Does an Exercise and Incontinence Intervention Save Healthcare Costs in a Nursing Home Population?

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OBJECTIVES: To determine whether an intervention that combines low-intensity exercise and incontinence care offsets some of its costs by reducing the incidence of selected health conditions in nursing home residents.

DESIGN: Randomized, controlled trial with the incidence and costs of selected, acute conditions compared between a 6-month baseline and an 8-month intervention phase.

SETTING: Four nursing homes.

PARTICIPANTS: One hundred ninety incontinent, long-stay nursing home residents.

INTERVENTION: Low-intensity, functionally oriented exercise and incontinence care were provided every 2 hours from 8:00 a.m. to 4:00 p.m. for 5 days a week for 8 months.

MEASUREMENTS: Predefined acute conditions hypothesized to be related to physical inactivity, incontinence, or immobility were abstracted from residents' medical records by blinded observers during a 6-month baseline period and throughout the 8-month intervention. Conditions included those in the dermatological, genitourinary, gastrointestinal, respiratory and cardiovascular systems; falls; pain; and psychiatric and nutritional disturbances. Costs were determined using Current Procedural Terminology Center and Medicare allowable cost reimbursement at a rate of 80%.

RESULTS: The intervention group had significantly better functional outcomes than the control group (strength, mobility endurance, urinary and fecal incontinence) and a reduction of 10% in the incidence of the acute conditions, which was not significant. There were no significant differences between groups in the cost of assessing and treating these acute conditions between baseline and intervention.

CONCLUSION: The intervention, which is consistent with federal and clinical practice guidelines, significantly improved functional outcomes but did not reduce the incidence and costs of selected acute health conditions. The cost of implementing these labor-intensive interventions for frail nursing home residents will have to be justified based on functional and quality-of-life outcomes and are unlikely to be offset by savings in medical care costs in this population. **J Am Geriatr Soc 51:161–168, 2003.**

Key words: costs; FIT exercise; health outcomes; incontinence

The rapid growth of the U.S. population living into extreme old age and concerns about the quality of care provided in many of this country's nursing homes (NHs) highlight the urgent need to test interventions that will improve outcomes for frail older people. Such interventions must be feasible and cost-effective in this setting and population. Impaired mobility and urinary incontinence are common comorbidities in NH residents.[1,2] These conditions are associated with physical inactivity and with numerous related health problems, including pressure ulcers, urinary and respiratory tract infections, falls, and constipation.[3–7] Immobility and incontinence are also significant risk factors for acute hospitalization and mortality in this population.[8] Federal rules recommend specific exercise and incontinence care interventions for these conditions in NHs.[9] Clinical practice guidelines also recommend mobility and incontinence interventions to prevent pressure ulcers,[10] and other guidelines for pain and nutrition recommend regular exercise as a key component of managing these conditions.[11,12] However, the rationale supporting these federal recommendations and clinical practice guidelines is based on correlational data and expert consensus. No prospective randomized clinical trials have evaluated whether improved exercise and incontinence care can prevent morbidity and related costs in NH residents.

Previous studies have demonstrated the feasibility and beneficial effects of a low-intensity, functionally oriented exercise program (Functional Incidental Training (FIT)) and incontinence care on several outcomes in NH residents, including continence, physical activity, and mobility

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endurance, but not on overall health.[13,14] Improved health outcomes are particularly important because FIT is labor intensive and most NHs cannot implement it without a substantial increase in staffing.[14,15] A randomized, controlled clinical trial of FIT was conducted that demonstrated that the intervention had significant positive effects on measures of upper body strength, urinary and fecal incontinence, physical activity, and mobility endurance.[14] An additional a priori hypothesis was that this intervention would decrease the incidence of selected acute conditions associated with low physical activity and incontinence and thereby offset its costs. This paper reports the effects of this intervention on selected health outcomes and related costs.

