Effect of Polypharmacy on Medication Adherence in Patients with Type 2 Diabetes mellitus

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ABSTRACT

Objective: Non-adherence to treatment is an important and often unrecognized risk factor that contributes to reduced control of blood sugar hence this study aims at assessing the level of medication adherence in diabetic patients. It also determines to investigate beliefs about medications held by people with diabetes, and whether these beliefs influence adherence. Methods: This is a cohort study done for six months in which a sample size of 160 members was included. This study was conducted in a tertiary care teaching hospital in south India. The study included participants with at least one cholesterol level measured, one clinic visit in the previous 6 months, prescribed with at least 2 drugs. Out of 160, 125 (78.1%) patients agreed to participate and agreed to be interviewed, 35 (21.8%) refused for adherence assessment and beliefs about medicines interview. The patients were interviewed by using Morisky 8 item medication adherence and beliefs about medicines questionnaire. Results and Discussion: There is no association between the adherence score and the sociodemographic variables like age, gender, level of education, duration of diabetes. Patients with normal weight have high adherence and is statistically significant with a p value of 0.0004. Patients with co morbidities have high morisky medication adherence score when compared to those who don’t have co morbidities (p = 0.0001). Greater the no. of medicines taken higher the concerns score (p = 0.038). Necessity, concerns, and differential necessity-concerns score of adherers and non adherers are not significant. Conclusion: In this sample, patients reported very high medication adherence rates regardless of number of medicines prescribed. Most people with diabetes have positive beliefs about the necessity of their medication. However, levels of concern are also high. Physicians should not feel deterred from prescribing multiple agents in order to achieve adequate control of hyperglycemia, hypotension, and hyperlipidemia.

Key words: Beliefs about medicines, Diabetes, Medication adherence, Morisky scale, Polypharmacy.

INTRODUCTION

Diabetes is a group of metabolic disorders characterized by hyperglycemia. It is associated with abnormalities in carbohydrate, fat and protein metabolism and results in chronic complications including microvascular, macrovascular, and neuropathic disorders. Diabetes as a chronic disease requires medical care and education to prevent acute and long term complications. In India the prevalence of diabetes is increasing. According to the Diabetes atlas 2006 published by the International Diabetes Federation, the number of people with diabetes in India is currently around 40.9 million is expected to rise to 69.9 million by 2025. Diabetes and other chronic non-communicable diseases (NCDs) are significant public health challenges in the 21st century. It is estimated that 3.8 million deaths were attributable to diabetes in 2007, equivalent to 6% of
all deaths globally. India has the largest population of diabetes patients when compared to any other country, diabetes deaths accounts for 9.7%.³

Polypharmacy is “the prescription, administration, or use of more medications than are clinically indicated.” Inappropriate drug combinations, unnecessary medications, and inappropriate drugs for specific patients (such as the elderly) constitute the problems of polypharmacy. Thus, patients receiving only two medications could have polypharmacy.⁴ Polypharmacy (multiple drug regimen) is the natural consequence of providing evidence-based medical care to patients with Type 2 diabetes.

- Typically, multidrug regimens are required to control hyperglycemia and the associated metabolic risk factors of hypertension and hyperlipidemia
- Patient adherence to prescribed medications is crucial to the goal of reaching metabolic control.⁵
- Causes of Polypharmacy
  - Multiple prescribers
  - Aging population
  - Complex drug therapies
  - Psychosocial contributions
  - Adverse drug reactions that may be interpreted as new medical conditions.⁶

Consequences of Polypharmacy

- Adverse drug events
- Drug-drug interactions
- Potential duplication of therapy
- Increased costs
- Decreased adherence to the drug regimen
- Emergency department visits, hospitalizations, additional medical or surgical interventions
- Decreased quality of life.

