

# Long-Term Effects on Medical Costs of Improving Depression Outcomes in Patients With Depression and Diabetes

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**OBJECTIVE** — The purpose of this study was to examine the 5-year effects on total health care costs of the Pathways depression intervention program for patients with diabetes and comorbid depression compared with usual primary care.

**RESEARCH DESIGN AND METHODS** — The Pathways Study was conducted in nine primary care practices of a large HMO and enrolled 329 patients with diabetes and comorbid major depression. The current study analyzed the differences in long-term medical costs between intervention and usual care patients. Participants were randomly assigned to a nurse depression intervention ( $n = 164$ ) or to usual primary care ( $n = 165$ ). The intervention included education about depression, behavioral activation, and a choice of either starting with support of antidepressant medication treatment by the primary care doctor or problem-solving therapy in primary care. Interventions were provided for up to 12 months, and the main outcome measures are health costs over a 5-year period.

**RESULTS** — Patients in the intervention arm of the study had improved depression outcomes and trends for reduced 5-year mean total medical costs of  $-\$3,907$  (95% CI  $-\$15,454$  less to  $\$7,640$  more) compared with usual care patients. A sensitivity analysis found that these cost differences were largely explained by the patients with depression and the most severe medical comorbidity.

**CONCLUSIONS** — The Pathways depression collaborative care program improved depression outcomes compared with usual care with no evidence of greater long-term costs and with trends for reduced costs among the more severely medically ill patients with diabetes.

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Major depression and/or dysthymia have been found to occur in ~12% of patients with diabetes (1). After controlling for severity of diabetes and other medical comorbidities, comorbid depression has been shown to be associated with higher diabetes symptom burden (2), additive functional impairment (3), and poor self-care (i.e., adherence to diet, exercise, cessation of smoking, and taking disease control medication) (4). Recent longitudinal studies have also

shown that comorbid depression in patients with diabetes is associated with increasing rates of macrovascular and microvascular complications (5) and increased mortality (5,6). Given the poor self-care and complications associated with depression, it is not surprising that those with comorbid depression and diabetes have significantly higher medical costs than those with diabetes alone (7).

Two large-scale effectiveness studies that compared a nurse collaborative care

depression intervention with usual primary care in patients with diabetes and depression showed that collaborative care was associated with enhanced quality of depression care and improved depression outcomes over a 2-year period (8,9). Cost-effectiveness analyses from these two studies both showed that the increased mental health costs associated with the intervention in year 1 of the trial were offset by cost savings in medical costs in year 2 (10,11). Given the improved depressive and cost outcomes over a 2-year period in these trials, we hypothesized that cost savings may extend over a 5-year period. The purpose of this study was to examine the 5-year total medical costs in intervention and usual care patients with diabetes and depression enrolled in the Pathways Study. This cost analysis will be presented from the perspective of the health plan or insurer.

## RESEARCH DESIGN AND METHODS

The Pathways Study was a randomized controlled trial of a nurse collaborative care depression intervention versus usual care for patients with comorbid major depression and/or dysthymia and diabetes. Patients with depression were identified from a population-based screening of patients with diabetes using the Patient Health Questionnaire-9 (PHQ-9) (12). Patients with diabetes were identified from a diabetes register developed to improve quality of diabetes. The methods have been described in detail previously (9).

A survey that assessed age, sex, years of education, employment status, race, and marital status was mailed to patients on the depression registry. Questions about clinical status included age at onset of diabetes, duration of diabetes, and current diabetes treatments. When surveys were not initially returned, a second and third mailing and telephone reminder were used to achieve a final response rate of 61.7%.

Eligible patients were ambulatory, were English-speaking, had adequate hearing to complete a telephone interview, and planned to be enrolled at Group Health Cooperative (GHC) during the

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**Abbreviations:** DCM, depression care manager; GHC, Group Health Cooperative; SCL-20, Hopkins Symptom Checklist-20; PHQ-9, Patient Health Questionnaire-9; PST-PC, problem-solving treatment developed for primary care.

