VALUE IN HEALTH ▮ (2017) ▮▮▮–▮▮▮

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Cost-Effectiveness of a Technology-Facilitated Depression Care Management Adoption Model in Safety-Net Primary Care Patients with Type 2 Diabetes

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ABSTRACT

Background: The Diabetes-Depression Care-Management Adoption Trial is a translational study of safety-net primary care predominantly Hispanic/Latino patients with type 2 diabetes in collaboration with the Los Angeles County Department of Health Services. **Objectives:** To evaluate the cost-effectiveness of an information and communication technology (ICT)-facilitated depression care management program. **Methods:** Cost-effectiveness of the ICT-facilitated care (TC) delivery model was evaluated relative to a usual care (UC) and a supported care (SC) model. TC added automated low-intensity periodic depression assessment calls to patients. Patient-reported outcomes included the 12-Item Short Form Health Survey converted into quality-adjusted life-years (QALYs) and the 9-Item Patient Health Questionnaire–calculated depression-free days (DFDs). Costs and outcomes data were collected over a 24-month period (–6 to 0 months baseline, 0 to 18 months study intervention). **Results:** A sample of 1406 patients (484 in UC, 480 in SC, and 442 in TC) was enrolled in the nonrandomized trial. TC had a significant improvement in DFDs (17.3; $P = 0.011$) and significantly greater 12-Item Short Form Health Survey utility improvement (2.1%; $P = 0.031$) compared with UC. Medical costs were statistically significantly lower for TC (–$2328; $P = 0.001$) relative to UC but not significantly lower than for SC. TC had more than a 50% probability of being cost-effective relative to SC at willingness-to-pay thresholds of more than $50,000/QALY. **Conclusions:** An ICT-facilitated depression care (TC) delivery model improved QALYs, DFDs, and medical costs. It was cost-effective compared with SC and dominant compared with UC.

Keywords: automated assessment, cost-effectiveness analysis, cost-utility analysis, depression, direct health care costs, disease management, health technology assessment, primary care, telemedicine.

Introduction

Depression, an often-ignored comorbidity for those with chronic illness [1], creates significant challenges for primary care systems because it worsens health status and outcomes, increases health care utilization and costs, and elevates suicide risk [2–6]. This is particularly true for Hispanic/Latino patients served by safety-net primary care providers, who often find it challenging to engage patients with major depression, particularly when accompanied by concurrent chronic illnesses, because it requires active and ongoing depression symptoms assessment and management on top of managing other medical conditions such as diabetes [7–10]. Concurrently, Hispanic/Latino are less likely to receive guideline-congruent depression care even after controlling for clinical and economic factors [11], more likely to be served by physicians who fail to detect existing mental health problems [12,13], and at higher risk of discontinuing antidepressant use during the first 30 days of treatment [14,15].

An increasingly popular supported care delivery model involves team-based support for chronic care functions and uses patient disease registry information systems to support guideline- and protocol-based clinical decisions [8]. Despite its effectiveness [16–19], integrating depression comorbidity care remains a substantial challenge, especially in terms of proactive screening, treatment follow-up, and long-term monitoring and management, because of the intensive labor and time needed to collect, summarize, and review individual or aggregate patient data to facilitate care [8].

Harnessing advanced information and communication technologies (ICTs) to automate key aspects of depression care is a promising approach to facilitating adoption of the team-based collaborative depression care model [8]. For example, automated

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1098-3015$36.00 – see front matter

https://doi.org/10.1016/j.jval.2017.11.005

speech recognition telephonic assessment technology [20,21] combined with an electronic decision rules and priorities management system [22] can automate depression assessments, patient self-management behavior prompting, optimization of treatment follow-up, and ongoing monitoring and management. This approach can fill gaps in the current implementation of depression care to facilitate optimal adaptive depression management in primary care that could simultaneously improve health care outcomes at reduced costs, reduce the physical or economic burden on patients, and be responsive to patient choice.

The Diabetes-Depression Care-Management Adoption Trial (DCAT) [8,23–29] is a translational study conducted in collaboration with the Los Angeles County Department of Health Services (LACDHS), the second-largest safety-net care system in the United States. Using a comparative effectiveness research design, this quasi-experimental nonrandomized study compared three delivery models in three groups: usual care (UC), team-supported care (SC), and ICT-facilitated care (TC). This article evaluates the cost-effectiveness of the ICT-facilitated care delivery model, implemented in the TC group of the DCAT, in a predominantly Hispanic/Latino safety-net primary care population with type 2 diabetes from a government program or payer perspective.

