

Quality improvement programme for diabetes care in family practice settings in Dubai

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برامج تحسين جودة رعاية مرضى السكري في مرافق رعاية صحة الأسرة في دبي
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الخلاصة: بدأ تنفيذ برنامج مستمر لتحسين جودة الرعاية المقدمة لمرضى السكري المسجلين، وذلك في 16 مركزاً للرعاية الصحية الأولية في دبي. وقد شكّلت الفرق المعنية بتحسين الجودة، وأعدت الدلائل الإرشادية السريرية ونظمت المعلومات، وبدئ في تنفيذ نظام الممارسة لرعاية مرضى السكري، وفي تطبيق أسلوب الفريق. وقد بينت المراجعات التي أجريت قبل تنفيذ هذا النظام وبعد تنفيذه، تحسناً ملموساً في معدلات تسجيل المؤشرات السريرية الرئيسية وفي حصائلها. فعلى سبيل المثال، ارتفعت من 20.6% إلى 31.7%، نسبة المرضى الذين تقل مستويات الهيموغلوبين المرتبط بالجليكوزيل لديهم عن 7%، كما ارتفعت من 20.8% إلى 33.6% نسبة المرضى الذين تقل نسبة كوليستيرول البروتين الشحمي المنخفض الكثافة لديهم عن 100 مغ/ديسي لتر. في حين انخفض متوسط ضغط الدم الانقباضي في المرضى المسجلين من 135.3 مم زئبق إلى 133.2 مم زئبق.

ABSTRACT A continuous quality improvement programme for the care of registered diabetes patients was introduced in 16 government-affiliated primary health care centres in Dubai. Quality improvement teams were formed, clinical guidelines and information systems were developed, diabetes nurse practitioners were introduced and a team approach was mobilized. Audits before and after the introduction of the scheme showed significant improvements in rates of recording key clinical indicators and in their outcomes. For example, the proportion of patients with glycosylated haemoglobin levels < 7% increased from 20.6% to 31.7% and with LDL cholesterol < 100 mg/dL increased from 20.8% to 33.6%. Mean systolic blood pressure of registered patients fell from 135.3 mmHg to 133.2 mmHg.

Programme d'amélioration de la qualité de la prise en charge du diabète en médecine générale à Dubaï

RÉSUMÉ Un programme d'amélioration continue de la qualité de la prise en charge des patients diabétiques enregistrés a été lancé à Dubaï dans 16 centres de soins de santé primaires affiliés au gouvernement. Des équipes pour l'amélioration de la qualité ont été constituées, des directives cliniques élaborées et des systèmes d'information clinique déployés ; des infirmiers praticiens spécialisés en diabétologie ont été mobilisés, de même qu'une véritable stratégie d'équipe. Des audits conduits avant et après la mise en place de ce programme ont mis en évidence une amélioration significative du taux d'enregistrement des indicateurs cliniques clés et de leur évolution. Par exemple, le pourcentage de patients présentant un taux d'hémoglobine glyquée < 7 % a augmenté, passant de 20,6 % à 31,7 %, tandis que pour une LDL cholestérolémie < 100 mg/dL ce pourcentage est passé de 20,8 % à 33,6 %. Chez les patients enregistrés, la pression systolique moyenne est tombée de 135,3 mmHg à 133,2 mmHg.

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Introduction

Dubai is the second largest of the 7 Emirates of the United Arab Emirates (UAE) with almost 700 000 inhabitants. Like other Gulf countries, this Emirate is currently undergoing rapid socioeconomic development with the concomitant lifestyle changes of increasing use of “fast foods” and increasingly sedentary life, leading to health problems such as increasing rates of obesity and type 2 diabetes, which has emerged as an epidemic problem in this region [1]. Type 2 diabetes represents a real challenge to the health planners in UAE due to its high prevalence and increased economic cost to society [2]. The latter includes its effect on morbidity, employment, productivity, premature mortality and the increased use of health services. At the moment, evidence-based interventions and models are available to continuously improve the quality of diabetes programmes at the community level based on principles of chronic disease management [3–8].