Adherence is defined as the extent to which a person’s behavior taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider.⁷ Adherence to medication treatment is essential in order to obtain the full therapeutic benefit of diabetes management.⁸

Diabetes is a chronic condition in which evidence clearly links improved metabolic control via drug therapy to better outcomes. Because of this linkage, one might expect that greater adherence to medical regimens would be associated with better metabolic control, both due to a direct effect and possibly as a marker of adherence to other diabetes self-management behaviors.⁹

Adherence to medication is influenced by several factors such as lack of information, complexity of regimen, concomitant disease, perceptions of benefit, side effects, medication cost, and emotional well being.⁹

MATERIALS AND METHODS

Study design and study period

This is a cohort study done for six months.

Source of data

All the data was collected in the previously designed data collection form. The data required for the cohort study was collected on daily basis for six months. Morisky 8-item medication adherence scale is used to assess the medication adherence in the patients. Beliefs about medicines questionnaire is used to assess beliefs about the diabetic medicines by a diabetic patient.

Sample size

A sample size of 160 members were included in the study in which 35 members did not come for follow up and even did not answer the call. As a consequence, the total sample size included for the study was 125 patients with diabetes.

Inclusion criteria

The study includes,

- One cholesterol level measured
- At least one clinic visit in the previous 6 months
- Prescribed with at least 2 drugs.

Exclusion criteria

The study excludes,

- Patients with terminal illness or cognitive deficits (determined from the medical record)
- Patients who could not communicate in spoken English and Telugu (either directly or through family members).

Method of collection of data

Informed consent was obtained from the study participants after explaining the study details.

Structured interviews were conducted to determine self-reported adherence to diabetes-related medicines. Morisky 8-Item Medication Adherence Questionnaire was used to assess the medication adherence in the patients. Beliefs about Medicines Questionnaire would be used to assess the patient attitude towards medicine. The classes of medicines in this
survey included oral hypoglycemic agents, insulin, antihypertensive agents, lipid-lowering medicines and aspirin. Demographic information, blood pressure measurement, blood glucose levels, and cholesterol values were collected from case sheets. Agreed patients for adherence assessment were interviewed and asked to recall and report the number of missed doses of drugs for 7 days.

**Questionnaires**

**Morisky 8-Item Medication Adherence Questionnaire**

Self-reported adherence would be assessed for diabetes related medicine using the following questions. Patients respond yes or no for the following questions and each answer with yes is given 1 point and no with 0 points. Score 8 is considered high adherence, 6 to <8 is considered as middle adherence and score<6 as low adherence.

**Beliefs about Medicines Questionnaire**

The BMQ consists of two five-item scales assessing patients’ beliefs about the necessity of prescribed medication for controlling their disease and their concerns about potential adverse consequences of taking it. Respondents indicate their degree of agreement with each statement on a five-point Likert scale, ranging from 1 strongly disagree to 5 strongly agrees. Scores obtained for individual items within both scales are summed. Thus, total scores for the Necessity and Concerns Scales range from 5 to 25. Higher scores indicate stronger beliefs. A necessity–concerns differential is calculated as the difference between the necessity and the concerns scales, with a possible range of -20 to +20.

**Statistical analysis**

Descriptive statistics were used to describe demographic and disease characteristics of the patients and for medication adherences scores. Adherers will be compared with non adherers by using chi-square test. Various variables are correlated with medication adherence score by using Pearson correlation coefficient. Various variables are correlated with necessity and concerns scale by using Pearson correlation coefficient. t-test is used to identify the relationship between the adherence and beliefs about medicines.

**RESULTS**

The mean age of patients was 55.7 years (± 9.65), with a minimum age of 40 and maximum of 65 years, and the majority (55.2%) of them were females (Table 1).
Table 2 calculates the characteristics of the patients according the group of adherence. The mean age and standard deviation of low adherers is 56.8 ± 8.5, moderate adherer is 56.1 ± 10.7, and high adherer is 55.2 ± 9.7. The MMAS mean and standard deviation of low, moderate, high adherers is 14 ± 1.1, 5.72 ± 1.37, 8 ± 0.00 respectively.

