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Training Non-Nursing Staff to Assist with Nutritional Care Delivery in Nursing Homes: A Cost-Effectiveness Analysis

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Author Contributions:

Dr. Sandra F. Simmons served as the Principal Investigator on the NIA-funded study so she led all aspects of this study from concept and design, oversight of data collection and analyses and preparation of this manuscript.

Dr. Heidi Silver was a Co-investigator on the study; and, her Nutrition Lab analyzed all of the nutrient intake data.

Drs. Matt Shotwell and Xulei Liu were biostatisticians responsible for several of the analyses and corresponding write-up of analysis section and results tables.

Drs. Emmett Keeler and Ruopeng An conducted the cost-effectiveness analysis, and prepared this section of the manuscript and related Figures.

Emily Hollingsworth served as the Project Coordinator of the study, organized all data collection tasks, provided oversight on data entry, data cleaning procedures; while, Emily Long prepared study databases for the biostatistics and cost-effectiveness analyses and also created results Tables.

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Abstract

Objectives—A Centers for Medicare and Medicaid Services (CMS) regulation allows nursing homes (NHs) to train non-nursing staff to provide feeding assistance. The purpose of this randomized, controlled trial was to determine the impact and cost-effectiveness of training non-nursing staff to provide feeding assistance for nutritionally at risk residents.

Design—Randomized, controlled trial.

Setting and Participants—One-hundred-twenty-two long-stay NH residents with an order for caloric supplementation were recruited from five community NHs.

Intervention—Research staff provided an 8-hour training curriculum to non-nursing staff. Trained staff were assigned to between-meal supplement or snack delivery for the intervention group; while, the control group received usual care.

Measurements—Research staff used standardized observations and weighed intake methods to measure frequency of between-meal delivery, staff assistance time and residents' caloric intake.

Results—A total of 50 staff (mean = 10 per site) completed training. The intervention had a significant effect on between-meal caloric intake ($F = 56.29$, $P < .001$) with the intervention group consuming, on average, 163.33 (95% CI = [120.19, 206.47]) calories per person/day more than the usual care control group. The intervention costs were \$1.27/person/day higher than usual care ($P < .001$). The incremental cost-effectiveness ratio for the intervention was 134 kcals/per dollar. The increase in cost was due to the higher frequency and number of snack items given per person/day and the associated staff time to provide assistance.

Conclusion—It is cost-effective to train non-nursing staff to provide caloric supplementation and this practice has a positive impact on residents' between-meal intake.

Keywords

feeding assistant regulation; staff training; unintentional weight loss; long term care

Introduction

Inadequate food and fluid intake and associated unintentional weight loss continue to be prevalent among nursing home (NH) residents ^{1,2}, despite multiple intervention studies which demonstrate that behavioral interventions are efficacious in improving dietary intake and/or body weight when administered by dedicated research staff ³⁻⁷. Specifically, improvements in mealtime assistance, as provided by research staff, have been shown to increase caloric intake during meals among 40% to 50% of long-stay NH residents with inadequate intake ^{5,8,9}. Similarly, improvements in the delivery of oral liquid nutrition supplements and/or snacks between meals, as provided by research staff, have been shown to increase total daily caloric intake among as much as 80% of NH residents, including those who do not otherwise increase their intake in response to mealtime assistance ^{5-7,9}. Unfortunately, these intervention studies also have revealed that efficacious mealtime assistance and between-meal caloric supplementation require significantly more time relative to routine NH care practices during and between-meals, which are typically the responsibility of nurse aide staff.

Specifically, optimal mealtime assistance requires an average of 35 minutes or more per person per meal ^{5,8,9}. Similarly, achieving additional caloric intake between meals (e.g., from snacks and/or supplements) requires an average of 10 to 15 minutes per person per offer ^{5-7,9}. In contrast, studies have shown that residents in need of mealtime assistance actually receive an average of less than 10 minutes per person/meal from nurse aide staff as part of usual care practice ^{5,8-10}; and, those with an order for caloric supplementation three times daily between meals receive, on average, only one between-meal supplement offer per day with less than two minutes of nurse aide staff assistance to promote consumption ^{5-7,9,11}. Together, these studies suggest that the time required for optimal mealtime assistance and/or caloric supplementation between meals represents a significant barrier to implementing these interventions in daily NH care practice. Other studies have shown that both nurse aide and overall staffing levels (nurse aides + licensed nurses) are significantly associated with NH care quality, including the quality of feeding assistance care and the prevalence of unintentional weight loss ¹²⁻¹⁵.