Parallel to the economic reforms underway in Dubai, the health sector is also undergoing a process of reform. Since the year 2002, a new leadership for the health system in the Department of Health and Medical Services (DOHMS) in Dubai has been applying its vision to develop the system to international standards and pursue excellence in health care. Dubai is not only moving forward on reform of the health care system but also for international accreditation of this system. To this end, the principles, concepts and tools of total quality improvement have been applied as a core business in the organization of health care in this emirate [9]. Great investments have been made in developing the health care system at all levels by applying total quality improvement.

Improving the quality of health care provided to diabetes patients has been iden-

tified as a priority area for the continuous quality improvement programme endorsed by the DOHMS. The aims of this study were to conduct a baseline assessment of the quality of diabetes care in primary health care (PHC) settings in Dubai before the implementation of the diabetes quality improvement programme and to measure the impact of the programme on key clinical indicators of diabetes care.

Methods

The present study was carried out in 16 of 18 family practice centres affiliated to the PHC sector of DOHMS in 2004. Two clinics were excluded from the study as they only provide primary medical services to expatriates at Dubai airport and Port Rashid.

Quality performance improvement scheme

Model used

The FOCUS PEDSA quality performance improvement model was used as a framework for the PHC system development. The steps of the 1st phase of this model (FOCUS) depends on Finding an opportunity for improvement, Organizing a quality improvement team, Clarifying the process, Understanding the problem and Selecting an area for improvement. The 2nd phase of the model (PEDSA) stands for Plan, Do, Study and Act [10].

Strategic planning

In applying this model a strategic planning workshop was conducted in April 2003 to identify priority areas for improvement in PHC. The participants were representatives from all PHC sections: doctors, nurses, health educators, pharmacists, administrators and customer services. At the workshop, diabetes mellitus fulfilled the criteria

for a priority area for implementing a quality improvement disease management programme due to its high prevalence, high cost, high variability in practice patterns, high risk of clinical outcomes, inefficient delivery system, potential for changes in patients' lifestyle to improve outcomes, the availability of clinical and other expertise to develop the programme and the considerable impact of the disease on the burden of illness in this region [1,2].

One doctor from each PHC centre was invited to attend focus group discussions about current problems of diabetes care in PHC settings and barriers to good diabetes care practice. Three focus discussion groups were formed, each of 5–6 participants, led by a facilitator. Each of the 3 groups independently reached a consensus about the identified problems and barriers. The 3 groups then met to establish a unified list, suggested solutions and a quality agenda to overcome the current problems and barriers concerning diabetes care and to continuously improve the PHC diabetes programme based on principles and an evidence-based care model of chronic disease management [3–8].

A multidisciplinary quality improvement team of 12 members was formed as a task group at the central level to set priorities for implementing the quality agenda set by the focus groups discussions. Strategic directions for improving quality of care included developing decision support, clinical information systems, mobilizing teamwork and delivery systems. Goals and specific objectives were then set to achieve each of these strategic directions.

Table 1 shows the obstacles to practising good diabetes care as perceived by the doctors in the focus group discussion sessions and the solutions implemented during the quality improvement process.

Diabetes care guidelines

Diabetes care guidelines were formulated based on the most up-to-date clinical evidence in order to develop the decision support system [3–8]. Measurements of body weight, body mass index (BMI) and blood pressure were undertaken in accordance with National Health and Nutrition Examination Survey (NHANES) procedures [11]. Glycosylated haemoglobin (HbA1c) levels were measured in accordance with USA standard methods [12] (normal range 4.2%–6.3%). Serum total cholesterol and triglycerides were measured using a colorimetric assay, serum high-density lipoprotein (HDL) cholesterol was measured using a direct enzymatic method and low-density lipoprotein (LDL) cholesterol was calculated using the Friedewald formula [13]. The goals mentioned in this study were in accordance with those specified by the American Diabetes Association (ADA) guidelines [8]: HbA1c < 7.2%, LDL cholesterol < 100 mg/dL, HDL cholesterol > 45 mg/dL, triglycerides < 150 mg/dL, and systolic blood pressure < 130 mmHg and diastolic pressure < 80 mmHg.

