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المجلد السادس عشر / المتوسط

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المجلة الصحية لشرق المتوسط

هي المجلة الرسمية التي تصدر عن المكتب الإقليمي لشرق المتوسط بمنظمة الصحة العالمية. وهي منبر لتقديم السياسات والمبادرات الجديدة في الخدمات الصحية والترويج لها، ولتبادل الآراء والمفاهيم والمعطيات الوبائية ونتائج الأبحاث وغير ذلك من المعلومات، وخاصة ما يتعلق منها بإقليم شرق المتوسط. وهي موجهة إلى كل أعضاء المهن الصحية، والكليات الطبية وسائر المعاهد التعليمية، وكذا المنظمات غير الحكومية المعنية، والمراكز المتعاونة مع منظمة الصحة العالمية والأفراد المهتمين بالصحة في الإقليم وخارجه.

EASTERN MEDITERRANEAN HEALTH JOURNAL

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Letter from the Editor

Achievement of the United Nations (UN) Millennium Development Goals (MDGs) cannot be accomplished without addressing gender inequalities in health, including those impacting on reproductive health. MDG 5, "Improving maternal health", has the explicit target of ensuring reproductive health for all women. Progress towards MDG 5 is monitored through achievement of two targets: reduce maternal mortality ratio by three-quarters between 1990 and 2015; and achieve, by 2015, universal access to reproductive health care.

The WHO Regional Office programme on Gender in Health and Development focuses on ways that gender as a social construct affects the health of both men and women. Gender inequality has a higher toll on women's health because their relatively lower status across cultures has restricted their access to resources for health, including education, health information and employment.

The necessity to improve reproductive health has received increasing priority throughout the WHO Eastern Mediterranean Region. Recognizing the importance of reproductive health research as an area of strategic priority for policy formulation and programme development, implementation, monitoring and evaluation, the Regional Office has developed a directory for reproductive health research conducted in the Region since 1990. It aims to facilitate exchange of research-related experience in the field of reproductive health between and within countries. In addition, it is expected to further support utilization of data in the development and implementation of reproductive health programmes.

A conference entitled "Women Deliver 2010" will be held in Washington DC on 7–9 June 2010. The theme is: "Delivering solutions for girls and women", with the focus on political, economic, social/cultural, and technological solutions. The main objective of the conference is to highlight the importance of investing in women to achieve the MDGs through political, economic, sociocultural and technological solutions.

"Women Deliver 2010" is jointly supported by WHO and other UN agencies, bilateral donors and foundations, and will bring together experts and scholars in maternal health and mortality as well as in human rights, gender, HIV/AIDS, education, micro-enterprise, labour and sexual and reproductive health, including family planning. The conference aims to move the dialogue to the global arena with two messages: the MDGs will not be achieved without investing in women and there is just enough time, if we commit funding now, to achieve MDG5 by 2015.

رسالة من المحرر

يتعذر بلوغ المرامي الإنمائية للألفية دون التصدي للفروق في العدالة الصحية بين الجنسين، ومن بينها تلك الفروق التي تُلقِي بظلالها على الصحة الإنجابية. فالمرمى الخامس من المرامي الإنمائية للألفية والمتعلق بتحسين صحة الأمهات حُدِّد له هدف واضح هو: ضمان أن يتمتع جميع النساء بالصحة الإنجابية. ويُرصد التقدم المُحرز باتجاه هذا المرمى من خلال تحقيق هدفين هما تقليص معدل وفيات الأمهات بمقدار ثلاثة أرباع بين عامي 1990 و2015، وتحقيق الإتاحة الشاملة للصحة الإنجابية بحلول عام 2015.

ويركز برنامج منظمة الصحة العالمية في المكتب الإقليمي المعني بالجندر في الصحة والتنمية على الطرق التي يؤثر خلالها باعتباره إحدى البنى الاجتماعية على الصحة لدى كلٍّ من الرجال والنساء. فانهدام العدالة بين الجنسين يؤدي إلى قائمة طويلة من التأثيرات على صحة النساء لما هن من منزلة تعتبر نسبياً أدنى من الرجال في سائر الثقافات، مما ينقص من وصولهن إلى الموارد الصحية، ومنها التثقيف، والمعلومات الصحية، وفرص العمل والتوظيف.

وقد نالت ضرورة تحسين الصحة الإنجابية أولوية متزايدة في جميع أرجاء إقليم شرق المتوسط لمنظمة الصحة العالمية، وإدراكاً من المكتب الإقليمي لشرق المتوسط لأهمية البحوث في الصحة الإنجابية واعتبارها أحد المجالات ذات الأولوية الاستراتيجية لصياغة السياسات ولتطوير البرامج وتنفيذها وتقييمها فقد أعد دليلاً للبحوث في مجال الصحة الإنجابية التي نفذت في الإقليم منذ عام 1990؛ وكان هدفه تسهيل تبادل الخبرات المتعلقة بالبحوث في مجال الصحة الإنجابية ضمن البلدان وفيما بينها.

وسيعقد في الفترة 7 – 9 حزيران/يونيو 2010 في العاصمة الأمريكية واشنطن مؤتمرًا تحت عنوان «النساء يساهمن بالعطاء 2010»، وسيكون شعاره «تقديم الحلول للبنات والنساء» مع التركيز على الحلول السياسية والاقتصادية والاجتماعية والثقافية والتكنولوجية. وتتمثل الأغراض الرئيسية لهذا المؤتمر بتوضيح أهمية الاستثمار في صحة النساء لبلوغ المرامي الإنمائية للألفية من خلال حلول سياسية واقتصادية واجتماعية وثقافية وتكنولوجية.

ويتلقى مؤتمر النساء يساهمن بالعطاء 2010 الدعم المشترك من منظمة الصحة العالمية، ووكالات الأمم المتحدة الأخرى، والمؤسسات، والأطراف المانحة الثنائية الأطراف، وفيه سيجتمع خبراء وعلماء حول قضايا الوفيات وصحة الأمهات وحقوق الإنسان والجندر والإيدز والعدوى بفيروسه والتثقيف والمشروعات الصغيرة والعمل والصحة الإنجابية والجنسية وفي تنظيم الأسرة. ويهدف المؤتمر لتحريك الحوار نحو العالمية، مع رسالتين هما: لن يكون بلوغ المرامي الإنمائية للألفية دون الاستثمار في صحة النساء، وليس هناك من الوقت ما يكفي لبلوغ المرامي الإنمائية للألفية إذا ما التزمنا بالتمويل في الوقت الحاضر لتحقيق المرامي الإنمائية للألفية عام 2015.

Cholera outbreak in Baghdad in 2007: an epidemiological study

J.M. Khwaif¹, A.H. Hayyawi² and T.I. Yousif¹

فاشية الكوليرا في بغداد عام 2007: دراسة وبائية

جاسم محمد خويف، علي حسن حياوي، تغريد اسحق يوسف

الخلاصة: حدث وباء بالكوليرا في العراق عام 2007، وبلغ عدد الحالات 4667 حالة. وقد شخّصت الحالة الأولى في بغداد، في 19 أيلول/سبتمبر 2007، وكانت آخر حالة في 13 كانون الأول/ديسمبر 2007. وعلى وجه الإجمالي أبلغ عن 136 حالة (2.9% من مجمل الحالات في العراق) وقعت في 6 مناطق من مناطق بغداد البالغ عددها 13 منطقة. العمر الوسطي للحالات 11 سنة (وتراوح بين 0.3 و61 سنة). وحدثت 3 وفيات مما يجعل معدلات إماتة الحالات 2.2%. وقد أكد الاختبار الجراثيمي أن الفاشية ناجمة عن ضمة الكوليرا 01، النمط البيولوجي الطور، والنمط المصلي (السيرولوجي) إنابا. وقد كانت هذه الذرية مقاومة للتريمثوبريم – سلفاميثوكسازول، ولكنها مستجيبة (حساسة) للتتراسيكلين وللكورامفينيكول. وقد كانت الحاجة ماسة لبذل الجهود في بغداد لتوفير الماء المأمون للشرب والإصحاح الملائم، نظراً لقلّة توافر مياه الحنفية ولأن التلوث بمياه المجاري قد ساهم في نشر هذا المرض.

ABSTRACT In 2007 there was an epidemic of cholera in Iraq with 4667 cases. The first case in Baghdad was diagnosed on 19 September 2007 and the last case on 13 December 2007. In all, 136 cases were reported (2.9% of the country total) in 6 of the 13 districts of Baghdad. The median age of the cases was 11 years (range = 0.3–71 years). There were 3 deaths giving a case fatality rate of 2.2%. Bacteriological testing confirmed that the outbreak was caused by *Vibrio cholerae* 01, biotype El Tor, serotype Inaba. The strain was resistant to trimethoprim-sulfamethoxazole, but sensitive to tetracycline and chloramphenicol. Efforts are needed in Baghdad to establish safe drinking-water and proper sanitation as limited availability of tap-water and sewage contamination probably contributed to the spread of the disease.

Flambée du choléra à Bagdad en 2007 : étude épidémiologique

RÉSUMÉ En 2007, l'Iraq a connu une épidémie de choléra, avec 4 667 cas recensés. Le premier cas observé à Bagdad a été diagnostiqué le 19 septembre 2007, et le dernier le 13 décembre de la même année. Au total, 136 cas ont été signalés dans six des 13 quartiers de Bagdad (2,9 % des cas identifiés dans l'ensemble du pays). L'âge moyen des malades était de 11 ans (fourchette = 0,3 – 71 ans). Trois décès ont été constatés, soit un taux de létalité de 2,2 %. Les analyses bactériologiques ont confirmé que cette flambée était due à la présence de *Vibrio cholerae* 01, biotype El Tor, sérotype Inaba. Cette souche était résistante à l'association triméthoprim – sulfaméthoxazole, mais sensible à la tétracycline et au chloramphénicol. Des efforts sont nécessaires à Bagdad pour garantir la disponibilité d'eau de boisson saine et un système d'assainissement adéquat, l'accès limité à l'eau courante et la contamination par les eaux usées ayant probablement contribué à la propagation de la maladie.

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Introduction

Cholera is a diarrhoeal disease caused by infection with the bacterium *Vibrio cholerae* biotype 01 or 0139; both children and adults can be affected [1].

Iraq is at risk of cholera epidemics because it lies on the route of pilgrimage to Mecca and contains a number of holy shrines [2]. Cholera first spread to Basra during the epidemic of 1820 and there were a great number of deaths [2]. The disease also spread to Baghdad, with similar consequences. The disease then completely disappeared from Iraq to reappear again in August 1966 as a part of the 7th pandemic spread [3,4]. Since then occasional outbreaks have continued in Iraq [5] (Figure 1). Cholera became endemic in all governorates of Iraq following the 1991 Gulf Crisis. Rural areas were particularly affected with the high risk period occurring from April to November [6].

In the 1991 outbreak, one-third of the total number of reported cases in Iraq were in Baghdad city, while in the inter-epidemic period 1991–98, Baghdad had a smaller proportion of the total. However, in 1999 the reported cases in Baghdad again represented around one-third of the total reported cases [7,8]. From 1999, the reported cases of cholera fell to reach a low of 35

cases in 2005 and in the 3 years prior to 2007 no cases of cholera were reported in Baghdad in the 4-month period September–December.

However, in 2007, a cholera outbreak emerged throughout Iraq. This paper documents the epidemiological situation in Baghdad during this last cholera epidemic.

Methods

Background

The central province, Baghdad, is the capital of Iraq. It had a population of about 6.5 million in 2007. It is divided by the Tigris River into 2 sides, Al-Resafa to the east and Al-Karkh to the west.

The central area of Baghdad, which is within the boundaries of Baghdad Municipality, is supplied by safe piped-water through 2 major water projects, 1 on each side; in addition to that, there are many small water plants. The areas outside the boundaries of Baghdad Municipality are supplied with water either from small water plants, which are under the supervision of the Ministry of Municipalities and General Works, or they take their water from tankers, wells or directly from the river.

A few districts in Baghdad are served by an efficient sewage disposal system,

some areas possess a sewage disposal net but it is old and inefficient, while most other districts of the city do not even have this sewage disposal net.

Health services are provided by 2 directorates of health (DOH), one on each side of the river. Many primary health care centres (PHCCs) are distributed throughout Baghdad. PHCCs sharing the same geographical locality are connected to a Primary Health Care District (PHCD). Seven of these districts are linked to the Baghdad Al-Karkh DOH and 6 are linked to Baghdad Al-Resafa DOH. The population served by Al-Resafa DOH is 3 650 383 and by Al-Karkh DOH 2 937 300. Several general and specialty hospitals on both sides are connected to each DOH.

Case definition

The Iraqi Ministry of Health (MOH) annually issues and distributes the National Cholera Control Plan (NCCP) to every governorate. This plan uses World Health Organization (WHO) definition for a cholera outbreak. WHO states that: "a cholera outbreak should be suspected if there is a sudden increase in daily number of patients with acute watery diarrhoea, especially patients who pass the 'rice water stool' typical of cholera". Isolation of *V. cholerae* 01 or 0139 from the stool of any patient with diarrhoea supports the diagnoses of an outbreak.

Case detection

The NCCP includes procedures for handling samples. Stool samples collected in PHCCs are transported in Cary–Blair medium to the nearest hospital. In the hospital laboratory, stool samples collected from both PHCCs and the hospital itself are processed in TCBS (thiosulfate–citrate–bile salts–sucrose agar) medium for diagnosis of *V. cholerae*. Stools found positive for *V. cholerae* are transferred to the Reference Laboratory at the Central Public Health Laboratory, where further analysis is done to confirm the diagnoses, identify the

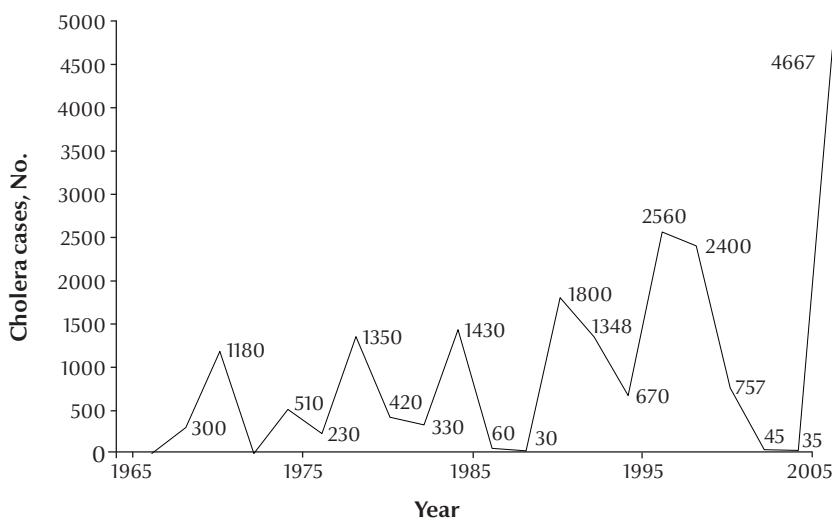


Figure 1 Reported cholera cases in Iraq, 1967–2007

specific serotype and carry out sensitivity testing. Each confirmed case is notified to the national Communicable Disease Control Centre in Baghdad.

In an epidemic situation, NCCP strengthens coordination and cooperation between all involved sectors and stakeholders. It also strengthens the surveillance activities, which include: establishing a zero weekly report of diarrhoeal cases; ensuring testing of all cases who meet the stated case definition of cholera in hospitals and diarrhoeal cases attending the PHCCs (routine situation); and maintaining daily routine examination of drinking water by PHCCs for chlorine levels.

The 2007 outbreak

In the 2007 outbreak in Baghdad, the first case was diagnosed on 19 September 2007. This was a 45-year-old married woman from Al-Madaen district. This case resulted in the activation of the National Cholera Control Committee at the MOH level and the Cholera Committee at the Baghdad level.

Both Baghdad Al-Resafa DOH and Baghdad Al-Karkh DOH established "rapid response and case detection teams" to start the immediate epidemiological work that included: visiting each diagnosed cholera case at their home; collecting personal data by direct interview; examining the contacts; and assessing the environmental situation (type of water supply and the method of sewage disposal). These data were reported and sent to the Communicable Disease Control Centre in the DOH; these reports have been reviewed and united in a single epidemiological report. The data were analysed using *Epi-Info*, version 3.3.

Results

The total number of reported cases in the 2007 cholera epidemic in Iraq was 4667, of which 136 (2.9%) were in Baghdad. The first case reported in Baghdad

was on 19 September, while the last was on 13 December. No cholera cases had been reported in the same period in the previous 3 years. Five carriers (0.5%) were identified among the asymptomatic household contacts of the cholera cases examined. Three patients with cholera died, giving a case fatality rate (CFR) for Baghdad of 2.2%.

The median age of the cases was 11 years (range 0.3–71 years); 33.1% of the patients were less than 5 years of age, and cumulatively 44.1% were less than 10 years (Table 1). Males constituted 49.5% of the patients, giving a male to female ratio of 1:1.03.

Out of the 136 cholera cases, 80 (58.8%) cases were admitted to hospitals while the remaining 56 (41.2%) were treated as outpatients with either oral rehydration solution (ORS) alone or ORS and antibiotics.

Isolate testing confirmed that this outbreak was caused by *V. cholerae* 01, biotype El Tor, serotype Inaba. The strain was resistant to trimethoprim-sulfamethoxazole, but was sensitive to the commonly used antibiotics tetracycline and chloramphenicol.

Cholera cases were reported in 6 out of 13 districts. The highest number of cases was in Al-Baladiyatt district: 49 (36.0%) cases giving an attack rate (AR) of 6.2 cases per 100 000. The lowest number of cases was in Al-Dorha district: 1 (0.7%) case giving an AR of 0.2 cases per 100 000. The highest AR (12.8 cases per 100 000) was in Al-Madean district. There were 4 carriers in Al-Madaen district and 1 in Al-Karkh district. There were 3 deaths reported

during the outbreak, 2 in Al-Karkh district and 1 in Al-Madaen district, giving a case fatality rate (CFR) for Baghdad of 2.2%. The overall carrier rate was 0.02% (Table 2) (Figure 2).

Just over half the cases (76) had tap-water for drinking and daily use, 3 depended on untreated river water for drinking while 57 obtained their water from additional sources (tankers, wells, river) due to a severe shortage of tap-water (Table 3). Less than half (41.2%) of the patients lived in places served by a sewage disposal net, while 58.8% lived in places lacking this service. Most patients (94.9%) had not eaten outside the home in the week prior to onset.

Figure 3 shows the time distribution of cases. The first case was reported in the 38th week of 2007 (ending September 23), but no cases were reported in week 39 (ending September 30); they started to reappear in week 40 (ending October 7). Thereafter cases continued to be reported and reached a peak in week 46 (ending November 18), dropping to 1 case in week 50 (ending December 16). This was the last case in Baghdad of the 2007 outbreak.

Discussion

The 2007 cholera epidemic was in fact anticipated from the trend of the disease in the previous years and because of the presence of some risk factors and environmental circumstances favourable for the spread of *V. cholera*, such as damaged infrastructure due to multiple crises, limited access to safe drinking

Table 1 Distribution of cholera cases according to age group

Age group (years)	No. of cases	%	Cumulative %
0–4	45	33.1	33.1
5–9	15	11.0	44.1
10–14	14	10.3	54.4
15–44	45	33.1	87.5
45–	17	12.5	100.0
Total	136	100.0	

Table 2 Distribution of cases, carriers and deaths according to districts in Baghdad

District	Estimated population	Cases	Carriers	Deaths	Attack rate (per 100 000 population)
Al-Baladiyatt	784 587	49	0	0	6.2
Al-Madaen	352 890	45	4	1	12.8
Al-Resafa	528 826	27	0	0	5.1
Al-Sadder	992 000	7	0	0	0.7
Al-Karkh	615 062	7	1	2	1.1
Al-Dorah	665 688	1	0	0	0.2



Figure 2 Distribution of cholera cases, carriers and deaths in different districts of Baghdad, 2007

water. Thus there were strategies in place to deal with an outbreak.

Reported cases in Baghdad during the previous epidemic (1999) were about one-third of the total reported cases in

Iraq, while in the 2007 epidemic only 3% of the cases were in Baghdad. This could be related to the causative serogroup Inaba, which prefers moderate temperatures. This could explain why the epidemic started in northern areas of Iraq where the highest incidence was also reported. It then reached Baghdad when the temperature became lower and suitable for the strain.

In this outbreak, the carrier rate was relatively low (0.02%), which may be related to the difficulties in reaching all the household contacts to be examined. These difficulties resulted from either wrong addresses given by the patients or from security restrictions. However this carrier rate is similar to that in the 1991 epidemic in Baghdad (0.99%) [7].

The CFR of 2.2% in this outbreak is higher than that considered tolerable by WHO (not exceeding 1%) [1]. It is higher than the CFR in the 1991

and 1999 epidemics in Baghdad [7,8], and also the CFR in the 2002 epidemic in India [9] and the 1998 epidemic in Ecuador [10]. However, it is lower than the CFR among children in Nigeria (5.3%) in the 1996 epidemic [11], Kenya (4%) in the 1997 population epidemic [12], and the global CFR which was 4.5% in 1997 and 3.6% in 1998 [13]. The high CFR in the recent Baghdad outbreak could be explained by the fact that the first death occurred due to acute renal failure as a result of delay in transporting the patient to hospital. The other 2 deaths were in a special facility for mentally retarded and disabled children; one was a 13-year-old child who died before reaching hospital and the other was a 12-year-old child who died after reaching hospital, again because of acute renal failure due to dehydration. After these 2 deaths, medical staff from the nearby hospital and PHCC visited the facility daily. These 2 deaths could have been avoided if there had been a 24-hour clinic for the children at the facility. The facility was also visited by a team from WHO and both the MOH and WHO concluded that intense efforts were required (hygiene, medical attention and sanitation) along with close follow-up to improve the situation in this institution [14].

Usual signs and symptoms of severe dehydration and diarrhoea were seen only occasionally in the 2007 epidemic. About 40% of cases were mild and treated by ORS with or without antibiotics on an outpatient basis. This rate is lower than that of the 1991 epidemic where 52.3% of the cases were considered mild [7]. In the 1978 epidemic in Bahrain, only 20% of the cases were severe and needed hospitalization [15]. This supports the WHO statement that during epidemics, half of the cases can be managed outside hospital with ORS with or without antibiotics [1].

Bacteriological study of all isolates in this outbreak revealed that *V. cholerae*, biotype El Tor, serogroup O1, serotype Inaba was present in all isolates. In the

Table 3 Distribution of cholera cases according to some risk factors

Risk factor	No. of patients (n = 136)	%
Source of water		
Tap	76	55.9
River	3	2.2
Other ^a	57	41.9
Availability of sewage disposal net		
Yes	56	41.2
No	80	58.8
History of eating out 1 week prior to onset		
Yes	7	5.1
No	129	94.9

^aTankers, wells, river in addition to tap-water.

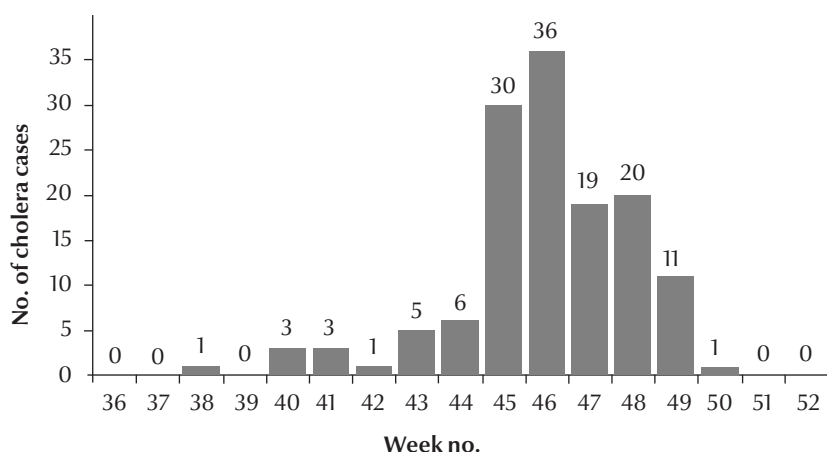


Figure 3 Distribution of cholera cases according to week of the year 2007

1991 epidemic both serotypes Ogawa and NAG were responsible for the reported cases, with a rate of 81.6% for Ogawa [7]. In the 1999 epidemic serotype Ogawa was responsible for 79.6% of cases, Inaba 12.1%, parahaemolyticus 2% and nonparahaemolyticus 2%; serogroup 0139 was found only in 2 isolates [8]. Serotype Inaba was not present at all in the 1991 epidemic, but it was found in the 1999 epidemic at a rate of 12.1%. In the 2007 outbreak all cases were due to serotype Inaba.

The strain of *V. cholerae* in the recent outbreak was resistant to trimethoprim-sulfamethoxazole but sensitive to other antibiotics including tetracycline and chloramphenicol. The resistance to trimethoprim-sulfamethoxazole has been reported in other studies [12,16], but in the Indian epidemic in 2000, both 01 and 0139 isolates were sensitive to trimethoprim-sulfamethoxazole [17]. The sensitivity of the cholera strain to tetracycline in the recent epidemic concurs with other studies [10,12,17], but not with a study in western Kenya in 1980 [18]. In the 1999 Baghdad epidemic, 30% of the cases admitted to hospital were resistant to tetracycline [8]. The sensitivity of the cholera strain to tetracycline in this epidemic could be because the recent outbreak was caused only by serotype Inaba.

One-third (33.1%) of the cases occurred among those under 5 years of age

and 44.1% among those under 10 year of age. In the 1991 epidemic, the rate among those under 10 year was 30.7% [6], and in the 1999 epidemic the rate among those under 5 years was 33.4% [8]. This result is consistent with studies in endemic areas where the highest incidence was among toddlers and children below school age [19–21].

More than half of the cases had access to tap-water for their general usage. Baghdad generally suffers from shortages of tap-water supply, this shortage increases as one descends from northern areas where the 2 major water projects are located. The shortage becomes much more acute during the long, hot Iraqi summer, when the need for water increases. People dealt with this shortage by either using an electric pump or resorting to additional water sources like digging wells (usually water unsafe for human consumption and not bacteriologically tested) and tankers (again unsafe water and not under the control of the central authorities).

A great amount of the infrastructure destruction occurred as a result of the multiple crises suffered by Iraq, which caused great damage to both water-pipes and sewage disposal net. The water-pipes came from different water plants with water fit for human consumption, but further along, away from the plants, the water becomes

contaminated by old or damaged pipes or by the sewage stream in areas not served by a sewage net. In addition, the unplanned settlement of immigrant families in certain areas which had no water pipes or sewage disposal nets, forced the inhabitants to obtain water by digging down to the mains pipe and drawing water using devices in an unorganized and incorrect manner, which led to leakage and contamination of the water inside the pipes.

The peak incidence in this outbreak was at week 46 in 2007 (end November 18) after which it steadily decreased to the last reported case at week 50 (end December 16). During the 2007 outbreak, all possible preventive measures were taken to reduce the risk of transmission of cholera. Epidemic preparedness for cholera and surveillance of diarrhoeal disease was intensified in all directions. In addition, the decreasing temperature played a role in containment of the outbreak.

This outbreak was characterized by the high number of cholera cases in those under 5 years of age. The expected contamination of water, aggregation of cases in 1 remote districts far removed from main water projects, and the very low history of eating out of the home could lead to a conclusion that this outbreak was most probably transmitted through the water.

Cholera is a preventable disease and can be controlled. What can be learned from the 2007 outbreak is that intensive efforts are needed in Baghdad to establish safe drinking-water and proper sanitation for all people; have laboratory and therapeutic needs available on the spot; and ensure year-round surveillance activities for early detection of cholera cases.

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References

1. WHO Global Task Force on Cholera Control. *Cholera outbreak, assessing the outbreak, response and improve preparedness*. Geneva, World Health Organization, 2004.
2. Al-Wardi A. Cholera epidemic. In: *Social aspects of Iraqi modern history*. Baghdad, Matba'at al-adib al-baghdadiyya, 1996:244-4.
3. Benson AS. Cholera. In: Evans AS, Brachman PS, eds. *Bacterial infection of humans: epidemiology and control*, 2nd ed. New York, Plenum, 1991:207-25.
4. Al-Awqati QS, Mekkiya M, Thmer M. Establishment of cholera treatment unit under epidemic conditions in a developing country. *Lancet*, 1969, 1:252-3.
5. *Weekly situation report on acute watery diarrhoea and cholera in Iraq*. Amman, World Health Organization Regional Office for the Eastern Mediterranean, WHO Representative Office in Iraq, 2008 (Sitrep No. 49) , http://www.emro.who.int/iraq/pdf/Sitrep_48.pdf, accessed 11 January 2010).
6. *Communicable disease profile, Iraq*. Geneva, World Health Organization, 2003 (WHO/CDS/2003/17) (<http://www.who.int/infectious-disease-news/IDdocs/whocds200317/1profile.pdf>, accessed 11 January 2010).
7. Yousif TI. *Epidemiological study of cholera outbreak in Baghdad, 1991*. [Dissertation]. Baghdad, University of Baghdad, 1993.
8. Al-Abbassi AM, Ahmed S, Al-Hadithi T. Cholera epidemic in Baghdad during 1999: clinical and bacteriological profile of hospitalized cases. *Eastern Mediterranean health journal*, 2005, 11(1/2):6-13.
9. Phukan AC et al. A cholera epidemic in rural area of northeast of India. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2004, 98(9):263-6.
10. Gabastou JM et al. Características de la epidemia de colera de 1998 en Ecuador, durante el fenómeno de "El Niño" [Characteristics of the cholera epidemic of 1998 in Ecuador during El Niño]. *Revista panamericana de salud pública*, 2002, 12(3):157-64.
11. Falade AG, Lawoyin T. Feature of the 1996 cholera epidemic among Nigerian children in Ibadan, Nigeria. *Journal of tropical paediatrics*, 1999, 45(1):59-62.
12. Shapiro RL et al. Transmission of epidemic *Vibrio cholerae* O1 in rural western Kenya associated with drinking water from Lake Victoria: An environmental reservoir for cholera. *American journal of tropical hygiene*, 1999, 60(2):271-6.
13. Cholera 1998. *Weekly epidemiological record*, 1999, 74(31):257-64.
14. *Weekly situation report on cholera in Iraq*. Amman, World Health Organization Regional Office for the Eastern Mediterranean, WHO Representative Office in Iraq, 2007 (Sitrep No. 38, week 47, 25 November 2007) ([http://www.reliefweb.int/rw/RWFiles2007.nsf/FilesByRWDocUnidFilename/AMMF-79YEPU-full_report.pdf/\\$File/full_report.pdf](http://www.reliefweb.int/rw/RWFiles2007.nsf/FilesByRWDocUnidFilename/AMMF-79YEPU-full_report.pdf/$File/full_report.pdf), accessed 11 January 2010).
15. Gunn RA et al. Cholera in Bahrain epidemiological characteristics of an outbreak. *Bulletin of the World Health Organization*, 1981, 59(1):61-6.
16. Ndour CT et al. L'épidémie de choléra de 2004 à Dakar, Sénégal : aspects épidémiologiques, cliniques, et thérapeutiques [Cholera epidemic of 2004 in Dakar, Senegal: epidemiological, clinical, and therapeutic aspects.] *Médecine tropicale*, 2006, 66(1):33-8.
17. Samal B et al. Epidemic of *Vibrio cholerae* serogroup O139 in Barhampur, Orissa. *Indian journal of medical research*, 2001, 114:10-1.
18. Finch MJ et al. Epidemiology of antimicrobial resistant cholera in Kenya and East Africa. *American journal of tropical hygiene*, 1988, 39:484-90.
19. Bhattacharya SK et al. Cholera in young children in an endemic area. *Lancet*, 1992, 340:1549.
20. Franco AA et al. Cholera in Lima, Peru correlates with prior isolation of *Vibrio cholerae* from the environment. *American journal of epidemiology*, 1997, 146(12):1067-75.
21. Mintz ED, Tauxe RV, Levin MM. The global resurgence of cholera. In: Noah N, O'Mahony M, eds. *Communicable diseases epidemiology and control*. London, John Wiley, 1998:63-94.

Burden of *Haemophilus influenzae* type b disease in Pakistani children

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عبء الأمراض الناجمة عن المستدمية النزلية من النمط بي لدى الأطفال في باكستان

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الخلاصة: يُقدَّر أن عبء الأمراض الناجمة عن المستدمية النزلية من النمط بي لدى الأطفال في باكستان ضئيل. وقد أجرى الباحثون ترصُّداً استباقياً في 8 مواقع خافرة في كراتشي، وحيدر آباد في شهر كانون الثاني/يناير 2004. وأجروا لـ 1481 طفلاً دون 5 سنوات بزلًا فطنياً بسبب الاشتباه بإصابتهم بالتهاب السحايا الجرثومي. وقد حَقَّقَت 237 عينة (16.0%)، مأخوذة من الأطفال، معايير التهاب السحايا الجرثومي المحتمل، وكشف الباحثون المستدمية النزلية من النمط بي لدى 45 منهم (19.0%). وبلغ معدل الوقوع الأدنى المكتشف لالتهاب السحايا الناجم عن المستدمية النزلية من النمط بي في حيدر آباد 7.6 لكل مئة ألف من الأطفال دون سن الخامسة، و38.1 لكل مئة ألف من الأطفال فوق السنة من العمر. وبناء على ما تقدم، فهناك ما يبرر ضرورة إدراج التطعيم باللقاح المضاد للمستدمية النزلية من النمط «بي» في البرنامج الباكستاني الموسع للتمنيع.

ABSTRACT Estimates of the burden of *Haemophilus influenzae* type b (Hib) in children in Pakistan are limited. A prospective surveillance was set up in 8 sentinel sites in Karachi and Hyderabad in January 2004. A total of 1481 children aged < 5 years underwent lumbar puncture for suspected acute bacterial meningitis. Specimens from 237 (16.0%) children met the criteria for probable bacterial meningitis, and Hib was detected in 45 of them (19.0%). The minimum detected incidence of Hib meningitis in the Hyderabad area was 7.6 per 100 000 in children < 5 years of age, and 38.1 per 100 000 children < 1 year. Hib vaccination is justified for inclusion in Pakistan's expanded programme of immunization.

Poids de l'infection à *Haemophilus influenzae* de type b chez les enfants pakistanais

RÉSUMÉ L'estimation du poids de l'infection à *Haemophilus influenzae* de type b (Hib) chez les enfants pakistanais est limitée. Une surveillance prospective a été mise en place sur huit sites sentinelles à Karachi et Hyderabad en janvier 2004. Au total, 1 481 enfants âgés de moins de cinq ans ont subi une ponction lombaire en raison d'une suspicion de méningite bactérienne aiguë. Les échantillons prélevés sur 237 enfants (16 %) présentaient les critères d'une probable méningite bactérienne, et le Hib a été détectée chez 45 d'entre eux (19 %). L'incidence de méningite à Hib la plus faible constatée dans la région d'Hyderabad était de 7,6 pour 100 000 chez les enfants de moins de cinq ans, et de 38,1 pour 100 000 chez ceux âgés de moins d'un an. L'inclusion du vaccin anti-Hib dans le programme élargi de vaccination du Pakistan est justifiée.

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Introduction

Haemophilus influenzae type b (Hib) is an important childhood pathogen, causing pneumonia, meningitis and sepsis, primarily in children under 5 years of age [1–3]. Hib has also been shown to be responsible for a high proportion of childhood pneumonia [4–6]. In industrialized countries where the Hib conjugate vaccine has been part of routine childhood immunizations for over a decade Hib invasive disease has virtually disappeared [7].

Despite the availability of the Hib vaccine for over 15 years and its proven efficacy, many obstacles have prevented developing countries in Asia and Africa from introducing it in their Expanded Programmes on Immunization (EPI). Paramount among these is that the magnitude of the disease burden and its cost to society has not been easy to demonstrate because of inadequate surveillance capacities. A review of experience in 4 developing countries showed that local surveillance data were critical in the decision to adopt Hib vaccine [8]. Another deterring factor has been the high cost of the vaccine compared to other routine vaccines in the EPI. However, many developing countries have found the vaccine to be cost-effective [9–12].

There has been much debate on the seemingly low prevalence of invasive Hib disease in Asian countries. However, Hib are fastidious organisms which are difficult to culture in resource-poor laboratories. When adequate laboratory facilities have been made available, Hib have been shown to be the leading cause of childhood meningitis in most Asian countries, including Pakistan [13,14]. Another important problem in estimating the burden of invasive disease due to Hib is that the most common invasive infection is pneumonia and it is very difficult to identify the etiologic agents of pneumonia in children [15,16]. For these reasons, the most accurate estimation of how much severe

acute respiratory infection (ARI) is due to Hib is only available from trials of Hib vaccine [17].

Realizing the importance of adequate surveillance for Hib-associated disease, the World Health Organization (WHO) has developed a generic protocol for population-based surveillance [16]. This recommends that surveillance efforts in developing countries should focus on meningitis because its diagnosis is relatively straightforward and meningitis surveillance can yield very accurate estimates of Hib incidence.

The primary objective of our study was to determine the burden of meningitis due to Hib in children aged 5 years in 2 urban centres (Karachi and Hyderabad) of southern Sindh, Pakistan, by sentinel site surveillance using the WHO generic protocol. This information will enable policy-makers to make a rational decision about introducing Hib vaccine in Pakistan.

Methods

Study setting

In March 2004 prospective surveillance was set up in 8 sentinel sites in Karachi and Hyderabad that fulfilled the following criteria: easy accessibility for patients; more than 50 paediatric beds; 24-hour availability of skilled personnel to perform lumbar punctures for cerebrospinal fluid (CSF) analysis; and close proximity to one of the laboratory collection points of the Aga Khan University Hospital (AKUH) laboratory (none of the public sector hospitals had adequate laboratory facilities to detect Hib meningitis). These included 5 public sector hospitals (4 in Karachi, 1 in Hyderabad), 2 large private sector hospitals with high quality microbiology laboratories (both in Karachi) and 1 private university hospital (in Hyderabad).

All paediatric consultants who were members of the Sindh chapter of the Pakistan Paediatric Association were

informed about the study and the availability of free CSF analysis at AKUH for any patient with suspected bacterial meningitis.

Sample

During the study period any child aged < 5 years was eligible for the study if he/she had undergone a lumbar puncture for clinical suspicion of acute bacterial meningitis at any of the hospitals in the surveillance system, or whose specimen had been sent to the AKUH laboratory by a paediatric consultant, and was resident in Karachi or Hyderabad.

Transport of specimens and laboratory procedures

Participating hospitals and paediatricians were requested to send CSF specimens obtained from any child clinically suspected to have acute bacterial meningitis to their respective AKUH laboratory collection point. Specimens were transported to the laboratory at room temperature and underwent immediate analysis for cell count. If the cell count was ≥ 30 cells per mm^3 , then latex antigen testing for Hib, pneumococci and *Neisseria meningitidis* was performed using Wellcogen bacterial antigen detection kits. Due to limited funding for the study and low yields from cultures due to transport delays, CSF culture was only performed on specimens with abnormal cell counts or negative latex antigen tests.

Patients with proven Hib meningitis diagnosed at 1 public sector hospital in Karachi (National Institute of Child Health) were followed for 3 months to assess complications.

Reporting, data recording and analysis

The results were reported immediately to the child's physician, as is the current practice at the AKUH laboratory. Electronic and hard copy laboratory reports were maintained by a designated laboratory technician at the AKUH laboratory. Surveillance data were entered into

a computer in a timely fashion by one of the research officers functioning as project coordinator. Patient confidentiality was maintained and the research review and ethical review committee of AKUH approved the study.

Data analysis

Data were double-entered and analysed in SPSS, version 14.0 and Microsoft Excel. Descriptive statistics were performed for mean scores and percentages.

Results

Over the 12-month surveillance period (1 March 2004 to 28 February 2005), the surveillance system detected 1481 children aged < 5 years who had undergone lumbar puncture for suspected acute bacterial meningitis. Over 90% of them presented at public sector hospitals. Of these 1481, specimens from 237 (16.0%) children met the criteria for possible bacterial meningitis (cell count > 100 per mm³, with polymorphonuclear predominance, glucose < 40 mg/dL). Hib was detected in the CSF of 45 children (19.0%) and pneumococci in 34 (14.3%).

Of the 45 children with Hib meningitis, 28 were from Karachi and 17 from Hyderabad. Over 90% of the cases of Hib meningitis were in children < 1 year of age (20 aged < 6 months, 22 aged 7–11 months). All the cases from Hyderabad were < 1 year of age. The

youngest child with Hib meningitis was 11 days old. Prior use of antimicrobials before the lumbar puncture was performed was reported by 54% of families.

Table 1 shows the surveillance results from each city for children aged < 1 year and < 5 years. In metropolitan Hyderabad and surrounding population (catchment approximately 222 855 children < 5 years extrapolating from the census of 1998) the minimum detected incidence of Hib meningitis in children aged < 5 years was 7.6 per 100 000 (95% CI: 4.29–12.59). In Karachi, the minimum detected rate was 1.2 per 100 000 children aged < 5 years.

Follow-up information was available 3 months after discharge for a total of 15 children diagnosed with Hib meningitis at the National Institute of Child Health during the surveillance period (Table 2). Five of the 15 suffered mild to moderate neurologic sequelae and 3 had severe sequelae. There were no deaths, although the parents of 1 child who was critically ill left the hospital against medical advice and the child probably died at home.

Discussion

Hib was detected in 19.0% of children with possible bacterial meningitis in Karachi and Hyderabad, making it the commonest cause of acute bacterial meningitis in children in these cities in

Pakistan. The limitations of applying the WHO generic protocol for population-based surveillance of Hib [16] in our setting were the requirement that catchment areas be clearly defined and health care utilization rates should be high to accurately capture all cases of meningitis—a situation that does not exist in any area of Pakistan where it would also be possible to do good surveillance and have the laboratory capacity to diagnose Hib. Therefore, the estimated rate of Hib meningitis of 38.1 per 100 000 infants and 7.6 per 100 000 population < 5 years for Hyderabad is a minimum, and is likely to be a significant underestimate because we were unable (due to budgetary limitations) to capture cases from one of the public sector hospitals in the area, many smaller private hospitals were not included and many infants may have died at home without ever being admitted to a hospital.

In Karachi, the detected rate of Hib meningitis of 1.2 per 100 000 in children aged < 5 years is just the tip of the iceberg of infection because the public sector hospitals participating in the sentinel surveillance system see a very small fraction of the disease burden in Karachi, whereas in Hyderabad there are fewer private facilities that can provide care to very sick children. The 1994 National Health Survey of Pakistan found that 80% of health care activity in Pakistan occurs in the private sector [18]. In large urban cities such as Karachi, this figure is even higher. In

Table 1 Rates of *Haemophilus influenzae* type b (Hib) meningitis in 8 sentinel hospitals by city and child's age group

City/age group	Population in this age category ^a	No. of cases	Hib meningitis Rate per 100 000 population	95% CI
Hyderabad				
< 12 months	44 571	17	38.10	22.35–61.40
< 59 months	222 855	17	7.60	4.29–12.59
Karachi				
< 12 months	460 676	21	4.56	2.56–7.23
< 59 months	2 303 380	28	1.21	0.09–1.59

^aExtrapolated from 1998 census report: Pakistan census 1998, Federal Bureau of Statistics.
CI = confidence interval.

Table 2 Outcome of children with *Haemophilus influenzae* type b meningitis admitted to a large public sector hospital (National Institute of Child Health, Hyderabad) (n = 15)

Outcome	No. of cases	%
Normal	6	40.0
Mild to moderate deficit (partial hearing loss, seizure disorder, mild developmental delay)	5	33.3
Severe sequelae (significant hearing loss or motor deficits, hydrocephalus, severe developmental delay)	3	20.0
Lost to follow-up (left hospital against medical advice) ^a	1	6.7
Deaths recorded	0	0.0

^aWas severely ill at the time of leaving.

addition, we commonly observed that many children with suspected meningitis did not undergo lumbar puncture for a variety of reasons. Many smaller hospitals did not have skilled personnel available at night and did not have supplies for lumbar puncture, and instead empirically treated suspected meningitis with 3rd generation cephalosporins. In the larger public sector hospitals that were part of our sentinel site surveillance, many children were brought in in a very unstable condition and could not undergo lumbar puncture. There was also a fairly high refusal rate by families who consider lumbar puncture a highly invasive test, especially in private hospitals. We also observed prior antibiotic therapy reporting rates of 54% for patients undergoing lumbar puncture. Finally, our experience of working in several low-income communities of Karachi shows that health care utilization patterns are very poor, with 70% of families of sick infants refusing to take their babies to the hospital despite the provision of transport [19]. Our verbal autopsy studies in these communities show that fever with seizures is a common cause of death in infants, for which hospital care was never sought [19]. All these factors result in a serious underestimate of the burden of Hib meningitis. With the assumption that we may have captured only 10%–20% of the cases of Hib meningitis in Hyderabad we could estimate an adjusted annual incidence of 38–76 per 100 000 children < 5 years, which is substantial, and comparable

to rates observed in many African and Latin American countries [16].

