Objective: To evaluate the cost-effectiveness of a telephone versus a letter intervention administered by a pharmacist-managed medication therapy management (MTM) program aimed at improving the initiation of guideline-recommended cardiovascular pharmacotherapies, specifically angiotensin-converting enzyme inhibitors/angiotensin receptor blockers and statins, in Medicare Part D diabetic patients.

Study Design: Decision analytic pharmacoeconomic model.

Methods: A model was developed to evaluate the comparative cost-effectiveness of a telephone- versus letter-based MTM strategy aimed at improving adherence to guideline-recommended cardiovascular medications in diabetic Medicare Part D MTM eligible enrollees managed by one pharmaceutical benefits manager. Treatment success was defined as acceptance of guideline-recommended medications for cardiovascular disease and dyslipidemia in addition to no cardiovascular events (ie, myocardial infarction, stroke, cardiovascular death) or other major adverse medication events over a 5-year time horizon.

Results: The simulation study found that 96.86% of enrollees receiving telephone interventions would achieve treatment success with guideline acceptance. Cost reductions using the telephone intervention were also noted in 29.86% of cases, with the overall incremental cost-effectiveness ratio (ICER) determined to be $4684 per additional 5-year treatment success with the telephone intervention relative to the letter intervention.

Conclusions: This decision analysis found that almost all Part D enrollees receiving pharmacist-based telephone interventions (vs the mailings) would achieve treatment success with acceptance of guideline-recommended cardiovascular therapies. In addition, improvements in costs were found in more than one-fourth of cases, with an ICER of $4684 per additional 5-year treatment success.
The economic cost of nonadherence is estimated to be around $100 billion annually. With rising healthcare costs and recent implementation of new healthcare reform, efficient allocation of resources that will provide the greatest impact on health outcomes is critical.

Although the implementation or addition of a pharmacist-delivered medication therapy management program was shown to be associated with higher costs relative to the standard of care (ie, letter intervention), the benefits in terms of health outcomes (eg, decreases in stroke, heart attack, and mortality) that could be realized over a 5-year period were significant, making such a program cost-effective.

Although this review assessed prior research evaluating economic impacts of pharmacist-based patient care interventions, it was reported that many investigations did not assess costs or outcomes in a comprehensive fashion, nor were interventions among older persons investigated extensively. As such, comprehensive economic analyses investigating the impact of pharmacist interventions on clinical or economic outcomes are essential to assess the role of these providers within the healthcare team. The purpose of this analysis was to evaluate the cost-effectiveness of a telephone- versus a letter-based pharmacist MTM program for initiation of guideline-recommended cardiovascular pharmacotherapies in Medicare Part D diabetic patients.

**METHODS**

**Study Design and Patient Population**

A decision-analytic model was developed to assess the comparative cost-effectiveness of telephone versus letter interventions as a means of improving adherence to guideline-recommended cardiovascular medications in a diabetic Medicare Part D enrollee population. The decision tree appears in Figure 1. The base case chosen was that of a 65-year-old male with type 2 diabetes mellitus enrolled in a Medicare Part D plan and being treated for secondary prevention of cardiovascular morbidity and mortality. A 5-year time horizon was used to assess the impact of therapies on clinical outcomes. In addition, clinical trials in this area most often observed patients over a 4- to 5-year time frame, providing data for the model for this length of time. The perspective chosen for cost and resource consumption was that of a third-party payer providing prescription and medical service coverage.

The study’s treatment interventions were performed by Medication Management Center (MMC) at the University of Arizona (UA). These interventions targeted diabetic patients enrolled in Medicare Part D plans administered by a national pharmaceutical benefits manager who had an indication for, but were not receiving, ACE inhibitor/ARB and/or statin therapies. These patients received either a telephone call or letter from the UA pharmacist-based medication MMC. Those receiving a telephone intervention spoke to an MMC pharmacist who discussed ACE inhibitor/ARB and statin guidelines, and the potential addition of these treatments based on the final recommendation by the patient’s physician. Alternatively, patients may have received a letter that listed all current prescription information and subsequently advised patients to discuss these treatments with their physician; however no specific ACE inhibitor/ARB or statin recommendations were made. To control for possible baseline differences in patients receiving the telephone or letter interventions, each patient receiving a telephone intervention was matched to up to 3 patients receiving a letter intervention using a nearest neighbor propensity-score algorithm, which included preintervention drug group, sex, age, RxRisk score, total costs, and number of prescription claims as variables. Results for 182 patients receiving the telephone intervention and 535 matched patients receiving the letter intervention were included in the present study. Details of the intervention are described elsewhere.

