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# Clinical Audit of Diabetes Care in the Bahrain Defence Forces Hospital

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# مراجعة إكلينيكية لجودة الرعاية الصحية لمرضى السكري في مستشفى البحرين العسكري

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**الملخص**: **الهدف**: أثبتت المراجعات الإكلينيكية للرعاية الصحية الأولية في مملكة البحرين أن الرعاية المقدمة لمرضى السكري لا تستوفي الأهداف المعتمدة دولياً. تعد هذه الدراسة الأولى من نوعها في تقييم جودة الرعاية لمرضى السكري في أحد مستشفيات البحرين. **الطريقة**: مراجعة إكلينيكية استعادية لعينة عشوائية من المرضى المترددين على عيادة الغدد الصماء و السكري في مستشفى البحرين العسكري خلال 15 شهراً متتالية حتى يونيو2010. تمت مراجعة السجلات الطبية إلكترونياً و يدوياً ل 287 مصاباً بالسكري لتقييم المقاييس الأساسية ونتائج جودة الرعاية ، وتم تحليل البيانات إحصائياً. **النتائج**: 74% من عينة المرضى اشتملت على الذكور و كان وسيط العمر 54 عاماً. بلغت نسبة الإصابة بالنوع الأول للسكري 5%. تمت متابعة المعدل التراكمي للسكر، ضغط الدم، نسبة الدهون، كرياتينين و الوزن بنسبة تفوق 90% من المرضى. في حين لقت المقاييس الأخرى كالتدخين (8%) و منسب كتلة الجسم (19%) نسبة متابعة أقل. كما كانت نسبة التحري عن مضاعفات السكري قليلة، حيث تم فحص شبكية العين (42%)، فحص القدم (22%) و اختبار البيل الألبومينية الزهيدة (23%) من المرضى. **الخلاصة**: بينت هذه الدراسة أن تطبيق معايير الجودة القائم على الأدلة لا يزال يشكل تحديات للممارسات الحالية في رعاية مرضى السكري ، حيث أن نسبة التحري عن مضاعفات السكري في عيادة السكر في هذا المستشفى منخفضة. يؤكد المؤلفون على أهمية تطبيق أسلوب منهجي في رعاية مرضى السكري يهدف إلى تحسين جودة الرعاية المقدمة لمرضى السكر مما يؤدي إلى تقليل خطر الإصابة بأمراض القلب و الأوعية الدموية وبالتالي تقليل تكاليف الرعاية الصحية على المدى البعيد.

**مفتاح الكلمات**: **السكري، ضمان الجودة، الرعاية الصحية، مراجعة إكلينيكية، البحرين**.

**abstract:** ***Objectives:*** Primary care audits in Bahrain have consistently revealed a failure to meet recognised standards of delivery of process and outcome measures to patients with diabetes. This study aimed to establish for the first time the quality of diabetes care in a Bahraini hospital setting. ***Methods:*** A retrospective clinical audit was conducted of a random sample of patients attending the Diabetes and Endocrine Center at the Bahrain Defence Forces Hospital over a 15-month period which ended in June 2010. The medical records of 287 patients with diabetes were reviewed electronically and manually for process and outcome measures, and a statistical analysis was performed. ***Results***: Of the patients, 47% were male, with a median age of 54 years, and 5% had type 1 diabetes. Measured processes, including haemoglobin A1c, blood pressure, lipids, creatinine and weight, were recorded in over 90% of the patients. Smoking (8%) and the patient's body mass index (19%) were less frequently recorded. Screening for complications was low, with retinal screening in 42%, foot inspection in 22% and microalbuminuria in 23% of patients. ***Conclusion***: This study shows that the implementation of recognised evidence-based practice continues to pose challenges in routine clinical care. Screening levels for the complications of diabetes were low in this hospital diabetes clinic. It is important to implement a systematic approach to diabetes care to improve the quality of care of patients with diabetes which could lead to a lowering of cardiovascular risk and a reduction in healthcare costs in the long term.

