

# Impact of a Pharmacist Led Comprehensive Medication Management Program in Patients with Diabetes in a Rural Health Care Setting

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**D**iabetes is a chronic disease that continues to be of great concern in the United States, with 37 million people living with diabetes in 2022.<sup>1</sup> This equates to about 1 in 10 Americans diagnosed with diabetes. Of the 37 million patients diagnosed with diabetes, approximately 90-95% have type 2 diabetes.<sup>2</sup> Diabetes comes with a substantial medical cost burden, estimated around \$327 billion in medical costs and lost wages. When compared to those without a diagnosis of diabetes, patients with diabetes have more than twice the medical costs, along with an increased risk for blindness, kidney failure, heart disease, stroke, and amputation.

There is an increased risk for complications in patients with diabetes, and it was the seventh leading cause of death in the United States in 2023.<sup>2</sup> Fortunately, treatment options are available that can help manage diabetes and minimize the risk of micro- and macrovascular complications.<sup>3</sup> Lifestyle and behavior modifications with diet and exercise have shown benefit and reduce the need for oral and injectable diabetes medications. Unfortunately, non-pharmacologic interventions require great motivation from the patient, and studies have shown there is great diversity in motivation levels of patients when adhering to these regimens.<sup>4</sup> When focusing on pharmacologic approaches, there are numerous options that continue to expand. Even with various treatment options, patients can still experience inadequate blood glucose control and an inability to reach target goals of therapy.

The inability to reach treatment goals results from complex medication regimens that cause unwanted adverse drug effects, financial burden, poor medication adherence, or confusion for the patient.

## Abstract

**Background:** Pharmacists providing care in rural areas help increase healthcare access for patients. Further integration of pharmacists into the healthcare team helps patients meet their treatment goals and reduce financial burdens. The Marshfield Clinic Health System (MCHS) Diabetes Care Management program aims to provide high-quality, patient-centered care to enrolled patients through comprehensive medication management (CMM) services. Continued analysis of the Diabetes Care Management program is crucial for understanding the impact pharmacists have on patients with diabetes and determining the feasibility of expanding this service system wide.

**Methods:** As a quality improvement project, this initiative was exempted by the Institutional Review Board. The primary outcome of this study was to analyze the change in hemoglobin A1c (HbA1c) in patients with uncontrolled type 2 diabetes contacted by a pharmacist. A pharmacist provided CMM services and performed a medication reconciliation telephonically with the patient. Pharmacists identified medication-related problems and offered recommendations to the provider. Pharmacists performed follow-up telephone calls to assess each patient's tolerance for medication therapy and additional opportunities to optimize the patient's medication regimen. Secondary outcomes included evaluation of change in blood pressure, change in low-density lipoprotein (LDL) cholesterol, change in hospitalizations, and proportion of patients that reached HbA1c < 8%.

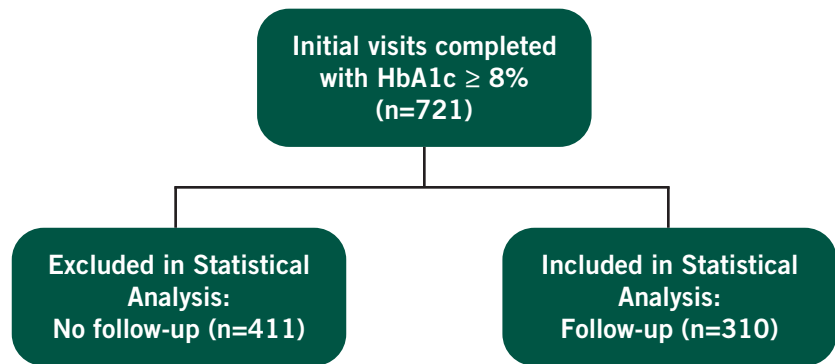
**Results:** There were 310 unique enrollments who completed at least one follow-up visit with a pharmacist and were included in the final statistical analysis. There was a statistically significant decrease in average change in HbA1c from baseline to most recent follow-up visits for patients enrolled in the MCHS Diabetes Care Management Program, which was -1.0% (95% CI: -1.2 to -0.8, p-value: <0.001).