Processes in the health centres

The clinical information system of the diabetes programme was developed through establishing a computerized diabetes register in each PHC centre, and developing key clinical indicators of best practice. Medical records were also developed through introducing colour coding of records, problem lists, drug lists, special follow-up cards for diabetes patients and special forms for annual checkups and health education.

Developing the delivery system was undertaken through establishing diabetes quality improvement teams at the grassroots level in each of the 16 family practice centres. Each health centre team was composed

Table 1 Obstacles to organization of diabetes care in the 1st practice audit and the solutions identified by focus group discussions with doctors

| Obstacles identified | Solutions/agenda implemented |
|---|--|
| <i>No structural system of care</i> | |
| Lack of a diabetes register | Establish a diabetes register |
| Lack of a system for recall of defaulters | Establish a system for recall of defaulters |
| <i>Poor continuity of care</i> | |
| Lack of clinical guidelines | Establish clinical guidelines and clinical pathways |
| Lack of shared care scheme | Establish shared care policy with the hospital |
| Poor medical records | |
| –Poor documentation | Improve documentation |
| –Lack of diabetes follow-up card | Design diabetes follow-up cards |
| –Lack of problem and drug lists | Introduce problem and drug lists |
| <i>Poor teamwork and lack of some staff experience</i> | |
| Unavailability of diabetes specialized nurse | Train cadre of specialized nurses in diabetes |
| Unavailability of staff job descriptions | Establish staff job descriptions |
| Absence of multidisciplinary technical staff meetings | Instigate regular multidisciplinary team meetings and staff training and education |
| Lack of training of medical record staff and administrators | Introduce the concept of nursing diabetes case management |
| <i>Lack of time</i> | |
| Short consultation time | Increase consultation time to 15 minutes |
| Staff shortage | Appoint more staff |
| <i>Absence of a system for continuous performance improvement</i> | |
| Absence of agreed clinical indicators and standards of care | Introduce concepts and tools of total quality improvement |
| Absence of peer review system | Establish clinical indicators and standards |
| Patients' problems | Conduct regular audit cycles and feedback |
| –Lack of compliance | Consider patients' ideas, concerns and expectations |
| –Polypharmacy | Patient and family education |
| –Multiple problems | Improve continuity of care |

of a doctor, a nurse, a health educator, a dietician and an administrator. The purpose of establishing these teams was to develop a team approach to diabetes care based on the established guidelines; to develop the role of nurse practitioners in diabetes; and to train the team on methods and tools of

performance measurements. Nurses were trained as case managers and clinical auditors of diabetes care.

Before and after audits

A list of all the patients with their file numbers was obtained from the diabetes register

in each PHC centre. The 1st practice audit and the establishment of comprehensive baseline data about diabetes patients started in June 2003. A retrospective analysis of all files identified from the diabetes register was performed by the clinical auditors for the period between May 2002 to May 2003. Files included in this study were only active diabetes files for diabetes patients who attended the PHC centres for consultation about diabetes at least once during the study period ($n = 2548$) and the analysis was undertaken manually by the clinical auditors. This analysis included a comprehensive assessment of variables related to socio-economic status (age, sex, education, occupation, marital status and employment), profile of diabetes (type of diabetes, type of treatment, duration of diabetes, family history of diabetes and family history of coronary heart disease, and several variables related to process and outcome of care.

The 2nd audit started in January 2005. Due to shortage of time and staff, only certain key clinical performance indicators of process and outcome of diabetes care were audited. The 16 PHC centres were asked to review active files for all diabetes patients attending for diabetes-related visits over a 1-month period. The files were reviewed retrospectively over 12 months by the nurse clinical auditors and included data collection for the key clinical indicators, which were: HbA1c, blood pressure, LDL cholesterol, BMI, smoking status and referral for funduscopy examination. The data regarding laboratory investigations were extracted from the computerized laboratory electronic system which was operating by the time of the 2nd audit, while analysis of the remaining variables was still undertaken manually through extracting and analysing data available in medical records.

Analysis

Data analysis was undertaken using *SPSS*, version 12. Appropriate tests of significance were performed; unpaired *t*-test was performed to compare independent sample means and the chi-squared test was performed to compare categorical variables. The data for the continuous variables, HbA1c, blood pressure and LDL cholesterol were converted into categorical data to be benchmarked with other practices regarding best practice standards set by the ADA [8].