Table 3 shows that there is no association between the adherence score and the sociodemographic variables like gender, level of education. Patients with normal weight have high adherence and is statistically significant with (p=0.0004). Those who have co morbidities have high morisky medication adherence score when compared to those who don’t have co morbidities (p=0.0001).

Table 4 shows that there is no association between the adherence score and the sociodemographic variables like age, duration of diabetes. There was a negative correlation with number of drugs taken and adherence, lesser the number of drugs taken the adherence is high but it is not statistically significant. There was also a negative correlation with post prandial blood sugar and adherence, patients with high post prandial blood sugar has less adherence which is not statistically significant.

Table 5 gives the patterns of adherence in patients taking 2 or more diabetes-related medications.

**Beliefs about medicines questionnaire**

The majority of the sample (96%) believed in the necessity of their medication for maintaining health. Medication was considered important for both the maintenance of current health and future health. However, overall 46.88% reported concerns about potential adverse consequences of taking their medication. Nearly 51.2% were concerned about potential long-term adverse effects of their medications. Another area of concern was becoming dependent upon medications (46.4% had scores greater than the scale midpoint).

The mean necessity score of 21.41 ± 1.867 was significantly greater than the mean concerns score of 15.29 ± 3.1. The mean necessity–concern differential was 6.1 ± 3.61. For 3 (2.4%) respondents their necessity score was lower than their concerns score (i.e. a negative necessity–concerns differential). For 2 (1.6%) respondents their necessity and concerns scores were equal (Table 6).
Associations of beliefs about medicines

**Necessity of medication**

The mean necessity score for women (20.1 ± 2.24) was less to that when compared to men (22.8 ± 1.38). Correlations between necessity scores and other variables are shown in Table 7.

There was no association between the necessity score and the sociodemographic variables of age. Duration of diabetes, no. of drugs taken, Mean morisky medication adherence, post prandial blood sugar and total cholesterol were all not associated with greater belief in the necessity of medications.

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**Table 5: Patterns of adherence in patients taking 2 or more diabetes-related medications (n = 125)**

<table>
<thead>
<tr>
<th>Medications prescribed per patient</th>
<th>Medications per patient with less-than-perfect 7 day self reported adherence rates (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>Patients (n)</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>28</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>125</td>
</tr>
</tbody>
</table>

**Table 6: Percentage of respondents agreeing/strongly agreeing with Beliefs about medicines questionnaire**

<table>
<thead>
<tr>
<th>Sample n=125</th>
<th>% agreeing or strongly agreeing</th>
</tr>
</thead>
</table>

**Necessity scale**

- My health at present, depends on my medicines: 97.6%
- My life would be impossible without my medicines: 96%
- Without my medicines I would become very ill: 96.8%
- My health in the future will depend on my medicines: 96%
- My medicines protect me from becoming worse: 93.6%

**Concerns scale**

- Having to take medicines worries me: 30.4%
- I sometimes worry about the long term effects of my medicines: 51.2%
- My medicines are a mystery to me: 66.4%
- My medicines disrupt my life: 40%
- I some worry about becoming too dependent on my medicines: 46.4%

**Table 7: Associations of study variables with Beliefs about Medicines Necessity Specific scores**

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Pearson's correlation</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>125</td>
<td>0.06</td>
<td>0.506</td>
</tr>
<tr>
<td>Duration of diabetes</td>
<td>125</td>
<td>0.0369</td>
<td>0.68</td>
</tr>
<tr>
<td>No. of drugs taken</td>
<td>125</td>
<td>-0.137</td>
<td>0.127</td>
</tr>
<tr>
<td>Mean Morisky medication adherence</td>
<td>125</td>
<td>0.03</td>
<td>0.739</td>
</tr>
<tr>
<td>Postprandial blood sugar (mg/dl)</td>
<td>125</td>
<td>0.04149</td>
<td>0.64</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>125</td>
<td>0.0078</td>
<td>0.93</td>
</tr>
</tbody>
</table>
Concerns about medication

Concerns scores for men (15.14 ± 3.2) and women (15.39 ± 3.6) were almost similar. Associations of study variables with Beliefs about Medicines Specific Concerns scores were given in Table 8. Greater the no. of medicines taken higher the concerns score (p=0.038). There was no association between the concerns score and the sociodemographic variables of age.

