Treatment outcomes in a cohort of Palestine refugees with diabetes mellitus followed through use of E-Health over 3 years in Jordan

Short Communication

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Abstract

OBJECTIVE The aim of this study was to use E-Health to report on 12-month, 24-month and 36-month outcomes and late-stage complications of a cohort of Palestine refugees with diabetes mellitus (DM) registered in the second quarter of 2010 in a primary healthcare clinic in Amman, Jordan.
METHOD Retrospective cohort study with treatment outcomes censored at 12-month time points using E-Health in UNRWA's Nuzha Primary Health Care Clinic.
RESULTS Of 119 newly registered DM patients, 61% were female, 90% were aged ≥40 years, 92% had type 2 DM with 73% of those having hypertension and one-third of patients were newly diagnosed. In the first 3 years of follow-up, the proportion of clinic attendees decreased from 72% to 64% and then to 61%; the proportion lost to-follow-up increased from 9% to 19% and then to 29%. At the three time points of follow-up, 71–78% had blood glucose ≤180 mg/dl; 63–74% had cholesterol <200 mg/dl; and about 90% had blood pressure <140/90 mmHg. Obesity remained constant at 50%. The proportion of patients with late-stage complications increased from 1% at baseline to 7% at 1 year, 14% at 2 years and 15% at 3 years.
CONCLUSION Nuzha PHC Clinic was able to monitor a cohort of DM patients for 3 years using E-Health and the principles of cohort analysis. This further endorses the use of cohort analysis for managing patients with DM and other non-communicable diseases.

keywords cohort reports, diabetes mellitus, Jordan, Palestine refugees, survival analysis

Introduction

There is a global pandemic of diabetes mellitus (DM) with the numbers increasing annually and expected to reach 552 million by 2030 (International Diabetes Federation 2012). Complications of DM are major causes of disability and are associated with reduced quality of life and premature death. DM and other non-communicable diseases (NCDs) have become a high-priority international issue since the UN High-Level Meeting on NCDs in September 2011. Among the five priority actions agreed by countries and international agencies for NCD control is one on monitoring progress and accountability (Beaglehole *et al.* 2012; WHO 2012).

The work of the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) includes the prevention and treatment of NCDs (Khader *et al.* 2012b; UNRWA 2013). In 2012, we reported on the use of cohort analysis in an UNRWA primary healthcare (PHC) centre in Jordan using a real-time, point-of-care, electronic medical record system (E-Health)

for monitoring and managing diabetes mellitus (DM) in Palestine refugees (Khader *et al.* 2012b). The focus of that study was to report on cumulative cohort treatment outcomes of patients ever registered, and while these provided a useful cross-sectional snapshot of the clinic programme at a set time point, the results were limited by the fact that the patients' time in the cohort varied from a few years to a few days. Although that report did include a small cohort of patients followed over 12 months, this period is too short for patients with DM, and it would be more informative to follow patients for a longer duration.

We have now been using E-Health at Nuzha PHC Clinic, Amman, Jordan, for 3 years, and this enables us to perform a longer cohort analysis. The aim of the study therefore was to use E-Health to report on 12-month, 24-month and 36-month outcomes of a cohort of patients with DM who were registered in the second quarter of 2010.

Methods

This was a retrospective cohort study of PHC clinic data using E-Health. The study was conducted in Nuzha PHC Clinic in Amman, the capital city of Jordan, and the setting has been previously described (Khader *et al.* 2012b). In brief, Nuzha PHC Clinic serves a catchment population of approximately 55,000 Palestine refugees, and all services at the clinic are provided free of charge.

The screening for and management of DM and hypertension have also been previously described (Khader *et al.* 2012a,b). In brief, Palestine refugees attending the clinic are screened annually for DM and 6-monthly for hypertension if they are 40 or older, at risk of NCDs or are pre-conception or pregnant women. The diagnosis of DM is based on two fasting blood glucose (FBG) measurements, both of which must be ≥126 mg/dl (WHO 2006; UNRWA 2009).