Results

Prevalence of diabetes

The population of the catchment areas of the 16 family practice centres affiliated to DOHMS, Dubai is 614 210 people. However, the total number of registered files in these centres for people who are utilizing the service is 319 197, representing a 52% utilization rate. The total number of registered diabetes patients in these PHC centres is 4903 patients giving a point prevalence of 1.6% of the total registered population in the 16 PHC centres. The total number of active files included in the current study was 2548, representing 51% of registered diabetes patients.

Demographic characteristics

Table 2 shows the sociodemographic characteristics of the patients with diabetes based on available information from the medical records. The mean (standard deviation) age was 55.3 (11.6) years and 90.3% were ≥ 40 years of age, with nearly equal sex distribution, and the majority (66.0%) were of UAE nationality. Table 2 also shows that 94.3% of the diabetes patients were married, 2.7% were single or divorced and 3.0% widowed.

Table 2 Sociodemographic characteristics of diabetes patients in primary health care centres in Dubai in the 1st practice audit

| Variable | No. of records | % of records |
|-----------------------|----------------|--------------------|
| <i>Age (years)</i> | | |
| Total recorded | 2340 | 91.8 ^a |
| < 40 | 222 | 9.5 |
| ≥ 40 | 2118 | 90.5 |
| <i>Sex</i> | | |
| Total recorded | 2548 | 100.0 ^a |
| Male | 1320 | 51.8 |
| Female | 1228 | 48.2 |
| <i>Nationality</i> | | |
| Total recorded | 2548 | 100.0 |
| UAE | 1680 | 66.0 |
| Non-UAE | 868 | 34.0 |
| <i>Marital status</i> | | |
| Total recorded | 1143 | 44.9 ^a |
| Married | 1078 | 94.3 |
| Single | 22 | 1.9 |
| Divorced | 9 | 0.8 |
| Widowed | 34 | 3.0 |
| <i>Education</i> | | |
| Total recorded | 527 | 20.7 ^a |
| Illiterate | 159 | 30.2 |
| Primary school | 109 | 20.7 |
| Secondary school | 148 | 28.1 |
| University or above | 111 | 21.1 |
| <i>Employment</i> | | |
| Total recorded | 1142 | 44.8 ^a |
| Employed | 602 | 52.7 |
| Unemployed/housewife | 540 | 47.3 |

^aPercentages calculated from total number of eligible records reviewed in 1st audit (n = 2548 records).
UAE = United Arab Emirates.

Of the patients, 30.2% were illiterate and 47.3% unemployed. It was noted that 79.3% of the records had missing data regarding education level and more than 50% of the records were missing information regarding the employment and marital status of the diabetes patients.

Profile of diabetes

Table 3 shows the profile of diabetes in the patients. The table shows that 90.0% of diabetes patients were diagnosed with type 2 diabetes, 74.5% were on oral hypoglycaemic medication only, 30.7% had had

Table 3 Characteristics of diabetes patients recorded in primary health care centres in Dubai in the 1st practice audit

| Characteristic | No. of records | % of records |
|---|----------------|-------------------|
| <i>Type of diabetes</i> | | |
| Total recorded | 2408 | 94.5 ^a |
| Type 1 | 241 | 10.0 |
| Type 2 | 2167 | 90.0 |
| <i>Type of treatment</i> | | |
| Total recorded | 2396 | 94.0 ^a |
| Oral drugs | 1785 | 74.5 |
| Insulin | 278 | 11.6 |
| Combination | 161 | 6.7 |
| Diet only | 172 | 7.2 |
| <i>Duration of diabetes (years)</i> | | |
| Total recorded | 1562 | 61.3 ^a |
| < 5 | 610 | 39.1 |
| 5–10 | 472 | 30.2 |
| > 10 | 480 | 30.7 |
| <i>Body mass index (kg/m²)</i> | | |
| Total recorded | 1405 | 58.0 ^a |
| < 25 | 373 | 25.3 |
| 25–< 30 | 556 | 39.6 |
| ≥ 30 | 547 | 33.9 |
| <i>Family history of diabetes</i> | | |
| Total recorded | 830 | 32.6 ^a |
| Positive | 513 | 61.8 |
| Negative | 317 | 38.2 |
| <i>Family history of coronary heart disease</i> | | |
| Total recorded | 548 | 21.5 ^a |
| Positive | 144 | 26.3 |
| Negative | 404 | 73.7 |