Probabilities used to assess the costs and outcomes of the treatment pathways were obtained from several sources. The probabilities for telephone or letter intervention success were obtained from an intervention carried out by the pharmacist-based MMC. Patients not receiving guideline-recommended ACE inhibitor/ARB and/or statin therapies were included as part of this study. Specifically, those individuals may ultimately have been taking only 1 guideline-recommended therapy (ie, an ACE inhibitor/ARB only or statin only) or taking neither medication. Thus, they were initially classified into 1 of 3 initial drug groups: (1) ACE inhibitor/ARB only, (2) statin only, or (3) neither. The proportions of matched patients in each initial drug group are shown in Table 1. Patients were then propensity-score–matched based on their preintervention drug group, among the other criteria described above.

**Clinical Outcomes**

A clinical outcome of treatment success in the current study was defined as acceptance of guideline-recommended medications for CVD and dyslipidemia in addition to no cardiovascular events (ie, myocardial infarction, stroke, cardiovascular death) or other major adverse medication events over a 5-year time horizon.
The probabilities for the clinical effectiveness outcomes, including major vascular events and adverse drug events, were obtained from the literature and are presented in Table 2. The combined major vascular events of interest were myocardial infarction, stroke, or cardiovascular death while on ACE inhibitor/ARB and/or statin therapy over a 5-year time period. A literature search of randomized controlled trials was conducted to find studies that investigated the use of ACE inhibitor/ARBs or statins in the diabetic population, with the primary outcomes reported in each study being myocardial infarction, stroke, and cardiovascular death. Importantly, the studies utilized were the Heart Outcomes Protection Study subgroup analysis, the Micro-HOPE study, for outcomes and adverse events associated with ACE inhibitor/ARB use, and the Heart Protection Study (HPS) subgroup analysis in diabetic patients for data on adverse events and vascular events for patients taking statins.16-18 The durations of follow-up for each study were slightly different, 4.8 years for the HPS study of diabetic patients and 4.5 years for the Micro-HOPE study.
To standardize follow-up at 5 years, the probabilities for events were converted into annual rates (assumed constant), then calculated accordingly as:

\[
    r = - \frac{1}{t} \ln(1 - p)
\]

where \( r \) = rate, \( t \) = unit of time, \( p \) = probability; and

\[
    p = 1 - e^{-rt}
\]

where \( p \) = probability and \( r \) = constant rate per unit time \( t \).

Concerning clinical trials used within the decision analysis, the HPS measured a combined outcome for the 3 major vascular events of interest. The Micro-HOPE study reported a combined event for first major coronary event, including myocardial infarction and coronary death, but reported the events for strokes separately. Thus, these events were combined to arrive at 1 major vascular event total, from which a probability was derived. Though patients may have experienced a stroke and major coronary event, it was assumed these groups were mutually exclusive. Importantly, the aforementioned clinical trials reported a proportion of patients utilizing both agents (ie, ACE inhibitor/ARB and statin), though no single trial focused principally on the benefits of both agents used concomitantly in the diabetic population. Thus, the probability of having an event while taking both an ACE inhibitor/ARB plus a statin was derived from the product of annual rates appearing in clinical trials.

