# Impact of a Managed-Medicare Physical Activity Benefit on Health Care Utilization and Costs in Older Adults With Diabetes

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**OBJECTIVE** — The purpose of this article was to determine the effects of a managed-Medicare physical activity benefit on health care utilization and costs among older adults with diabetes.

**RESEARCH DESIGN AND METHODS** — This retrospective cohort study used administrative and claims data for 527 patients from a diabetes registry of a staff model HMO. Participants ($n = 163$) were enrolled in the HMO for at least 1 year before joining the Enhanced Fitness Program (EFP), a community-based physical activity program for which the HMO pays for each EFP class attended. Control subjects were matched to participants according to the index date of EFP enrollment ($n = 364$). Multivariate regression models were used to determine 12-month postindex differences in health care use and costs between participants and control subjects while adjusting for age, sex, chronic disease burden, EFP attendance, prevention score, heart registry, and respective baseline use and costs.

**RESULTS** — Participants and control subjects were similar at baseline with respect to age (75 ± 5.5 years), A1C levels (7.4 ± 1.4%), chronic disease burden, prevention score, and health care use and costs. After exposure to the program, there was a trend toward lower hospital admissions in EFP participants compared with control subjects (13.5 vs. 20.9%, $P = 0.08$), whereas total health care costs were not different ($P = 0.39$). EFP participants who attended ≥1 exercise session/week on average had ~41% less total health care costs compared with those attending <1 session/week ($P = 0.03$) and with control subjects ($P = 0.02$).

**CONCLUSIONS** — Although elective participation in a community-based physical activity benefit at any level was not associated with lower inpatient or total health care costs, greater participation in the program may lower health care costs. These findings warrant additional investigations to determine whether policies to offer and promote a community-based physical activity benefit in older adults with diabetes can reduce health care costs.

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The many benefits of physical activity for older adults extend beyond better health, improved functioning, and increased quality of life to include significantly reduced health care costs and mortality (1–4). However, only 16% of individuals aged 65–74 years report participating in at least 30 min of moderate activity ≥5 days/week; these figures are incrementally lower for older cohorts (5). Physical activity is particularly relevant for older adults with diabetes because those who have diabetes are predisposed to higher rates of functional disability, cardiovascular disease, and premature death (4). Moreover, national diabetes practice guidelines recommend physical activity as an important component of diabetes management (6).

It is estimated that 18% of Medicare beneficiaries have diabetes. The health care costs associated with this condition account for 32% of total Medicare spending (7). Limited observational data suggest that health care costs for a previously sedentary adult >50 years of age can be reduced by as much as $2,200/year if he or she engages in moderate physical activity for at least 3 days/week (8). These combined statistics provide a compelling case for all stakeholders including patients, employers, and health plans to explore strategies to promote and support physical activity. One promising strategy is the use of a health plan benefit to pay for exercise programs specifically designed for older adults. However, there are limited data on the impact of such benefit incentives on health care costs for older adults with diabetes. The purpose of this study was to determine the effects of a managed-Medicare physical activity benefit on both outpatient and inpatient service utilization and costs among older adults with diabetes. We made use of an analytic framework from an earlier study but incorporated a larger and more recent sample to permit analysis of a diabetic subgroup, using better adjustment for selection bias (9).

## RESEARCH DESIGN AND METHODS

— This study was based at Group Health Cooperative of Puget Sound (GHC), a consumer-governed, staff model HMO with >500,000 members. We received administrative and claims data on a total of 1,675 GHC members who participated in the Enhanced Fitness Program (EFP) between 1 January 1998 and 30 December 2003, were aged ≥65 years, and were continuously en-

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**Abbreviations:** EFP, Enhanced Fitness Program; GHC, Group Health Cooperative of Puget Sound.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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rolled at GHC for at least 1 year before the date of joining the EFP. Three control subjects who were matched on age and sex were selected for every EFP participant. Control subjects were also enrolled at GHC for 1 year before the index date of the referent participant ($n = 4,814$).

From this larger dataset, only members who were on the diabetes registry of GHC, were not missing baseline cost and utilization data, and had at least 1 year of follow-up after the index date were included as EFP participants in this analysis ($n = 163$). Control subjects were also selected from the diabetes registry and were a subset of the matched control subjects from the larger dataset ($n = 364$). Members were added to the GHC diabetes registry based on one of the following criteria: *1*) currently taking any diabetes medication, *2*) having fasting glucose ≥126 mg/dl confirmed by a second out-of-range test within 1 year, *3*) having a random plasma glucose ≥200 mg/dl also confirmed by a second out-of-range test within 1 year, or *4*) having a hospital discharge diagnosis of diabetes at any time during GHC enrollment or two outpatient diagnoses (ICD-9) of diabetes (10).