A notable finding is that most cases of Hib meningitis were concentrated in the very young age group, with over 90% observed in the < 1-year-olds, and almost half in children < 6 months of age, indicating early exposure. Hib meningitis-adjusted incidence rates in the infant age group in Hyderabad may therefore be 190–380 per 100 000 children < 1 year (using 20% of 222 855 as the denominator population of < 1-year old-children). Therefore, the annual number of cases of Hib meningitis in children < 1 year in Pakistan is estimated at 10 000–21 000.

Hib meningitis represents only a fraction of the burden of invasive Hib disease, although it the most severe form of invasive disease with a high rate of permanent disability. The clinical syndrome of pneumonia is much more common, and results in many more deaths, but is under-recognized because of the difficulty of obtaining appropriate specimens. ARI is the most common cause of childhood deaths in Pakistan, responsible for 24% or 120 000 deaths of the 500 000 annual child deaths in Pakistan [20]. Using WHO's generic protocol for estimating Hib-related ARI childhood mortality, as well as the estimation by Black et al. [20], we derived a rate of ARI-specific mortality of 25 per 1000 children < 5 years, and Hib-specific ARI mortality of 2.3 per 1000 children < 5 years [16]. However, whether Hib vaccine will be

useful in the prevention of ARI-related mortality remains unproven in Asian countries [17].

Pakistan is a Global Alliance for Vaccines and Immunization (GAVI)-eligible country, and hepatitis B virus (HBV) vaccination, in combination with diphtheria/pertussis/tetanus (DTP), was introduced in Pakistan with GAVI support in 2006. The additional cost of introducing pentavalent vaccine including Hib conjugate (DPT-HBV-Hib) using the GAVI/UNICEF procurement cost [21] of an additional US\$ 0.30 per dose of Hib for Pakistan works out at US\$ 5.71 million [5 500 000 birth cohort × 3 doses × 0.70 (coverage) × 1.1 (wastage) × US\$ 1.50]. The cost to the government of Pakistan per Hib meningitis case averted is thus an estimated US\$ 268.7–537.3, making Hib vaccine a very cost-effective intervention based on preventing meningitis cases alone.

We faced many constraints in choosing appropriate surveillance sites in Karachi and Hyderabad. Public sector hospitals in the area have woefully inadequate facilities to CSF analysis, culture for Hib or perform latex antigen testing. We could not identify a single large paediatric facility in the public sector that had appropriate facilities for CSF culture or the resources to do latex antigen testing. On the other hand, these hospitals see the majority of sick children from the lower socioeconomic groups, where Hib disease would be expected to be most prevalent. Sustainable sentinel site surveillance networks for bacterial meningitis (Hib and pneumococcus) detection in public sector hospitals are needed, and a high priority should be given to improving the capacity and increasing resources for microbiology laboratories of public sector hospitals in Pakistan.

Due to budgetary constraints we could only record outcome at 3 months for children with Hib meningitis at 1 hospital in Karachi. Our limited data showed that nearly two-thirds of

children (9 of 15) suffered significant complications with an impact on quality of life. The long-term sequelae and the resultant human and financial burden of providing care to survivors of Hib meningitis are also under-recognized and should be included in the estimations of vaccine cost-effectiveness.

We conclude that Hib is the commonest cause of bacterial meningitis in children in Pakistan and that there is a substantial burden of invasive Hib disease. The decision to include Hib in routine EPI in Pakistan from 2008 is thus warranted based on the burden of meningitis alone. Additional studies are recommended to evaluate the impact of Hib vaccine introduction on the preventable fraction of severe pneumonia.

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References

1. Funkhouser A, Steinhoff MC, Ward J. *Haemophilus influenzae* disease and immunization in developing countries. *Reviews of infectious diseases*, 1991, 13(Suppl. 6):S542-54.
2. Schillinger JA, Wenger JD, Perkins BA. Major childhood infectious diseases: bacterial meningitis. In: Murray CJL, Lopez AD, eds. *The global burden of disease*. Cambridge, Massachusetts, Harvard University Press, 1996.
3. Biljmer HA. World-wide epidemiology of *Haemophilus influenzae* meningitis; industrialized versus non-industrialized countries. *Vaccine*, 1991, 9(Suppl.):S5-9.
4. Lehmann D. Epidemiology of acute respiratory tract infections, especially those due to *Haemophilus influenzae*, in Papua New Guinea children. *Journal of infectious diseases*, 1992, 165:S20-5.
5. Mulholland EK, Hilton S, Adegbola R. Randomized trial of *Haemophilus influenzae* type-b tetanus protein conjugate vaccine for prevention of pneumonia and meningitis in Gambian infants. *Lancet*, 1997, 349:1191-7.
6. Levine OS, Lagos R, Munoz A. Defining the burden of pneumonia in children preventable by vaccination against Hib. *Pediatric infectious disease journal*, 1999, 18:1060-4.
7. Peltola H, Kilpi T, Antila M. Rapid disappearance of *Haemophilus influenzae* type b meningitis after routine childhood immunization with conjugate vaccines. *Lancet*, 1992, 340:592-4.
8. Wenger JD et al. Introduction of Hib conjugate vaccines in the non-industrialized world: experience in four "newly adopting countries". *Vaccine*, 1999, 18:736-42.
9. Hussey GD, Lasser ML, Reekie WD. The costs and benefits of a vaccination programme for *Haemophilus influenzae* type b disease. *South African medical journal*, 1995, 85:20-5.
10. Limcango MR et al. Cost-benefit analysis of a *Haemophilus influenzae* type b meningitis prevention programme in The Philippines. *Pharmacoeconomics*, 2001, 19:391-400.
11. Levine OS et al. Cost-benefit analysis for the use of *Haemophilus influenzae* type b conjugate vaccine in Santiago, Chile. *American journal of epidemiology*, 1993, 137:1221-8.
12. Miller MA. An assessment of the value of *Haemophilus influenzae* type b conjugate vaccine in Asia. *Pediatric infectious disease journal*, 1998, 17:S152-9.
13. Peltola H. Need for *Haemophilus influenzae* type b vaccination in Asia as evidenced by epidemiology of bacterial meningitis. *Pediatric infectious disease journal*, 1998, 17:S148-51.
14. Bhutta ZA. Burden of *Haemophilus influenzae* and *Streptococcus pneumoniae* infections during childhood in Pakistan. *Journal of the College of Physicians and Surgeons-Pakistan*, 2000, 10:346-54.
15. Isaacs D. Problems in determining the etiology of community-acquired childhood pneumonia. *Pediatric infectious disease journal*, 1989, 8:143-8.
16. Levine OS et al. *Generic protocol for population-based surveillance of Haemophilus influenzae type b*. Geneva, World Health Organization, 1996 (WHO/VRD/GEN/95.05).
17. Gessner BD et al. Incidences of vaccine-preventable *Haemophilus influenzae* type b pneumonia and meningitis in Indonesian children: hamlet-randomized vaccine-probe trial. *Lancet*, 2005, 365:43-52.
18. *National health survey of Pakistan*. Islamabad, Government of Pakistan, 1994.
19. Zaidi AKM, Bhutta ZA. *Care-seeking in low-income urban and semi-urban populations of Karachi*. Karachi, Aga Khan University, 2007.
20. Black RE, Morris S, Bryce J. Where and why are 10 million children dying every year? *Lancet*, 2003, 361:2226-34.
21. *Co-financing policy and country grouping document*. GAVI Alliance [online document] 2007 (http://www.gavialliance.org/resources/Co_financing_policy_and_country_grouping_document.doc, accessed 15 November 2009).

Fever prevalence and management among three rural communities in the North West Zone, Somalia

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معدل انتشار الحمى وتديرها علاجياً في ثلاث من المجتمعات الريفية في المنطقة الشمالية الغربية في الصومال

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الخلاصة: أجرى الباحثون مسحاً مستعرضاً شمل 1375 من السكان، وثلاث قرى مختارة في منطقة حبيلي، وهي من المناطق الشمالية الغربية في الصومال، وذلك في الفترة بين آذار/ مارس، وأب/ أغسطس 2008. وقد درس الباحثون وجود العدوى بالمalaria ومدة انتشار الحمى المبلغ عنها ذاتياً لمدة 14 يوماً سبقت إجراء المسح. وقد اتضح أن جميع عينات الدم كانت سلبية لأنواع المتصورات. وقد كانت مدة الانتشار للحميات خلال 14 يوماً 4.8% في شهر آذار/ مارس، و0.6% في شهر آب/ أغسطس. وتوافق معظم الحميات (84.4%) عنها مع أعراض أخرى، منها السعال، وسيلان أنفي، وألم الحلق، وقد شُفي 48 حالة من بين الحالات البالغ عددها 64 قبل يوم المراقبة (وسطي الفترة 5.4 أيام). وعولج 18 حالة حمى فقط (37.5%) في مرفق رسمي لتقديم الرعاية الصحية؛ 7 منها خلال 24 ساعة من بدء الأعراض، و10 منها خلال 24 - 72 ساعة من بدء الأعراض. ولم يدرس الباحثون أي حالة حمى بحثاً عن المalarيا، وعالجوا جميع الحالات بالمضادات الحيوية وخافضات الحرارة والفيتامينات.

ABSTRACT Between March and August 2008 we undertook 2 cross-sectional surveys among 1375 residents of 3 randomly selected villages in the district of Gebiley in the North-West Zone, Somalia. We investigated for the presence of malaria infection and the period prevalence of self-reported fever 14 days prior to both surveys. All blood samples examined were negative for both species of *Plasmodium*. The period prevalence of 14-day fevers was 4.8% in March and 0.6% in August; the majority of fevers (84.4%) were associated with other symptoms including cough, running nose and sore throat; 48/64 cases had resolved by the day of interview (mean duration 5.4 days). Only 18 (37.5%) fever cases were managed at a formal health care facility: 7 within 24 hours and 10 within 24-72 hours of onset. None of the fevers were investigated for malaria; they were treated with antibiotics, antipyretics and vitamins.

Prévalence et prise en charge de la fièvre dans trois communautés rurales du nord-ouest de la Somalie

RÉSUMÉ Entre mars et août 2008, nous avons réalisé deux études transversales sur 1 375 habitants de trois villages sélectionnés au hasard dans le district de Gabiley, au nord-ouest de la Somalie. Nos travaux portaient sur la présence d'une infection paludique ainsi que sur la prévalence périodique des épisodes de fièvre autodéclarés, survenus 14 jours avant les deux études. Tous les prélèvements sanguins analysés se sont révélés négatifs aux deux espèces de *Plasmodium*. La prévalence périodique des épisodes de fièvre remontant à 14 jours était de 4,8 % en mars, et de 0,6 % en août ; la majorité de ces épisodes (84,4 %) étaient associés à d'autres symptômes tels qu'une toux, des écoulements nasaux et des maux de gorge. Quarante-huit cas sur 64 étaient résolus le jour de l'entrevue (durée moyenne de l'épisode : 5,4 jours). Seuls 18 cas de fièvre (37,5 %) ont été pris en charge dans un établissement de soins de santé conventionnel : sept dans les 24 heures et dix dans les 24 à 72 heures suivant l'apparition de la fièvre. Le paludisme n'a été recherché chez aucun de ces patients, lesquels ont été traités par antibiotiques, antipyrétiques et vitamines.

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Introduction

The Horn of Africa does not share the same malaria epidemiology as other parts of the African continent. Across Sudan, Djibouti, Ethiopia, Eritrea and Somalia, *Plasmodium falciparum* and *P. vivax* co-exist. The intensity of malaria transmission is predominantly very low and is maintained almost universally by *Anopheles arabiensis*. Large areas of semi-arid territory are home to scattered pastoralist and nomadic communities, where conflict and population displacement have damaged the existing sparse routine health services [1].

The prompt and effective treatment of clinical malaria forms the bedrock of all national malaria control strategies irrespective of dominant malaria ecology. Fever is a non-specific symptom of malaria and is used across Africa as the main presenting clinical feature for presumptive malaria therapy. In addition, fever treatment within 48 hours with effective antimalarials is used as the milestone parameter in national sample surveys to measure the success of malaria case-management policies.

In Somalia, the 18 years of conflict and civil war has resulted in a series of humanitarian disasters which left millions deprived of basic health and social services. Attempts are being made to reconstruct the health sector, coordinated by the Somalia Support Secretariat Health Sector Committee. In 2000, the ministries of health of the 3 regional areas of Somalia established a national malaria strategy [2] and through a coalition of development partners secured funding from the Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM) to implement preventative and curative malaria services. The national malaria strategy emphasizes the diagnosis and treatment of malaria within 24 hours of onset of fever with acceptable quality and appropriate dosages of the first line anti-malaria combination therapy (artesunate and

sulphadoxine-pyrimethamine) and an expected coverage of 80% by 2010.

Very little is known about the basic infection and clinical epidemiology of malaria in Somalia, and even less is known across the North-West Zone of Somalia. In 1946, a malaria reconnaissance mission was undertaken across the then British Somaliland by Wilson [3]. He completed an opportunistic series of village-based parasitological surveys showing an overall *P. falciparum* parasitological index among 600 people surveyed of 11.3%: *P. malariae* 1.3% and *P. vivax* 0.3% [3]. Using more recent parasitological data from across Somalia generated as part of food emergency surveys, geospatial models suggest that infection prevalence in most parts of the North-West Zone is < 5% [4]. Glasgow and MacInnes in 1943 [5] described *An. gambiae* larval and adult distributions—later confirmed by Maffi in 1958 [6] as *An. arabiensis*—close to rain-pans and pools and alongside running rivers of the northern foothills.

Nothing is currently known about the extent of febrile illness among the population, the proportion attributed to malaria infection, disease risks or patterns of treatment-seeking behaviour among rural populations in this region of Somalia.

Here we present the results of 2 cross-sectional surveys aimed at describing the risks of fever, malaria infection and treatment-seeking behaviour in 3 rural communities in the district of Gebiley, Somalia North-West Zone.

Methods

Study area and communities

The North-West Zone of Somalia neighbours Djibouti in the north and borders the Red Sea on the east and Ethiopia to the west. Gebiley district is situated 52 km west of the capital city, Hargeisa, connected by a tarmac road (Figure 1). The majority of the population of this district lives in the town of Gebiley, with

the surrounding rural communities connected by small roads. There is no current settlement map or population census of the district. In April 2007, we conducted a rapid survey of settlements and crude population counts across the district to update older census maps. These were used with satellite imagery available on Google Earth [7] to create a sampling frame of 163 communities. We excluded the 4 urban settlements and all rural settlements with estimated populations of less than 100 people ($n = 18$ settlements) to randomly select 3 moderately sized communities for the purposes of the present survey using spatial random sampling techniques in Arcview, version 3.2.

The district has a predominantly arid landscape with small hills and patches of irrigated farmlands. It is an area of acutely seasonal rainfall with an average annual precipitation of 59.9 mm between 2004 and 2007, with 2 peaks in April and August. The rural communities are predominantly agro-pastoralists of the Isak clan (Somali). They herd goats, sheep, cows and camels, and practise subsistence farming.

Gebiley district has 1 functioning hospital operated by the Ministry of Health and Labour (MoHL) that supports a network of 4 mother and child health centres/out-patient department (MCH/OPD) clinics run by qualified nurses and supported by auxiliary nurses and midwives. There are an additional 15 health posts (HPs) staffed by community health workers (Figure 1). Malaria diagnostic services are provided at the district hospital and MCH/OPD centres using rapid diagnostic tests. There are several private drug stores in Gebiley town, which sell all types of medication with and without prescription.

The 3 randomly selected communities are shown in Figure 1: Badahabo is 7 km west of Gebiley town spanning the main road; Xuunshaley is 25 km west of Gebiley town and 0.1 km from the main road; and Ceel Bardaale is 42 km north-west of Gebiley town and 17 km from

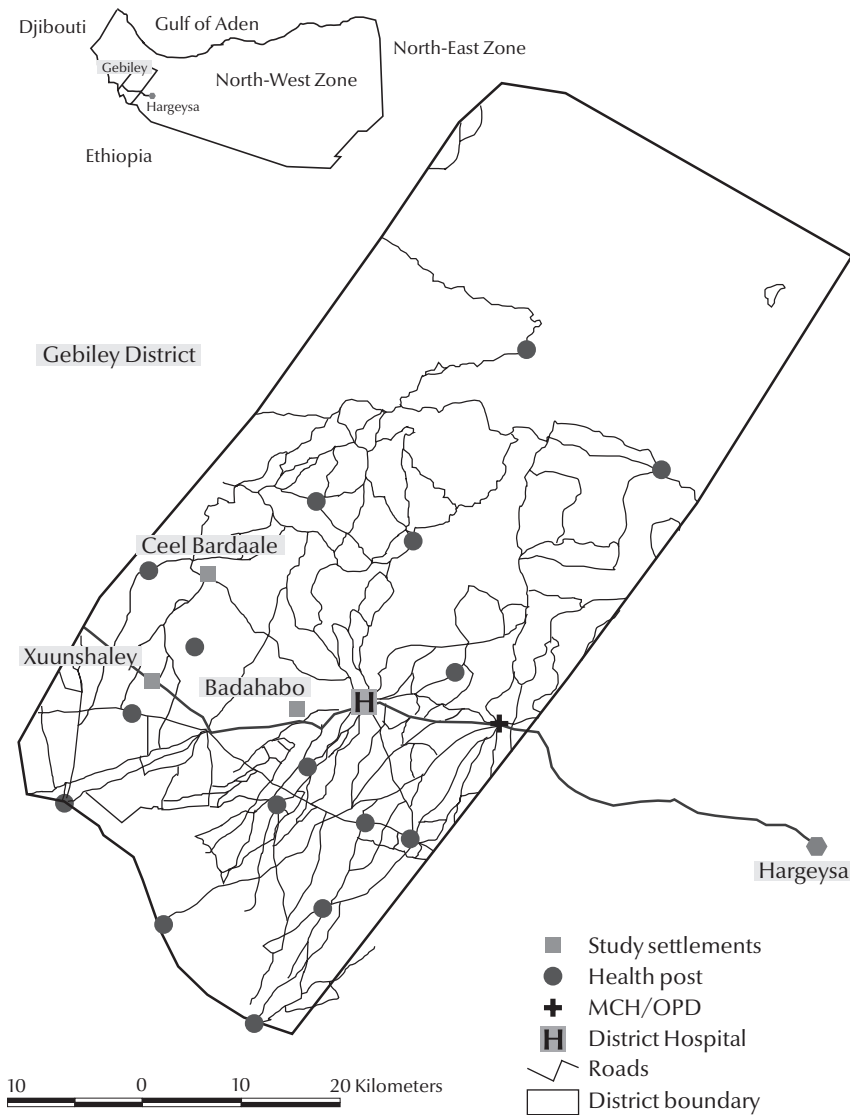


Figure 1 Map of North-West Zone showing Gebiley district (insert); main map shows the position of the 3 selected villages, health services and road networks within Gebiley district

the main road, where households are located along a seasonal river. Only Ceel Bardaale had a functioning HP, established in 1994 and run by the MoHL.

Survey procedures

Investigators and staff from the MoHL and the World Health Organization (WHO) office in Hargeisa visited each village 2 weeks before the first cross-sectional survey in March 2008 to explain the purpose of the survey and discuss participation with the clan elders. Thereafter each homestead was visited and informed consent for participation sought from every head of homestead.

Homesteads from whom approval was obtained were geolocated using a Global Positioning System (Garmin eTrex, Garmin Ltd., Kansas, United States of America). Records were made of basic wealth assets (type of housing, ownership of radios, bicycles, mobile telephones, etc.) and sources of water, cooking fuel and sewage disposal; finally all *de jure* resident household members were enumerated to record age, sex, education status and mosquito net ownership.

Informed written consent was obtained from all participants before collecting any individual level information. For illiterate participants, informed

consent was obtained in the presence of a literate witness who was not part of the study team. For children below the age of 18 years, informed written consent was obtained from child's guardian. In addition, children aged 12–18 years were informed about the purpose of taking a blood sample and requested to sign or thumb print an assent form. Copies of the consent and assent forms were given to participants. Participants had the right to refuse participation or withdraw from the study at any stage.

Every consenting resident present in the village during the survey period was questioned on the occurrence of fever in the previous 14 days, its duration and whether the symptom was present on the day of the survey. The investigations were conducted through parents or guardians of all resident children below the age of 12 years. For every reported fever, further details were recorded on when and where the fever was treated and the types of medications and interventions used. A photo-illustrated guide was used to assist recall accuracy on drug types available in the region. Interviews were conducted by trained field workers in Somali dialects spoken by the communities. Clinic records available within the homestead were reviewed and respondents or their mothers/guardians were asked to show medicine packaging if these were still available.

At the end of each interview MoHL technicians took a single finger prick blood sample from each respondent for the preparation of a rapid *P. falciparum* antigen-specific diagnostic test (Paracheck-Pf, Orchid Biomedical Systems, Goa, India) and a thick and thin blood smear on a glass slide labelled according to homestead and individual unique identifier. All rapid test results were provided to the respondent and used to treat possible positive cases in the field. Thin blood films were fixed at the end of the working day and stained the next morning using 3% Giemsa solution according to WHO standard procedures [8]. On each slide, 100 high

power magnification fields were examined by microscopy for *P. falciparum* and *P. vivax* and a further 100 fields examined if the first 100 were negative.

The first survey was completed between 29 March and 20 April 2008 and the repeat survey in the same village homesteads was undertaken between 16 August and 18 September 2008, 6 weeks after the onset of the rains reported from Gebiley district for 2008.

All data were entered within 3 weeks of completion of survey procedures using customized data entry screens in *EpiInfo*, version 6. Data were analysed using *SPSS*, version 14. Descriptive statistics were used to reveal the point and period prevalence and 95% confidence interval (CI) of the prevalence of fever by age, sex, wealth, location and action taken to treat this fever. Family wealth was determined based on a number of variables that showed variation from

one homestead to another namely possession of radio or television (0 = no, 1 = yes), possession of a mobile phone (0 = no, 1 = yes) and number of heads of sheep (0 = none, 1 = 1–10, 2 = > 10), goats (0 = none, 1 = 1–15, 2 = > 15), cows (0 = none, 1 = 1–5, 2 = > 5), camels (0 = none, 1 = 1–2, 2 = > 2) and donkeys (0 = none, 1 = 1–2, 2 = > 2). The generated sum of scores was used to classify homesteads into upper, middle or lower wealth tertiles (Table 1).

Table 1 Characteristics of the survey participants and homestead in 3 rural communities in Gebiley, 2008

Variable	Xuunshaley		Badahabo		Ceel Bardaale		Total	
	No.	%	No.	%	No.	%	No.	%
March								
Homesteads, total	55		31		130		216	
Surveyed homesteads	52		31		130		213	
Residents, total	275		198		806		1279	
Persons refused to participate	28		1		7		36	
Surveyed residents	247		185		746		1178	
August								
Homesteads, total	59		31		124		215	
Surveyed homesteads	58		30		119		208	
Residents, total	329		214		820		1363	
Persons refused to participate	16		15		44		75	
Persons away at time of survey	42		39		79		160	
Surveyed residents	271		160		697		1128	
Total homesteads March & August	62		32		134		228	
Wealth asset of homestead^a								
Radio	21	33.9	9	28.1	49	36.8	79	34.8
Mobile telephone	4	6.5	1	3.1	20	15.0	25	11.0
Cows	60	96.8	32	100.0	80	60.2	172	75.8
Goats	26	41.9	13	40.6	123	92.5	162	71.4
Sheep	40	64.5	13	40.6	105	78.9	158	69.6
Donkeys	29	46.8	14	43.8	94	70.7	137	60.4
Camels	14	22.6	5	15.6	45	33.8	64	28.2
Wealth ranking of homestead^a								
Lower wealth tertile	28	45.2	19	59.4	2	18.8	72	31.7
Middle wealth tertile	29	46.8	12	37.5	70	52.6	111	48.9
Upper wealth tertile	5	8.1	1	3.1	38	28.6	44	19.4
Net use (homestead, March)								
Usually sleep under a net	0	0.0	0	0.0	22	3	22	1.9
Slept under a net last night	0	0.0	0	0.0	11	1.5	11	1.0
Net use (homestead, August)								
Usually sleep under a net	0	0.0	0	0.0	25	3.6	25	2.2
Slept under a net last night	0	0.0	0	0.0	12	1.7	12	1.1

^aWealth assets and ranking could not be done for 1 homestead in Ceel Bardaale because of missing data (percentage calculated out of 227 households and 133 households in Ceel Bardaale)

Ethical approval

The research protocol was approved by the Research Ethics Review Committee, WHO Headquarters, Geneva (RPC246-EMRO) and the Ethical Committee, MoHL (dated 27 November 2007).

Survey coverage

In March 2008, a total of 216 homesteads were mapped across the 3 villages and 1279 residents were enumerated (Table 1). Three households with 13 residents refused to participate in addition to 13 people in the surveyed households. In August 2008, 202 (93.5%) of the homesteads were still occupied, 12 new homesteads had been established and 1363 residents were enumerated (Table 1). During the August survey 75 residents refused to participate and 160 (11.7%) could not be traced despite 3 repeat visits over 3 weeks (Table 1). In the 2 surveys, 228 homesteads were visited and 1375 individuals were interviewed: 925 in March and August, 253 in March only and 197 in August only.

Homestead and population characteristics

The majority of households (92%) were of the traditional *akal/aqal* type of rounded sticks and thatch/plastic coverings with a single door entrance with sand or earth floors. The majority of homesteads (87.8%) were headed by a man. The majority of homestead heads had never been to school (81.7%) and 75.1% were either illiterate or just able to read. Only 2.4% of homesteads had access to a pit latrine. No homestead had electricity and none of the households in the 3 villages had access to a bicycle or motorcycle. Only 13 households (6.1%) reported owning a mosquito net in March 2008. Of the 17 nets identified, only 8 were treated with insecticide and the 17 nets were used by 22 people representing 1.9% population coverage and 1.0% use during the night prior to the survey. In August, these estimates of usual and previous night use of nets remained similar; 2.2% and 1.1% respectively. All nets were located in Ceel Bardaale, the wealthiest and largest village (Table 1).

Prevalence of fever and malaria infection

The 14-day period prevalence of self-reported fever in March 2008 was 4.8% (57/1178) including 15 people (1.3%) who reported fever as present on the day of survey (Table 2). The corresponding value for the August survey was 0.6% (7/1128) of the population and only 1 person reported fever on the day of the survey (Table 2).

Of the 64 self-reported fevers over the previous 14 days during the combined March and August surveys, 48 (75%) had resolved after a mean duration of 5.4 (standard deviation 2.67) days and in 16 (25.0%) the fever had started 2–13 days prior to the survey and had not resolved by the day of the survey (Table 2). The majority of fevers ($n = 54$; 84.4%) reported in the previous 14 days were associated with other symptoms including cough ($n = 38$), headache ($n = 21$) and running nose ($n = 10$) (Table 3). Seventeen of those with fever and cough were aged under 15 years and 12 were aged > 60 years. Self reported fever was more prevalent among males, those aged < 5 years, those > 15 years and those in the middle wealth tertile.

Table 2 Fever prevalence in 3 rural communities in Gebiley, 2008

Date/fever category	Xuunshaley			Badahabo			Ceel Bardaale			Total	
	No.	%	95% CI	No.	%	95% CI	No.	%	95% CI	No.	%
March											
14-day fever prevalence	32/247	13.0	9.03–17.79	9/185	4.9	2.25–9.03	16/746	2.1	1.23–3.46	57/1178	4.8
Day of interview reported fever	9/247	3.6	1.67–6.80	2/185	1.1	0.13–3.85	4/746	0.5	0.15–1.37	15/1178	1.3
Resolved fevers	23/32	71.9	53.25–86.25	7/9	77.8	40.00–97.19	12/16	75.0	47.62–92.73	42/57	73.7
August											
14-day fever prevalence	0/271	0		2/160	1.3	0.15–4.44	5/697	0.7	0.23–1.67	7/1128	0.6
Day of interview reported fever	0/271	0		1/160	0.6	0.02–3.43	0/697	0.0		1/1128	0.09
Resolved fevers	–			1/2	50.00	1.26–98.74	5/5	100.0	47.82–100	6/7	85.7
Overall total reported fevers ($n = 64$)											
CI = confidence interval.											

Overall total reported fevers ($n = 64$)
CI = confidence interval.

Table 3 Characteristics of participants with fever

Characteristic	No.	%	95% CI
Sex			
Male (<i>n</i> = 693)	39	5.6	4.09–7.54
Female (<i>n</i> = 682)	25	3.64	2.37–5.33
Age			
< 5 years (<i>n</i> = 255)	12	4.7	2.57–7.86
5–14 years (<i>n</i> = 409)	18	4.4	2.71–6.74
15+ years (<i>n</i> = 711)	34	4.8	3.39–6.54
Wealth ranking			
Lower tertile (<i>n</i> = 374)	13	3.5	1.86–5.87
Middle tertile (<i>n</i> = 662)	41	6.2	4.48–8.31
Upper tertile (<i>n</i> = 339)	10	2.9	1.42–5.35
Symptoms associated with fever (<i>n</i> = 64)			
Headache	21	32.8	
Body ache	10	15.6	
Nausea/vomiting	1	1.5	
Abdominal pain	7	10.9	
Diarrhoea	6	9.4	
Running nose	10	15.6	
Sore throat	5	7.8	
Cough	38	59.4	
Breathing difficulty	6	9.4	

CI = confidence interval.

However, none of these differences was statistically significant, with overlapping 95% CI (Table 3).

Blood samples were collected from 1173 individuals in March and 1106 individuals in August to test at the point of survey for *P. falciparum* specific antigen; all were negative. The 2279 blood smears examined by microscopy several months after the survey were all negative for *P. falciparum* and *P. vivax*.

Actions taken to treat the fever

In March and August 48 cases of fever reported to have occurred over the previous 14 days had resolved by the day of the interview, and therefore could be used to define complete treatment actions. At least 1 reported action was taken to manage 31/48 (64.6%) of these fevers: the first action taken was predominantly reported to be prayers or supplications (35.4% of respondents).

Only 37.5% (*n* = 18) of fevers were managed at a formal health post

or clinic at any time during the illness. Seven (38.9%) visited an HP or MCH/OPD within 24 hours, 7 (38.9%) within 24–< 48 hours and 3 (16.7%) within 48–< 72 hours. Only 1 person visited an HP or MCH/OPD more than 72 hours from the onset of fever. Most of those who visited a health facility were in the middle (*n* = 11, 61.1%) and upper (*n* = 6, 33.3%) wealth tertiles, most were men (*n* = 13, 72.2%) and half were children below the age of 15 years (*n* = 9, 50.0%). Medicines used to treat the febrile illnesses included antibiotics, antipyretics and vitamins. None reported the prescription or use of an antimalarial drug and none of the fevers was investigated by microscopy or rapid diagnostic tests

Discussion

Among the residents of 3 rural communities in Gebiley district, fever was a relatively rare condition when investigated

in March and August of 2008. Across the 2 surveys, a total of 64 fevers were reported among 2306 person-fortnight observations, a projected estimated incidence of 0.72 fever events per person per year. We were surprised by this low period prevalence of a condition considerably more prevalent in other African settings when investigated using identical methodologies. Outside southern Africa, the predicted incidence of fever ranged from 3 to 13 attacks per child aged < 5 years per year [9] compared to a projected incident fever rate of 0.69 among the children of this age range in the 3 villages in this study.

The word for fever, *xumad* (pronounced *humad*), is unambiguous in the local vernacular and unlikely to have been misinterpreted. Most fevers were associated with other symptoms, notably those indicative of upper respiratory tract and gastrointestinal infections. We did not investigate across the surveys the full range of morbid conditions affecting these communities as the entry point for this investigation was fever. It is notable however that none of the people examined harboured malaria infection in their peripheral blood. Fever prevalence was, therefore, independent of malaria and likely to be a consequence of the acquisition of other circulating bacterial and viral infections. What this study may suggest is that the overall prevalence of fever may well scale with the likelihood and intensity of malaria transmission in a given setting and this simple proxy of “malaria risk” merits further investigation.

There is no doubt that these communities are impoverished with no electricity, ready access to water or material goods. Just over a third of those having febrile events visited a health post or health centre. When asked about the possible reasons why treatment was not sought for their fevers outside the home, respondents said that they thought the fever was mild and that it would resolve spontaneously and if they did wish to seek treatment, it would cost too much

to travel, obtain a consultation and pay for the medicines. This does have implications for possible future major malaria outbreaks in this area.

Transmission of both *P. falciparum* and *P. vivax* is possible in all 3 villages following the identification of *Anopheles arabiensis* larvae in breeding sites surrounding the villages in July 2008 [F.S. Deria, 2008, *Entomological survey in three villages of Gebiley district, Somaliland*, unpublished report] and the description of infection among human hosts in neighbouring villages [4]. The threat of an outbreak of malaria is always present in these communities, particularly after heavy rains or the importation of infection by nomadic pastoralists. Should an outbreak of fever/malaria occur in these communities, it is unlikely it would be detected promptly given the incipient delays in fever treatment and the fact that none of the fevers were parasitologically investigated by health care

personnel. It would therefore be advisable to improve community awareness of the potential seriousness of fevers and the need for their thorough investigation. Overcoming physical barriers of access to diagnostic services, costs of diagnosis and the perceived benign nature of all febrile events should be issues that require addressing as part of improved malaria surveillance for outbreak detection in this area of Somalia.

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References

1. Sheik-Mohammed A, Velema JP. Where health care has no access: the nomadic populations of sub-Saharan Africa. *Tropical medicine & international health*, 1999; 4:695-707.
2. Capobianco E. *Somalia malaria strategy 2005-2010*. New York, United Nations Children's Fund, 2005.
3. Wilson DB. Malaria in British Somaliland. *East African medical journal*, 1949, 26:283-91.
4. Noor AM et al. Spatial prediction of *Plasmodium falciparum* prevalence in Somalia. *Malaria journal*, 2008, 7:159.
5. Glasgow JP, MacInnes DG. *Anopheles* of British Somaliland. *East African medical journal*, 1943; 20:176-9.
6. Maffi M. Contributo alla conoscenza della fauna anofelinica della Somalia [Contribution to the knowledge of the anopheline fauna of Somalia]. *Rivista di malariologia*, 1958, 37:73-5.
7. *Google Earth* [website]. Seattle, United States of America, Google, 2009 (<http://earth.google.com/>, accessed 10 December 2009).
8. *Basic laboratory methods in medical parasitology*. Geneva, World Health Organization, 1991.
9. Snow RW, Eckert E, Teklehaimanot A. Estimating the needs for artesunate-based combination therapy for malaria case-management in Africa. *Trends in parasitology*, 2003, 19:363-9.

Analyse coût-efficacité des stratégies de dépistage du cancer du col utérin en Tunisie

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تحليل الفعالية لقاء التكاليف لاستراتيجية التحري عن سرطان عنق الرحم في تونس
هاجر بن قبران، هاجر عون الله السخيري، فوزي وسلافي، حاتم فريخا، نور الدين عاشور، محمد حصايري

الخلاصة: هدف الباحثون إلى التعرف على أكثر الاستراتيجيات ملائمةً للتحري عن سرطان عنق الرحم (دورياً كل 3 أو 5 أو 10 سنوات) في تونس، مع الأخذ بالاعتبار معدل وقوع المرض وتكاليف التحري والآثار الاقتصادية. وأجرى الباحثون محاكاةً لمتابعة أتراب منهن مليون امرأة من تتراوح أعمارهن بين 35 و39 عاماً لمدة 30 عاماً. وقد استند حساب تكاليف الرعاية الصحية السنوية على معطيات مستمدة من ملفات طبية للمريضات اللاتي شُخصن على أنهن مصابات بسرطان عنق الرحم عام 2004 في المعهد الوطني للسرطان في تونس. واتضح أنه لمستوى يبلغ 60٪ من التغطية بالتحري، سينخفض سرطان عنق الرحم بمقدار 49.2٪ للتحري في فترات دورية كل 3 سنوات، وسيكون الانخفاض بمقدار 40.3٪ للتحري في فترات دورية كل 5 سنوات، و33.1٪ كل 10 سنوات. ومن وجهة نظر الفعالية لقاء التكاليف فإن للتحري كل 10 سنوات أقل تكلفة سنوية لتجنب حالة واحدة من سرطان عنق الرحم.

RÉSUMÉ Notre objectif était d'identifier parmi les stratégies de dépistage du cancer du col utérin (périodicité de 3, 5 ou 10 ans) celle qui serait la plus appropriée pour la Tunisie, compte tenu du coût du dépistage, de l'incidence de la maladie et de la rentabilité économique. Nous avons simulé le suivi d'une cohorte fictive d'un million de femmes âgées entre 35 et 39 ans sur une période de 30 ans. Pour le calcul du coût annuel direct de la prise en charge des malades, nous nous sommes basés sur les données du dossier médical des malades diagnostiqués en 2004 à l'Institut de Cancérologie de Tunis. Pour une couverture de 60 %, un frottis réalisé tous les 3 ans s'accompagne d'une diminution de l'incidence de 49,2 % ; cette diminution serait de 40,3 % et de 33,1 % pour des périodicités de dépistage respectives de 5 et 10 ans. La stratégie avec une périodicité de 10 ans avait le meilleur rapport coût-efficacité, étant celle qui minimise le coût moyen d'un cas de cancer du col utérin qu'on pourrait éviter.

Cost-effectiveness analysis of screening strategies for cervical cancer in Tunisia

ABSTRACT We aimed to identify the most appropriate screening strategy for cervical cancer (periodicity of 3, 5 or 10 years) for Tunisia, taking into consideration the incidence of the disease, costs of screening and economic implications. We simulated follow-up of a fictitious cohort of 1 million women 35–39 years over 30 years. Computation of yearly medical care costs was based on data from medical files of patients diagnosed with cervical cancer in 2004 at the National Institute of Cancer, Tunis. For a 60% coverage level of screening, cervical cancer reduction would be 49.2% for a 3-year periodicity. The reduction would be 40.3% and 33.1% for 5 and 10 years periodicity respectively. Considering cost-effectiveness, 10-year screening gave the lowest annual cost to avoid 1 cervical cancer case.

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Introduction

Le cancer du col de l'utérus est un problème de santé publique dans les pays en développement, représentant le premier cancer de la femme dans plusieurs de ces pays. Il se place en troisième position parmi les cancers les plus fréquents dans le monde, avec 80 % des cas dans les pays en développement. Il représente la principale cause de décès par cancer chez les femmes dans les pays en voie de développement, avec approximativement 190 000 décès chaque année [1]. Les taux d'incidence les plus élevés sont observés en Amérique centrale et en Afrique subsaharienne [1]. Au cours des dernières années, il a été démontré que le papillomavirus humain (HPV-*Human Papilloma Virus*) est impliqué dans la genèse de la majorité des cas du cancer du col [2-6]. Le risque est estimé entre 15 % et 25 % dans les 2 à 4 ans suivant le diagnostic [7]. Les facteurs responsables de cette évolution seraient des troubles immunologiques associés à la parité [8]. D'autres facteurs de risque du cancer du col utérin ont été identifiés [9,10].

L'incidence et la mortalité de ce cancer ont été profondément influencées par les programmes structurés de dépistage et de traitement des lésions pré-néoplasiques [11]. Le frottis cervical (FC) constitue selon la conférence de consensus de Lille le seul test de dépistage ayant fait l'objet d'une évaluation de son efficacité, avec une sensibilité et une spécificité pouvant atteindre 85 % dans certains pays développés [12]. L'application du FC permet de détecter des lésions dysplasiques pouvant être traitées, ce qui permet d'éviter avec quasi-certitude l'évolution vers un cancer invasif [13].

En Tunisie, l'incidence du cancer du col utérin dans la région du Nord, qui couvre autour de 50 % de la population tunisienne, a été estimée à 5,4/100 000 femmes au cours de la période 1999-2003 [14]. Selon l'enquête nationale à

indicateurs multiples MICS- 3 (MICS - *Multiple Indicators Cluster Survey*)-2006, la proportion de femmes ayant bénéficié d'au moins un frottis cervical au titre d'un dépistage du cancer du col utérin est de 12 % [15]. Durant cette période de récession économique et de contraintes budgétaires qui en résultent, les décisions en matière de choix des interventions dans le domaine de la santé sont soumises de plus en plus à des analyses médico-économiques de type coût/efficacité. La mise en place d'un dépistage de cancer du col utérin, malgré son inscription dans le « plan cancer » tunisien 2006-2010 avec une périodicité « tous les 5 ans », se heurte à des difficultés financières. C'est dans ce contexte qu'une analyse coût-efficacité des différentes périodicités du dépistage du cancer du col utérin en Tunisie trouve sa justification.

Le présent travail s'insère dans ce cadre : il vise à analyser et comparer les rapports coût-efficacité de certaines stratégies de dépistage du cancer du col utérin, selon la périodicité de ce dépistage et le niveau de couverture.

Méthodes

Nous avons identifié trois stratégies de dépistage selon la périodicité (tous les 3 ans, tous les 5 ans ou tous les 10 ans). La question posée consiste à identifier parmi ces stratégies celle qui serait la plus appropriée à la situation épidémiologique en Tunisie, compte tenu du coût du dépistage, de l'incidence de la maladie et de la rentabilité économique. Ces différentes stratégies ont été comparées entre elles, en prenant comme critère principal le coût d'un cas évité.

Calcul du coût annuel des frottis de dépistage

Pour calculer le coût annuel du dépistage pour chacune des stratégies, nous avons considéré une cohorte

fictive d'un million de femmes âgées entre 35 et 39 ans. Nous avons simulé un suivi de 30 ans, soit 10 examens pour une périodicité de 3 ans, 6 examens pour la périodicité de 5 ans et 3 examens pour celle de 10 ans. Le coût total du dépistage à prix constant a été obtenu en multipliant l'effectif de la cohorte par le nombre de frottis à réaliser pour chaque femme durant la période de 30 ans et par le coût unitaire d'un frottis. Le coût annuel à prix constant a été obtenu en divisant ce coût total par 30.

Calcul du nombre annuel de cas évitables grâce au dépistage

Pour calculer le pourcentage de cas qu'on peut prévenir pour chaque stratégie, nous avons utilisé la formule suivante [16] :

$$\text{Pourcentage de cas prévenus} = \text{Po} \frac{(1/\text{RR} - 1)}{(1/\text{RR})}$$

où Po représente le niveau de couverture par le dépistage et RR, le risque relatif de dépistage du cancer du col utérin. Les études ont montré que ce risque relatif serait de 0,18 pour une périodicité de 3 ans, de 0,37 pour celle de 5 ans et de 0,58 pour celle de 10 ans [17,18]. Pour calculer le nombre de cas prévenus par le dépistage, on multiplie la proportion des cas prévenus par le nombre de cas incidents. Celui-ci est calculé en soumettant la cohorte de femmes aux taux d'incidence selon l'âge du cancer du col utérin, observés au cours de la période 1999-2003 [14], au fur et à mesure que les femmes progressent en âge. Les taux d'incidence observés selon l'âge durant cette période étaient respectivement de 5,0/100 000 pour la tranche d'âge 35-39 ans, 7,5/100 000 pour la tranche d'âge 40-44 ans, 14,4/100 000 pour la tranche d'âge 45-49 ans, 17,4/100 000 pour la tranche d'âge 50-54 ans, 16,8/100 000 pour la tranche d'âge 55-59 ans et 19,5/100 000 pour la tranche d'âge 60-64 ans [14].

Calcul du coût annuel direct de la prise en charge des malades

Pour le calcul du coût direct à prix constant de la prise en charge des malades, nous nous sommes basés sur les données du dossier médical des malades nouvellement diagnostiqués en 2004 à l'Institut de Cancérologie Salah Azaïez de Tunis. Nous avons utilisé les tarifs selon la nomenclature des actes professionnels des médecins, biologistes, chirurgiens dentistes, sages-femmes et auxiliaires médicaux [19]. Les données collectées sont relatives :

- au nombre de journées d'hospitalisation ;
- au nombre de consultations effectuées ;
- aux examens complémentaires réalisés ;
- aux actes à visée diagnostique et/ou thérapeutique ;
- aux traitements prescrits.

