

# Hypertension and treatment outcomes in Palestine refugees in United Nations Relief and Works Agency primary health care clinics in Jordan

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## Abstract

**OBJECTIVE** In six United Nations Relief and Works Agency (UNRWA) primary health care clinics in Jordan serving Palestine refugees diagnosed with hypertension, to determine the number, characteristics, programme outcomes and measures of disease control for those registered up to 30 June, 2013, and in those who attended clinic in the second quarter of 2013, the prevalence of disease-related complications between those with hypertension only and hypertension combined with diabetes mellitus.

**METHOD** Retrospective cohort study with programme and outcome data collected and analysed using E-Health.

**RESULTS** There were 18 881 patients registered with hypertension with females (64%) and persons aged  $\geq 40$  years (87%) predominating. At baseline, cigarette smoking was recorded in 17%, physical inactivity in 48% and obesity in 71% of patients. 77% of all registered patients attended clinic in the second quarter of 2013; of these, 50% had hypertension and diabetes and 50% had hypertension alone; 9% did not attend the clinics and 10% were lost to follow-up. Amongst those attending clinic, 92% had their blood pressure measured, of whom 83% had blood pressure  $< 140/90$  mm Hg. There were significantly more patients with hypertension and diabetes ( $N = 966$ , 13%) who had disease-related complications than patients who had hypertension alone ( $N = 472$ , 6%) [OR 2.2, 95% CI 2.0–2.5], and these differences were found for both males [18% vs. 10%, OR 1.9, 95% CI 1.6–2.2] and females [11% vs. 5%, OR 2.4, 95% CI 2.1–2.9].

**CONCLUSION** Large numbers of Palestine refugees are being registered and treated for hypertension in UNRWA primary health care clinics in Jordan. Cohort analysis and E-Health can be used to regularly assess caseload, programme outcomes, clinic performance, blood pressure control and cumulative prevalence of disease-related complications. Current challenges include the need to increase clinic attendance and attain better control of blood pressure.

**keywords** hypertension, diabetes mellitus, Palestine refugees, Jordan, cohort reports

## Introduction

Over the last 50 years, the diagnosis and treatment of high blood pressure (hypertension) have been hailed as a great medical success. Despite this achievement, the global burden is huge and increasing. In 2010, hypertension was said to be the largest risk factor for overall global burden of disease and global mortality, and was

estimated to have contributed to 9.4 million deaths globally in the year (Lim *et al.* 2012).

The United Nations Relief and Works Agency for Palestine Refugees (UNRWA) has worked in the Near East for over 60 years, providing health, education and social services for more than 5 million Palestine refugees in Jordan, Lebanon, Syria, the West Bank and Gaza Strip. Hypertension is a major problem amongst the served

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population. Registered number of patients with hypertension increased from 108 299 in 2005 to 175 382 in 2011 (UNRWA 2005, 2011), and the current prevalence of hypertension amongst persons 40 years of age or older attending UNRWA health facilities is 17.5% (UNRWA 2011).

At the primary health care level in many parts of the world, the management of hypertension and blood pressure-related diseases is poor with episodic, unstructured and unmonitored care being the norm (MacMahon *et al.* 2008). Such poor quality service can be improved. In 2012, we reported on the value of cohort analysis and the use of real-time electronic medical record systems at the point-of-care (E-Health) for monitoring incidence, prevalence and treatment outcomes of Palestine refugees with hypertension in Nuzha Primary Health Care (PHC) Clinic, Amman, Jordan (Khader *et al.* 2012). Cohort analysis with aggregate data censored at a set point in time allowed quarterly assessments to be undertaken of clinic performance and patient outcomes leading to better planning of services. Following the report, a decision was made to improve the practice and recording of routine clinic measurements and to expand the use of cohort analysis to other PHC clinics that already had E-Health.

Our aim therefore was to use the same method of cohort analysis with aggregate data at a set point in time to report on the total number of patients registered with hypertension at six PHC clinics in Jordan along with their outcomes. Specific objectives were to report on (i) the number, characteristics, programme outcomes and measures of disease control of all patients with hypertension ever registered up to the end of June 2013, stratified by gender and (ii) the cumulative burden of disease-related complications between those with hypertension only and hypertension combined with diabetes mellitus, again stratified by gender.

