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Cost-Effectiveness Analysis of Collaborative Care Management of Major Depression among Low-Income, Predominantly Hispanics with Diabetes

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ABSTRACT

Objective: To evaluate the cost-effectiveness of a socioculturally adapted collaborative depression care program among low-income Hispanics with diabetes. **Research design and methods:** A randomized controlled trial of 387 patients with diabetes (96.5% Hispanic) with clinically significant depression followed over 18 months evaluated the cost-effectiveness of the Multifaceted Diabetes and Depression Program aimed at increasing patient exposure to evidence-based depression psychotherapy and/or pharmacotherapy in two public safety net clinics. Patient medical care costs and utilization were captured from Los Angeles County Department of Health Services claims records. Patient-reported outcomes included Short-Form Health Survey-12 and Patient Health Questionnaire-9-calculated depression-free days. **Results:** Intervention patients had significantly greater Short-Form Health Survey-12 utility improvement from baseline compared with controls over the 18-month evaluation period (4.8%; $P < 0.001$) and a corresponding significant improvement in depression-free days (43.0; $P < 0.001$). Medical cost differences were not statistically significant in ordinary least squares and log-transformed cost regressions. The average costs of the Multifaceted Diabetes and Depression Program study intervention were $515 per patient. The program's cost-effectiveness averaged $4053 per quality-adjusted life-year per MDDP recipient and was more than 90% likely to fall below $12,000 per quality-adjusted life-year. **Conclusions:** Socioculturally adapted collaborative depression care improved utility and quality of life in predominantly low-income Hispanic patients with diabetes and was highly cost-effective.

Keywords: depression, diabetes-related complications, direct care health costs, cost-utility analysis, randomized clinical trial.

Introduction

Diabetes is the fifth leading cause of death among Hispanics and is twice as prevalent in this population as in non-Hispanic whites [1], with Mexican Americans being 1.9 times more likely to have diabetes compared with non-Hispanic white adults of similar age [2]. The comorbidity of diabetes and depression is estimated to be around 25% in the elderly Mexican American population [3] and as high as 33% in Hispanic primary care samples [4,5]. Hispanics also have greater risk of cardiovascular illness and functional disability, and difficulty with diabetes management can contribute to depression [4,6]. Compared with non-Hispanic whites, Hispanics are less likely to receive guideline-congruent depression care even after controlling for clinical and economic factors [7], more likely to be served by physicians who fail to detect a mental health problem when one exists [8,9], and at higher risk to discontinue antidepressant use during the first 30 days of treatment [10,11].

A randomized clinical trial implemented a health services effectiveness collaborative care model—the Multifaceted Diabetes and Depression Program (MDDP)—aimed at increasing exposure of low-income, predominantly Hispanic diabetes patients with comorbid depression to evidence-based depression psychotherapy and/or pharmacotherapy to examine both the quality of depression care and outcomes compared with enhanced usual care (EUC) [12]. As shown by Ell and colleagues [12], MDDP intervention patients had significantly greater depression improvement compared with usual care patients. As Ell et al. reported, although there was no statistically significant improvement in glycemic control, there were significant improvements over 18 months in reported diabetes symptoms, anxiety, Short-Form Health Survey-12 (SF-12) emotional, physical, and pain-related functioning, Sheehan disability, financial situation, and number of social stressors ($P = 0.04$ for disability and SF-12 physical and $P < 0.001$ for all others).

Prior studies of predominantly non-Hispanic whites have found similar depression care interventions to be highly cost-effective in older adults with multiple chronic medical illnesses [13], older adults with diabetes comorbidity [14], and adults with diabetes comorbidity visiting primary care clinics of a large health maintenance organization [15]. To our knowledge this is the first

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research to evaluate the cost-effectiveness of a randomized controlled trial depression intervention targeted at low-income Hispanic patients with diabetes comorbidity.

Methods

As described by Ell and colleagues [12], the randomized controlled trial, approved by the University of Southern California Institutional Review Board, was conducted in Los Angeles County public community clinics. Trained bilingual study recruiters identified diabetes patients from medical charts. Study-eligible patients were 18 years or older, reported at least one of two cardinal depression symptoms (items 1 or 2 of the Patient Health Questionnaire-9 [PHQ-9] survey) more than half the days in a 2-week prestudy period, and also scored ≥10 on the PHQ-9, indicating a high likelihood of clinically significant depression. Patients meeting study criteria were randomized to either EUC or the MDDP. Key elements in the MDDP are based on evidence-based depression practice guidelines for primary care and are responsive to known barriers to treatment among patients in public safety net clinics. The structured stepped care algorithm 12-month intervention included 1) Problem-solving therapy provided by bilingual graduate social work diabetes depression clinical specialists (DDCS) and/or antidepressant medications prescribed by the treating primary care provider (PCP); 2) DDCS monthly telephone follow-up symptom monitoring, treatment maintenance, and relapse prevention; and 3) care and service system navigation by the DDCS and an assistant patient navigator. A psychiatrist and PI (Ell) provided weekly telephone DDCS supervision and, if requested, the psychiatrist provided PCP antidepressant medication telephone consultation.

