



Assessment of Achievement of American Diabetes Association (ADA) Targets in Patients with Type 2 Diabetes Mellitus at a Tertiary Care Centre in Eastern Nepal

This article was published in the following Dove Press journal:
Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy

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Background: Management of type 2 diabetes is not limited to blood glucose control, it also addresses blood pressure and lipid levels in order to prevent associated vascular complications and improve the chances of survival and quality-of-life. Although the American Diabetes Association (ADA) has laid specific target levels for glycated hemoglobin, blood pressure and serum low density cholesterol to be achieved by non-pregnant patients with type 2 diabetes mellitus, these are not being achieved in practice. We took on this study to describe the extent of ADA target achievement at our center.

Methods: We analyzed data of type 2 diabetes patients who attended the endocrinology clinic at our hospital within the past 1 year from the start of the study. Data of the pregnant women and patients with mentions of conditions that might interfere with measurement of HbA1c were excluded.

Results: We analyzed 336 records, 45.8% (n=154) males and 54.16% (n=182) females. The mean age of patients was 52.28±11.9 years. The percentages of patients who had HbA1c <7%, blood pressure <140/90 mm of Hg, and LDL-c <100 mg/dL were 56.5%, 72%, and 56.3%, respectively. Only 37.8% of patients were found to have achieved all three ADA targets. Our findings show that a higher percentage of patients who were ≥50 years of age met LDL-c goals as compared to those <50 years of age, 61.9% vs 49% ($P<0.05$) and that blood pressure control was better among younger age group, 78.9% vs 66.7% ($P<0.05$).

Conclusion: Our study highlights that a significant proportion of patients missed on achieving the ADA targets. This is worrisome and further studies should be done to find out possible reasons behind this.

Keywords: type 2 diabetes mellitus, American Diabetes Association targets, Nepal

Introduction

Diabetes is not only hyperglycemia but comes added with micro and macro vascular complications increasing the economic burden, morbidity, and premature deaths. Hence, treating the patients effectively is crucial to prevent or delay such complications. It has been well established that a reduction in hemoglobin A1c (A1C) and blood pressure (BP) levels significantly reduces microvascular complications. In addition, BP and lipid control substantially reduce cardiovascular disease (CVD), the major cause of death for individuals with diabetes.¹⁻⁴ Therefore, the American Diabetes Association (ADA) recommends that patients with type 2

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diabetes achieve an HbA1c <7%, BP <140/90 mmHg and low-density cholesterol (LDL) <100 mg/dL.⁵ Though these target levels are individualized depending upon the age and medical history of patients, this has been recommended to be followed for most non-pregnant adults with type 2 diabetes mellitus. Despite these clinical recommendations, the availability of evidence-based guidelines and vast knowledge about the complications of diabetes, clinical goals for diabetes outcomes are not being achieved in routine care as a result of insufficient treatment, continuously progressing characteristics of diabetes, changing lifestyles, various causes of diabetes, and so on.^{1,3,5-7} Although abundant studies have commented upon this issue, they have been conducted mostly in other countries and, to our knowledge, no such report is present in our setting. Hence, this study is impactful as it comments upon achievement of recommended ADA goals and will serve as a basis for further studies to analyse the various factors involved in improvement in the quality of Diabetes care in the Nepalese population.

Materials and Methods

This is a hospital based retrospective descriptive study/Registry analysis of a study duration of 9 months, where data was collected from patient records maintained at the Endocrinology and Diabetic clinic, B.P.Koirala Institute of Health Sciences (BPKIHS), located in the city of Dharan in Eastern Nepal. Any lacking information about biochemical tests was availed from the records of the Clinical biochemistry lab, BPKIHS. Records of all patients with type 2 diabetes mellitus who had sought medical care from a diabetic clinic within the past year from the start of the study were included in the study, whereas records of pregnant women and patient records with any mention of conditions that interfere with measurement of HbA1c were excluded. The most recent values of HbA1c, parameters of

lipid profile (HDL, LDL, Triglycerides, Total cholesterol), and blood pressure of patients meeting inclusion criteria were noted and analyzed. Data was entered in MS Excel 2007, and analyzed with Statistical Package for Social Sciences (SPSS Inc., Chicago, IL). Normality test was performed using Kolmogorov Smirnov test. Descriptive and inferential statistics were applied as required. Student's *t*-test was used to compare the results. $P < 0.05$ was considered as statistically significant at 95% confidence intervals. The study was started after obtaining ethical clearance from the Institutional Review Committee (IRC), BPKIHS, code no. IRC/1003/017. As this study did not require contact with patients and also, any data which would uncover identity of the participants were not used, taking consent from the participants was exempted by the IRC. The procedures and measures were done in accordance with the Declaration of Helsinki.