## Methods

### Design and setting

This was a descriptive study of a cumulative cohort of patients who were monitored using an E-health record system in Jordan. The study was conducted in six PHC Clinics in Jordan, a country of 6 million people that includes 2 million registered Palestine refugees. UNRWA has 24 PHC clinics in Jordan, and in 2012 served a population of 1 175 021 refugees. The six PHC clinics (Nuzha, Taybeh, Marka, S.Baqaa, Baqaa and Suf) situated in or near to Amman, the capital city, served 302 539 (26%) refugees in 2012. Each clinic is staffed by up to

four doctors and a variable number of nurses. All screening, diagnosis and treatment services at the clinic are provided free of charge.

### Screening and management of hypertension

All Palestine refugees who attend the clinics are screened for hypertension if they are at least 40 years old, if they are at risk of non-communicable diseases and if they are pregnant women or women planning to get pregnant. Blood pressure screening is performed by a trained nurse and the diagnosis is confirmed by a medical officer if the blood pressure is  $\geq 140/90$  mm Hg on several separate occasions. Those who do not have hypertension are followed up and screened every 6 months (UNRWA 2009). Persons diagnosed with hypertension are clinically assessed at baseline for complications and co-morbidities such as diabetes mellitus (defined as two fasting blood glucose measurements, both of which must be  $\geq 126$  mg/dl (UNRWA 2009; WHO 2006), and these data along with demographic and clinical information are recorded in an E-Health system (see below). Information is also recorded at the time of registration on smoking, physical inactivity and obesity (defined as body mass index  $\geq 30$  kg/m<sup>2</sup>). Patients are classified as having new or previously diagnosed hypertension, the diagnosis made either within or outside of the UNRWA system, and a record is also made about whether the patient has been transferred in from another UNRWA clinic.

Patients are managed according to a standard algorithm with diet and lifestyle advice and different classes of antihypertensive drugs that include diuretics, beta-blockers, calcium channel blockers, angiotensin-converting enzyme (ACE) inhibitors and methyldopa, the latter being mainly used for pregnancy-induced hypertension (UNRWA 2009). Patients with uncontrolled hypertension are seen weekly or monthly until their blood pressure is  $< 140/90$  mm Hg, and they are then followed every 3 months.

During quarterly visits, patients are supposed to be assessed as follows: measurement of body mass index and blood pressure and the presence of complications (defined as blindness, end-stage renal failure, myocardial infarction, congestive cardiac failure, stroke and above-ankle amputation). For those diagnosed with hypertension and diabetes, postprandial blood glucose measurements are meant to be done using  $< 180$  mg/dl as the normal value. Once in every 12 months, all patients with hypertension are expected to have fasting blood tests for total cholesterol and serum creatinine and those without diabetes are also expected to be screened for the disease with fasting blood glucose.

### Electronic health system at Nuzha PHC clinic

The electronic health system (E-Health) was set up in 2009 in Nuzha PHC Clinic and piloted for 6 months. The system was then adopted and has been further expanded to other PHC centres. E-Health is currently operational in six UNRWA clinics in Jordan and has been previously described (Khader *et al.* 2012). In brief, clinicians and nurses use password protected computers, which are available in every work station, to enter patient information during clinical encounters at the point-of-care. All patients have a health card and a unique UNRWA identification number, and these are used to trace the patients' electronic data files at the clinic visits. The unique patient numbers are also used to check whether there is any duplication of records in the different clinics when patients transfer between clinics, and corrective measures are undertaken in these circumstances. All computers are connected to a central server that stores the data.

All hypertension patients at Nuzha PHC clinic seen from October 2009 onwards have had their data entered to E-Health. In the other five clinics, all hypertension patients seen from mid-2011 onwards have had their data entered to E-Health. For patients who died, were lost-to-follow-up or transferred-out prior to these times, data have not been entered to E-Health.

### Patient population

All patients who were registered and entered into the E-Health system with hypertension from October 2009 in Nuzha PHC clinic and from mid-2011 in the other five clinics up to 30th June 2013 were included in the study.

### Source of data, variables, cohort reporting formats and analysis

Patient data were obtained from the clinic E-Health systems. Baseline variables included age, sex, new or previously known diagnosis of hypertension, smoking status, physical inactivity, body mass index. Variables obtained on the 30 June 2013 (the census date) included programme outcomes of all registered patients; in those who attended the clinic in the quarter from 1 April to 30 June 2013, the measures of disease control and the presence of one or more late-stage complications. Comparisons of risk factors, programmatic outcomes and late-stage complications between males and females and between those with hypertension alone and hypertension combined with diabetes were done using the chi-square test and expressed as odds ratios with

95% confidence intervals. The level of significance was set at 5%.