METHODS

Overview and Subject Recruitment

Subjects were recruited from one nonprofit and three proprietary NHs. Criteria for inclusion were incontinence of urine (as identified by NH staff and verified by checks for wetness) and free of a catheter, ability to follow a simple one-step instruction, and not being on Medicare Part A reimbursement for postacute skilled care or terminal illness. Research staff obtained consents directly from those residents who could provide consent and, for other eligible residents, from their designated representatives. In all cases, assent was obtained from the residents for their participation. Subjects were monitored for the occurrence of predefined acute conditions prospectively for up to a 6-month baseline period, and subjects were randomized within NHs by computerized programs into intervention and control groups. Trained research staff, not indigenous NH staff, conducted the intervention, which was maintained for 8 months. The University of California at Los Angeles Human Subjects Protection Committee approved the study.

Subject Characteristics

A structured review of medical records was performed for demographic data, functional status, past and current health conditions, and current medications and treatments. Research staff assessed cognitive status using the Mini-Mental State Examination (MMSE).[16] A study physician determined baseline medical comorbidity using the Cumulative Illness Rating Scale for Geriatrics (CIRS-G).[17] The CIRS-G is a clinician-rated scale of severity of disease (ranging from 0 = no problem to 4 = extremely severe) in each of 14 organ systems based on a detailed manual with specific scoring criteria. It has been validated for use in frail and institutionalized older people. Here the CIRS-G total score is reported as the sum of scores for all 14 organ systems. To assess reliability of the CIRS-G, two study physicians independently completed the scale in 47 subjects (interrater comparison of CIRS-G total score, Pearson correlation coefficient, $r = 0.71$, $P < .0001$).

The FIT Intervention

Research staff implemented the intervention 5 days a week, every 2 hours, between 8:00 a.m. and 4:00 p.m. for 8 months. During each episode of care, subjects were prompted to toilet and were changed if they were wet. Before or after this incontinence care, they were encouraged to walk or, if not ambulatory, to wheel their chairs and to repeat sit-to-stands up to eight times using the minimum level of human assistance necessary. During one trial per day, usually while the subject was in bed, upper body resistance training (arm curls or arm raises) was performed. Before and after each trial, subjects were offered fluids with a prompting protocol that significantly increased fluid intake.[18] Target goals for the exercise were set individually and adjusted on a weekly basis. Research staff independent of staff providing the intervention and blinded to group assignment completed standardized assessments of physical activity, incontinence, and functional status before the intervention and at 8 and 32 weeks postintervention for all subjects, including those randomized to the control group. The control group subjects received usual care from NH staff during the 32-week intervention period, and no changes were observed in their physical activity or other measures collected during the 8- and 32-week postintervention assessments, which would suggest that usual care practices did not change during the intervention.

Identification and Monitoring of Acute Conditions

Three project geriatricians identified acute conditions that were most likely to be sensitive to an intervention that addresses physical inactivity, incontinence, and immobility. Conditions were selected based on published literature or clinical experience and included the dermatological, genitourinary, gastrointestinal, respiratory, endocrine, neurological, and cardiovascular systems; falls; pain; and psychiatric and nutritional disturbances (see Table 2). Standardized criteria for the acute conditions were based on previous work and are available from the authors upon request.[19] To identify these conditions, trained research nurses and physicians blinded to group assignment reviewed subjects' records weekly throughout the 6-month baseline and 8-month intervention periods. Two raters, who independently reviewed 462 resident-weeks of data, determined reliability. There was 91% agreement between the raters in the detection of specific conditions (where agreement meant that both raters reported that a specific condition had occurred, with a kappa = 0.71, $P < .0001$).