**Conclusions:** The inclusion of a pharmacist on an interdisciplinary health care team showed a reduction in HbA1c values and other laboratory values that are important for patients with type 2 diabetes. As demonstrated in this quality improvement project, pharmacists are an integral component of a patient's health care team. Through comprehensive medication management services provided by pharmacists, patients diabetes management improved, decreasing their risk of health complications and medical costs.

Therapeutic inertia, known as a failure to start or increase drug therapy in an appropriate timeframe, has been shown to be another contributing factor in patients not reaching necessary therapy goals.<sup>5</sup> Access to care and necessary follow-up has long been a barrier to patients reaching therapeutic goals, which is especially true in rural areas because of lack of access to resources, fewer community-based initiatives, lower health literacy, and financial burden.<sup>6,7</sup> The increased burden in rural areas leads to higher morbidity, mortality, and economic losses for those patients with type 2 diabetes. Clinical pharmacists are strategically positioned to help bridge this gap and reduce the burden within rural areas for patients with type 2 diabetes.

Pharmacists are uniquely trained to perform comprehensive medication management (CMM) services with patients and help overcome the barriers they often encounter. Pharmacists working in

**FIGURE 1. Patients Included in Study Analysis**



this capacity alongside other health care providers are positioned to help patients better achieve their goals of therapy. Studies have shown the addition of a pharmacist to the multidisciplinary team has allowed a greater proportion of patients to meet goals of therapy pertaining to diabetes and other disease states.<sup>8,9</sup> Pharmacists help recognize drug therapy opportunities; assess adverse effects, medication affordability, adherence,

medication administration technique; and provide overall patient education. All these factors can help to improve patient understanding and engagement, leading to increased treatment success of disease state management. Pharmacists' incorporation into the patient care team may help patients meet surrogate outcomes and goals that are often monitored for patients with type 2 diabetes, including hemoglobin A1c



(HbA1c), blood pressure, and low-density lipoprotein cholesterol (LDL cholesterol). Targeting the reduction in these surrogate markers helps decrease complications for patients with diabetes and the annual health care costs associated with these patients.

Studies have shown pharmacist addition to care teams leads to decreased health care costs, with one study showing 24% lower health care costs for diabetes patients during the first year when compared to those care teams without pharmacist involvement.<sup>10</sup> Another study showed a 13% reduction in monthly medical costs for patients with diabetes within the treatment group that had a pharmacist incorporated.<sup>11</sup> Additionally, a study looking at hospital readmissions found patients with direct pharmacist involvement resulted in 9.8% of patients experiencing a readmission within 30 days of discharge compared to 20.4% of patients who did not receive direct pharmacist involvement.<sup>12</sup> Another study showed a 1% reduction in HbA1c equates to a 2% reduction in all health care costs.<sup>13</sup> These results emphasize the importance of the pharmacist on the multidisciplinary team and that the presence of a pharmacist can help decrease the high medical costs commonly accrued in patients with diabetes.

Pharmacists are a vital piece of a patient's health care team, and further integration within this team will help patients meet necessary treatment goals and reduce medical financial burden. Pharmacists providing care to patients in rural areas allow for another touchpoint and additional health care access for patients, optimizing patient care and ensuring the highest quality of care is provided. The Diabetes Care Management pilot program within

Marshfield Clinic Health System (MCHS) aims to continue to provide the best care possible to its patients with diabetes by optimizing the use of pharmacists and their role in CMM. The purpose of this project is to conduct an analysis of the Diabetes Care Management program to evaluate the impact on patients enrolled and the feasibility of continuing to expand this program.

## Methods

This quality improvement project was determined to be exempt from oversight by the Institutional Review Board. Marshfield Clinic Health System includes more than 60 Clinic locations, 11 hospitals, Marshfield Children's Hospital and Marshfield Clinic Research Institute, all located throughout the state of Wisconsin and Michigan's Upper Peninsula.

Patients 18 years or older with uncontrolled type 2 diabetes, defined as HbA1c  $\geq$  8%, being followed by providers throughout MCHS from August 2019 through December 2023 were identified and offered enrollment in this quality improvement project (Figure 1). Patients were excluded in the final analysis if at least one follow-up visit was not completed within one year of their initial visit with a pharmacist.