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next 12-month period. Psychiatric exclusions were as follows: 1) in current care with a psychiatrist, 2) use of antipsychotic medication or mood stabilizer medication based on GHC's automated pharmacy data, 3) a diagnosis of bipolar disorder or schizophrenia based on GHC's automated diagnostic data, and 4) interview suggesting significant dementia. Patients were required to have a PHQ-9 score of  $\geq 10$  to be eligible for the study as well as Hopkins Symptom Checklist-20 (SCL-20) depression mean item score of  $>1.1$  2 weeks later.

Of 7,841 eligible patients, 4,839 returned questionnaires (61.7% of those eligible) and 1,038 were eligible for baseline screening based on a PHQ-9 score of  $\geq 10$ . A total of 851 (82.0%) of the 1,038 respondents were successfully reached by telephone for baseline screening, and 375 met the criteria for the randomized trial (based on the second screening SCL-20 depression score of  $>1.1$ ). Only 46 (12.3%) of 375 eligible patients refused to participate. Recruitment began on 18 April 2001 and ended on 8 May 2002.

The study was conducted in nine primary care clinics of GHC, a mixed-model prepaid health plan serving  $\sim 500,000$  members in Washington state. Study procedures were reviewed and approved by the institutional review board at GHC. The GHC population is representative of the population of Washington state.

### Intervention group

The Pathways intervention was a stepped collaborative care program that was delivered by a nurse depression care manager (DCM). The intervention was designed to improve quality of care and outcomes of depression but not to directly improve diabetes education or care. The DCM provided a behavioral activation intervention to all patients (i.e., increasing positive activities such as exercise) and an initial choice of enhanced treatment of antidepressant medication prescribed by the primary care physician or problem-solving treatment developed for primary care (PST-PC) (13). DCMs received weekly supervision by a psychiatrist and primary care doctor to monitor clinical progress and to receive recommendations about adjusting antidepressant medication. DCMs also received weekly supervision with a psychologist on PST-PC. Initial choice of medication treatment could be augmented with PST-PC based on partial response or nonresponse and vice versa. The DCMs followed patients in

person and by telephone every 2 weeks over the acute treatment phase (3–6 months) and approximately once a month in the continuation phase (6–12 months).

### Usual primary care

For patients assigned to usual primary care, primary care physicians were notified about the patient's depression diagnosis and could provide antidepressant medication and/or referral to the GHC Mental Health Service.

### Measures

Use and cost of health services provided by GHC were measured using the health plan's computerized health care use and cost data. This system uses general ledger costs to calculate actual budget-based cost (not charges) for all services provided or purchased by GHC. Costs for intervention services provided by study staff (including supervision) were calculated using actual salary and fringe benefit rates plus a 30% overhead rate (e.g., space and administrative support). Resulting unit costs were \$79 for each in-person nurse visit (typically 30 min) and \$31 for each telephone contact (typically 10–15 min). These estimates included time required for outreach efforts and record keeping (e.g.,  $\sim 45$  min of nurse time was allowed for each 10- to 15-min telephone contact). Intervention costs also included a fixed \$57 for each participant assigned to the intervention program for costs of supervision and information system support. Computerized pharmacy records were used to compute a chronic disease comorbidity score known as RxRisk, which has been found to be a significant predictor of total future health care costs and mortality (14).

The PHQ-9 was used to screen for depression (12). The PHQ-9 (at a cutoff score of  $\geq 10$  with  $\geq 5$  symptoms scored as being present for half the days or more, including at least one cardinal symptom) has been found to have high agreement with structured interviews in establishing a diagnosis of major depression (12). The SCL-20, a 20-item depression measure (15), was used as a second-stage screen  $\sim 2$  weeks after the initial PHQ-9 was completed. An SCL-20 mean item score of  $>1.1$  was required, corresponding to a moderate level of depression symptoms for patients to be randomly assigned. The SCL-20 has been shown to be more sensitive to change than many standard depression measures (15).

Our hypotheses focused on outpatient costs and total costs defined as outpatient, inpatient, and long-term care services provided or purchased by GHC, as well as all services provided by the intervention staff. Complete cost data were only available for participants remaining enrolled in the GHC health plan.