Event probabilities for persons not utilizing pharmacotherapy were derived from the UKPDS Risk Engine V2.0 calculator. The inputs used for age, duration of diabetes, systolic blood pressure, and glycated hemoglobin (A1C) were derived from the Micro-HOPE study, whereas the values for cholesterol were used from the HPS study. The 5-year risk of coronary heart disease was calculated at 18.9% and the 5-year risk of stroke was calculated at 5.3%. Because the risk calculator did not provide a risk figure for a coronary heart disease event and stroke combined, these were initially calculated as 1-year risks and then summed to be converted to a combined 5-year risk. Overall, the combined outcome probabilities were discounted at a rate of 2.5%.

**Table 1. Proportion of Patients Receiving Each Treatment Before (shaded rows) and After Interventions**

| Table 1. Proportion of Patients Receiving Each Treatment Before (shaded rows) and After Interventions
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Telephone (n = 182)</th>
<th>Letter (n = 535)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range Used in Sensitivity Analyses</td>
<td>Range Used in Sensitivity Analyses</td>
</tr>
<tr>
<td>No. (probability)</td>
<td></td>
<td>No. (probability)</td>
</tr>
<tr>
<td>Neither</td>
<td>58 (0.319) 0.255-0.382 172 (0.322) 0.257-0.386</td>
<td>172 (0.322) 0.257-0.386</td>
</tr>
<tr>
<td>Both</td>
<td>9 (0.155) 0.124-0.186 1 (0.006) 0.0048-0.0072</td>
<td>9 (0.052) 0.042-0.094</td>
</tr>
<tr>
<td>ACE inhibitor only</td>
<td>15 (0.259) 0.207-0.311</td>
<td>9 (0.052) 0.042-0.094</td>
</tr>
<tr>
<td>Statin only</td>
<td>8 (0.138) 0.110-0.166 4 (0.023) 0.019-0.028</td>
<td>4 (0.023) 0.019-0.028</td>
</tr>
<tr>
<td>Neither</td>
<td>26 (0.448) 0.358-0.538 158 (0.919) 0.735-1.0*</td>
<td>158 (0.919) 0.735-1.0*</td>
</tr>
<tr>
<td>ACE inhibitor only (no statin)</td>
<td>39 (0.214) 0.171-0.257 114 (0.213) 0.170-0.256</td>
<td>114 (0.213) 0.170-0.256</td>
</tr>
<tr>
<td>Both</td>
<td>6 (0.154) 0.123-0.185 15 (0.131) 0.105-0.157</td>
<td>15 (0.131) 0.105-0.157</td>
</tr>
<tr>
<td>ACE inhibitor only</td>
<td>31 (0.795) 0.636-0.954 81 (0.710) 0.568-0.852</td>
<td>81 (0.710) 0.568-0.852</td>
</tr>
<tr>
<td>Statin only</td>
<td>1 (0.0255) 0.0204-0.0306 0 (0.001) 0.0008-0.0012</td>
<td>0 (0.001) 0.0008-0.0012</td>
</tr>
<tr>
<td>Neither</td>
<td>1 (0.0255) 0.0204-0.0306 18 (0.158) 0.126-0.1896</td>
<td>18 (0.158) 0.126-0.1896</td>
</tr>
<tr>
<td>Statin only (no ACE inhibitor)</td>
<td>85 (0.467) 0.374-0.560 249 (0.465) 0.372-0.559</td>
<td>249 (0.465) 0.372-0.559</td>
</tr>
<tr>
<td>Both</td>
<td>35 (0.412) 0.329-0.494 18 (0.072) 0.058-0.086</td>
<td>18 (0.072) 0.058-0.086</td>
</tr>
<tr>
<td>ACE inhibitor only</td>
<td>1 (0.012) 0.0096-0.0144 2 (0.008) 0.0064-0.0096</td>
<td>2 (0.008) 0.0064-0.0096</td>
</tr>
<tr>
<td>Statin only</td>
<td>45 (0.529) 0.423-0.635 156 (0.627) 0.502-0.752</td>
<td>156 (0.627) 0.502-0.752</td>
</tr>
<tr>
<td>Neither</td>
<td>4 (0.047) 0.038-0.056 73 (0.293) 0.234-0.352</td>
<td>73 (0.293) 0.234-0.352</td>
</tr>
</tbody>
</table>

ACE indicates angiotensin-converting enzyme; ARB, angiotensin receptor blocker.