***Keywords:*** Diabetes; Quality; Care; Audit; Bahrain.

**Advances in Knowledge**

- *Clinical audits of diabetes care have been conducted at primary care settings in Bahrain and have shown underperformance compared to evidence-based practice recommendations.*
- *This study is the first clinical audit conducted in a secondary care setting in Bahrain and reveals a similar underperformance compared with international standards of diabetes care. The reasons for this need to be explored and suggestions for change made.*

**Application to Patient Care**

- *This study suggests that a more systematic approach to diabetes care would lead to a lowering of cardiovascular risk and improved detection of complications at an earlier stage, leading to an improvement in patient outcomes.*

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The rising prevalence of diabetes is placing an enormous economic and health burden on the nations of the world.[1] The majority of this burden is related to the treatment of and mortality from the complications of diabetes. There is abundant evidence to indicate that good control of glycaemia, blood pressure and lipids in patients with diabetes reduces the risk of both microvascular and macrovascular complications.[2–4] In addition, early detection of complications from diabetes enables early intervention leading to improved outcomes.[5] There is also good evidence that the delivery of structured diabetes care to the population, combined with increased patient involvement and self-management, improves the long-term outcomes of diabetes.[6–8] Yet it remains a challenge to translate the wealth of research evidence into practice, although reports from some countries suggest this is being addressed.[9,10]

Bahrain has the ninth highest prevalence of diabetes in the world, with an estimated prevalence of 22.4% in 2012.[11] Coping with such a high prevalence demands the involvement of both primary and secondary care. Clinical audits of diabetes care within primary care in Bahrain have consistently shown an underperformance compared with agreed standards.[12–14] They also compare less than favourably with the clinical audits from some other countries.[15–18] There have, to date, been no published clinical audits of hospital-based diabetes care in Bahrain. This study aimed to establish the quality of diabetes care in a Bahraini secondary care setting.

## Methods

The population of Bahrain is approximately one million, 40% of whom are expatriates. The national health service provides free care at the point-of-contact for Bahraini citizens. It does not have a fully established shared care diabetes service, with many patients having direct access to secondary care services. The Bahrain Defence Forces (BDF) Hospital is the second largest hospital in Bahrain, with 400 beds, and serves inpatient, outpatient and emergency patients. The main mission of the BDF Hospital is to provide healthcare services for the military and interior forces and their families, emergency services for the public, and specialised medical care for referral patients, government dignitaries and the royal court. The majority of patients have an association with the military or interior forces. Care for patients with diabetes is delivered in a dedicated Diabetes & Endocrine Center with doctors, specialist nurses, dietetic and podiatry support. Approximately 3,500 patients attend the Diabetes & Endocrine Center at the BDF Hospital. Appointment intervals for patients with diabetes vary according to the individual need, from weekly to 6 monthly, with a median of 4 months.

The study was designed as a retrospective clinical audit of the medical records of a random sample of all patients attending for diabetes care in the Diabetes & Endocrine Center at the BDF Hospital within the previous 15-month period to June 2010. Permission to carry out the clinical audit was given by the BDF Hospital.

A sample size of 353 patients was estimated to give a 95% chance of being within 5% of the true result of establishing the prevalence of the main process measures (haemoglobin A1C test [HbA1c], blood pressure and low-density lipoprotein [LDL] cholesterol) for this population size (3,500). As there is no dedicated diabetes register, a computer-generated random sample of 500 patients attending the BDF Diabetes & Endocrine Center was taken from the hospital database, allowing for an estimated 20% of patients without diabetes (hypothyroidism, impaired glucose tolerance or gestational diabetes mellitus). Some patients were excluded (n = 213) as they did not have diabetes mellitus or were aged under 18 years, leaving a sample size of 287 patients. This gives a 95% chance of being within 6% of the true result for this population.

Data were collected from both the electronic and manual hospital records of the patients in the sample. Data collection was carried out in July and August 2010, and parameters recorded between 1st April 2009 and 30th June 2010 were searched for. This 15-month duration was chosen to allow for delayed appointments since guidelines indicate that all parameters, including retinal screening, should have been completed at least annually. However, only the latest available parameter was included in the study in order to avoid data duplication. A selection of patient records was reviewed by two researchers to ensure reliability. Data were entered directly into an Excel spread sheet (Microsoft Inc., Redmond, Washington, USA) from the medical records by the researcher. Parameters included patients'

demographic details; the presence of vascular risk factors (hyperglycaemia, hyperlipidaemia and hypertension [HTN]) and their levels of control; medications, and the screening for and the presence of complications. Demographics, laboratory investigations and medications were available from the electronic records; other data were collected from the manual records. Complications were deemed to be present if a diagnosis was recorded in the medical records. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), Version 17 (IBM Corp., Chicago, Illinois, USA). Descriptive analyses were performed, and the variables were cross-tabulated using parametric and non-parametric tests of association. Significance was defined as a *P* value of less than 0.05.

## Results

Manual medical records were missing for 24 of the 287 patients, resulting in 263 full data-sets. Of the 287 patients, 136 (47.4%) were male. The median age was 54 years (range 18–87 years) and the median age at diagnosis was 43 years (range 3–79 years); 14 (5.4%) patients had type 1 diabetes.