### Ethics

Approval for the study was obtained from UNRWA Headquarters, Jordan, and as this was regarded as a routine programme audit, 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 characteristics of 18 881 patients with hypertension ever registered up to the end of June 2013 are shown in Table 1. There were more females, 87% were aged 40 years and above, nearly half of the patients had both hypertension and diabetes and there was an almost equal distribution of patients with new and previously known disease at the time they were registered.

Additional baseline risk factors identified at the time of registration are shown in Table 2. Seventeen per cent of patients with hypertension were current smokers, 48% were physically inactive and 71% were obese. Current cigarette smoking was significantly more common in males (34%) compared with females (7%), whilst physical inactivity and obesity were significantly more common in females.

Programme outcomes and measures of disease control in patients ever registered up to the end of June 2013 are shown in Table 3. There were 14 532 (77%) patients who attended the clinic during the second quarter, April to June 2013. Nine per cent did not attend the scheduled visit and the remainder (14%) were either dead, transferred-out or lost-to-follow-up. Significantly fewer males attended the clinic compared with females, with all other adverse parameters such as failed to attend, died, transferred-out and being lost-to-follow-up being more common than in females.

Of those who attended the clinic in the second quarter, 92% had their blood pressure measured. Fewer males had their blood pressure controlled compared with females. Body mass index was also measured in the majority of patients, with 53% of males and only 28% of females being classified as non-obese. In patients with hypertension and diabetes who attended the clinic in the second quarter, 90% had their postprandial blood glucose measured, with 70% having blood glucose values below 180 mg/dl, these results being slightly better for males than for females.

**Table 1** Number and characteristics of patients ever registered with hypertension at six PHC clinics up to 30th June 2013, Jordan

| Patient characteristics           | Nuzha<br>PHC<br>N | Taybeh<br>PHC<br>N | Marka<br>PHC<br>N | S. Baqaa<br>PHC<br>N | Baqaa<br>PHC<br>N | Suf<br>PHC<br>N | All clinics<br>N (%) |
|-----------------------------------|-------------------|--------------------|-------------------|----------------------|-------------------|-----------------|----------------------|
| Ever registered with hypertension | 5048              | 2607               | 3351              | 2494                 | 4113              | 1268            | 18 881               |
| Male                              | 2007              | 937                | 1182              | 895                  | 1355              | 455             | 6831 (36)            |
| Female                            | 3041              | 1670               | 2169              | 1599                 | 2758              | 813             | 12 050 (64)          |
| Age group at registration, years  |                   |                    |                   |                      |                   |                 |                      |
| <20                               | 6                 | 4                  | 9                 | 1                    | 9                 | 7               | 36                   |
| 20–39                             | 552               | 291                | 509               | 268                  | 543               | 288             | 2451 (13)            |
| 40–59                             | 2961              | 1560               | 1960              | 1520                 | 2375              | 694             | 11 070 (59)          |
| 60 and above                      | 1529              | 752                | 873               | 705                  | 1186              | 279             | 5324 (28)            |
| Disease category                  |                   |                    |                   |                      |                   |                 |                      |
| Hypertension                      | 2530              | 1298               | 1763              | 1272                 | 2045              | 808             | 9716 (51)            |
| Hypertension with diabetes        | 2518              | 1309               | 1588              | 1222                 | 2068              | 460             | 9165 (49)            |
| Diagnosis                         |                   |                    |                   |                      |                   |                 |                      |
| New                               | 1828              | 960                | 1725              | 1261                 | 2580              | 988             | 9342 (49)            |
| Previously known                  | 3220              | 1647               | 1626              | 1233                 | 1533              | 280             | 9539 (51)            |

PHC, primary health care clinic.

New: date of registration within 4 weeks of date of diagnosis; Previously known: date of registration 4 weeks or later from the date of diagnosis and includes patients transferred in from other UNRWA clinics.

**Table 2** Additional risk factors recorded at the time of registration in all patients ever registered with hypertension at six PHC clinics, Jordan

| Additional risk factors                   | All patients<br>N (%) | Males<br>N (%) | Females<br>N (%) | Odds Ratio OR* (95% CI,<br>P value) |
|---|-----------------------|----------------|------------------|-------------------------------------|
| All patients registered with hypertension | 18 881                | 6831           | 120 50           |                                     |
| Current smokers                           | 3145 (17)             | 2305 (34)      | 840 (7)          | 6.8 (6.2–7.4), $P < 0.001$          |
| Physical inactivity                       | 9032 (48)             | 2792 (41)      | 6240 (52)        | 0.64 (0.60–0.68), $P < 0.001$       |
| Obesity                                   | 13 493 (71)           | 4147 (61)      | 9346 (78)        | 0.45 (0.42–0.48), $P < 0.001$       |

PHC, primary health care clinic.