* Based on the Medication Management Center interventions conducted.15

* Indicates 1.0 was the upper limit for the sensitivity range.

**Adverse Events**

Either predominant or severe adverse events (eg, cough for ACE inhibitor/ARB, myalgias and elevated liver
enzymes for statins) were included in the decision analysis (Table 2). Probabilities for common adverse events were extracted from the Micro-HOPE and HPS diabetes subgroup analysis studies, respectively, and minor adverse events were assumed to require at least 3 physician office visits, laboratory tests, and a switch of therapy after 2 years of therapy. For patients on an ACE and experiencing cough, a switch to an ARB was assumed to carry forward similar probabilities of major vascular events. Patients experiencing myalgias or increases in liver enzymes were assumed to be switched to another statin of similar potency, cost, and impact on the combined outcome of interest. Probabilities were modeled across the 5-year time horizon, suggesting these events may occur at any time.

Major adverse events deemed to be most severe were angioedema for ACE and rhabdomyolysis for statins, requiring hospitalization and drug discontinuation. Although the Micro-HOPE study provided estimates of angioedema in the diabetic population, probabilities for rhabdomyolysis were obtained from the larger HPS study.\(^2^0\) Consistent with minor ADRs, rhabdomyolysis with statins was assumed to occur after 2 years of therapy, with discontinuation of any statin therapy thereafter. Patients experiencing angioedema were assumed to incur this condition in the first 6 months of ACE initiation, followed by a discontinuation of ACE therapy and no switch to an ARB. Finally, patients experiencing major adverse events and discontinuing the therapies of interest were assumed to have the same probability of having an event as if they had not had the therapy at all.

### Costs

The resources consumed and subsequent costs used within the model are presented in Table 2. Cost estimates

---

**Table 2. Undiscounted and Discounted Probabilities With Ranges Used in Sensitivity Analyses**

<table>
<thead>
<tr>
<th>Event</th>
<th>Probability</th>
<th>Range Used in Sensitivity Analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>With both ACE inhibitor and statin</td>
<td>0.114</td>
<td>0.0808-0.1212</td>
</tr>
<tr>
<td>With ACE inhibitor only</td>
<td>0.168 (0.153)</td>
<td>0.1184-0.1776</td>
</tr>
<tr>
<td>With statin only</td>
<td>0.149 (0.144)</td>
<td>0.1056-0.1584</td>
</tr>
<tr>
<td>With neither</td>
<td>0.232</td>
<td>0.1632-0.2448</td>
</tr>
<tr>
<td>Major ADR with statin</td>
<td>0.0005</td>
<td>0.00038-0.00057</td>
</tr>
<tr>
<td>Major ADR with ACE inhibitor</td>
<td>0.00333 (0.003)</td>
<td>0.00266-0.00399</td>
</tr>
<tr>
<td>Minor ADR with statin</td>
<td>0.0063 (0.006)</td>
<td>0.00479-0.00719</td>
</tr>
<tr>
<td>Minor ADR with ACE inhibitor</td>
<td>0.0773 (0.07)</td>
<td>0.0589-0.08832</td>
</tr>
</tbody>
</table>

**Cost, $**

<table>
<thead>
<tr>
<th>Event</th>
<th>Cost, $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter (^d)</td>
<td>2</td>
</tr>
<tr>
<td>Telephone (^d)</td>
<td>60</td>
</tr>
<tr>
<td>ACE inhibitor over 5 years</td>
<td>3429</td>
</tr>
<tr>
<td>Statin over 5 years</td>
<td>7458</td>
</tr>
<tr>
<td>ACE inhibitor major ADR (^d)</td>
<td>5134</td>
</tr>
<tr>
<td>ACE inhibitor with major ADR (^d)</td>
<td>331</td>
</tr>
<tr>
<td>Statin major ADR</td>
<td>9503</td>
</tr>
<tr>
<td>Statin (2 years) with major ADR</td>
<td>2983</td>
</tr>
<tr>
<td>ACE inhibitor minor ADR</td>
<td>192</td>
</tr>
<tr>
<td>ACE inhibitor/ARB switch (2 years ACE inhibitor, 3 years ARB) with minor ADR</td>
<td>3846</td>
</tr>
<tr>
<td>Statin minor ADR</td>
<td>336</td>
</tr>
</tbody>
</table>

\(^a\) Standardized to 5 years for event probabilities. Original event probabilities are in parentheses.