The EFP is a group-based exercise program that meets 3 times/week and is currently offered to community-dwelling older adults at >30 community-based sites in the Seattle/Puget Sound area. The program, taught by certified fitness instructors, was designed to increase health and functional abilities of relatively sedentary older adults. All classes follow a standardized format of 5 min of warm up, 20–25 min of moderate-intensity aerobics, 20 min of resistance strength training, and 10 min of flexibility and balance training. Since October 1998, GHC has paid the per-visit costs for all of its Medicare-eligible enrollees who elect to participate in the EFP.

### Data sources

Inpatient utilization, primary care visits, and three summary cost variables (total, inpatient, and primary care) were chosen for comparison. Primary care costs were selected because a more general "outpatient" cost summary was not available. Primary care costs included all direct and indirect costs associated with visits or telephone calls by primary care or preventive medicine personnel that are related to either direct patient care, preventive services, or risk factor reduction counseling. Total health care costs included additional categories such as inpatient hospital, emergency, pharmacy, and long-term care costs.

Each cost summary measure was obtained from GHC administrative data, which have been used extensively in prior research (11,12). The source of cost estimates was the Decision Support System, which integrates clinical information, units of service, and actual costs from the general ledger for 15 separate feeder systems. GHC identifies all costs as either direct patient care costs or overhead costs (those shared by more than one department). All overhead costs are fully allocated to individual patient care departments. Departments captured in the database include medical staff, nursing, pharmacy, laboratory, radiology, hospital inpatient, and community health services. Units of service are weighted by relative value units for ancillary departments, technical relative value units for radiology, College of Anatomical Pathology units for laboratory, and visit length for outpatient visits. From this process, the precise cost for each unit of service delivered is then calculated, and costs are assigned to patients based on units of service used.

The analysis included several covariates that could potentially influence both EFP participation and the outcomes of health care use and costs. RxRisk is a measure of chronic disease burden and comorbidity that was previously shown to have validity comparable to that of ambulatory care groups for predicting total future health costs (13). It was calculated for each member on the basis of age, sex, and pharmacy utilization data for a 6-month period before the index date (14). To adjust for potential differences in future health care costs attributable to differences in general "prevention-seeking" behaviors between EFP users and nonusers, we constructed a "prevention score" for each member. This score was derived from the sum of the number of times a subject received colon cancer screening (fecal occult blood test or flexible sigmoidoscopy), a screening mammogram, prostate cancer screening, an influenza vaccine, or a pneumococcal vaccine during the 2 years immediately preceding the index date (range 0–8).

### Statistical analysis

Two-tailed $t$ tests and $\chi^2$ tests were used for unadjusted baseline comparisons between EFP participants and control groups. Health care cost data are generally highly skewed and often demonstrate a variance proportional to the square of the mean (gamma distribution) (15). Therefore, we used multivariate generalized linear models with a log-link function and gamma distributional assumptions to test differences in health care costs between EFP participants and control subjects during the 12 months after the index date while adjusting for age, sex, RxRisk, EFP attendance, prevention score, inclusion in the heart registry of the HMO, and respective baseline use and costs. Poisson regression was used to compare utilization counts between the two groups. Because a large percentage of subjects had no related inpatient expenses at baseline and follow-up, gamma regression was used to compare inpatient costs only for individuals in each group who had any costs.

Exploratory subgroup analyses were also performed to determine differences in total health care costs in members who attended ≥1 EFP session/week and those who attended <1 session/week. Average attendance was determined by adding all EFP visits across the year and dividing by 52 for number of visits per week. Because in this study we were interested primarily in differences in total health care costs between EFP participants and control subjects and because subgroup analyses were purely exploratory, statistical tests were not adjusted for multiple comparisons.

To attempt further balancing of observed covariates, we used propensity score quintiles with regression adjustment in a sensitivity analysis (16,17). We estimated a logit model to generate each patient's propensity of joining EFP and created quintiles of participants and control subjects with similar predicted propensity scores. The propensity score was then entered as an additional covariate in our cost model. The inclusion of propensity scores did not change the results of any of the models, so we present results from the simpler multivariate models.

Robust SEs that did not require the distributional assumptions to be exact were used in all regressions. All statistical procedures were performed with Stata 9.0 (Stata, College Station, TX). Institutional review boards at GHC and the University of Washington approved the study protocol.