Eligible patients were flagged for pharmacist review. The pharmacist would then provide CMM services telephonically to the patient and send electronic communications to their provider regarding drug therapy opportunities (DTOs). The pharmacist completed follow-up calls every 3 to 6 months to assess drug therapy changes and to identify additional DTOs. Patients continued to be evaluated by their

**TABLE 1. Baseline Characteristics of Patients Included in Final Statistical Analysis**

Characteristic	Follow-up (n = 310)
Age (years)	66.8 $\pm$ 12.8
Initial HbA1c (%)	9.3 $\pm$ 1.5
Initial systolic BP (mmHg)	132 $\pm$ 17
Initial diastolic (mmHg)	74 $\pm$ 10
BP < 140/90 mmHg (%)	232 (74.8)
Initial LDL (mg/dL)	82.2 $\pm$ 39.2
Appropriate statin intensity (%)	186 (80.5)
Hospitalizations	0.3 $\pm$ 0.9
<b>Hypoglycemia</b>	
Never	194 (67.4)
Yearly	25 (8.7)
Monthly	41 (14.2)
Weekly	28 (9.7)
<b>Barriers</b>	
None	38 (12.3)
Knowledge	17 (5.5)
Practical issues	230 (74.2)
Motivation or self-efficacy	21 (6.8)
<b>Insurance</b>	
Medicare	185 (59.7)
Medicaid	47 (15.2)
Commercial	67 (21.6)
None/self-pay	3 (1.0)
<i>Mean <math>\pm</math> SD reported for continuous variables. Counts (%) reported for categorical variables. Complete-case analysis was used when missing data was present: initial LDL (n=21), appropriate statin (n=79), hospitalizations (n=214), hypoglycemia (n=22). Barriers and insurance are not mutually exclusive.</i>	

**TABLE 2. Change in Outcomes From Baseline to Most Recent Follow-up Visit**

Outcome	Initial Contact	Most Recent Contact	Average Difference	95% CI	p-value
HbA1c (%)	9.4 $\pm$ 1.4	8.4 $\pm$ 1.4	-1.0 $\pm$ 1.6	(-1.2, -0.8)	<0.001
Systolic BP (mmHg)	132 $\pm$ 17	128 $\pm$ 13	-3.9 $\pm$ 16.7	(-6.0, -1.8)	<0.001
Diastolic BP (mmHg)	74 $\pm$ 10	72 $\pm$ 10	-1.4 $\pm$ 11.0	(-2.8, -0.01)	0.049
LDL Cholesterol (mg/dL)	82 $\pm$ 39	71 $\pm$ 31	-10.7 $\pm$ 27.3	(-15.1, -6.4)	<0.001
Hospitalizations	0.3 $\pm$ 0.9	0.1 $\pm$ 0.4	-0.2 $\pm$ 0.8	(-0.3, -0.02)	0.024
<i>A paired t-test was used to test whether the change from initial contact was different from zero. Mean paired difference, 95% CI and p-values were reported. Complete case analysis was used when missing data was present: most recent HbA1c (n=79), most recent BP (n=63), LDL (n=157), hospitalizations (n=214)</i>					

primary care provider (PCP) at regular intervals as determined by the provider.