Determination of Health Costs

For each condition, data were collected from the medical records to calculate the costs of diagnostic testing and treatment related to that episode that occurred in the NH. Treatment costs were included for the duration of the episode. Costs of tests and treatments were assigned based on 1997–98 Medicare and Medicaid reimbursement amounts. Diagnostic tests included laboratory tests, radiology tests, and physician and specialist visits and procedures. Costs were calculated by first assigning an appropriate Current Procedural Terminology (CPT) code for that test or procedure, then assigning a cost to each identified CPT-coded item based on the assumption that Medicare reimburses 80% of the regional Medicare Allowable Cost. Treatment costs included routine and as needed medications, nurse-administered treatments, rehabilitative and other therapies, and durable medical equipment. All medications were assigned the published average wholesale price in 1997–98 plus an additional fee per prescription based on common practice in the participating NHs. For rehabilitative thera-

pies, a base price per week was established using the average number of "units" (the method used to bill for these services). This base price was multiplied by 80% (the amount reimbursable by Medicare) and the number of weeks of treatment.

Data Analyses

An incidence rate for each acute condition was calculated by dividing the number of episodes by the total number of resident weeks monitored. All subjects who had at least 1 month of baseline data and began the intervention phase were included in this analysis. Because some subjects did not complete the full intervention period, the time interval for the detection of acute conditions varied and the incidence data are reported as the number of episodes per thousand resident-weeks monitored. Power analyses based on preliminary sickness data collected in one NH suggested that a 20% reduction in the selected acute conditions could be detected with the anticipated sample size that could be recruited and retained within the budgetary limitations of the clinical trial reported in this paper (power of 0.8, alpha 0.05, and two-tailed test). This 20% reduction was considered feasible to achieve because preliminary data suggested there would be a major effect on the incontinence and physical activity measures correlated with these acute conditions. Descriptive statistics were used for the cost of diagnosis and treatment for each acute condition. The analysis of differences between intervention and control groups was accomplished using negative binomial modeling for outcome variables expressed in the form of counts (episodes of the acute conditions) or logit models for outcomes more appropriately defined as binary variables. Differences between groups on cost variables were analyzed using inverse hyperbolic sine models, because this is the most appropriate modeling for skewed cost differences.[20]

Because the dependent variable in the cost model is the difference between standardized intervention period costs and baseline period costs, it can assume negative values, making a logarithmic or exponential transformation unfeasible. The inverse hyperbolic sine model is specifically designed for distributions where the dependent variable is heavy tailed and assumes negative and positive values and is therefore the most appropriate estimation methodology available. However, to ensure that these results were not sensitive to the estimation methodology, an ordinary least squares model was estimated. The estimates from the inverse hyperbolic sine model and the ordinary least squares model were not statistically different, and only the former model is reported in this paper.

RESULTS

Six hundred thirty-three residents occupied long-stay beds in the four participating NHs. Of these, 452 (69%) were initially identified as incontinent, and 330 (73%) of these incontinent residents met inclusion criteria. Informed consent was obtained from 257 (79%) of these 330 residents. Of the 257 consented subjects, 190 (74%) entered the intervention phase of the trial (98 control and 92 intervention). Reasons for attrition during baseline included transfers, death, or refusal to cooperate and withdrawal of consent. One hundred seventy-two (91%; 85 intervention and 87 control) completed the 8-week follow-up (incontinence, physical activity, and functional status) assessments, and 148 (77%; 74 intervention and 74 control) completed the 32-week assessments. Attrition after the baseline assessments was primarily due to death (28 subjects) or a prolonged illness that prevented the resident from participating in any component of the follow-up assessments. Table 1 presents selected descriptive data for the intervention and control groups. There were no significant differences between groups on any of these characteristics as determined by *t* tests for continuous variables and chi-square tests for categorical variables. There were no differences between intervention and control residents in mortality (14 residents per group died after baseline) or in the frequency of hospitalizations. The intervention group had 21 and 20 hospitalizations outside the NH during baseline and intervention, respectively, whereas the control group