Results

A total of 336 records were analyzed, out of which 154 (45.8%) were of male patients and 182 (54.2%) were of female patients. Mean age of patients (in years) was 52.28 ± 11.9 . Females had higher values of TC, HDL-C, SBP, and DBP and lower value of LDL-C than males, the difference was not significant. Table 1 shows the general characteristics of patients.

The "ABCs of Diabetes" are defined as hemoglobin A1c <7.0%, blood pressure <140/90 millimeters of mercury (mm of Hg), and low density lipoprotein cholesterol (LDL-C) <100 mg/dL. Table 2 presents the status of achievement of these goals among our patients. Seventy-two percent of patients met the blood pressure goals, followed by 56.5% and 56.3% of patients who met the HbA1c and LDL goals, respectively. All three goals were met by only 37.8% of patients.

Table 1 General Characteristic of Patients

| Parameters | Male (n=154) | Female (n=182) | P-value | Total |
|------------------------|--------------|----------------|---------|------------|
| Age (years) | 51.68±12.02 | 51.59±12.13 | 0.8 | 52.28±11.9 |
| T. cholesterol (mg/dL) | 181.4±44.5 | 188.2±41.9 | 0.1 | 185±43.2 |
| HDL-c (mg/dL) | 42.9±17.2 | 43.2±8.2 | 0.8 | 43.1±13.1 |
| LDL-c (mg/dL) | 102±27.9 | 99±27.6 | 0.5 | 100.9±27.7 |
| HbA1c (%) | 6.9±2 | 6.9±1.6 | 0.7 | 6.9±8 |
| SBP (mm of Hg) | 118.1±15.1 | 120.2±16.2 | 0.2 | 119.3±15.7 |
| DBP (mm of Hg) | 76.6±10.2 | 77±10.2 | 0.6 | 76.9±10.2 |

Abbreviations: HDL-c, high density lipoprotein; LDL-c, low density lipoprotein; HbA1c, glycated hemoglobin; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 2 Status of Achievement of ADA Targets

| Number of ADA Targets Met | Percentage of Total (n=336) |
|-------------------------------------|-----------------------------|
| All three | 127 (37.8%) |
| Only HbA1c (<7%) | 190 (56.5%) |
| Only SBP (<140 mm of Hg) | 277 (82.4%) |
| Only DBP (<90 mm of Hg) | 265 (78.9%) |
| Both SBP and DBP (<140/90 mm of Hg) | 242 (72%) |
| Only LDL-c (<100 mg/dl) | 189 (56.3%) |

Abbreviations: ADA, American Diabetes Association; HDL-c, high density lipoprotein; LDL-c, low density lipoprotein; HbA1c, glycated hemoglobin; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 3 Status of Achievement of ADA Targets Dichotomized by Age

| Number of ADA Targets Met | <50 years (n=147) | ≥50 years (n=189) | P-value |
|-------------------------------------|-------------------|-------------------|---------|
| All three | 54(36.7%) | 73 (38.6%) | 0.7 |
| Only HbA1c (<7%) | 75 (51%) | 115 (60.8%) | 0.07 |
| Only SBP (<140 mm of Hg) | 128 (87.1%) | 149 (78.8%) | 0.04* |
| Only DBP (<90 mm of Hg) | 124 (84.4%) | 141 (74.6%) | 0.03* |
| Both SBP and DBP (<140/90 mm of Hg) | 116 (78.9%) | 126 (66.7%) | 0.01* |
| Only LDL-c (<100 mg/dL) | 72 (49%) | 117 (61.9%) | 0.01* |

Note: *P-value significant at level of <0.05.

