Quality of Care for Type 2 Diabetes Mellitus in a Military Primary Care Setting

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ABSTRACT

- **Objective:** To assess the quality of care provided to patients with type 2 diabetes in a military primary care setting.
- **Design:** Cross-sectional records-based study.
- **Methods:** The records of 543 adults with type 2 diabetes at the Al Kharj Military Industry Corporation Hospital, Saudi Arabia, were reviewed, and 16 process and 7 outcome quality indicators were assessed.
- **Results:** Compliance with process indicators was variable, with more than 90% of the patients having measurement of HbA1c at least twice yearly and serum cholesterol, triglycerides, and creatinine at least once yearly, whereas less than half had LDL and HDL cholesterol, microalbuminuria, albumin-creatinine ratio, and foot examination at least once yearly. None had documented influenza or pneumococcal vaccination. For outcome indicators, 10.4% had glycemic control and 18.7% had controlled hypertension. Only 3 patients (0.6%) had both glycemic and LDL control, 9 patients (1.7%) had controlled glycemia and hypertension, and 1 patient (0.2%) had control of the 3 parameters. The mean level of HbA1c was lowest among patients controlled by diet only ($P < 0.001$).
- **Conclusion:** The findings indicate low compliance with process quality indicators and even worse compliance with outcome indicators, particularly when combined. The wide gap between optimum outcomes and actual practice points to the need for concerted efforts to implement improvement interventions to close the gap.

Diabetes mellitus (DM) is a global health problem with associated significant morbidity and mortality reaching epidemic proportions [1]. It is one of the most common chronic health problems in Saudi Arabia, with an overall prevalence in adults reaching 23.7% [2]. Moreover, high rates of complications were noted in a study of type 2 diabetes patients admitted to King Khalid University Hospital, Riyadh, such as nephropathy (32.1%), acute coronary syndrome (23.1%), cataracts (22.9%), retinopathy (16.7%), and myocardial infarction (14.3%) [3]. Most diabetes complications are due to micro- and macrovascular disorders [4].

The care for most chronic diseases is now provided in primary care settings [5], and the last 2 decades have witnessed a considerable shift in the care of diabetes from secondary and tertiary care to primary care [6]. The main responsibility for diabetic control and preventative follow-up falls to family physicians and primary care providers. This role is of major importance given the evidence that strict control of blood glucose, blood pressure, and cholesterol can lower the risk of diabetic complications [7,8].

Despite the many diabetes management guidelines and programs, the compliance of primary care providers with practice recommendations is inadequate [9]. Consequently, a significant proportion of diabetic patients remains at high risk and develop diabetes-related complications [10].

Standards for measuring quality of diabetes care have been developed [11,12]. The American Diabetes Association (ADA) evidence-based standards of care for diabetes are widely recognized quality indicators [13]. This study sought to examine the extent to which the ADA guidelines are applied in our study setting. Our objective was to assess the quality of care provided to type 2 diabetes patients in a military primary care setting using the ADA indicators.

METHODS

Setting

This cross-sectional record-based study was conducted at the Al Kharj Military Hospital, Al Kharj, Saudi Arabia, and Riyadh Military Hospital, Riyadh, Saudi Arabia.
between January and March 2011. This 127-bed general hospital is a part of Riyadh Al Kharj Hospital Program, which provides health care services to the employees of the Military Industry Corporation Complex and their dependents; 132,351 patients had registered medical records at the time of the study. The population served consists mainly of Saudis living in an agricultural community located 50 km from the capital, Riyadh. It has large food processing industries and excellent connections to other urban centers in the country through a system of highways and railroad. The region has one of the lowest illiteracy rates in the Kingdom. The study population has free access to our hospital, which offers inpatient and outpatient services in different specialties in addition to primary care services. Twenty multinational physicians provide the primary care services in 13 general practice, 2 well-baby, 1 staff health, and 2 chronic diseases clinics. They received 183,759 walk-in and booked patient visits during the year 2009. The total number of diabetic patients registered in the center is approximately 7000.

**Patient Sample**

The criteria for patient study inclusion were being an adult with established diagnosis of type 2 diabetes and having a medical record at the hospital. A target HbA1c of < 7% of 24% [14] was utilized in sample size calculation using Epi-Info 6.04 program for personal computers. Accordingly, a sample size of 543 patients was required for estimation of this indicator—or other indicators with equal or higher prevalence—with 2% standard error at 95% level of confidence, and accounting for an expected dropout rate of about 15%. A consecutive sampling technique was used in recruiting patients from primary care clinics. The study protocol was approved by the family and community medicine department research committee.

The recruitment of the sample was through the outpatient clinics. The researchers approached the patients attending the clinics who fulfilled the inclusion criteria, explained to them the aim and process of the study and invited them to participate, indicating their rights to refuse or withdraw with no reason given or consequences. The confidentiality of any obtained information was ensured. The patients who gave their oral consent to review their medical records were included in the study sample.