Methods

As described by Wu et al. [8], the DCAT was conducted from 2011 to 2013 in collaboration with the LACDHS. Institutional review board approval was obtained from the University of Southern California, Olive View–UCLA Medical Center, and Los Angeles Biomedical Research Institute.

Eight public ambulatory care clinics were selected to participate in the DCAT on the basis of criteria that reflect geographic and diabetes care model diversity. The UC group included two community clinics and represents the status quo of clinical practice, in which primary care physicians and their staff perform the translation and adoption of depression care evidence. The SC group used disease management team staff members, including physicians, nurse practitioners, nurses, and social workers, acquainted with guidelines and protocols to support diabetes care management for high-risk or high-use patients. The SC model included a homegrown, Web-based chronic disease management registry (DMR) system to support clinical assessment and decisions. The TC group involved a fully automated telephonic assessment (ATA) system provided in Spanish or English and linked with the DMR to trigger depression care management calls on the basis of patient medical records, call history, and patient preferences [23]. This model was designed to assist time-pressured clinical social workers and medical and nursing providers by routinely screening and monitoring patient depression symptoms, treatment adherence, and communication with providers.

Trained bilingual study recruiters identified patients with type 2 diabetes from database and clinical records. Study-eligible patients were 18 years or older, had been diagnosed with type 2 diabetes, had a working phone number, spoke English or Spanish, and could read and understand the consent form. Patients with possible suicidal ideation, cognitive impairment, alcohol abuse, or recent lithium or antipsychotic medication use at baseline were ineligible for the trial.

As previously described, the DCAT compared three delivery models in three groups: UC, SC, and TC. During the recruitment of TC participants, the recruiters demonstrated ATA calls to participants and assessed their preferences (e.g., language, call time, and password-protected access) [8]. The DCAT project assistant configured patient enrollment and baseline information in the DMR. An algorithm-driven electronic rule and priorities management system then processed DMR clinical and patient preferences data to determine automated call characteristics for each patient (including frequency of call, applicable modules, questions to be asked, language, and call time). Patients then received low-intensity periodic calls assessing depression symptoms and treatment adherence. For patients without history or current diagnosis of depression, the ATA calls were made once per quarter, otherwise once per month. Patient responses to the ATA calls were automatically documented in the DMR. If patients exhibited depressive symptoms, self-harm intentions, or concerns about medication, automated tasks or alerts would engage providers (e.g., nurse care managers, social workers, and emergency responders) to provide appropriate care management. Previous publications have detailed the technology design [23] and evaluated patient acceptance [24] and engagement [28] in the TC approach.

Data Collection

The complete set of data collection instruments is described in detail elsewhere [8]. Patients were surveyed at baseline (–6 to 0 months) and outcomes were reported at 6-month intervals thereafter (0 to 18 months). We evaluated cost and cost-effectiveness outcomes during the 18-month follow-up evaluation period relative to the baseline period.

The DCAT study aimed to accelerate the adoption of the collaborative care depression model. Two previous studies of this care model, the Improving Mood-Promoting Access to Collaborative Treatment randomized controlled trial and the Multifaceted Diabetes and Depression Program study, have conducted cost-effectiveness analyses to establish the economic values of the collaborative care model [30,31]. These studies used the 12-Item Short Form Health Survey (SF-12) and depression-free days (DFDs) as the predetermined outcome measures. To be consistent and comparable with the previous studies, the DCAT also chose the SF-12 and DFDs as outcome measures.

DFDs were calculated using the 9-Item Patient Health Questionnaire (PHQ-9). A PHQ-9 score of less than 5 indicated that the patient had one DFD, whereas a PHQ-9 score greater than 14 indicated no DFDs. Scores between 5 and 14 reflected linearly interpolated (0–1) depression scores between remission and major depression [32]. 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 on the basis of a structured psychiatric interview [33,34]. Health-related quality of life was assessed using the Medical Outcomes Study SF-12 physical and mental component summaries fitted to the Brazier and Roberts' six-dimensional health state short form utility scale [35]. As with the previous collaborative depression care studies, these utility scores and DFDs 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 the LACDHS electronic medical services records for all study participants, on the basis of the *International Classification of Diseases, Ninth Revision*, Diagnosis-Related Group, National Drug Code, and Current Procedures Terminology (4th edition) coding. Because county payments are confidential and to make the cost analysis generalizable beyond Southern California, we used 2013 Medicare prices to measure medical service costs per unit. Medicare prices (payment amounts allowed by Medicare) were attached to these medical services on the basis of the RBRVS EZ-Fees software program, which creates and analyzes physician payments using Medicare's Resource-Based Relative Value Scale for all services except pharmaceuticals [36]. Because the same prices were