\(^b\) Outcome probabilities were discounted at 2.5% and costs were discounted at 5%. Costs were inflated to 2010 values using the Consumer Price Index medical care component where appropriate.

\(^c\) Ranges represent ±20% of the discounted estimate.

\(^d\) Values were not discounted because costs were either sunk or had been incurred within a 1-year time horizon.

ACE indicates angiotensin-converting enzyme; ADR, adverse drug reaction; ARB, angiotensin receptor blocker; NA, not applicable.
of the letter and telephone interventions, which included materials and time, were provided by the UA MMC. The cost for a major vascular event was established as the most expensive event: a myocardial infarction. The mean cost was obtained from HCUPnet using International Classification of Diseases, 9th edition (ICD-9) code 410.xx. The costs for angioedema (ICD-9 code 995.1) and rhabdomyolysis (ICD-9 code 728.88) were also obtained from HCUPnet. Those having a major ACE ADR were assumed to utilize 6 months’ worth of medication, and those experiencing a major statin ADR were assumed to use 2 years’ worth of medication. Resources consumed for a minor ACE ADR included 2 years of ACE therapy, 3 years of ARB therapy after the switch, and 3 additional 15-minute physician office visits for an established patient. The median office visit costs were obtained from the Physicians Fee Reference 2010 Current Procedural Terminology code 99213 (ie, office or other outpatient visit for the evaluation and management of an established patient). Costs incurred for a minor ADR with a statin also included office visits and the cost of liver function and/or creatinine kinase testing. Patients were assumed to have been switched to a statin product of similar efficacy and price, which they were adherent to.

Medication costs were obtained from the 2010 Red Book, using the average wholesale prices minus 20% plus a $2 dispensing fee for generic simvastatin 40 mg and ramipril 10 mg, because these were the drugs and average doses of medication used in the HPS and Micro-HOPE studies. The cost of an ARB, in the event the patient had a minor ADR with an ACE and switched, was based on the average wholesale price minus 20% of the average monthly cost of all commercially available ARBs in 2010. All costs were discounted at a 5% rate and inflation adjusted to 2010 prices when appropriate using the Consumer Price Index for medical care services or commodities. The cost of a major vascular event was assumed to be incurred at year 5. The cost of a major statin ADR, as well as the cost of both minor ADRs, was assumed to be incurred at year 2. Those costs that are either considered sunk or incurred within 1 year of therapy were not discounted.

Statistical Analyses

All analyses were conducted utilizing TreeAge Pro 2009 Suite (TreeAge Software, Inc, Williamstown, Massachusetts). A probabilistic sensitivity analysis was conducted via a second-order Monte Carlo simulation of 10,000 samples. Beta distributions were utilized for probabilities and gamma distributions for costs, wherein point estimates and standard deviations were utilized to define these distributions. The standard deviation for all variables was assumed to be 50% of the mean values. Additionally, 1-way sensitivity analyses of probabilities and costs were conducted to test the robustness of results. The range of values used for these analyses was ±20% of the point estimate used for the base case analysis. In addition, discounting values were varied from 0 to 5% for outcomes and 0 to 10% for costs to determine if the overall results were sensitive to these inputs.

Results of the model were presented as both average and incremental cost-effectiveness ratios (ICER) as:25

\[
\text{Average cost-effectiveness ratio for an intervention:} \frac{\sum \text{costs of intervention}}{\sum \text{effect of intervention}}
\]

\[
\text{ICER for telephone versus letter intervention:} \frac{\sum \text{Cost}_{\text{telephone intervention}} - \sum \text{Cost}_{\text{letter intervention}}}{\sum \text{Effect}_{\text{telephone intervention}} - \sum \text{Effect}_{\text{letter intervention}}}
\]

The 95% confidence intervals were reported to reflect a range of uncertainty around these values.