In response to this evidence, the Centers for Medicare and Medicaid Services (CMS) issued a federal regulation in 2003 that allows NHs to train non-nursing staff or community volunteers to assist with feeding during and/or between meals if they complete a federally-required eight-hour curriculum ¹⁶. Although almost all states nationwide now allow this practice, few studies have directly examined the impact of training non-nursing staff to provide food and beverage assistance ¹⁷⁻²⁰; and none, to our knowledge, have examined the cost-effectiveness of this approach. The purpose of this randomized, controlled trial was to determine the impact and cost-effectiveness of training non-nursing staff to assist with nutritional care between meals for long-stay residents with an order for caloric supplementation. The following research questions were addressed:

1. How many and what type(s) of NH staff will be willing to complete the required eight-hour training curriculum related to nutritional care?

2. What is the impact of trained staff on the frequency of supplement and snack delivery between-meals for residents with an order for caloric supplementation?
3. What is the impact of trained staff on residents' between-meal and total caloric intake?
4. What is the cost-effectiveness of training non-nursing staff to provide nutritional care based on staff time per episode of care and residents' caloric intake?

Methods

Setting and Recruitment

Participants were recruited from five community NHs, four of which were for-profit, which housed a total of 507 residents (average occupancy rate = 79%). Total staffing (licensed nurses and nurse aides) ranged from 1.70 to 3.85 and nurse aide staffing ranged from 0.97 to 2.37 hours per resident per day. Both total and nurse aide staffing in the participating NHs were below the national averages of 4.14 and 2.47, respectively, based on publicly-reported federal data at the time of the study²¹. (www.medicare.gov/nursinghomecompare).

Figure one shows the flow of participants through the study. A total of 228 residents met inclusion criteria, which required residents to be long-stay (non-Medicare), capable of oral food and beverage intake (no enteral or parental nutrition support) but with no history of aspiration (per the federal regulation and clinical discretion of the facility Director-of-Nursing and/or Speech Therapist), not receiving hospice care, and not on a planned weight loss regimen at the time of the study. In addition, eligible residents also were required to have an order for caloric supplementation (oral liquid nutrition supplements and/or between-meal snacks).

Written consent was obtained from the resident or their responsible party for 148 (65%) eligible residents. Study procedures were approved by the university-affiliated Institutional Review Board. Following consent, 20 participants were lost from the study due to death (n=10), discontinuation of the caloric supplementation order (n=5), transfer out of the facility (n=3), transfer to hospice (n=1), or insertion of a feeding tube (n=1). The remaining 128 participants completed baseline assessments and were randomized into the usual care control group (n=65) or the intervention group (n=63) using a computerized random numbers table. Following randomization, an additional 34 participants were lost from the study (Figure 1). The remaining 94 participants completed all 24 intervention weeks. However, a total of 122 participants, who were randomized and completed at least one month of intervention, comprised the sample for the primary intent-to-treat data analysis (Figure 1 and Data Analysis section).

Measures

To describe the study sample, demographic information (i.e., age, sex, ethnicity, length of NH residency) was retrieved from each participant's medical record along with medical diagnoses (i.e., dementia, depression, dysphagia), prescribed medications and diet orders using a standardized form. Each participant's need for assistance with eating was retrieved from their most recent Minimum Data Set (MDS) assessment (section G. item 1h) which is

scored 0 (completely independent) to 4 (completely dependent). Recent weight loss history also was retrieved from the MDS (section K, item 3a) and defined as equal to or greater than 5% of body weight in the last 30 days or 10% in the last 180 days²². Research staff assessed participants' cognitive status using the Mini-Mental State Exam (MMSE), a standardized, performance-based assessment with scores ranging from 0 (severely impaired or comatose) to 30 (cognitively intact)²³.