Table 1. Selected Characteristics of Study Participants

Characteristic	Intervention Group (n = 92)	Control Group (n = 98)
Age, mean ± SD	87.3 ± 8.0	88.6 ± 6.7
Female, %	80	90
White, %	90	90
Length of stay in nursing home, years, mean ± SD	2.1 ± 2.6	2.4 ± 2.6
Number of diagnoses, mean ± SD	9.1 ± 4.1	10.0 ± 4.9
Number of routine medications, mean ± SD	7.3 ± 3.8	7.5 ± 4.5
Number of as needed (prn) medications, mean ± SD	2.8 ± 1.9	2.9 ± 1.8
Cumulative Illness Rating Scale score, mean ± SD*	19.7 ± 6.4	19.6 ± 5.3
Attrition due to death, %	10	10
Attrition due to illness, %	10	2
Mini-Mental State Examination score, mean ± SD†	12 ± 8	14 ± 7

Note: There were no significant differences between groups.

*The total score is the sum of severity scores, ranging from 0 = no problems to 4 = extremely severe, for 14 organ systems. Total possible score ranges from 0 to 56.

†Total possible score range is 0 to 30.

SD = standard deviation.

Table 2. Acute Conditions in the Control and Intervention Groups at Baseline and Follow-Up

	Control Group (n = 98)						Intervention Group (n = 92)						
	Baseline			Follow-Up			Baseline			Follow-Up			
	Residents	Episodes		Residents	Episodes		Residents	Episodes		Residents	Episodes		
Condition	n		Incidence*	n		Incidence*	n		Incidence*	n		Incidence*	*P*-value
Dermatological													.91
Skin irritation	50	125	46	54	78	36	42	97	38	45	73	36	
Pressure ulcer													
Stage I	14	21	8	12	26	12	11	14	5	10	16	8	
Stage II	22	31	12	15	25	11	21	34	13	13	19	9	
Stage II	2	2	1	2	3	1	2	2	1	2	2	1	
Stage IV			0	1	1	1	2	2	1	0	0	0	
Respiratory													.42
Pneumonia	14	17	6	16	20	9	10	13	5	7	8	4	
Acute bronchitis	10	12	4	9	12	6	8	9	4	9	10	5	
Gastrointestinal													.43
Constipation/fecal impaction	26	37	14	20	25	11	27	42	16	17	21	10	
Musculoskeletal													.88
Pain	41	58	22	26	40	18	40	52	20	26	33	16	
Falls and injuries													.40
Any fall	22	39	14	29	45	21	19	29	11	17	26	13	
Fall with skin injury	14	18	7	13	16	7	5	5	2	7	8	4	
Fall with bone fracture	2	3	1	1	2	1	3	3	1	4	4	2	
Other injury	4	4	2	3	3	1	1	1	0	1	1	1	
Fall without injury	9	14	5	18	24	11	13	20	8	9	13	6	

(continued)

Table 2. (Continued)

	Control Group (n = 98)						Intervention Group (n = 92)						
	Baseline			Follow-Up			Baseline			Follow-Up			
	Residents	Episodes		Residents	Episodes		Residents	Episodes		Residents	Episodes		
Condition	n		Incidence*	n		Incidence*	n		Incidence*	n		Incidence*	*P*-value
Psychiatric													.68
Any condition	32	45	17	17	24	11	34	43	17	12	18	9	
Depression	22	24	9	10	10	5	18	20	8	4	4	2	
Psychosis	6	10	4	6	8	4	5	5	2	5	6	3	
Agitation	6	6	2	4	4	2	13	15	6	5	7	3	
Anxiety	4	5	2	2	2	1	3	3	1	1	1	1	
Genitourinary													.36
Urinary tract infection	21	29	11	18	25	11	19	29	11	22	33	16	
Nutrition													.94
Any problem	19	20	7	22	25	11	25	27	11	25	29	14	
Weight loss	7	7	3	11	11	5	9	10	4	10	10	5	
Weight loss (not meeting criteria)	11	11	4	11	12	6	16	17	7	13	15	7	
Dehydration	2	2	1	2	2	1	0	0	0	4	4	2	
Cardiovascular													.11
Any problem	10	10	4	13	17	8	13	19	7	10	12	6	
Angina pectoris	6	6	2	1	1	1	4	5	2	2	2	1	
Congestive heart failure	2	2	1	9	10	5	5	5	2	8	8	4	
Other cardiovascular	4	4	2	8	9	4	10	13	5	3	5	3	
Endocrine													.30
Hyperglycemia	3	3	1	2	3	1	3	5	2	2	2	1	
Hypoglycemia	0	0	0	2	2	1	1	1	0	1	2	1	
Neurological													.18
Cerebral ischemia (transient ischemic attack or stroke)	4	4	2	2	2	1	1	1	0	3	4	2	