Persons diagnosed with DM are clinically assessed for late-stage complications, additional risk factors such as smoking and physical activity, and co-morbidities such as hypertension (defined as systolic blood pressure ≥140 or diastolic blood pressure ≥90 mmHg), and all patient data are recorded in the E-Health system. Patients are categorised into three main groups: DM type 1, DM type 2 and DM type 2 with hypertension, and further classified as new or previously diagnosed. Patients are managed according to a standard algorithm with diet and lifestyle advice, oral hypoglycaemic drugs and insulin, and every quarter they are assessed clinically and for late-stage complications. There is quarterly assessment of body mass index (weight in Kg/height in metres^2), blood pressure and 2 hour postprandial blood glucose (PPBG) and annual assessment of blood cholesterol. The E-Health system, which has been previously described (Khader *et al.* 2012b), is used by clinic staff to record all clinical information using electronic keyboard-operated work stations.

New patients at Nuzha PHC Clinic who were registered and entered into the E-Health system with DM in quarter 2 (April to June) 2010 were included in the study.

Patient data were obtained from the clinic E-Health system. Data variables at baseline included age, sex, category of DM, new or previously known diagnosis of DM, smoking status, physical activity, body mass index and complications of disease. Treatment outcomes, measures of disease control and late-stage complications were determined at 12 months (data censored for quarter 2, 2011, by 30 June 2011), 24 months (data censored for quarter 2, 2012, by 30 June 2012) and 36 months (data

Table 1 Number and characteristics of patients with diabetes mellitus registered in Nuzha Primary Health Care Clinic in quarter 2 – April to June 2010

Patient characteristics	Number (%)
Newly registered with DM	119
Gender	
Male	46 (39)
Female	73 (61)
Age group at registration in years	
<20	0
20–39	12 (10)
40–59	71 (60)
60 and above	36 (30)
Disease category	
DM type 1	10 (8)
DM type 2	29 (24)
DM type 2 with hypertension	80 (68)
Diagnosis	
New	39 (33)
Previously known	80 (67)
Modifiable and additional risk factors:	
Current smoker	27 (23)
Physical inactivity	50 (42)
Obesity (BMI ≥ 30)	68 (57)
One or more late complications at the time of registration*	1
Patients who have had a myocardial infarction	1
Patients with congestive cardiac failure	1
Patients who have had a stroke	0
Patients who are blind	0
Patients with end-stage renal disease	0
Patients who have had above-ankle amputation	0

DM, diabetes mellitus; BMI, body mass index.
*Patients may have one or more complications.

censored for quarter 2, 2013, by 30 June 2013). Differences in outcomes between baseline and the annual time periods were compared using chi-square test for linear trend with levels of significance set at 5%.

Approval for the study was obtained from UNRWA Headquarters, Jordan. As this was a programme audit of routinely collected data, no local ethics approval was required. Ethics approval for publication of the study was obtained from the Union Ethics Advisory Group, Paris, France.

Results

The number and characteristics of 119 new patients with DM registered in quarter 2, 2010, are shown in Table 1. Of these, 61% were females, 90% were aged 40 years and older, type 2 DM accounted for 92% of all patients with 73% of those having associated hypertension, one-third of patients were newly diagnosed, and one patient had late-stage complications.

Treatment outcomes, measures of disease control and burden of late-stage complications at 12 months, 24 months and 36 months are shown in Table 2. From 2010, there was a progressive decrease in the proportion of patients attending clinic each year in quarter 2 (chi-square test for trend = 47.9, $P < 0.001$) and a progressive increase in the proportion that was lost to follow-up (chi-square test for trend = 43.5, $P < 0.001$). Deaths and transfer-outs remained similar. Patients who attended the clinic each year had all disease control measures performed, with the proportion having blood glucose and cholesterol levels below the cut-off threshold

Table 2 12-month, 24-month and 36-month treatment outcomes in patients with diabetes mellitus registered in Nuzha Primary Health Care Clinic in quarter 2 – April to June 2010