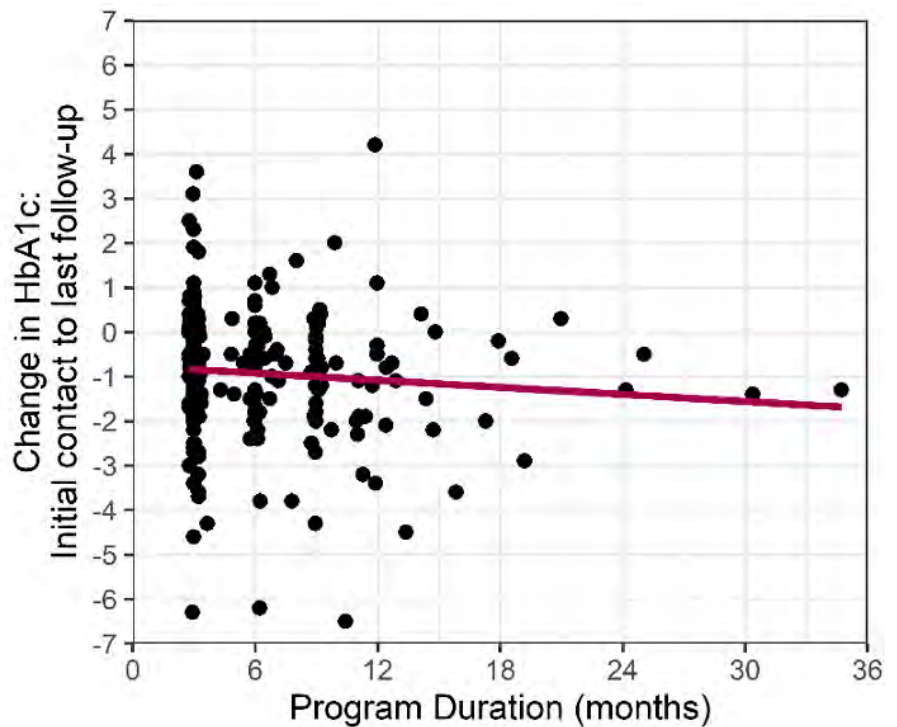
The pharmacist providing the CMM service conducted a medication history assessing for adverse drug effects, administration techniques, patient-reported blood glucose levels, adherence, comorbid disease states, and any barriers to care the patient may be experiencing. The CMM was completed prior to an upcoming PCP appointment. After providing telephonic calls, pharmacists identified any DTOs and provided recommendations to the PCP. Pharmacists documented their interaction and recommendations in the electronic medical record. The pharmacists focused on optimizing medication therapy for all patients' disease states to improve health outcomes and help patients meet their therapeutic goals.

As part of the telephonic visit, patients were mailed medication lists with action plans that included information discussed during their CMM visit and items for the patient to discuss with their PCP at their next scheduled appointment. The patient and PCP could then perform shared decision-making to consider the best way to proceed with therapy options. Patients were considered graduated from the program if their HbA1c decreased to < 8% or were considered unable to reach if they did not answer follow-up phone calls and/or a mailed letter.

All data were manually extracted from the MCHS electronic medical record through patient chart reviews to obtain laboratory values, vital signs, medication history, and other pertinent information. Data for DTOs that were electronically sent to providers was obtained through a tracking document managed by Clinical Pharmacy Services at MCHS.

The primary outcome was a change in HbA1c from initial CMM visit to last follow-up CMM visit. It was analyzed by comparing the baseline value from the patient's initial visit to the last value obtained while the patient was enrolled in the program to assess the effect of pharmacist intervention. Secondary outcomes include evaluation of the change in blood pressure, LDL cholesterol, hospitalizations, proportion of patients that reach HbA1c < 8%, blood pressure <140/90 mmHg, appropriate statin therapy, and correlation between program duration and

**FIGURE 2. Change in HbA1C Based on Participant Duration within the Program**



change in HbA1c.

Patient characteristics of unique enrollments (at least 1 year apart) were reported using means and standard deviation (SD) for continuous variables and counts and percentages for categorical variables. Differences in patient characteristics by follow-up were assessed using t-tests and chi-squared tests. Complete case analysis was used when missing data was present.

Among patients with follow-up, mean HbA1c, systolic and diastolic pressure, LDL cholesterol, and hospitalizations per year were reported at initial contact and most recent contact. A paired t-test was used to assess for changes in HbA1c, blood pressure, LDL cholesterol, and hospitalizations per year. Mean paired differences, 95% confidence intervals, and p-values were

reported. The proportion of patients meeting therapeutic goals (HbA1c <8%, BP <140/90 mmHg, appropriate statin) was reported at initial contact and most recent contact. The correlation between program duration, defined as time between most recent contact and initial contact, and reduction in HbA1c was assessed using Pearson's correlation coefficient. All analyses were completed in R version 4.1.1.<sup>14</sup>

## Results

There were 721 unique enrollments from 686 unique patients that met inclusion criteria. Initial visits were completed between August 2019 and December 2023. There were 310 unique enrollments who completed at least one follow-up visit with a pharmacist and were included in the final statistical analysis (Figure 1).