**Data Abstraction**

The researchers developed a checklist for data abstraction. It included basic personal and medical information of the patient and 16 process and 7 outcome quality indicators based on the ADA recommendations [13] and covering the areas of control of glycemia, early detection and treatment of glycemic complications, and cardiovascular disease. The tool was rigorously reviewed and pilot tested on 50 patient records to assess its feasibility and the availability of data. The sources of data were the patient last encounter form, medical record, and laboratory and pharmacy registries. Any missing data were considered as not done.

**Analysis**

Data entry and statistical analysis were done using the SPSS 14.0 personal computer package. Analysis of variance was done to investigate the relation between the level of HbA1c and the treatment regimen. Statistical significance was set at \( P < 0.05 \).

**RESULTS**

The study sample consisted of 543 patients with type 2 diabetes. Their ages ranged between 26 and 95 years, with a mean age (SD) of 57 (12) years and a median of 56 years. About two-thirds (63.7%) were women. According to body mass index (BMI), 26.8% were overweight and 65.1% obese. More than half of the patients (61.7%) were on oral hypoglycemic agents, 11.0% on insulin, 23.2% on combined oral agents and insulin, and 4.1% controlled by diet only. The majority was taking aspirin (78.6%), lipid-lowering agents (72.2%), and antihypertensive drugs, either angiotensin-converting enzyme (ACE) inhibitors (42.0%) or angiotensin II receptor blockers (31.1%).

The ADA quality care standards showed wide variation in their implementation. As Table 1 shows, some processes were completed in more than 90% of the patients, such as HbA1c testing at least twice yearly and serum cholesterol, triglycerides, and creatinine measurement at least once yearly. Conversely, other process indicators were done for less than half of the patients, such as LDL and HDL cholesterol measurement, microalbuminuria and albumin-creatinine ratio, and foot examination at least once yearly, as well as BMI checking and documentation of exercise at routine clinic visits. None of the patients had documented influenza or pneumococcal vaccination.

With regard to outcome indicators, Table 1 demonstrates that the best achievements of goals were related to blood lipids (except LDL cholesterol), and microal-
buminuria, although most of the rates were only slightly above 50%. On the other hand, the achievement of glycemic control was very low.

Examination of the control of glycemia, hypertension, and serum LDL cholesterol in the whole sample singly and combined revealed very low rates of goal achievements (Figure). Singly, the best control was for blood pressure, while the lowest was for LDL cholesterol. When combined, very low rates were shown. Only one patient (0.2%) had control of the 3 parameters.

The mean level of HbA1c in the total sample was 9.4%, with a wide range (Table 2). The level among patients controlled by diet only was the lowest (\( P < 0.001 \)), followed by those on oral medications (\( P = 0.001 \)), while it was highest in the insulin and combined groups.

**DISCUSSION**

The study results indicate generally poor control of diabetes among patients attending our primary clinics. There was better achievement of process indicators than of outcome indicators. The achievement of the target of HbA1c < 7% was very low (9.9%) compared to similar studies, which reported rates of 54% in general practice settings in Belgium [15] and 59.9% in primary health care settings in Germany [16]. In Barbados primary care settings, the rate was 28%, which is still more than double

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**Table 1. Performance on Quality Indicators (n = 543)**

<table>
<thead>
<tr>
<th>Process Indicators</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c twice annually</td>
<td>519</td>
<td>95.6</td>
</tr>
<tr>
<td>BP measured at routine diabetes visits</td>
<td>470</td>
<td>86.6</td>
</tr>
<tr>
<td>Total cholesterol annually</td>
<td>504</td>
<td>92.8</td>
</tr>
<tr>
<td>LDL cholesterol annually</td>
<td>174</td>
<td>32.0</td>
</tr>
<tr>
<td>Triglycerides annually</td>
<td>504</td>
<td>92.8</td>
</tr>
<tr>
<td>HDL cholesterol annually</td>
<td>174</td>
<td>32.0</td>
</tr>
<tr>
<td>Microalbuminuria or albumin-to-creatinine annually</td>
<td>114</td>
<td>21.0</td>
</tr>
<tr>
<td>Serum creatinine annually</td>
<td>505</td>
<td>93.0</td>
</tr>
<tr>
<td>Foot examination annually</td>
<td>200</td>
<td>36.8</td>
</tr>
<tr>
<td>Weight check at routine visits</td>
<td>449</td>
<td>82.7</td>
</tr>
<tr>
<td>BMI check at routine visits</td>
<td>122</td>
<td>22.5</td>
</tr>
<tr>
<td>Referral for eye exam annually</td>
<td>439</td>
<td>80.8</td>
</tr>
<tr>
<td>Documentation of diabetes education at routine visits</td>
<td>284</td>
<td>52.3</td>
</tr>
<tr>
<td>Documentation of exercise at routine diabetes visit</td>
<td>176</td>
<td>32.4</td>
</tr>
<tr>
<td>Influenza and/or pneumococcal vaccination</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome Indicators</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c &lt; 7%</td>
<td>54</td>
<td>10.4</td>
</tr>
<tr>
<td>BP &lt; 130/80 mm Hg</td>
<td>88</td>
<td>18.7</td>
</tr>
<tr>
<td>Total cholesterol &lt; 200 mg/dL</td>
<td>358</td>
<td>71.0</td>
</tr>
<tr>
<td>LDL cholesterol &lt; 100 mg/dL</td>
<td>48</td>
<td>27.6</td>
</tr>
<tr>
<td>Triglycerides &lt; 150 mg/dL</td>
<td>289</td>
<td>57.3</td>
</tr>
<tr>
<td>HDL cholesterol &gt; 50 mg/dL</td>
<td>98</td>
<td>56.3</td>
</tr>
<tr>
<td>No microalbuminuria</td>
<td>65</td>
<td>57.0</td>
</tr>
</tbody>
</table>