Screening for cardiovascular risk factors and complications of diabetes are summarised in Table 1. A total of 53 (20%) patients were recorded as having ischaemic heart disease (IHD), 17 (6.5%) had cerebrovascular disease (CVD) and 10 (3.8%) had peripheral vascular disease. Also, 72 (27.4%) patients were recorded as having diabetic retinopathy, 27 (10.3%) diabetic nephropathy and 26 (9.9%) diabetic neuropathy. A total of 187 (71%) patients were recorded as having HTN and 181 (69%) had hyperlipidaemia (with raised LDL).

On review of the medications, 182 (69%) patients were on metformin, 143 (54%) on sulfonylureas, 29 (11%) on other oral hypoglycaemic agents, 122 (46%) on combination hypoglycaemic medication, and 111 (42%) on insulin. Of these 111, 14 had type 1 diabetes. The others had type 2 diabetes and were also taking oral hypoglycemic agents. A total of 138 (52%) patients were on antiplatelet agents or anticoagulants, 173 (66%) on lipid-lowering agents and 188 (71%) on anti-hypertensive medications. Patients with established macrovascular complications were more likely to be on antiplatelet agents (82% *versus* 42%; $\chi^2 = 32.1$, 1

**Table 1:** Processes and outcome measures of diabetic patients at the Bahrain Defence Forces Hospital

| Processes measured/recorded | Frequency, n (%) | Mean (± SD) |
|---|---|---|
| **HbA1c** | 278 (96.8) | |
| <7% | 91 (32) | 8.2% (± 1.9) |
| >10% | 54 (19.4) | |
| ***Systolic BP, mmHg** | 260 (98.8) | |
| <130 | 67 (26) | 146 mmHg (± 22.6) |
| >160 | 65 (24.7) | |
| ***Diastolic BP, mmHg** | 260 (98.8) | |
| <70 | 60 (23) | 77.8 mmHg (± 12.5) |
| >90 | 42 (16) | |
| **Total cholesterol, mmol/L** | 275 (95.8) | |
| <4 | 87 (32) | 4.4 mmol/L (± 1.0) |
| >5 | 90 (31.4) | |
| **LDL cholesterol, mmol/L** | 274 (95.5) | |
| <1.8 | 33 (12) | 2.8 mmol/L (± 0.9) |
| >2.6 | 177 (61.7) | |
| **HDL cholesterol** | 274 (95.5) | 1.1 mmol/L (± 0.3) |
| **Triglycerides** | 275 (95.8) | 1.8 (± 1.1) |
| ***Smoking** | 20 (7.6) | |
| **Smokers** | 8 (40) | |
| **Non-smokers** | 9 (45) | |
| **Ex-smokers** | 3 (15) | |
| ***Alcohol intake** | 4 (1.5) | |
| ***Height** | 42 (16) | |
| ***Weight** | 240 (91.2) | |
| ***BMI, Kg/m²** | 50 (19) | |
| <25 | 7 (14) | |
| 25–29 | 13 (26) | 33.3 Kg/m² (± 9.9) |
| 30–39 | 19 (38) | |
| ≥40 | 50 (22) | |
| ***Retinal screening** | 111 (42) | |
| ***Foot inspection** | 59 (22) | |
| ***Podiatrist visits** | 7 (3) | |
| **Albumin:creatinine ratio** | 67 (23.3) | 4.5 mg/g (+/-9) |
| **Creatinine** | 278 (96.8) | 77.7 mmol/l (+/-85) |

* *n = 263 as manual medical records missing for 24 of the total 287 patients. SD = standard deviation; HbAc1 = haemoglobin Ac1; BP = blood pressure; LDL = low-density lipoprotein; HDL = high-density lipoprotein; BMI = body mass index.*

degrees of freedom [df], $P$ <0.001). Men aged over 50 years (66% *versus* 27%; $\chi^2$ = 17.0, 1 df, $P$ <0.001) and women aged over 60 years (77% *versus* 40%; $\chi^2$ = 17.1, 1 df, $P$ <0.001) were also more likely to be on antiplatelet agents.

Women were found to have higher high-density lipoprotein (HDL) levels (mean HDL 1.23, 95% confidence interval [CI] 1.18–1.28) compared to men (mean HDL 1.01, 95% CI 0.98–1.05). Older age was associated with a lower HbA1c (F-test = 7.16, 1 df, $P$ = 0.008), higher blood pressure (F = 9.96, 1 df, $P$ = 0.002), increased diabetic complications (F = 2.34, 56 df, $P$ <0.001) and increased polypharmacy (F = 2.48, 56 df, $P$ <0.001).