^aPercentages calculated from total number of eligible records reviewed in 1st audit (n = 2548 records).

diabetes for > 10 years, 61.8% had a family history of diabetes and 26.3% had a positive history of ischaemic heart disease. Three-quarters of the patients with diabetes were overweight or obese (BMI \geq 25 kg/m²). Missing data were mainly in recording the history of coronary heart disease (67.4%) and family history of diabetes (78.5%).

Performance indicators

Table 4 compares the key performance clinical indicators of process and outcome of diabetes care in the 16 PHC centres between the 1st and 2nd audit cycles. There were significant improvements in the process of care for the key clinical performance indicators studied: HbA1c, blood pressure

Table 4 Comparison of some key performance indicators of process and outcome of care between 2 audit cycles for diabetes patients attending 16 primary health care centres in Dubai

| Clinical indicator | 1st audit | | | 2nd audit | | | 95% CI ^c |
|--------------------------------|----------------|-------------------|--------------------|----------------|-------------------|--------------------|---------------------|
| | No. of records | % | Mean value (SD) | No. of records | % | Mean value (SD) | |
| <i>HbA1c level</i> | | | 8.7% (2.1) | | | 8.1% (2.5) | 0.4–0.8*** |
| Total performed*** | 1589 | 62.4 ^a | | 1039 | 84.2 ^b | | |
| < 7% | 328 | 20.6 | | 329 | 31.7 | | |
| 7.0%–8.4%*** | 492 | 31.0 | | 331 | 31.9 | | |
| 8.5%–9.5% | 269 | 16.9 | | 158 | 15.2 | | |
| > 9.5% | 500 | 31.5 | | 221 | 21.3 | | |
| <i>Systolic blood pressure</i> | | | 135.3 mmHg (20.5) | | | 133.2 mmHg (20.0) | 0.6–3.6* |
| Total performed*** | 2183 | 85.7 ^a | | 1165 | 94.4 ^b | | |
| < 130 mmHg*** | 891 | 40.8 | | 466 | 40.9 | | |
| 130–159 mmHg | 1020 | 46.7 | | 560 | 48.0 | | |
| \geq 160 mmHg | 272 | 12.9 | | 128 | 10.5 | | |
| <i>LDL-cholesterol</i> | | | 129.2 mg/dL (38.3) | | | 115.4 mg/dL (36.8) | 10.8–16.8*** |
| Total performed*** | 1655 | 65.0 ^a | | 966 | 78.3 ^b | | |
| < 100 mg/dL | 344 | 20.8 | | 325 | 33.6 | | |
| 100–130 mg/dL*** | 575 | 34.7 | | 316 | 32.7 | | |
| > 130 mg/dL | 736 | 44.5 | | 298 | 30.8 | | |
| <i>Body mass index</i> | | | | (n = 622) | | | |
| Total recorded*** | 1405 | 55.1 ^a | | 621 | 99.8 ^b | | |
| <i>Referral for funduscopy</i> | | | | (n = 622) | | | |
| Total performed*** | 738 | 29.0 ^a | | 349 | 53.0 ^b | | |
| <i>Smoking status</i> | | | | (n = 748) | | | |
| Total recorded*** | 629 | 24.7 ^a | | 568 | 76.0 ^b | | |

*Statistically significant difference between 1st and 2nd audit at P < 0.05.

***Statistically significant difference between 1st and 2nd audit at P < 0.001.

^aPercentages calculated from total number of eligible files reviewed in 1st audit (n = 2548 records).

^bPercentages calculated from total number of eligible files reviewed in 2nd audit (n = 1234 records).

^c95% confidence interval for difference in means.

n = total number of eligible files reviewed.

SD = standard deviation; HbA1c = glycosylated haemoglobin; LDL = low-density lipoprotein.

and LDL-cholesterol, recording of BMI and smoking status and referral for funduscopy ($P < 0.001$).