Abbreviations: ADA, American Diabetes Association; HDL-c, high density lipoprotein; LDL-c, low density lipoprotein; HbA1c, glycated hemoglobin; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 4 Status of Achievement of ADA Targets Dichotomized by Gender

| Number of ADA Targets Met | Male (n=154) | Female (n=182) | P-value |
|-------------------------------------|--------------|----------------|---------|
| All three | 57 (37%) | 70 (38.5%) | 0.7 |
| Only HbA1c (<7%) | 83 (53.9%) | 107 (58.8%) | 0.3 |
| Only SBP (<140 mm of Hg) | 129 (83.8%) | 148 (81.3%) | 0.5 |
| Only DBP (<90 mm of Hg) | 125 (81.2%) | 140 (76.9%) | 0.3 |
| Both SBP and DBP (<140/90 mm of Hg) | 117 (76%) | 125 (68.7%) | 0.1 |
| Only LDL-c (<100 mg/dL) | 84 (54.5%) | 105 (57.7%) | 0.5 |

Abbreviations: ADA, American Diabetes Association; HDL-c, high density lipoprotein; LDL-c, low density lipoprotein; HbA1c, glycated hemoglobin; SBP, systolic blood pressure; DBP, diastolic blood pressure.

We divided patients into two groups according to age. [Table 3](#) depicts the difference in attainment of ADA targets between the two groups. A significantly higher percentage of younger patients met the blood pressure target as compared to older patients, whereas the LDL-c target was met by a greater percentage of older patients.

We dichotomized our findings according to gender, as shown in [Table 4](#). Gender did not seem to influence the achievement of treatment targets.

Discussion

This study is a registry analysis done at a tertiary care centre of Nepal which describes the status of glycemic, blood pressure, and lipid control in type 2 diabetes patients as suggested by the

ADA. This knowledge can be helpful to healthcare providers to improve diabetes care and reduce associated mortality and morbidity. Our findings suggest that only 37.8% of participants met all three ADA criteria of Diabetes control. Achieving these goals seems to be a difficult task, as mentioned in various reports in the literature. Vouri et al⁸ aimed to compare the status of ADA goal achievement at their hospital with the data reported in the literature from the National Health and Nutrition Examination Survey (NHANES) for several time periods (eg, 1988–1994, 1999–2000, 1999–2002, and 2003–2004), Look Action for Health in Diabetes (Look AHEAD, 2001–2004), and community-based endocrinology practice (CBEP, 2000–2004). The prevalence of attainment of the 3-part ABC goal was: 5.2% in the National Health and

Nutrition Examination Survey (NHANES) 1988–1994, 7.3% in NHANES 1999–2000, 7.0% in NHANES 1999–2002, 13.2% in NHANES 2003–2004, 10.1% in Look Action for Health in Diabetes (AHEAD) 2001–2004, and 22.0% in community-based endocrinology practice (CBEP) 2000–2004. These large studies analyzed data from different time periods and indicated suboptimal achievement of ADA targets. Vouri et al also compared the targets achievement in years 2001–2002 and 2008–2009 at their center. They concluded there was an improvement in HbA1c, blood pressure, and LDL-c from 43.2% to 54%, 29.2% to 41.8%, and 49.5% to 66.6% in 2008–2009 as compared to 2001–2002. This was possible by performing, first, frequent diabetes classes and clinics, second, implementing a telephone based home care coordination program, and, finally, adding computerized clinical reminders to the electronic medical record for conducting diabetes performance measures. This study describes a commendable journey of improvement in accomplishing the ADA targets. But, in contrast to these findings, Menon and Alhuwalia⁹ report low prevalence of meeting ADA targets and also no significant improvement by addressing required issues at their center. They enrolled 100 Diabetic patients and followed them up monthly with blood pressure recordings and estimation of blood glucose for 6 months. The treatment modifications were done to achieve levels of HbA1c, BP, and LDL-C as per ADA guidelines. Education on diabetes control was provided in OPD. All patients were counseled about diet. Levels of HbA1c and serum lipids were estimated at baseline, 3 and 6 months. On the contrary to the increase in achievement of ADA goals by addressing mentioned issues as shown by Vouri et al,⁸ this study concluded that, despite so many efforts, no significant improvement could be achieved at 6 months. The study quoted that

Failure to achieve ABC targets could be related to patient, physician and systemic factors. Quality of diabetes care is dependent on interaction between the above three factors, eg, the primary responsibility of a patient in diabetes care is adherence to life style measures and anti diabetic medications which is dependent on a healthy interaction between the health care provider and the patient. Systemic factors interact with patient in the form of providing accessibility and availability of medicines. Systemic factors interact with physician factors including administrative, time pressures and educational barriers.