Note: Numbers rounded to nearest whole number.

*Episodes/week × 1,000 = episodes per 1,000 resident weeks.

had 24 and 22. The total number of days in the hospital for all subjects ranged from 112 during baseline to 203 during the intervention phase for the control group and from 122 days during baseline to 156 days during the intervention phase for the intervention group. These differences were not significant.

As reported previously, significant group-by-time interactions between intervention and control groups were observed on most functional and incontinence measures at 32 weeks.[14] These included upper body strength, the frequency of urinary and fecal incontinence, physical activity, and mobility endurance. In all cases, the intervention group performed significantly better on these measures than the control group. The significant differences between groups in mobility endurance occurred because the intervention group maintained endurance, whereas the control group showed a significant decline.

Table 2 illustrates the incidence of acute conditions by count and the percentage of subjects who experienced at least one episode. Intervention group subjects experienced an average of 4.29 acute episodes during baseline, whereas the control group experienced an average of 4.38. During the follow-up intervention periods, the control group experienced an average of 3.56 episodes per resident, whereas the intervention group experienced an average of 3.04 episodes. These data suggest that the two groups were comparable at baseline, but the average change statistic from baseline to intervention is confounded by differential monitoring periods because of subject attrition. The control group was monitored for 2,704 resident weeks during baseline and 2,193 resident weeks during intervention. The intervention group was monitored for 2,575 resident weeks during baseline and 2,044 during intervention. The incidence rate was therefore calculated for each acute condition by dividing the number of episodes that a resident experienced by the number of resident weeks monitored. The data in Table 2 illustrate these incidence rates in episodes per week times 1,000, or the incidence per 1,000 resident weeks of monitoring.

There were no significant intervention effects on incidence rates when the data were analyzed by major organ systems (e.g., dermatological, respiratory). Analyses for each organ system were accomplished by first calculating the difference score on the incidence rate between baseline and intervention for the control and intervention groups separately. These difference scores were then compared between groups with *t* tests. The *P*-values in the last column of Table 2 show the results of these *t* tests. The analysis of intervention effects using negative binomial modeling also revealed no statistically significant differences between the intervention and control groups when all sickness events together were analyzed. Control variables were tested to adjust for any small discrepancies in the comparability of the groups, including demographic characteristics, acute condition-related variables (the incidence of intervention-related acute conditions during the baseline period, the incidence of nonintervention-related conditions during the baseline period, number of diagnoses at baseline, number of medications taken at baseline, and the CIRS-G score), indicator variables for each nursing home, indicator variables for attrition due to death, and attrition due to another reason. It was assumed that attrition was exogenous to the intervention and therefore included an indicator for attrition as a control variable. An exposure term was also included to account for the variable study length across subjects. Exhaustive specification checks were conducted to determine the sensitivity of the results to the inclusion of these control variables. The robustness of the results was also determined to include additional control variables, varying the specification of the length of exposure, and checking assumptions on attrition by using a sample that contains only residents who remain in the sample until the end of the study. The results for the intervention do not vary meaningfully as a result of including the control variables described above, so data were analyzed on all subjects who survived past the baseline performance assessment. For this reason, as the final model specification, a parsimonious specification that excludes statistically insignificant control variables was selected. Based on these analyses, the intervention did not have a statistically significant effect on the number of intervention-related acute conditions, as is shown in Table 3. The coefficients from the negative binomial model reported in Table 3 can be interpreted as percentage effects. Therefore, the results show that the fitness intervention reduces the number of fitness-related sickness episodes by 10%, but this effect is not statistically significant. The baseline incidence rate of acute conditions, the number of diagnoses, and subjects who did not complete the trial were variables significantly associated with the incidence rate of acute events during the intervention period. Power analyses of these data indicated that there would have had to have been a decrease in conditions related to FIT by 16% to reach significance at the .05 level with 80% power and assuming a two-tailed test.