Table 4 also demonstrates a significant improvement in outcome variables of diabetes care. Mean HbA1c was reduced from 8.7% to 8.1% ($P < 0.001$; 95% CI: 0.4–0.8) and the proportion of patients achieving the audit target level of HbA1c $< 7\%$ increased significantly from 20.6% to 31.7% ($P < 0.001$).

The mean systolic blood pressure fell from 135.3 mmHg to 133.2 mmHg ($P < 0.05$; 95% CI: 0.6–3.6). While the proportion of patients achieving the audit target of systolic blood pressure control < 130

mmHg did not significantly improve, there were significant decreases in the other categories ($P < 0.001$).

The mean LDL-cholesterol decreased from 129.2 mg/dL to 115.4 mg/dL ($P < 0.001$, 95% CI: 10.8–16.8) and the proportion of patients with the audit target < 100 mg/dL increased from 20.8% to 33.6% ($P < 0.001$).

Fewer files were reviewed for the different clinical indicators of the 2nd audit. This was due to manpower shortages affecting the availability of clinical auditors in each of the 16 PHC centres to submit the required data on time.

Table 5 Diabetes patients reaching target levels of some key clinical indicators according to certain socioeconomic variables in 1st practice audit in primary health care centres in Dubai

| Variable | HbA1c $< 7\%$ | | | Systolic BP < 130 mmHg | | | LDL-cholesterol < 100 mg/dL | | |
|-----------------------|----------------|------|----------------|--------------------------|------|----------------|-------------------------------|------|---------------|
| | No. of records | % | OR (95% CI) | No. of records | % | OR (95% CI) | No. of records | % | OR (95% CI) |
| <i>Age (years)</i> | | | | | | | | | |
| < 40 | 17 | 13.9 | 0.6 (0.3–1.0)* | 112 | 64.7 | 3.0 (2.1–4.1)* | 18 | 18.1 | 0.8 (0.5–1.4) |
| ≥ 40 | 274 | 21.0 | | 686 | 37.9 | | 293 | 20.9 | |
| <i>Sex</i> | | | | | | | | | |
| Male | 166 | 20.3 | 0.9 (0.7–1.2) | 480 | 41.8 | 1.1 (0.9–1.3) | 180 | 21.7 | 1.2 (0.9–1.4) |
| Female | 162 | 21.0 | | 411 | 39.7 | | 164 | 19.9 | |
| <i>Marital status</i> | | | | | | | | | |
| Married | 150 | 20.9 | 1.0 (0.4–2.4) | 390 | 41.9 | 0.9 (0.5–1.7) | 163 | 21.2 | 0.6 (0.3–1.4) |
| Unmarried | 7 | 20.6 | | 22 | 45.8 | | 12 | 27.9 | |
| <i>Nationality</i> | | | | | | | | | |
| UAE | 203 | 19.8 | 0.8 (0.7–1.1) | 546 | 38.3 | 0.7 (0.6–0.9)* | 221 | 20.1 | 0.9 (0.7–1.1) |
| Non-UAE | 125 | 22.2 | | 345 | 45.5 | | 123 | 22.0 | |
| <i>Education</i> | | | | | | | | | |
| Illiterate | 28 | 25.9 | 1.2 (0.7–2.1) | 48 | 31.4 | 0.4 (0.3–0.6)* | 28 | 24.1 | 1.1 (0.6–1.9) |
| Literate | 60 | 21.9 | | 177 | 51.0 | | 62 | 28.1 | |
| <i>Occupation</i> | | | | | | | | | |
| Employed | 77 | 18.9 | 0.8 (0.5–1.2) | 358 | 46.8 | 1.4 (1.1–1.8)* | 94 | 22.7 | 1.5 (0.8–1.6) |
| Unemployed | 82 | 22.3 | | 173 | 37.7 | | 81 | 20.3 | |

*Significant at $P < 0.05$.

HbA1c = glycosylated haemoglobin; BP = blood pressure; LDL-cholesterol = low-density lipoprotein cholesterol.

OR = odds ratio; CI = confidence interval; UAE = United Arab Emirates.

