more quickly to digital tools and checklists. Rural trainees showed slightly lower initial scores but improved steadily and nearly matched urban trainees by 6 months.

Table 6. Reported Stratified Patterns

Stratification Variable	Reported Pattern	Interpretation
Prior caregiving experience	Trainees with less than 6 months of experience showed the greatest improvement	The framework may be especially beneficial for early-career trainees

Stratification Variable	Reported Pattern	Interpretation
Education level	Participants with higher education adapted faster to digital tools and checklists	Digital orientation may need strengthening for trainees with lower educational exposure
Rural versus urban work setting	Rural trainees started with slightly lower scores but improved steadily and nearly matched urban trainees by 6 months	The framework may be adaptable across settings, but rural trainees may need additional early support

Table 6 summarizes the available subgroup findings. These patterns suggest that the intervention may have differential uptake and learning effects across experience, education, and work-setting categories. The strongest reported benefit was among less experienced trainees, which is consistent with the purpose of a structured competency-building model. However, the manuscript does not provide subgroup sample sizes, exact scores, standard deviations, p-values, or interaction tests. These findings should therefore be interpreted as exploratory and hypothesis-generating rather than confirmatory.

The cost component indicated an average training cost of approximately USD 420 per caregiver, including trainer fees, materials, simulation resources, and trainee time. The intervention was associated with an estimated annual cost reduction of approximately USD 950 per patient, attributed to fewer medication errors, reduced hospital readmissions, and lower complication rates.

Table 7. Cost and Cost-Offset Indicators

Cost Indicator	Reported Value
Average training cost per caregiver	USD 420
Estimated annual cost reduction per patient	USD 950
Main sources of estimated savings	Reduced Readmissions, fewer medication errors, fewer complications

Table 7 shows that the competency-based training framework required upfront investment but was associated with estimated downstream savings. The reported difference between delivery cost and estimated patient-level annual savings suggests potential economic value. However, because the manuscript does not report a formal economic perspective, costing year, analytic horizon, incremental cost-effectiveness ratio, uncertainty interval, or sensitivity analysis, this finding should not be described as definitive cost-effectiveness. It is more accurate to state that the framework showed a favorable preliminary cost-offset profile.

Overall, the results suggest that the competency-based training framework was feasible to deliver, acceptable to trainees, adopted by most participants, and delivered with high reported fidelity. The intervention group showed larger competency gains than the comparison group, maintained higher scores over 6 months, and demonstrated more favorable patient-related indicators across satisfaction, infection incidence, medication errors, falls, readmissions, and SF-36 quality-of-life scores. The findings are promising for implementation in home health aide training institutes; however, the absence of cluster-adjusted statistical testing, standard deviations, confidence intervals, p-values, subgroup denominators, and detailed fidelity and cost methods limits the strength of causal interpretation.

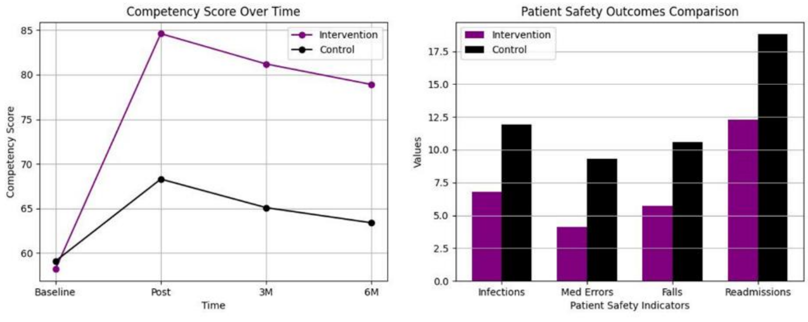

Figure 1. Competency scores over time and patient safety outcomes following competency-based training. The left panel shows mean caregiver competency scores at baseline, immediately after training, 3 months, and 6 months in the intervention and control groups. The right panel compares post-training patient safety and service-utilization indicators between groups, including infections, medication errors, falls, and readmissions.

The intervention group showed a marked improvement in competency scores from baseline to post-training, followed by a slight decline at 3 and 6 months, but scores remained consistently higher than the control group throughout follow-up. In contrast, the control group showed only modest improvement after traditional training and a gradual decline over time. Patient safety indicators also favored the intervention group, with lower reported infections, medication errors, falls, and readmissions compared with the control group. Together, these findings suggest that the competency-based training framework was associated with stronger caregiver skill acquisition, better short-term skill retention, and more favorable patient safety outcomes than traditional training.