Separate analyses were also conducted to identify changes between groups for urinary tract infections, pressure ulcers, skin irritations, falls, constipation, and pneumonia, because they had a relatively high baseline incidence compared with the other conditions that were studied. There was only a significant difference between groups on the fall outcome variable, "number of residents experiencing a fall," using a logit analysis. More specifically, in this model, the following variables were predictive of falls: belonging to the intervention group (odds ratio (OR) ± standard error = 0.46 ± 0.18, $P < .04$) and baseline rate of falls (OR = 3.6 ± 1.4, $P < .01$). Table 2 indicates that the group differences were due to the control group showing

Table 3. Effect of the Intervention on the Incidence of Acute Conditions

Variable	Coefficient Estimate Mean ± Standard Error
Resident belongs to intervention group	−0.1 ± 0.1
Log (baseline incidence of acute conditions)	0.3* ± 0.1
Number of diagnoses	0.03* ± 0.01
Resident did not complete trial	0.6* ± 0.2

Note: Estimates are obtained from negative binomial models.
*Significant at the 1% level.

an increase in incidence rate of falls from baseline to follow-up while the intervention group remained stable. Given the multiple comparisons made in the study, this significant group difference in falls is interesting, but should be interpreted cautiously.

The average cost per resident per week to evaluate and treat the selected acute conditions was $36.81 for the control and $30.38 for the intervention group during baseline. During postbaseline periods, these numbers were reduced to $24.42 for the intervention group but increased slightly for the control group to $38.36. However, the cost data were highly skewed, which dramatically influenced the average costs. Therefore, the cost data were analyzed using a hyperbolic sine model. The dependent variable in this model was the difference between standardized intervention-period costs and baseline-period costs. Using this model, the cost changes did not approach statistical significance.

DISCUSSION

The FIT intervention resulted in significantly better functional outcomes than usual care but did not reduce the incidence or costs of acute conditions that were hypothesized to be associated with physical inactivity, incontinence, and impaired mobility. The trial had adequate statistical power to detect a modest 16% change in conditions related to FIT, but a change of only 10% was actually observed, and there was no difference between groups on health cost measures. Thus, this labor-intensive intervention will require increased investment in staffing in most NHs, which will not be offset by reduced medical care costs. A previous paper reported that a ratio of five residents to one aide would be necessary to implement the intervention and that more than 90% of the nation's NHs would have to significantly increase staffing to do so.[14]

The trained research staff detected virtually all of the clinically important acute conditions that occurred during the 6-month baseline and 8-month follow-up monitoring periods. Although daily or weekly histories and physical examination might have detected more episodes than medical record reviews and interviews of nursing staff, this would have been prohibitively expensive. Moreover, detection bias between the intervention and control groups was unlikely. Thus, the most plausible explanation for the outcomes of this trial is that good low-intensity exercise and incontinence care does not prevent health problems in a frail, institutionalized population that suffers from numerous chronic conditions and is highly susceptible to the development of acute medical conditions.

These results must be interpreted in light of the population that was studied. The NH residents enrolled were from only four NHs, were all incontinent and capable of following a one-step command, and were in the NH for chronic but not postacute care. Although these characteristics are typical of the majority of NH residents, the subject selection criteria necessarily limit the generalizability of the results to the NH population as a whole. Providing exercise to less-frail and continent residents may produce better health outcomes than those reported in this study.