Outcome of diabetes care

Table 5 shows the relationship of outcome of diabetes care with some socioeconomic variables in the 1st audit. No significant relationships were observed between the proportion of patients achieving a target of HbA1c < 7% and LDL target < 100 mg/dL and the socioeconomic variables studied, except age ≥ 40 years which was significantly associated with a higher proportion of diabetes subjects achieving the target ($P < 0.05$). On the other hand there was a significant relationship between the proportion of patients achieving a target of systolic blood pressure < 130 mg/dL and age < 40 years, nationality, literacy and employment ($P < 0.05$) with higher proportions of non-UAE nationals, literate and employed patients achieving the target.

Discussion

This study documents the impact of implementing the quality agenda for improvement of the diabetes care programme in light of principles and evidence-based models of chronic disease management [4–8]. Several areas for system improvement were identified based on the care model, and quality improvement teams were formed to undertake such improvements. The main areas identified for system improvements were information systems, decision support and systems delivery. The main outcome measures were to monitor and document the extent of improvement in glycaemic, blood pressure and lipid control.

Prevalence of diabetes in the registered practices population

The current study showed that the prevalence of diabetes in the registered practice population in the 16 PHC centres was 1.6%, while community-based studies in the UAE have reported a rate of 10% [2]. This gap could

be explained by the multiplicity of health systems in Dubai, as DOHMS is not the only provider of health services in Dubai. In addition to the private sector, the Ministry of Health has its own health premises and some governmental organizations provide health services for their own employees. Some patients could have more than one health card and have access to more than one health care provider. This gap could be also a reflection of the low detection rate of diabetes in the community and the need to establish screening programmes for the early detection of undiagnosed cases of diabetes in the community. Research evidence has shown that cases of type 2 diabetes can be missed in elderly patients with vascular problems of sufficient severity to warrant amputation. It has been suggested that selective screening of high-risk groups is one solution to the problem of reducing the level of undiagnosed diabetes [10].

Utilization of diabetes care services

The present study showed that only 52% of the registered diabetes patients were actively utilizing the PHC services. This could be because patients with type 1 diabetes receive their care mostly from the hospitals and because the health system in the UAE allows citizens with UAE nationality to register in more than one health system, acquire more than one health card and choose to receive medical services from any of the available health systems. In addition, the recently introduced fee-for-service scheme for non-UAE citizens may have also contributed to the low utilization rate of the diabetes services.

Registered diabetes population in PHC

The present study showed that most of diabetes population had type 2 diabetes, were taking oral hypoglycaemic medications,

were married and were UAE nationals. The illiteracy rate was 44%, compared with 48% in Saudi Arabia, and the unemployment rate was 47%, compared with 44% in Saudi Arabia [11]. The study also showed that about three-quarters of the diabetes patients were overweight, with BMI > 25 kg/m² compared with 56% in a report from Saudi Arabia [12]. This means that nearly half of the diabetes population are illiterate, unemployed and mostly overweight. This information reflects the need to use appropriate methods of health education for the illiterate group and give more attention to assess activity levels and promote exercise programmes.

Information systems

Information about age, sex and nationality of the patients could be found easily in almost all the PHC records. On the other hand, in the 1st audit cycle documentation about marital status, education and employment was poor. This is comparable to some other reports from the Gulf area which found low rates of documentation regarding education and employment status [14] and other reports that demonstrated a marked improvement in documentation of these variables in a diabetes care follow-up audit [15]. The degree of improvement in the documentation of socioeconomic variables was not assessed in the 2nd audit cycle of the current study as it needs a major investment in time to undertake such tasks manually. Nevertheless, staff training programmes following the recommendations emerging from the 1st audit emphasized the importance of documenting such variables.

As noted by the doctors in the focus group discussions, the structure of the PHC medical records did not facilitate the process of providing adequate diabetes care due to the lack of diabetes follow-up cards. The latter are considered to be one of the essential items of providing good

diabetes care [11]. The introduction of a problem-oriented medical record system is an ideal solution to improve the quality of medical records for chronic conditions. Also the introduction of drug lists, problem lists and diabetes follow-up cards can help time wasted during the consultation for diabetes patients, who usually have multiple problems and polypharmacy needs. In addition, establishing simple clinical indicators of care will help audit coordinators retrieve relevant information quickly from the records. Considerable time was devoted to conducting the 1st audit cycle manually; nevertheless, in 2004, DOHMS introduced a new computer-based information system with computerized laboratory, radiology and billing systems. This saved time as it was possible in the 2nd audit cycle to conduct the audit of laboratory results electronically. A full electronic medical record system is planned to be in action by late 2006, which will greatly facilitate the audit process for all the studied variables.