Body Weight

Body weight was assessed by research staff at baseline and monthly throughout the 24-week intervention using a standardized protocol^{5,7,24}. This protocol required research staff to weigh participants in the morning, prior to breakfast but following incontinence care, while the resident wore clean bed clothes using the facility scale calibrated to zero. Body weight assessments were used to calculate body mass index (BMI) and estimate daily caloric requirements (Refer to Table 1 footnotes for formulas) for each participant. A BMI value less than 21 was considered indicative of nutrition risk²⁵. Monthly weight values also were used to determine weight changes from baseline to post intervention. The last available monthly weight value was used as the resident's final weight for those lost from the study.

Oral Food and Beverage Intake

Food, beverage and liquid supplement intake was measured for each participant based on standardized observations and weighed intake methods determined reliable and valid in prior studies^{5,7,26–29}. Research staff observed all three scheduled meals and between-meal periods (morning, afternoon and evening) on two week days within the same week for a total of six meal and six between-meal observations per participant at baseline and monthly post intervention. Each observation period lasted from the time of meal, snack or supplement delivery to the time items were removed by staff, which averaged 1.5 hours per period for both meals and between-meals. Research staff recorded the amount of NH staff time (i.e., nurse aides or trained staff) spent providing any type of assistance to promote consumption (e.g., set-up, verbal cueing, physical assistance) using a stop watch (to record minutes and seconds)^{5,7}. Assistance could be provided continuously throughout the entire meal or snack period or intermittently (i.e., interrupted by other care tasks). If intermittent, research staff recorded the start and end time(s) for each episode of assistance and summed all episodes for an individual resident meal or snack period to yield a total assistance time per person.

On the same two days as observations, research staff also weighed all foods, beverages and supplements provided during and between meals using a calibrated, digital scale. Specifically, individual items were weighed prior to being served and then again following consumption (± 0.1 g) outside the direct view of the resident. Intake data from the pre-post weights (± 0.1 g) were entered into the Nutrition Data System for Research software (NDS-R version 2008, Nutrition Coordinating Center, University of Minnesota, MN) for quantification of energy and nutrient intake.

Intervention Protocol: Staff Training

Training was provided jointly by the research team and the facility Staff Developer, who was a Registered Nurse, and facility Registered Dietitian. Upper-level management within each

site (Administrator, Director of Nursing, Staff Developer) was allowed to guide the recruitment efforts for staff to participate in training. Three facilities required participation from certain departments (e.g., housekeeping, nutrition services, social activities); whereas, the remaining two facilities asked for staff to volunteer for training.

Training activities followed the federal and state of Tennessee requirements, both of which required eight hours of content followed by a written or performance-based skills assessment¹⁶. A standardized, 13-item checklist (coded as present/absent for each item) was developed by this team for the purpose of the performance-based skills assessment, which was completed for each trainee until all (100%) items were achieved during a feeding assistance care delivery episode based on direct observations by research staff. The 13-items reflected specific components of the required training (e.g., wash their hands prior to offering foods or fluids) and also aligned with common dietary (e.g., offered items consistent with prescribed orders) and dignity (e.g., offered resident a choice of more than one option) federal regulations evaluated by surveyors, as defined by federally-cited deficiencies commonly known as F-tags.

Staff who participated in training were paid their usual hourly wage during the required eight-hours of training, which was scheduled during their routine work shifts (e.g., training activities were typically scheduled in 1–2 hour increments over several weeks). Upon completion of training and the performance evaluation, each trained staff was scheduled to provide assistance during at least one between-meal period per week, although trained staff also could be utilized during meals at the discretion of each site. The rationale for primarily utilizing trained staff between meals as part of this study was two-fold. First, prior studies have shown that most residents with inadequate intake will increase their caloric intake in response to supplement and/or snack delivery between meals^{5–7,9}. Secondly, this approach requires less time relative to mealtime assistance, which makes it more feasible to implement in daily care practice, in particular for staff with other primary job roles in the facility.