DISCUSSION

The present cluster-based hybrid effectiveness–implementation study evaluated the implementation of a structured competency-based training framework for home health aide trainees across selected healthcare training institutes. The principal finding was that the framework was feasible to deliver, acceptable to trainees, adopted by a high proportion of participants, and delivered with high reported fidelity. In addition to these implementation outcomes, the intervention group showed larger improvements in caregiver competency than the comparison group, and these gains were largely maintained at 3-month and 6-month follow-up. Patient-related indicators, including satisfaction, infection incidence, medication errors, fall rates, hospital readmissions, and SF-36 quality-of-life scores, were also more favorable in the intervention group. These findings suggest that a competency-based training model may be a practical and potentially scalable approach for strengthening home health aide preparation in community-based care settings, although the results should be interpreted cautiously because cluster-adjusted inferential statistics, confidence intervals, and complete denominator reporting were not available in the current dataset.

The implementation findings are particularly important because the study addressed not only whether trainees improved after training but also whether the training framework could be delivered within real training environments. The high adoption rate, reflected by completion of the competency-based program among 86 of 92 intervention trainees, indicates that the model was operationally manageable for most participants. Similarly, the reported fidelity of 91% suggests that most planned training components were delivered according to the intended structure. These findings are consistent with implementation science principles, which emphasize that interventions cannot be judged only by their intended effectiveness; they must also be assessed according to reach, adoption, delivery quality, feasibility, and maintenance in routine settings (3,4,12,13). In this study, the combination of structured competencies, direct observation, simulation-based practice, digital logs, and trainer feedback appears to have supported implementation across participating institutes.

The findings align well with the RE-AIM framework. Reach was demonstrated through inclusion of six healthcare training institutes and 180 trainees, although future reporting should clarify the number of eligible institutes and trainees approached to allow a more complete estimate of representativeness. Effectiveness was reflected in improved caregiver competency and more favorable patient-related indicators, but the absence of statistical precision limits conclusions about the magnitude and certainty of these effects. Adoption was high, as most intervention trainees completed the program. Implementation was supported by reported fidelity and use of standardized checklists and digital logs, although more detailed reporting of dose delivered, dose received, adaptations, and site-level variation is needed. Maintenance was suggested by retention of higher competency scores at 3 and 6 months, with the intervention group retaining most of its immediate post-training gain. This framework-based interpretation strengthens the manuscript by showing that the competency-based model was evaluated as a real-world implementation strategy rather than only as an educational intervention.

The improvement in caregiver competency is consistent with the theoretical basis of competency-based education, which emphasizes observable performance, repeated practice, feedback, and progression based on demonstrated ability rather than instructional exposure alone (6,7). The intervention group improved from a baseline competency score of 58.2 to 84.6 immediately after training and retained a score of 78.9 at 6 months, while the comparison group improved from 59.1 to 68.3 post-training and declined to 63.4 at 6 months. This pattern suggests that structured skill demonstration and feedback may support deeper learning and more durable performance than traditional lecture-based training. However, because standard deviations, confidence intervals, assessor reliability, and cluster-adjusted models were not reported, these findings should be described as descriptive evidence of sustained competency improvement rather than definitive proof of superiority.

The patient-related findings also support the practical relevance of the intervention. Compared with the comparison group, the intervention group had higher patient satisfaction, lower infection incidence, fewer medication errors, fewer falls, lower hospital readmission rates, and higher SF-36 quality-of-life scores. These outcomes are clinically meaningful because home health aides often support patients who are older, functionally limited, chronically ill, or at risk of preventable adverse events. Improved infection control, safer mobility assistance, better medication-related support, and more responsive communication may plausibly contribute to improved patient safety indicators. Previous evidence has linked structured training, patient-safety practices, and caregiver competence with better health service outcomes, including reduced infections, safer medication practices, and lower fall risk (19,20,26). Nevertheless, these patient-related findings should be interpreted as secondary service indicators rather than direct causal outcomes because the manuscript does not provide patient denominators, case-mix characteristics, observation periods, adjustment for clustering, or adjustment for potential confounding.

