The impact of pharmacists providing direct patient care as members of interprofessional teams on diabetes management

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The purpose of this study was to evaluate the impact of pharmacist providing direct patient care as a member of interprofessional team on diabetes management.

This study is a retrospective chart review of diabetes patients seen by a pharmacist in an endocrinology clinic affiliated with an academic medical center. The following patient outcomes were recorded pre and post the pharmacist intervention: glycemic control as measured by change in hemoglobin A1c (HbA1c), change in systolic blood pressure (SBP) and diastolic blood pressure (DBP), statin use, and use of angiotensin converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs).

144 charts were reviewed, 28 of which were included in the study. A statistically significant improvement in HbA1c was observed in patients following the pharmacist intervention. The mean pre-intervention HbA1c was 8.77% (±SD 2.48) while the post-intervention HbA1c was 7.59% (±SD 1.18), with a p-value of 0.040. A decrease in blood pressure was also observed; however, this decrease was not statistically significant. There was no statistically significant difference in use of ACEI/ARB and statins pre- and post-intervention.

The results suggest that involvement of pharmacists in direct patient care as members of interprofessional team in our specialty ambulatory care clinic is associated with a positive impact on the glycemic control in patients with diabetes.

1. Background

Diabetes is a progressive, chronic metabolic disease characterized by hyperglycemia (Standards of Medical Care in Diabetes, 2016). Chronic hyperglycemia associated with diabetes can cause multi-organ damage resulting in ophthalmic, renal, neurologic, cardiovascular, and other significant complications (ADA, 2016). According to the Centers for Disease Control and Prevention (CDC) 2014 Diabetes Statistics, it is estimated that 9.3% of the U. S. population had diabetes in 2012 (CDC, 2014). Out of these 29.1 million people, 8.1 million were undiagnosed (CDC, 2014). Moreover, diabetes places a tremendous economic burden on health systems. The economic burden of pre-diabetes and diabetes in the U.S. in 2007, for example, was $218 billion signifying an annual cost of approximately $700 for each American regardless of diabetes status (Dall et al., 2010).

The American Diabetes Association (ADA) standards of medical care highlight that therapy should be individualized and tailored to the specific needs of each patient (ADA, 2016). An interprofessional approach is also important to the successful management of diabetes (Jacobs et al., 2012). It is well documented in the literature that pharmacists play a significant role in achieving positive patient outcomes through disease management (Nowak et al., 2002). Pharmacists can contribute to interprofessional teams with their extensive training in chronic disease management (Nowak et al., 2002). Studies have shown that pharmacist involvement in diabetes care improves glycemic control and adherence to ADA standards of care (Nowak et al., 2002).
The primary objective of this study was to evaluate the impact of pharmacist providing direct patient care as a member of an interprofessional team in a specialty ambulatory care setting on the glycemic control in patients with diabetes.

2. Methods

This study is a retrospective chart review of diabetes patients seen by a pharmacist in Banner-University Medical Center South Campus (BUMC-S) Diabetes Physician Offices between August 2014 and May 2015. This study was approved by the Human Subjects Protection Program Institutional Review Board (IRB) of the University of Arizona.

Pharmacists in BUMC-S endocrinology clinic collaborate with endocrinologists, nurses, and dietitians to provide diabetes care. Working closely with physicians, they adjust medications, order labs, make necessary referrals, and provide diabetes self-management education/support (DSME/S) to aid patients in diabetes management.

Patients were included if they were aged 18 years or older, were seen at least twice by a clinical pharmacist during the study period, and had HbA1c values within 6 months prior to or at their first visit with the pharmacist and within 6 months after the first visit with the pharmacist.

Using the electronic health record system, Epic, the following patient data were collected: age, sex, body mass index (BMI), type and duration of diabetes, HbA1c, SBP, DBP, lipid panel, insulin use, insulin pump use, ACEI/ARB and statin use, and presence of comorbidities, such as microalbuminuria, hypertension (HTN), dyslipidemia, coronary artery disease (CAD), retinopathy, and chronic kidney disease (CKD).