Intervention Protocol: Implementation 24 weeks

Participants randomized to the control group continued to receive routine care as it was usually provided by nurse aide staff. Participants randomized to the intervention group were assigned to trained staff for between-meal assistance following baseline assessments. Trained staff were asked to provide supplements and/or snacks twice per day (morning and afternoon), five week days per week, for 24 consecutive weeks. Trained staff were also encouraged to offer a variety of food (e.g., assorted flavors of puddings, applesauce, cheese and crackers, peanut butter and crackers), beverage (e.g., assorted juices) and supplement (e.g., both fluid and solid supplements) options in conjunction with assistance (e.g., opening containers, verbal cueing, physical help) to promote consumption. All items were provided by the facility kitchen. The following cost-relevant information was documented at baseline and monthly throughout the 24-week intervention: staff time (minutes and seconds) to provide supplements or snacks between meals and provide assistance to promote consumption, residents' refusal rates, and cost of snacks and supplements (per facility costs).

In addition, for the intervention group only, research staff also used the same 13-item skills assessment to monitor intervention implementation by trained staff. The goal of the data collection protocol was to randomly conduct four between-meal observations per resident (N=61) per week for each of the 24 study weeks, to yield a total of 96 possible observations per participant. However, the number of successfully completed observations varied weekly due to a between-meal snack not being offered during an observation period, resident factors (e.g., hospitalization, illness) and holidays during which research personnel was not present at the NH site. The intent of this protocol was to monitor the consistency with which trained staff provided between-meal nutritional care throughout the study period.

Data Analyses

All baseline characteristics (Table 1) were compared between participants who completed (N=94) and those lost from the study (N=54) using independent samples t-tests for continuous variables and Pearson's chi-square tests for categorical variables. Multivariate, repeated measures regression analyses were conducted to examine intervention effects on caloric intake and body weight, while controlling for the effects of selected covariates (i.e., baseline value, facility site, depression diagnosis, dementia diagnosis, age and sex). In preliminary analyses, there was no evidence of a time (month) effect on caloric intake or body weight. Thus, the effect of time was ignored in the final analyses. A compound symmetric variance-covariance structure was used to account for within-subject correlations among the monthly caloric intake and weight measurements. The effect of the intervention relative to the control was tested using multivariate Wald (F) tests and the empirical variance estimator. Wald 95% confidence intervals were computed for the corresponding effect estimates. The primary analysis was an intent-to-treat analysis for all randomized participants who also had at least one post-intervention measure for each outcome (Figure 1. N=122 of 128 Data Analysis). All analyses were performed in SAS for Windows version 9.4 (SAS Institute Inc., Cary, NC).

Cost-Effectiveness Analysis

The cost-effectiveness analysis used the monthly weighed intake data for between-meal and total daily caloric intake as the measures of effect. Increasing calorie intake is a therapeutic goal, but the specific dollar value of health improvements associated with increasing caloric intake is not known. Thus, the cost effectiveness analysis addressed the economically most efficient method of increasing calorie intake. The daily average incremental costs in dollars/cents and gains in caloric intake for the intervention group in comparison to the control group were calculated using weighted least squares (WLS) regression. The outcome variables were the average daily between-meal intake, total caloric intake, and between-meal costs per person during the 24-week intervention period. Daily between-meal costs were calculated as the sum of additional daily food, beverage and/or supplement costs between meals and associated labor costs for delivery and assistance. Labor cost was the product of staff time (minutes) per episode of care (supplement or snack delivery twice per day/person) and the average earning rate of Certified Nursing Assistants (CNAs), who typically provide supplement and snack delivery. In 2014, the Bureau of Labor Statistics estimate for the hourly rate of CNAs was \$12.62³⁰. Assuming a 10% fringe benefit rate, the hourly rate was adjusted up to \$13.88 per hour, or \$0.23 per minute.

The treatment variable in the WLS regression analyses was the dichotomous variable for intervention group membership with the usual care control group as the reference group. The regression analyses adjusted for the baseline values of the outcome measures (i.e., daily between-meal and total caloric intake and cost per episode of care) as well as other baseline characteristics including sex, age, ethnicity (non-Hispanic white versus minority), depression diagnosis, dementia diagnosis, and facility site.