EUC patients received standard clinic care and in addition were given patient- and family-focused depression educational pamphlets (Spanish or English) and a community, financial, social services, transportation, and child care resource list. EUC PCPs were informed of patient depression diagnoses and their study participation and could prescribe antidepressants or refer patients to community mental health care. Patients could also independently seek mental health treatment.

Data collection

The complete set of data collection instruments is described in detail elsewhere [12]. Patients were surveyed at baseline, and outcomes were reported at 6-month intervals thereafter (out to 24 months). Consistent with the prior assessment of study outcomes [12], we evaluated the cost and cost-effectiveness outcomes within the 18-month follow-up evaluation period. Cost and cost-effectiveness results measured out to 24 months were similar.

Depression-free days (DFDs) were calculated from the PHQ-9. A PHQ-9 score of <5 meant that the patient has one full DFD, and a PHQ-9 score of >14 meant 0 DFDs. Scores between 5 and 14 reflected linearly interpolated (0–1) depression scores between remission and major depression [16]. The PHQ-9 was used because it provides both a dichotomous diagnosis of major depression and a continuous severity score and has been found to have high sensitivity and specificity for a diagnosis of major depressive disorder (MDD) based on structured psychiatric interview [17,18]. Health-related quality of life (QoL) was assessed by using the Medical Outcomes Study Short-Form Health Survey (SF-12) Physical Component Summary and Mental Component Summary fitted to the Brazier and Roberts SF-6D utility scale [19]. These utility scores were used to estimate quality-adjusted life-years (QALYs) gained during the evaluation period relative to baseline.

Medical care costs and utilization were obtained from Los Angeles County Department of Health Service electronic medical services records for all study patients, based on Medicare International Classification of Diseases-9, Diagnosis-Related Groups, National Drug Code, and Current Procedures Terminology-4coding. Because county payments are confidential and also so as to make the cost analysis generalizable beyond southern California, we used 2009 Medicare prices to measure medical service costs per unit. Medicare prices (payment amounts allowed by Medicare) were attached to these medical services based on the RBRVS EZ-Fees software program that creates and analyzes physician payments by using Medicare's Resource Based Relative Value Scale for all services except pharmaceuticals [20]. Because the Medicare outpatient drug program (Medicare Part D) was not implemented until after the study was initiated, drug prices were obtained from the 2009 Federal Supply Schedule price list [21]. Because the same 2009 prices were assigned to all medical services, regardless of time period, medical cost inflation was not relevant to the cost estimates.

Intervention costs were measured as actual budget-based cost (not charges) for all DDCS and patient navigator services, using actual salary plus a 32% fringe benefit. Resulting unit costs were $71 per patient visit (90 minutes), $35 per DDCS telephone follow-up (45 minutes), and $10 for each patient navigation call (10–15 minutes). Estimates included record keeping time. Additional costs included $10 for relaxation videotape, $136 per patient for DDCS communication with PCP, and $21 per patient for clinical supervision.

Statistical methods

The key outcomes of interest for the cost-effectiveness analysis were medical and intervention costs, DFDs, and SF-12 utilities. We conducted the primary cost-effectiveness analysis in terms of cost per QALY from a payer perspective, with additional consideration of the overall impacts on medical costs, QoL, and DFDs.

Intent-to-treat analysis was conducted to evaluate all intervention effects. Differences-in-differences regression models were estimated to evaluate systematic cost and utilization differences between EUC and MDDP at 6-, 12- and 18-month follow-up [22,23]. The differences-in-differences regression analysis method is a powerful method for adjusting for any individual-specific unobservable factors that are time-invariant and account for variation in the outcomes.

This is demonstrated in the following equation specification. Suppose that we are interested in the regression specification for an outcome O_{it}, where i is the subscript for individual i and t is the subscript for time period t (O_{i0} represents outcomes measured at the preintervention baseline for individual i). Suppose we have a $(1 \times J)$ vector of J observable exogenous characteristics X_{it}, with the jth characteristic X_{ijt} for individual i at time t. Suppose there is an additional $(1 \times K)$ vector of K time-invariant unobservable individual-level exogenous characteristics I_i (e.g., underlying health, personal attitudes and/or behaviors, personality traits, aptitudes, and background) with the kth unobservable characteristic I_{ik}. Let e_{it} represent the residual random error for each individual i at each time point t. Then, we can write the panel data regression specification for O_{it} as

$$O_{i0} = \beta_0 X_{i0} + \delta I_i + e_{i0} \quad (t = 0) \tag{1}$$

$$O_{it} = \beta_0 X_{i0} + \delta I_i + \beta X_{it} + \gamma\ \text{Treatment} + \xi_1\ \text{Time} + \xi_2\ \text{Time}^2 + e_{it} \quad (t = 6, 12, 18\ \text{ months}) \tag{2}$$

where γ is the treatment effect parameter and ξ_1 and ξ_2 capture a (quadratic) time trend.

We can combine Equations 1 and 2 into the differencing estimation equation:

$$O^*_{it} = (O_{it} - O_{i0}) = \beta X_{it} + \gamma\ \text{Treatment} + \xi_1\ \text{Time} + \xi_2\ \text{Time}^2 + e^*_{it} \quad (t = 6, 12, 18\ \text{ months}) \tag{3}$$