Le coût direct médical est égal à la somme des frais des différents postes de consommation (hôtellerie, consultations externes, examens complémentaires, actes de diagnostic tels que les actes d'endoscopie, actes opératoires, traitements de chimiothérapie et de radiothérapie). Concernant les frais hôteliers d'hospitalisation, une journée d'hospitalisation coûte USD 30,7 dans

les services de chirurgie et USD 46,1 dans les services de réanimation. Le coût de cette journée d'hospitalisation est un coût macroéconomique qui englobe les frais hôteliers proprement dits, ainsi que ceux du personnel et des médicaments non spécifiques. Le coût d'une consultation externe a été fixé à USD 7,7. Les résultats relatifs au coût de prise en charge ont fait l'objet d'une publication [20].

Calcul du coût annuel d'un cas évité pour chaque stratégie

Le coût annuel d'un cas à prévenir pour chaque stratégie est égal au coût annuel du dépistage additionné du coût annuel de prise en charge (coût annuel du dépistage + coût annuel de prise en charge) sur le nombre de cas qui pourraient être évités. La meilleure stratégie sur le plan économique est celle qui minimise ce dernier coût. La comparaison des coûts annuels par cas évité selon les trois stratégies a été réalisée avec une analyse de la sensibilité en considérant une variation de l'incidence du cancer du col à plus ou moins 10 %.

Résultats

Le nombre de cas incidents durant un suivi de 30 ans pour cette cohorte d'un million de femmes est égal à 4030 cas, soit un nombre annuel moyen égal à 135 cas.

Le tableau 1 résume les proportions et le nombre annuel de cas de cancer du col utérin évitables par le dépistage selon la périodicité et le niveau de couverture. Les meilleurs résultats sont observés pour la périodicité tous les trois ans. C'est ainsi que pour une couverture de 60 %, on pourrait éviter 66 cas pour cette stratégie « tous les 3 ans » ; ce nombre est de 54 cas pour la stratégie « tous les 5 ans » et de 45 cas pour celle « tous les 10 ans ».

Le tableau 2 résume le coût annuel de prise en charge des cas qui n'ont pas pu être évités par le dépistage, ainsi que le coût total annuel incluant le coût de dépistage et le coût de prise en charge des cas incidents. Le coût total diminue avec la réduction de l'intervalle de temps entre deux tours de dépistage et il augmente avec le niveau de couverture.

Le coût annuel par cas évité de cancer du col utérin selon la périodicité est résumé dans la figure 1. Il est égal, pour un niveau de couverture de 60 %, à USD 19 810 pour une périodicité de 3 ans, à USD 15 726 et à USD 11 497 pour des périodicités de 5 et 10 ans respectivement.

L'analyse de la sensibilité, basée sur une variation de l'incidence du cancer du col à plus ou moins 10 %, a mis en évidence que malgré ces variations, la stratégie de dépistage du cancer du col utérin tous les 10 ans demeure celle qui a le meilleur rapport coût efficacité (Figures 2, 3 et 4).

Tableau 1 Cas annuels de cancer évitables par le dépistage selon la périodicité et le niveau de couverture

Couverture (%)	Cas annuels évitables selon la périodicité adoptée					
	3 ans		5 ans		10 ans	
	(%)	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>
20	16,4	22	13,4	18	11,0	15
30	24,6	33	20,2	27	16,5	22
40	32,8	44	26,9	36	22,1	30
50	41,0	55	33,6	45	27,6	37
60	49,2	66	40,3	54	33,1	45
70	57,4	77	47,1	64	38,6	52
80	65,6	89	53,8	73	44,1	60
90	73,8	100	60,5	82	49,6	67

Nombre annuel de cas incidents = 135.

Tableau 2 Coût total annuel du dépistage selon la périodicité adoptée et le niveau de couverture

Couverture (%)	Coûts annuels selon la périodicité adoptée (USD)					
	3 ans		5 ans		10 ans	
	Nombre de frottis réalisés	Coût de prise en charge des cas incidents	Coût total du dépistage ^a	Nombre de frottis réalisés	Coût de prise en charge des cas incidents	Coût total du dépistage ^a
20	66 667	276 073	850 432	40 000	285 822	630 437
30	100 000	248 994	1 110 532	60 000	263 617	780 540
40	133 333	221 915	1 370 633	80 000	241 412	930 642
50	166 667	194 836	1 630 734	100 000	219 207	1 080 745
60	200 000	167 757	1 890 834	120 000	197 002	1 230 848
70	233 333	140 678	2 150 935	140 000	174 798	1 380 952
80	266 667	113 599	2 411 035	160 000	152 593	1 531 055
90	300 000	86 521	2 671 136	180 000	130 388	1 681 158

^aCoût incluant les frais des frottis et le coût de prise en charge.

Coût d'un frottis = US\$ 8,6.

1 US\$ = TND 1,3.

Discussion

Sil'efficacité du dépistage par le frottis cervical a été amplement étudiée, sa rentabilité économique varie selon les pays, notamment en fonction de l'incidence de cette néoplasie. En Tunisie, l'incidence de ce cancer est relativement faible [14]. Cette incidence est quasi similaire à celle observée dans les pays qui ont enregistré des résultats très probants grâce au dépistage.

En conséquence, l'analyse coût/efficacité des stratégies de dépistage du cancer du col utérin est amplement justifiée ; elle permettrait une analyse de la rentabilité économique des différentes stratégies du dépistage du cancer du col utérin utilisant le frottis cervical, selon la périodicité.

Cette étude a permis de mieux éclairer les choix en matière de périodicité du dépistage du cancer du col utérin. Toutefois, elle comporte certaines limites. Ainsi, pour la prise en charge des patientes, les coûts supportés par le bénéficiaire et sa famille n'ont pas été comptabilisés par manque d'informations. D'autre part, les coûts d'organisation et de formation du programme de dépistage (campagnes d'information, de sensibilisation, formation du personnel, etc.) n'ont pas été pris en compte puisque seul le coût du frottis cervical a été comptabilisé dans cette étude. Certes, les coûts d'investissement et de formation du personnel sont pertinents à calculer ; toutefois, ces coûts sont sensiblement similaires pour les périodicités analysées et le fait de ne pas les inclure n'affecterait pas les différentes comparaisons.

Le présent travail a mis en évidence que la stratégie avec une périodicité de 10 ans avait le meilleur rapport coût-efficacité. Ce résultat demeure valable après une analyse de la sensibilité en faisant varier l'incidence du cancer du col utérin. En effet, pour une couverture de 60 %, le coût annuel d'un cas évité par le dépistage est égal à USD 11 497 pour une périodicité de 10 ans contre USD 15 726 et USD 19 810 pour des périodicités de 5 et 3 ans respectivement. Cependant, la périodicité adoptée dans les pays de l'Europe occidentale et de l'Amérique du Nord varie de 2 à 5 ans ; l'application de cette périodicité a entraîné une diminution importante de l'incidence et de la mortalité par cancer du col au cours des 40 à 50 dernières années. Toutefois, les résultats d'une étude menée par Schaffer et al. [21,22] ont montré que l'efficacité d'un dépistage du cancer du col utérin qui débute à 25 ans à raison d'un frottis tous les 3 à 5 ans est similaire à celle d'un dépistage à raison d'un frottis annuel, alors que le coût marginal par année supplémentaire d'espérance de vie gagnée est plus de 50 fois plus faible avec beaucoup moins d'effets délétères (faux positifs, faux négatifs, sur-diagnosics et sur-traitements). De même, selon une étude australienne, le coût du dépistage annuel par année de vie sauvée était de USD 376 alors qu'il était de USD 117,1 pour une périodicité

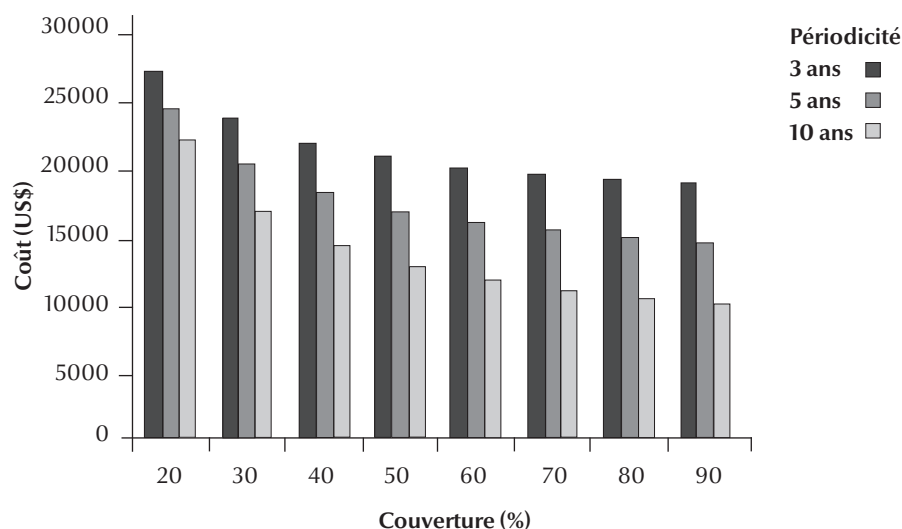


Figure 1 Coût annuel par cas évité de cancer du col utérin selon la périodicité adoptée et le niveau de couverture

du dépistage de 3 ans avec une relative réduction du nombre total d'années de vie sauvées par le programme (< 5 %) [23].

Quelle que soit la périodicité adoptée, la baisse de l'incidence du cancer du col utérin ne pourra être obtenue que si ce dépistage est bien organisé à travers un programme bien structuré ; en effet, dans certains pays en développement ayant mis en place des programmes

très limités de dépistage, il n'a pas été observé de baisse de l'incidence [24].

Conclusion

Un dépistage du cancer du col utérin pratiqué tous les 10 ans présente le meilleur rapport coût-efficacité en Tunisie. Un frottis réalisé tous les dix ans s'accompagnerait d'une diminution de l'incidence du cancer du col de

33,1 % pour une couverture de 60 %. L'investissement dans toute action de dépistage nouvelle n'est opportun que si l'on peut garantir une assurance qualité du dépistage, ainsi qu'une bonne couverture des femmes cible. Ce programme de dépistage devrait ainsi être associé à une formation des professionnels concernés par cette prestation et à un programme de sensibilisation des femmes pour recourir au dépistage.

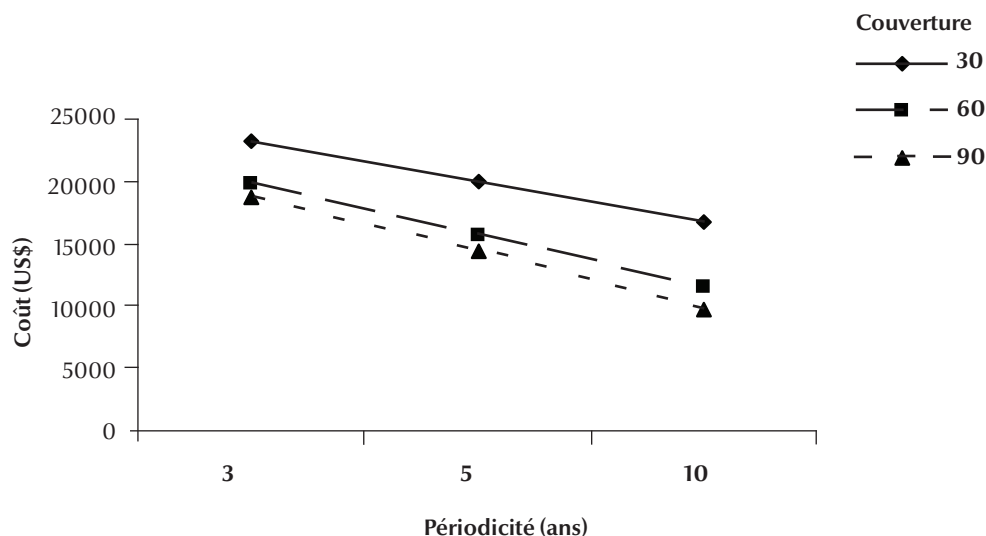


Figure 2 Coût annuel par cas évité selon la périodicité et la couverture (incidence du registre du Nord)

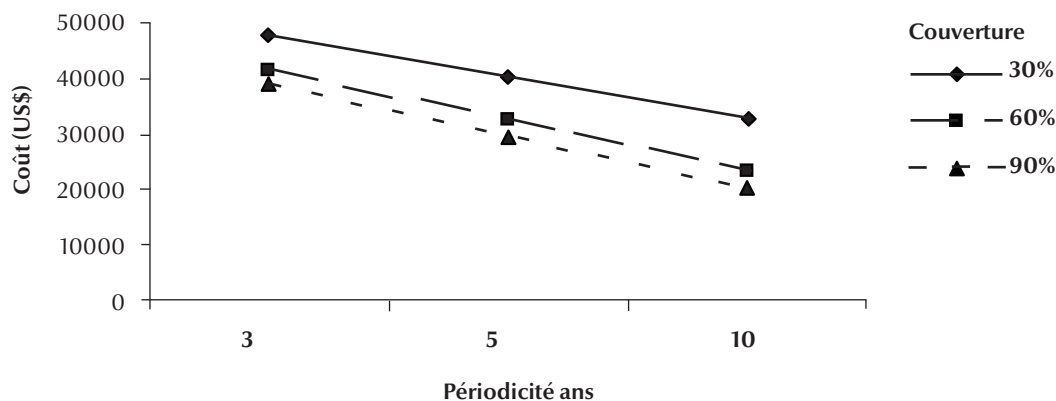


Figure 3 Coût annuel par cas évité selon la périodicité et la couverture (incidence réduite de 10%)

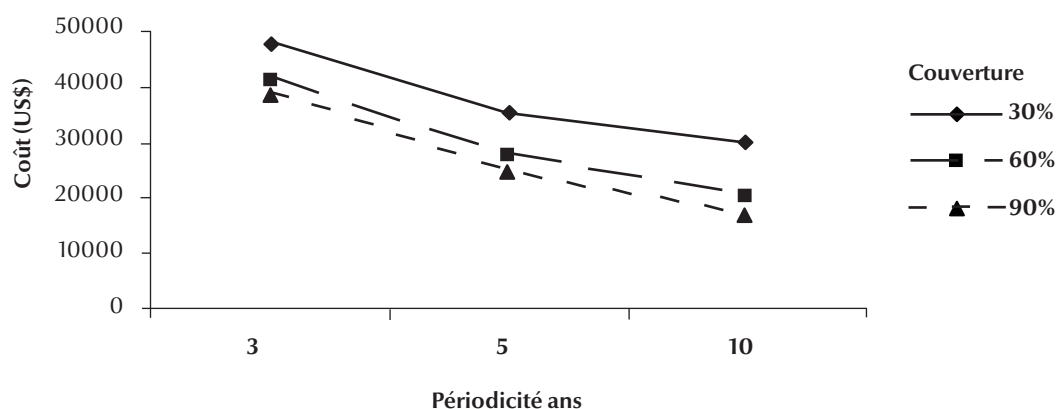


Figure 4 Coût annuel par cas évité selon la périodicité et la couverture (incidence majorée de 10%)

References

- Pisani P et al. Estimates of the worldwide mortality from 25 cancers in 1990. *International journal of cancer*, 1999, 83(1):18-29 [Erratum *International journal of cancer*, 1999, 83:870-3].
- Bosch FX et al. Prevalence of human papillomavirus in cervical cancer: a worldwide perspective. International biological study on cervical cancer (IBSCC) Study Group. *Journal of the National Cancer Institute*, 1995, 87(11):796-802.
- Baseman JG, Koutsky LA. The epidemiology of human papillomavirus infections. *Journal of clinical virology*, 2005, 32(Suppl. 1):S16-24.
- Muñoz N et al. Chapter 1: HPV in the etiology of human cancer. *Vaccine*, 2006, 24(Suppl. 3):S1-10.
- Cox JT. The development of cervical cancer and its precursors: what is the role of human papillomavirus infection? *Current opinions in obstetrics & gynecology*, 2006, 18(Suppl 1):S5-13.
- Hildesheim A et al. Persistence of type-specific human papillomavirus infection among cytologically normal women. *Journal of infectious diseases*, 1994, 169(2):235-40.
- Koutsky LA et al. A cohort study of the risk of cervical intraepithelial neoplasia grade 2 or 3 in relation to papillomavirus infection. *New England journal of medicine*, 1992, 327(18):1272-8.
- Schiffman MH et al. Epidemiologic evidence showing that human papillomavirus infection causes most cervical intraepithelial neoplasia. *Journal of the National Cancer Institute*, 1993, 85(12):958-64.
- Munoz N et al. Risk factors for cervical intraepithelial neoplasia grade III/carcinoma in situ in Spain and Colombia. *Cancer epidemiology, biomarkers & prevention*, 1993, 2(5):423-31.
- Butterworth CE Jr et al. Folate deficiency and cervical dysplasia. *Journal of the American Medical Association*, 1992, 267(4):528-33.
- Hakama M. Trends in the incidence of cervical cancer in Nordic countries. In: Magnus K, ed. *Trends in cancer incidence*. Washington DC, Hemisphere, 1982.
- Fédération des Gynécologues et Obstétriciens de Langue française. Conférence de consensus sur le dépistage du cancer du col utérin, Lille 5-8 septembre 1990. Recommandations. *Journal de gynécologie, obstétrique et biologie de la reproduction*, 1990, 19:1-16.
- Soutter WP, Fletcher A. Invasive cancer in women with mild dyskaryosis followed up cytologically. *British medical journal*, 1994, 308(6941):1421-3.
- Ben Abdallah M, Zheni S. *Registre des cancers Nord - 1994*. Tunis, Institut Salah Azaiez, 2000:84.

15. Ministère de la Santé publique/Office national de la Famille et de la Population (ONFP). *Enquête Multiple Indicators Cluster Survey – Tunisie 2006*. Tunis, ONFP, 2008:110.
16. Rothman KJ. *Modern epidemiology*. Boston, Little Brown, 1986.
17. La Vecchia C et al. "Pap" smear and the risk of cervical neoplasia: quantitative estimates from a case-control study. *Lancet*, 1984, 2(8406):779–82.
18. Olesen F. A case-control study of cervical cytology before diagnosis of cervical cancer in Denmark. *International journal of epidemiology*, 1988, 17(3):501–8.
19. *Tarifs et nomenclature des actes professionnels des médecins, biologistes, chirurgiens dentistes, sages-femmes et auxiliaires médicaux*. Tunis, Imprimerie officielle de la République tunisienne, 1995.
20. Ben Gobrane H et al. Estimation du coût de la prise en charge du cancer invasif du col de l'utérus en Tunisie. *Santé publique*, 2009, 21:561–9.
21. Schaffer P. Le dépistage du cancer du col de l'utérus. *Bulletin du cancer*, 1996, 83(9):736–41.
22. Schaffer P, Allemand H. Évaluation économique du dépistage du cancer du col de l'utérus. *Concours médical*, 1995, 37:2501–13.
23. Anderson R, Haas M, Shanahan M. The cost-effectiveness of cervical screening in Australia: what is the impact of screening at different intervals or over a different age range? *Australian and New Zealand journal of public health*, 2008, 32(1):43–52.
24. Bergeron C et al. Coût du dépistage et de la prise en charge des lésions précancéreuses du col utérin en France. *Gynécologie, obstétrique & fertilité*, 2006, 34(11):1036–42.

Accès à l'eau

À cinq ans de l'échéance fixée pour la réalisation de l'objectif du Millénaire pour le développement (OMD) relatif à l'amélioration des sources d'eau de boisson, beaucoup reste à faire:

- 884 millions de personnes n'ont toujours pas accès à une source d'eau de boisson améliorée;
- les habitants des campagnes ont cinq fois moins de chances d'avoir accès à une source d'eau de boisson améliorée que les ceux des villes.

On relève cependant des signes encourageants:

- 84% de la population des pays en développement ont désormais accès à une source d'eau de boisson améliorée;
- en 2000, 1 milliard de personnes de plus qu'en 1990 avaient accès à une source d'eau améliorée.

Rapport 2010 du Programme conjoint OMS/UNICEF de suivi de l'approvisionnement en eau et de l'assainissement (http://www.who.int/mediacentre/news/releases/2010/water_20100315/fr/index.html)

Hyperglycaemia, hypertension and their risk factors among Palestine refugees served by UNRWA

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فرط سكر الدم وفرط ضغط الدم وعوامل خطرهما لدى اللاجئين الفلسطينيين الذين يتلقون خدمات الأنروا

حميد سالم أبو موسى، شاهين يوسف، فلافي ريكاردو، وفاء زيدان، جويدو ساباتينيلي

الخلاصة: في حزيران/يونيو 2007 قِيمَ الباحثون أنشطة تحري الأمراض غير السارية التي تقدمها الأنروا لـ 7762 لاجئاً بتحري السكري من النمط 2 وفرط ضغط الدم لديهم في الأردن، والجمهورية العربية السورية، ولبنان، وقطاع غزة، والضفة الغربية. وقد حوّل المشاركون في الدراسة في غالب الأحيان بسبب العمر (من الجنسين)، ثم بسبب التدخين (الذكور)، ثم بسبب سوابق عائلية (الإناث). وقد شُخّصَ السكري أو فرط ضغط الدم لدى 9٪ من مجمل الناس الذي تم تحريمهم. ووجد الباحثون أن مما يزيد خطر وجود السكري أو فرط ضغط الدم أو كليهما كون الشخص أكبر عمراً من 40 عاماً، حيث يزداد الخطر بمقدار 3.5 أضعاف، وكونه بديناً، حيث يزداد الخطر بمقدار 1.6 ضعف، وله سوابق عائلية للإصابة بالسكري أو بمرض قلبي وعائي، حيث يزداد الخطر بمقدار 1.2 ضعف. وناقش الباحثون التفاوتات في كشف عوامل الخطر وحصائل التحري وعلاقتها بالتفاوتات في أنماط الحياة.

ABSTRACT UNRWA's noncommunicable disease screening activities were evaluated among 7762 refugees screened for hypertension and type 2 diabetes in Jordan, Syrian Arab Republic, Lebanon, Gaza Strip and West Bank in June 2007. People were referred for screening most commonly because of age (both sexes), followed by smoking (males) and family history (females). A total of 9% of screened people were diagnosed with hypertension/diabetes. Being older than 40 years, obese or with a positive family history of diabetes or cardiovascular disease increased the risk of presenting with hypertension and/or hyperglycaemia 3.5, 1.6 and 1.2 times respectively. Differences in risk factor detection and screening outcome in relation to differences in lifestyle are discussed.

Hyperglycémie, hypertension artérielle et facteurs de risque de ces maladies chez les réfugiés palestiniens pris en charge par l'UNRWA

RÉSUMÉ Les activités de dépistage des maladies non transmissibles de l'Office de secours et de travaux des Nations Unies pour les réfugiés de Palestine dans le Proche-Orient UNRWA) ont été évaluées auprès de 7762 réfugiés ayant fait l'objet d'un dépistage de l'hypertension artérielle et du diabète de type 2 en Cisjordanie, à Gaza, en Jordanie, au Liban et en République arabe syrienne en juin 2007. Les patients ont été orientés vers ce dépistage principalement en raison de leur âge (pour les deux sexes), mais également pour cause de tabagisme (hommes) ou d'antécédents familiaux (femmes). Au total, un diagnostic d'hypertension artérielle et/ou de diabète a été établi chez 9 % des personnes examinées. Le fait d'avoir plus de 40 ans, d'être obèse ou de présenter des antécédents familiaux de diabète ou de maladie cardiovasculaire multiplie le risque d'hypertension artérielle ou d'hyperglycémie par 3,5, 1,6 et 1,2, respectivement. Cette étude traite également des disparités liées aux différences d'hygiène de vie en termes de détection des facteurs de risque et de résultat du dépistage.

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Introduction

Attention is increasingly being paid to noncommunicable diseases (NCDs) in low- and middle-income countries. Diseases such as cardiovascular disease (CVD), diabetes and cancer now account for 70% of the adult burden of disease in middle-income countries, not far behind the recorded burden of disease in developed countries of 80%. If the current trend is maintained, by 2020 NCDs will account for 80% of the global burden of disease [1].

UNRWA, the United Nations Relief and Works Agency for Palestine Refugees in the Near East, was established in 1949 by the United Nations General Assembly to carry out direct relief and works programmes for Palestine refugees. Operating in a context characterized by chronic political instability and a worsening socioeconomic situation, UNRWA is unique in terms of its long-standing commitment to one group of refugees and has contributed to the welfare and human development of 4 generations of Palestine refugees.

As part of the disease prevention and control sub-programme UNRWA has been promoting primary, secondary and tertiary prevention of NCDs since 2005. Due to constraints in financial and human resources, the interventions only target hypertension and type 2 diabetes mellitus.

Methods

At the time of the study UNRWA's 129 primary health care facilities offered health services to 4.6 million registered Palestinian refugees in Jordan, Lebanon, Syrian Arab Republic, West Bank and the Gaza Strip. In 2006 the estimated total population served by the primary health care services was 3.2 million people, accounting for 73% of the registered refugee population at the time.

Screening for NCDs at UNRWA clinics is offered to all people aged 40

years or over attending health clinics either as patients or accompanying family members. Individuals presenting with risk factors associated with diabetes and/or hypertension are encouraged to undergo screening even if they are below 40 years old. These risk factors included obesity (body mass index ≥ 30 kg/m²), history of smoking (> 1 year), gestational diabetes and/or hypertension and positive family history of diabetes mellitus and/or CVD. People with random abnormal blood pressure readings ($\geq 140/\geq 90$ mmHg) or high random glycaemia (≥ 126 mg/dL) are referred for further investigation and evaluated for diagnosis. Hypertensive and diabetic patients are then referred to the NCD division of the clinic for registration and medical follow-up.

To assess the detection rate of hypertension and hyperglycaemia and their risk factors among people accessing screening and the outcome of UNRWA's screening activities, a case-series study was conducted among 7762 people who underwent screening for diabetes and hypertension in June 2007 in 3 UNRWA health centres randomly selected from each area of UNRWA operations (Jordan, Syrian Arab Republic, Lebanon, West Bank and Gaza Strip). Areas of UNRWA operation are referred to in this paper as "fields".

Data were entered and analysed with *Epi6* and *Analysis* (*Epi-Info* Windows, version 3.4.1). The statistical difference in the distribution of risk factors and outcomes of the screening by field and sex was calculated using the chi-squared

test. *P*-values < 0.05 were considered statistically significant. A multiple logistic regression model was used for the risk factor multivariate analysis. Although there were more women than men in all fields the distribution was not constant and the correlation between sex and field was significant ($\chi^2 = 62.3$; $P < 0.01$). For this reason the data analysis was stratified by sex.

Results

The study population comprised 5317 (68.5%) females and 2445 (31.5%) males and the overall mean age was 45.5 (standard deviation 13.9) years.

Due to the screening protocol, age was the main factor that determined the enrolment of patients. However, the proportion of people screened aged 40+ years varied significantly among areas of operation, from around 50% in Gaza for both sexes to around 90% in the West Bank (Table 1). A statistically significant variation among fields was also observed in the proportion of females and males aged 40+ years who were screened (females: $\chi^2 = 636.2$, $P < 0.01$; males: $\chi^2 = 219.4$, $P < 0.01$). The second reason for screening was smoking for males and positive family history of NCDs for females.

Across all fields, 69.2% of the males and 67.3% of the females had 2 or more risk factors, with significant variations between the 5 fields for females ($\chi^2 = 159.8$, $P < 0.01$) and for males ($\chi^2 = 21.2$, $P < 0.01$).

Table 1 Distribution of Palestine refugees aged 40+ years screened for diabetes and hypertension by United Nations Relief and Works Agency for Palestine Refugees in the Near East

Area of operation	Males (<i>n</i> = 2445) %	Females (<i>n</i> = 5317) %	Total (<i>n</i> = 7762) %
Jordan	76.8	77.4	77.2
Lebanon	86.0	91.5	89.1
Syrian Arab Republic	70.5	50.3	55.7
Gaza Strip	54.2	51.9	52.6
West Bank	94.6	88.6	90.4

As shown in Table 2 the frequency of smoking and obesity varied significantly between the sexes and among fields independently of sex. The highest proportion of obese people was found Jordan (32.7% of males and 53.7% of females) and the Occupied Palestinian Territories (34.1% of males in Gaza and 52.6% of females in the West Bank) while the lowest proportion in both males and females were observed in Lebanon (22.4% of males and 38.7% of females). In Lebanon smoking was widespread among both sexes (59.5% of males and 39.9% of females), whereas smoking was reported by a very small number of women in Jordan (8.4%) and the Occupied Palestinian Territories (0.6% in Gaza and 6.1% in West Bank). A statistically significant variation was observed in the number of screened people who reported a positive family history of diabetes and/or CVD by field for females ($\chi^2 = 204.2$, $P < 0.01$) and for males ($\chi^2 = 53.9$, $P < 0.01$), with the highest proportion of cases in Gaza (45.4% for males and 51.9% for females). There was no correlation between this risk factor and sex ($\chi^2 = 0.77$, $P > 0.05$).

Being older than 40 years, being obese or having a family history of diabetes and/or CVD increased the risk of developing diabetes or hypertension by 3.5, 1.6 and 1.2 times respectively (Table 3). Moreover, the risk of developing disease increased with increasing number of risk factors in the same person, being 2.7 times the risk in people with 4 risk factors compared with those with only 1 risk factor.

Overall 18.7% of the screened population presented with high blood pressure ($\geq 140/\geq 90$ mmHg), 9.8% had random blood glucose values ≥ 126 mg/dL and 17.7% had random blood cholesterol values ≥ 200 mg/mL (Table 4). Variations were statistically significant between fields (independently of sex) and between the sexes. Of the people who underwent screening 9.0% were diagnosed with hypertension and/or diabetes and were referred to the NCD clinics; 13.6% of these were diagnosed with both conditions. Significant variations were found between fields for females ($\chi^2 = 112.6$, $P < 0.01$) and for males ($\chi^2 = 39.2$, $P < 0.01$), with the highest proportion of cases diagnosed in the Occupied Palestinian Territories and the lowest in Jordan and the Syrian Arab Republic. Males were diagnosed with NCDs more often than females ($\chi^2 = 11$, $P < 0.01$).

Discussion

For the past 20 years there has been a growing awareness of the burden of NCDs in the Eastern Mediterranean Region (EMR). Among NCDs, diabetes and hypertension share a common pathogenesis and complications. CVDs are the major complication of type 2 diabetes, causing 50% or more of all deaths from diabetes as well as substantial morbidity [2]. Moreover the prognosis of hypertension is influenced by associated clinical conditions that include diabetes [3].

CVDs are the major cause of illness and death in the EMR, accounting for 31% of deaths, and almost 26% of the adult population of the Region is estimated to be affected by hypertension [3–5]. The World Health Organization Regional Office for the Eastern Mediterranean has stated that the adult prevalence rate of diabetes in the EMR ranges from as low as 3.5% to as high as 30.0%. [6]. Available estimates suggest

Table 2 Obesity, smoking and family history of diabetes and/or cardiovascular disease by sex and field in the screened Palestine refugees

Area of operation	Obesity ^a				Family history ^b				Smoking			
	Males		Females		Males		Females		Males		Females	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Jordan	280	32.7	957	53.7	323	37.7	536	30.1	411	48.0	150	8.4
Lebanon	72	22.4	168	38.7	68	21.2	107	24.7	191	59.5	173	39.9
Syrian Arab Republic	105	25.0	493	42.7	179	42.6	457	39.6	240	57.1	177	15.3
Gaza Strip	168	34.1	471	41.6	224	45.4	587	51.9	244	49.5	7	0.6
West Bank	102	28.7	429	52.6	137	38.6	393	48.2	155	43.7	50	6.1
Frequency variation by field	$\chi^2 = 20.9$; $P < 0.01$		$\chi^2 = 75.9$; $P < 0.01$		$\chi^2 = 53.9$; $P < 0.01$		$\chi^2 = 204.2$; $P < 0.01$		$\chi^2 = 26.7$; $P < 0.01$		$\chi^2 = 570.4$; $P < 0.01$	
Total	727	29.7	2518	47.4	931	38.1	2080	39.1	1241	50.8	557	10.5
Frequency variation by sex	$\chi^2 = 230$; $P < 0.01$		$\chi^2 = 230$; $P < 0.01$		$\chi^2 = 53.9$; $P < 0.01$		$\chi^2 = 204.2$; $P < 0.01$		$\chi^2 = 26.7$; $P < 0.01$		$\chi^2 = 570.4$; $P < 0.01$	

^aBody mass index ≥ 30 kg/m².

^bPositive family history of diabetes and/or cardiovascular disease.

Table 3 Multivariate analysis of risk factors for diabetes and/or cardiovascular disease in the screened Palestine refugees

Risk factor	Odds ratio	95% CI	P-value
Family history ^a	1.2	1.0–1.5	< 0.05
Age ≥ 40 years	3.5	2.6–4.6	< 0.01
Obesity ^b	1.6	1.4–1.9	< 0.01
Smoking history	1.0	0.8–1.2	> 0.05
2 risk factors ^c	1.6	1.3–2.0	< 0.01
3 risk factors ^c	2.3	1.9–2.9	< 0.01
4 risk factors ^c	2.7	1.8–4.1	< 0.01

Likelihood ratio P-value < 0.01.

^aPositive family history of diabetes and/or cardiovascular disease; ^bbody mass index ≥ 30 kg/m²; ^cversus 1 risk factor.

CI = confidence interval.

that by 2010, 26.6 million people in the Middle East and Northern Africa will be living with diabetes, a number that is expected to double in the next 20 years [7]. Type 2 diabetes is predominant and, as in other regions with a high prevalence of type 2 diabetes, the onset of the disease tends to occur at a relatively young age [8].

The observed epidemiological trend is likely to lead to an increase in the burden of NCDs in future years. The region will have to face the socio-economic consequences of the growing prevalence of NCD-related disease and the economic burden of a growing number of chronic patients requiring medical care. However, the high cost [9] and long duration of treatments for NCD are not the only issues to be faced in the EMR. The Region is tackling the double burden of communicable and noncommunicable diseases [10] and ultimately this is raising sustainability issues, with disparities in access

to treatment between countries and within the same country (according to sex, rural/urban setting and different social and economic status).

The risk factors for diabetes and hypertension used as screening criteria were both modifiable (smoking and obesity) and non-modifiable (family history). Our study shows again that age was the determinant that most strongly correlated with the development of hyperglycaemia or hypertension, increasing the risk 3.5-fold in people aged 40 years or older. The next most important correlates were obesity (1.6-fold higher risk) and family history of diabetes and/or CVD (1.2-fold higher risk). As expected, the greater the number of risk factors, the higher the risk of actually being diagnosed with diabetes/hypertension, confirming the need to specifically target people with multiple risk factors during screening initiatives for NCD.

Almost 70% of the screened population were female, and significant

differences in the frequency of risk detection were observed between males and females for all risk factors except family history of diabetes/CVD. Moreover, the differences among fields in risk factor detection and screening outcomes were statistically significant. This is most probably a manifestation of the diverse social and cultural environments to which the refugees are exposed and the different behavioural patterns between the sexes.

Available data from national and subnational surveys conducted in corresponding territories on the prevalence of obesity was compared with the detection rate for obesity in this study (Table 5). Palestine refugees have higher levels of obesity than the population of the host country in Jordan and Lebanon but not in the Syrian Arab Republic, perhaps because society there is predominantly rural and there may be favourable lifestyle factors such as better access to fruits and vegetables. The high frequency of obesity among refugees in the Occupied Palestinian Territories could be related to a lack of attention to healthier lifestyles, including good nutrition and exercise. However, in fields such as Gaza the lower consumption of certain foods could also be influenced by the limitations imposed on movement of people and goods that account for a poorer choice and higher prices in food markets.

The high prevalence of obesity, however, was not a localized phenomenon as it reflects a more generalized change in the nutrition profile of the population

Table 4 Outcome of screening for high blood pressure, blood sugar and cholesterol in the screened Palestine refugees

Parameter	Screened population		Frequency variation stratified by sex	Frequency variation between sexes
	No.	%		
Blood pressure ≥ 140/≥ 90 mmHg	1453	18.7	Females $\chi^2 = 63$, $P < 0.01$ Males $\chi^2 = 30.6$, $P < 0.01$	$\chi^2 = 35.6$, $P < 0.01$
Random blood glucose ≥ 126 mg/dL	611	9.8	Females $\chi^2 = 54$, $P < 0.01$ Males $\chi^2 = 41$, $P < 0.01$	$\chi^2 = 43.4$, $P < 0.01$
Random blood cholesterol ≥ 200 mg/mL	1020	17.7	Females $\chi^2 = 249$, $P < 0.01$ Males $\chi^2 = 11.1$, $P < 0.05$	$\chi^2 = 14.6$, $P < 0.01$

Table 5 Prevalence of obesity (body mass index ≥ 30 kg/m²) in the host countries and Eastern Mediterranean Region and detection rates in the present study of Palestine refugees

Country/population	Males %	Females %	Source
Jordan			
Host country	10.3	16.2	2002 national survey, age > 18 yrs
Palestine refugees ^a	32.7	53.7	UNRWA 2007
Lebanon			
Host country	14.3	18.8	1997 national survey, age > 20 yrs
Palestine refugees ^a	22.4	38.7	UNRWA 2007
Gaza Strip and West Bank			
Host country	30.0	50.0	2003 survey, Birzeit University
Gaza: Palestine refugees ^a	34.1	41.6	UNRWA 2007
West Bank: Palestine refugees ^a	28.7	52.6	UNRWA 2007
Syrian Arab Republic			
Host country (subnational)	28.8	46.4	2006 Aleppo survey, age 18–65 yrs
Palestine refugees ^a	25.0	42.7	UNRWA 2007
Israel	19.8	25.4	2001 national survey, age 25–64 yrs
Eastern Mediterranean Region	30–60	35–75	Musaiger AO [10]

UNRWA = United Nations Relief and Works Agency for Palestine Refugees in the Near East.

^aData refer only to the Palestinian refugees screened for noncommunicable diseases at UNRWA health centres.

of the EMR. The Food and Agriculture Organization Regional Office for the Near East analysed the nutritional profile of the region, revealing a 2-fold increase in energy and protein availability between 1961 and 1990 and a 3-fold increase in fat availability, with no comparable increase in the availability of vegetables and only a slight increase in the per capita supply of fruits. This resulted in an increase in calorie consumption and an increased prevalence of obesity in the population [1].

The prevalence of tobacco use in the region compared with the smoking detection rate in the UNRWA study showed an opposite trend, with Palestine refugees apparently smoking less than the population of the host country in the Syrian Arab Republic, Lebanon and the West Bank and Gaza Strip (Table 6). However, this could be due to different study designs that may have included tobacco use practices other than cigarette smoking. Specific research on this aspect is currently being carried out.

From a public health perspective, our case-series study strongly suggests that obesity, in particular among women, and smoking, particularly among men, are health priorities in the Palestine refugee population served by UNRWA. For this to be addressed effectively, integration at the community level between educational, curative and preventive interventions is required.

UNRWA's cross-cutting approach to primary health care is certainly an asset in developing activities focusing on NCD prevention in vulnerable communities. The health programme addresses the issue of refugees' health from birth to old age, implementing health prevention and promotion activities at various levels. Moreover, coordination among the health, education and relief programmes brings health education from exclusively medical environments into schools and other community aggregation centres.

The challenges facing UNRWA in the near future are numerous, however.

Table 6 Prevalence of tobacco use in the hosting countries and Eastern Mediterranean Region and smoking detection rates in the present study of Palestine refugees

Country/population	Males %	Females %	Source
Jordan			
Host country	50.5	8.3	2002 national survey, age > 18 yrs
Palestine refugees ^a	48.0	8.4	UNRWA 2007
Lebanon			
Host country	60.7	46.9	1997 national survey, age > 19 yrs
Palestine refugees ^a	59.5	39.9	UNRWA 2007
Gaza Strip and West Bank			
Host country	20.0	18.0	EMRO country profile 2004
Gaza: Palestine refugees ^a	49.5	0.6	UNRWA 2007
West Bank: Palestine refugees ^a	43.7	6.1	UNRWA 2007
Syrian Arab Republic			
Host country (subnational)	62.0	21.0	2004 Aleppo survey, age 18–65 yrs
Palestine refugees ^a	57.1	15.3	UNRWA 2007
Israel	38.6	22.1	2001 national survey, age 25–64 yrs
Eastern Mediterranean Region	34.2	8.7	1998 WHO

UNRWA = United Nations Relief and Works Agency for Palestine Refugees in the Near East; EMRO = World Health Organization Regional Office for the Eastern Mediterranean; WHO = World Health Organization.

^aData refer only to the Palestinian refugees screened for noncommunicable diseases at UNRWA health centres.

The long-term commitment to the refugee population it serves, its growing social and economical vulnerability and the financial constraints of the Agency itself pose sustainability issues. Moreover the changing health needs of the refugees need to be addressed, and this often involves creating or expanding services. Improving communication among fields and programmes will also be essential to coordinate activities in view of the Agency's complexity and the diverse countries/territories in which it operates.

Limitations of the study

The paper presents the results of a case-series study. The study design created certain selection biases. First, screening was conducted only among those accessing UNRWA health clinics and therefore the screened population may not be representative of the Palestine refugee population served by UNRWA. The main consequence of this was

an imbalance in the number of males and females sampled in the study. A second selection bias might have been introduced by the screening criteria. While being older than 40 years justified screening per se, screening of younger people was encouraged only when other risk factors were present. This may have led to an overestimate of the role of age as a risk factor for both hyperglycaemia and hypertension. This limits the possibility of extrapolating the results to the general UNRWA screened population. However, the high numbers enrolled in our study increases the credibility of the results, and the first selection bias was partly addressed in the analysis.

A third selection bias may have been introduced during the data collection. Although homogeneous screening criteria were adopted, the screening process appears to have been adjusted differently, with correspondingly different outcomes, among different fields. For example, Gaza had the highest

proportion of persons screened under age 40 years, the highest proportion of cases with a positive family history and the highest proportion of screened people actually diagnosed with a NCD. This poses questions about the comparability of the results among fields and their extrapolation to the refugee population as a whole.

The possibility of conducting operational research in 5 countries/territories at the same time is both a great asset and a challenge for UNRWA and more efforts are needed to standardize programme implementation and data collection in different fields.

Acknowledgements

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References

1. Boutayeb A, Boutayeb S. The burden of non communicable diseases in developing countries. *International journal for equity in health*, 2005, 4(1):2.
2. International Diabetes Federation [website] (<http://www.diabetesatlas.org/content/what-is-diabetes>, accessed 10 March 2010).
3. Alwan A. Noncommunicable diseases: a major challenge to public health in the region. *Eastern Mediterranean health journal*, 1997, 3:6-16.
4. Khatib O. Noncommunicable diseases: risk factors and regional strategies for prevention and care *Eastern Mediterranean health journal*, 2004, 4:778-88.
5. *Report on the consultation on establishing an integrated regional non communicable disease network. Cairo, Egypt 24-26 June 2001*. Cairo, World Health Organization Regional Office for the Eastern Mediterranean, 2001 (WHO-EM/NCD/027/E/L) (http://whqlibdoc.who.int/emro/2001/WHO-EM_NCD_027_E_L.pdf, accessed 8 February 2010).
6. World Health Organization Regional Office for the Eastern Mediterranean [website] (http://www.emro.who.int/ncd/pdf/Diabetes_in_EMRO.pdf, accessed 10 March 2010).
7. International Diabetes Federation [website] (<http://www.diabetesatlas.org/content/middle-east-and-north-africa>, accessed 10 March 2010).
8. Allgot B et al. *Diabetes atlas*, 2nd ed. Brussels, International Diabetes Federation, 2003.
9. Disease Control Priority Project. *Non-communicable diseases*. Washington DC, International Bank for Reconstruction and Development/World Bank, 2006.
10. Musaiger AO. Overweight and obesity in the Eastern Mediterranean Region: can we control it? *Eastern Mediterranean health journal*, 2004, 10(6):789-93.