## RESULTS

### Baseline characteristics

Participants and control subjects were similar in age, RxRisk, and most individ-

**Table 1—*Characteristics of subjects with diabetes before EFP enrollment***

| | Control subjects | EFP participants | *P* value* |
|---|---|---|---|
| *n* | 364 | 163 | |
| Demographics | | | |
| Age | 74.7 ± 5.2 | 75.3 ± 6.0 | 0.29 |
| Sex (% female) | 76.4 | 66.9 | 0.02 |
| Comorbidities† | | | |
| RxRisk ($) | 3,835.7 ± 2,546.6 | 3,663.4 ± 2,419.2 | 0.46 |
| Arthritis | 71 (19) | 34 (21) | 0.68 |
| Coronary artery disease | 90 (24) | 32 (20) | 0.22 |
| Congestive heart failure | 49 (13) | 11 (7) | 0.03 |
| Hypertension | 142 (39) | 63 (39) | 0.99 |
| Depression | 41 (11) | 19 (12) | 0.86 |
| A1C (%) | 7.4 ± 1.5 (*n* = 342) | 7.3 ± 1.2 (*n* = 152) | 0.60 |
| Prevention score‡ | 1.6 ± 1.6 | 2.0 ± 1.6 | 0.02 |
| Utilization summary measures | | | |
| Hospitalized during baseline | 53 (14.4) | 29 (17.8) | 0.32 |
| Diabetes-related hospitalization | 52 (14.3) | 24 (14.7) | 0.90 |
| Annual primary care visits | 7.0 ± 5.8 | 7.3 ± 6.5 | 0.54 |
| Diabetes-related visits | 4.4 ± 4.0 | 4.2 ± 3.7 | 0.58 |
| Cost summary measures | | | |
| Annual total health care costs ($) | 5,764 ± 7,309 | 6,541 ± 8,624 | 0.32 |
| Annual inpatient costs ($)§ | 9,056 ± 9,449 | 8,253 ± 11,351 | 0.75 |
| Annual primary care costs ($) | 910 ± 904 | 1,029 ± 1,097 | 0.23 |

Data are means ± SD or *n* (%) unless otherwise indicated. *Unadjusted comparisons using *t* test for unequal variance (continuous variables) or $\chi^2$ test (dichotomous variables). †RxRisk is expressed as predicted 6-month costs. Higher costs represent higher comorbidity; comorbid conditions (arthritis, coronary artery disease, congestive heart failure, hypertension, and depression) were derived from problem lists for outpatient visits. ‡Prevention score is the sum of the number of times a subject received colon cancer screening (fecal occult blood test or flexible sigmoidoscopy), a screening mammogram, prostate cancer screening, an influenza vaccine, or a pneumococcal vaccine during the 2 years immediately preceding the index date (range 0–8). §Average inpatient costs for members who had inpatient costs.

ual comorbid conditions, A1C levels, and baseline health care use and cost variables (Table 1). There were significant differences in the sex distribution ($P = 0.02$), number of subjects with congestive heart failure ($P = 0.03$), and prevention scores between EFP participants and control subjects ($P = 0.02$).

### Unadjusted comparisons between EFP participants and control subjects

The follow-up interval for all subjects was 12 months. Average total costs for EFP participants and control subjects were not significantly different ($7,278 vs. $8,637) (Table 2). Participants used more primary care services compared with control subjects (8.2 vs. 7.0 visits, $P = 0.06$; $1,103 vs. $935, $P = 0.08$). Of EFP participants, 13.5% were admitted to the hospital at least once during follow-up compared with 20.9% of control subjects ($P = 0.04$). The average annual inpatient costs for EFP participants were not significantly different from those of control subjects ($9,859 vs. $11,049, $P = 0.64$).

### Adjusted comparisons between EFP participants and control subjects

After adjustment for possible imbalances in age, sex, RxRisk, EFP attendance, prevention score, heart registry, and each respective use and cost variable, total annual health care costs remained similar between EFP participants and control subjects (Table 2). The differences in hospitalization rates between the two groups were no longer significant ($P = 0.08$). Primary care use and costs were higher in EFP participants compared with control subjects ($P < 0.001$ and 0.04, respectively).