### Statistics

Demographic variables were compared between the usual care and case management groups using  $\chi^2$  analyses and *t* tests for dichotomous and continuous variables, respectively. Cost differences for any demographic group variables that, by chance of randomization, occurred in statistically significant proportions in the treatment groups were compared using *t* tests. Means, SDs, mean difference between usual care and case management, and the 95% CI for the difference were calculated for all cost categories for the usual care and case management groups individually.

To both compute an adjusted point estimate of the total cost difference over 5 years between the case management and usual care groups and to arrive at a more conservative estimate of the cost difference, we performed a bootstrapped ordinary least squares regression analysis. We used 10,000 replications of the ordinary least squares model to estimate the 5-year total cost differences between the groups while simultaneously adjusting for age, sex, race, education, and medical severity. We report the bootstrapped  $\beta$  coefficient for the intervention effect, which is interpreted as adjusted mean difference in U.S. dollars between the groups and its 95% CI.

Because we observed the nonsignificant trend for usual care compared with intervention patients to have higher medical comorbidity at baseline based on the RxRisk score, we also included a sensitivity analysis that estimated intervention and usual care mean 5-year total costs by tertiles of severity on RxRisk, adjusting for education, race/ethnicity, and RxRisk. RxRisk is a measure of medical comorbidity developed from pharmacy records and predicts total medical costs over the subsequent year (14). The following are the predicted RxRisk costs by tertile: lowest tertile \$200–\$1,635, middle tertile \$1,636–\$3,768, and highest tertile \$3,769–\$35,481.

**RESULTS**— Table 1 shows the baseline demographic, socioeconomic, and

**Table 1—Baseline characteristics of participants assigned to case management and usual care groups**

	Case management intervention	Usual care	Test statistic
<i>n</i>	165	164	
Age (years)	58 ± 12	57 ± 12	$t_{324} = 0.5$ $P = 0.63$
Female sex	57 (35)	56 (34)	$\chi^2 = 0.01$ $P = 0.91$
White	115 (71)	131 (80)	$\chi^2 = 4.24$ $P = 0.04$
>1 year college	50 (31)	36 (22)	$\chi^2 = 3.10$ $P = 0.08$
Type 2 diabetes	157 (96)	156 (96)	$\chi^2 = 0.08$ $P = 0.77$
Years since diabetes diagnosis	10.2 ± 10.1	9.6 ± 8.7	$t_{327} = 0.58$ $P = 0.56$
SCL-20 depression score	1.71 ± 0.51	1.63 ± 0.46	$t_{327} = 1.39$ $P = 0.17$
RxRisk score (14)	3,366 ± 3,020	3,937 ± 4,019	$t_{327} = 1.90$ $P = 0.059$

Data are *n* (%) or means ± SD.

clinical characteristics of the intervention and usual care patients. The only significant difference was that intervention patients were more likely to be non-Caucasian.

Of the 329 patients enrolled in the study, there were 21 deaths in usual care

patients and 17 deaths in intervention patients over the 5-year follow-up period. There was no difference in death rates in any of the individual 1-year periods or total 5-year period. Similarly, a total of 56 (33.9%) usual care patients and 59 (36.0%) intervention patients had at least

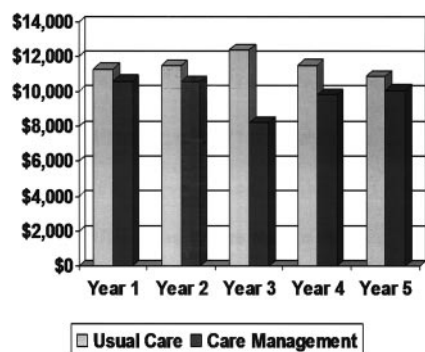
one or more disenrollment period from the health plan over the 5-year periods. There was also no difference between intervention and usual care patients in the total number of enrollment periods.