Comparison of artificial neural network and binary logistic regression for determination of impaired glucose tolerance/diabetes

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مقارنة بين الشبكة العصبية الاصطناعية والتحوف اللوجستي الثنائي للتعرف على السكري وخلل تحمل الغلوكوز

انوشروان كاظم نجاد، زيبا بتوندي، جواد فردمال

الخلاصة: قارن الباحثون بين نماذج مركزة على الشبكة العصبية الاصطناعية (المدرک المتعدد الطبقات) والتحوف اللوجستي الثنائي، من حيث قدرتهم على التمييز بين الأشخاص غير المصابين بالمرض وبين المصابين بالسكري أو بخلل تحمل الغلوكوز، الذين يشخصون بقياس الغلوكوز بعد الصيام، وقد جمع الباحثون المعطيات الديموغرافية (السكانية) والقياسات البشرية والسريية من 7222 مشارك في الدراسة من تتراوح أعمارهم بين 30 و88 عاماً في دراسة السكر والشحوم في طهران. وبلغت القيمة الإحصائية لكابا كوهين 0.229 بالنسبة للتحوف اللوجستي، و0.218 بالنسبة للمدرک، وبلغت المساحة تحت المنحى ROC 0.760 بالنسبة للتحوف اللوجستي، و0.770 بالنسبة للمدرک. ولم يكن هناك فرق في الأداء بين النماذج استناداً إلى التحوف اللوجستي والشبكة العصبية الاصطناعية من حيث التفريق بين المصابين بخلل تحمل الغلوكوز والسكري وغير المصابين بالمرض.

ABSTRACT Models based on an artificial neural network (the multilayer perceptron) and binary logistic regression were compared in their ability to differentiate between disease-free subjects and those with impaired glucose tolerance or diabetes mellitus diagnosed by fasting plasma glucose. Demographic, anthropometric and clinical data were collected from 7222 participants aged 30–88 years in the Tehran Lipid and Glucose Study. The kappa statistics were 0.229 and 0.218 and the area under the ROC curves were 0.760 and 0.770 for the logistic regression and perceptron respectively. There was no performance difference between models based on logistic regression and an artificial neural network for differentiating impaired glucose tolerance/diabetes patients from disease-free patients.

Comparaison d'un réseau de neurones artificiels et de la régression logistique binaire dans la détermination de l'altération de la tolérance au glucose et du diabète

RÉSUMÉ Des modèles reposant sur un réseau de neurones artificiels (de type perceptron multicouche) et sur la régression logistique binaire ont été comparés. Ce parallèle portait sur leur capacité de différenciation entre sujets sains et individus présentant une altération de la tolérance au glucose ou un diabète sucré diagnostiqué par glycémie à jeun. Les données démographiques, anthropométriques et cliniques des 7 222 participants, âgés de 30 à 88 ans, de l'étude sur les lipides et le glucose réalisée à Téhéran ont été récupérées. Le test statistique Kappa de Cohen a permis d'obtenir des coefficients de 0,229 et 0,218 et les aires sous les courbes ROC étaient de 0,760 et 0,770 pour la régression logistique et le modèle de type perceptron, respectivement. Aucune différence n'a été constatée entre le modèle de régression logistique et celui reposant sur un réseau de neurones artificiels en termes de performance de distinction entre sujets sains et patients présentant une altération de la tolérance au glucose ou un diabète.

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Introduction

Artificial intelligence has been proposed as a reasoning tool to support clinical decision-making since the earliest days of computing [1–5]. Artificial neural networks are a computer modelling technique based on the observed behaviours of biological neurons [6]. This is a non-parametric pattern recognition method which can recognize hidden patterns between independent and dependent variables [7].

In 1957, Rosenblatt invented the perceptron, an artificial neuron, in which dendrites are replaced by weighted inputs that are summed inside the artificial neuron and pass through a suitable threshold (activation) [8]. The activated outputs transfer from inner to output layers and produce an output to simulate a desired output (target) at the end. By a learning algorithm, the neural net achieves a form of learning by modifying weights proportional to the difference between the target and the gained output [9]. A typical multilayer perceptron is illustrated in Figure 1. Artificial neural networks have been applied to diagnosis and decision-making in various medical fields [10–14].

Statistical methods such as discriminant analysis and logistic regression have commonly been used to develop models for clinical diagnosis and treatment [3]. But studies published in recent years have reported that the artificial

neural networks approach improves prediction in several situations including prognosis of breast cancer in women after surgery [15], modelling for surgical decision-making for patients with traumatic brain injury [3] and survival of alcoholic patients with severe liver disease [14]. In contrast, others have reported that artificial neural networks and statistical models yielded similar results [7,16].

Diabetes mellitus (DM) is a common chronic disease in the adult population and is associated with a significantly increased risk of micro- and macrovascular disease. DM is frequently insidious in onset and patients may be relatively symptom-free for years before diagnosis. In the Islamic Republic of Iran, there are about 3 million individuals affected by DM and with increasing urbanization, the prevalence of DM is rising rapidly. There is thus an urgent need to identify and manage patients with DM, especially in groups at higher risk for the disease and its complications [17].

In this study, we developed a multilayer perceptron artificial neural network to differentiate between disease-free subjects and those with impaired glucose tolerance (IGT) or DM and compared the accuracy of this model with the more traditional method of binary logistic regression for the prediction of patients' glucose metabolism status.

Methods

Study population

The data for the study were obtained from the database of the Tehran Lipid and Glucose Study (TLGS), which was conducted to determine the risk factors for atherosclerosis among Tehran's urban population, to develop population-based measures to change the lifestyle of the population and to prevent the rising trend of DM and dyslipidaemia [18]. For the TLGS, cluster random sampling was used to recruit 15 000 people from the 13th district of urban Tehran, the capital of the Islamic Republic of Iran. Among this population, 7222 adults aged 30–88 years (43.2% male and 56.8% female) who had no prior record of DM and had complete information were the subjects of the present study. Data were collected at the TLGS clinic between February 1999 and August 2001.

Patients' demographic and clinical characteristics

Fasting plasma glucose (FPG) level was used to classify the glucose metabolism status of each subject according to American Diabetes Association (ADA) criteria [19]. A blood sample was drawn into vacutainer tubes between 07:00 and 09:00 hours from all study participants after a 12–14 hour overnight fast. Subjects were classified as: normal glucose or disease-free ($\text{FPG} < 110 \text{ mg/dL}$); IGT ($\text{FPG} \geq 110 < 126 \text{ mg/dL}$); or diabetic ($\text{FPG} \geq 126 \text{ mg/dL}$).

The demographic and clinical data used as predictors in the models were: patient's age, body mass index (BMI), waist-to-hip ratio (WHR), history of hypertension and history of diagnosis of hyperlipidaemia. Hypertension was defined as any prior diagnosis of hypertension by a physician or if the patient was taking antihypertensive medication at the time of interview or in the previous 1 month. Weight and height were measured according to standard protocols. BMI was calculated by dividing the weight (kilogram) by the

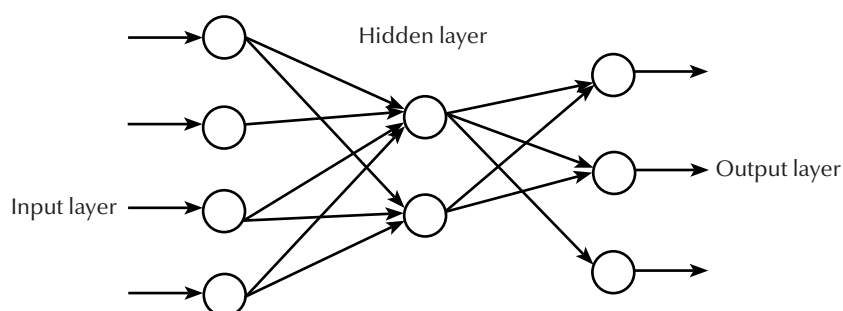


Figure 1 Typical multilayer perceptron model with 4 neurons in the input layer, 2 in the hidden layer and 3 in the output layer and with no direct connection from input to output layers

square of height (metres). WHR was the waist circumference measured at the level of the umbilicus divided by the hip circumference measured over light clothing at the widest girth of the hip.

Prediction models

We applied 2 different models to the patient data. The first was a standard binary logistic regression analysis. The second was a standard feed-forward error back-propagation multilayer perceptron with a 3-layer topology (input, hidden and output layers) with 4 neurons in the hidden layer and no direct connection from the input to output layers [9]. Given enough hidden nodes and sufficient data, it can approximate any function to any desired degree of accuracy. The error back-propagation learning algorithm is a powerful approach and, despite its slow convergence, is one of the most popular and successful algorithms for pattern recognition.

The 2 different models were compared in their ability to predict glucose metabolism status from the patients' demographic and clinical data. To do this we first merged the subjects in the

DM and IGT groups. Then we split the database into 2 groups: a training dataset containing approximately 75% of the sample and a testing dataset containing approximately 25% of subjects. The training dataset was used to develop the logistic regression and perceptron models by introducing the disease status of subjects (according to ADA criteria) into the models. The testing dataset was used by the models for predicting the glucose tolerance status of subjects.

Comparison tools were the kappa measurement of agreement and the area under the receiver operating characteristics (ROC) curve. The ROC curve was obtained by plotting 1 minus the specificity rate against the sensitivity rate for all possible cut-off points.

Software

The neural network development software used in this study was R, version 2.5.0 package (nnet version 7.2-290) (R is an open-source system available at <http://www.r-project.org>). Other statistical analyses, including descriptive statistics and analysis of variance (ANOVA) to compare mean values

and the binary logistic regression, were performed using SPSS, version 13.0.

Results

Patients' clinical characteristics

Among 7222 participants aged 30 years or over, 629 (8.7%) suffered from DM, 418 (5.8%) had IGT and the remainder were disease-free by ADA criteria.

The mean age in this study was 47.7 [standard deviation (SD) 12.5] years overall and 46.4 (SD 12.3) years for the disease-free group (Table 1). One-way ANOVA indicated that the mean age of the 3 groups was significantly different ($P < 0.001$) and Tukey *post hoc* multiple comparison test showed that the disease-free group was younger than the DM ($P < 0.001$) and IGT patients ($P < 0.001$).

Those in the disease-free group had a lower mean BMI than those in the DM ($P < 0.001$) and IGT groups ($P < 0.001$) Table 1. The lowest and the highest WHR were 0.56 and 1.45 respectively. Subjects in the DM and IGT groups had higher WHR

Table 1 Characteristics of subjects in different fasting plasma glucose status groups

Variable	Disease-free (n = 6175)		IGT (n = 418)		DM (n = 629)		Total (n = 7222)
	Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)
Age (years)	46.4 (12.3)		52.9 (12.0)		57.0 (10.2)		47.7 (12.5)
Anthropometric measures							
BMI (kg/m ²)	27.3 (4.5)		29.5 (4.9)		28.8 (4.6)		27.6 (4.6)
WHR	0.88 (0.08)		0.93 (0.08)		0.94 (0.08)		0.89 (0.09)
	No.	%	No.	%	No.	%	No.
Sex							
Male	2704	43.8	179	42.8	239	38.0	3122
Female	3471	56.2	239	57.2	390	62.0	4100
History of hyperlipidaemia							
Yes	1379	22.3	152	36.4	321	51.0	1852
No	4796	77.7	266	63.6	308	49.0	5370
History of hypertension							
Yes	931	15.1	128	30.6	239	38.0	1298
No	5244	84.9	290	69.4	390	62.0	5924

SD = standard deviation.

IGT = impaired glucose tolerance; DM = diabetes mellitus; BMI = body mass index; WHR = waist-to-hip ratio.

than those in the disease-free group (Table 1).

The chi-squared test indicated that there was a significant association between glucose tolerance status and history of hyperlipidaemia ($P < 0.001$). Table 1 shows that the IGT and particularly the DM groups had a higher proportion of subjects with a positive history of hyperlipidaemia compared with the disease-free group (36.4%, 51.0% and 22.3% for the IGT, DM and disease-free groups respectively). Participants with DM or IGT were more likely to have a positive history of hypertension than those diagnosed as disease-free (30.6%, 38.0% and 15.1% for IGT, DM and disease-free groups respectively). The association between glucose tolerance status and history of hypertension was significant ($P < 0.001$).

Table 2 illustrates the glucose tolerance status of the training and testing datasets of the sample.

Comparison of models

Using binary logistic regression all factors were significantly associated with glucose tolerance status (Table 3). Age, sex, BMI and WHR were significant risk factors for DM. Meanwhile, those who were suffering from hyperlipidaemia or hypertension had a higher risk of DM and IGT.

Table 4 shows the true and predicted status of subjects in the training and testing datasets as well as for all subjects. Binary logistic regression correctly classified 72.2% of cases with IGT or DM in the training dataset, 71.0% in the testing set and 71.9% of all subjects. The area under the ROC curve for this model was 0.760 and the kappa statistic was 0.229, showing that the emerged classification was not due to chance ($P < 0.001$).

The sensitivities of the perceptron for the training and testing datasets and for all subjects were 79.4%, 77.1% and

Table 2 Distribution of fasting plasma glucose status of the samples in the training and testing datasets

Variable	Training dataset		Testing dataset		Total
	No.	%	No.	%	No.
Disease-free	4673	75.7	1502	24.3	6175
IGT or DM	802	76.6	245	23.4	1047
Total	5475	75.8	1747	24.2	7222

IGT = impaired glucose tolerance; DM = diabetes mellitus.

78.9% respectively (Table 5). These values were obtained using 0.136 as the cut-off point. Based on Table 5, the specificities of ANN for the training, testing and total of the dataset were 62.2%, 59.4% and 61.5% respectively. kappa statistic was 0.218 which was significantly different from zero. The area under the ROC curve for this model was 0.770.

Discussion

In this study, we used the TLGS database to develop models to try to distinguish patients with IGT or DM from disease-free patients. The accuracy of the perceptron and binary logistic regression models in predicting a subject's glucose tolerance status were compared using the kappa statistic and the area under the ROC curve. The kappa value for logistic regression (0.229) was slightly higher than for the perceptron (0.218). Although the kappa values were significantly different

from zero, they were far from 1. The small number of covariates may be responsible for the low kappa values and the large number of subjects may be the cause of the significance. Therefore in terms of the kappa statistic the neural network model did not perform better than binary logistic regression. Also, the area under the ROC curve was barely different in the 2 models (0.760 for logistic regression and 0.770 for perceptron). The 2 models not only resulted in almost the same confusion matrix for the training dataset, but also for the testing dataset.

For binary logistic regression, a good model depends on determining the relation of the mean response (or logit function of it) to the predictor(s). But it is sometimes difficult to guess the appropriate form for this relationship. Nevertheless, logistic regression can identify the effect and the direction of each factor on the (mean) response.

On the other hand, artificial neural networks are useful tools for prediction

Table 3 Odds ratios and coefficients of binary logistic regression analysis of factors associated with glucose tolerance status

Characteristic	Coefficient	SE	OR	95% CI
Intercept	-9.954	0.531**	–	–
Sex (male)	-0.244	0.098*	0.78	0.65–0.95
Age	0.040	0.004**	1.04	1.03–1.05
History of hyperlipidaemia	0.573	0.085**	1.77	1.50–2.10
History of hypertension	0.247	0.098*	1.28	1.06–1.55
BMI	0.061	0.010**	1.06	1.04–1.08
WHR	4.680	0.611**	1.60	1.42–1.80 ^a

* $P < 0.05$; ** $P < 0.01$.

^aComputed for 0.1 increase in WHR.

SE = standard error; OR = odds ratio; CI = confidence interval; BMI = body mass index; WHR = waist-to-hip ratio.

Table 4 Number of correct diagnoses of glucose tolerance status using binary logistic regression model

True status	Predicted status using logistic regression		
	Disease-free	IGT or DM	Total
	No.	No.	No.
<i>Training dataset</i>			
Disease-free	3148	1525	4673
IGT or DM	223	579	802
Total	3371	2104	5475
<i>Testing dataset</i>			
Disease-free	985	517	1502
IGT or DM	71	174	245
Total	1056	691	1747
<i>Overall</i>			
Disease-free	4133	2042	6175
IGT or DM	294	753	1047
Total	4427	2795	7222

IGT = impaired glucose tolerance; DM = diabetes mellitus.

Table 5 Number of correct diagnoses of glucose tolerance status using multilayer perceptron model

True status	Predicted status using perceptron		
	Disease-free	IGT or diabetic	Total
	No.	No.	No.
<i>Training dataset</i>			
Disease-free	2907	1766	4673
IGT or DM	165	637	802
Total	3072	2403	5475
<i>Testing dataset</i>			
Disease-free	892	610	1502
IGT or DM	56	189	245
Total	948	799	1747
<i>Overall</i>			
Disease-free	3799	2376	6175
IGT or DM	221	826	1047
Total	4020	3202	7222

IGT = impaired glucose tolerance; DM = diabetes mellitus.

when the form of the relation is unknown. Determining the factor contributions in artificial neural networks models, however, is intrinsically difficult. Unlike traditional statistical models, neural networks do not help in identifying the most statistically influential input factor. The complexity of neural

networks makes it difficult to relate their output to input. Hart and Wyatt argued that this "black box" aspect is the major barrier to the acceptance of neural networks for medical decision systems [20]. If prediction is the only objective, then neural network models provide acceptable results whereas binary logistic

regression could also identify the effect of factors on the classification.

We conclude that this study did not demonstrate a significant performance difference between models based on logistic regression and an artificial neural network for differentiating IGT and DM patients from disease-free ones.

References

1. Alonso-Betanzos A et al. Applying statistical uncertainty-based and connectionist approaches to the prediction of fetal outcome: a comparative study. *Artificial intelligence in medicine*, 1999, 17(1):37-57.
2. Lisboa PJA. A review of evidence of health benefit from artificial neural networks in medical intervention. *Neural networks*, 2002, 15:11-39.
3. Li YC, Chiu WT, Jian WS. Neural networks modeling for surgical decisions on traumatic brain injury patients. *International journal of medical informatics*, 2000, 57:389-405.
4. Schwartz WB. Medicine and the computer: the promise and problems of change. *New England journal of medicine*, 1970, 283:1257-64.
5. Shortliffe EH. The adolescence of AI in medicine: will the field come of age in the '90s? *Artificial intelligence in medicine*, 1993, 5(2):93-106.
6. Park J, Edington DE. A sequential neural network model for diabetes prediction. *Artificial intelligence in medicine*, 2001, 23(3):277-93.
7. Ergun U et al. Classification of carotid artery stenosis of patients with diabetes by neural networks and logistic regression. *Computers in biology and medicine*, 2004, 34:389-405.
8. Rosenblatt F. *The perceptron: a perceiving and recognizing automation*. Cornell Aeronautical Laboratory report 85-460-1. Ithaca, New York, Cornell Aeronautical Laboratory, 1957.
9. Bishop CM. *Neural networks for pattern recognition*. Oxford, Oxford University Press, 1995.
10. Ronco AL. Use of artificial neural networks in modeling associations of discriminant factors: towards an intelligent selective breast cancer screening. *Artificial intelligence in medicine*, 1999, 16(3):299-309.
11. Kennedy RL et al. An artificial neural network system for diagnosis of AMI in the accident and emergency department: evaluation and comparison with serum myoglobin measurements. *Computer methods and programs in biomedicine*, 1997, 52(2):93-103.
12. Cross SS et al. Image analysis of low magnification images of fine needle aspirates of the breast produces useful discrimination between benign and malignant cases. *Cytopathology*, 1997, 8:265-73.
13. Dybowski R, Gant V. Artificial neural network in pathology and medical laboratories. *Lancet*, 1995, 346:1203-7.
14. Lapuerta P, Rajan S, Bonacini M. Neural networks of outcomes in alcoholic patients with severe liver disease. *Hepatology*, 1997, 25:302-6.
15. Lisboa PJA et al. A Bayesian neural networks approach for modeling censored data with an application to prognosis after surgery for breast cancer. *Artificial intelligence in medicine*, 2003, 28(1):1-25.
16. Tafeit E et al. The determination of three subcutaneous adipose tissue compartments in non-insulin-dependent diabetes mellitus women with artificial neural networks and factor analysis. *Artificial intelligence in medicine*, 1999, 17:181-93.
17. Azizi F et al. Distribution of blood pressure and prevalence of hypertension in Tehran adult population: Tehran Lipid and Glucose Study (TLGS), 1999-2000. *Journal of human hypertension*, 2002, 16(5):305-12.
18. Azizi F, Rahmani M, Emami H. Tehran Lipid and Glucose Study: rationale and design. *CVD prevention*, 2000, 3:242-7.
19. The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes care*, 1997, 20:1183-97.
20. Hart A, Wyatt J. Evaluating black boxes as medical decision-aids: issues arising from a study of neural networks. *Medical informatics*, 1990, 15:229-36.

Note from the Editor

We wish to draw the kind attention of our potential authors to the importance of applying the editorial requirements of EMHJ when preparing their manuscripts for submission for publication. These provisions can be seen in the Guidelines for Authors, which are available online at <http://www.emro.who.int/emhj.htm>, and are published at the end of the first issue of each volume. We regret that we are unable to consider papers that do not conform to the Guidelines.

Control of diabetes mellitus in the Eastern province of Saudi Arabia: results of screening campaign

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تضيق السكري في الولايات الشرقية من المملكة العربية السعودية: نتائج حملة التحري

نضيرة عباس البغلي، خالد عبد الرحمن التركي، عقيل جمعان الغامدي، أحمد قاسم الزبير، محمود محمد الأمير، فاضل عباس البغلي

الخلاصة: لتقييم وضع تضيق السكري في الولايات الشرقية من المملكة العربية السعودية، دعا الباحثون جميع السكان السعوديين ممن تزيد أعمارهم عن 30 عاماً للمساهمة في حملة تحري شملت 197 681 شخصاً اتضح أن 15.7% منهم كانوا مشخصين على أنهم سكريين. وقد جمع الباحثون المعطيات الاجتماعية والديموغرافية والسريية من المرضى. واتضح أن 33.8% من المرضى قد وصلوا إلى مستوى الغلوكوز المستهدف (أقل من 130 ميلي غرام/ديسي لتر في دم الأوعية الشعرية على الصيام وأقل من 180 ملي غرام عشوائياً). وأوضح التحوف اللوجستي المتعدد أن تقدّم العمر والتدخين الحالي وانخفاض مستوى النشاط البدني يترافقون إلى مستوى يُعتد به إحصائياً مع عدم ضبط السكري. ويترافق ارتفاع ضغط الدم ترافقاً إيجابياً مع ضبط السكر. إن المعدل الإجمالي لضبط سكر الدم منخفض لدى عامة السكان في هذه الولايات.

ABSTRACT To assess the status of diabetes mellitus (DM) control in the Eastern province of Saudi Arabia, all Saudi Arabian residents aged 30 years and above were invited to participate in a screening campaign. Of 197 681 participants screened 15.7% had a previous diagnosis of DM. Sociodemographic and clinical data were collected from these patients. Only 33.8% of patients were achieving their glycaemic control target (fasting or random capillary blood glucose < 130 mg/dL or < 180 mg/dL respectively). Multiple logistic regression analysis showed that higher age, current smoking and lower level of physical activity were significantly associated with uncontrolled DM. Hypertension was positively associated with glycaemic control. The overall rate of diabetes control is unacceptably low in the general population of this province.

Contrôle du diabète sucré dans la province orientale d'Arabie saoudite : résultats de la campagne de dépistage

RÉSUMÉ En vue d'évaluer l'état de la lutte contre le diabète sucré dans la province orientale de l'Arabie saoudite, tous les habitants âgés de 30 ans et plus ont été invités à participer à une campagne de dépistage. Sur les 197 681 personnes dépistées, 15,7 % présentaient un diagnostic antérieur de diabète sucré. Les données sociodémographiques et cliniques de ces patients ont été recueillies. Seuls 33,8 % d'entre eux atteignaient leur objectif de contrôle glycémique (glycémie à jeun ou glycémie aléatoire dans le sang capillaire < 130 mg/dl ou < 180 mg/dl, respectivement). Une analyse de régression logistique multiple a montré qu'un âge avancé, le tabagisme au moment de l'étude et une faible activité physique étaient significativement associés à un diabète sucré non contrôlé. Une corrélation positive a également été observée entre hypertension artérielle et contrôle glycémique. La faiblesse du taux global de contrôle du diabète au sein de la population de cette province en général n'est pas acceptable.

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Introduction

Diabetes mellitus (DM) is accompanied by long-term microvascular, neurological and macrovascular complications [1]. Glycaemic control is fundamental to the management of diabetes. The United Kingdom Prospective Diabetes Study (UKPDS) [2,3] and other randomized controlled trials [4] have demonstrated the effectiveness of good control of DM in the reduction of clinically important retinopathy, including vision-threatening lesions, and of nephropathy and neuropathy. Meta-analysis of the evidence similarly supports the potential of glycaemic control in reducing cardiovascular disease (CVD) [5]. Additional analysis indicates that therapy to achieve near normalization of blood glucose levels is cost effective compared with other treatments [6,7].

On the other hand, it has been found that, while tight glycaemic control decreases the risk of microvascular complications, it carries the risk of developing hypoglycaemia and weight gain [8]. Hence the goal of therapy is to achieve blood glucose as close to normal as possible while avoiding hypoglycaemia.

The recent recommendations of the American Diabetes Association for glycaemic control targets in adults are a glycosylated haemoglobin (HbA1c) level < 7.0%, pre-prandial capillary plasma glucose (CPG) 70–130 mg/dL (3.9–7.2 mmol/L) and a peak post-prandial CPG < 180 mg/dL (< 10.0 mmol/L) [9].

In Saudi Arabia, there is a scarcity of published epidemiological data on glycaemic control in DM and the factors associated with it. The aim of this study was to assess the pattern of follow-up and status of glycaemic control in patients with a previous diagnosis of DM according to their sociodemographic and clinical risk factors.

Methods

This study was part of a larger screening campaign conducted in the Eastern province of Saudi Arabia between 28 August 2004 and 18 February 2005. The methodology has been described previously [10]. A scientific committee established the detailed procedures for the campaign, including the standards for running the campaign, validation of instruments and health education materials to be used, staff training, financial supervision and data processing and entry. A media campaign was organized in each health sector (district) of the province using written and audiovisual materials, and posters on billboards in the streets and other public places.

Sample

The target population was all Saudi Arabian residents of the Eastern province of Saudi Arabia, aged 30 years and above, excluding pregnant women (650 000 subjects). They were invited to participate in a screening campaign for the early detection of DM and hypertension by attending one of the 300+ examination centres distributed in all primary health care centres, all government hospitals and most private hospitals and dispensaries, in addition to mobile teams in public venues.

The analysis described in this paper included only those participants who were previously diagnosed diabetics being managed by dietary methods or antidiabetic drugs; those who were newly diagnosed with DM during the campaign were excluded.

Data collection

A structured questionnaire for data collection was developed using information obtained from focus groups and was validated by experts in the fields of DM and hypertension. Specially trained members of health teams interviewed the participants and completed the questionnaire. Information

was recorded about age, sex, place of residence, marital status, occupation, education, family income, physical activity and smoking. Current smoking was defined by subjects' self-reports as having ever smoked > 100 cigarettes and currently smoking, every day or occasionally, for 1 month or more before the campaign any tobacco products including waterpipe (*shisha*). This group was compared with nonsmokers (ex- and never smokers). Physical activity at work or leisure was grouped into 4 categories: no physical activity (completely sedentary lifestyle, e.g. reading, watching TV); mild physical activity (< 3 hours per week, e.g. ordinary housework, walking), moderate exercise (3+ hours exercise per week, e.g. cycling or walking); and strenuous physical activity (5+ hours per week, e.g. jogging or swimming).

Clinical data were also obtained. Participants were asked if they had been previously diagnosed with DM and were being treated for high blood glucose and, if so, the place of treatment. The participants underwent measurements of weight, height, blood pressure and CPG. Body mass index (BMI) was calculated as weight in kilograms divided by height in metres squared. BMI 25.0–29.9 kg/m² was classified as overweight, BMI ≥ 30.0 kg/m² as obese, and BMI 18.5–24.9 kg/m² as normal. Blood pressure (BP) was measured and hypertension was diagnosed based on the recommendations of the 7th report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VII) [11]. Whole blood glucose concentration was measured using a portable glucometer, based on reflectance photometry. Glycaemic control targets were defined as preprandial CPG < 130 mg/dL after fasting for > 8 hours or random postprandial CPG < 180 mg/dL. Patients with CPG levels above those readings were defined as having uncontrolled glycaemia. Family

history of DM and personal history of CVD were also recorded.

Coordinators were assigned for each sector to supervise the examination centres, to ensure all forms were completed, to follow up defaulters and to liaise with coordinators in other health sectors and the main supervision committees. The forms were collected from each sector and were double-checked for completeness. Ineligible people were excluded and forms with incomplete data or unconfirmed results were sent back to the health sectors with a covering letter for corrections to be made.

The participants were assured of the confidentiality of the information collected, after explaining the purpose of the campaign. In addition, health education materials were distributed to high-risk groups.

Data analysis

The differences between previously diagnosed diabetics with controlled and uncontrolled glycaemia were assessed using analysis of variance (ANOVA). The chi-squared test was used to assess the relationship between glycaemic control and socioeconomic and

clinical risk factors. Cardiovascular risk factors found to be associated with uncontrolled DM were included in the multiple logistic regression and age and sex were included in the model. Age was treated as a continuous measure and the other variables as categorical measures. The odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. P value < 0.05 was considered statistically significant.

Results

Prevalence of DM and patients' background characteristics

Data were missing for 912 people (0.5%) out of the total of 197 681 participants in the campaign. The prevalence of previously diagnosed DM was 15.7% ($n = 30\,798$), constituting 30.4% of the target population. A higher proportion of the women were diagnosed with DM (16 307, 16.9%) than the men (14 486, 14.4%), $P < 0.001$.

Among these previously diagnosed diabetics, 97.5% were receiving treatment through different health care facilities, most commonly Ministry of

Health (MOH) facilities (65.0%), followed by other government hospitals (17.9%) or private facilities (11.8%), while (2.8%) were treated in multiple health care facilities; for 1214 subjects the place of treatment was unknown.

CPG values were obtained for 30 749 (99.8%) of these patients with previously diagnosed DM. Of these, 10 384 (33.8%) were achieving the glycaemic control target. Random CPG was obtained for 22 348 patients, 37.1% of whom had controlled glycaemia (< 180 mg/dL). Fasting CPG level was obtained for 8401 patients and 24.9% had controlled fasting CPG levels (< 130 mg/dL).

Table 1 shows the mean fasting CPG and random CPG levels according to age and sex. In men the mean fasting CPG did not vary significantly with age, whereas random CPG increased with age and reached its peak in the age group 60–69 years ($P < 0.001$). For women the fasting CPG levels increased significantly with age, peaking in the age group 50–59 years ($P < 0.001$), while random CPG reached its peak in the age group 60–69 years. Women in general had higher mean fasting CPG

Table 1 Mean fasting and random capillary blood glucose (CBG) levels by age in men and women with previously diagnosed diabetes mellitus

Sex/age (years)	No.	Fasting CBG (mg/dL) Mean (SD)	<i>P</i> -value	No.	Random CBG (mg/dL) Mean (SD)	<i>P</i> -value
Men						
30–39	344	180.9 (81.8)	0.265	1 878	223.9 (110.4)	< 0.001
40–49	696	181.9 (73.8)		3 657	232.1 (106.3)	
50–59	701	183.8 (74.3)		3 059	236.4 (107.0)	
60–69	703	185.2 (77.6)		1 941	240.4 (105.7)	
70+	394	174.8 (73.2)		1 005	239.1 (108.1)	
Total	2 838	182.1 (75.8)		11 540	233.9 (107.3)	
Women						
30–39	608	185.0 (90.0)	< 0.001	1 868	213.1 (106.6)	< 0.001
40–49	1 688	194.7 (82.2)		3 866	231.9 (110.4)	
50–59	1 689	197.5 (81.1)		2 781	239.4 (110.0)	
60–69	1 025	188.4 (75.2)		1 502	239.5 (107.5)	
70+	508	183.4 (77.6)		641	239.4 (108.7)	
Total	5 518	192.3 (81.2)		10 658	232.1 (109.5)	

SD = standard deviation.

levels but lower mean random CPG levels than men ($P < 0.001$).

Blood pressure measurements showed that 14 423 (46.9%) patients had systolic blood pressure < 130 mmHg, 8794 (28.6%) had diastolic blood pressure < 80 mmHg and 6926 (22.5%) had blood pressure within the range currently recommended by the American Diabetes Association (systolic < 130 mmHg and diastolic < 80 mmHg).

Relationship between glycaemic control and patients' characteristics

The proportion of patients with controlled glycaemia was generally higher in the younger age groups (Table 2). More men than women had glycaemic control ($P < 0.001$). The highest rate of glycaemic control was found in patients managed at private health facilities and the lowest among those managed in multiple health care facilities, followed by those managed in MOH health care facilities ($P < 0.001$).

The highest rate of glycaemic control was recorded among patients whose marital status was single and

those with professional employment, while the lowest was noted among the widowed and self-employed ($P < 0.001$) (Table 3). The proportion of patients with controlled glycaemia increased as the level of education and income increased ($P < 0.001$).

Table 4 shows the distribution of glycaemic control in relation to geographic sectors of the Eastern province. The highest rate of glycaemic control was among patients in Khober and the lowest was in Qaria Olaya. Lower rates of glycaemic control were recorded in rural than in urban areas [588 (22.7%) versus 9795 (34.8%) ($P < 0.001$)].

Risk factors for poor glycaemic control

Table 5 shows the comorbidity risk factors for patients diagnosed with DM compared with the total screened participants. The most prevalent associated risk factors for previous diagnosis of DM were positive family history of DM (19.0%), positive history of CVD (47.0%), hypertension (41.0%), obesity (19.4%) and low physical activity (18.5%), while those diagnosed with DM were less likely to

be current smokers than subjects without a previous diagnosis of DM (12.1%) ($P < 0.001$).

The distribution of glycaemic control in patients with previously diagnosed DM in relation to the same risk factors is shown in Table 6. Significantly more patients who were hypertensive had controlled CPG level than those who were pre-hypertensive or non-hypertensive. Regarding BMI, the highest rate of glycaemic control was among patients who were obese, followed by those who were overweight ($P < 0.002$). On the other hand, no significant association was observed in the rate of glycaemic control comparing those with and without a history of CVD or comparing current smokers with non-smokers.

Multiple logistic regression analysis, with blood glucose control as the dependent variable, was performed to evaluate which factors were independently associated with glycaemic control in patients with diagnosed DM (Table 7). Increasing age was significantly associated with uncontrolled DM (OR = 1.02; 95% CI: 1.01–1.02, $P < 0.001$),

Table 2 Distribution of patients with controlled and uncontrolled glycaemia by age, sex and place of follow up

Variable	Total no.	Controlled glycaemia		Uncontrolled glycaemia		P-value
		No.	%	No.	%	
Age (years)						
30–39	4 697	1 954	41.6	2 743	58.4	< 0.001
40–49	9 904	3 433	34.7	6 471	65.3	
50–59	8 229	2 594	31.5	5 635	68.5	
60–69	5 170	1 541	29.8	3 629	70.2	
70+	2 547	801	31.4	1 746	68.6	
Sex^a						
Male	14 461	4 980	34.4	9 481	65.6	0.022
Female	16 270	5 401	33.2	10 869	66.8	
Place of follow-up						
MOH facility	19 192	5 739	29.9	13 483	70.1	< 0.001
Other government hospital	5 302	1 983	37.4	3 319	62.6	
Private facility	3481	1 439	41.3	2 042	58.7	
Multiple places	825	245	29.7	580	70.3	

^aData missing for some patients.

SD = standard deviation; MOH = Ministry of Health

Table 3 Distribution of patients with controlled and uncontrolled glycaemia by socioeconomic status

Variable	No.	Controlled glycaemia		Uncontrolled glycaemia	
		No.	%	No.	%
Marital status***					
Single	468	209	43.0	277	57.0
Married	26 439	9 009	34.1	17 430	65.9
Widowed	3 004	915	30.5	2 089	69.5
Divorced	536	166	31.0	370	69.0
Occupation***					
Self-employed	3 029	924	30.5	2 105	69.5
Housewife	13 964	4 595	32.9	9 369	67.1
Military	1 889	692	36.1	1 207	63.9
Professional	1 722	687	39.8	1 040	60.2
Technical	924	358	38.7	566	61.3
Non-technical	1 036	306	29.6	730	70.5
Administrative	3 557	1 392	39.1	2 165	60.9
Unemployed	3 765	1 173	31.2	2 592	68.8
Education***					
Illiterate	13 186	3 807	28.9	9 379	71.1
Read & write	3 082	1 007	32.7	2 075	75.3
Primary	4 411	1 534	34.8	2 877	65.2
Intermediate	3 080	1 174	38.1	1 906	61.9
Secondary	3 810	1 543	40.5	2 267	59.5
University	2 218	987	44.5	1 231	55.5
Higher degree	182	90	49.5	92	50.5
Income (Saudi riyals per month)***					
< 2000	7 764	2 367	30.5	5 397	69.5
2000-< 5000	7 612	2 411	31.7	5 201	68.3
5000-< 7000	4 120	1 455	35.3	2 665	64.7
> 7000	6 083	2 471	40.6	3 612	59.4

***P < 0.001

and glycaemic control was also less common among patients who were current smokers (OR = 1.11; 95% CI: 1.02–1.20, $P = 0.018$) or who had a sedentary level of physical activity. On the other hand, being hypertensive was positively associated with glycaemic control (OR = 0.80; 95% CI: 0.76–0.85, $P < 0.001$).

Moderate or strenuous physical activity, sex, BMI, being pre-hypertensive or having a history of CVD did not show any significant association with glycaemic control.

Discussion

The importance of glycaemic control in the management of DM has been highlighted by the Diabetes Control and Complications Trial [12], which found an approximately 50% to 70% reduction in the risk for retinopathy, nephropathy and neuropathy when there was intensive therapy for type 1 DM. Similar dramatic reductions in the risk of microvascular complications in type 2 DM were found in the United Kingdom Prospective Diabetes Study [3]. However, the standard of care for DM

is suboptimal in most clinical settings [13–15]. In our study only one-third of diabetic patients achieved the recommended glycaemic level and less than one-quarter of them had blood pressure control. Data from the National Health and Nutrition Examination Survey in 1999–2000 showed that 35.8% of diabetics had achieved their glycaemic target, and 35.8% had achieved the target blood pressure of < 130/80 mmHg [16], which are better rates of control than in our study. This could be related to the inclusion of younger subjects (20 years and above) than in our study of over 30-year-olds.

The management of DM provides an excellent model for the quality of health care administered in different clinical settings and the health disparities in different regions, as illustrated by our finding that certain districts and rural populations experienced a disproportionate disease burden due to DM. This was also true for patients receiving management through MOH facilities than in other settings. Our study also provided a benchmark for quality of diabetes care across different groups, such as age, sex and socioeconomic subgroups.

The level of glycaemic control in our DM patients increased as their level of education and income increased. Populations of lower socioeconomic status have been shown to have a higher rate of diabetes-related complications and this has been attributed to a lower quality of care for these patients [15,17]. However, health care in Saudi Arabia is accessible to all and provided free of charge for the citizen population so the poor control of DM may be due to risk factors other than disparities in health care. Failure to achieve the glycaemic target in spite of the availability of efficacious treatment has been studied before, and is influenced by different factors related to the patient, provider and health care system and may be explained by a breakdown

Table 4 Distribution of patients with controlled and uncontrolled glycaemia by health sectors (districts) of the Eastern province

Health sector	No.	Controlled glycaemia		Uncontrolled glycaemia		P-value
		No.	%	No.	%	
Dammam	4858	1869	38.5	2989	61.5	< 0.001
Khober	4 455	1935	43.4	2520	56.6	
Qateif	3 210	1271	39.6	1939	60.4	
Ras Tanura	732	234	32.0	498	68.0	
Bqaiq	850	201	23.6	649	76.4	
Safwa	600	194	32.3	406	67.7	
Jubail	703	293	41.7	410	58.3	
Khafji	538	148	27.5	390	72.5	
Oraera	198	42	21.2	156	78.8	
Nuaeria	634	147	23.2	487	76.8	
Sarar	441	101	22.9	340	77.1	
Qaria Olaya	296	54	18.2	242	81.8	
Rafeia	176	43	24.4	133	75.6	
Al-Hassa	11 177	3392	30.3	7785	69.7	
Hafr-Albaten	1 867	459	24.6	1408	75.4	

Table 5 Comorbidity risk factors among patients with previously diagnosed diabetes mellitus (DM)

Variable	Total subjects No.	Previously diagnosed DM No.	%	P-value
Family history of DM				
Yes	100 109	19 005	19.0	< 0.001
No	96 660	11 793	12.2	
Personal history of CVD				
Yes	5 372	2 526	47.0	< 0.001
No	191 397	28 272	14.8	
Blood pressure				
Hypertensive	30 484	12 492	41.0	< 0.001
Non-hypertensive	166 285	18 306	11.0	
Tobacco smoking				
Current smoker	33 065	4 003	12.1	< 0.001
Nonsmoker	163 164	26 677	16.3	
BMI				
Underweight	2 617	120	4.6	< 0.001
Normal weight	38 651	3 670	9.5	
Overweight	68 720	10 219	14.9	
Obese	85 780	16 633	19.4	
Physical activity				
Sedentary	50 535	9 372	18.5	< 0.001
Mild	104 382	16 379	15.7	
Moderate	35 847	4 384	12.2	
Strenuous	4 623	439	9.5	

CVD = cardiovascular disease; BMI = body mass index.

Table 6 Distribution of patients with controlled and uncontrolled glycaemia by health risk factors

Variable	Total	Controlled glycaemia		Uncontrolled glycaemia		P-value
	No.	No.	%	No.	%	
Personal history of CVD						
Yes	2 522	860	34.1	1 662	65.9	0.725
No	28 214	9 524	33.8	860	66.2	
Blood pressure						
Hypertensive	12 468	4 455	35.7	8 013	64.3	< 0.001
Pre-hypertensive	527	158	30.0	369	70.0	
Non-hypertensive	17 738	5 768	32.5	11 970	67.5	
Tobacco smoking						
Current smoker	3 997	1 372	34.3	2 625	65.7	0.44
Nonsmoker	26 622	8 972	33.7	17 650	66.3	
BMI						
Underweight	120	41	34.2	79	65.8	0.002
Normal weight	3 660	1 146	31.3	2 514	68.7	
Overweight	10 198	3 403	33.4	6 795	66.6	
Obese	16 604	5 740	34.6	10 864	65.4	
Physical activity						
Sedentary	9 360	3 220	34.4	6 140	65.5	0.001
Mild	16 347	5 379	32.9	10 968	67.1	
Moderate	4 370	1 525	34.9	2 845	65.1	
Strenuous	438	173	39.5	265	60.5	

CVD = cardiovascular disease; BMI = body mass index.

of communication related to these 3 factors [18].

Substantial attention has been focused recently on the organizational and economic aspects of medical care for diabetic patients [19] and this is reflected by our findings which suggest that better knowledge and motivation of patients plays a major part in glycaemic control and self-care practice of adults with DM. This has been highlighted by different organizations and shown to have major implications for health care policy [9,20]. A meta-analysis that reviewed the efficacy of diabetes education has found that approaches based on diet instruction and social learning were the most effective interventions for achieving glycaemic control [21,22]. Naik et al. stressed the importance of patients actively self-monitoring their blood glucose levels, and then communicating these results to their physician,

who can then adjust the medication to reach the glycaemic targets [23].

In univariate analysis, obesity was associated with having glycaemic control, but regression analysis could not show a significant relationship between BMI and glycaemic control. The same was found by other researchers who attributed the anomaly to the type of cross-sectional study in which patients with good glycaemic control gain weight and patients with poor glycaemic control lose weight due to the disease process [15]. Our explanation is that this may be due to the greater concern of obese individuals to control their glycaemic level.

Good blood pressure control is a central outcome of high-quality diabetes care. The JNC VII report in 2003 recommended that blood pressure be reduced to less than 130/80 mmHg [11], due to consistent evidence that intensive control of blood pressure in

adults with type 2 DM prevents both microvascular and macrovascular diseases [24,25]. Clinical trials indicated that reducing blood pressure by 10 mmHg would decrease macrovascular and microvascular complications and mortality rates by 35% [25]. Our findings revealed that individuals with DM have better control of hypertension, and this may reflect more concern and care among groups at risk than others.