The primary outcome was to evaluate the pharmacist's impact on glycemic control, as determined by the change in HbA1c pre and post pharmacist involvement. Secondary outcomes were the pharmacist’s impact on measures such as SBP and DBP, and ACEI/ARB and statin use. Statistical analysis was performed using the software STATA 14.1. Demographic data was analyzed by descriptive analysis. A paired t-test was used for continuous data with a priori alpha of p < 0.05.

3. Results

144 charts were reviewed, 28 of which were included in the study (Fig. 1). The remaining 116 charts were excluded for the following reasons: patient was not seen by the clinical pharmacist or was seen only once during the study period, was only seen after the study period, or lacked a post-intervention HbA1c.

Baseline patient characteristics are summarized in Table 1. Significantly more females (64.29%) compared to males (35.71%) were included in the study (p-value < 0.001). The mean age of patients was 52.07 years and the majority (60.71%) had Type 2 Diabetes Mellitus (T2DM). Except for one patient who was only on oral antidiabetic medications, the remainder of patients were on insulin at baseline (96.43%). Of those patients on insulin, 8 were on insulin pumps (28.57%). Sixteen patients had hypertension (57.14%) and eighteen had dyslipidemia (64.29%). Regarding diabetes complications, 6 patients had CAD, 4 had diabetic retinopathy, 5 had CKD, and 9 had microalbuminuria. The mean number of visits with the clinical pharmacist was 3.46 (±SD 1.598), with a minimum of 2 visits and a maximum of 7 visits.

Regarding the primary endpoint, there was a statistically significant improvement in HbA1c post pharmacist intervention. The mean pre-intervention HbA1c was 8.77% (±SD 2.48), while the post-intervention HbA1c value was 7.59 (±SD 1.18), with a p-value of 0.040 (Table 2).

There was no statistically significant difference in either SBP or DBP pre and post pharmacist intervention. The mean pre-intervention SBP was 131.39 mmHg (±SD 23.61), while the mean post-intervention SBP was 120.92 mmHg (±SD 28.39), with a p-value of 0.094. The mean pre-intervention DBP was 75.96 mmHg (±SD 11.82), while the mean post-intervention DBP was 71.92 mmHg (±SD 12.91), with a p-value of 0.055. Moreover, there was no statistically significant difference in ACEI/ARB use pre and post pharmacist intervention (Table 3). A total of 16 patients were on an ACEI or ARB prior to pharmacist intervention, increasing to 17 patients following pharmacist intervention. Similarly, there was no statistically significant difference in statin use pre and post pharmacist intervention.

4. Discussion

The results of our study showed improved glycemic control in patients with diabetes, which is consistent with such improvement reported by a large body of literature at a greater scale. Glycemic improvement with pharmacist involvement in direct patient care has been documented in the literature (Clifford et al., 2005; Bluml et al., 2014; Coast-Senior et al., 1998; Chisholm-Burns et al., 2010). A study by Bluml et al. for example, observed that pharmacist involvement in providing direct care resulted in a significant improvement in HbA1c and other clinical measures,
Baseline characteristics.

| Patient characteristics | Data |
|-------------------------|------|
| Subjects, total no.     | 28   |
| Male, no. (%)           | 10 (35.7) |
| Mean Age, Years (±SD)   | 52.07 (18.35) |
| Mean BMI (±SD)          | 31.49 (8.86) |
| T2DM, no. (%)           | 17 (60.71) |
| Mean Duration of Diabetes, Years (±SD) | 18.1 (14.49) |
| Insulin Use, no. (%)    | 27 (96.43) |
| Microalbuminuria, no. (%) | 9 (32.14) |
| HTN, no. (%)            | 16 (57.14) |
| Dyslipidemia, no. (%)   | 18 (64.29) |
| CAD, no. (%)            | 6 (21.43) |
| Diabetic Retinopathy, no. (%) | 4 (14.29) |
| CKD, no. (%)            | 5 (17.86) |
| ACEI/ARB Use, no. (%)   | 16 (57.14) |
| Statin Use, no. (%)     | 19 (67.86) |
| Mean # of Visits (±SD)  | 3.46 (1.6) |

BMI = body mass index, T2DM = type 2 diabetes mellitus, HTN = hypertension, CAD = coronary artery disease, CKD = chronic kidney disease, ACEI = angiotensin converting enzyme inhibitor, ARB = angiotensin receptor blocker.