The process and outcome measures from this study were compared with the standards of care achieved in other local and international audits [Table 2].[14,17,19,20]

## Discussion

This study reveals that the delivery of recognised evidence-based interventions to improve diabetes outcomes has not been fully realised in this hospital diabetes clinic in Bahrain. In particular, control of hyperglycaemia and HTN lags behind that achieved in other countries.[10,15–20] The impact of failing to lower cardiovascular risk in patients with diabetes is likely to be considerable, with a higher progression to micro- and macrovascular complications, and the subsequent increased personal and economic costs associated with diabetes complications.[1] The impact of the failure to achieve adequate control of cardiovascular risk factors in patients with diabetes can be determined. A 10% reduction in HbA1c levels, from the population mean of 8.2% in this study to a population mean of 7.2%, would lead to a risk reduction of 15% for all adverse diabetes outcomes.[21] Similarly, a 10 mmHg reduction in the mean population systolic blood pressure would lead to a 22% reduction in risk of coronary heart disease events and a 41% reduction in strokes.[22] Lipid lowering has similar effects. The importance of striving for improved control of risk factors for the complications of diabetes not only contributes to improving the quality of patients' lives but also to reducing healthcare costs. Such improvements have been documented in the UK,[20] the USA[10] and the United Arab Emirates.[17]

However, this study has shown that many process measures are carried out for the majority of patients, and this compares favourably with the situation in other countries. It is difficult to explain the low levels of recording of lifestyle behaviours that significantly contribute to cardiovascular risk, such as smoking and alcohol consumption. Cultural barriers to asking about these habits may

**Table 2:** Comparison of process and outcomes measures in the diabetes clinics of the Bahrain Defense Forces Hospital (Bahrain), Isa Town Health Centre (Bahrain), Diabetes Centre (Saudi Arabia), Al-Ain Health Centres (United Arab Emirates) and Wales (UK). All figures are percentages of populations with diabetes

| | BDF, Bahrain (2010) | Isa Town HC, Bahrain (2005)[14] | Saudi Arabia Diabetes Centre (2006)[19] | Al-Ain HC, UAE (2008)[17] | National Diabetes Audit, UK (2009–10)[20] |
|---|---|---|---|---|---|
| **Measure recorded** | | | | | |
| | % | % | % | % | % |
| **HbA1c** | 96.8 | 65.9 | 88.1 | 76 | 92 |
| **BP** | 98.8 | 91.8 | 100 | 91.9 | 94.7 |
| **Cholesterol** | 95.8 | 74.3 | NR | 80.3 | 91 |
| **Creatinine** | 96.8 | NR | NR | NR | 91 |
| **BMI** | 19 | NR | 100 | 83.5 | 89 |
| **Retinal screening** | 42 | 31.9 | 35.4 | 31.3 | 82 |
| **Peripheral pulses** | 13 | NR | 12.7 | NR | 83 |
| **Neuropathy testing** | 17 | NR | 12.7 | NR | 83 |
| **Microalbumin** | 23.3 | 33.4 | 28.8 | 83.6 | 85 |
| **Outcomes** | | | | | |
| **HbA1c, %** | | | | | |
| <7 | 32 | 20.4 | 8.1 | 45.6 | NR |
| <7.5 | 45.7 | 29.4 | NR | NR | 63 |
| >10 | 19 | 34.5 | 34.6 | 10 | 7.9 |
| **BP, mmHg** | | | | | |
| <130/80 | 22 | 13.7 | 36.5 | 42.9 | 51.1 |
| <140/90 | 43 | NR | 60.8 | 67.5 | 70 |
| **LDL cholesterol, mmol/L** <2.6 | 40 | 24 | 27.7 | 39.4 | NR |
| **Total cholesterol, mmol/L** <5 | 68.6 | 40.2 | NR | 79.6 | 78.3 |

*BDF = Bahrain Defense Forces Hospital; HC = health centre; UAE = United Arab Emirates HbAc1 = haemoglobin Ac1; BP = blood pressure; NR = not recorded; BMI = body mass index; LDL = low-density lipoprotein.*

play a part, although it is difficult to understand why doctors should not seek a smoking history from every patient when rates of smoking in Bahrain are similar to most developed countries. Failure to record these habits reduces cost-effective opportunities to counsel about smoking and alcohol cessation or reduction.[23] The absence of height-recording in order to establish body mass index (BMI) is similarly worrying in a generally obese population, as dietary advice to encourage weight loss has been shown to improve HbA1c.[23,24] In addition, screening for complications in this hospital clinic may be comparable with that in other Gulf countries but is much less than that achieved in England and Wales.[19] The delivery of diabetes care to the population in England and Wales has demonstrated that screening for complications of diabetes in the majority of the population is feasible.[20] The prevalence of macrovascular events in the BDF Endocrinology & Diabetes Center are similar to those cited by the Centers for Disease Control and Prevention [CDC] (IHD: 20.2% *versus* 20% and CVD: 7.9% *versus* 6.5%, for the CDC in 2007 *versus* the BDF in 2010, respectively).