The key finding of this study—that the overall rate of diabetes control in Eastern province of Saudi Arabia is unacceptably low in the general population—has important implications. Improving health care disparities in glycaemic control should be a public health priority in order to reduce diabetes-related morbidity and mortality in the community. Patients need to be empowered with the knowledge and resources to enhance their individual par-

Table 7 Multiple logistic regression model of variables associated with glycaemic control in patients with previously diagnosed diabetes mellitus

Variable	Logistic regression coefficient	Odds ratio	95% CI	P-value
Age	0.015	1.00	1.01–1.02	< 0.001
Sex		1		
Women				
Men	–0.10	0.99	0.93–1.05	0.750
Personal history of CVD	0.024	1.02	0.93–1.14	0.644
Blood pressure		1		
Normal				< 0.001
Hypertensive	–0.220	0.80	0.76–0.85	< 0.001
Pre-hypertensive	0.180	1.20	0.94–1.52	0.137
Tobacco smoking				
Current smoker				
Nonsmoker	0.10	1.11	1.02–1.20	0.018
BMI		1		
Underweight				0.078
Normal weight	0.118	1.13	0.71–1.79	0.618
Overweight	–0.005	1.00	0.63–1.58	0.983
Obese	0.003	1.00	0.63–1.59	0.989
Physical activity		1		
Sedentary				0.011
Mild	0.078	1.08	1.02–1.15	0.14
Moderate	–0.005	1.00	0.91–1.09	0.920
Strenuous	–0.162	0.85	0.68–1.06	0.148

CVD = cardiovascular disease; BMI = body mass index; CI = confidence interval.

participation in diabetes self-care in order to improve their glycaemic control.

There were some limitations to this study. Details about management regimens and the duration of diagnosed diabetes were not known. HbA1c, which is a strong indicator of glycaemic control and which would give us a more comprehensive picture, was not measured. However, this study had its strengths, including the large sample size. Subjects with undiagnosed DM were excluded from this study, as they were not aware of their disease status and were not in a position to control their blood glucose and related cardiovascular risks. Finally, we reported the distribution of random CBG, fasting CBG level and blood pressure on the basis of clinical examination and not on records.

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References

- Bloomgarden Z. The epidemiology of complications. *Diabetes care*, 2002, 25:924–32.
- Effect of intensive blood-glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34). UK Prospective Diabetes Study (UKPDS) Group. *Lancet*, 1998, 352:854–65.
- Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. *Lancet*, 1998, 352:837–53.
- Ohkubo Y et al. Intensive insulin therapy prevents the progression of diabetic microvascular complications in Japanese patients with non-insulin-dependent diabetes mellitus: a randomized prospective 6-year study. *Diabetes research and clinical practice*, 1995, 28:103–17.
- Selvin E et al. Meta-analysis: glycosylated hemoglobin and cardiovascular disease in diabetes mellitus. *Annals of internal medicine*, 2004, 141:421–31.
- Eastman RC et al. Model of complications of NIDDM. II. Analysis of the health benefits and cost-effectiveness of treating NIDDM with the goal of normoglycemia. *Diabetes care*, 1997, 20:735–44.
- Eastman RC et al. Model of complications of NIDDM. I. Model construction and assumptions. *Diabetes care*, 1997, 20:725–34.
- Stratton IM et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. *British medical journal*, 2000, 321:405–12.
- American Diabetes Association. Standards of medical care in diabetes—2008. *Diabetes care*, 2008, 31(Suppl. 1):S12–54.
- Al-Ghamdi A et al. A community-based screening campaign for the detection of diabetes mellitus and hypertension in the eastern province, Saudi Arabia: methods and participation rate. *Journal of family and community medicine*, 2007, 14(3):91–7.
- Chobanian AV et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension*, 2003, 42:1206–52.
- The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *New England journal of medicine*, 1993, 329:977–86.
- Brechner RJ et al. Ophthalmic examination among adults with diagnosed diabetes mellitus. *Journal of the American Medical Association*, 1993, 270:1714–8.
- Beckles GL et al. Population-based assessment of the level of care among adults with diabetes in the US. *Diabetes care*, 1998, 21:1432–8.

15. Harris MI et al. Racial and ethnic differences in glycemic control of adults with type 2 diabetes. *Diabetes care*, 1999, 22:403-8.
16. Saydah SH, Fradkin J, Cowie CC. Poor control of risk factors for vascular disease among adults with previously diagnosed diabetes. *Journal of the American Medical Association*, 2004, 291:335-42.
17. Peek ME, Cargill A, Huang ES. Diabetes health disparities: a systematic review of health care interventions. *Medical care research and review*, 2007, 64(5 Suppl.):101S-56S.
18. Pringle M et al. Influences on control in diabetes mellitus: patient, doctor, practice, or delivery of care? *British medical journal*, 1993, 306:630-4.
19. Bransome ED Jr. Financing the care of diabetes mellitus in the U.S. Background, problems, and challenges. *Diabetes care*, 1992, 15(Suppl. 1):1-5.
20. Norris SL, Engelgau MM, Narayan KM. Effectiveness of self-management training in type 2 diabetes: a systematic review of randomized controlled trials. *Diabetes care*, 2001, 24:561-87.
21. Padgett D et al. Meta-analysis of the effects of educational and psychosocial interventions on management of diabetes mellitus. *Journal of clinical epidemiology*, 1988, 41:1007-30.
22. Norris SL et al. Self-management education for adults with type 2 diabetes: a meta-analysis of the effect on glycemic control. *Diabetes care*, 2002, 25:1159-71.
23. Naik AD et al. Improving hypertension control in diabetes mellitus: the effects of collaborative and proactive health communication. *Circulation*, 2008, 117:1361-8.
24. Cooper ME, Johnston CI. Optimizing treatment of hypertension in patients with diabetes. *Journal of the American Medical Association*, 2000, 283:3177-9.
25. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. UK Prospective Diabetes Study Group. *British medical journal*, 1998, 317:703-13.

Second Annual Meeting of the Global Diabetes Alliance (GDA 2), Cairo, Egypt, 26-29 October, 2010

Cairo will host the second Global Diabetes Alliance Congress, a very special event whose goal is to unify protocols for epidemiological surveys and prevention and management of diabetes and its related disorders. This Congress will be dedicated to the presentation of updates on the diabetes epidemic in various parts of the world (including the Middle East and Africa) and workshops designed to initiate collaborative research projects among groups of investigators throughout the world. The programme can be accessed from the conference website at: <http://conf.global-diabetes.org/index.htm>

Allaitement maternel exclusif et allaitement mixte : connaissances, attitudes et pratiques des mères primipares

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الإرضاع المقتصر على الثدي والإطعام المختلط للرضع: المعارف والمواقف والممارسات لدى الأمهات البكرات
فتحي بن سلامة، أنيس أياري، فوزية أوزيني، عمران بلحاج، نور الدين عاشور

الخلاصة: قِيم الباحثون المعارف والمواقف والممارسات لدى الأمهات البكرات فيما يتعلق بالإرضاع المقتصر على الثدي والإرضاع باللبن الاصطناعي. فأجرى الباحثون مقابلات شملت 260 امرأة، وأوضحت النتائج أن 41.5٪ من النسوة يقتصرن على الإرضاع من الثدي، فيما يقدم 58.5٪ منهن لأطفالهن اللبن الاصطناعي عبر القنينة لوحدها أو مع الإرضاع من الثدي. ومن بين اللواتي يرضعن أطفالهن، فإن 43٪ منهن لم يرضعن أطفالهن بعد ولادتهن مباشرة، ولا يعرفن شيئاً عن اللبأ. ولم يكن مجمل الوضع حول المعارف والمواقف والممارسات لدى الأمهات يبعث على الرضى فيما يتعلق بالقواعد الذهبية للإرضاع الناجح من الثدي، وبالمدة المثالية للإرضاع المقتصر على الثدي، وبالطعام الذي ينبغي أن يدخل ضمن التغذية التكميلية ووقت إدخاله، وقد يكون ذلك ناجماً عن انخفاض مستوى الالتحاق بالمدارس وضعف المعلومات، ومن هنا فإن تحسين استراتيجيات رعاية الأمهات خلال فترة الحمل وبعدها أمر ضروري.

RÉSUMÉ Nous avons évalué les connaissances, les attitudes et les pratiques de femmes primipares vis-à-vis de l'allaitement maternel exclusif et du lait artificiel. Au total, 260 femmes ont été interrogées. Les résultats montrent que 41,5 % de ces femmes utilisent en exclusivité l'allaitement maternel et 58,5 % utilisent le lait artificiel seul ou en complément au lait maternel. Parmi les mères qui allaitent, 43,0 % n'ont donné le sein pour la première fois que le lendemain de l'accouchement et n'ont aucune information sur le colostrum. Les connaissances, les attitudes et les pratiques des mères primipares sont insatisfaisantes concernant les règles à suivre lors de la mise au sein de l'enfant, la durée idéale de l'allaitement maternel exclusif et les aliments essentiels à introduire lors du début de la diversification de l'alimentation du nourrisson. Cela pourrait être dû entre autres à un niveau d'information et de scolarisation faible, d'où l'intérêt de l'amélioration des stratégies de prise en charge des jeunes mères durant les phases pré- et post-natales.

Exclusive breastfeeding and mixed feeding: knowledge, attitudes and practices of primiparous mothers

ABSTRACT We assessed the knowledge attitudes and practices of primiparous women with regard to exclusive breastfeeding and the use of formula milk. A total of 260 women were interviewed and the results showed that 41.5% of the women breastfed exclusively while 58.5% bottle-fed only or did so together with breastfeeding. Of those who breastfed, 43.0% did not do so soon after giving birth and did not know about colostrum. Overall, the knowledge, attitudes and practices of the mothers were unsatisfactory concerning the golden rules for successful breastfeeding, the ideal duration of exclusive breastfeeding and the food to include when introducing complementary feeding. This might be due to a low level of schooling and information, hence the need for improving strategies for maternal care during the antenatal and postnatal periods.

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Introduction

Si l'allaitement maternel est largement désiré et adopté par les mères partout dans le monde, la réussite de sa poursuite reste tributaire de plusieurs facteurs. Les études disponibles tirent une réelle sonnette d'alarme face au déclin observé concernant la pratique de l'allaitement maternel [1]. En effet, on assiste actuellement à une tendance à la régression de cette pratique en rapport avec les progrès dans la fabrication, la commercialisation des laits industriels et le manque d'information et de sensibilisation des mères. Les formules lactées du commerce destinées aux enfants dont les mères ne souhaitent ou ne peuvent pas allaiter constituent aujourd'hui une alternative sanitaire tout à fait acceptable, sans qu'il soit culpabilisant pour les parents de les utiliser, mais les bénéfices avancés de l'allaitement maternel, souvent issus d'observations réalisées, conduisent néanmoins à encourager les femmes à allaiter de façon exclusive pendant au moins six mois.

Cependant, les connaissances, les attitudes et les pratiques des mères demeurent insuffisantes. Malgré les bénéfices indiscutables de l'allaitement maternel tant pour l'enfant que pour sa mère, sa pratique reste insuffisante ou mal menée par les mères, surtout s'il s'agit de femmes primipares. Dans ce contexte, nous avons réalisé une enquête auprès d'un groupe de femmes primipares, dont les objectifs sont de connaître la perception de celles-ci vis-à-vis de l'intérêt du lait et de l'allaitement maternels, d'évaluer leur niveau de connaissance vis-à-vis des règles à suivre pour mener à bien l'opération de l'allaitement et enfin d'évaluer la perception des femmes qui optent pour l'allaitement mixte vis-à-vis de l'intérêt du lait pharmaceutique.

Méthodes

Population étudiée

Notre travail a concerné un échantillon de 260 femmes primipares venant consulter en pédiatrie ou pour la vaccination de leurs enfants au Centre de Soins de Santé de Base (CSSB) de l'Ariana.

L'enquête a duré cinq semaines. Lors de notre passage au CSSB, en collaboration avec le médecin coordinateur, la diététicienne et la sage-femme, nous consultons les fiches d'inscription du jour pour repérer les femmes primipares et les prendre à part pour l'enquête. Chaque femme choisie est interrogée à part de façon dirigée.

Méthodes

Pour réaliser l'enquête, nous avons utilisé un questionnaire comportant 25 questions fermées et semi-ouvertes. Les questions nous ont permis essentiellement de recueillir les informations sur l'âge de la femme et de son enfant, son niveau d'instruction, sa profession, sa pratique et son comportement pendant la mise au sein de l'enfant, ses connaissances sur les avantages du lait maternel, les conditions où la mère ne doit pas allaiter l'enfant, l'âge du début de la diversification de l'alimentation de l'enfant et les principaux aliments à introduire.

De même des questions ont été posées aux mères utilisant le lait artificiel concernant essentiellement ses avantages pour l'enfant, les conditions de mise de l'enfant au biberon et les différents types de lait disponibles selon l'âge de l'enfant.

Les questions ont été posées par nous-même en utilisant un langage simple et facile à comprendre par la femme. Avant la mise en forme définitive du questionnaire, nous l'avons testé auprès de 10 femmes primipares venant consulter au PMI (Centre de Protection de la Mère et de l'Enfant) de la même région où nous avons réalisé l'enquête.

Analyse statistique

Les données ont été saisies au moyen du logiciel Excel et analysées au moyen du logiciel SPSS version 11.5. Nous avons calculé des fréquences simples et des fréquences relatives (pourcentages) pour les variables qualitatives. Nous avons calculé des moyennes et des écarts types pour les variables quantitatives. Les comparaisons de pourcentage sur séries indépendantes ont été effectuées par le test du χ^2 de Pearson, et en cas de non-validité de ce test, et de comparaison de deux pourcentages, par le test exact bilatéral de Fisher.

Résultats

L'âge moyen des femmes est de 27,9 ans (4,03). Le mode est de 28 ans. L'âge moyen des enfants est de 5,17 mois (3,8). Trois pour cent des femmes enquêtées sont analphabètes, 27 % ont un niveau de scolarisation primaire, 30 % ont un niveau secondaire et 40 % un niveau supérieur. Uniquement 13 % des femmes travaillent : parmi celles-ci, 40 % sont des cadres moyens ou ouvrières, 10 % sont des cadres supérieurs, 20 % sont des fonctionnaires et 30 % ont une fonction libérale.

Informations concernant le lait maternel avant l'accouchement

Nos résultats ont montré que seulement 44 des femmes ont été informées sur les avantages et l'intérêt de l'allaitement maternel. Dans la majorité des cas (58 %), la source principale d'information était les parents, dans 23 % des cas, c'était le médecin et la sage-femme et dans 19 %, la sage-femme et la diététicienne.

Première mise au sein après l'accouchement

D'après le tableau 1 ci-dessous, nous constatons que la plupart des femmes (43 %) ne donnent le sein

Tableau 1 Première mise au sein du bébé chez les femmes enquêtées

Moment de la première mise au sein	Nbre	%
Première heure après l'accouchement	52	20
Quelques heures après l'accouchement	96	37
Le lendemain	112	43
Total	260	100

que le lendemain de l'accouchement alors que seulement 20 % des femmes donnent le sein dès la première heure après l'accouchement.

Exclusivité de l'allaitement au sein

D'après le tableau 2, on remarque que la majorité des femmes ne donnent pas le sein de manière exclusive (58,5 %). Les justifications données par les mères enquêtées qui n'allaitent pas en exclusivité sont les suivantes : 15 % des femmes trouvent que l'allaitement exclusif au sein est fatigant alors qu'environ 24 % des femmes disent que c'est à cause de l'enfant qui ne veut pas accepter le sein. Une femme sur cinq explique la non-exclusivité de l'allaitement au sein par le manque de temps et le refus du sein par l'enfant. Le tableau 3 ci-dessous donne les principales réponses à ce propos.

Concernant l'âge d'introduction du biberon en cas de mixité, 56 % des femmes qui ont opté pour ce mode d'allaitement l'ont fait dès la naissance, 24 % à 2 mois et 20 % 3 mois après l'accouchement.

Connaissances des mères utilisant la mixité concernant l'utilisation du biberon et le lait artificiel

Nos résultats ont montré que uniquement 13 % des femmes allaitantes utilisant la mixité pour l'allaitement de l'enfant savent

qu'il y a un type de lait adapté pour chaque groupe d'âge, alors que 40 % dans ce même groupe de femmes ne connaissent pas l'existence de différents types de lait pour bébé.

De même, concernant les circonstances où la mère doit allaiter l'enfant au moyen de lait artificiel telles que la dépression et la fatigue après l'accouchement, une infection chez la mère, nous avons trouvé que seulement 31 % ont un niveau de connaissance acceptable.

Connaissances sur l'intérêt nutritionnel du lait artificiel

Nous avons demandé aux femmes primipares enquêtées utilisant la mixité ou en exclusivité le lait artificiel si celui-ci protège mieux contre les maladies et les infections car il contient des produits pharmaceutiques.

Les réponses à cette question ont montré que 36 % confirment ces avantages ; 41 % ont répondu qu'elles ne connaissent rien sur ce sujet malgré l'utilisation de ce type de lait.

Connaissances des mères concernant les avantages de l'allaitement maternel

Afin d'apprécier les connaissances des mères concernant les avantages du lait maternel, à savoir le lait maternel protège contre les maladies infectieuses, assure une bonne croissance, protège

contre l'allergie, donne un sentiment d'amour et de sécurité, un moyen de contraception et diminue le risque du cancer, nous avons catégorisé de façon arbitraire les différentes réponses en trois niveaux et ce, selon le pourcentage de bonnes réponses données par les mères par rapport au total des réponses exactes aux questions posées :

- niveau de connaissance satisfaisant : pourcentage de bonnes réponses $\geq$ 70 % ;
- niveau de connaissance moyen : pourcentage entre 40 % et 60 % ;
- niveau insuffisant : pourcentage $<$ 30 %.

Le tableau 4 ci-dessous résume les résultats à ce propos.

D'après le tableau 4, on observe qu'une mère sur deux a un niveau de connaissance insuffisant concernant les différents avantages du lait maternel.

Connaissances des mères concernant les conditions de contre-indication de l'allaitement au sein

Nous avons utilisé la même procédure précédemment citée pour l'appréciation du niveau de connaissance des mères concernant les circonstances durant lesquelles on ne donne pas le sein au bébé, entre autres maladies cardiaques de la mère, troubles psychiques et abcès du sein. D'après le tableau 4 ci-dessous, on remarque d'après ces données que dans la majorité des cas (60 %), les femmes primipares ont un faible niveau de connaissances.

Par ailleurs, concernant l'âge limite d'allaitement au sein, d'après les mères qui le font en exclusivité, nous avons trouvé que 29 % des mères pensent que l'âge limite d'allaitement au sein est de 3 à 4 mois, alors que seulement une femme sur cinq pense qu'on doit allaiter au sein au-delà de 4 mois.

À propos du nombre de tétées à donner au bébé, nous avons trouvé que la majorité des femmes enquêtées (73 %) et qui allaitent exclusivement au sein le

Tableau 2 Utilisation de l'allaitement maternel

Mode d'allaitement	Nbre	%
Exclusivité d'allaitement	108	41,5
Mixité	152	58,5
Total	260	100

Tableau 3 Différentes raisons données pour la non-exclusivité de l'utilisation du lait maternel

Raisons	Nbre	%
Manque de temps (1)	44	29
L'allaitement exclusif au sein est fatigant (2)	23	15
L'enfant ne veut pas accepter le sein (3)	37	24
(1) et (2)	30	20
(1) et (3)	18	12
Total	152	100

font à la demande du bébé et donc, elles n'ont pas un nombre limité de tétées par jour.

Connaissances des mères concernant les règles d'hygiène lors de l'allaitement au sein

Nous avons demandé aux mères enquêtées si elles connaissent les principaux actes hygiéniques à respecter par la mère lors de l'allaitement au sein, tels que le lavage des mains à chaque tétée, la vidange du premier sein avant de passer au second, le séchage du mamelon au cours de l'allaitement et enfin, le badigeonnage du mamelon avec une goutte de lait en fin de tétée.

Nous remarquons que deux femmes sur trois ne connaissent pas suffisamment et convenablement ces principes. Le tableau 4 ci-dessous résume la répartition des niveaux de connaissance des mères à ce propos.

Diversification de l'alimentation de l'enfant

Pour l'âge d'introduction d'autres aliments avec le lait maternel (mixité de l'alimentation du nourrisson), nous avons trouvé pour l'ensemble des femmes enquêtées que 8 % sont pour l'âge entre 6 et 12 mois, 20 % pour 4 mois et 72 % proposent entre 2 à 3 mois. Les aliments les plus proposés au cours de cette phase sont le yaourt,

le bouillon de légumes, les œufs, le riz, le sorgho, les biscuits cuisis, la préparation à base de farine et la purée de pommes de terre. Par ailleurs, nous avons proposé une liste d'aliments aux mères en leur demandant de choisir ceux qui sont une bonne source de protéines utiles pour la croissance de l'enfant. Les principaux aliments que nous avons proposés sont l'œuf, la banane, les viandes, le poisson, la farine, le sorgho, les biscuits, l'orange et le yaourt. Les niveaux de connaissance des mères à propos de ce sujet sont donnés dans le tableau 4 ci-dessous.

Discussion

Notre travail a porté sur 260 femmes primipares allaitantes, venant consulter au Centre de Soins de Santé de Base de l'Ariana, une des plus grandes régions du grand Tunis.

Notre enquête vise à montrer la place du lait maternel dans l'alimentation des nourrissons des mères primipares et à évaluer le niveau des connaissances de ces mères ainsi que de celui des femmes qui optent pour un allaitement mixte vis-à-vis respectivement du lait maternel et du lait artificiel. Comme nous le savons, le lait maternel doit avoir une place importante dans l'alimentation du nouveau-né. La femme primipare doit être bien préparée avant son accouchement et doit avoir des connaissances satisfaisantes concernant l'hygiène de vie de son premier bébé, son alimentation et surtout l'utilité du lait maternel et ses avantages nutritionnels ainsi que les particularités de la diversification [1-4].

Nos principaux résultats ont montré qu'environ 30 % des femmes ont un niveau de scolarité faible (analphabètes ou scolarité primaire). Seulement 13 % des femmes travaillent. Ces facteurs sont très importants pour la prise de décision concernant l'adoption de tout comportement. En effet, le niveau d'études élevé est un facteur

Tableau 4 Connaissances des mères concernant certains aspects de l'allaitement maternel/l'alimentation du nourrisson

Niveau de connaissance	Nbre	%	Valeurs
Avantages du lait maternel			$\chi^2 = 18,17, p = 0,00013$
Satisfaisant	52	20	
Moyen	78	30	
Insuffisant	130	50	
Conditions de contre-indication de l'allaitement au sein			$\chi^2 = 36,62, p < 0,001$
Satisfaisant	29	11	
Moyen	75	29	
Insuffisant	156	60	
Règles d'hygiène lors de l'allaitement au sein			$\chi^2 = 56,69, p < 0,001$
Satisfaisant	36	14	
Moyen	52	20	
Insuffisant	172	66	
Aliments sources de protéines de bonne qualité			$\chi^2 = 7,31, p = 2,025$
Satisfaisant	111	43	
Moyen	94	36	
Insuffisant	55	21	
Total	260	100	

régulièrement associé à une durée prolongée d'allaitement maternel [5,6]. Quant au niveau socio-économique, un déclin de l'allaitement maternel lié à l'accroissement du niveau de vie est noté dans les pays en développement. Ceci est confirmé par le travail de Meziane qui a trouvé que 76,6 % des femmes pauvres donnaient de manière satisfaisante le sein contre 38,4 % des femmes aisées [7,8]. Dans les pays industrialisés, il existe une corrélation positive entre le niveau socio-économique élevé et le taux de démarrage précoce de l'allaitement maternel [9].

Dans notre travail, nous avons trouvé que parmi les femmes primipares enquêtées, uniquement 44 % ont été informées sur l'importance de l'allaitement au sein et sur les avantages qui en découlent, ce qui est très insuffisant. Nous avons également trouvé que seulement 20 % des femmes primipares ont donné le sein au nourrisson pour la première fois dès la première heure après l'accouchement et ce, malgré l'importance nutritionnelle du colostrum. Ces femmes ont été informées en consultation prénatale par les professionnels de la santé uniquement dans 42 % des cas (médecin, sage-femme et diététicienne). Il s'est avéré par des études que l'évolution des attitudes et pratiques vis-à-vis de l'allaitement maternel dès la naissance expliquerait en grande partie l'évolution du taux et de la durée de l'allaitement maternel.

Le rôle des professionnels de la santé et de leur organisation dans le succès de l'allaitement maternel est indiscutable. C'est ainsi que l'Organisation mondiale de la Santé (OMS) et l'UNICEF ont lancé en 1992 l'initiative « Hôpitaux amis des bébés » [10,11].

Nos résultats ont montré également que 58,5 % des femmes optent pour la mixité très tôt et ont recours au lait artificiel. Les motifs donnés par ces femmes sont essentiellement : le manque de temps (29 %), l'allaitement

exclusif au sein est fatigant (15 %), le refus du sein par l'enfant (24 %). Ces justifications données par ces mères primipares pourraient être dues entre autres à un manque d'information, d'autant plus qu'elles n'ont pas encore été exposées à de mauvaises expériences antérieures. Parmi les constatations déduites figure le risque de malnutrition auquel pourraient être exposés ces nourrissons à court ou à long terme suite à l'arrêt précoce ou l'abandon de l'allaitement maternel.

C'est pour cette raison qu'il serait impératif d'encadrer encore plus les femmes allaitantes et d'observer un effort plus remarquable de la part des professionnels de la santé pour aider les femmes allaitantes et surtout primipares à surmonter les difficultés rencontrées lors de l'allaitement. En effet, une étude néerlandaise a montré qu'une des premières causes de cessation de l'allaitement durant les premières semaines tient à des difficultés et que celles-ci sont souvent liées à une mauvaise information sur la technique de mise en route [12].

De même, plusieurs études ont montré qu'un encadrement des femmes allaitantes et un accompagnement dans les premières semaines pouvaient considérablement réduire le nombre d'arrêts liés aux difficultés [13,14].

Nos résultats ont également montré un niveau de connaissance des mères primipares faible concernant les avantages du lait maternel (40 %), les conditions de contre-indication de la mise de l'enfant au sein (60 %), les bons gestes et les techniques hygiéniques à respecter lors de l'allaitement au sein (66 %). Ces données sont très importantes et montrent bien l'absence d'une stratégie d'IEC (Information/Éducation/Communication) qui pourrait soutenir, encadrer et améliorer le niveau de connaissance, les attitudes et pratiques de ces femmes primipares. Cette situation nous semble inquiétante compte tenu de la

protection substantielle de l'allaitement maternel, réduisant la morbidité et la mortalité infantile, et du caractère vital de l'allaitement maternel dans les pays en développement [15]. Pour les femmes utilisant le lait artificiel, nous avons également trouvé des lacunes au niveau de leur niveau de connaissance concernant la rythmicité des tétées, les différents types de lait existants et les conditions d'allaitement. Cette situation est encore bien pire que celle concernant le lait maternel vu l'incapacité du lait artificiel à protéger le bébé contre les infections et lui assurer une satiété sous un faible volume. La majorité des mères primipares enquêtées (72 %) proposent l'âge de 2 à 3 mois comme période d'introduction d'autres aliments pour l'enfant (diversification). Seulement 8 % sont pour l'âge de 6 à 12 mois et 20 % pour l'âge de 4 mois.

Parmi les aliments les plus proposés par les mères au cours de cette phase de diversification, nous avons trouvé : yaourt, bouillon de légumes, œufs, riz, *drôo* (poudre de sorgho), biscuits cuits, *assida* (bouillie à base de semoule ou de farine) et purée de pomme de terre. Cette diversification et mixité précoces pourraient être insuffisantes pour couvrir les besoins de l'enfant. Nasraoui *et al.* ont montré l'insuffisance de l'alimentation diversifiée précocement comparativement à celle des bébés exclusivement allaités au sein jusqu'à 5 mois [16].

Enfin, nos résultats ont montré que 21 % des mères enquêtées ne connaissent pas les aliments sources de protéines de bonne qualité tels qu'œufs, poissons et viandes qui sont d'une importance énorme pour la croissance et le développement staturo-pondéral de l'enfant.

En général, nous avons trouvé que le niveau de connaissance, d'attitude et de pratique des mères primipares n'est pas très encourageant pour la bonne promotion du lait maternel. Ces constatations ont été confirmées par

d'autres études. Au Maroc, des études ont montré que si l'allaitement maternel est largement désiré et adopté par les mères comme partout dans le monde, la réussite de sa poursuite reste tributaire de plusieurs facteurs. On assiste à une tendance à la régression de l'allaitement maternel en rapport avec les progrès dans la fabrication, la commercialisation des laits industriels et le manque d'information et de sensibilisation des mères [17,18].

Conclusion

L'allaitement maternel reste toujours un acte très complexe, le plus naturel et bénéfique qu'il est malaisé de remplacer, dans l'état actuel des choses. Aucune autre action ne peut influencer aussi intensément la santé présente et future du bébé. C'est pourquoi l'allaitement maternel doit rester un impératif absolu. Il n'est bien sûr pas question de culpabiliser les mères qui ne souhaitent pas allaiter ou souhaitent

le faire seulement pendant une courte période. Cependant, il faut tout faire pour que toutes les femmes qui veulent allaiter puissent le faire dans des conditions satisfaisantes pour elles-mêmes et leur enfant. Ainsi, les décideurs des programmes de santé de la mère et de l'enfant doivent mieux réfléchir sur la stratégie d'encadrement et d'information des mères en matière de nutrition pendant la prise en charge et le suivi lors des périodes pré- et postnatales.

Références

1. Loras-Duclaux I. Conseils pratiques aux mères qui souhaitent allaiter. *Archives de pédiatrie*, 2000, 7(5):541-8.
2. Picciano MF. Nutrient composition of human milk. *Pediatric clinics of North America*, 2001, 48:53-67.
3. Kunz C. Oligosaccharides in human milk: structural, functional and metabolic aspects. *Annual review of nutrition*, 2000, 20:699-722.
4. Picciano MF. Representative values for constituents of human milk. *Pediatric clinics of North America*, 2001, 48:263-4.
5. Dubois L, Girard M. Social determinants of initiation, duration and exclusivity of breastfeeding at the population level. The results of the Longitudinal Study of Child Development in Quebec (ELDEQ1998-2002). *Canadian journal of public health*, 2003, 94:300-5.
6. Chapman DJ, Perez-Escamilla R. Maternal perception of the onset of lactation is a valid, public health indicator of lactogenesis stage II. *Journal of nutrition*, 2000, 130:2972-80.
7. Ego A et al. Les arrêts prématurés d'allaitement maternel. *Archives de pédiatrie*, 2003, 10(1):11-8.
8. Meziane EM. *Enquête sur l'allaitement maternel. À propos de 1200 cas de 0 à 18 mois à Oujda* [Thèse de médecine]. Rabat, Faculté de Médecine de Rabat, 1981.
9. Labarère J et al. Initiation et durée de l'allaitement maternel dans les établissements d'Aix et Chambéry (France). *Archives de pédiatrie*, 2001, 8(8):807-15.
10. Mzid A, Marrekchi F, Elleuch S. La place du lait maternel dans l'alimentation du nourrisson. *Revue maghrébienne de pédiatrie*, 1995, 5(6):301-5.
11. Schneider C. Allaitement en maternité : les difficultés rencontrées. XXIV^e Journées nationales de néonatalogie. *Progrès en néonatalogie*, 2004, 14:133-48.
12. Lanting IL, Van Wouwe PV, Reijneveld SA. Infant milk feeding practices in the Netherlands and associated factors. *Acta paediatrica*, 2005, 94:935-42.
13. Callahan S, Danel M, Teisseyre N. La thérapie comportementale et cognitive appliquée à l'allaitement. Première partie : intérêt et élaboration d'une intervention post-partum. *Journal de Thérapie comportementale et cognitive*, 2003, 13(3):128-32.
14. Schafer E et al. Volunteer peer counselors increase breastfeeding duration among rural low income women. *Birth*, 1998, 25:101-66.
15. Fanello S et al. Critères de choix concernant l'alimentation du nouveau-né : une enquête auprès de 308 femmes. *Archives de pédiatrie*, 2003, 10(1):19-24.
16. Nasraoui A et al. Âge d'introduction des aliments chez les nourrissons de la région de Tunis. *Médecine et nutrition*, 1998, 34(5):193-6.
17. Bocquet A et al. Allaitement maternel : les bénéfices pour la santé de l'enfant et de sa mère. *Archives de pédiatrie*, 2005, 12(Suppl. S3):S145-65.
18. Rjimati L et al. Allaitement maternel. *Les cahiers du Médecin*, 1999, Tome II, 8:50-1.

Predictors of gestational diabetes mellitus in a high-parity community in Saudi Arabia

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المنبتات بالسكّري الحُملي في المجتمعات ذات المعدّلات العالية في تكرار الولادات في المملكة العربية السعودية
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الخلاصة: أجرى الباحثان هذه الدراسة في الرياض عاصمة المملكة العربية السعودية حول معدّل انتشار السكّري الحُملي ومنبتاته في مجموعة من الحوامل ذوات معدّلات عالية في تكرار الولادات، وعددهن 633 امرأة، و50.1٪ منهن من المفرطات في تكرار الولادة. واتضح أن معدّل السكّري الحُملي 12.5٪ وفقاً لمعايير منظمة الصحة العالمية و3.8٪ وفقاً للرابطة الأمريكية للسكّري، وأن متعّدات الولادة لديهن احتمال للإصابة بالسكّري الحُملي بمقدار يزيد عما لدى غير الولودات بـ 8.29 مرّة. إلا أنه بعد تعديل المعطيات وفقاً لأعمار الأمهات وسوابق الإسقاط، فإن غير الولودات لديهن احتمال للإصابة بالسكّري الحُملي بمقدار يزيد عما لدى الولودات بمقدار 2.95 مرّة. ويزداد احتمال الإصابة بالسكّري الحُملي لدى الولودات من 2٪ في عمر 20 عاماً إلى 21٪ في عمر 40 عاماً. إن المعدّل المرتفع للسكّري الحُملي بين المفرطات في تكرار الولادة قد ينجم عن التأثير المربك لعمر الأم.

ABSTRACT A study in Riyadh, Saudi Arabia investigated the prevalence of gestational diabetes mellitus (GDM) and its predictors in a high-parity group of pregnant women ($n = 633$, 50.1% grand multiparas). The prevalence of GDM was 12.5% and 3.8% by World Health Organization and American Diabetes Association criteria respectively. Multiparous women were 8.29 times more likely to have GDM than nulliparous women. However, after adjustment for maternal age and history of abortion, nulliparous women were 2.95 times more likely to develop GDM than parous women. The probability of GDM for a parous woman increased from 2% to 21% when age increased from 20 to 40 years. The high rate of GDM among grand multiparas may be due to the confounding effect of maternal age.

Facteurs prédictifs du diabète gestationnel au sein d'une communauté à parité élevée en Arabie saoudite

RÉSUMÉ Une étude portant sur la prévalence du diabète gestationnel et sur ses facteurs prédictifs au sein d'un groupe de femmes enceintes à la parité élevée ($n = 633$, dont 50,1 % de grandes multipares) a été réalisée à Riyad (Arabie saoudite). La prévalence de cette maladie était de 12,5 % et de 3,8 % selon les critères de l'OMS et de l'ADA, respectivement. La probabilité des femmes multipares de présenter un diabète gestationnel était 8,29 fois supérieure à celles des femmes nullipares. Toutefois, après ajustement des données en fonction de l'âge maternel et des antécédents d'avortement, les nullipares se sont révélées 2,95 fois plus susceptibles de présenter un diabète gestationnel que les femmes pares. La probabilité pour la femme pare de contracter cette maladie augmente de 2 % à 21 % entre 20 et 40 ans. Le fort taux de diabète gestationnel chez les grandes multipares peut être lié au facteur confusionnel de l'âge maternel.

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Introduction

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of varying degrees of severity with onset or first recognition during pregnancy [1,2]. Women with GDM are at risk of pre-eclampsia and their babies are at risk of macrosomia and perinatal mortality [3,4]. The prevalence of GDM ranges from 1% to 14% of all pregnancies, depending on the population studied and the diagnostic tests and criteria employed [5]. The oral glucose tolerance test (OGTT) has for several decades been the international standard for the diagnosis of diabetes in nonpregnant adults. However, the criteria for defining diabetes differ between the American Diabetes Association (ADA) [1,6] and the World Health Organization (WHO) [2], with the WHO now characterizing GDM as the joint category of diabetes and impaired glucose tolerance. The appropriateness of these different diagnostic criteria has been debated [7]; nevertheless women meeting the definition for GDM by either set of criteria are at greater risk of complications than women without the diagnosis.

Screening for GDM using risk-factor assessment is common practice internationally, although an obvious limitation is that data on risk factors related to prior obstetric events are not available for nulliparous women [8]. High parity (5+) is common in developing countries, especially in Arab nations such as Saudi Arabia where large families are the norm [9]. The association between multiparity and pregnancy outcomes has been studied extensively [10–12], as has the relationship between parity and risk of type 2 diabetes [13]. However, the findings are inconsistent, and whether multiparity is related to adverse maternal and fetal outcomes remains uncertain.

The aim of the present study was to estimate the prevalence of GDM among pregnant women attending the King Fahd National Guard hospital, Riyadh,

Saudi Arabia, using both WHO and ADA criteria and to investigate parity as a predictor of GDM in this high-parity community of pregnant women.

Methods

All pregnant women attending the antenatal clinic of King Fahd hospital, part of the National Guard Health Affairs services, are routinely subjected to an OGTT at 24–28 weeks gestation. The diagnosis of GDM is based upon the results of both the fasting sample and/or the 2-hour OGTT test. The treating physician is notified immediately of any abnormal results, so that the woman can be referred to a specialized GDM clinic.

Sample

All pregnant women who attended the antenatal clinic during the period July 2005–July 2006 ($n = 770$), who had no previous history of diabetes without pregnancy were the target group of the present study. After excluding women who suffered an abortion before reaching 24–28 weeks gestation ($n = 30$) and those who refused the OGTT or did not attend for testing ($n = 107$), the final sample was 633 pregnant women.

Data collection

The OGTT was performed in the morning after a 12-hour overnight fast and 3 days of minimal carbohydrate diet and unlimited physical activity. Plasma glucose was determined before and 2 hours after administration of a 75 g glucose solution (Glucola) [5]. GDM was considered present if venous plasma glucose was equal or greater than the threshold values according to WHO criteria (fasting plasma glucose ≥ 7.0 mmol/L or plasma glucose 2 hours after glucose load ≥ 7.8 mmol/L) [2] and according to the ADA criteria (fasting plasma glucose ≥ 5.3 mmol/L and plasma glucose 2 hours after glucose load ≥ 8.6 mmol/L) [1].

A review was made of the records of all pregnant women to collect data on age, gravidity, parity and history of previous abortion. Parity was classified as: nulliparous (no previous viable pregnancy), multiparous (given birth to 1–4 children) and grand-multiparous (given birth to 5+ children) [10–12,14–16].

Ethical issues

The blood tests were performed free of charge as a part of the ongoing routine care of pregnant women at this centre and the women signed consent for management at the first booking antenatal visit. For the present study the records of all data were kept confidential. The study received ethical clearance from the institutional review board and the ethics committee of King Abdulaziz Medical City, National Guard Health Affairs in Riyadh.

Analysis

Data were analysed using SPSS, version 11. The chi-squared test was applied to compare categorical data. To investigate parity as a predictor of GDM, logistic regression analysis was applied with GDM as the dependant variable against maternal age, parity (nulliparous versus parous) and history of previous abortion (positive versus negative history) as independent variables. Analysis of covariance (ANCOVA) was used to compare means of fasting glucose and 2-h glucose, adjusted for age and history of abortion, between nulliparous and parous women. Significance was assumed if P -value was less than 0.05.

Results

The 2-h OGTT was completed by, 633 (82%) women. According to WHO criteria, GDM was diagnosed in 79 women, a prevalence of 12.5% (95% CI: 10.0%–15.3%), while according to ADA criteria there were only 24 women with GDM, a prevalence of 3.8% (95% CI: 2.4%–5.6%) (Table 1). Only 24 women

Table 1 Results of 2-hour 75 g oral glucose tolerance test in pregnant women according to both World Health Organization (WHO) and American Diabetic Association (ADA) criteria for diagnosis of diabetes mellitus

WHO criteria	ADA criteria				Total	
	Diabetes		No diabetes			
	No.	%	No.	%	No.	%
Diabetes	24	29.6	55	70.4	79	12.5
No diabetes	0	–	554	100.0	554	87.5
Total	24	3.8	609	96.2	633	100.0

$k = 0.433$, $P < 0.001$.

Sources: WHO 1999 [2]; ADA 2000 [1].

(100% of ADA-defined cases and 29.6% of WHO-defined cases) were positive by both criteria. All ADA-defined cases were detected by WHO criteria, while only 29.6% of the WHO-defined cases were detected by ADA criteria.

Among this group, 31 (50.1%) were grand multiparas. Table 2 shows the univariate association of GDM with maternal age, parity and history of abortion. The prevalence of GDM according to WHO criteria was significantly associated with maternal age ($\chi^2_{LT} = 2.89$, $P < 0.001$) and parity ($\chi^2 = 18.06$, $P < 0.001$) but not with a history of abortion

($\chi^2 = 4.85$, $df = 3$, $P = 0.18$). There was a significant and progressive increased prevalence of GDM with increasing maternal age, from 5.6% at 20–29 years to 28.3% among women aged 40+ years. The prevalence of GDM was 9.5% (95% CI: 3.6%–19.6%) among the nulliparous women, 6.3% (95% CI: 3.9%–10.5%) among the multiparas (1–4 live births) and 18.2% (95% CI: 14.1%–23.2%) among grand-multiparous women (5+ live births). Multiparous women were 8 times more likely to have GDM [unadjusted odds ratio (OR) 8.29, 95% CI: 1.01–179.87] than nulliparous women.

Logistic regression analysis was applied, with maternal age, parity and history of abortion as independent variables against GDM as the dependant variable (Table 3). When the regression model was assessed for goodness of fit, 87.1% of all cases were found to be correctly classified according to the presence of GDM. Table 3 shows the estimated coefficients and their exponential from the logistic regression model that predicted GDM from a constant and the variables: age in years, parity (1 for nulliparous) and history of abortion (1 for positive history). The χ^2 -value for the model was 30.55

Table 2 Prevalence of gestational diabetes mellitus (GDM) among pregnant women by World Health Organization criteria according to selected maternal characteristics

Characteristic	Total (<i>n</i> = 633)		Prevalence of GDM		OR	95% CI
	No.	%	No.	%		
<i>Age group (years)</i>						
< 20	21	3.3	0	0.0	1	
20–29	180	28.4	10	5.6	1.20	0.15–27.05
30–39	379	59.9	54	14.2	3.62	0.50–73.66
40+	53	8.4	15	28.3	8.29	1.01–179.87*
$\chi^2_{LT} = 22.89, P < 0.001$						
<i>Parity (no. of live births)</i>						
Nulliparous (0)	63	9.9	6	9.5	1	
Multiparous (1–4)	253	40.0	16	6.3	0.68	0.24–2.03
Grand multiparous (5+)	317	50.1	57	18.2	2.12	0.83–5.75
$\chi^2 = 18.06, df = 2, P < 0.001$						
<i>Previous abortion (no.)</i>						
0	351	55.4	36	10.3	1	
1	176	27.8	28	15.9	1.77	1.02–3.09*
2	77	12.2	11	14.3	1.46	0.66–3.14
3+	29	4.6	4	13.8	1.40	0.39–4.57
$\chi^2 = 3.76, df = 3, P = 0.29$						

* $P < 0.05$.

OR = odds ratio; CI = confidence interval.

Table 3 Logistic regression analysis of gestational diabetes mellitus with maternal age, parity and history of abortion

Independent variable	β	SE	P-value	OR	95% CI
Maternal age	0.0124	0.025	< 0.001	1.13	1.08–1.19
Abortion (+ve history = 1)	0.341	0.253	0.18	1.41	0.86–2.31
Parity (nulliparous = 1)	1.083	0.540	0.045	2.95	1.03–8.51
Constant	-6.288	0.905	< 0.001	0.002	

SE = standard error; OR = odds ratio; CI = confidence interval.

($P < 0.0001$). Age was the most highly significant predictor of GDM, with increasing maternal age associated with a greater likelihood of GDM (OR 1.13; 95% CI: 1.08–1.19, $P < 0.001$). Nulliparity was significantly associated with the occurrence of GDM after adjusting for maternal age and history of abortion (OR 2.95; 95% CI: 1.03–8.51, $P < 0.05$). A history of abortion was not associated with GDM after this adjustment (OR 1.41; 95% CI: 0.86–2.31, $P = 0.18$).