Outcomes in patients with diabetes pre and post pharmacist intervention.

| Variable                        | Mean (±SD) Before (n=28) | Mean (±SD) After (n=28) | p-Value |
|---------------------------------|--------------------------|--------------------------|---------|
| HbA1c, %                        | 8.77 (2.48)              | 7.598 (1.18)             | 0.04    |
| Systolic blood pressure (mmHg)  | 131.39 (23.61)           | 120.92 (28.39)           | 0.094   |
| Diastolic blood pressure (mmHg) | 75.96 (11.82)            | 71.92 (12.91)            | 0.055   |

ACEI = angiotensin converting enzyme inhibitor, ARB = angiotensin receptor blocker.

ACEI/ARB and statin use pre and post pharmacist intervention.

| Variable                        | Pre          | Post         |
|---------------------------------|--------------|--------------|
| ACEI/ARB Use, no. (%)           | 16 (57.14)   | 17 (60.71)   |
| Statin Use, no. (%)             | 19 (67.86)   | 19 (67.86)   |

Including blood pressure and low density lipoprotein (LDL) (Blum et al., 2014). A statistically significant decrease in HbA1c by 0.8% (p-value < 0.001) and a mean change in LDL by −7.7 mg/dL (p-value < 0.001) were observed in this study. Moreover, lower SBP (−1.2 mmHg) and DBP (−0.7 mmHg) values were observed; however, this decrease was not statistically significant (p-value 0.254 and 0.274 respectively) (Blum et al., 2014).

Similarly, Coast-Senior et al. found that primary outcome measures (changes in HbA1c, fasting blood glucose, and random blood glucose) were significantly reduced following pharmacist involvement in direct care (Coast-Senior et al., 1998). HbA1c was reduced from baseline by 2.2% (p-value 0.00004). Fasting blood glucose concentrations decreased by 65 mg/dL (p-value < 0.01), and the random blood glucose concentrations decreased by 82 mg/dL (p-value 0.00001) (Coast-Senior et al., 1998).

A recent non-randomized clinical trial evaluated the effectiveness of incorporating clinical pharmacists into an ambulatory health care team to improve disease control and adherence to medications in patients with diabetes or hypertension (Mino-Leon et al., 2015). In terms of medication adherence, the study showed a significant improvement in the intervention group (p-value 0.006). Patients counselled by pharmacist were at least 55% more likely to achieve BP control and 13% to achieve glycemic control when compared to the control group (usual care) (Mino-Leon et al., 2015).

In our study, lower SBP and DBP values were observed following pharmacist intervention; however, this decrease was not statistically significant. This may be attributed to mean SBP and DBP values at baseline that show overall blood pressure control. The small sample size may have also led to this lack of statistical significance.

There was no statistically significant difference regarding the use of ACEI/ARB in this study. Of note, that this study did not report dose adjustments of these medications or switches from one medication to another. Moreover, at baseline 9 patients (32.14%) had microalbuminuria and all were on an ACEI or ARB post pharmacist intervention.

There are some limitations to this study. It utilized a small sample, largely due to the study period being shortly following the establishment of pharmacist services at the clinic, which decreases the generalizability of the results. This small sample size, and the wide age range of patients—including younger patients without indications for statin and/or ACEI/ARB use—hindered the ability to evaluate these outcomes. Another limitation that may potentially be a source of bias is that due to the team-based nature of the interventions in the joint physician–pharmacist visits; there is no documentation of the specific interventions made by pharmacists. This limitation was best managed by the pre and post pharmacist addition design of the study. Furthermore, the short time span of the study and follow-up period hindered the ability to evaluate long-term outcomes associated with the pharmacist intervention.

In conclusion, results from this study suggests that pharmacist involvement in an interprofessional team at our endocrinology clinic has resulted in an improved glycemic control as shown by significant change in HbA1c.

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