Current smoker: currently smoking cigarettes from one cigarette per week upwards. Physical inactivity: <20 min of exercise three times per week. Obesity: body mass index  $\geq 30$  kg/m<sup>2</sup>.

\*Males compared with females.

The prevalence of late-stage complications as of June 30, 2013, for those with hypertension alone and those with hypertension and diabetes is shown in Table 4. Within each category (hypertension alone and hypertension and diabetes), males had a significantly increased prevalence of myocardial infarction and stroke compared with females. A significantly higher proportion of patients with both hypertension and diabetes (13%) had disease-related complications compared with patients who had hypertension alone (6%) [OR 2.2, 95% CI 2.0–2.5,  $P < 0.001$ ], and this was found for both males [18% *vs.* 10%, OR 1.9, 95% CI 1.6–2.2,  $P < 0.001$ ] and females [11% *vs.* 5%, OR 2.4, 95% CI 2.1–2.9,  $P < 0.001$ ]. Those with hypertension and diabetes also had an excess

prevalence of myocardial infarction, congestive cardiac failure, stroke and blindness compared with those with hypertension alone ( $P < 0.01$ ).

## Discussion

This retrospective analysis of a cohort of patients registered with hypertension at six UNRWA primary health care clinics and assessed for outcomes at a set point of time provides useful information about the case load and management of this condition. Altogether, nearly 19 000 patients with hypertension had ever been registered. About half of these patients were in the newly diagnosed category, which confirms the importance of the regular

**Table 3** Programme outcomes and measures of disease control in patients registered with hypertension at six PHC clinics and assessed by 30th June 2013, Jordan

| Patient characteristics and treatment outcomes                                       | All<br>N (%) | Males<br>N (%) | Females<br>N (%) | Odds Ratio OR* (95% CI,<br>P value) |
|--|--------------|----------------|------------------|-------------------------------------|
| Patients registered with hypertension by 30 June, 2013                               | 18 881       | 6831           | 12 050           |                                     |
| Principal programme outcome on 30 June, 2013   |              |                |                  |                                     |
| Attended the clinic in the second quarter of 2013                                    | 14 532 (77)  | 5002 (73)      | 9530 (79)        | 0.7 (0.7–0.8), <i>P</i> < 0.001     |
| Did not attend the clinic in the second quarter of 2013                              | 1785 (9)     | 742 (11)       | 1043 (9)         | 1.3 (1.2–1.4), <i>P</i> < 0.001     |
| Dead   | 534 (3)      | 260 (4)        | 274 (2)          | 1.7 (1.4–2.0), <i>P</i> < 0.001     |
| Transferred-out  | 224 (1)      | 97 (1)         | 127 (1)          | 1.4 (1.0–1.8), <i>P</i> = 0.02      |
| Lost-to-follow-up  | 1806 (10)    | 730 (11)       | 1076 (9)         | 1.2 (1.1–1.4), <i>P</i> < 0.001     |
| Of those who attended the clinic in second quarter, 2013                             | 14 532       | 5002           | 9530             |                                     |
| Blood pressure measured in the quarter   | 13 315 (92)  | 4601 (92)      | 8714 (91)        | 1.1 (0.9–1.2)                       |
| Blood pressure <140/90   | 11 089 (83)  | 3696 (80)      | 7393 (85)        | 0.7 (0.7–0.8), <i>P</i> < 0.001     |
| Body mass index measured in the quarter  | 13 979 (96)  | 4848 (97)      | 9131 (96)        | 1.4 (1.1–1.7), <i>P</i> < 0.001     |
| Body mass index <30 kg/m <sup>2</sup>  | 5087 (36)    | 2568 (53)      | 2519 (28)        | 3.0 (2.7–3.2), <i>P</i> < 0.001     |
| Of those with hypertension and diabetes attending the clinic in second quarter, 2013 | 7256         | 2703           | 4553             |                                     |
| Postprandial blood glucose measured  | 6529 (90)    | 2426 (90)      | 4103 (90)        | 1.0 (0.8–1.2)                       |
| Postprandial blood glucose ≤180 mg/dl  | 4564 (70)    | 1733 (71)      | 2832 (69)        | 1.2 (1.0–1.3), <i>P</i> = 0.04      |

PHC, primary health care clinic.