Duration of diabetes, post prandial blood sugar and total cholesterol were all not associated with greater belief in the concerns of medications.

Relationship of drug adherence to beliefs about medications

Necessity scores for the adherent (21.4 ± 1.8158) and non-adherent (21.4 ± 1.96) drug therapy groups were not significantly different (t=0.116, p=0.97). Concerns scores of the adherent group (15.4 ± 3.02) and non-adherent group (15.12 ± 3.24, t=0.4932, p=0.622) were not significantly different. The necessity–concerns differential was not significantly higher for the adherent group (5.96 ± 3.569) than for the non-adherent group (6.32 ± 3.69, t=0.05450, p=0.5867).

DISCUSSION

After assessing the medication use in 125 patients with type 2 diabetes, it was determined that regardless the number of medications prescribed patients reported very high 7-day medication adherence rates. In this study, only those patients with high adherence (score of 8) were considered adherent and those with middle and low adherer were considered as non adherent. Patients with normal weight have high adherence when compared to obese and overweight patients. Patients with co morbidities have high adherence when compared to patients with no co morbidities. The association between self reported adherence and corresponding metabolic control was weak.

We used Morisky 8 item medication adherence scale and beliefs about medicines questionnaire to measure simultaneous medication adherence and beliefs for patients on multiple drug therapy. As like the study conducted by Grant et al, Patients were not expecting to be asked about their previous week’s medication adherence, there was also less chance for patients to modify their pill-taking behavior in anticipation of the interviews.

We conclude that in a group of patients with good overall adherence, polypharmacy alone does not lead to reduced medication adherence.

The main finding of beliefs about medicines in our study was that 96% of people with diabetes have positive beliefs about the necessity of their medication. However, strong concerns about potential adverse effects, particularly long-term effects, were also expressed by almost half the respondents. There was no association between the necessity score and the sociodemographic variables of age. Duration of diabetes, no. of drugs taken, Mean morisky medication adherence, post prandial blood sugar and total cholesterol were all not associated with greater belief in the necessity of medications.

Greater the no. of medicines taken higher the concerns score. There was no association between the concerns score and the sociodemographic variables of age. Duration of diabetes, post prandial blood sugar and total cholesterol were all not associated with greater belief in the concerns of medications.

Necessity scores for the adherent and non-adherent drug therapy groups were not significantly different. Concerns scores of the adherent group were not significantly lower than those of the non-adherent group. The necessity–concerns differential was also not significantly higher for the adherent group than for the non-adherent group.

CONCLUSION

In this sample, patients reported very high medication adherence rates regardless of number of medicines prescribed. Therefore physicians should not feel deterred
from prescribing multiple agents in order to achieve adequate control of hyperglycemia, hypertension, and hyperlipidemia.

Most patients with diabetes have positive beliefs about the necessity of their medication. However, levels of concern were also high. The beliefs about Medicines Questionnaire may provide a focus for patients to discuss their beliefs, providing opportunities to improve adherence. Patient beliefs of the prescribed medicines show the impact on current and future health and may lead to improved overall adherence.

ACKNOWLEDGEMENT
I would like to thank my heartfelt and fervent thanks to our principal Dr. Chakka Gopinath, M. Pharm., Ph.D., for his moral support to complete my project work.

CONFLICT OF INTEREST
The authors declare no conflict of interest.

ABBREVIATIONS

- **NCDs**: Non-communicable diseases
- **BMQ**: Beliefs about Medicines Questionnaire
- **MMAS**: Mean Morisky medication adherence scale

REFERENCES