**Table 2—*Utilization and costs with EFP enrollment 1 year after index start date***

| | | EFP participants (*n* = 163)† | | | |
|---|---|---|---|---|---|
| | Controls (*n* = 364) | Unadjusted | *P* value | Adjusted | *P* value* |
| Utilization measures | | | | | |
| Hospitalized during follow-up | 76 (20.9) | 22 (13.5) | 0.04 | 22 (13.5) | 0.08 |
| Annual primary care visits | 7.0 (6.3–7.6) | 8.2 (7.1–9.2) | 0.06 | 8.2 (7.7–8.8) | <0.001 |
| Diabetes-related visits | 5.1 (4.6–5.6) | 4.5 (3.9–5.1) | 0.12 | 4.7 (4.3–5.1) | 0.06 |
| Cost measures | | | | | |
| Annual total health care costs ($) | 8,637 (7,249–10,025) | 7,278 (5,795–8,762) | 0.19 | 7,601 (5,700–10,105) | 0.39 |
| Annual inpatient costs ($)‡ | 11,049 (8,203–13,895) | 9,859 (5,528–14,191) | 0.64 | 9,723 (5,635–16,794) | 0.64 |
| Annual primary care costs ($) | 935 (838–1,032) | 1,103 (938–1,269) | 0.08 | 1,103 (944–1,299) | 0.04 |
| EFP attendance (classes) | | | | | |
| Months 1–6 | — | 26 ± 47 (median 26 [range 1–67]) | | | |
| Months 7–12 | — | 20 ± 23 (median 13 [range 0–78]) | | | |
| Total months 1–12 | — | 48 ± 37 (median 43 [range 1–145]) | | | |

Data are means (95% CI) unless otherwise indicated. **P* values derived from robust SE estimates from gamma (costs) or Poisson (utilization) regression analyses. †Adjusted follow-up health care use and costs for EFP participants were derived by multiplying average control estimates by the ratio of participant/control estimates from multivariate regression models that adjusted for age, sex, RxRisk, EFP attendance, prevention score, heart registry, and respective baseline use and cost. ‡Values and comparisons based on average annual inpatient costs for members who had any inpatient costs.

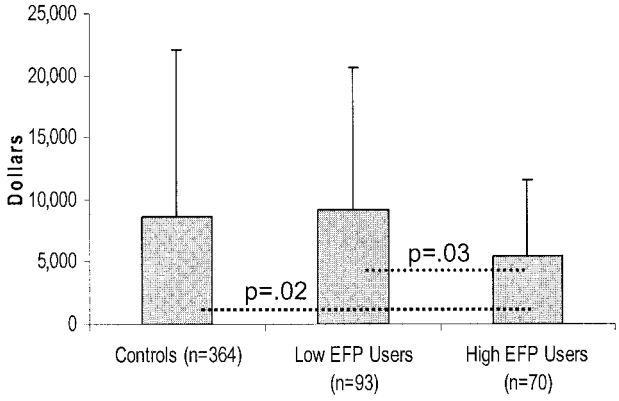


**Figure 1**—*Total adjusted mean ± SD annual health care costs by level of EFP use (control vs. high EFP users,* P *= 0.02; low EFP users vs. high EFP users,* P *= 0.03).*

### Exploratory analysis: effects of EFP attendance

The average exercise program attendance over the 12 months was 0.92 class/week. High EFP users were defined as attending ≥1 class/week on average ($n$ = 70) and low EFP users as attending <1 class/week ($n$ = 93). High EFP users had a mean attendance of 1.7 classes/week, whereas low EFP users attended 0.4 class/week over the 12-month follow-up period. Only 47% of all participants attended at least 1 EFP class 6 months after their index start date. For high EFP users, the percentage of nonattendance in any month across the 12 months ranged from 5.7 to 24.3% whereas nonattendance in the low EFP users ranged from 8.6 to 84%.

At baseline, all three groups were comparable in age, RxRisk, and A1C levels. However, there were significantly more men among high EFP users (44%) compared with control subjects (23%) and low EFP users (25%) ($P$ = 0.001). There was an incremental increase in baseline prevention scores across all three groups (control subjects 1.6 ± 1.6; low EFP 1.8 ± 1.6; high EFP 2.3 ± 1.7; $P$ = 0.01). There were no other important differences in any baseline use or cost measures between these subgroups. In adjusted models, high EFP users had lower total annual health care costs ($5,441 [95% CI 3,628–7,946]) compared with low EFP users ($9,155 [6,564–12,869], $P$ = 0.03) and control subjects ($8,637 [7,249–10,025], $P$ = 0.02) (Fig. 1).

**CONCLUSIONS** — We found that older Medicare beneficiaries with diabetes who participated in an HMO-sponsored community-based exercise program had slightly fewer hospitalizations 12 months after program enrollment compared with similar enrollees who did not participate. Although there were no significant differences in inpatient or total health care costs between control subjects and members with any participation in EFP, those who participated in EFP more frequently incurred total health care costs that were, on average, 37% lower (−$3,196; $P$ = 0.02) than those of control subjects and 41% lower (−$3,714; $P$ = 0.03) than members who did not use EFP regularly. Higher users had more average visits to EFP per week and fewer months with nonattendance. Because EFP sessions involve physical activities considered moderate in intensity, it is likely that high EFP use is at least a marker for regular moderate physical activity participation. In this context, it is plausible that lower health care costs for high EFP users, even after adjusting for potential sources of confounding or selection bias, may have been mediated by a direct effect of regular exercise on improved cardiometabolic risk factor control and fewer hospital admissions for acute hyperglycemic and cardiovascular complications. Once an individual was hospitalized for such an indication, however, it is not surprising that EFP use did not appear to have a beneficial effect on the duration or complexity of inpatient care, so inpatient costs were no different between participants and control subjects.