**TABLE 3. Percent of Patients Meeting Their Therapeutic Goals**

Therapeutic Goal	Initial Contact	Most Recent Contact	Improvement
HbA1c < 8%	0%	37.7%	37.7
BP < 140/90 mmHg	74.8%	83.8%	9.0
Appropriate statin intensity	80.5%	87.9%	7.4
<i>Missing data present in the following: most recent BP (n=63), initial appropriate statin (n=79), most recent appropriate statin (n=70)</i>			

On average, included patients were 66.8 years old with an initial HbA1c of 9.3% (Table 1). Regarding therapeutic goals at baseline, no patients had an HbA1c of < 8%; 74.8% of patients had a blood pressure of < 140/90 mmHg, and 80.5% of patients were taking an appropriate intensity statin. Most patients experienced practical barriers, were insured through Medicare, and never had symptoms of hypoglycemia.

There was a statistically significant decrease in average change in HbA1c from baseline to most recent follow-up visits for patients enrolled in the MCHS Diabetes Care Management Program, which was -1.0% (95% CI: -1.2 to -0.8, p-value: <0.001).

### Secondary Outcomes

**Change in blood pressure:** There was a statistically significant decrease in both the average change in systolic blood pressure and diastolic blood pressure from baseline to most recent follow-up visit for patients enrolled in the MCHS Diabetes Care Management Program of -3.9 mmHg (95% CI: -6.0 to -1.8, p-value: <0.001) and -1.4 mmHg (95% CI: -2.8 to -0.01, p-value: 0.049), respectively (Table 2).

**Change in LDL cholesterol:** There was a statistically significant decrease in average change in LDL cholesterol from baseline to most recent follow-up visits of -10.7 mg/dL (95% CI: -15.1 to -6.4, p-value: <0.001) (Table 2).

**Change in hospitalizations:** There was a statistically significant decrease in the average incidence of hospitalizations due to diabetes from one year prior to initial visit to one year after initial visit of -0.2 (95% CI: -0.3 to 0.02, p-value: 0.024)(Table 2).

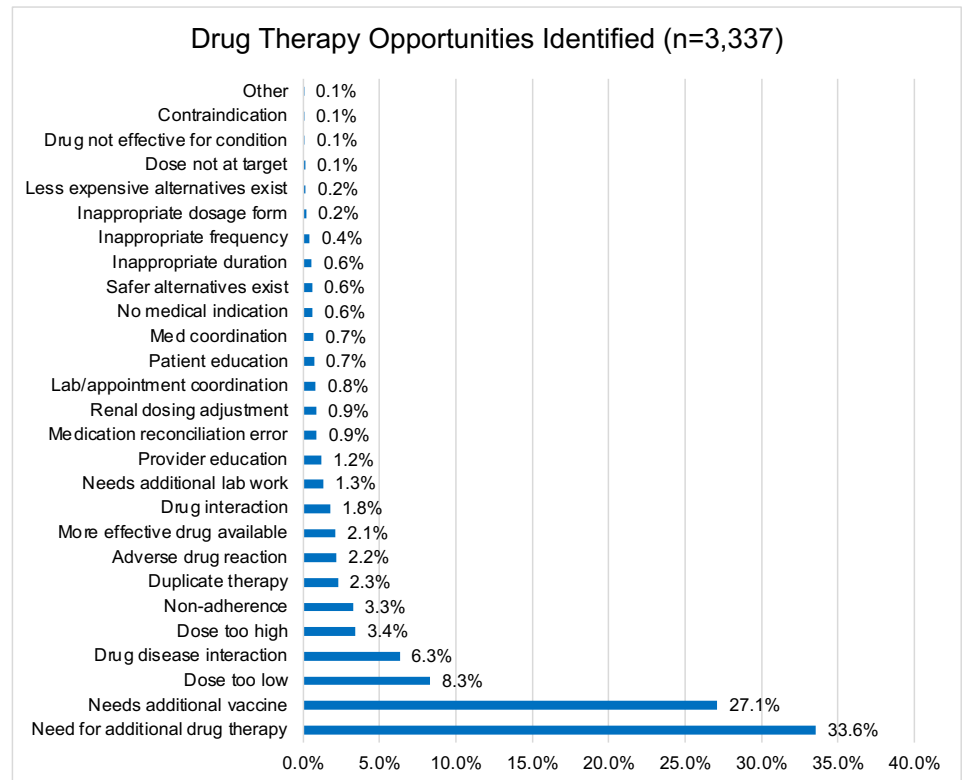
### Proportion of Patients Meeting HbA1C Goal

At baseline, no patients were meeting an HbA1C goal of < 8%, and 37.7% were meeting HbA1C goal at most recent follow-up (Table 3).