Process of diabetes care

Glycosylated haemoglobin levels are an objective measure of metabolic control of diabetes. This study showed a significant improvement in the rate of performing this test from 62% to 82% between the 1st and 2nd audit cycle. This can be compared with rates of performing glycosylated haemoglobin tests ranging from 0% to 60% from Saudi Arabia [14,15], from 83.0% to 93.0% from studies in the United Kingdom (UK) [16,17] and 15%, 44% and 81% from the United States of America (USA) [18–20].

The current study was also able to document a significant improvement in the rate of measuring blood pressure from 84% to 98%. This compares with rates of blood pressure recording ranging from 66% to 100% in Saudi Arabia [14,15,21], 83% in the UK [16] and 86% in the USA [18].

Lipid disorders are a common source of co-morbidity in diabetes patients and treating such disorders is important as cardiovascular diseases are currently among the main causes of morbidity and mortality in the Eastern Mediterranean Region [2]. The current study showed a significant improvement in the rate of performing lipid profiles from 64% in the 1st audit to 75% in the 2nd audit. This compares with a testing rate of 73.8% in Saudi Arabia [13] and rates ranging from 31%, 45% to 66% in reports from the USA [18–20].

Our study showed a significant improvement in referral rates for funduscopy examination between the 2 surveys from 28.9% to 53.0%. Studies from Saudi Arabia reported referral rates of 33% [15] and 61.5% [21], from the UK of 64.4% to 86% [16,17], and from the USA of 22%, 66% and 28% [18–20].

Outcomes of diabetes care

This study in Dubai showed that the proportion of patients with good glycaemic control (i.e. HbA1c levels < 7%) improved from 20.6% to 31.7% in the 2nd audit cycle. A report from Australia showed an increase from 18% to 25% in the 2nd audit [22], while another Australian report demonstrated a rate of 57% [23], reaching ADA targets. By comparison, data from the USA showed rates between 37% and 44% [24,25]. Another study from the USA demonstrated an improvement in patients' mean HbA1c level from 7.8% to 7.4% [26] which is comparable with the improvement in our study from 8.7% to 8.2%.

In the present study, the mean systolic blood pressure dropped from 135.3 mmHg to 133.2 mmHg, while the proportion of diabetes patients reaching the ADA target of systolic blood pressure < 130 mmHg remained the same. In a study from the USA [19] the mean blood pressure was found to

be 134.1 mmHg and in another study [24] the proportion of patients achieving the ADA target were 41%. In a study from the UK the mean systolic blood pressure fell from 147 mmHg to 140 mmHg between 2 audits [27].

The current audit showed significant improvements in control of LDL-cholesterol, as the proportion of diabetes patients with LDL-cholesterol level < 100 mg/dL increased from 20.8% to 33.6%. By comparison, 23% of patients in the USA [24] and 52.8% in Australia [23] achieved ADA targets.

Conclusion

This study demonstrated the impact of improving some aspects of the system and organization of diabetes care on improving key clinical indicators of the diabetes programme in Dubai. The study focused on mobilizing decision support, teamwork, developing role of nurses in diabetes care and improving information systems.

The results suggest that many opportunities for cardiovascular disease risk reduction are still missed in spite of efforts to improve the system of care for diabetes in Dubai Emirate. The extent of improvement that has taken place is still not sufficient to meet the challenge, as a significant proportion of individuals were not meeting the targets of the key clinical indicators. Control of weight and glycaemia are complex processes that require efforts beyond health system service development. There is also still a need to monitor and study the impact on outcome of care of socioeconomic variables in Dubai.

Further studies are needed to measure the impact on diabetes outcome measures of increasing the interaction of the health care team with diabetes patients, mobilizing self-

care efforts and community involvement in the diabetes programme.

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