Given the previous coefficients, the logistic regression equation for the probability of occurrence of GDM was: $Z = -6.288 + 0.124$ (age in years) $+ 0.341$ (history of abortion) $+ 1.038$ (parity). Applying this to a pregnant woman who is 20 years with values of 0 for the remaining independent variables (i.e. a parous woman with no history of abortion), we find: $Z = -6.288 + 0.124$ (20) $= -3.808$. The probability of GDM is then estimated as: $1/1 + e^{-z} = 1/1 + e^{-(-3.808)} = 0.02$. Based on this, we would predict that a nulliparous woman is only 2% likely to get GDM. Following the same procedure for a woman aged 40 years, the estimated probability of GDM was: $1/1 + e^{-(-1.328)} = 0.21$,

i.e. GDM is 21% likely to occur at this age. However, if this same woman of 40 years of age was nulliparous, then applying the value of 1 for parity, the estimated probability of GDM is $1/1 + e^{-(-0.245)} = 0.44$, i.e. the probability will rise to 44%, indicating a higher possibility of GDM.

Table 4 compares nulliparous and parous women according to selected variables. In the bivariate analysis, parous women had a significantly higher mean maternal age [32.62 (SD 5.47) years versus 22.40 (SD 4.01) years] ($t = 19.83$, $P < 0.001$) and higher rate of positive history of previous abortion (48.4% versus 12.5%) ($\chi^2 = 34.02$, $P < 0.001$). The groups were similar in terms of the results of the OGTT. However, after adjustment for age and previous history of abortion, nulliparous women had significantly higher mean 2-h glucose values ($P < 0.01$) and higher prevalence of GDM ($P = 0.045$).

Discussion

GDM is an asymptomatic condition most of the time and the effectiveness

of its detection has not been adequately tested. Based on ADA criteria for diagnosis of GDM, 3.8% of the studied pregnant women who completed the 2-h 75 g OGTT had a diagnosis of GDM. The corresponding figure according to WHO criteria for GDM was 12.5%. The latter figure is comparable with the incidence in Jeddah city (12.5%) [17] but is higher than the figures reported for Saudis living in the Dammam [18] or Riyadh [19] areas. It is compatible with figures from other nearby countries [20], but still higher than those of some developed countries [21]. However, comparison of the incidence in different communities may lack validity due to the diversity in the diagnostic criteria used.

The findings of the present study revealed that all cases of GDM by ADA criteria were detected by WHO criteria, while less than 30% of cases detected by WHO criteria were also diagnosed by ADA criteria. Meanwhile, the number of GDM cases according to WHO criteria ($n = 79$) was more than 3 times that for cases detected by ADA ($n = 24$). This is consistent with the guidelines of the Society of Obstetricians and

Table 4 Comparison between nulliparous and parous women according to selected variables

Variable	Nulliparous ($n = 63$)	Parous ($n = 572$)	P-value (unadjusted)	P-value (adjusted) ^a
Mean (SD) maternal age (years)	22.4 (4.0)	32.6 (5.5)	$t = 19.83$, $P < 0.001$	–
Positive history of abortion (%)	12.5	48.4	$\chi^2 = 34.02$, $P < 0.001$	–
Fasting plasma glucose (mmol/L)	4.92	5.02	0.24	0.61
2-hour plasma glucose (mmol/L)	6.08	6.15	0.71	0.01
Prevalence of GDM (%)	9.5	12.8	0.30	0.045

Data are shown for women whose data were available.

^aAdjustment was made for maternal age and history of abortion.

GDM = gestational diabetes mellitus; SD = standard deviation.

Gynaecologists of Canada, who reported that the use of WHO criteria would approximately double the number of women diagnosed with GDM [22].

According to Schmidt et al. [4], women meeting the definition for GDM by either WHO or ADA criteria were at greater risk of pre-eclampsia and their babies were at greater risk of macrosomia and perinatal mortality than women without GDM. Thus, until consensus criteria are reached, these 2 criteria are valid options for the detection of adverse pregnancy outcomes. However, assuming that effective treatment is available, WHO criteria, by identifying a larger number of cases, may have greater potential for screening.

High parity (parity 5+) is common in developing countries, especially in Arab nations where large families are the norm. The incidence of grand multiparity ranges from 0.6% in Croatia and Hong Kong [15] to 5% in Trinidad [14], 11% in Nigeria [23] and above 30% in the United Arab Emirates [24] and Sudan [11]. In the present study, 50.1% of all pregnant women were grand multiparas. Many studies have been conducted to investigate the relationship between high parity and adverse birth outcome [10–12, 14–16]. The relationship between parity and risk of type 2 diabetes has also been examined [13]. Most reported associations between parity and diabetes have not been adjusted for age or body adiposity, both of which are likely to be important confounding factors [13, 25]. In studies that have presented results adjusted for age and adiposity [13, 26, 27], the findings have been highly inconsistent. In the present study, when parity was used as an ordinal variable, GDM

was significantly more prevalent among nulliparas as well as grand-multiparas, while it showed the lowest prevalence among multiparous women (1–4 live births). However, when using this parity variable as a dichotomous variable (nulliparous versus parous), no significant difference was detected in GDM prevalence between the 2 groups in the bivariate analysis. After adjustment by logistic regression analysis for both maternal age and history of previous abortion (both showed highly significant differences between the 2 groups), a significant association between parity and GDM was detected, so that GDM was about 3 times more likely to occur in nulliparous than in parous women. Meanwhile, the mean value of the 2-h OGTT, after adjusting for age and history of abortion, using ANCOVA, was significantly higher among the nulliparous group than among the parous group ($P = 0.01$).

It has been reported that many complications are associated with grand multiparity, including GDM, which was shown to increase with maternal age [16]. That is to say, the association between parity and adverse maternal complications might actually be due to the confounding effect of maternal age. In the present study, maternal age was strongly associated with the occurrence of GDM, with pregnant women aged 40+ years about 8 times more likely to have gestational diabetes ($OR = 8.29$) compared with younger women. Even after adjusting for parity and history of previous abortion using logistic regression analysis, maternal age was still a significant independent predictor of GDM. The results of the present study revealed that the probability of

occurrence of GDM increased from 2% to 21% when age increased from 20 to 40 years, and this later probability was doubled (i.e. 44%) for women who were nulliparous.

Some limitations have to be addressed in the present study. First it was a relatively small sample size that might not allow the results to be generalized. Secondly we used only 2 of the 3 readings of plasma glucose recommended for diagnosing GDM by the ADA (fasting and 2-h, but not 1-h readings).

From the findings of this study, and considering its limitations, we conclude that:

- According to WHO criteria the prevalence of GDM at King Fahd National Guard Hospital is high (12.5%).
- Nulliparity could be considered as a significant independent predictor of GDM until further studies with higher numbers of nulliparas are done to support this finding.
- Maternal age is a significant predictor of GDM, and the high rate of GDM among grand multiparas could be due to the confounding effect of maternal age.

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References

1. American Diabetes Association. Gestational diabetes mellitus. *Diabetes care*, 2000, 23(Suppl. 1):S77–9.
2. *Definition, diagnosis and classification of diabetes mellitus and its complications: Report of a WHO Consultation. Part 1: diagnosis and classification of diabetes mellitus*. Geneva, World Health Organization, 1999 (WHO/NCD/NCS/99.2).
3. Kjos SL, Buchanan TA. Gestational diabetes. *New England journal of medicine*, 1999, 341:1749–56.

4. Schmidt MI et al. Gestational diabetes mellitus diagnosed with a 2-h 75-g oral glucose tolerance test and adverse pregnancy outcomes. *Diabetes care*, 2001, 24:1151-5.
5. *Diabetes mellitus. Report of a WHO study group*. Geneva, World Health Organization, 1985 (WHO Technical Report Series, No. 727).
6. Metzger BE, Coustan DR. Summary and recommendations of the Fourth International Workshop-Conference on Gestational Diabetes Mellitus. The Organizing Committee. *Diabetes care*, 1998, 21(Suppl. 1):B161-7.
7. Gabir MM et al. The 1997 American Diabetes Association and 1999 World Health Organization criteria for hyperglycemia in the diagnosis and prediction of diabetes. *Diabetes care*, 2000, 23(8):1108-12.
8. Russell MA, Carpenter MW, Coustan DR. Screening and diagnosis of gestational diabetes mellitus. *Clinical obstetrics and gynecology*, 2007, 50(4):949-58.
9. Kumari AS, Badrinath P. Extreme grandmultiparity: is it an obstetric risk factor? *European journal of obstetrics, gynecology, and reproductive biology*, 2002, 101:22-5.
10. Bai J et al. Parity and pregnancy outcomes. *American journal of obstetrics and gynecology*, 2002, 186:274-8.
11. Aziz FA. Pregnancy and labor of grand multiparous Sudanese women. *International journal of gynecology and obstetrics*, 1980, 18:144-6.
12. Eidelman AI et al. The grand multipara: is she still at risk? *American journal of obstetrics and gynecology*, 1988, 158:389-92.
13. Boyko EJ et al. Effects of childbearing on glucose tolerance and NIDDM prevalence. *Diabetes care*, 1990, 13:848-54.
14. Roopnarinesingh S, Ramsewak S, Reddy S. Complications of grand multiparity. *West Indian medical journal*, 1988, 37:222-5.
15. King PA, Duthie SJ, Ma HK. Grand multiparity: a reappraisal of the risks. *International journal of gynecology and obstetrics*, 1991, 36:13-6.
16. Aliyu MH et al. High parity and adverse birth outcomes: exploring the maze. *Birth*, 2005, 32:1.
17. Ardawi MSM et al. Screening for gestational diabetes mellitus in pregnant females. *Saudi medical journal*, 2000, 21(2):155-60.
18. Khwaja SS, Al-Suleiman SA, Al-Sibai MH. Screening for gestational diabetes in a teaching hospital in Saudi Arabia. *Australian and New Zealand journal of obstetrics & gynaecology*, 1989, 29:209-11.
19. Al-Shawaf T, Akiel A, Moghbraby SA. Gestational diabetes and impaired glucose tolerance of pregnancy in Riyadh. *British journal of obstetrics and gynaecology*, 1988, 95:84-90.
20. Al-Mahroos S et al. A population-based screening for gestational diabetes mellitus in non-diabetic women in Bahrain. *Annals of Saudi medicine*, 2005, 25:29-33.
21. Naylor CD et al. Cesarean delivery in relation to birth weight and gestational glucose tolerance: pathophysiology or practice style? Toronto Trihospital Gestational Diabetes Investigators. *Journal of the American Medical Association*, 1996, 275:1165-70.
22. Society of Obstetricians and Gynaecologists of Canada. Screening for gestational diabetes. *Journal of obstetrics and gynaecology Canada*, 2002, 24(11):894-903.
23. Ozumba BC, Igwegbe AO. The challenge of grandmultiparity in Nigerian obstetric practice. *International journal of gynecology and obstetrics*, 1992, 37:259-64.
24. Rizk DE, Khalfan M, Ezimokhai M. Obstetric outcome in grand multipara in the United Arab Emirates. A case control study. *Archives of gynecology and obstetrics*, 2001, 264:194-8.
25. Manson JE et al. Parity and incidence of non-insulin dependent diabetes mellitus. *American journal of medicine*, 1992, 93:13-8.
26. Cowan LD et al. Parity, postmenopausal estrogen use, and cardiovascular disease risk factors among American Indian women: the Strong Heart Study. *Journal of women's health*, 1997, 4:441-9.
27. Kritz-Silverstein D et al. Relation of pregnancy history to insulin levels in older, nondiabetic women. *American journal of epidemiology*, 1994, 140:375-82.

Evaluation of effect of silymarin on granulosa cell apoptosis and follicular development in patients undergoing *in vitro* fertilization

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تقييم أثر السيليمارين على استماتة الخلايا الحبيبية والتطور الجريبي في مرضى الإخصاب في المختبر

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الخلاصة: يهدف البحث إلى دراسة آثار السيليمارين على التطور الجريبي. وقد أدرج الباحثون في هذه الدراسة 40 امرأة ممن يجربن الإخصاب في المختبر ويتمتعن بصحة جيدة. فأجروا لمن تحريضاً للإباضة، وعيّن بعضهن على أسس عشوائية ومعممة لتلقي السيليمارين (70 ميلي غرام ثلاث مرات يومياً) أو الدواء الغفل منذ بداية دورة التحريض. وقّيم الباحثون عدد وجودة الخلايا البيضية التي حصلوا عليها، ودرسوا استماتة الخلايا الحبيبية، فلم يجدوا فرقاً بين مجموعتين كان في إحداها العدد الوسطي للجريبات يساوي أو يزيد على 18 ميلي متر (قوة الاحتمال $P = 0.131$)، والعدد الوسطي للخلايا البيضية التي حصلوا عليها (قوة الاحتمال $P = 0.209$)، وثخانة بطانة الرحم (قوة الاحتمال $P = 0.673$). إلا أن النسبة المئوية للاستماتة الإجمالية في المجموعة المدروسة كانت منخفضة بدرجة يُعتد بها إحصائياً عما هي عليه في المجموعة التي تلقت الدواء الغفل (قوة الاحتمال $P = 0.032$). وتشير هذه المعطيات إلى أن إعطاء السيليمارين لمريضات الإخصاب في المختبر بالتزامن مع موجهة الغدد التناسلية يؤدي إلى إنقاص استماتة الخلايا الحبيبية ولكنه لا تأثير له على تعزيز التطور الجريبي، وعلى الحصول على الخلايا البيضية، وعلى ثخانة بطانة الرحم.

ABSTRACT To investigate the effects of silymarin on follicular development, we enrolled 40 healthy women undergoing *in vitro* fertilization (IVF) due to male factor infertility in this trial. They underwent ovulation induction and on a random and blind basis, patients were assigned to receive silymarin (70 mg $\times$ 3/day) or placebo from the beginning of the induction cycle. The number and quality of oocytes retrieved were evaluated and apoptosis of granulosa cells was studied. There was no significant difference between the groups for mean number of follicles ≥ 18 mm ($P = 0.131$), mean number of oocytes retrieved ($P = 0.209$) or endometrial thickness ($P = 0.673$). However, the proportion of total apoptosis in the study group was significantly lower than in the placebo group ($P = 0.032$). These data suggest that administration of silymarin in IVF patients concomitantly with gonadotropin results in reduction of granulosa cell apoptosis but does not have any effect in promotion of follicular development, oocyte retrieval or endometrial thickness.

Évaluation de l'effet de la silymarine sur l'apoptose des cellules de la granulosa et le développement folliculaire chez les patientes subissant une fécondation *in vitro*

RÉSUMÉ Pour étudier les effets de la silymarine sur le développement folliculaire, nous avons recruté 40 femmes en bonne santé subissant une fécondation *in vitro* (FIV) en raison d'une infertilité masculine. Ces patientes ont été soumises à une induction d'ovulation et ont reçu, sur la base d'une répartition aléatoire et en aveugle, de la silymarine (70 mg $\times$ 3 fois par jour) ou un placebo, dès le début du cycle d'induction. Le nombre et la qualité des ovocytes prélevés ont été évalués, et l'apoptose des cellules de la granulosa a été étudiée. Aucune différence significative n'a été observée entre les deux groupes en termes de nombre moyen de follicules ≥ 18 mm ($P = 0,131$), de nombre moyen d'ovocytes prélevés ($P = 0,209$) ou d'épaisseur de l'endomètre ($P = 0,673$). Toutefois, la proportion de l'apoptose totale dans le groupe d'expérimentation était significativement inférieure à celle observée dans le groupe sous placebo ($P = 0,032$). Ces données suggèrent que, chez les patientes qui subissent une FIV, l'administration concomitante de silymarine et de gonadotrophine induit une réduction de l'apoptose des cellules de la granulosa, mais n'a aucun effet sur la stimulation du développement folliculaire, sur le nombre d'ovocytes prélevés ni sur l'épaisseur de l'endomètre.

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Introduction

Normal maturation and growth of oocytes depends on adequate support from ovarian granulosa cells of the follicles [1]. Therefore, apoptosis of granulosa cells seems to have a negative effect on follicular development, oocyte quality and pregnancy rates [2].

Reactive oxygen species (ROS) serve not only as key signal molecules in physiological processes, but also have a role in pathological processes in female reproduction. ROS are involved in the modulation of an entire spectrum of physiological reproductive functions such as folliculogenesis, oocyte maturation, steroidogenesis, corpus luteal function and luteolysis [3]. The role of ROS in gynaecological disease and assisted reproduction has been widely studied in recent years.

Follicular fluid microenvironment has a crucial role in determining the quality of the oocyte. There is a potent antioxidant enzymatic defence in human follicular fluid that protects oocytes against oxidative stress (OS) [3,4]. Changes in the antioxidant enzymatic pattern could impair ROS scavenging efficacy in the follicular environment and result in OS. It has been shown that increased ROS concentration in the follicular fluid has been associated with increased granulosa cell apoptosis and thus impaired follicular development [5].

Silymarin, which is a standardized extract (a mixture of 3 isomeric flavonolignans) from dried fruits of milk thistle, *Silybum marianum*, appears to function as an antioxidant by scavenging free radicals to increase glutathione levels and activate superoxide dismutase (SOD) and glutathione peroxidases; it also inhibits the formation of damaging chemicals [6,7]. It has also been shown to act as a membrane stabilizer, preventing lipoperoxidation and associated cell damage in some experimental models [8].

In a study by Plíšková et al. silymarin and its components elicited partial or full estrogen receptor activation. Silybin B, one of the components of silymarin, has (probable) weak estrogen receptor (ER)-mediated activity. Silybin-A and other flavonolignans are inactive, and taxifolin, which is a minor constituent of silymarin, is a potent ER-agonist [9]. Considering the antioxidant effect and estrogen receptor activity, it is suggested that silymarin and its components can affect folliculogenesis, oocyte maturation, granulosa cell apoptosis and endometrial thickness.

This is the first attempt to evaluate the effects of silymarin on folliculogenesis and granulosa cell apoptosis. To study the actual effect of silymarin and to determine whether supplementation can increase the pregnancy rate in infertile patients undergoing assisted reproduction, we carried out an interventional study.

Methods

Forty healthy women undergoing *in vitro* fertilization (IVF) for male factor infertility were included from the patients attending the Infertility Clinic of Monasteries Hospital at Mashhad University of Medical Sciences between April 2006 and April 2007. Inclusion criteria were: the cause of infertility should be exclusively a male factor (total motile sperm count < 5 million per sample); women should undergo intracytoplasmic sperm injection cycles; age should be 18–35 years. Exclusion criteria were: cigarette smoking and taking vitamin C, vitamin E and other antioxidants recently or concurrently.

For all patients, demographic data, physical examination findings, hormonal and tubal assessment and probable concomitant disease were recorded.

Before the beginning of the cycles, patients were divided into 2 groups of 20 on a random and blinded basis. All the patients underwent a standard long

protocol of IVF cycle. After pituitary down regulation with GnRh analogue and from the first day of ovarian stimulation, one group of patients received gonadotropin plus silymarin (70 mg × 3/day) and the other group gonadotropin plus placebo. Transvaginal ultrasound examination was performed to evaluate follicular development and endometrial thickness on the sixth day after human menopausal gonadotropin administration and then every other day according to the follicular size. When at least 3 follicles measured ≥ 18 mm, human chorionic gonadotropin (HCG) 10 000 U was administered intramuscularly. 34–36 h after HCG injection, egg recovery was performed under transvaginal ultrasonographic guidance.

The number of follicles and endometrial thickness were recorded and oocyte quality examined by an embryologist according to a comprehensive grading system, which included evaluation of oocyte maturational status, morphological quality, and fertilization capacity from grade I to grade IV [10].

Measurement of granulosa cell apoptosis was performed by flow cytometry. Apoptotic granulosa cells were detected using Annexin V and propidium iodide. For 10 women selected at random (due to economic constraints, we could not manage more) granulosa cells were isolated from each aspirated follicle using hyaluronidase. Analysis of phosphatidylserine exposure in granulosa cells was carried out by the following process: first granulosa cells were washed with calcium buffer and the cell concentration was adjusted to 1.5×10^6 cells/mL in calcium buffer. Then 10 µL annexin V-FITC was added to 100 µL cell suspension and incubated for 20 minutes on ice in the dark. After incubation, the cells were washed again with calcium buffer; 10 µL propidium iodide was added to the suspension and incubated at least 10 minutes on ice, then the cell suspension was ready to analyse by flow cytometer. Positive con-

trol was carried out by Dexamethasone incubation

The number of follicles of different sizes, endometrial thickness on day of HCG injection, the number, and quality of oocytes retrieved and the percentage of early and total apoptosis were analysed for the 2 groups. P -value < 0.05 was considered significant.

Results

All 40 women completed the study. The mean age of patients was 28.38 [standard deviation (SD) 4.59] years in the study group and 27.59 (SD 4.05) years in the placebo group, and was not significantly different. Other paraclinical parameters are listed in Table 1.

The mean number of follicles ≥ 18 mm and 15–18 mm and also the total number of oocytes retrieved were not significantly greater in the therapeutic group ($P = 0.118$, 0.360 and 0.125 respectively) (Table 2). There was no significant difference between the 2 groups regarding endometrial thickness ($P = 0.673$).

The proportion of early apoptosis and total apoptosis in therapeutic group was significantly lower than in the control group ($P = 0.014$ and 0.027 respectively) while late apoptosis was reduced, but not significantly ($P = 0.086$) (Table 3).

Discussion

Granulosa cells are essential in the normal follicular maturation process since they produce steroidal hormones and growth factors and also they play a crucial role in follicular atresia. Apoptosis of granulosa cells seems to have a negative effect on follicular maturation. A higher incidence of apoptotic granulosa cell has been associated with fewer oocytes retrieved and poorer quality of oocytes and embryos [2].

Table 1 Baseline characteristics of the sylimarin group and the placebo group

Parameter	Therapeutic group Mean (SD)	Control group Mean (SD)	Overall Mean (SD)
Age (years)	28.38 (4.59)	27.59 (4.05)	27.97 (4.29)
LH (mIU/mL) on day 3	5.75 (3.20)	5.17 (2.20)	5.45 (2.72)
FSH (mIU/mL) on day 3	6.68 (2.16)	6.89 (3.10)	6.79 (2.65)
LH/FSH on day 3	0.94 (0.58)	0.91 (0.54)	0.92 (0.55)
TSH (mIU/mL)	1.84 (1.33)	2.09 (1.30)	1.97 (1.30)
Prolactin (mIU/mL)	218.71 (218.23)	237.22 (230.38)	228.18 (222.04)

SD = standard deviation.

LH = luteinizing hormone.

FSH = follicle stimulating hormone.

TSH = thyroid stimulating hormone.

Various pathological stimuli such as OS can initiate apoptosis in mammalian oocytes [11]. Intra-cellular accumulation of ROS, i.e. OS, can damage cells by causing nucleic acid strand breaks, lipid peroxidation, protein degradation and ultimately, cell death [12]. It has been suggested that steroidogenically active cells such as granulosa cells of antral follicles, require high levels of energy production and thus generate large amounts of ROS [13]. Therefore it is possible that OS is involved in the mechanisms that trigger apoptosis in

healthy steroidogenic antral follicles [2].

An increasing number of published studies have pointed towards increased importance of the role of OS in female reproduction [2,3]. OS can be overcome by reducing generation of ROS or increasing the amounts of total antioxidant capacity.

Pradeep et al. indicated that sylimarin exhibits good hepatoprotectivity and antioxidant potential against diethyl nitrosamine-induced hepatocellular damage in rats [14].

Table 2 Mean number of follicles and oocytes retrieved in the sylimarin group and the placebo group

Parameter	Therapeutic group Mean (SD)	Control group Mean (SD)	P -value ^a
No. of follicles ≥ 18 mm	7.76 (3.37)	6.14 (3.40)	0.118
No. of follicles 15–17 mm	3.28 (3.27)	4.61 (4.35)	0.360
No. of oocytes retrieved	10.09 (3.56)	8.52 (4.54)	0.125
Endometrial thickness (mm)	9.83 (1.79)	10.08 (2.11)	0.673

SD = standard deviation.

^aMann-Whitney U-test.

Table 3 Mean percentage of granulosa cell apoptosis in the sylimarin group and the placebo group

Apoptosis	Therapeutic group Mean (SD)	Control group Mean (SD)	P -value ^a
Early	2.70 (1.61)	13.77 (10.06)	0.014
Late	2.17 (2.65)	5.77 (2.33)	0.086
Total	4.88 (2.48)	19.54 (12.15)	0.027

SD = standard deviation.

^aMann-Whitney U-test.

Regarding the antioxidant effect of silymarin on fertility, Jancar et al. reported that an increased percentage of ROS-producing granulosa cells resulted in fewer oocytes retrieved and diminished implantation rate [2].

Tsani et al. evaluated opposing effects of glutathione depletion and follicle-stimulating hormone on reactive oxygen species and apoptosis in cultured pre-ovulatory follicles. They found that OS induced apoptosis in pre-ovulatory follicles and antiapoptotic effect of follicle stimulating hormone was mediated

by stimulation of follicular glutathione synthesis and suppression of ROS production [15]. Our findings demonstrated that apoptosis of granulosa cells was reduced but follicular development was not increased significantly by silymarin administration in women undergoing intracytoplasmic sperm injection for male factor infertility.

In a study by Plíšková et al. silymarin elicited partial ER activation, with the silybin B component being probably responsible for a majority of the weak ER-mediated activity of silymarin [9];

silybin A and other flavonolignans were found to be inactive, and the potent ER-agonist toxifolin is only a minor constituent of silymarin. In the study by Kummer et al. uterotrophic effects of 30 days treatment with Silymarin were evident from increased heights of the luminal epithelium and endometrium of ovariectomized rats [16].

In our study the endometrial thickness on the day of HCG injection did not differ significantly in the treatment and control groups; this may be because of the short treatment period.

References

1. Sharpe-Timms KL, Zimmer RL. Oocyte and pre-embryo classification. In: Keel BA, May JV, De Jonge CJ, eds. *Handbook of the assisted reproduction laboratory*. London, CRC Press LLC, 2000:179-96.
2. Jancar N et al. Effect of opoptosis and reactive oxygen species production in human granolusa cells on oocyte fertilization and blastocyst development. *Journal of assisted reproduction and genetics*, 2007, 24:91-7.
3. Agarwal A, Gupta S, Sharma RK. Role of oxidative stress in female reproduction. *Reproductive biology and endocrinology*, 2005, 14:3-28.
4. Carbone MC et al. Antioxidant enzymatic defences in human follicular fluid: characterization and age-dependent changes. *Molecular human reproduction*, 2003, 9(11):639-43.
5. Valdez KE, Cuneo SP, Turzillo AM. Regulation of apoptosis in the atresia of dominant bovine follicles of the first follicular wave following ovulation. *Journal of reproduction*, 2005, 130:71-81.
6. Dermarderosian A. *The review of natural products*, 1st ed. St Louis, Facts and Comparisons Inc., 2001:405-9.
7. Fleming T, ed. *PDR for herbal medicines*. Montvale, New Jersey, Medical Economics Co., 2005:566-7.
8. Shalan MG et al. Amelioration of lead toxicity on rat liver with vitamin C and silymarin supplements. *Toxicology*, 2006, 206:1-15.
9. Plíšková M et al. Effects of silymarin flavonolignans and synthetic silybin derivatives on estrogen and aryl hydrocarbon receptor activation. *Toxicology*, 2005, 215(1/2):80-9.
10. Dale B, Di Matteo L, Wilding M. Mitochondria in reproduction. In: Elder K, Cohen J, eds. *Human preimplantation embryo selection*. London, Informa HealthCare, 2007:276-9.
11. Roth Z, Hansen PJ. Involvement of apoptosis in distruption of developmental competence of bovine oocytes by heat shock during maturation. *Biology of reproduction*, 2004, 71(6):1898-906.
12. Yu BP. Cellular defences against damage from reactive oxygen species. *Physiological reviews*, 1994, 74:139-62.
13. Rapoport R, Shlan D, Hanukoglu I. Electron leakage from the adrenal cortex mito chondrial P450 scc and P450 cll systems: NADPH and steroid dependence. *Archives of biochemistry and biophysics*, 199, 5617:412-6.
14. Pradeep K, Mohan CV, Karthikeyan S. Silymarin modulates the oxidant - antioxidant imbalance during diethyl nitrosamine induced oxidative stress in rats. *European journal of pharmacology*, 2007, 560:110-6.
15. Tsai-Turton M, Luderer U. Opposing effects of glutathione depletion and follicle-simulating hormone on reactive oxygen species and apoptosis in cultured preovulatory rat follicles. *Endocrinology*, 2006, 147(3):1224-36.
16. Kummer V et al. Estrogenic effects of silymarin in ovariectomized rats. *Veterinarni-Medicina-UZPI (Czech Republic)*, 2001, 46:17-23.

Insulin-like growth factor-1 and zinc status of goitrous primary-school children in Arak, Islamic Republic of Iran

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عامل النمو الشبيه بالأنسولين - 1 وحالة الزنك في أطفال المدارس الابتدائية المصابين بتضخم الدرقية في أراك، جمهورية إيران الإسلامية

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الخلاصة: رغم وجود برنامج وطني ناجح ليؤدّن الملح، يتواصل وجود تضخم الدرقية بين الأطفال الإيرانيين. وقد أجرى الباحثون دراسة مستعرضة في أراك حول معدل انتشار تضخم الدرقية ووجدوا أنه 5.2% في عينة مقدارها 6520 طفلاً من المدارس الابتدائية. ثم قيّم الباحثون عينات فرعية تتألف من 193 طفلاً مصاباً بتضخم الدرقية مع 151 من الأطفال الأصحاء، لمعايرة اليود المفرغ في البول، ومرتسم الهرمون الدرقي، وعامل النمو الشبيه بالأنسولين - 1 ووزنك المصل. وقد وجد الباحثون أن المستوى الوسطي لليود في البول لدى الأطفال المصابين بتضخم الدرقية 17.4 ميكروغرام/ديسي لتر، ولدى الأطفال الأصحاء 15.3 ميكروغرام/ديسي لتر، مما يشير إلى أن استهلاك اليود كان كافياً. ولم يكن هناك تباين ذي أهمية يُعتد بها إحصائياً بين الأطفال المصابين بتضخم الدرقية والأطفال الأصحاء من حيث مستوى اليود المفرغ في البول، وعامل النمو الشبيه بالأنسولين - 1 ووزنك المصل. وتمس الحاجة لتقييم العوامل الأخرى لتفسير الانتشار المتبقي لتضخم الدرقية.

ABSTRACT Despite a successful national salt iodization programme, endemic goitre still persists in Iranian children. In a cross-sectional study in Arak the prevalence of goitre was 5.2% in a sample of 6520 primary-school children. Subsamples of 193 children with goitre and 151 healthy children were assessed for urinary iodine excretion, thyroid hormone profile, insulin-like growth factor-1 (IGF-1) and serum zinc. The mean urinary iodine levels of goitrous children and healthy children were 17.4 µg/dL and 15.3 µg/dL respectively, suggesting that iodine consumption was adequate. No significant differences were found between goitrous and healthy schoolchildren in mean levels of urinary iodine, serum IGF-1 or serum zinc. Other factors need be evaluated to explain the residual prevalence of goitre.

Facteur de croissance IGF-1 et bilan en zinc chez des élèves du primaire présentant un goitre à Arak (République islamique d'Iran)

RÉSUMÉ Malgré le succès d'un programme national d'iodation du sel, le goitre endémique persiste toujours chez les enfants iraniens. Une étude transversale réalisée à Arak a révélé que la prévalence du goitre dans un échantillon de 6 520 élèves du primaire était de 5,2 %. L'excrétion urinaire de l'iode, le profil thyroïdien, ainsi que le dosage du facteur de croissance IGF-1 et du zinc sérique ont été évalués dans des sous-échantillons de 193 enfants présentant un goitre et de 151 enfants en bonne santé. La concentration d'iode urinaire moyenne des enfants qui présentaient un goitre et des enfants sains était respectivement de 17,4 µg/dl et 15,3 µg/dl, suggérant un apport en iode adéquat. Aucune différence significative en termes de concentration moyenne d'iode urinaire ou de taux sérique de facteur de croissance IGF-1 ou de zinc n'a été constatée entre les élèves qui présentaient un goitre et ceux qui n'en avaient pas. D'autres facteurs devront être évalués pour expliquer la persistance de la prévalence du goitre.

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Introduction

Iodine deficiency used to be common in the Islamic Republic of Iran and, after a national programme of salt iodization was set up in 1994, considerable success has been achieved in reducing endemic goitre. Nationwide monitoring in the past decade found adequate urinary iodine excretion (UIE) levels in school-children, suggesting that nutritional iodine consumption was adequate [1,2]. Nevertheless endemic goitre still persists in Iranian schoolchildren [3].

Various explanations can be suggested for the residual prevalence of goitre, including environmental and genetic factors. There is some evidence of a positive correlation between serum insulin-like growth factor-1 (IGF-1) levels and the size of the thyroid [4] and that a decrease in serum IGF-1 levels has a favourable effect on thyroid size [5] although others have shown no correlation [6]. The interaction of thyroid hormones with zinc status has also been investigated. There are some reports that zinc deficiency may contribute to the pathogenesis of endemic goitre [7,8] and affect the metabolism of thyroid hormones [9]. Another survey suggested that zinc deficiency is a goitrogenic factor that maintains and aggravates the severity of goitre endemicity in the presence of iodine deficiency [10]. Some animal studies showed that zinc deficiency can decrease serum tri-iodothyronine (T_3) and thyroxine (T_4) levels [11] and that zinc supplements activate thyroid function [12].

The aim of the present study was to evaluate some of the preventable risk factors for the persistence of goitre among Iranian schoolchildren almost 10 years after mandatory iodine supplementation. We measured the prevalence of goitre and its association with UIE, thyroid hormones, IGF-1 and zinc levels in primary-school children in Arak, Islamic Republic of Iran.

Methods

The present study was a cross-sectional descriptive study, conducted during the school year 2005–06 in 16 urban government primary schools (8 boys' and 8 girls' schools) in Arak, the capital of Markazi province in the Islamic Republic of Iran.

Sample

The schools were chosen using a 1-stage clustered random sampling technique from 2 different educational divisions in Arak educational organization. The sites were selected to include areas with different environmental and socio-economic characteristics.

All students in the chosen schools were included in the study and 6520 schoolchildren aged 6–11 years were screened for thyroid gland volume. Goitre was assessed clinically and assigned to 1 of 3 stages according to the World Health Organization/International Council for the Control of Iodine Deficiency Disorders/United Nations Children's Fund (WHO/ICCIDD/UNICEF) criteria: stage 0 (no palpable or visible goitre; stage 1 (goitre detectable only by palpation and not visible when the neck is in the normal position, and including nodular glands even if not goitrous); stage 2 (goitre visible with the neck in normal position, and is consistent with an enlarged thyroid when the neck is palpated) [13].

Of 6520 children screened, 400 students aged 6–11 years (200 goitrous and 200 healthy) and their parents were selected using random number tables and invited to participate in the laboratory investigations. The exclusion criteria were the presence of any systemic chronic disease or having received prior thyroid medication. The biochemical evaluations included measurements of urinary iodine, total serum T_4 , total serum T_3 , serum thyroid-stimulating hormone (TSH), serum IGF-1 and serum zinc level.

Data collection

Casual urine samples were obtained from children in the morning hours and were frozen until analysis. Urinary iodine concentrations were measured at the University of Arak by alkaline washing, followed by iodide extraction from ash residue and spectrophotometry using the Sandell–Kolthoff reaction [14]. The normal level of urinary iodine was defined as $\geq 10.0 \mu\text{g/dL}$, mild iodine deficiency $5.0\text{--}9.9 \mu\text{g/dL}$, moderate iodine deficiency $2.0\text{--}4.9 \mu\text{g/dL}$ and severe iodine deficiency $< 2.0 \mu\text{g/dL}$.

Blood samples were obtained from the children and serum was prepared and frozen until analysis. Total T_4 and total T_3 were measured by radioimmunoassay (Radim EIA kit, Italy). The detection limits of the T_4 and T_3 assays were 4.0 ng/mL and 0.15 ng/mL , and normal ranges were $45\text{--}120 \text{ ng/mL}$ and $0.5\text{--}1.6 \text{ ng/mL}$ respectively. Serum TSH concentration was measured by immunoassay technique (Radim IEMA kit, Italy). The detection limit of the TSH assay was 0.1 mU/L , and the normal reference range was $0.32\text{--}4.00 \text{ mU/L}$.

Serum IGF-I was assayed by a competitive binding radioimmunoassay (Nichols Institute Diagnostics, California). The intra-assay coefficient of variation (CV) was less than 3%, and the interassay CV was less than 8.4%.

The children's zinc serum status was evaluated by an improved version of the method of Lampugnani et al. [15]. The serum zinc concentration was determined by spectrophotometric methods after deproteinization of samples. The chromogen used was 4-(2-pyridylazo) resorcinol sodium salt. The interference of iron and copper ions was eliminated by masking agents. The absorbance of the obtained colour solution was recorded at $\lambda = 490 \text{ nm}$. The absorption was proportional to the zinc concentration. Zinc deficiency was defined as a zinc level $\leq 65 \text{ mg/dL}$ [8].

The ethics committee of Arak University of Medical Sciences approved the study, which was carried out in accordance with the ethical standards of the Helsinki Declaration, 1975 (revised 1983). Written permission for the study was obtained from the Education Organization of Arak city and the headteachers and chiefs of the schools involved. Parents also signed consent forms.

Statistical analysis

The differences between groups of subjects were assessed by the chi-squared and Mann–Whitney tests for comparisons between frequencies. Statistical significance was set at $P < 0.05$.

Results

The clinical examinations showed that the prevalence of goitre (stage 1 and 2) among the whole schoolchild population in Arak was 5.2%, ranging from 3.6% to 6.4% in different schools. Of the 340 children with goitre, 43.5% were classified as stage 2 according to the WHO/ICCIDD/UNICEF criteria. The prevalence of goitre increased with age, from 3.0% in children aged 6–7 years to 6.3% in children aged 11 years ($P < 0.001$). The prevalence of goitre was higher in girls (200/3163, 6.3%) than in boys (140/3357, 4.2%), although this was not significant statistically.

Some of the invited individuals, mainly in the healthy group, did not attend the clinic and therefore complete laboratory data were obtained for 193 children with goitre and 151 healthy children. There was no significant difference in the demographic characteristics of the goitrous and healthy groups of this subsample (Table 1).

The mean urine iodine level of goitrous children was 17.4 [standard deviation (SD 3.7)] $\mu\text{g/dL}$ and was not significantly different from the mean urine iodine level of healthy schoolchildren [15.3 (SD 3.2) $\mu\text{g/dL}$] ($P = 0.77$) (Table 2).

There was no significant difference in the mean serum level of IGF-1 between goitrous and healthy children [101.0 (SD 12.1) ng/mL versus 84.0 (SD 10.7) ng/mL] ($P = 0.2$) (Table 2).

Zinc deficiency (serum zinc level ≤ 65 mg/dL) was found in 21 (10.8%) of the goitrous children and 11 (7.2%) of the healthy children. No children had serum zinc concentration < 55 mg/dL. The mean serum zinc level of goitrous children [84.3 (SD 14.1) mg/dL] was not significantly different from that of healthy children [89.0 (SD 17.0) mg/dL] ($P = 0.16$) (Table 2).

The mean serum total T_3 and T_4 levels in zinc-deficient children were similar to those without deficiency, whereas serum TSH was significantly lower in

zinc-deficient children ($P = 0.04$) (Table 3). Of the zinc-deficient children, 62.5% had goitre compared with only 45.1% of those without zinc deficiency, although this was not a statistically significant difference ($P > 0.46$).

Discussion

Because goitre represents maladaptation of the thyroid to iodine deficiency, a reduction of the goitre rate to $< 5\%$ in school-age children is thought to indicate the disappearance of iodine deficiency disorder as a significant public health problem [13]. In our study, the prevalence of goitre in the sample of schoolchildren in Arak was 5.2%, which is slightly higher than this criterion but is dramatically lower than the goitre rate of 20% reported in a previous study in Arak in 1997 [16].

Our results showing that the total mean urinary iodine concentrations of the goitrous and healthy children were above the cut-off for abnormal levels indicate that the iodine supply in children's diets in Arak is adequate. It supports the suggestion that iodine deficiency was not the cause of the persistence of goitre after a decade of successful nationwide salt iodination and that other goitreogenic factors may be responsible for the continuing prevalence of goitre in this area of Islamic Republic of Iran.

Growth factors are well-documented factors regulating the proliferation of follicle cells of the thyroid in many *in vitro* experiments [17]. It has been demonstrated that IGF-1 stimulates cellular mitogenesis of thyrocytes, whereas TGF- β 1 inhibits the proliferation of follicle cells of the thyroid in experimental conditions [4]. In our study we did not find any significant difference in serum IGF-1 levels between goitrous and healthy children. These results were similar to Aydin et al.'s study in Turkey [6]. This might be due to the negative impact of thyroid dysfunction on IGF-1 levels. There are some other reports of a negative impact

Table 1 Demographic characteristics of schoolchildren with and without goitre

Variable	With goitre (<i>n</i> = 193)	Without goitre (<i>n</i> = 151)	<i>P</i> -value
Age [mean (SD)] (years)	9.33 (1.36)	8.90 (1.35)	0.13 ^a
Males [No. (%)]	106 (55)	92 (61)	0.26 ^a
Females [No. (%)]	87 (45)	59 (39)	0.38 ^a
Weight [mean (SD)] (kg)	29 (6.2)	28 (5.9)	0.12 ^b
Height [mean (SD)] (cm)	136 (9.0)	134 (8.5)	0.16 ^b
BMI [mean (SD)] (kg/m ²)	15.7 (1.8)	15.7 (1.9)	0.81 ^b
Educational sampling area 1 [No (%)]	77 (40)	67 (45)	0.53 ^a
Educational sampling area 2 [No (%)]	116 (60)	84 (55)	0.99 ^a

^a χ^2 -test; ^bMann–Whitney test.

SD = standard deviation; BMI = body mass index.

Table 2 Thyroid function tests, urine iodine, insulinlike growth factor and zinc status of schoolchildren with and without goitre

Variable	With goitre (n = 193)		Without goitre (n = 151)		P-value
	Mean	95% CI	Mean	95% CI	
Urine iodine (µg/mL)	17.4	13.7–21.1	15.3	12.1–18.5	0.75 ^a
Serum T ₄ (ng/mL)	85.6	82.9–88.3	85.6	82.6–88.6	0.88 ^a
Serum T ₃ (ng/mL)	1.36	1.30–1.42	1.28	1.22–1.33	0.06 ^a
Serum TSH (µg/mL)	2.46	2.04–2.88	2.25	2.06–2.44	0.25 ^a
Serum IGF-1 (ng/mL)	101.0	76.8–125.2	84.0	62.6–105.4	0.22 ^a
Serum zinc (µg/dL)	84.3	79.9–88.7	89.0	84.0–93.9	0.11 ^b

^aMann–Whitney test; ^bStudent t-test.

T₃ = tri-iodothyronine; T₄ = thyroxine; TSH = thyroid-stimulating hormone; IGF-1 = insulinlike growth factor.
CI = confidence interval.

of thyroid dysfunction or iodine deficiency on IGF-1 levels [18,19].

Mild-to-moderate zinc deficiency is common in developing countries because of a low dietary intake of zinc-rich animal-source foods, in which zinc is more bioavailable, and a high consumption of legumes and cereal grains, which contain inhibitors of zinc absorption [20–22]. No children had serum zinc concentration < 55 mg/dL, below the cut-off for moderate deficiency, but serum zinc ≤ 65 mg/dL, indicating mild zinc deficiency, was found in 10.8% of the goitrous children and 7.2% of the healthy children. This rate is lower than that found in other developing countries (30%–55%) [23,24], but still higher than in industrialized nations [25].

In our study, the plasma TSH level was significantly lower in zinc-deficient children, but serum total T₃ and T₄ concentrations were not affected by zinc status. T₄ to T₃ conversion and feedback to the hypophysis may be

affected by zinc deficiency. In animal studies, severe zinc-deficient rats had flattened epithelial cells, colloid accumulation and lower T₃ concentration [26,27]. However, the thyroid glands of zinc-deficient animals were smaller in size and pale or whitish pale in colour. Histopathologically, these glands showed atrophy and degeneration in the follicles [11]. Olivieri et al. did not find any relation between human zinc status and thyroid function [28], whereas Onishchenko et al. found that in regions exposed to some toxic metals and organic compounds zinc deficiency was a goitrogenic factor that aggravated the severity of goitre prevalence in the presence of iodine deficiency [10].

In a zinc deletion–repletion study carried out in humans, TSH, total T₄ and free T₄ tended to decrease during the depletion phase and returned to control levels after zinc repletion [29]. Those results suggested that zinc may play an important role in thyroid hormone

metabolism, although the exact mechanism by which zinc affects thyroid hormone function is far from clear.