The weight in the WLS analysis was the number of post-intervention months with non-missing values of the outcome measures, ranging from one to six. For instance, if a participant's caloric intake was recorded for the first five months post-intervention but missing for the last month, a weight of five was assigned. Thus, a larger weight was assigned to participants who remained in the study longer, whose average values should have smaller variance. Reasons for a missing caloric intake value were due to drop-out status (e.g., transferred out of facility or to hospice, death, feeding tube insertion, discontinuation of caloric supplementation order).

The uncertainty in the cost-effectiveness was determined using cost-effectiveness acceptability curves (CEAC), which is a method that builds on the net benefit (NB) approach^{31,32}. Given a monetary value (λ) of a one unit gain in caloric intake, the net benefit of the intervention was defined as: $NB = \lambda \times E - C$ where E is the effectiveness (i.e., gain in caloric intake) and C is the total intervention cost. To generate the CEAC, a distribution of costs and benefits was obtained by bootstrapping the trial data.³³ Participants were randomly selected with replacement keeping their own individual costs and caloric gains. A total of 1,000 pairs of mean caloric gains and costs were generated using bootstrapping for both groups, and the NB estimated for each pair as λ ranged from \$0 to \$0.1 in increments of \$0.005. The proportion of bootstrapped pairs with NB greater than zero is the probability the intervention was cost-effective conditional on the assumed monetary value of caloric gains. Those probabilities were subsequently plotted for every value of λ , producing the CEAC^{32,33}.

Results

Nursing Home Resident Participants

Table 1 shows the characteristics of the NH resident participants overall (N=122) and by group. Overall, participants were predominately female (80%) and non-Hispanic white (65%), with an average age of 83.6 ($\pm$ 10.4) and an average length of stay of 2.7 ($\pm$ 2.4) years. Fifty-four percent had a diagnosis of depression and 38% had a diagnosis of dysphagia. Participants had moderate to severe cognitive impairment as evidenced by an average MMSE score of 12 ($\pm$ 7.9) with 78% having a dementia diagnosis. Seventy percent had at least one routine medication with anorexic side effects^{34,35}.

The majority (70%) had an order for a modified diet, and most (91%) were rated by NH staff as requiring assistance to eat (i.e., supervision to total dependence). Twenty-six percent had a BMI indicative of being underweight at baseline, and 8% had MDS documentation of recent weight loss. Participants had an estimated daily energy requirement of approximately 1390 ($\pm$ 210) kcals per person/day (see Table 1 footnotes for formula)³⁶.

There were no significant differences between participants who completed (N=94) and those lost from the study (N=54) for any of the characteristics shown in Table 1. Despite randomization, the intervention group, by chance, was significantly older (86 vs 82, $t = -2.08$, $P = .040$) and had a lower proportion of participants with dysphagia (28% versus 48%, $\chi^2 = 5.03$, $P = .025$) and a higher proportion with a BMI value below 21 compared to the control group at baseline (36% versus 16%, $\chi^2 = 6.10$, $P = .014$). Related to BMI, the intervention group also had a significantly lower estimated daily energy requirement at baseline (1339 vs 1436 kcals, $t = 2.62$, $P = .010$).

Number and Type of Trained Staff

A total of 50 staff completed the training curriculum across all five sites (mean = 10, range 7 to 15 staff per site). Staff who completed training had a primary job role within the NH in the following departments (N): Housekeeping (15), Upper-Level Administration (12), Nutrition Services (10), Social Activities (5), outside community Volunteers (3), Nurse Managers (2), Maintenance (2) and Speech Therapy (1). With the exception of the three outside volunteers, staff who completed training represented full-time employees who primarily worked the day shift during week days (7am to 3pm). A total of 40 trained staff (80%) consistently provided supplements and/or snacks to participants between meals throughout the 24 study weeks. Of the remaining 10 trained staff, seven were no longer employed by the facility after 24 weeks.

Intervention Implementation – Intervention Group Only

Using the standardized, performance-based skills assessment 13-item form, research staff completed 4,876 between-meal observations (mean = 79.9 observations per resident of a possible total of 96 per resident) across all 24 study weeks for the intervention group to monitor implementation. Trained staff were observed to provide between-meal nutritional care delivery for intervention participants during 73.4% of these weekly observations overall. Across all observations, trained staff averaged a completion rate of 67.8% ($\pm 18.9\%$) across the 13 items.