BMI = body mass index; BP = blood pressure.
our rate. In addition, the mean HbA1c level of our sample (9.4%) was high compared with mean levels reported in other studies. For instance, a mean level of 6.9% was reported in primary care settings in the Netherlands [17], and the mean was 7.43% among diabetic patients in a rural health care setting in Montana [18] and 8.6% in community health centers in Chicago [19]. Our mean is even higher than the means found in a primary care practice in Riyadh, Saudi Arabia, which ranged between 7.65% and 7.84% [20]. However, these latter primary care settings were affiliated with a University hospital (King Khalid University Hospital), which might explain some of the difference with our study. Meanwhile, Babwah [21] reported a mean HbA1c similar to ours (9.44%) in diabetic patients attending a Trinidad health center. However, the author showed a significant reduction in this mean to 7.96% at a 36-month follow-up of a quality improvement program.

Statistically significant differences in the mean HbA1c levels were seen among the different treatment regimens. Patients controlled only by diet had the lowest, whereas patients on insulin therapy only or insulin combined with oral hypoglycemic agents had the highest. This should not imply better control without medications and worse control with insulin due to the cross-sectional design of our study, where temporal relationships cannot be ascertained. Thus, we cannot differentiate whether the high HbA1c mean led to the choice of the treatment regimen, or was a consequence of this regimen. A similar finding was previously documented by Voorham et al [17]. However, Otieno et al [22] found that diabetic patients on oral agents had the highest mean HbA1c, but in agreement with our findings, those on dietary regimen only had the lowest mean. They attributed their finding to better endogenous insulin production among these latter patients.

Although almost all of our patients (95.6%) had their HbA1c checked at least twice a year according to guidelines, less than one-tenth of them achieved glycemic control. In contrast to these findings, Wong et al [23] saw lower compliance with HbA1c checking (92.8%), but 58.0% of their patients achieved glycemic control. Our paradoxical finding might be attributed to the lack of concerted efforts in the provision of diabetic care services. The role of dietitians and
health educators seems to be less prominent compared to lab checking, where about half of the patients had no documentation of receiving health education regarding diabetes. Additionally, only about one-third or less of our patients had their BMI and feet checked and had documentation of exercise according to guidelines. A similar discrepancy between process and outcome indicators was reported in a study in Sweden where logistic regression analysis did not reveal any significant association between adherence to guidelines and the outcomes of diabetic patients [24].

The achievements of other targets were slightly better, with about one-fifth of the patients having controlled blood pressure, and about half having controlled blood lipids. Nonetheless, the percentages of our patients with controlled blood pressure are still far lower than those reported in previous studies, ranging from 28% [25] to 50% [15]. For blood lipid control, our figures are comparable to or even better than those seen in the literature: 9% to 29% [25], 36.4% [23], 48% to 52% [26], and 46% to 71% [24].

When we looked at the combined measure of achieving all 3 outcome goals, outcomes were very poor. Thus, out of 543 patients, only 1 (0.2%) achieved the combined targets for HbA1c, blood pressure, and blood lipids. The finding is alarming; it might be attributed to factors related to our patient population, with generally low levels of education and health-seeking behaviors. Nonetheless, service-related factors cannot be ignored as the center is just starting a dedicated diabetes control service. A holistic approach to the patient, taking into account the individual, is needed.

The quality of care provided to type 2 diabetes patients in our center appears to be far from the evidence-based standards of medical care. This implies that our center needs major efforts for improvement of these services.

Our study’s limitations include it being a cross-sectional record-based study, with all the problems of incomplete data and lack of temporality. For instance, none of the patients had documented influenza or pneumococcal vaccination, although these vaccines are often used in our primary care setting; this supports the presence of the problem of incomplete records. Nonetheless, the lack of accurate documentation is a reflection of poor quality. Therefore, we recommend developing a quality improvement program targeting the identified gaps in process indicators, and focusing on the most deficient outcome indicators.

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REFERENCES