RESULTS

The results of the decision analysis are presented in Table 3. The average cost of the letter intervention was lower than that of the telephone intervention (ie, $5471 vs $7110); however, the average effectiveness was also lower (ie, 0.056 vs 0.247). The average cost-effectiveness ratio for the letter intervention was therefore higher than that for the telephone intervention (ie, $112,216 average cost per treatment success vs $32,328 average cost per treatment success). When an incremental analysis was conducted with the letter intervention as the baseline comparator, the resulting ICER was $4684 per additional treatment success for patients receiving the telephone intervention, indicating that the telephone intervention offered increased effect but at an increased cost relative to the letter intervention.

The cost-effectiveness plane generated from the Monte Carlo simulation is presented in Figure 2. Overall, the scatter plot indicated that the telephone intervention was more effective and more costly in 67% of simulated cases. In 29.86% of simulations, the telephone intervention was the dominant strategy, with higher effectiveness and lower costs than the letter intervention. The telephone intervention was associated with lower cost and lower
Cost-Effectiveness of MTM in Medicare Part D Diabetic Enrollees

One-way sensitivity analyses found that the model was robust to key input parameters, including costs and event probabilities. These results indicated that the model was most sensitive to the cost of the event and the probability of having an event if the patient was taking neither medication after either intervention. However, when these values were varied over a wide range of possible values, the overall results of the analysis did not change. Additionally, a sensitivity analysis of discounting factors was conducted, again with no change in results and conclusions of the study.

**DISCUSSION**

The present study compared a pharmacist-based MTM telephone intervention with a mailing. Both interventions sought to improve adherence to guidelines for cardiovascular pharmacotherapies in Medicare Part D MTM eligible diabetic patients. Results indicated that some 67% of simulated cases warranted a trade-off between cost and effectiveness, in that telephone interventions were associated with increased effects at increased costs. In more than 29.86% of the cases, the telephone-based strategy offered an optimal result of reduction in costs and an increase in effectiveness (ie, dominant). Overall, these findings suggest that pharmacist-based telephone interventions are effective in terms of achieving a successful treatment outcome relative to letter interventions at slight increases in overall costs. However, more than one-quarter of cases may have decreased costs in addition to improved outcomes.

The findings from this study parallel others within the scientific literature. For example, a recent comprehensive literature review and meta-analysis of pharmacist-based interventions by Chisholm-Burns and colleagues reported the beneficial impacts on patient care and outcomes, particularly in therapeutic and safety outcomes. Overall, 16% of studies showed a favorable economic impact with pharmacist interventions versus comparator groups, whereas 42% of studies reported mixed results, 5% reported no effect, and 37% had unclear results. Of the 126 articles reviewed, 62 were focused within outpatient,

**Table 3. Comparative Cost-Effectiveness From Monte Carlo Simulation**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Average Cost, $ (95% CI)</th>
<th>Incremental Cost, $ (95% CI)</th>
<th>Average Effect (95% CI)</th>
<th>Incremental Effect (95% CI)</th>
<th>Average CE, $ (95% CI)</th>
<th>ICER, $ (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter</td>
<td>5471 (1634-12,274) NA</td>
<td>0.056 (0.017-0.122) NA</td>
<td>NA</td>
<td>NA</td>
<td>112,216 (33,843-276,790) NA</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>7110 (1931-15,874) 1639 (-5210-9838)</td>
<td>0.247 (0.061-0.552) 0.192 (-0.006-0.501)</td>
<td>32,328 (12,496-73,711)</td>
<td>4684 (-160,676-93,368)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ICER indicates incremental cost-effectiveness ratio; NA, not applicable.