Impact of Trained Staff on Frequency of Between-Meal Delivery and Staff Time

At baseline, the intervention and control groups received a comparable number of between-meal snacks (i.e., food, beverage or liquid supplements) per person per day (1.47 ± 0.55 versus 1.46 ± 0.53 , respectively), with beverages being the most common item given to residents (65.4%). This frequency of between-meal delivery occurred for both groups, despite having an order to receive between-meal items two to three times per day. Nurse aide staff spent an average of 1.53 (± 1.22) minutes per person per offer providing assistance when a between-meal item was given during baseline across all participants.

Following training, the frequency of between-meal delivery for the intervention group, who was assisted by trained staff, significantly increased to an average of 1.90 (± 0.29) per person/day; whereas, there was no change in the frequency of delivery for the control group (1.43 ± 0.29), who continued to be assisted by nurse aides. Specifically, the odds of receiving more than one daily between-meal snack was 8.88 times higher in the intervention group relative to the control group (CI = [5.60, 14.10], $P < .0001$). In other words, for a

typical resident, the likelihood of receiving more than one daily between-meal snack was 54% (CI=[40.9, 66.9]) for those in the control group, versus 91% (CI=[85.3, 95.0]) for those in the intervention group.

In addition to a higher frequency of offers, intervention participants also received food items more frequently between meals from trained staff relative to the control group (mean = 1.34 ± 0.74 per person/day versus 0.59 ± 0.49 , respectively; $t = -6.59$, $P < .001$); whereas, beverages and liquid supplements between meals remained comparable between the two groups. The intervention group also received significantly more assistance (CI = [34.47, 109.54], $P < .0001$) from trained staff to promote consumption (2.86 ± 1.87 minutes/person/offer) relative to the control group, who received assistance from nurse aide staff (1.62 ± 1.33 minutes/person/offer).

Impact of Trained Staff on Residents' Between Meal and Total Caloric Intake

The intervention had a significant effect on between-meal caloric intake ($F = 56.29$, $P < .001$) from baseline to each subsequent month of intervention relative to usual care (Figure 2). The between-meal intake of the intervention group was, on average, 163.33 (95% CI = [120.19, 206.47]) calories per person/day higher than that of the usual care control group. The observed increase in between-meal caloric intake occurred within the first month following staff training and was maintained over the six months of intervention (Figure 2).

Despite the significant increase in between-meal calories for the intervention group, total caloric intake (meals + between meals) did not change significantly (Figure 3). This was, in part, due to a lower meal intake for the intervention group at baseline relative to the control group, even with randomization (1183.83 ± 491.83 versus 1391.60 ± 449.36 , respectively) and, meal intake remained low for both groups throughout the 24-study weeks (i.e., both groups consistently consumed less than half of each served meal). Specifically, there was no change in meal intake for either group during the 24 study weeks. Thus, the significant increase in between-meal calories for the intervention group resulted in their total intake becoming more comparable to the usual care control group at each time point post intervention (Figure 3). As a reminder, baseline intake was included as a covariate in the analyses, which examined changes over time rather than final values (*Data Analysis*). The amount of assistance provided by nurse aide staff during meals also remained comparable for both groups from baseline to intervention, with an average of six to eight minutes per person/meal at all measurement points and all meals. Trained staff provided assistance during only a small proportion (7%) of observed meals, most often lunch, for both groups as mealtime assistance was not the focus of the intervention.

Impact of Trained Staff on Residents' Body Weight

There was not a significant effect of the intervention on participants' body weights from baseline to post intervention. The median weight change in the intervention group was 0.30 (Interquartile range [IQR] = 11.85) pounds across all 24 study weeks; while, the median weight change in the control group was -2.20 (IQR = 11.95) pounds. Thus, there was a trend for weight maintenance in the intervention group compared to weight loss in the usual care control group but significant variability in both groups.