The implementation process also highlights several contextual issues that may influence future scale-up. The program was reported as feasible within existing institutional schedules, suggesting that the training model can be integrated into routine certification environments without major disruption. Trainee acceptability was favorable, with 87% reporting that the competency-based format was more useful than traditional training. This likely reflects the practical relevance of simulation, direct observation, and structured feedback for a workforce whose responsibilities are task-based and patient-facing. However, the initial difficulty with digital logs indicates that technology-supported implementation requires orientation, support, and possibly adaptation for trainees with lower digital literacy. The stratified findings also suggest that participants with higher educational levels adapted faster to digital tools, while rural trainees improved steadily after lower initial scores. These patterns indicate that scale-up should not use a rigid one-size-fits-all model; rather, implementation may require contextual tailoring while preserving core components such as competency levels, direct observation, simulation, checklists, and feedback.

The cost findings suggest a favorable preliminary economic signal. The average training cost was approximately USD 420 per caregiver, while the estimated annual cost reduction was approximately USD 950 per patient, attributed to reduced readmissions, medication errors, and complications. This suggests that investment in structured training may be offset by downstream improvements in care quality and reduced service utilization. However, the economic findings should be framed cautiously. The analysis does not provide a formal analytic perspective, costing year, time horizon, sensitivity analysis, incremental cost-effectiveness ratio, or uncertainty estimates. Therefore, it should be described as a basic cost-offset estimate rather than a formal cost-effectiveness analysis. Future studies should include a full economic evaluation alongside implementation outcomes to determine whether the framework provides value for agencies, training institutes, payers, and patients.

The study has several limitations that should be acknowledged clearly. First, the cluster allocation process was not fully described, and it remains unclear whether institutes were randomized, matched, or assigned purposively. This limits causal inference and may introduce selection bias at the institutional level. Second, the small number of clusters limits statistical power and restricts the ability to account for between-institute variation. Third, the reported statistical analysis did not include cluster-adjusted or repeated-measures models, even though participants were nested within institutes and assessed across multiple time points. Fourth, competency scoring relied on observation checklists, but the manuscript does not provide the checklist score range, assessor training procedures, blinding status, or inter-rater reliability. Fifth, patient outcome reporting lacked denominators, observation periods, case-mix adjustment, and verification procedures. Sixth, implementation outcomes such as feasibility, acceptability, fidelity, and sustainability were reported descriptively, but their measurement instruments, thresholds, and site-level variation were not fully specified. Seventh, follow-up was limited to 6 months, which provides only early evidence of maintenance and does not establish long-term sustainability. Finally, because the study was conducted in selected training institutes in the United States, generalizability to other states, agencies, regulatory environments, or international home-care systems may be limited.

Despite these limitations, the study contributes useful preliminary evidence for implementation of competency-based training in home health aide education. Its main strength is the integration of implementation outcomes with caregiver competency and patient-related indicators, which allows a broader assessment of real-world training value. The use of a cluster-based design, structured competency levels, direct observation scoring, simulation, digital logs, and follow-up assessments strengthens the practical relevance of the work. Future research should build on these findings through larger pragmatic cluster trials or stepped-wedge implementation studies with clear allocation procedures, cluster-adjusted analysis, standardized fidelity tools, complete denominator reporting, longer follow-up, mixed-methods process evaluation, and formal economic evaluation. Stakeholder co-design involving trainees, trainers, home-care agencies, patients, and family caregivers may also improve acceptability, contextual fit, and long-term sustainability.

CONCLUSION

The competency-based training framework for home health aide trainees was feasible to deliver across participating training institutes, acceptable to most trainees, adopted by a high proportion of participants, and delivered with high reported fidelity. The intervention group showed greater descriptive improvement in caregiver competency than the comparison group, and higher competency scores were maintained at 3 and 6 months, suggesting favorable early maintenance of skills. Secondary patient-related indicators, including satisfaction, infection incidence, medication errors, fall rates, readmissions, and SF-36 quality-of-life scores, were also more favorable in the intervention group, although these findings should be interpreted cautiously because complete denominators, confidence intervals, p-values, and cluster-adjusted analyses were not available. The preliminary cost-offset estimate suggests potential economic value, but formal cost-effectiveness evaluation is still needed. Overall, the findings support further refinement, framework-guided implementation, and larger pragmatic evaluation of competency-based training as a strategy to strengthen home health aide preparation and improve the quality and safety of home-based care.

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