Some of the selected children did not complete the survey and this was a limitation of the present study. Furthermore, as our study was limited to data from 16 urban schools in Arak it may not be possible to generalize the results to the whole schoolchild population of Islamic Republic of Iran.

To summarize, normal levels of urine iodine were found in both goitrous and healthy children. We found no significant differences in thyroid hormone, zinc, iodine or IGF-1 levels between goitrous and healthy schoolchildren. There was no significant difference in the prevalence of goitre between children with low and normal zinc levels. Further studies are needed to explain the residual prevalence of goitre the Islamic Republic of Iran.

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Table 3 Comparison of thyroid hormone levels of schoolchildren with and without zinc deficiency

Variable	Serum zinc level		P-value
	Deficient ≤ 65 mg/dL (n = 32)	Normal > 65 mg/dL (n = 312)	
	Mean (SD)	Mean (SD)	
Serum T ₄ (ng/mL)	90 (18.2)	82 (21.8)	0.3 ^a
Serum T ₃ (ng/mL)	1.35 (0.30)	1.30 (0.05)	0.3 ^a
Serum TSH (µg/mL)	1.50 (1.05)	2.78 (0.30)	0.04 ^a

^aMann–Whitney test.

T₃ = tri-iodothyronine; T₄ = thyroxine; TSH = thyroid-stimulating hormone; SD = standard deviation.

References

- Salarkia N et al. Evaluation of the impact of an iodine supplementation program on severely iodine-deficient school-children with hypothyroidism. *Public health nutrition*, 2003, 6:529-33.
- Azizi F et al. Goiter prevalence, urinary iodine excretion, thyroid function and anti-thyroid antibodies after 12 years of salt iodization in Shahriar, Iran. *International journal for vitamin and nutrition research*, 2002, 72:291-5.
- Azizi F et al. Sustainable control of iodine deficiency in Iran: beneficial results of the implementation of the mandatory law on salt iodization. *Journal of endocrinological investigation*, 2002, 25:409-13.
- Brzozowska M et al. Stezenie IGF-1 i TGFbeta-1 w surowicy krwi a wielkosc tarczycy u dzieci z prawidłowym wydalaniem jodu w moczu [The level of IGF-1 and TGF-beta-1 in the blood serum and the thyroid size in children with normal ioduria]. *Endokrynologia, diabetologia i choroby przemiany materii wieku rozwojowego*, 2005, 11(4):215-20.
- Cannavò S et al. Goiter and impairment of thyroid function in acromegalic patients: Basal evaluation and follow-up. *Hormone and metabolic research*, 2000, 32(5):190-5.
- Aydin K et al. Insulin-like growth factor-1 and insulin-like growth binding protein-3 levels of children living in an iodine and selenium deficient endemic goiter area. *Biological trace element research*, 2002, 90(1-3):25-30.
- Farkhutdinova LM. The goiter as a biogeochemical problem. *Doklady Akademii nauk*, 2004, 396:705-6.
- Ozata M et al. Iodine and zinc, but not selenium and copper, deficiency exists in a male Turkish population with endemic goiter. *Biological trace element research*, 1999, 69:211-6.
- Kralik A et al. Influence of zinc and selenium deficiency on parameters relating to thyroid hormone metabolism. *Hormone and metabolic research*, 1996, 28:223-6.
- Onishchenko GG, Zaitseva NV, Zemlianova MA. [Prevention of endemic goiter in areas jointly exposed to natural and industrial chemical factors]. *Gigiena i sanitaria*, 2004, 1:12-7 [in Russian].
- Gupta RP et al. Effect of experimental zinc deficiency on thyroid gland in guinea-pigs. *Annals of nutrition and metabolism*, 1997, 41:376-8.
- Baltaci AK et al. Opposite effects of zinc and melatonin on thyroid hormones in rats. *Toxicology*, 2004, 195:69-75.
- WHO/UNICEF/ICCIDD. *Assessment of iodine deficiency disorders and monitoring their elimination: a guide for programmer manager*, 2nd ed. Geneva, World Health Organization, 2001.
- Pino S et al. Ammonium persulfate: a safe alternative oxidizing reagent for measuring urinary iodine. *Clinical chemistry*, 1996, 42:239-43.
- Lampugnani L et al. A simple colorimetric method for the zinc assay in blood. *Analytical letters*, 1990, 23:1665-83.
- Fani A. Thyroid diseases and goiter in Markazi province. *Medical journal of Arak*, 2000, 5:221-34.
- Carneiro C et al. TGF-beta1 actions on FRTL-5 cells provide a model for the physiological regulation of thyroid growth. *Oncogene*, 1998, 16(11):1455-65.
- Alikasifoglu A et al. Serum insulin-like growth factor-I (IGF-I) and IGF-binding protein-3 levels in severe iodine deficiency. *Turkish journal of paediatrics*, 2002, 44(3):215-8.
- Iglesias et al. Serum insulin-like growth factor type I, insulin-like growth factor-binding protein-1, and insulin-like growth factor-binding protein-3 concentrations in patients with thyroid dysfunction. *Thyroid*, 2001, 11(11):1043-8.
- Rosado JL. Zinc and copper: proposed fortification levels and recommended zinc compounds. *Nutrition*, 2003, 133:2985S-9S.
- Black RE. Zinc deficiency, infectious disease and mortality in the developing world. *Journal of nutrition*, 2003, 133:1485S-9S.
- Gibson RS. Zinc: the missing link in combating micronutrient malnutrition in developing countries. *Proceedings of the Nutrition Society*, 2006, 65:51-60.
- Bhatnagar S et al. Zinc in child health and disease. *Indian journal of pediatrics*, 2004, 71:991-5.
- Hettiarachchi M et al. Prevalence and severity of micronutrient deficiency: a cross-sectional study among adolescents in Sri Lanka. *Asia Pacific journal of clinical nutrition*, 2006, 15:56-63.
- Hampel R et al. Serum zinc levels and goiter epidemiology in Germany. *Zeitschrift für Ernährungswissenschaft*, 1997, 36:12-5.
- Ruz M et al. Single and multiple selenium-zinc-iodine deficiencies affect rat thyroid metabolism and ultrastructure. *Journal of nutrition*, 1999, 129:174-80.
- Morley JE et al. Zinc deficiency, chronic starvation, and hypothalamic-pituitary-thyroid function. *American journal of clinical nutrition*, 1980, 33:1767-70.
- Olivieri O et al. Selenium, zinc, and thyroid hormones in healthy subjects: low t3/t4 ratio in the elderly is related to impaired selenium status. *Biological trace element research*, 1996, 51(1):31-41.
- Wada L et al. Effect of low zinc intakes on basal metabolic rate, thyroid hormones and protein utilization in adult men. *Journal of nutrition*, 1986, 116:1045-53.

Prevalence of asthma among schoolchildren in Ahvaz, Islamic Republic of Iran

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معدل انتشار الربو بين أطفال المدارس في الأهواز، جمهورية إيران الإسلامية

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الخلاصة: حدد الباحثون معدل انتشار الربو لدى عينة عشوائية من أطفال المدارس في مدينة الأهواز، جنوب غرب جمهورية إيران الإسلامية وذلك استناداً إلى بروتوكول الدراسة الدولية للربو والأرجحية لدى الأطفال ووجدوا أن معدل انتشار الوزيز في الوقت الحاضر 7.4٪ أو في أي وقت مضى 11.1٪ وذلك بين 1410 أطفال ممن تتراوح أعمارهم بين 6 - 7 سنوات (وفق إبلاغ الأبوين)، ومعدل حدوث الوزيز في الوقت الحاضر 10.3٪، وفي أي وقت مضى 17.7٪ بين 1450 طفلاً تتراوح أعمارهم بين 13 و 14 عاماً حسب إبلاغهم الذاتي. ولوحظ أن معدل انتشار الربو في أي وقت مضى كان أعلى بقدر يُعتد به إحصائياً لدى الأطفال الذين تتراوح أعمارهم بين 13 - 14 عاماً (9.8٪) مما هو عليه لدى الأطفال الذين تتراوح أعمارهم بين 6 و 7 سنوات (6.8٪)؛ إلا أن الباحثين لم يلاحظوا أية فروق ذات أهمية يُعتد بها إحصائياً بين الذكور والإناث في أي من المجموعتين. وأجرى الباحثون مقارنات مع معطيات المدن الإيرانية الأخرى ومع المعطيات الدولية.

ABSTRACT The prevalence of asthma was determined in a random sample of schoolchildren in Ahvaz city, south-west Islamic Republic of Iran, based on the International Study of Asthma and Allergy in Childhood (ISAAC) protocol. The prevalence of ever wheeze and current wheeze was 11.1% and 7.4% among 1410 children aged 6-7 years (parent-reported) and 17.7% and 10.3% among 1450 children aged 13-14 years (self-reported). The prevalence of ever asthma was significantly higher among 13-14-year-olds (9.8%) than 6-7-year-olds (6.8%) but no significant difference was found between males and females in either age group. Comparisons are made with other Iranian cities and international data.

Prévalence de l'asthme chez les élèves d'Ahvaz (République islamique d'Iran)

RÉSUMÉ La prévalence de l'asthme a été déterminée selon le protocole de l'Étude internationale de l'asthme et des allergies chez les enfants (ISAAC) sur un échantillon d'élèves de la ville d'Ahvaz (sud-ouest de la République islamique d'Iran) sélectionnés au hasard. La prévalence de la respiration sifflante diagnostiquée à un moment quelconque et de la respiration sifflante actuellement diagnostiquée était de 11,1 % et 7,4 % chez les 1 410 enfants âgés de 6 à 7 ans (épisodes déclarés par les parents), et de 17,7 % et 10,3 % parmi les 1 450 enfants âgés de 13 à 14 ans (épisodes auto-déclarés). La prévalence de l'asthme diagnostiqué à un moment quelconque était significativement plus élevée chez les 13 - 14 ans (9,8 %) que chez les 6 - 7 ans (6,8 %), mais aucune différence significative n'a été observée entre les garçons et les filles dans les deux groupes d'âge. Des comparaisons sont effectuées avec d'autres villes iraniennes et des données internationales.

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Introduction

Asthma is one of the most common chronic respiratory disorders and the prevalence of asthma and atopy has been increasing worldwide over the last 2 decades, especially in children [1,2]. The reported prevalence of asthma and other allergic disorders varies both within and between countries [3]. International and regional comparisons of asthma have been greatly facilitated by the International Study of Asthma and Allergies in Childhood (ISAAC) programme, which has formulated a standard questionnaire to collect data on the prevalence and severity of asthma [4]. The first results of ISAAC showed that the prevalence of asthma symptoms varied in different countries from 1.6% to 36.8% [4]. Genetics, lifestyle and environmental factors may play a role in these variations [5].

Because only a limited number of studies have been conducted on asthma in the south-west of the Islamic Republic of Iran, the epidemiology of this disease is still not fully understood in the region. This study was therefore designed to determine the prevalence of asthma and wheezing among schoolchildren of Ahvaz city in Khuzestan province and to compare the results with other studies in the Islamic Republic of Iran using the same protocol. It was hoped that the study would be helpful to health system policy-makers in planning asthma prevention programmes in the region.

Methods

A descriptive cross-sectional study in 2007 was conducted on schoolchildren in 2 age groups: 6–7 and 13–14 years in the city of Ahvaz in the centre of Khuzestan province, in the south-west of the Islamic Republic of Iran. Ahvaz is in the interior at an altitude of 18 m above sea level. In general, the city has an extremely hot and humid climate during summer.

The population of Ahvaz is 1 338 000, some of whom are of Arab descent.

Sample

The sample size was estimated as 2401, based on an asthma prevalence of 6.7% from a study carried out in Bushehr, a city located in the south of the Islamic Republic of Iran with a similar geographic environment [6], and 95% confidence (error 0.05) and accuracy 1% ($d = 0.01$). To allow for non-responses the sample size was increased to 3000.

The sampling frame of the survey was a list of all primary and intermediate schools provided by the Ahvaz Ministry of Education, indicating the district and region, number of schools and number of children in primary schools for the 6–7 years age group and preparatory/intermediate for the 13–14 years age group. A total of 32 schools, 16 for the 6–7 years age group and 16 for the 13–14 years age group among the 4 region of the Ahvaz city (each region 4 schools) were chosen randomly.

Ethical approval of the study protocol was obtained from both the Ministry of Health and the Ministry of Education.

Questionnaire and data collection

We used the ISAAC questionnaire for the survey [3]. The questionnaire was translated into Farsi by a specialized medical translator. The Farsi version was revised by a consultant paediatrician and an immunologist, and then back translated into English to check its equivalence. After obtaining consent from the school authorities, the 6–7-year-old schoolchildren were asked to take the questionnaires home with a letter of explanation. The questionnaire was completed by the parents of each child and returned to the school. The 13–14-year-olds completed the questionnaires in the classroom under the supervision of professionally trained interviewers according to phase 1 of the ISAAC methodology [3].

Definition of terms

The following terms were defined: ever wheeze (wheezing or whistling in the chest at any time in the past); current wheeze (wheezing or whistling in the chest at any time in the past 12 months); severe wheeze (wheezing severe enough to limit speech to only 1 or 2 words at a time between breaths); exercise-related wheeze (whistling sounds in the chest during or after exercise); nocturnal cough (dry cough at night, apart from a cough associated with a cold or a chest infection); ever asthma (ever had asthma diagnosed by physician at any time in the past).

Analysis

The questionnaires were coded, entered into the computer and processed according to ISAAC guidelines. The data were analysed using SPSS, version 15. We calculated the prevalence for each of the symptoms and presented them as simple frequencies. The significance of difference between proportions was calculated using the chi-squared test, with P value < 0.05 as the level of significance.

Results

Of the 3000 questionnaires distributed, 2860 completed questionnaires were returned, a response rate of 95.3%. There were 1410 (49.3%) children aged 6–7 years old and 1450 (50.7%) aged 13–14 years old.

Table 1 shows the prevalence of wheeze and asthma in schoolchildren by age group and sex. According to parents' reports 156 (11.1%) of 6–7-year-old schoolchildren were reported to have ever suffered wheeze, with no significant difference between boys and girls (11.8% versus 10.5%) ($P = 0.36$). The questionnaire to the 13–14 years age group showed that 250 (17.7%) of them had experienced wheezing in their lifetime, 16.2% of males and 18.8% of females. Although the proportion of

Table 1 Prevalence of asthma and asthma symptoms in schoolchildren in Ahvaz by age group and sex

Variable	Age 6-7 years					Age 13-14 years				
	Boys (n = 591)		Girls (n = 891)		Total (n = 1410)	Boys (n = 658)		Girls (n = 792)		Total (n = 1450)
	%	No.	%	No.		%	No.	%	No.	
Ever wheeze	11.8	156	10.5	103	11.1	16.2	256	18.8	177	17.7
Current wheeze ^a	7.5	103	7.3	103	7.4	10.3	145	10.0	145	10.3
Wheeze attacks in past year:										
< 4 episodes	13.7	45	14.9	45	14.5	23.7	69	16.4	19.2	19.2
> 12 episodes	4.3	11	3.1	11	3.5	4.4	14	3.6	3.9	3.9
Episodes of sleep disturbance by wheeze in past year:										
< 1 per week	7.1	28	11.6	28	9.8	18.8	49	12.6	14.8	14.8
≥ 1 per week	14.3	29	7.5	29	10.2	8.5	32	10.2	9.6	9.6
Severe speech-limiting wheeze in past year	7.2	25	8.5	25	8.0	11.0	38	10.6	10.7	10.7
Ever asthma ^b	6.6	92	7.0	92	6.8	11.6	123	8.7	9.8	9.8
Exercise-related wheeze in past year	3.4	51	3.8	51	3.8	16.4	202	16.4	16.4	16.4
Nocturnal cough in past year	7.9	126	9.9	126	9.1	17.0	222	18.7	18.1	18.1

^aWheezing or whistling in the chest at any time in the past 12 months; ^bever been diagnosed with asthma. CI = confidence interval.

females was higher, this difference was not statistically significant ($P = 0.19$).

The prevalence of ever wheeze and the prevalence of wheeze and exercise wheeze in the previous 12 months were significantly higher in the 13-14 years age group (17.7%, 10.2% and 16.4% respectively) compared with the 6-7 years age group (11.1%, 7.4% and 3.8% respectively) (Table 1).

Ever asthma, i.e. a history of physician-diagnosed asthma, was reported for 6.8% of the 6-7-year-olds, 6.6% of boys and 7.0% of the girls ($P = 0.76$) (Table 1). Ever asthma was reported by 9.8% of the 13-14-year-old schoolchildren. Although ever asthma was more prevalent in boys than girls (11.6% versus 8.7%), the difference was not statistically significant ($P = 0.10$).

The prevalence of nocturnal cough was significantly higher in the older age group than in the younger children (18.1% versus 9.1%, $P < 0.001$) but was not significantly different between the sexes in either age group.

Exercise-related wheeze in the previous year was significantly higher in the 13-14-year-olds (16.4%) than 6-7-year-olds (3.8%) ($P < 0.01$), but had a similar rate for boys and girls in both age groups.

No sex- or age-dominance was seen in the rate of severe asthma symptoms (sleep-disturbing and speech-limiting wheeze). A higher rate of speech limiting wheeze was reported by 13-14-year-olds compared with 6-7-year-olds, although this was not statistically significant.

Discussion

We found that the prevalence of ever asthma among schoolchildren in Ahvaz was 9.8% in 13-14-year-olds and 6.8% in 6-7-year-olds. Both these figures are higher than the mean prevalence of asthma in the Middle East according to data from the Global Initiative for Asthma (5.8%) [7]. A previous study in Ahvaz in 2005 found an asthma prevalence of 8.7% [8], but the rates reported from other Iranian cities range from 2.1% to 7.1%, using the ISAAC written questionnaire in 6-14-year-old schoolchildren [9,10-12]. The prevalence of asthma in the current study using the ISAAC protocol was also lower than in neighbouring countries in the Persian Gulf region where similar surveys were done, namely Iraq, Kuwait, Oman, Qatar and Saudi Arabia [6]. The Islamic Republic of Iran ranked 28th in the

prevalence of current asthma among the 56 countries where the ISAAC study was done.

The finding that the lifetime asthma prevalence in Ahvaz was closer to that of surrounding Arab countries but different from other cities in the Islamic Republic of Iran may be explained by similarities in the climate (humid and very hot) between Ahvaz city and neighbouring Arab countries. Our results were similar to another 2 cities of Islamic Republic of Iran, Boushehr and Gorgan, both of which are located near the sea, have high humidity and low altitude, suggesting that geographical location could affect the asthma prevalence in these regions. A study in Saudi Arabia showed major differences in the prevalence of bronchial asthma comparing coastal and inland areas with different climates [13]. Other studies in Western Europe (57 centres in 12 countries) also showed an association between altitude, temperature and humidity and the prevalence of asthma symptoms in these age groups [14].

For the 6–7 years age group, the prevalence of ever asthma of 6.8% puts Ahvaz in the high prevalence category when compared with some other cities

in Islamic Republic of Iran using the same ISAAC protocol (Table 2)—Qazvin 2.0% [15], Tehran 2.2% [10] and Rasht 7.1% [11]—and in the low prevalence category of ever asthma among countries around the Persian Gulf—Iraq 22.3% [16], Qatar 19.8% [17] and Oman 10.5% [18].

Consistent with most studies in other countries, the rate of ever asthma in the 13–14-year-old schoolchildren was higher than in the 6–7-year-old schoolchildren. The prevalence of ever asthma in the 13–14 years age group in Ahvaz (9.8%) was the highest among the 6 cities in the Islamic Republic of Iran using the ISAAC questionnaire (Table 2)—Urmia 2.1% [11], Qazvin 2.2% [15], Tehran 2.6% [10], Rasht 4.7% [11], Bushehr 6.7% [9] and Gorgan 7.0% [19]. However, the prevalence of ever asthma in the 13–14 year age group was similarly lower than reported in this age group in neighbouring Arab countries—in Saudi Arabia 23.0% [20], Iraq 22.3% [16], Oman 20.7% [18], Qatar 19.8% [17], Kuwait 16.8% [21] and the United Arab Emirates 13.0% [22].

Ever wheeze showed a higher prevalence compared with ever asthma

regardless of age. This might be due to wheezing resulting from causes other than asthma, but the most likely explanation is an underdiagnosis of asthma or the reluctance of physicians to label a child as asthmatic.

Evidence from the ISAAC study showed that the distribution of childhood asthma varied between global populations from less than 2% to 33% [4]. This variability may be related to differences in racial composition, environmental factors, climate, health facilities, diet and lifestyle. Since the Islamic Republic of Iran is a large country with diverse geographical areas, the different prevalences found in different cities may be due to the type of weather, the level of air pollution and genetic factors.

One striking finding in our study was that the prevalence of ever asthma and severe asthma symptoms did not differ significantly between boys and girls. Many regional studies have shown a predominance among boys in the prevalence of wheeze and ever asthma, whereas other studies from Lebanon, Turkey and India found similar rates of wheeze and ever asthma for both sexes [4,23–24].

Table 2 Prevalence of asthma and asthma symptoms in schoolchildren in Ahvaz and other cities in the Islamic Republic of Iran by age group using the International Study of Asthma and Allergies in Childhood (ISAAC) protocol. Sources: [9–12,15,19]

Age group/ city	Ever wheeze %	Current wheeze ^a %	Ever asthma ^b %	Sleep-disturbing wheeze ^c %	Speech-limiting wheeze %
6–7 years					
Ahvaz	11.1	7.3	6.8	10.2	8.0
Tehran	15.6	8.6	2.2	18.4	1.5
Rasht	22.0	n/a	7.1	6.0	12.6
Qazvin	10.0	10.2	2.0	35.7	n/a
13–14 years					
Ahvaz	17.7	10.0	9.8	9.6	10.7
Tehran	17.3	10.9	2.6	5.2	3.0
Rasht	24.0	n/a	4.7	4.3	9.7
Qazvin	26.0	17.6	2.2	36.9	n/a
Urmia	23.7	14.5	2.1	n/a	n/a
Gorgan	30.5	20.1	7.0	4.2	11.8
Bushehr	19.8	10.8	6.7	10.6	31.8
Birjand	18.0	10.1	n/a	8.9	4.0

^aWheezing or whistling in the chest at any time in the past 12 months; ^bEver been diagnosed with asthma; ^cincludes children awakening more than once/night per week. n/a = data not available.

As our results demonstrate, the overall proportion of girls with a positive history of ever wheeze was the same as boys, but there was a significantly higher rate in 13–14-year-olds versus 6–7-year-olds, i.e. the prevalence of ever asthma increased with increasing age, as it did in other studies [4,10]. If wheeze is considered the main symptom of asthma, this finding is similar those of most clinical studies: that the prevalence of asthma in adolescents is higher than in younger children.

Asthma severity is assessed in the ISAAC questionnaire by asking about sleep-disturbing wheeze and speech-limiting wheeze. As shown, no sex- or age-dominance was detected regarding these 2 indices of symptom severity. A higher rate of speech limitation was reported by 13–14-year-olds compared with the 6–7-year-old group although this was not significant. For the 6–7 years age group, the Islamic Republic of Iran ranked 27 out of 38 countries in the ISAAC global ranking for the prevalence of sleep-disturbing wheeze. Among the 3 cities in the Islamic Republic of Iran with data for this age group Ahvaz had the lowest proportion of children with severe asthma symptoms (sleep-disturbing and speech-limiting wheeze), and also among the 3 Eastern Mediterranean countries with data for this age group Ahvaz had the highest proportion of children with severe asthma symptoms [16–18]. For the 13–14 years age group, the Islamic Republic of Iran ranked 23 out of 56 countries in

the ISAAC global ranking for the prevalence rate of sleep-disturbing wheeze. Among the 7 cities in Islamic Republic of Iran with data for this age group Ahvaz had the lowest proportion of children with severe asthma symptoms (sleep-disturbing and speech-limiting wheeze) and also among the 3 Eastern Mediterranean countries with data for this age group Ahvaz had the highest proportion of children with severe asthma symptoms [17,18,21].

It has been estimated that wheeze and asthma symptoms improve with age and that remission of asthma is about 50% [16]. We found, however, that the prevalence of ever wheeze, current wheeze, exercise-related wheeze and nocturnal cough in the previous year was significantly lower from the reports of parents of 6–7 year olds than the self-reports of adolescents. These findings may reflect under-reporting by parents (parents' recall bias) and/or over-reporting by adolescents or different interpretation of questions. These biases usually accompany questionnaire-based studies.

The significantly higher rate of nocturnal cough among adolescents might be due to reports of night cough resulting from other causes, such as common colds or chest infections, because adolescents may not have the experience to differentiate the cause of their cough. Exercise may cause more wheezing in adolescents than in 6–7-year-old children because the frequency of participation in competitive sports

and vigorous exercise activities is higher among adolescents. Exercise-induced wheeze and night cough were reported equally by both sexes in both age groups, but at a significantly higher rate among the 13–14-year-old group.

This study had some limitations, including the possibility of recall bias in questionnaires and the lack of objective laboratory measures. The prevalence of asthma was based on data from a questionnaire with questions concerning symptoms or a previous diagnosis of asthma.

Conclusions

Our results demonstrate that Ahvaz city has a relatively high prevalence of asthma in schoolchildren compared with other cities in Islamic Republic of Iran, but a low prevalence compared with neighbouring Arab countries where the ISAAC protocol was used. The prevalence of asthma was higher in 13–14-year-olds compared with 6–7-year-olds, but was approximately equal in boys and girls.

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References

1. Wong GW, Chow CM. Childhood asthma epidemiology: Insight from comparative studies of rural and urban populations. *Pediatric pulmonology*, 2008, 43:107–16.
2. Downs SH et al. Continued increase in the prevalence of asthma and atopy. *Archives of disease in childhood*, 2001, 84:20–3.
3. Partridge MR, Alwan A. Prevention of asthma and approaches for enhanced care in the Eastern Mediterranean Region. *Eastern Mediterranean health journal*, 1997, 3(1):133–43.
4. Asher MI et al. International study of asthma and allergies in childhood (ISAAC): rationale and methods. *European respiratory journal*, 1995, 8:483–91.
5. Ece A et al. Prevalence of asthma and other allergic disorders among schoolchildren in Diyarbakir, Turkey. *Turkish journal of pediatrics*, 2001, 43:286–92.
6. Beasley R. Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: ISAAC. *Lancet*, 1998, 351:1225–32.
7. Masoli M et al. *Global burden of asthma*. Geneva, Global Initiative for Asthma, 2004.
8. Pezeshkpour Z, Ziyaei T, Taheri M, *Survey of prevalence of asthma in schoolchildren in Ahvaz* [MD thesis]. Department of Paediatrics, Ahvaz Jundi-Shapur University of Medical Sciences, 2010.

- diatrics, Faculty of Medicine, Ahvaz Jundi-Shapur University of Medical Sciences, Ahvaz, Islamic Republic of Iran, 2005.
9. Hatami G et al. Prevalence of asthma and asthma-related symptoms among 13–14 yr. schoolchildren in Bushehr, ISAAC. *Iranian south medical journal*, 2002, 5(2):167–75.
 10. Reza Masjedi M et al. Prevalence and severity of asthma symptoms in children of Tehran: International Study of Asthma and Allergies in Childhood (ISAAC). *Iranian journal of allergy, asthma and immunology*, 2004, 3(1):25–30.
 11. Abbasi Ranjbar Z. Prevalence of asthma symptoms in children. *Journal of Guilan University of Medical Sciences*, 2006, 56(14):1–9.
 12. Rahimi Rad MH, Hejazi ME, Behrouzian R. Asthma and other allergic diseases in 13–14-year-old schoolchildren in Urmia: an ISAAC study. *Eastern Mediterranean health journal*, 2007, 13(5):1005–16.
 13. Bener A et al. Prevalence of asthma and wheeze in two different climatic areas of Saudi Arabia. *Indian journal of chest diseases and allied sciences*, 1993, 35(1):9–15.
 14. Weiland SK et al. Climate and the prevalence of symptoms of asthma, allergic rhinitis, and atopic eczema in children. *Occupational and environmental medicine*, 2004, 61:609–15.
 15. Zohal MA, Hasheminasab R. Prevalence of asthma among school-age children in Qazvin (2003). *Journal of Qazvin University of Medical Sciences*, 2006, 9(4):64–8.
 16. Al-Thamiri D, Al-Kubaisy W, Ali SH. Asthma prevalence and severity among primary-school children in Baghdad. *Eastern Mediterranean health journal*, 2005, 11(1/2):1179–86.
 17. Janahi IA et al. Prevalence of asthma among qatari schoolchildren: international study of asthma and allergies in childhood, Qatar. *Pediatric pulmonology*, 2006, 41(1):80–6.
 18. Al-Riyami BMS et al. A relatively high prevalence and severity of asthma, allergic rhinitis and atopic eczema in schoolchildren in the Sultanate of Oman. *Respirology*, 2003, 8(1):69–76.
 19. Bazzazi H et al. The prevalence of asthma and allergic disorders among school children in Gorgan. *Journal of research in medical sciences*, 2007, 1(12):28–33.
 20. Al-Frayh AR et al. Increased prevalence of asthma in Saudi Arabia. *Annals of allergy, asthma and immunology*, 2001, 86(3):292–6.
 21. Behbehani NA et al. Prevalence of asthma, allergic rhinitis, and eczema in 13- to 14-year-old children in Kuwait: an ISAAC study. *Annals of allergy, asthma and immunology*, 2000, 85:58–63.
 22. Bener A et al. Prevalence of asthma among Emirates school children. *European journal of epidemiology*, 1994, 10:271–8.
 23. Ramadan FM et al. Prevalence of asthma and asthma symptoms in children in urban Lebanon. *Saudi medical journal*, 1999, 20(6):453–7.
 24. Paramesh H. Epidemiology of asthma in India. *Indian journal of pediatrics*, 2002, 69(4):309–12.

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Prevalence of overweight and obesity among adolescents in Irbid governorate, Jordan

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معدّل انتشار فرط الوزن والسمنة بين المراهقين في محافظة إربد، الأردن
نسرين نايف أبو بكر، صالح محمد درادكة

الخلاصة: تتفاقم أهمية فرط الوزن والسمنة بين المشكلات الصحية في كل من البلدان النامية والمتقدمة. واستهدف الباحثون في هذه الدراسة المستعرضة التعرف على معدل انتشار فرط الوزن والسمنة بين المراهقين الذين تتراوح أعمارهم بين 13 و16 عاماً في محافظة إربد، الأردن، ومقارنة الانتشار وفق الجنس ومنطقة السكن والوضع الاقتصادي والاجتماعي. أخذ الباحثون عينة عنقودية عشوائية تتألف من 1355 من أطفال المدارس، ووجدوا أن معدل انتشار فرط الوزن والسمنة (عندما يتجاوز مَنَسَب كتلة الجسم الشريحة المئوية الـ 85) بلغت 24.4% (منهم 15.7% من المصابين بفرط الوزن و8.7% من المصابين بالسمنة)، وأن هذه النتائج أعلى لدى الطالبات، ولدى الطلاب الذين يعيشون في مناطق ريفية ولدى الطلاب الذين يعمل أبواهم. أن المعدل المرتفع لفرط الوزن يؤثر قلقاً كبيراً وجدياً في أوساط الصحة العمومية في الأردن.

ABSTRACT Overweight and obesity is an escalating health problem in both developed and developing countries. This descriptive cross-sectional study aimed to determine the prevalence of overweight and obesity among adolescents aged 13–16 years in Irbid governorate, Jordan, and to compare the prevalence by sex, residential area and socioeconomic status. In a cluster random sample of 1355 school students the prevalence of overweight and obesity (body mass index $\geq$ 85th percentile) was 24.4% (15.7% overweight and 8.7 % obese) and was significantly higher among female students, students who lived in urban areas and those with working parents. This high prevalence of overweight is a serious concern for public health in Jordan.

Prévalence de la surcharge pondérale et de l'obésité chez les adolescents du gouvernorat d'Irbid (Jordanie)

RÉSUMÉ La surcharge pondérale et l'obésité sont un problème grandissant dans les pays industrialisés comme dans les pays en développement. Le but de cette étude descriptive transversale était de déterminer la prévalence de la surcharge pondérale et de l'obésité chez les adolescents âgés de 13 à 16 ans dans le gouvernorat d'Irbid (Jordanie), et d'établir des comparaisons en fonction du sexe, de la zone de résidence et du statut socioéconomique. Dans un échantillon aléatoire de grappes de 1355 élèves, la prévalence de la surcharge pondérale et de l'obésité (indice de masse corporelle $\geq$ 85e percentile) était de 24,4 % (dont 15,7 % en surcharge pondérale et 8,7 % souffrant d'obésité). Elle était significativement supérieure chez les filles, les élèves vivant dans des zones urbaines et ceux dont les parents travaillent. Cette prévalence élevée de la surcharge pondérale fait peser de graves inquiétudes sur la santé publique en Jordanie.

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Introduction

Overweight and obesity is an escalating health problem in both developed and developing countries. The International Obesity Task Force report showed that 1 in 10 children worldwide is overweight; a total of 155 million children and adolescents are overweight and around 30–45 million are classified as obese [1]. The main contributing forces in the increasing prevalence of overweight and obesity are believed to be increasing urbanization and the globalization of food markets. With rising incomes and urbanizing populations, physical activity levels tend to decline and diets increasingly shift to include foods higher in saturated fats and sugars [2].

Overweight and obesity are risk factors for many health problems, regardless of a person's age. Children and adolescents who are overweight and obese, however, face a greater risk of health problems—including type 2 diabetes mellitus, high blood pressure, high blood lipids, asthma, sleep apnoea, orthopaedic problems and psychosocial problems—than their normal weight peers [3]. There is an urgent need to investigate the magnitude of this problem in developing countries such as Jordan, and to implement prevention strategies as early as childhood by involving families, schools and the whole community.

National estimates of the prevalence of overweight and obesity among adolescents are currently unavailable in Jordan. One study in 1997 found that the overall prevalence of obesity among semi-urban communities in Jordan was 49.7% (32.7% in males and 59.8% in females) [4]. The objectives of the present study were to determine the prevalence of overweight and obesity among adolescent school students aged 13–16 years in Irbid governorate, Jordan, and to compare the prevalence by sex, residential area and socioeconomic status. Such data will provide health care providers and school administrators with useful information about the prevalence

and factors associated with overweight and obesity in order to design prevention strategies for adolescents.

Methods

A descriptive, exploratory cross-sectional design was used to estimate the prevalence of overweight and obesity among adolescents in Irbid governorate.

Study setting

Data collection was conducted in the primary and secondary schools of Irbid governorate (male and female, public and private schools). Irbid is situated in the north-west of Jordan, 80 km to the north of the capital, Amman. The total population of Jordan is around 5 800 000 [5], with more than 25% aged 10–19 years. Approximately 18% of the Jordanian population reside in Irbid governorate, around 30% in rural areas [6]. About 99% of Jordanian children of school age attend primary school and drop-out rates in secondary school are very low [6].

Sample

The population for this study was all students aged 13–16 years old (i.e. 8th, 9th and 10th school grades) in all Irbid educational directorates. A cluster random sample was used. A list of public schools was obtained from the education directorates and clusters were created for each of the 7 directorates, then clusters were created for male and female schools and 2 schools were selected randomly from each cluster (1 girls' school and 1 boys' school). Finally, 3 classes from each school were selected randomly, 1 section for each grade (8th, 9th and 10th). Private schools were only present in 2 of the directorates. A list of private schools in each directorate was created and 2 schools were randomly selected from each list. The total number of schools used for data collection was 18. The total sample

size was 1355 participants aged 13–16 years, based on the following formula: $N = [(1.96)^2 \times pq] / d^2$, where N = sample size, p = expected prevalence, $q = 1 - p$, d = margin of error

To calculate the 95% confidence interval for an expected prevalence of 25% (based on the average percentage prevalence of overweight and obesity in the world) with a margin of error (d) of not more than 0.03, the required sample size was 800. To cover for nonparticipation, we enlarged the sample as follows: $N = (1.96)^2 \times (0.25) \times (1 - 0.25) / (0.03)^2 = 800$.

Data collection

Each student who agreed to participate was interviewed first to collect sociodemographic data using a structured questionnaire, and then the student's weight and height were recorded. To eliminate interviewer bias, the study was conducted by 1 interviewer only in May 2007.

The following sociodemographic were collected: age, sex, education level of student (8th, 9th or 10th grade), residence (urban/rural), family income, parents' education level and parents' employment status. For the purpose of this study a rural area was defined as a sparsely settled place away from the influence of large cities and having an agricultural character. Urban area was defined as the area with an increased density of human-created structures in comparison to the areas surrounding it and further developed by the process of urbanization. Low family income was defined as ≤ 200 Jordanian dirhams (JD) per month, middle income as 201–600 JD per month and high income as ≥ 600 JD per month. When a student was unable to identify the family income level the response was recorded as "don't know". Students were asked if their father and mother had a job or not; the type of job was not recorded. These variables were selected because they could easily be reported by this age

group. Other variables such as exercise were not collected because they are hard to quantify accurately by self-report in this age group, and they were beyond the scope of this study.

Anthropometric measurements were taken from all participants after the interview. Body weight of the student in light clothing and with bare feet or stockings was measured with a digital scale to the nearest 0.1 kg, and height without shoes was measured by a wall-mounted stadiometer and recorded to the nearest 0.5 cm. The reliability of the anthropometric measures was checked during the data collection period and the digital scale was calibrated and checked daily.

Body mass index (BMI) was calculated from the weight (kg)/ height² (m²). Overweight and obesity were categorized according to age–sex specific percentiles of BMI using the Centers for Disease Control BMI-for-age growth charts [7]: underweight (BMI < 5th percentile); normal weight (BMI 5th–< 85th percentile), overweight (BMI 85th–< 95th percentile) or obesity (BMI ≥ 95th percentile).

Ethical considerations

Confidentiality was maintained by data coding. Approval to conduct the study in schools was obtained from the department of research at the Ministry of Education. An informed consent was obtained from each participant. Participants were informed about the purpose of the study, that their participation was voluntary and that their anonymity was assured. The data collection process was done separately in a private room for each student to ensure privacy.

Data analysis

SPSS, version 15 was used to analyse the data. Descriptive statistics such as means, standard deviations (SD) and frequencies were used. Chi-squared analysis was performed to test the association between variables. $P < 0.05$ was considered as the cut-off value for significance.

Results

Description of the sample

Only 2 students refused to participate in the study, giving a response rate of 98.9%. Of the 1355 who participated, 55.6% were female [mean age 14.8 (SD 0.9) years] and 44.4% were male [mean age 14.8 (SD 0.9) years]. About one-fifth of the sample were from private schools, and a majority (70.8%) were from rural areas (Table 1).

One-third of the sample (32.0%) reported having a low family income, 37.5% middle income and 11.0% high income, while 19.3% did not know their family income.

The children's reports of their parents' education level were that 34.0% of fathers and 38.0% of mothers had an educational level below high school while 32.8% of the fathers and 29.5% of the mothers had above high-school education. Just over two-thirds of the fathers had jobs (68.1%), while only 16.4% of the mothers had jobs (Table 1).

Prevalence of overweight and obesity

Data on BMI showed that 4.3% of the total sample was underweight, 71.3% normal weight, 15.7 % overweight and 8.7% obese. Thus, the overall prevalence of overweight and obesity among these adolescents was 24.4%. The rate of overweight and obesity was highest among students aged 13 years (31.8%) and the rate obesity was the lowest among students aged 16 years (23.0%) (Table 2).

Prevalence of overweight and obesity by sex

There was a statically significant difference between males and females in terms of overweight ($\chi^2 = 23.7$, $df = 1$, $P < 0.001$) and obesity ($\chi^2 = 7.63$, $df = 1$, $P = 0.006$). The prevalence of overweight was higher in female (18.9%) than male students (11.8%) (Table 2). However, the prevalence of obesity among males (12.3%) was higher than females (5.8%).

Table 1 Demographic data of the sample of adolescents (n = 1355)

Demographic data	No.	%
Age (years)		
13	63	4.6
14	468	34.5
15	437	32.3
16	387	28.6
School grade		
8th	487	35.9
9th	458	33.8
10th	410	30.3
Sex		
Male	602	44.4
Female	753	55.6
Residential area		
Rural	959	70.8
Urban	396	29.2
School		
Private	273	20.1
Public	1082	79.9
Family income^a		
Low	436	32.2
Middle	508	37.5
High	149	11.0
Don't know	262	19.3
Father's education level		
Below high school	461	34.0
High school	450	33.2
Above high school	444	32.8
Mother's education level		
Below high school	515	38.0
High school	440	32.5
Above high school	400	29.5
Father employed		
Yes	923	68.1
No	432	31.9
Mother employed		
Yes	222	16.4
No	1133	83.6

^aLow ≤ 200 JD per month; middle 201–600 JD per month; high ≥ 600 JD per month.

Prevalence of overweight and obesity by living area

There was a statistically significant difference between adolescents living in urban areas and those living in rural areas in terms of overweight ($\chi^2 = 33.9$, $df = 1$, $P < 0.001$) and obesity ($\chi^2 = 4.88$, $df = 3$, $P = 0.027$). The

Table 2 Prevalence of overweight and obesity among the sample of adolescents by age, sex and residential area (n = 1355)

Demographic data	Underweight		Normal		Overweight		Obesity		Total No.
	No.	%	No.	%	No.	%	No.	%	
Age (years)									
13	2	3.2	41	65.1	10	15.9	10	15.9	63
14	20	4.3	327	69.9	78	16.7	43	9.2	468
15	20	4.6	316	72.3	65	14.9	36	8.2	437
16	16	4.1	282	72.9	60	15.5	29	7.5	387
Sex ^a									
Male	37	6.1	420	69.8	71	11.8	74	12.3	602
Female	21	2.8	546	72.5	142	18.9	44	5.8	753
Residential area ^b									
Rural	41	4.3	699	72.9	150	15.6	69	7.2	959
Urban	17	4.3	267	67.4	63	15.9	49	12.4	396
Total	58	4.3	966	71.3	213	15.7	118	8.7	1355

^a $\chi^2 = 23.7$, $df = 1$, $P < 0.001$ (overweight); $\chi^2 = 7.63$, $df = 1$, $P = 0.006$ (obesity).

^b $\chi^2 = 33.9$, $df = 1$, $P < 0.001$ (overweight); $\chi^2 = 4.88$, $df = 3$, $P = 0.027$ (obesity).

prevalence of overweight and obesity was 22.8% among adolescents living in rural areas and 28.3% in urban areas. The prevalence of obesity was higher in urban (12.4%) than in rural areas (7.2%) (Table 2).

Prevalence of overweight and obesity by socioeconomic status

The prevalence of overweight and obesity in the present study among students in low, moderate and high income families was 19.9%, 24.65% and 28.2% respectively. However, there was no statistically significant association between weight and family income ($\chi^2 = 13.31$, $df = 12$, $P = 0.35$) (Table 3).

The prevalence of overweight and obesity was higher (26.3%) among adolescents with working fathers than

those with nonworking fathers (20.4%) and was also higher (26.2%) among adolescents with working mothers than those with nonworking mothers (24.1%) (Table 4). The differences between adolescents with working fathers and nonworking fathers was statistically significant for overweight ($\chi^2 = 47.9$, $df = 1$, $P < 0.001$) and for obesity ($\chi^2 = 24.7$, $df = 1$, $P < 0.001$). Similarly, there was a statistically significant difference between adolescents with working mothers and nonworking mothers for overweight ($\chi^2 = 24.7$, $df = 1$, $P < 0.001$) and obesity ($\chi^2 = 22.9$, $df = 1$, $P < 0.001$).

The prevalence of overweight and obesity was the highest among adolescents who had mothers and fathers with higher education (29.3% and 28.6% respectively). However, there was

no statistically significant association between overweight and father's education level ($\chi^2 = 17.25$, $df = 12$, $P = 0.14$) or mother's education level ($\chi^2 = 15.78$, $df = 12$, $P = 0.20$).

Discussion

Overweight and obesity is considered to be an epidemic in many developed and developing countries of the world. The prevalence varies greatly by age group, sex and socioeconomic status [8]. Using the CDC BMI-for-age sex-specific charts, the prevalence of overweight and obesity in this sample of adolescent students aged 13–16 years old was 24.4% (15.7% overweight and 8.7% obese).

Our study indicates that overweight and obesity is a major health problem in

Table 3 Prevalence of overweight and obesity among the sample of adolescents by family income (n = 1355)

Family income ^a	Underweight		Normal		Overweight		Obesity		Total No.
	No.	%	No.	%	No.	%	No.	%	
Low	20	4.6	329	75.5	59	13.5	28	6.4	436
Medium	23	4.5	358	70.5	79	15.6	48	9.4	508
High	6	4.0	101	67.8	23	15.4	19	12.8	149
Don't know	9	3.4	178	67.9	52	19.8	23	8.8	262
Total	58	4.3	966	71.3	213	15.7	118	8.7	1355

$\chi^2 = 13.31$, $df = 12$, $P = 0.35$.