Table 2 shows the unadjusted intervention versus control differences in each cost component, total ambulatory costs, and total costs (ambulatory, inpatient, and long-term care) over 5 years. For each component of costs measured, the intervention group tends to have lower mean costs than the control group with the exception of mental health costs. Mean ± SD 5-year outpatient mental health costs were higher in intervention (\$1,156 ± 1,749) versus usual care patients (\$532 ± 1,290), largely because of the \$543 intervention costs in the first 12 months. Patients in the intervention group compared with usual care control subjects had total outpatient (−\$2,880 [95% CI −\$4,898 to 10,659]) and total medical costs (−\$8,257 [−\$5,653 to 22,169]) that are not significantly different but trended lower for intervention patients. As shown in Table 2, the distribution of costs was highly skewed. Intervention patients had trends for lower interquartile ranges for total medical costs and total outpatient costs compared with usual care patients. Median total costs trended higher in in-

**Table 2—Costs broken down by categories**

Cost categories	Controls UC (\$) (mean ± SD)	Controls UC (\$) [median (IR)]*	Intervention CM (\$) (mean ± SD)	Intervention CM (\$) [median (IR)]*	Mean \$ difference score (95% CI)
<i>n</i>	165	165	164	164	
Overall total costs (inpatient + outpatient + LTC)	57,511 ± 75,158	29,829 (54,727)	49,254 ± 50,773	31,967 (49,074)	−8,257 (−5,653 to 22,169)
Total outpatient costs	37,188 ± 41,087	24,967 (29,618)	34,308 ± 29,736	26,698 (28,903)	−2,880 (−4,898 to 10,659)
Outpatient non-mental health costs	36,613 ± 40,948	24,590 (28,920)	33,125 ± 29,426	25,782 (28,697)	−3,488 (−4,250 to 11,226)
Emergency care	2,243 ± 4,034	363 (2,584)	2,169 ± 4,397	0 (2,104)	−74 (−841 to 989)
Laboratory	1,008 ± 1,140	684 (963)	788 ± 754	601 (687)	−220 (10 to 220)
Radiology	1,670 ± 3,474	956 (1,706)	1,472 ± 1,816	911 (1,757)	−179 (−404 to 799)
Primary care	5,099 ± 4,344	4,419 (3,767)	5,078 ± 4,178	4,314 (4,090)	−21 (−904 to 945)
Specialty care	5,188 ± 5,959	3,239 (5,564)	4,516 ± 5,016	3,086 (4,051)	−672 (−523 to 1,867)
Pharmacy	11,553 ± 14,924	8,239 (10,981)	9,570 ± 11,601	6,710 (7,425)	−1,893 (−917 to 4,884)
Other outpatient	9,853 ± 21,704	3,334 (8,213)	9,532 ± 13,840	5,599 (11,615)	−321 (−3,630 to 4,272)
Outpatient mental health costs	532 ± 1,290	0 (358)	1,156 ± 1,749	633 (694)	832 (−1,536 to 128)
Mental health visits	532 ± 1,290	0 (358)	614 ± 1,710	0 (359)	82 (−410 to 247)
Intervention visits	0	—	543 ± 228	546 (331)	543 (−578 to 508)
Inpatient non-mental health costs + LTC	15,894 ± 33,895	0 (17,050)	12,060 ± 22,074	0 (17,131)	−3,834 (−2,374 to 10,042)
Inpatient mental health costs	34 ± 323	0 (0)	204 ± 1,735	0 (0)	170 (−2,925 to 13,679)

Interquartile range (IR) is the difference between the 75th and 25th percentile in costs. CM, case management; LTC, long-term care; UC, usual care.



**Figure 1**—Total costs per year over 5 years: case management vs. usual care cost differences.

intervention compared with usual care patients, but most of the median cost components (i.e., emergency room, laboratory, radiology, primary care, specialty care, and pharmacy) trended higher in usual care compared with intervention patients, except for the category of other outpatient costs. Figure 1 also shows that, in each of the 5 years, there were similar trends for the intervention to be associated with lower total health care costs.

The bootstrapped adjusted coefficient for the difference in total medical costs was  $-\$3,907 \pm 5,891$  (mean  $\pm$  SE). This result is not statistically different as the 95% CI was  $-\$15,454$  to  $7,640$  and contains 0. This bootstrap difference in total medical costs was approximately half of the difference described in the unadjusted point estimate of the intervention versus usual care total cost differences.