Patient characteristics and treatment outcomes	12-month cohort outcome (30 Jun 2011) N (%)	24-month cohort outcome (30 Jun 2012) N (%)	36-month cohort outcome (30 Jun 2013) N (%)
Number of DM patients registered in quarter 2, 2010	119	119	119
Principal outcome			
Attended the clinic in quarter 2*	85 (72)	76 (64)	73 (61)
Did not attend clinic in quarter 2†	18 (15)	16 (13)	7 (6)
Dead‡	1 (1)	1 (1)	1 (1)
Transferred out§	4 (3)	4 (3)	4 (3)
Lost to follow-up¶	11 (9)	22 (19)	34 (29)
Of patients attending the clinic	85	76	73
PPBG measured	85	76	73
PPBG ≤ 180 mg/dl	60 (71)	59 (78)	52 (71)
Blood cholesterol measured	85	76	73
Blood cholesterol <200 mg/dl	63 (74)	48 (63)	46 (63)
Blood pressure measured	85	76	73
Blood pressure <140/90	77 (91)	67 (88)	68 (93)
BMI measured	85	76	73
Obese (BMI ≥ 30)	44 (52)	39 (51)	36 (49)
Of patients attending the clinic	85	76	73
One or more late complications	6 (7)	11 (14)	11 (15)
Myocardial infarction	5	6	6
Congestive cardiac failure	1	4	4
Stroke	3	5	5
Blind	0	0	0
End-stage renal disease‖	0	0	0
Above-ankle amputation	0	0	0

DM, diabetes mellitus; PPBG, postprandial blood glucose; BMI, body mass index.
*Attended the clinic = seen in the quarter 2 (April to Jun) of 2011, 2012 or 2013.
†Did not attend the clinic = not seen in quarter 2 (April to Jun) of 2011, 2012 or 2013.
‡Dead = died from any cause.
§Transferred out = permanently transferred out from the clinic to another clinic.
¶Lost to follow-up = no clinic attendance in the last 12 months.
‖Serum creatinine persistently ≥2.0 mg/dl.

varying between 63% and 78%. About 90% of patients each year had blood pressure <140/90 mm Hg. About half the patients remained obese. The proportion of patients with late-stage complications (the commonest being cardiovascular disease and stroke) increased from 1% at baseline to 7% at 1 year, 14% at 2 years and 15% at 3 years (chi-square test for trend = 15.4, $P < 0.001$).

Discussion

This report on patients with DM using E-Health and cohort analysis within the routine primary healthcare system to assess annual outcomes, measures of disease control and development of complications found, first, that there was a progressive loss of patients attending the clinic each year in quarter 2, the principal reason being a steady increase in patients who were lost to follow-up. Whether these patients had died or silently transferred out, as happens in HIV/AIDS programmes (Yu *et al.* 2007), is not known and requires further research. Second, it was encouraging to see that in patients attending the clinic, the routine measurements of blood glucose and cholesterol, blood pressure and body mass index were always performed. However, blood glucose and cholesterol levels remained stubbornly high in one quarter to one-third of patients. Blood pressure was in general well controlled, but there was no overall change in the cohort's prevalence of obesity. Third, there was a progressive increase in late-stage complications, predominantly due to cardiovascular disease and stroke. This may require more aggressive management of risk factors, such as persuading patients to quit cigarette smoking (Borland *et al.* 2012), more attention given to help patients lose weight and take exercise (Villareal *et al.* 2011; Snel *et al.* 2012*)* and more aggressive treatment for high cholesterol levels.

When E-Health was first used for cohort analysis in Nuzha PHC Clinic in 2012, there were initial problems with incomplete recording practices (Khader *et al.* 2012b), but one year later, the system was in good working order with clean and ready-to-use data. However, some 2010 baseline data, such as the recording of late-stage complications, may still be compromised with incomplete recording at that time, but we expect this to improve in the future.

There are important implications of this study. First, it endorses the use of E-Health and cohort analysis for monitoring and managing patients with DM and adds to the growing body of literature supporting the use of this approach for DM in other countries (Allain *et al.* 2011*)*. Second, it highlights where additional attention and resources may need to be placed within UNRWA clinics for the management of NCDs and prevention and treatment of associated disabilities. Finally, it shows the existence of gaps in our knowledge–for example, do patients who fail to attend the clinic in one quarter continue to do so in other quarters and what are the reasons for patients being lost to follow-up? Further research is needed to answer these questions.

In conclusion, the use of E-Health and cohort analysis has enabled Nuzha PHC Clinic to follow a cohort of over one hundred DM patients during a three-year period, demonstrating both the operational challenges in increasing losses to follow-up and late-stage complications but also positive findings of excellent clinical performance with respect to implementing disease control measurements.

Acknowledgement

The authors thank all UNRWA staff at Nuzha Primary Health Care Clinic for their support in managing and monitoring patients.

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