These data raise at least two critical issues for the care of the growing frail geriatric population who will require long-term institutional care: What can realistically be done to make the intervention more effective and should such an intervention be recommended for NH residents if it only affects function or quality of life, as opposed to health outcomes? One could argue that better outcomes might be produced if the intensity of the intervention was increased. This argument can be best made for the incontinence care component of the intervention, because the exercise components took place over a long period of time (8 months) and were delivered at sufficient intensity to produce significant effects on mobility, physical activity, and strength. Subjects were offered four opportunities per day to exercise and on average completed 3.2 of them. The primary reason for lack of compliance was fatigue, which suggests that increasing the exercise intensity would be difficult in this frail population, even if more-positive functional improvements were realistic. The incontinence care significantly decreased the frequency that residents were found incontinent of urine and stool, but these improvements only occurred during the 8:00 a.m. to 4:00 p.m. period and during the 5 days of the week that research staff implemented the intervention. Expanding the incontinence care to 24 hours per day, 7 days per week might be more feasible than increasing the intensity of the exercise, although many NH residents do not respond well to toileting between the hours of 10:00 p.m. and 5:00 a.m.[21] One might hypothesize that a more intensive incontinence intervention might have significant effects on the incidence of pressure ulcers (particularly Stage 2), constipation, and perhaps falls, because these measures showed positive trends in the intervention group.

Another approach to strengthening the FIT intervention would be to combine it with more intensive management of the residents' medical conditions. This potential strategy highlights an important limitation of the trial. The authors did not have control over the residents' medical care, nor did they attempt to influence it in any way. Medical care in NHs is changing as more specialty-trained physicians, gerontological nurse practitioners, and physicians assistants are trained and go out into practice; clinical practice guidelines, such as the Resident Assessment Protocols and the American Medical Directors Association guidelines, are developed and implemented; and the medical oversight in NHs becomes more professional through medical director certification and continuing education. However, there remains considerable room for improvement. Rapid identification and evaluation of acute medical conditions; increasing the use of underused preventive measures such as vaccines, nutritional interventions, and fall prevention programs; minimizing adverse drug reactions; and better management of chronic medical problems including pulmonary and cardiovascular conditions are examples. The combination of a behavioral intervention such as FIT with optimal medical management could be a powerful strategy for decreasing the incidence of acute conditions and their related morbidity and costs.

Increasing the intensity of the intervention or combining the intervention with optimal medical management would require even greater resources than those required to implement the FIT intervention in the current study. Based on the findings from this clinical trial, it is unlikely that savings resulting from reduced medical care costs that would be enjoyed by cost centers outside of the NH (e.g., Medicare, Medicaid, and private insurance sources) would

offset the costs of such interventions. It has also been documented that significant savings to the NH from reduced diapering costs cannot be expected, and minor cost savings from any source to the NH from this intervention are estimated, despite the fact that NHs would have to absorb increased intervention costs.[22] The resources necessary to implement these strategies must therefore be justified based on benefits in the areas of function and quality of life.

It is a limitation that a cost-effectiveness analysis needed to inform policy decisions about this intervention was beyond the scope of this paper. Because of this limitation, decisions about the dissemination of this intervention to NHs should not be made until a cost-effectiveness analysis is provided. Data upon which to project the increased intervention costs are available, but measures of effectiveness for this frail NH population may be more problematic. For example, translating the intervention's functional improvements into a quality-of-life-years scale to quantify effectiveness would allow the intervention to be compared with alternatives. However, all these functional improvements have not been translated into a quality-of-life-years numeric, and there may be conceptual problems with doing so, because most of the residents who participated in this trial were in the last 2 or 3 years of their life.

Improving human dignity and quality of life remains the best reason to provide exercise and good incontinence care to frail NH residents during their last years in the NH. The fact that these interventions are consistent with NH regulatory guidelines and with resident and family preferences provides support for this argument.[23] Given the rapid growth of the population that will live into extreme old age, it is imperative that society confront the question of how many resources can be allocated to achieve these outcomes.

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