The sensitivity analysis that examined intervention versus usual care 5-year total medical costs by tertile of severity of medical comorbidity showed that in the highest tertile (most severely ill), there was the largest trend for cost savings in intervention versus usual care patients (Table 3). In the lowest tertile of medical comorbidity, intervention patients tended to have higher mean costs than usual care patients, and, in the middle tertile, the mean costs are fairly equivalent. None of the intervention versus usual care differences found in any of the three tertiles are statistically significant, as the 95% CIs overlap.

**CONCLUSIONS**— The findings from this study show that enhanced treatment of depression was associated with total ambulatory and total medical costs that were not significantly different between intervention and usual care patients but trended lower in the intervention patients over a 5-year period. The same trends for cost savings in

total medical costs reported in the first 2 years after random assignment were seen in each of the subsequent years of the study. The data suggest trends in total medical cost savings of  $\sim$  $\$3,900$ , but the wide CIs also mean we cannot exclude the possibility that total medical costs might decrease by as much as  $\$15,454$  or increase by as much as  $\$7,640$ .

The sensitivity analysis results suggest that the largest trends for cost savings associated with the Pathways intervention are seen in the group of patients with depression who were in the most severely ill tertile of medical comorbidity. Interestingly, we have also shown that patients with  $\geq 2$  diabetes complications versus those with 0–1 complication had the largest intervention versus usual care differences on depression outcomes (16). These data suggest that health care organizations may want to target the scarce resource of depression case management to patients with depression and diabetes who have the highest levels of medical comorbidity.

Multiple studies have shown that depression in both primary care patients (17) and in those with comorbid diabetes (7) is associated with increased medical costs in every category measured, including primary care and medical specialty visits, emergency room, pharmacy, laboratory and X-rays, and inpatient days. Our data suggest that improving quality of depression care and depression outcomes associated with collaborative care is associated with nonsignificant trends for decreasing mean costs compared with usual primary care in each of these cost categories.

Most prior cost-effectiveness studies of collaborative care depression trials measured intervention versus usual care effects on costs and depression outcomes over 6–12 months (18). Because collaborative care interventions are “frontloaded” in the first 6 months, the highest costs are in the first year of treatment. The benefits

should begin to follow effective depression care and continue over extended periods of time. Several recent trials with analyses extended to 2 years have shown that the increased mental health costs of providing collaborative care are offset by medical cost savings in year 2 (10,11, 19,20). The current study extended these findings by showing trends for cost savings up to 5 years.

Enhancing depression care in patients with diabetes could potentially reduce medical costs in several ways. The adverse effect of depression on diabetes symptom burden and functioning could lead to higher medical utilization and testing (4,7). Also, adverse impact of depression on self-care in patients with diabetes could lead to increased medical complications and mortality (4–7). We have posited a bidirectional adverse impact of depression in patients with diabetes such that the association of depression with higher symptom burden, impaired functioning, and poor self-care leads to poor disease control and increased diabetes complications. Diabetes complications and resulting reduced functioning may then also contribute to psychological distress and depression (2–4).

Limitations of these data include the fact that the study occurred in one large HMO in one geographic region of the U.S., limiting generalizability. Also, the small sample size relative to measuring the high variability in cost data limits the precision of our estimates. Given that the 95% CIs for total ambulatory costs and total costs overlap with zero, the most conservative interpretation of this study is that the increased mental health costs associated with the intervention are offset by cost savings in medical costs by 2 years. Five-year total medical costs were similar, but there was a continuing nonsignificant trend for lower total medical costs in years 3–5 in intervention versus usual care patients. Finally, the exact

**Table 3**—Total 5-year CM versus UC costs (outpatient and inpatient) adjusted for RxRisk, education, and race by baseline RxRisk tertiles

	n	Mean \$ (adjusted)	SE	95% CI
Low (UC)	48	24,928	4,007	16,979–32,877
Low (CM)	58	33,013	3,644	25,785–40,242
Middle (UC)	55	39,328	5,646	28,136–50,521
Middle (CM)	57	41,941	5,544	30,950–52,931
High (UC)	62	97,614	11,004	75,797–119,432
High (CM)	49	78,570	12,402	53,982–103,157

CM, case management; UC, usual care.



mechanism by which enhanced treatment of depression leads to costs savings is not clear and needs to be explored in a larger study.

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