Cost-Effectiveness Analysis

Table 2 shows the between-meal costs for the intervention group relative to the control group. Baseline between-meal costs were low across all participants due to infrequent delivery (1 per person/day) and minimal to no staff assistance to promote consumption (< 2 minutes per person/offer). The intervention costs were \$1.27/person/day higher than usual care ($P < .001$). The incremental cost-effectiveness ratio for the intervention was 134 kcals/per dollar. The increase in cost was due to the higher frequency and number of snack items consumed per person/day and the associated staff time to provide assistance. Specifically, the intervention group received an average of 3.10 (± 1.28) snack items per person/day whereas the control group received an average of 1.59 (± 0.84) items ($t = -7.71$, $P < .0001$).

The cost-effectiveness acceptability curve (CEAC) for the intervention relative to the control group is shown in Figure 4 for daily gains in between-meal caloric intake. The CEAC shows the probability the intervention is worthwhile (i.e. has a “net benefit”) as a function of the dollar value assigned to caloric gain. The “y” axis begins at “0” probability, indicating the intervention is worthwhile if each calorie gained is assigned a low value, and increases to “100%”, indicating the intervention is worthwhile if each calorie gained is assigned a high value. As the dollar value of caloric gain increases, the number of bootstrapped samples where the value of the gain is greater than the cost (a “net benefit”) also increases. As shown in Figure 4, the probability of a net benefit from the intervention increases rapidly with the value assigned to caloric gain. For example, given a 1 cent value per unit of caloric gain, the probability of a net benefit is 96.3% for the intervention; and, as the assigned value of caloric gain increases further, the probability of a net benefit quickly reaches 100%.

Discussion

This study examined the impact of training non-nursing staff to assist with between-meal supplements and snacks for NH residents who had orders for caloric supplementation. Results demonstrate that it is cost-effective for community NHs to train non-nursing staff to augment traditional nurse aide staff to ensure that nutritionally at-risk residents receive between-meal caloric supplementation more frequently. Although significantly higher than usual care provided by nurse aides, the amount of trained staff time spent providing assistance between meals likely remained inadequate for the intervention group, most of whom required some level of staff assistance to eat (supervision to total dependence). Prior studies have shown that research staff spent an average of 10–15 minutes per person/offer and achieved even higher between-meal caloric gains when offers were made consistently two to three times daily^{5–7,9}. In contrast, both trained staff and nurse aide staff in this study averaged less than five minutes per person per offer. Still, it is notable that even this rather modest increase in staff time resulted in significantly higher between-meal caloric intake for the intervention group.

Similar to prior studies^{5,8–10}, both groups also likely received inadequate assistance during meals (mean 6–8 minutes per person/meal), and the amount of mealtime assistance did not change for either group during intervention. Trained staff did help occasionally during regularly-scheduled meals but not often enough to have a significant impact on meal intake.

The continued inadequate intake during meals throughout the study contributed to the lack of an effect on total caloric intake and body weight.

Still, this type of training program may be the most cost-effective, feasible way for NHs to augment their existing nurse aide staffing to improve daily dietary intakes, especially for NHs with nurse aide staffing below the national average such as the participating sites in this study. In theory, this program has the capacity for a larger impact if trained staff consistently helped with feeding assistance both during and between meals every day of the week. However, similar to nurse aide staff, trained staff also had competing demands on their time due to their primary job role, which interfered with their availability and/or willingness to help multiple times per day every day per week. This inconsistency in delivery throughout the 24 study weeks also contributed to more muted intervention effects relative to prior randomized, controlled trials of feeding assistance wherein dedicated research staff provided between-meal and/or mealtime assistance^{5,7}. In one prior study, mealtime assistance provided by dedicated research staff required an average of 42 minutes per resident/meal and between-meal delivery required an average of 13 minutes per resident/snack to achieve daily caloric gains between 300 and 400 calories, which resulted in significant effects on body weight over 24 weeks⁵. The willingness of NHs to consistently implement or expand this type of program may increase due to the combined recognition of unintentional weight loss as both a quality indicator by CMS (www.medicare.gov/nursinghomecompare) and, more recently, as a safety indicator by the National Quality Forum³⁷.