**Figure 2. Incremental Cost-Effectiveness Scatter Plot of Telephone Versus Letter Intervention**

effectiveness in 2.99% of simulated cases, and was dominated (ie, lower effectiveness and higher costs) in 0.15% of cases relative to the letter intervention.

effectiveness, in that telephone interventions were associated with increased effects at increased costs. In more than 29.86% of the cases, the telephone-based strategy offered an optimal result of reduction in costs and an increase in effectiveness (ie, dominant). Overall, these findings suggest that pharmacist-based telephone interventions are effective in terms of achieving a successful treatment outcome relative to letter interventions at slight increases in overall costs. However, more than one-quarter of cases may have decreased costs in addition to improved outcomes.

The findings from this study parallel others within the scientific literature. For example, a recent comprehensive literature review and meta-analysis of pharmacist-based interventions by Chisholm-Burns and colleagues reported the beneficial impacts on patient care and outcomes, particularly in therapeutic and safety outcomes. Overall, 16% of studies showed a favorable economic impact with pharmacist interventions versus comparator groups, whereas 42% of studies reported mixed results, 5% reported no effect, and 37% had unclear results. Of the 126 articles reviewed, 62 were focused within outpatient,
ambulatory, retail, and community settings; many also investigated diabetes, hypertension, and/or lipid management interventions. Importantly, a majority of pharmacist-based intervention studies that focused on diabetes used surrogate laboratory-based clinical outcomes (eg, changes in glucose, A1C), rather than focusing upon the broader management of cardiovascular risk factors (eg, hypertension, dyslipidemia). Most prior work that sought to investigate both clinical and economic outcomes also utilized a pre-post study design without an active control or comparator group. As Chisholm-Burns and colleagues noted in their analysis, partial cost analyses were frequent in the literature rather than the full economic analysis presented within the current cost-effectiveness analysis.11

Numerous studies have additionally investigated selected economic and clinical aspects of pharmaceutical care in diabetes, overall. Monte and colleagues evaluated the impact of clinical pharmacist services on primary diabetes end points (eg, A1C) and secondary metabolic end points (eg, blood pressure, cholesterol) in type 2 diabetic patients.26 Cardiovascular-related medical costs were found to have significantly decreased by $295 at 12 months. Anaya and colleagues investigated the clinical and economic impact of a pharmacist-managed collaborative drug therapy agreement in outpatient diabetic patients and found that A1C significantly decreased in the postintervention period versus baseline values, although low-density lipoprotein concentrations did not.27 For those with a primary or secondary diagnosis of diabetes who were admitted to the hospital, costs were significantly lower in the postintervention period versus the preintervention period ($636 vs $2434). Johnson and colleagues reported statistically significant reductions in A1C and cholesterol concentrations over 1 year with a clinical pharmacist-delivered disease care and MTM program, but no significant change in blood pressure during that time.28 Garrett and colleagues evaluated a 12-month pharmacy care service for diabetic patients in the community setting, finding significant improvements in A1C, blood pressure, and cholesterol concentrations in addition to cost reductions of $918 per patient per year relative to projected costs.29 The multisite observational study by Fera and colleagues found significant blood pressure and cholesterol improvements at a mean follow-up of 14.8 months, inducing medical and pharmaceutical cost reductions of 8.5% and 36.5%, respectively.30 Mean total healthcare cost per patient per year was reduced by $1079 relative to projections, and $278,512 in averted costs were estimated for employers. Finally, the notable Asheville Project, which has provided diabetes patients with education, training, monitoring, follow-up, and referral services since 1997, reported significant improvements in short- and long-term clinical, humanistic, and economic outcomes.31 The long-term clinical benefits included decreases in A1C and lipid levels. Costs were shown to shift from inpatient and outpatient services to medications with the intervention. However, an overall decrease in total direct medical costs was noted.31