However, the prevalence of retinopathy is higher (19.7% *versus* 27.4%, for the CDC in 2009 *versus* the BDF in 2010, respectively).[25] The CDC's rates of HTN and hyperlipidaemia in 2007 are comparable to the study population (HTN: 67% *versus* 71% and hyperlipidaemia: 62.6% *versus* 68.8%).[26] However, the figures from the BDF Endocrinology & Diabetes Center are based on the low rates of screening for complications; the reality is that the rates of microvascular complications are likely to be higher than those recorded in the patients' medical records. In the context of continuing evidence of suboptimal care and poor outcomes, the question arises as to what accounts for the relative success of some systems of diabetes care. Delivering high-quality care to people with diabetes is challenging. A systematic review of interventions to improve diabetes care in the community underlined the need for multifaceted professional interventions to enhance the performance of health professionals in managing diabetes; organisational interventions that facilitate the recall and structured review of patients; patient-oriented interventions to improve outcomes associated with patient education and behavioural change, and enhancements in the role of nurses in the provision of diabetes care.[23,27] It is increasingly clear from this existing evidence that the challenge of providing uniformly effective diabetes care has thus far defied a simple solution; multifaceted and complex interventions are necessary for the success of a diabetes care system.[6,23,27] Features of successful programmes include diabetes self-management education; adoption of practice guidelines; use of checklists and annual reviews; prompting; clinical audits and feedback; quality improvement programmes, and electronic medical records that allow prospective identification of those needing assessments or treatment modifications. These records can also be utilised in the waiting room to deliver questionnaires on well-being and to access data on the current condition of the patient as well as delivering patient education on diabetes.[28,29] Finally, teamwork that incorporates nurses or other healthcare workers in the implementation of detailed algorithms of care contributes to a successful programme.

Diabetes services that incorporate more of these elements demonstrated lower HbA1c levels and lower cardiovascular risk scores.[28] The absence of many of these features in the BDF Hospital Endocrinology & Diabetes Center likely contributes towards some aspects of the lower quality care highlighted in this study, particularly the lack of screening for smoking and for the complications of diabetes.

The main strength of this study is that it is the first published clinical audit of diabetes care within a secondary care setting in Bahrain. Second, it reflects the current practice at the diabetes clinic, thereby highlighting deficiencies and opening doors for quality improvement. This is deemed to be an important step in improving quality.[30] Finally, this study will serve as a baseline for future clinical audits of the quality of diabetes care.

There are several weaknesses to this study. First, the measures audited did not include dietician consultations, despite the large population of obese diabetics in Bahrain. Secondly, the current practice for prescribing or modifying medications for defined levels of HbA1c, blood pressure and lipids was not examined. Additionally, the population of patients enrolled in the study were from the BDF Hospital; hence, they had an association with the military or interior forces, and thus making it difficult to generalise the findings of the study to the entire Bahraini population. Moreover, the final

size of the study sample was 287, which is less than the calculated required sample size of 353 patients. Although this indicates that the study is slightly underpowered based on the original calculations, this is unlikely to lead to any change in the conclusions from the study. Finally, as with all audits, this study measured restrospective records of data, and as such cannot ascertain whether the procedures were accurately carried out. This may lead to the under-representation of some procedures that were performed but were not recorded, or that could not be identified due to missing records. It could also lead to the over-representation of some procedures, for instance when the actual examination was cursory but recorded as being complete.

## Conclusion

Overall, this study has highlighted several potential areas for improving the quality of diabetes care in the BDF Hospital Endocrinology & Diabetes Center. Of particular importance is the need for improving the control of cardiovascular risk factors and screening for diabetes complications. This is most likely to occur through a systematic approach to the delivery of diabetes care, incorporating many of the key elements of chronic disease management as outlined above. This should lead to improvements in the quality of life of patients with diabetes and lower healthcare costs in the long-term. There is also a need for regular clinical audits at the primary and secondary care settings to ensure continuous monitoring and improvement of the quality of diabetes care in Bahrain. There are plans to repeat this study in the future in the hope that many of the deficiencies will have been addressed, leading to an overall improvement in diabetes care.

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