### Proportion of Patients Meeting Blood Pressure Goal

At baseline 74.8% of patients were meeting a BP goal < 140/90 mmHg, and 83.8% were meeting BP goal at most recent follow-up. An additional 9% of patients reached treatment goal.

**FIGURE 3. Categories of DTOs Identified by Pharmacists**



### Proportion of Patients Taking Appropriate Statin Intensity

At baseline 80.5% of patients were taking an appropriate intensity statin, and 87.9% were taking an appropriate intensity statin at most recent follow-up. An additional 7.4% were taking appropriate intensity statin.

### Correlation Between Program Duration and Change in HbA1c

Considering that each patient's treatment regimen was individualized and the complexity of type 2 diabetes varied among patients, each patient required a different number of visits with a pharmacist. The change in HbA1c from initial visit to most recent visit was compared to each patient's enrollment length within the Diabetes Care Management Program at MCHS. Reduction in HbA1c was not correlated with time in the CMM program ( $r=-0.06$ ,  $p=0.405$ ) (Figure 2).

### Occurrence of DTOs and Acceptance/Refusal Rate

Among all patients who completed an initial telephonic visit with a pharmacist (n=721), there were 3,337 DTOs identified. Most of the DTOs identified involved a need for additional drug therapy or a need for additional vaccinations (Figure 3). Vaccinations that were reviewed include but are not limited to pneumococcal, influenza, and COVID-19. These vaccinations are important because they help prevent illnesses that can be further complicated by diabetes. DTOs were considered resolved if they resulted in patient or provider education, if the patient or provider refused the recommendation, or if the patient's medication therapy was changed based on the recommendation. At the time of statistical analysis, 3,059 DTOs were found to have resolutions and approximately 25% of DTO resolutions involved therapy change or education.

### Discussion

The main objective of this quality improvement project was to determine the impact of a pharmacist as part of

an interdisciplinary health care team by assessing changes in patient outcomes. There were statistically significant reductions in average HbA1c, systolic blood pressure, and LDL cholesterol. With the pharmacists focusing on CMM services and on patient specific barriers, there was an increased proportion of patients obtaining their goals of therapy from initial visit to most recent follow-up visit. The correlation between program duration and change in HbA1c was weak and not statistically significant.

The involvement of a pharmacist in an interdisciplinary team allows for the contribution of specialized knowledge of medications that can provide additional insight into potential therapy options. The pharmacist has the expertise to provide necessary education to the patient on their medications and different patient-specific barriers. Previous studies have shown that patient education significantly improves medication adherence. Increased adherence is important, considering that medication use is one of the cornerstones for treating diabetes.<sup>15</sup> Pharmacists were also able to educate providers, bringing forward that knowledge to additional patients. With the continued involvement of pharmacist staff and additional providers, the hope is to reach as many patients with uncontrolled type 2 diabetes within the system as possible and help them meet their goals of therapy.

This study has a few limitations to consider. There was no control arm involved in this project. A control arm would allow for a better picture of the exact benefit of the addition of a pharmacist to the healthcare team versus a team without one. Another potential limitation was pharmacists did not make direct medication changes without communicating with the prescribing provider. One final limitation to consider with this study was incomplete or inconsistent obtainment of laboratory values, so data had to be pulled forward from previous laboratory values, which may not have been a complete picture of the patient at a given time.

## Conclusions

The inclusion of a pharmacist on an interdisciplinary health care team was associated with a reduction in HbA1c values and other laboratory values that are important for patients with type 2 diabetes. Pharmacists also helped educate patients

and obtain their goals of therapy. As patients reduce their HbA1c values and continue to meet their therapeutic goals, their risk of health complications and medical costs decreases.

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**PR** This article has been peer-reviewed.  
The contribution in reviewing is greatly appreciated!

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**Acknowledgments:** Rachel Gabor – Biostatistician III and Carolyn Ostrander, MD

**Disclosure:** The authors declare no real or potential conflicts or financial interest in any product or service mentioned in the manuscript, including grants, equipment, medications, employment, gifts, and honoraria.

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