We were unable to identify other published studies in which the impact of a community-based exercise program on health resource use was specifically examined in older adults with diabetes. Perkins and Clark (18) studied the association between self-reported exercise and health care costs in older adults with multiple comorbidities. They found that subjects who reported walking at least 120 min/week had half the risk of hospitalizations compared with subjects who reported no walking. There were, however, no differences in total health care costs between the two groups. Wagner et al. (11) reported a similar increase in the number of primary care visits over a 2-year period in adult subjects with diabetes who participated in chronic care clinics from this same HMO. Processes of care and select health outcomes improved notably in the intervention arm without increasing median total health care costs and hospitalization. A recent systematic review of diabetes disease management programs showed that inpatient hospitalizations were reduced by a median of 18–31% (19). It should be noted that most of the studies included in this review had limited follow-up or were not specifically focused on older adults. Our findings of a 35% reduction in hospitalizations between EFP participants and control subjects as well as a 37% reduction in total health care costs between high EFP users and control subjects compare favorably to results of these disease management programs.

Although we were able to adjust for a number of key variables that were available from automated administrative data, we were unable to account for all possible differences in factors that could have an impact on health care use and costs. The finding that EFP participants had significantly more primary care visits compared with control subjects suggests a potential selection bias and differences in individual health and health-seeking behavior between the two groups. For instance, people who seek out more contact with the health care system might be more motivated to comply with medical treatments, engage in more health screening activities, increase their physical activity, improve their diet, or quit smoking. These behaviors may result in lower health care costs regardless of participation in a formal exercise program. We attempted to control for both health status and health-seeking behavior by including a measure of chronic disease burden, a summary prevention score, and even an empirically derived propensity score in our regression models; however, it is possible that the observed differences are still subject to residual confounding. For example, Simon et al. (12) found that adults with diabetes from this same HMO population who also have depression had a

50–75% increase in health care costs compared with those without depression. We found no appreciable differences in total health care costs when we controlled for baseline inpatient and outpatient mental health service use related to depression and other common comorbidities. It is possible, for instance, that because depression is often underdiagnosed and undertreated in older adults (20), this proxy covariate is an inadequate indicator and therefore does not fully account for the potential differences in overall well-being, self-care, and willingness to participate in a community exercise program. Another limitation was that we did not have data on physical activity outside of the EFP.

High EFP users could have lower health care costs if some participants were capable of more frequent exercise because of fewer health problems during follow-up. Because we were unable to link EFP attendance data with diagnoses of new health problems or exacerbations of existing illnesses, we examined mean differences in primary and specialty care visits and total costs between those members who no longer attended any EFP classes after 6 months and those who continued to attend. Although we found no significant differences in visit frequency and total costs, we acknowledge that this lack of difference does not necessarily reflect comparable health status between the low and high EFP users during follow-up but could simply be a function of inadequate power. It is important to note that although there were more women participating in the EFP, there were more men in the high EFP user group. This finding is consistent with other reports showing greater difficulty in retaining older women with chronic conditions in structured exercise programs for various reasons including greater comorbidity, lack of transportation, limited social support, and interpersonal loss (21–23). Results of randomized controlled studies of exercise in other chronic conditions suggest that exercise itself does not place patients at increased medical risk, but rather the setbacks associated with the development of new medical conditions or exacerbations of existing illnesses are key factors that interfere with exercise persistence (24, 25).

The main findings from this study do not provide definitive answers as to whether or not a community exercise health plan benefit for older adults with diabetes leads to reductions in total health care costs or if strategies by health care organizations to increase participation in such a benefit lead to greater organizational cost savings. However, the finding of reduced costs in members who attended more EFP classes should motivate more detailed, longitudinal, prospective multilevel studies of the natural trajectory of physical activity in older adults with diabetes. It is clear that a number of individual physical and psychological factors dynamically interact with and are shaped by the social and physical environment to influence whether or not older adults adopt and engage in regular physical activity over time (26). The best methodological approach to studying the mediating and moderating effects of these factors on physical activity engagement and, consequently, on health outcomes and expenditures remains elusive (27,28).

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