In addition to diabetes, multiple studies have also reported clinical and economic outcomes in pharmacist-based hypertension, cholesterol, or cardiac rehabilitation programs.32-39 Two of these investigations closely align with the current investigation in terms of clinical and economic outcomes assessed. The pharmacist MTM hypertension and dyslipidemia program investigated by Bunting and colleagues found that the risk of cardiovascular events—including myocardial infarction, acute coronary syndromes, transient ischemic attacks, heart failure, bypass, angioplasty, and peripheral vascular disease—significantly decreased by 53%.40 Furthermore, cardiovascular-related costs decreased by 46.5% from $13,932 per patient per year in the historical period compared with $734 in the study period, with expected (projected) costs versus actual costs in the study period decreasing by an estimated $928,926. In a similar study, Isetts and colleagues examined a pharmacist MTM program that focused on Healthcare Effectiveness Data and Information Set goals for hypertension and cholesterol.41 They found that total health expenditures decreased significantly (31.5%) in the postintervention period, with an estimated $700,000 per year in reduced annual health expenditures. Overall, these authors estimated the return on investment was more than $12 for each $1 invested in MTM costs.

Despite noting that the current decision analysis comprehensively assessed both costs and outcomes of a telephone MTM intervention relative to a letter-based comparator program, certain limitations must be considered in interpreting or generalizing the results. The MTM program on which this simulation was based noted that a substantial number of persons did not initiate guideline-recommended therapy with either intervention.15 Data for the long-term outcomes from the randomized controlled trials used in the model might also not be representative of other patient populations that might receive MTM services. The current analysis also assumed high levels of medication adherence, fixed disease progression, and optimal comorbid disease management. Several probabilities used in the decision analysis were based on clinical trials, which might not reflect real-world conditions. Finally, a strict definition of treatment success and failure was used.
in this model, wherein those receiving 1 medication only might be viewed as partially successful in regard to guideline adherence. Avenues of future research should seek to collect robust data on other patient-specific factors (e.g., demographic and clinical characteristics, and comorbid medications) and to assess their potential impact on outcomes. Furthermore, because that MTM cost eligibility has been lowered since the time of this study, follow-up analyses on patients that currently qualify are warranted.

CONCLUSION

This cost-effectiveness analysis compared a pharmacist-based MTM telephone intervention with a letter intervention for improving adherence to recommended guidelines for cardiovascular pharmacotherapies in Medicare Part D MTM-eligible diabetic patients. The results of this analysis show, across a 5-year simulated time horizon, the telephone intervention improved acceptance of guideline-recommended cardiovascular therapies in more than 96% of cases relative to letter-based interventions. Cost reductions were also noted in 29.86% of the telephone interventions, with the overall ICER determined to be $4684 per additional 5-year treatment success. Future investigations should seek to address the comparative cost-effectiveness of MTM services across various diseases, settings, and patient subgroups.

Author Affiliations: From NucleusX Market Access (ELO), Atlanta, GA; Mayo Clinic Arizona, Department of Health Science Research (MCG), Scottsdale, AZ; The University of Arizona Mel and Enid Zuckerman College of Public Health, Arizona Prevention Research Center (JC), Tucson, AZ; The University of Arizona College of Pharmacy (GHS), Norman, OK.

Funding Source: None.

Author Disclosures: Dr Olvey is a consultant for the companies that manufacture medications mentioned in this article. Dr Skrepnek was a prior faculty member at the University of Arizona, where the study’s interventions were performed. Dr Guy and Ms Chang have no conflicts of interest to disclose.

Authorship Information: Concept and design (MCG, ELO, GHS); acquisition of data (MCG); analysis and interpretation of data (MCG, JC, ELO, GHS); drafting of the manuscript (MCG, JC, GHS); critical revision of the manuscript for important intellectual content (MCG, JC, ELO, GHS); statistical analysis (ELO, GHS); provision of study materials and patients (MCG); obtaining funding (MCG); administrative, technical, or logistic support (MCG, JC); and supervision (MCG, GHS).

Address correspondence to: Grant H. Skrepnek, Associate Professor, The University of Oklahoma Health Sciences Center, College of Pharmacy & Stephenson Cancer Center, 1110 N Stonewall Ave, Oklahoma City, OK 73126. E-mail: Grant-Skrepnek@ouhsc.edu.

REFERENCES

Olvey • Guy • Chang • Skrepnek