Attended the clinic in the second quarter of 2013: seen by a doctor or nurse in the clinic during that quarter; Did not attend the clinic in the second quarter of 2013: not seen by a doctor or nurse in the clinic during that quarter; Dead: died at an time 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.

\*Males compared with females.

six-monthly screening for hypertension carried out amongst at-risk individuals at UNRWA clinics. An important finding was that between 40% and 50% of patients with hypertension had associated diabetes at registration. Given the association between these two conditions and their long-term complications, it further endorses the current UNRWA policy that diabetes should always be screened for at the same time that hypertension is diagnosed. Indeed, the American Society of Hypertension now recognises hypertension not as a single disease entity but as part of a bigger disease conglomerate that includes diabetes, obesity and kidney disease (Editorial 2014).

A high proportion of patients with hypertension had additional risk factors at the time of registration for non-communicable diseases such as cigarette smoking, physical inactivity and obesity, with more than one-third of males being smokers, and more than half of the women being physically inactive and three quarters of women being obese. There are ways to help people to quit smoking (Lancaster & Stead 2005; Borland *et al.* 2011; Mardle *et al.* 2012; Srivastava *et al.* 2013), improve physical activity and reduce obesity (Appel *et al.* 2011; Villareal *et al.* 2011). There seems little doubt about the effect of high body mass index and obesity on increasing the risk of coronary heart disease and stroke (The Global Burden

of Metabolic Risk Factors for Chronic Diseases Collaboration 2014), and growing evidence that in those with impaired glucose tolerance an increase in daily ambulatory activity may lead to a reduction in cardiovascular morbidity (Yates *et al.* 2014). Although these additional risk factors are screened for on registration, interventions to change lifestyle behaviour need to be introduced at UNRWA clinics for patients with hypertension and/or diabetes and they need to be accompanied by regular and appropriate monitoring.

It was encouraging to see that more than three quarters of patients who had ever been registered in the clinics attended the second quarter of 2013 for follow-up. Results for attendance were better for females than males, as has been found previously in blood pressure control clinics (Degoulet *et al.* 1983). About 20% of patients either did not attend the clinic in the second quarter or were classified as lost-to-follow-up, with these findings being more common in males compared with females. A study in Nuzha PHC in Jordan found that half of the patients with diabetes who did not attend the clinic in one quarter were eventually classified as lost-to-follow-up (Khader *et al.* 2014a), so it is important for UNRWA clinics to make contact and bring back patients to the clinic for another appointment in case of a no

A. Khader *et al.* Cohort reporting for hypertension**Table 4** Prevalence of complications in patients registered with hypertension at six PHC clinics and assessed by 30th June 2013, Jordan

|  | All<br>N (%) | Males<br>N (%) | Females<br>N (%) | Odds Ratio OR* (95% CI,<br>P value) |
|--|--------------|----------------|------------------|-------------------------------------|
| Complications in patients with hypertension only         |              |                |                  |                                     |
| Attended the clinic in the second quarter of 2013        | 7276         | 2299           | 4977             |                                     |
| Patients with one or more late complications             | 472 (6)      | 239 (10)       | 233 (5)          | 2.4 (2.0–2.9), $P < 0.001$          |
| Patients who had a myocardial infarction                 | 179 (2)      | 119 (5)        | 60 (1)           | 4.5 (3.3–6.1), $P < 0.001$          |
| Patients with congestive cardiac failure                 | 170 (2)      | 62 (3)         | 108 (2)          | 1.2 (0.9–1.7)                       |
| Patients who had a stroke                                | 148 (2)      | 70 (3)         | 78 (2)           | 2.0 (1.4–2.7), $P < 0.001$          |
| Patients with blindness                                  | 15 (0)       | 9 (0)          | 6 (0)            | –                                   |
| Patients with end-stage renal disease                    | 0            | 0              | 0                | –                                   |
| Patients who had an above-ankle amputation               | 0            | 0              | 0                | –                                   |
| Complications in patients with hypertension and diabetes |              |                |                  |                                     |
| Attended the clinic in the second quarter of 2013        | 7256         | 2703           | 4553             |                                     |
| Patients with one or more late complications             | 966 (13)     | 481 (18)       | 485 (11)         | 1.8 (1.6–2.1), $P < 0.001$          |
| Patients who had a myocardial infarction                 | 417 (6)      | 258 (10)       | 159 (3)          | 2.9 (2.4–3.6), $P < 0.001$          |
| Patients with congestive cardiac failure                 | 337 (5)      | 137 (5)        | 200 (4)          | 1.2 (0.9–1.5)                       |
| Patients who had a stroke                                | 289 (4)      | 132 (5)        | 157 (3)          | 1.4 (1.1–1.8), $P < 0.01$           |
| Patients with blindness                                  | 42 (1)       | 17 (1)         | 25 (1)           | 1.1 (0.6–2.1)                       |
| Patients with end-stage renal disease                    | 21 (0)       | 13 (0)         | 8 (0)            | –                                   |
| Patients who had an above-ankle amputation               | 14 (0)       | 6 (0)          | 8 (0)            | –                                   |