To our understanding, these factors vary not only across different countries and ethnic groups but also vary individually.

Our findings suggest about 2/3rds of patients could not achieve the treatment targets. The blood pressure target was met by the highest number of patients. This could be because measuring blood pressure is free of cost as compared to the biochemical parameters which burden patients with additional cost, especially when done regularly. Apart from this, lack of awareness regarding the disease process and complications also play an important role. It is important that elaborate studies be done to comment on different factors involved in suboptimal achievement of targets in our setting.

Several other studies conducted in both developing as well as developed countries have showed the achievement of these goals to be far from satisfactory. A study conducted at four Peripheral Diabetic clinics in Karachi district of Pakistan¹⁰ concluded the percentage of patients meeting HbA1c, blood pressure, and LDL-c targets to be only 59.04%, 13.02%, and 12.16%, respectively. A cross-sectional study conducted at the Endocrine and Metabolism Research Center outpatient clinics, Iran¹¹ reported the percentages of achievement of ABCs to be 37.4%, 35.3%, and 48.9%, respectively. All three targets were met by only 7.7%. Casagrande et al¹² analyzed national data from the NHANES in 2007–2010 and reported prevalence of achievement of ABCs to be 52.5%, 72%, and 56.5%, respectively. All three targets were met by only 18.8%. A review published by Pinchevsky et al¹³ analyzed data from 14 different studies and 19 different countries (17 high income, one upper middle income, and one low income country). On the one hand, although most of the studies found and included were from higher-income countries, poor control of ADA targets was common among all. But, on the other hand, a couple of European and American studies demonstrated 2–3 times better achievement of HbA1c and LDL targets as compared to low income countries. A study published in NEJM¹⁴ analyzed achievement of Goals in US Diabetes Care, 1999–2010 and concluded that, although there were improvements in risk-factor control and adherence to preventive practices from 1999 to 2010, almost half of patients with diabetes did not meet the recommended ADA goals. In a study done by Hussain et al¹⁵ it has been reported that only 37.2% and 16.5% of patients had normal LDL-C and HbA1c values, respectively. A study done in Hong Kong¹⁶ with an objective of looking into depressive symptoms and glycemic control concluded that all three targets were met by only 13% of patients followed by 40%, 35%, and 12% of patients who met two targets, one target and no target at all, respectively. Elbur et al¹⁷ reported that 49.7% of type 2 diabetes patients met LDL target and 30.9% reached the desired HbA1c target.

Our study shows gender does not influence the achievement of ADA goals. This is in contrast to findings reported by Casagrade et al¹² who stated the prevalence of meeting the A1C goal was higher in women than in men. They also commented that meeting the LDL-c goal was frequent in older as compared to younger individuals, which is in agreement with our results. This similar finding is commented on in a review published in NJEM.¹⁴ We did not attempt to look for reasons behind these findings as it was beyond the aim of study. But, since similar findings have been reported in the literature, there seems to be an association, and we suggest that further longitudinal studies could evaluate the same.

As discussed, studies done in various countries report most patients to have significantly missed the ADA targets. To our surprise, not only are the developing countries unable to achieve ADA goals, even developed countries lack behind.

Limitations

Due to the retrospective nature of the study and lack of contact with real patients, we could not include many important variables which could influence the result. We recommend a prospective study which will be able to evaluate and comment upon the causes behind the lack of achievement of ADA targets.

Conclusion

Our study reports a lack of achievement of ADA treatment targets in a significant number of patients. Such a result is alarming and we encourage more studies to be performed at different centers to comment on this issue. We also suggest performing studies to identify the reasons behind this so that they can be addressed in order to improve diabetes care.

Disclosure

The authors report no conflicts of interest for this work.

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