This study has a few notable limitations. First, the overall attrition rate was high (36.5%), although consistent with prior studies of this duration in the long-term care setting.^{5,7,24} Second, given the differences between groups at baseline, a more sophisticated randomization procedure that involved multivariate matching to improve covariate balance for select variables would have been beneficial. Lastly, the cost-effectiveness analysis only considered costs in terms of food, fluid and supplement items given and staff time per episode of care. The initial eight hours required for training was not considered in the cost estimate because each participating site agreed to schedule training during routine work shifts and pay staff at their regular hourly wage. Still, it is important to acknowledge that training requires an initial time commitment as well as on-going management effort. Future studies should examine the potential for web-based training materials to be made freely available to NHs through state Quality Improvement Organizations to ease the burden of training on facility Staff Developers and support broader uptake of this type of program in daily NH care practice.

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Figure 1.
Study Participant Flow Diagram

Figure 2.
Between-Meal Caloric Intake by Group and Study Month

Figure 3.
Total Caloric Intake by Group and Study Month

Figure 4.
Cost-Effectiveness Acceptability Curve for the Intervention relative to Usual Care

Table 1

Participant Characteristics (N=122)

Measure	Overall N=122	Usual Care N=61	Intervention N=61
<i>Demographic Characteristics</i>	Percent (n) or Mean (± Standard Deviation)	Percent (n) or Mean (± Standard Deviation)	Percent (n) or Mean (± Standard Deviation)
Female	80.3 (98)	75.4 (46)	85.2 (52)
White	64.5 (78)	60.7 (37)	68.3 (41)
Age	83.6 (± 10.43)	81.7 (± 10.97)	85.6 (± 9.56)
Length of Stay Years	2.72 (± 2.39)	2.61 (± 2.22)	2.82 (± 2.55)
<i>Medical Characteristics</i>			
Depression Diagnosis	54.1 (66)	54.1 (33)	54.1 (33)
Dementia Diagnosis	77.9 (95)	83.6 (51)	72.1 (44)
Dysphagia Diagnosis	37.7 (46)	47.5 (29)	27.9 (17)
1 anorexic medications	70.5 (86)	75.4 (46)	65.6 (40)
MMSE Total Score (0–30) *	12.04 (± 7.92)	11.88 (± 8.56)	12.29 (± 7.31)
<i>Nutritional Characteristics</i>			
Special Diet Order †	69.7 (85)	73.8 (45)	65.6 (40)
Number of Days Order in Place	454.61 (± 549.33)	425.28 (± 527.28)	485.17 (± 576.37)
MDS – Eating Dependency Rating 1 ‡	91.0 (111)	86.9 (53)	95.2 (58)
MDS – Recent Weight Loss 5% in 30 days or 10% in 180 days	8.2 (10)	6.6 (4)	9.8 (6)
Body Mass Index (BMI) < 21 §	26.2 (32)	16.4 (10)	36.1 (22)
Estimated Daily Caloric Requirements (kcal)	1306.26 (± 284.95)	1365.15 (± 273.94)	1247.38 (± 285.75)

* MMSE = Mini Mental State Exam

† Special diets included any restrictions (no added salt, no concentrated sugars) or altered texture (ground, mechanical soft, puree, thickened liquids).

‡ Minimum Data Set (MDS) eating dependency ratings of the need for (1) staff supervision, (2) minimal, (3) extensive or (4) total assistance to eat.

§ Body Mass Index (BMI) formula = $0.454 \text{ weight in pounds} / (0.254 \text{ height in inches})^2$ Four participants had missing data for height; thus, BMI could not be calculated.|| kcal formula: Men = $\text{kg} \times 23$; Women = $\text{kg} \times 21$

Table 2

Average Between-Meal Costs Per Person Per Day and Group Difference (n=122)

Group	Baseline Mean (SD)	Intervention Mean (SD)	Adjusted Mean Difference (SE)
Usual Care (N = 61)	\$0.80 (\$0.87)	\$0.80 (\$0.90)	N/A
Intervention (N =61)	\$0.86 (\$0.64)	\$2.04 (\$0.88)	\$1.27 (\$0.13) **

**
P < .001.

SD: Standard Deviation; SE: Standard Error; Costs include both the cost of the between-meal items (foods, fluids and supplements) and labor costs for delivery and assistance.