PHC, primary health care clinic.

\*Males compared with females.

show. This may require a more proactive approach than has hitherto been the case, and the clinics need to consider using, for example, mobile phones to help reduce the proportion of patients, particularly males, who fail to attend their quarterly scheduled visit (Lester *et al.* 2010).

Of those who attended the clinic in the second quarter of 2013, the majority of patients, both males and females, had their blood pressure and body mass index measured, although blood pressure was too high in a fifth of patients and a large proportion remained obese. Similarly, whilst the majority of patients with both hypertension and diabetes had their postprandial blood glucose measured, nearly one-third had elevated blood glucose levels. There needs to be more aggressive control of hypertension and diabetes if long-term complications are to be avoided.

Finally, our cross-sectional analysis showed that 6% of patients with hypertension alone had one or more late complications, and this increased twofold in those with both hypertension and diabetes, with males being more affected than females, maybe because of their higher prevalence of additional risk factors and poor compliance with appointments. With over 56 000 patients with hypertension in UNRWA clinics in Jordan and over 175 000 in UNRWA clinics in the region [Jordan, Syria, Lebanon, Gaza Strip and the West Bank] (UNRWA 2011) this extrapolates to a large number of patients with

chronic disability in need of long-term additional medical and community care. These monitoring data collected and presented on a quarterly basis are helpful for planning and directing the necessary resources to improve quality of life. However, it would also, in the future, be useful to evaluate the risk of disease-specific complications on a longitudinal cohort basis, as has been done in Jordan with diabetes (Khader *et al.* 2014b), to determine whether better control of hypertension and diabetes in successively enrolled cohorts can prevent these from occurring.

The strengths of this study are the large number of patients registered for care, which constitute about one-third of UNRWA's hypertension patients in Jordan. The study also followed STROBE guidelines for the reporting of observational data (von Elm *et al.* 2007). The limitations mainly relate to the use of already collected data, which may be wrongly entered or inaccurate and the cross-sectional method of analysis with places limits on the interpretation of data. Despite the limitations of this method compared with adopting a more longitudinal assessment using person-years of observation, cross-sectional analysis does provide a snapshot of patients ever registered, the proportion attending the clinic in a quarter, the clinic performance, blood pressure control and the burden of disease-related complications. Such information, updated and produced every quarter, not only

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allows UNRWA to review and assess the growing case load and care parameters but also to rationally plan for human resources, drugs and consumables which are needed at the facility level.

There are several implications of this study. First, it endorses the use of E-Health and cohort analysis for monitoring and managing patients with hypertension and diabetes, supporting the use of this methodology in Jordan and other countries for non-communicable diseases (Allain *et al.* 2011). Second, the most feasible ways to reduce the quarterly clinic attendance failures need to be determined and implemented. Third, the issue of how patients with late-stage complications and disability are managed and supported in the community, through, for example, occupational therapy needs more thorough evaluation. Finally, ongoing work that we are carrying out in Jordan on non-communicable diseases will help to improve the responsiveness of health systems to tackle this new and emerging burden of chronic disease and potentially allow UN targets for their control by 2025 to be realised (Atun *et al.* 2013; Horton 2013).

In conclusion, this study shows the high case load from hypertension and hypertension and diabetes at primary health care clinics in Jordan, and endorses the use of cohort analysis and E-Health for quarterly reporting of programme outcomes, disease control measures and prevalence of disease-related complications. More needs to be done to ensure better quarterly clinic attendance and better control of blood pressure and diabetes.

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