^aLow income ≤ 200 Jordanian dinars (JD) per month; medium income 201–600 JD per month; high income ≥ 600 JD per month.

Table 4 Prevalence of overweight and obesity among the sample of adolescents by parents' employment status (n = 1355)

Employment status	Underweight		Normal		Overweight		Obesity		Total No.
	No.	%	No.	%	No.	%	No.	%	
<i>Father employed</i>									
Yes	44	4.8	636	68.9	157	17.0	86	9.3	923
No	14	3.2	330	76.4	56	13.0	32	7.4	432
<i>Mother employed</i>									
Yes	10	4.5	154	69.4	25	11.3	33	14.9	222
No	48	4.2	812	71.7	188	16.6	85	7.5	1133
Total	58	4.3	966	71.3	213	15.7	118	8.7	1355

Father employed: $\chi^2 = 47.9$, $df = 1$, $P < 0.001$ (overweight); $\chi^2 = 24.7$, $df = 1$, $P < 0.001$ (obesity).

Mother employed: $\chi^2 = 24.7$, $df = 1$, $P < 0.001$ (overweight); $\chi^2 = 22.9$, $df = 1$, $P < 0.001$ (obesity).

Irbid governorate. It would be expected that the nutritional status of adolescents this governorate in the north of Jordan is different from other governorates in the central or southern parts of Jordan. The central region of Jordan includes the capital city, Amman, where it is likely that the average socioeconomic status is higher, the percentage of working mothers is higher and students are exposed to a greater number of fast-food restaurants. In contrast, in the southern region of Jordan socioeconomic status is slower, the percentage of working mothers is lower and students are more likely to benefit from home-cooked meals.

The prevalence of overweight and obesity in our study in the north of Jordan is higher than in some developed countries, where the prevalence of overweight and obesity among adolescents was shown to be 16.3% in the United States [9], 19.6% in Canada [10] and 22.7% in France [11]. However, in developing countries the picture is more complicated. The prevalence of overweight and obesity among adolescents in this study is higher than a study in India showing a rate of 16.8% among adolescents [12], but is less than in some other Arab countries, for example in Kuwait, where the prevalence of overweight and obesity among children was 50% [13] and in the United Arab Emirates, where it was 27% [8]. The reasons behind this may be the dietary habits in those Arab countries, where there is a high consumption of dates and

carbohydrate-rich food. At the same time as lifestyles worldwide are becoming more sedentary, the hot climate of Arab countries exacerbates the problem as it discourages people from participating in sports and other physical activities, cars are used for even short-distance travel and there is a tradition of taking afternoon naps after meals [14].

It is notable that the prevalence of overweight was higher among female students than male students, while the prevalence of obesity was higher among male than female students. This might be due to the different physiological composition of the female body or because female adolescents are more likely to try to control their weight to prevent obesity. While the study in France revealed no gender differences [11], a study in Canada showed that the prevalence of overweight and obesity was greater in boys than girls [10].

The prevalence of overweight and obesity among adolescents in urban areas was higher than in rural areas. An explanation might be that adolescents in urban areas eat more fast-food than adolescents in rural areas, since more restaurants are available in urban areas and less time is available for working mothers to cook traditional meals at home. The study results are consistent with a study in China showing that **obesity** was more prevalent in urban areas [9], but they disagree with studies conducted in the United States and Russia where obesity was higher in rural

areas [9]. This may be because walking and bicycling are more practical and safe in urban areas in more developed countries or because health promotion programmes about exercise and diet are more focused in urban than rural communities in these countries.

The prevalence of overweight and obesity among students with working fathers and mothers in the present study was significantly higher than among those with nonworking fathers and mothers. Furthermore, the prevalence rose with rising family incomes, although the difference did not reach statistical significance. Even so, the difference among the 3 income groups suggests that the prevalence of overweight and obesity increases as socioeconomic status rises. The influence of socioeconomic status on adolescents' lifestyles could be one reason. For example, diet and physical activity may differ; adolescents of high socioeconomic status (especially those with working mothers) have greater access to packaged and fast food and depend on automobiles for transport, while those of lower socioeconomic status (especially those with nonworking mothers) have access to more home-cooked meals and are more likely to walk to school.

The results of the present study are consistent with a study in another rapidly developing country, China, which indicated that as socioeconomic status rises, the prevalence of overweight and obesity increases [9]. The results

contrast, however, with data from the United States and Russia [9], which the prevalence of overweight and obesity decreases with higher socioeconomic status. In some developed countries the cost of food that is high in fat and sugar, especially fast food, is low in comparison with more traditional foods, and therefore affordable by people of low socioeconomic status. However, in Jordanian culture, fast-food restaurants are relatively expensive and eating there is affordable mainly by high socioeconomic status families.

The results cannot be generalized to Jordan as a whole because this study

was conducted only in the northern part of Jordan. The sample consisted of adolescents studying in the 8th to 10th grades, which make it hard to generalize to adolescents in other grades. Furthermore, the percentage of participant students who lived in rural areas was higher than the percentage in the total population.

Conclusions

The current study documented a high prevalence rate of overweight and obesity among male and female

adolescents aged 13–16 years old in Irbid governorate. This finding is a serious concern for public health in Jordan and calls for the creation of new prevention programmes at the individual, family and community level. More research is needed on the behavioural and biological causes of overweight and obesity, and on the prevalence among different regions and settings. Further research is also needed at the national level to identify the characteristics of individuals who have successfully maintained normal weight over the long term.

References

1. *IOTF demands action on childhood obesity crisis*. International Obesity TaskForce, 2007 [press release] (<http://www.ietf.org/media/IOTFmay12.htm>, accessed 27 January 2010).
2. *Obesity and overweight*. World Health Organization [online factsheet] (<http://www.who.int/mediacentre/factsheets/fs311/en/index.html>, accessed 27 January 2010).
3. Goossens L, Braet C, Decaluwe V. Loss of control over eating in obese youngsters. *Behavior research and therapy*, 2007, 45(1):1–9.
4. Ajlouni K, Jaddou H, Batieha A. Obesity in Jordan. *International journal of obesity*, 1998, 22(7):624–8.
5. *Main index*. Jordan Department of Statistics [website] (http://www.dos.gov.jo/dos_home_a/main/index.htm, accessed 27 January 2010).
6. *Multipurpose family survey analytic report*. Jordan Department of Statistics [website] (http://www.dos.gov.jo/sdb_pop/sdb_pop_a/ehsaat/analytical/analyt_a.htm, accessed 27 January 2010).
7. *About BMI for children and teens*. Atlanta, Georgia, Centers of Disease Control and Prevention, 2007 [online factsheet] (http://www.cdc.gov/nccdphp/dnpa/bmi/childrens_BMI/about_childrens_BMI.htm#What%20is%20BMI%20percentile, accessed 27 January 2010).
8. Kerkadi A, Aboelnaga N, Ibrahim W. Study of overweight and associated risk factors among primary female school children in Al-Ain city United Arab Emirates. *Emirates journal of agriculture sciences*, 2005, 17(1):43–56.
9. Wang Y. Cross-national comparison of childhood obesity: The epidemic and the relationship between obesity and socioeconomic status. *International journal of epidemiology*, 2001, 30:1129–36.
10. Janssen I et al. Overweight and obesity in Canadian adolescents and their associations with dietary habits and physical activity patterns. *Journal of adolescent health*, 2004, 35(5):360–7.
11. Klein-Platat K et al. Prevalence and sociodemographic determinants of overweight in young French adolescents. *Diabetes metabolic research review*, 2003, 19:153–8.
12. Ramachandran A et al. Prevalence of overweight in urban Indian adolescent school children. *Diabetes research and clinical practice*, 2002, 57(3):185–90.
13. Sorkhou I et al. Juvenile hypertension in Kuwait: prevalence and influence of obesity. *International pediatrics*, 2003, 18(3):178–84.
14. El-Hazmi M, Warsy A. The prevalence of obesity and overweight in 1–18-year-old Saudi children. *Annals of Saudi medicine*, 2002, 22(5-6):303–7.

Could the employment-based targeting approach serve Egypt in moving towards a social health insurance model?

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هل ساعد أسلوب الاستهداف المرتكز على التوظيف في مصر في التقدم نحو نموذج تأمين صحي اجتماعي؟
شيرين شوقي

الخلاصة: يستهدف نظام التأمين الصحي الاجتماعي الحالي في مصر الفئة المنتجة من السكان خلال خطة تركز على الموظفين، ولها حدود قصوى وفقاً لسقف التكاليف التي تُنفق، وتركز على الرعاية العلاجية. وقد استخدمت المعطيات المستمدة من مسح العقد الاجتماعي المصري لعام 2005 لتقييم الآثار المترتبة على الخطة المرتكزة على التوظيف، من حيث إمكانية التوصل للنظم الصحية، ومن حيث تمويلها. وقد أسفر التقييم عن أن 22.8% فقط من السكان في الفئة العمرية المنتجة قد استفادوا من هذه الخطة، وهم ممن تتراوح أعمارهم بين 19 و59 عاماً. وأن هذه الخطة تغطي 39.3% من العاملين، وهي منحازة نحو سكان المدن، والمسنين، والإناث، والأغنياء. ولم تؤد الخطة إلى الازدياد في الاستفادة من الخدمات، ولكنها أنقصت من النفقات المباشرة التي يدفعها المشمولون بها من جيوبهم. وانتهى المقال إلى القول بأن على مصر أن تمزج جميع خطط التأمين الصحي، وأن تتبنى أسلوباً مبتكراً للوصول إلى التغطية الشاملة.

ABSTRACT The current health insurance system in Egypt targets the productive population through an employment-based scheme bounded by a cost ceiling and focusing on curative care. Egypt Social Contract Survey data from 2005 were used to evaluate the impact of the employment-based scheme on health system accessibility and financing. Only 22.8% of the population in the productive age range (19–59 years) benefited from any health insurance scheme. The employment-based scheme covered 39.3% of the working population and was skewed towards urban areas, older people, females and the wealthier. It did not increase service utilization, but reduced out-of-pocket expenditure. Egypt should blend all health insurance schemes and adopt an innovative approach to reach universal coverage.

Le ciblage fondé sur l'emploi est-il une approche pouvant aider l'Égypte à s'orienter vers un modèle d'assurance maladie sociale ?

RÉSUMÉ Le système d'assurance maladie égyptien actuel cible la population active au moyen d'un dispositif fondé sur l'emploi, limité par un plafond de coûts et axé sur les soins curatifs. Les données de l'enquête sur le Contrat social égyptien réalisée en 2005 ont permis d'évaluer les effets du dispositif fondé sur l'emploi sur l'accessibilité et le financement du système d'assurance maladie. Seuls 22,8 % de la population en âge de travailler (de 19 à 59 ans) bénéficiaient alors d'une couverture maladie. Le dispositif fondé sur l'emploi couvrait 39,3 % de la population active et avantagerait les zones urbaines, les personnes âgées, les femmes et les personnes les plus aisées. Il n'a pas contribué à augmenter l'utilisation des services, mais a diminué les paiements directs. L'Égypte devrait fusionner tous les dispositifs d'assurance maladie et adopter une approche innovante afin de parvenir à une couverture universelle.

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Introduction

Egypt is currently working on reforming its health insurance system as part of a nationwide reform of health care. In the government's sixth 5-year plan, Egypt is targeting a gradual expansion of health insurance to cover new segments of the population, until universal coverage is achieved by 2012 [1].

The development of the insurance scheme in Egypt has 2 incremental phases. The first phase started with the 1936 law to insure blue-collar workers against occupational accidents, later expanded to cover health care services rather than just occupational accidents. The second phase started with the presidential decree that announced the birth of the health insurance organization (HIO) in 1964, aiming to provide health insurance for industrial workers and civil servants. Under the control of the Ministry of Health and Population (MOHP), the HIO acts as service purchaser and provider through several rented or owned clinics and hospitals. Since then, more socio-professional groups have been brought into compulsory insurance, albeit still mainly targeted on the public sector workforce. There were 3 important landmarks to this phase: in 1981 the families of insured individuals were brought under coverage; in 1992 the school health insurance law was issued to cover all enrolled students; and in 1997 insurance coverage was expanded to children under school age.

Health insurance in Egypt is funded by government subsidy together with users' and employer contributions, as well as cigarette taxation for the school health insurance scheme. For the employment-based scheme, a fixed percentage of the salary is collected from both the employee and the employer, while for the other schemes, a fixed sum of money is charged from the beneficiary [2]. The health insurance system functions with an upper limit on the cost of the health care and focuses on

curative care. In cases where the cost of medical care exceeds the threshold, limited exemptions are made with official approval from the MOHP.

The current health insurance system is being expanded towards a social health insurance model that involves compulsory membership, universal coverage and pooling of risk [3,4]. Evidence of the impact of the current health insurance schemes on health system performance is insufficient. The few available studies focus on the school health insurance scheme and there is scarce evidence of the impact of the employment-based health insurance targeting the population of productive age who represent Egypt's workforce and the country's main human resource.

The study aimed to evaluate the impact of the employment-based scheme on health system accessibility and financing, through 3 main questions: Does the employment-based approach reach all categories of the population? Does employment-based health insurance meet the beneficiaries' health needs? Is the employment-based health insurance scheme capable of increasing health care service utilization and relieving the financial burden borne by individuals?

Methods

Study population

The study made use of the Egypt Social Contract Survey Data from 2005 [5]. The sample was based on the same sampling frame as the Egypt Demographic and Health Survey 2005 [6]. The sample was designed to provide estimates of all major variables at the national and regional level.

Egypt is divided into 5 administrative regions covering 21 governorates (administrative geographic units). The administrative regions include the urban governorates (Cairo, Alexandria and Suez), urban Lower Egypt, rural Lower Egypt, urban Upper Egypt and

rural Upper Egypt. There were 15 060 individuals in the productive age groups. Most of the records (95.3%) had complete information on the health insurance coverage and were used for the analysis.

Data and variables

The survey data included sociodemographic information, insurance coverage details, health service utilization in the 12 months prior to data collection and total family expenditure and out-of-pocket expenditure on regular treatment and last health care service use within the 12 months prior to data collection. The analysis was restricted to the population in the productive ages: > 18 years (upper age limit for school health insurance) and < 60 years (lower age limit for pension health insurance). This age range was used to enable comparison between the groups with and without employment-based health insurance and in order to demonstrate the impact of the employment-based scheme.

Analysis

The data were weighed to give estimates that were representative of the population from which the sample was drawn. In all analyses, the employment-based health insurance was compared with other health insurance schemes among the working and non-working population, as well as with the non-insured population to represent the employment-based health insurance effect. The chi-squared test was used to detect significant difference between proportions, *t*-test was used to detect significant difference between 2 means and Kruskal–Wallis test for more than 2 means.

The impact of the health insurance coverage on increasing health care service utilization and reducing the financial burden borne by individuals was measured by 2 methods. The first method assessed the difference in the catastrophic payment head count and the out-of-pocket catastrophic payment

excess between the employment-based scheme and the other schemes or in the absence of health insurance coverage. The “catastrophic” label refers to the fact that falling ill can induce a sizeable, unpredictable shock to an individual’s living standard. The catastrophic payment head count (defined as 20% of the total expenditure [7]) is a straightforward way to measure the fraction of individuals whose health care costs exceed the threshold, thus indicating the magnitude of catastrophic payments in a population. The out-of-pocket catastrophic payment excess (calculated by subtracting 20% from the health spending fraction for those with catastrophic payments) captures the average degree by which payments exceed the threshold, thus measuring the intensity of catastrophic payment in a population.

The second method involved a 2-part model [8–10]. Part 1 was a logit model estimating the individual’s probability of using health care services. Part 2 was a log–linear model that estimated the annual per capita health expenditure incurred by an individual when using the health care services. As the employment-based scheme did not show significant interactions with the other independent variables, interaction terms were not included in the model.

STATA, version 9, computer package was used for data analysis.

Results

Characteristics of the study sample

A total of 14 359 individuals in the productive age range (between 19 and 59 years) were included in the study. The working population accounted for 46.1%. The majority of the non-working population (78.5%) were females, most of them (68.3%) housewives. The overall health insurance coverage was low, with just 22.8% of the population of productive age being covered. A higher

proportion of the working population were covered by an insurance scheme (39.3%), mostly (95.0%) employment-based. On the other hand, just 8.7% of the non-working population were covered. Table 1 shows the background characteristics of the study sample.

Health insurance coverage

At national level, 37.5% of the working population were covered by an employment-based scheme and only 1.8% of them had another form of health insurance coverage (Table 2). The population in urban regions benefited more than those in rural regions from health insurance. There was also a clear

increasing trend in the proportion of the health insurance beneficiaries by age group among the working population for both the employment-based and the other schemes. However, the non-working population had the highest proportion covered at the 2 age extremes, especially those ≤ 29 years, as the health insurance coverage in this age group was influenced by the school health insurance effect. Working females benefited more from health insurance coverage, whether employment-based or other schemes, than did working males. For the non-working population, the share of females with health insurance coverage was low compared

Table 1 Background characteristics of individuals in the productive age, Social Contract Survey, Egypt 2005

Variable	Total (n = 14 359)	Working population (n = 6626)	Non-working population (n = 7733)
Region^a			
Urban governorates ^b	28.2	29.1	27.5
Urban lower Egypt	10.1	11.2	9.2
Rural lower Egypt	32.9	32.1	33.6
Urban upper Egypt	7.0	7.1	6.8
Rural upper Egypt	21.8	20.4	22.9
Age (years)^a			
≤ 29	40.7	28.6	51.1
30–39	21.6	25.5	18.2
40–49	20.8	25.8	16.5
50–59	16.9	20.0	14.1
Sex^a			
Male	49.9	83.1	21.5
Female	50.1	16.9	78.5
Wealth quintiles^a			
Q1 (poorest)	17.2	16.0	18.2
Q2	19.0	17.4	20.4
Q3	20.0	19.6	20.3
Q4	21.4	20.5	22.1
Q5 (richest)	22.4	26.4	18.9
Health insurance scheme^a			
None	77.2	60.7	91.3
Employment-based	17.3	37.5	0.0
Private	0.3	0.5	0.2
Other ^c	5.2	1.3	8.5

^aP < 0.001.

^bCairo, Alexandria and Suez.

^cThrough Ministry of Health and Population, syndicates, school or a family member.

Table 2 Health insurance coverage by individuals' work status and type of insurance scheme, Social Contract Survey, Egypt 2005

Variable	Health insurance coverage		
	Working population		Non-working population
	Employment-based	Other schemes	Other schemes
	%	%	%
National^a	37.5	1.8	8.7
Region^a			
Urban governorates	38.7	3.1	8.8
Urban Lower Egypt	56.0	2.0	16.0
Rural Lower Egypt	37.4	1.0	8.7
Urban Upper Egypt	46.8	1.9	8.5
Rural Upper Egypt	22.7	0.8	5.6
Age (years)^a			
≤ 29	16.5	1.3	14.1
30–39	36.8	1.5	1.8
40–49	50.4	1.8	2.7
50–59	51.9	2.9	4.8
Sex^a			
Male	33.5	1.5	20.1
Female	57.5	3.4	5.6
Wealth quintile^a			
Q1 (poorest)	13.2	0.5	4.3
Q2	23.0	1.5	6.1
Q3	31.8	1.5	7.1
Q4	44.7	1.9	10.1
Q5 (richest)	60.5	2.9	15.8

^a $P < 0.001$.

with the non-working males or working females. The employment-based health insurance, as for the other insurance schemes, did not solve the problem of the lower wealth quintiles. There was a clear benefit from the health insurance coverage in favour of the wealthiest quintiles.

Health insurance utilization

At national level, it was estimated that only 41.3% of all health insurance beneficiaries used the scheme when purchasing health care. Among the working population, 43.5% of those with employment-based insurance used the scheme when purchasing health care services compared with 44.6% of beneficiaries of other scheme and 32.9%

of the non-working population with health insurance coverage (Table 3). Employment-based insurance was utilized more by the working population in the urban governorates and Lower Egypt than in Upper Egypt. There was still a gap in health insurance utilization favouring the urban regions in both Lower Egypt and Upper Egypt. Health insurance utilization among the non-working population was less than the employment-based scheme utilization in all regions. The employment-based scheme, as well as the other schemes, was used more by the older age groups (40+ years).

There was no significant difference in health insurance utilization between

males and females or among wealth quintiles.

Health service utilization and financial burden

It was estimated that 11.6% of the individuals in the productive age group were subject to catastrophic payments, with a mean percentage of excess payment of 15.1% above the threshold (20% of total expenditure). At national level, the insurance schemes other than the employment-based ones appeared to be dominant in reducing the proportion of individuals subject to catastrophic payment, while the employment-based scheme was dominant in reducing the excess out-of-pocket catastrophic payment (Table 4). As for the other schemes, the employment-based insurance was able to reduce the financial burden of health care in the urban governorates and for the younger age groups.

It was estimated that 23.9% of the sample used the health services during the 12 months prior to data collection. Around 94.2% of the service users reported regular purchase of medicine for chronic illnesses, 15.1% reported needing inpatient care and 89.7% reported outpatient care. The median annual per capita out-of-pocket expenditure on medicines for chronic illnesses and a single inpatient and/or a single outpatient health care service use was 225 Egyptian pounds (LE) (US\$ 1 was equivalent to around 6 LE at the time of data collection).

Table 5 shows the results of the 2-part model; the coefficients in the logit model were transferred into odds ratios to facilitate interpretation. The employment-based scheme did not significantly increase health service utilization; however, it significantly reduced the out-of-pocket expenditure on health care services ($P = 0.031$). The other health insurance schemes reduced the health service utilization ($P = 0.044$) but had no impact on reducing out-of-pocket expenditure on health.

Table 3 Health insurance utilization among beneficiaries by individuals' work status and type of insurance scheme, Social Contract Survey, Egypt 2005

Variable	Health insurance utilization		
	Working population		Non-working population
	Employment-based	Other schemes	Other schemes
	%	%	%
National^a	43.5	44.6	32.9
Region^b			
Urban governorates	54.7	44.8	42.9
Urban Lower Egypt	45.1	53.3	34.2
Rural Lower Egypt	42.6	52.4	30.8
Urban Upper Egypt	29.4	22.2	28.9
Rural Upper Egypt	26.6	22.2	19.2
Age (years)^c			
≤ 29	35.4	36.4	28.7
30–39	35.1	47.8	20.8
40–49	44.2	40.0	64.7
50–59	53.9	52.6	63.5
Sex			
Male	44.0	45.3	30.1
Female	42.1	43.2	35.5
Wealth quintile			
Q1 (poorest)	37.1	66.7	29.5
Q2	44.5	53.3	34.7
Q3	40.4	52.6	29.5
Q4	45.5	41.7	31.2
Q5 (richest)	44.1	40.0	35.5

^aP < 0.001.

^bEmployment-based P < 0.001; non-working population P = 0.002.

^cEmployment-based P < 0.001; non-working population P < 0.001.

The model also showed that as age increased, service utilization increased significantly ($P < 0.001$), with no difference between age groups regarding out-of-pocket expenditure. Females and the lowest 3 wealth quintiles showed a significant increase in health service utilization ($P < 0.001$) compared with the other groups, and again with no significant difference in the annual out-of-pocket expenditure on health care.

Discussion

Implementing social health insurance in a nation is a laudable goal and it takes a considerable degree of political will

to extend coverage to all population groups, including the poorest. The countries that operate such a system have spent from 25 to over 100 years to reach universal coverage and risk sharing [11–13].

Until now, the dominant health insurance system in Egypt targeting the productive population was the employment-based scheme. The primary objective of expanding health insurance coverage to employees was to improve their access to health care services and reduce inequitable access for the workforce. Then the objective became more optimistic: to expand the health insurance coverage to the employees' families to reach the unidentifiable portion of

the population that may be working in the informal sector or unemployed. Targeting this sector of the population is an easy way to reach a well-defined population of the workforce through their work place. Our results showed that only 22.8% of the population in the productive ages benefited from a health insurance scheme. This was nearly half the national level reported by the MOHP [14]. The difference in the proportion of health insurance coverage between the results of this study and the MOHP estimates could be explained by the influence of the school health insurance that was reported to cover 61% of children between 6 and 18 years [15].

The low health insurance coverage could be partly explained by a lack of awareness of non-obligatory health insurance schemes, as reflected in the low proportion of individuals reporting schemes other than the employment-based and the school health insurance. It could be also due to the limited family resources in a low-income country such as Egypt. Limited resources mean that people do not think beyond their current situation even if they are aware of the benefits of an insurance scheme. These 2 factors mean that people, especially those in good health, may judge the health insurance contributions to be too expensive and choose not to insure. However, the obligatory employment-based scheme was still unable to cover the majority of the working population as only 37.5% benefited from it.

Probably as a result of the higher likelihood of working in the formal sector, higher proportions of the working population were covered in urban areas, older age groups, among females and among the wealthier. Given the high proportion of the population who are not working in Egypt, in addition to those working in the informal sector, there is always a risk that some families, especially the disadvantaged, would have both the male and female partners falling into one of these groups. Thus the employment-based approach

Table 4 Financial burden of health service utilization by individuals' work status, Social Contract Survey, Egypt 2005

Variable	Financial burden of health service utilization					
	Employment-based		Other schemes		Non-beneficiaries	
	Catastrophic payment	Excess payment	Catastrophic payment	Excess payment	Catastrophic payment	Excess payment
	%	Mean %	%	Mean %	%	Mean %
National^a	11.1	10.9	7.7	12.3	12.0	16.2
Region^b						
Urban governorates	6.7	5.2	9.3	12.3	9.3	7.5
Urban Lower Egypt	10.8	7.3	8.1	5.4	15.8	18.5
Rural Lower Egypt	14.5	16.1	5.6	20.1	13.1	18.1
Urban Upper Egypt	13.2	12.4	11.1	4.8	13.6	19.1
Rural Upper Egypt	11.8	15.4	7.3	6.2	12.0	22.1
Age (years)^c						
≤ 29	5.8	6.9	3.6	4.6	5.3	8.7
30–39	6.7	7.8	11.5	18.1	11.0	17.0
40–49	11.8	12.9	14.1	35.0	18.4	19.8
50–59	16.4	13.1	26.7	42.3	25.9	33.3
Sex						
Male	10.6	11.0	6.1	16.1	9.7	16.4
Female	12.6	10.7	9.3	8.2	13.9	16.0
Wealth quintiles						
Q1 (poorest)	17.4	42.2	7.7	29.0	13.1	16.8
Q2	10.9	21.4	9.8	20.9	12.0	23.7
Q3	12.5	8.4	10.8	19.6	12.5	16.1
Q4	10.6	8.5	7.7	9.0	11.7	13.1
Q5 (richest)	10.0	7.0	5.4	3.8	10.6	10.0

^aCatastrophic payment $P < 0.001$; excess payment $P < 0.001$.^bEmployment-based, catastrophic and excess payment $P < 0.001$; non-beneficiaries, catastrophic and excess payment $P < 0.001$.^cEmployment-based, catastrophic and excess payment $P < 0.001$; other schemes, catastrophic and excess payment $P < 0.001$; non-beneficiaries, catastrophic and excess payment $P < 0.001$.**Table 5 Two-part model representing the probability of health service utilization and the incurred level of the annual per capita health expenditure by health service users, Social Contract Survey, Egypt 2005**

Variable	Probability of health service utilization			Conditional expenditure: log-linear model	
	OR	95% CI	P-value	Coefficient	P-value
Employment-based insurance	1.02	0.95–1.10	0.508	–2.16	0.031
Other insurance scheme	0.89	0.79–1.00	0.044	0.68	0.498
Rural area	1.04	0.99–1.10	0.133	0.32	0.751
Age ≤ 29 years	0.39	0.37–0.42	< 0.001	–0.24	0.812
Age 30–39 years	0.54	0.50–0.58	< 0.001	–0.30	0.764
Age 40–49 years	0.77	0.72–0.82	< 0.001	–0.27	0.784
Female	1.20	1.14–1.26	< 0.001	–0.44	0.657
Wealth quintile 1 (poorest)	1.21	1.11–1.31	< 0.001	–0.87	0.382
Wealth quintile 2	1.20	1.10–1.30	< 0.001	–0.59	0.556
Wealth quintile 3	1.18	1.09–1.27	< 0.001	–0.65	0.513
Wealth quintile 4	1.05	0.97–1.14	0.210	–0.33	0.745

OR = odds ratio; CI = confidence interval.

will always be problematic in reaching these categories of the population and their families, with resulting disparities in health insurance coverage. Consequently, it is expected that even with the expansion of the employment-based approach, coverage will be always skewed towards the most favoured population, in addition to the fact that universal coverage will be difficult to achieve.

The results of this study have shown that health insurance coverage did not meet the health needs of all beneficiaries. Given that the health insurance coverage was 22.8% and just 41.3% of the beneficiaries utilized the schemes in purchasing health care, this means that the schemes met the health needs of just 9.4% of the productive population. The employment-based scheme was more prevalent, covering 37.5% of the working population, but just 43.5% of those insured used the scheme in purchasing health care, thus the actual benefit from this scheme was estimated to be 16.3% of the working population. The urban skew in the employment-based scheme coverage was reflected in its utilization.

The fact that the system was not responsive to the health needs of all beneficiaries may be also influenced by the cost ceiling that may be too low to cope with the cost of the advancements in medical practice and the new technologies used to cure illnesses. Previous experience has also shown that health insurance systems in some countries suffer from non-compliance of health care providers, who prefer to charge the medical care costs directly in order to secure their payments [16].

The skew towards older ages in the employment-based scheme was also reflected in utilization, as the scheme was overburdened by insured users who were older and would be expected to be medium to high health risk. This adverse selection overloads the cost of health care and may risk sacrificing quality of care or mislead policy-makers into reducing the cost ceiling limit or charging individuals with more contributions.

This study aimed to assess the utilization of health services and the financial burden borne by individuals using the health services. However, the inpatient and outpatient utilization and cost may have been underestimated as they refer to the optimal condition of being subject to just one inpatient and/or outpatient event per year. Thus, the results should be interpreted with caution as they do not refer to actual annual health service utilization or per capita out-of-pocket expenditure on health. Although the employment-based scheme was not able to reduce the proportion of people subject to catastrophic payment, which is a reflection of the limited services provided or the unsuitability of the cost ceiling level, it is worth mentioning that the scheme contributed to reducing the excess out-of-pocket catastrophic payment. The employment-based scheme also failed to reduce the magnitude and intensity of catastrophic payment in rural areas and for the older population.

The results of the 2-part model showed that the current employment-based scheme was not effective in increasing health service utilization, but succeeded in reducing out-of-pocket expenditure on health. Health service utilization is a mix of multiple factors that depend on the availability of services, the quality of services and the extra out-of-pocket expenditure on health. Consequently, if services are not available or if their quality does not meet the beneficiaries' expectations, utilization is not expected to increase even in the presence of insurance coverage. Moreover, if the cost ceiling for the scheme is low and does not cover most of the health care expenses, the burden of out-of-pocket expenditure on health borne by beneficiaries will not encourage them to use the services.

This is another concern that calls for examination of the health services provided and the cost ceiling. The model has also confirmed that the health service utilization was overburdened by females, the lowest 3 wealth quintiles

and those aged at least 50 years, the categories expected to be medium to high health risk who benefited from an equal annual out-of-pocket expenditure on health similar to those postulated to be have low health risk.

If social health insurance remains a key health policy goal, Egypt is invited to take well-planned steps towards a workable social health insurance structure. As experience has shown, planning and implementation are expected to take time and the system is anticipated to progress with speed corresponding to the current percentage coverage and the economy of the country until universal coverage is achieved [17]. It is recommended that Egypt works on blending all types of health insurance schemes into a family model in an attempt to progress towards a social health insurance structure. The situation calls for adopting an innovative approach to progress towards universal coverage. There is a need to combine multiple identification sources in an attempt to identify any of the family members and tracking the identified member to cover the whole family in a process such as the network chain referral. This multiple channel approach may reduce the risk of overburdening the system with high health risks and may progress towards the principle of risk sharing.

The most difficult part of developing health insurance is recalculating the cost ceiling to meet the health needs of the country. This needs very cautious assessments of family income, population health needs and the actual cost of health care, taking into consideration family size and structure [17]. Debate may arise that the current contributions are too little to support the system; yet multiple efforts may assist through various fronts. First, risk sharing in the early stages of expansion may help in balancing the expenditure, as the rich will support the poor and the healthy will support the unhealthy. Secondly, widening the focus of the health insurance to include preventive care will reduce

the incidence of diseases and reduce the cost of curative care. A third helping factor would be to redefine the role of the HIO to be similar to its peers worldwide as a purchaser of health services and not a competitor to health service providers. As a purchaser of health services the HIO would relieve itself from the burden of health service provision and could demand that the MOHP ensures the provision of quality health care. The MOHP would charge the HIO with the actual health care fees, which would liberate the MOHP from the obligation of offering free health care and losing

revenue. Consequently, government subsidies could be mobilized gradually from MOHP expenditure to supporting health insurance funding.

Most of all, Egypt needs to develop a culture of health insurance within the country, through health insurance awareness programmes targeting all categories of the population.

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References

1. *Egypt's health sector reform and financing review. February 2004.* New York. World Bank, 2004 (Document No. 41197).
2. Nandakumar A et al. Health reform for children: the Egyptian experience with school health insurance. *Health policy*, 2000, 50:155–70.
3. Carrin G, James C. *Reaching universal coverage via social health insurance: key design features in the transition period. Discussion paper no. 2.* Geneva, World Health Organization, 2004 (EIP/ FER/DP.04.2).
4. Carrin G, James C. Social health insurance: key factors affecting the transition towards universal coverage. *International social security review*, 2005, 58(1):45–64.
5. Ramadan M. *Social contract database booklet.* Cairo, Egyptian Cabinet, Information and Decision Support Center, 2005.
6. El Zanaty F, Way A. *Egypt Demographic and Health Survey 2005.* Cairo, Ministry of Health and Population, National Population Council, El-Zanaty and Associates and ORC Macro, 2005.
7. *Catastrophic health care payments. Technical note no. 18.* New York, World Bank Group, 2006.
8. Duan N. Smearing estimate: a nonparametric retransformation model. *Journal of the American Statistical Association*, 1983, 78:605–10.
9. Mann WG et al. Health insurance and demand for medical care: evidence from a randomized experiment. *American economic review*, 1987, 77(3):251–77.
10. Manning WG, Duan N, Rogers WH. Monte Carlo evidence on the choice between sample selection and two-part models. *Journal of econometrics*, 1987, 35:59–82.
11. Bähringhausen T, Sauerborn R. One hundred and eighteen years of the German health insurance system: are there any lessons for middle and low-income countries? *Social science and medicine*, 2002, 54(10):1559–87.
12. Hofmarcher M, Rack H. *Health care systems in transition: Austria.* Copenhagen, World Health Organization, European Observatory on Health Systems and Policy, 2001.
13. Ogawa S et al. Scaling up community health insurance: Japan's experience with the 19th century Jyorei scheme. *Health policy and planning*, 2003, 18(3):270–8.
14. Rateb S. *Health insurance statistics.* Cairo, Egyptian Cabinet, Information and Decision Support Center, 2007.
15. Yip W, Berman P. Targeted health insurance in a low income country and its impact on access and equity in access: Egypt's school health insurance. *Health economics*, 2001, 10:207–20.
16. Carrin G. Social health insurance in developing countries: A continuing challenge. *International social security review*, 2002, 55(2):57–69.
17. Saltman R, Busse R, Figueras J. *Social health insurance systems in Western Europe. European Observatory on Health Systems and Policies Series.* Maidenhead, England, Open University Press, 2004.

Prevalence of current smoking in Eastern province, Saudi Arabia

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معدّل انتشار التدخين الحالي في الولاية الشرقية من المملكة العربية السعودية

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الخلاصة: استكمل جميع السكان في الولاية الشرقية للمملكة العربية السعودية ممن تزيد أعمارهم عن 30 عاماً استبياناً، حول التدخين، مبنياً على المقابلات. ووجد الباحثون أن معدل انتشار التدخين الحالي (المدخنون لأكثر من مئة سيجارة أو متعاطي أي نوع من أنواع منتجات التبغ ومنها الشيشة في أي وقت من حياتهم يومياً أو أحياناً لمدة شهر أو أكثر)، لدى 196 268 من المستجيبين كان 16.9% (28.7% بين الرجال و4.5% بين النساء). وقد كان هناك معدل انتشار أعلى للتدخين في الأعمار الأصغر لدى الرجال وفي الأعمار الأكبر لدى النساء. وأوضح تحليل التحوف اللوجستي المتعدد أن العوامل التي تترافق مع التدخين بشكل مستقل هي الحالة الاجتماعية الاقتصادية المتدنية، وانخفاض مستوى التعليم، وكون المرء مطلقاً، والمهنة مثل الجيش والمهنة الحرة.

ABSTRACT All Saudi Arabian residents of the Eastern province of Saudi Arabia aged 30+ years completed a structured interview questionnaire about smoking. The prevalence of current smoking (smoked > 100 cigarettes or any tobacco products including waterpipe in lifetime and still smoking daily or occasionally for 1 month or more) among 196 268 respondents was 16.9% (28.7% among men and 4.5% among women). There was a significantly higher prevalence of smoking at younger ages in men and older ages in women. Multiple logistic regression analysis showed that factors independently associated with smoking were lower socioeconomic status, lower education, being divorced and occupations such as the military and self-employed.

Prévalence du tabagisme actif dans la province orientale d'Arabie saoudite

RÉSUMÉ Tous les habitants de la province orientale d'Arabie saoudite âgés de 30 ans et plus ont rempli un questionnaire structuré sur le tabagisme. La prévalence du tabagisme actif (consommation de plus de 100 cigarettes ou de tout autre produit à base de tabac – y compris l'utilisation du narghilé – dans la vie, ou consommation journalière ou occasionnelle depuis un mois ou plus) chez 196 268 répondants était de 16,9 % (28,7 % pour les hommes et 4,5 % pour les femmes). Cette prévalence s'est avérée significativement plus élevée chez les hommes jeunes et chez les femmes plus âgées. L'analyse de régression logistique multiple a montré que les facteurs indépendamment associés au tabagisme étaient un faible statut socioéconomique, un faible niveau d'éducation, le fait d'être divorcé ou l'exercice de certaines professions telles que militaire ou travailleur indépendant.

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Introduction

Smoking is a major preventable cause of morbidity and mortality. It is associated with a wide range of diseases: pulmonary, gastrointestinal and cardiovascular diseases and different kinds of cancers [1–3]. This creates a considerable economic burden for any nation. The World Health Organization has reported that more than 4 million annual deaths are attributed to tobacco consumption; this is projected to be 10 million annually in 2030, most of the victims being from developing countries. While the prevalence of smoking in developed countries has been declining by 1% annually, the trend in developing countries is rising by 2% [4,5]. Between 1990 and 1997, the Middle East and Asia were the only regions in the world where cigarette sales increased by 24%.

In the Gulf Cooperation Council countries there are 30 000 smoking-related deaths per year, and 15% of total health care costs are spent on the treatment of smoking-related illness [6,7]. In Saudi Arabia estimates of the prevalence of tobacco consumption in different age groups vary widely, from 11.6% to 34.4% [8–13], possibly due to studies that focus on specific groups that are not representative of the whole population. In addition there are insufficient studies on smoking among women in Saudi Arabia. It has been noted that there are growing numbers of people, including women, who smoke waterpipes (*shisha*) and an increasing number of cafés serving *shisha*. Knowledge of the prevalence and factors associated with smoking is considered a baseline tool for evaluating the effectiveness of tobacco control programmes and for targeting antismoking initiatives on specific groups at risk.

We report here data on the prevalence of smoking in the Eastern province of Saudi Arabia and its association with sociodemographic and socioeconomic factors, with a focus on gender differences in smoking behaviour.

Methods

This study was part of a screening campaign conducted in the Eastern province of Saudi Arabia between 28 August 2004 and 18 February 2005. The methodology has been described previously [14]. A scientific committee established the detailed procedures for the campaign, including the standards for running the campaign, validation of instruments and health education materials to be used, staff training, financial supervision and data processing and entry. A media campaign was organized in each health sector (district) of the province using written and audiovisual materials, and posters on billboards in the streets and other public places.

Sample

The target population was all Saudi residents of the Eastern province of Saudi Arabia, aged 30 years and above, excluding pregnant women (650 000 subjects). They were invited to participate in a screening campaign for the early detection of diabetes mellitus and hypertension by attending one of the 300+ examination centres distributed in all primary health care centres, all government hospitals and most private hospitals and dispensaries in addition to mobile teams in public venues.

Data collection

A structured questionnaire for data collection was developed using information obtained from focus groups and validated by experts in the fields of diabetes and hypertension. Specially trained members of health teams interviewed the participants and completed the questionnaire.

The questionnaire comprised demographic information (age, sex, place of residence, marital status, occupation, education), medical history and lifestyle. Current smoking was defined by subjects' self-reports as having ever smoked > 100 cigarettes and currently smoking every day or occasionally, for 1 month or

more before the campaign, any tobacco products including *shisha*. All others were considered nonsmokers.

Coordinators were assigned for each sector to supervise the examination centres, to ensure all forms were completed, to follow up defaulters and to liaise with coordinators in other health sectors and the main supervision committees. The forms were collected from each sector and were double-checked for completeness. Ineligible people were excluded and forms with incomplete data or unconfirmed results were sent back to the health sectors with a covering letter for corrections to be made.

The purpose of the campaign was explained to participants and they were assured of the confidentiality of the information collected. Health education materials were distributed to high-risk groups.

Statistical analysis

The data were analysed using SPSS, version 15. Univariate analysis was performed to identify the association of sociodemographic factors with smoking prevalence. The significant variables were entered into a logistic regression analysis, where age was treated as a continuous variable and the rest as categorical variables. The results of the model are presented as odds ratio (OR) and 95% confidence interval (CI). P -value < 0.05 was the level of significance.

Results

The data of 196 268 out of 197 681 individuals who participated in the campaign were collected and included in the analysis; they comprised 30.2% of the total population of Saudi residents in the Eastern province. Men and women were 51% and 49% of the sample respectively.

The number of smokers was 33 084, giving a prevalence of current smoking of 16.9% (28.7% among men and 4.5% among women, $P < 0.001$). Among men

the highest prevalence was recorded in the youngest age group, 30–40 years (32.5%) ($P < 0.001$), whereas among women the highest prevalence was in the oldest age group, ≥ 70 years (8.5%) ($P < 0.001$) (Table 1). For occupation the highest rate of smoking was among military personnel, while professionals showed a significantly lower rate than

other occupations ($P < 0.001$). Smoking declined as education increased. However, in the total sample younger people and those who were single were significantly more likely to smoke than married and older people.

Qateif and Safwa sectors had the highest prevalence of smoking ($P < 0.001$); the lowest prevalence was in

Oraera ($P < 0.001$) (Table 2). Among men, the highest prevalence was in Hafr Albaten (36.4%) and the lowest in Oraera ($P < 0.001$). Among women the highest prevalence was in Safwa (23.1%) and Qateif (17.8%) (Table 2).

Due to the huge difference in the proportion of women who smoked in Qateif region than other regions, they

Table 1 Prevalence of current smoking by demographic characteristics in Eastern province of Saudi Arabia

Variable	Total ^a		Men		Women	
	No. of respondents	% smoking	No. of respondents	% smoking	No. of respondents	% smoking
Age (years)						
30–40	95 385	17.9	48 849	32.5	46 534	2.5
41–50	56 872	16.9	28 348	28.4	28 519	5.4
51–60	24 201	16.7	12 045	25.1	12 154	8.4
61–69	11 870	12.7	6 395	17.5	5 474	7.1
≥ 70	6 369	10.6	3 732	12.1	2 637	8.5
Marital status						
Single	11 636	20.9	5 475	41.7	6 161	2.4
Married	172 081	17.1	92 992	28.0	79 069	4.4
Widowed	8 296	8.5	416	18.5	7 879	8.0
Divorced	2 662	8.2	260	40.4	2 402	4.7
Occupation						
Self-employed	14 286	30.7	13 797	31.3	487	15.6
Housewife	71 789	5.0	n/a	n/a	71 784	5.0
Military	21 859	33.4	21 857	33.4	n/a	n/a
Professional ^b	21 577	14.2	12 348	23.6	9 229	1.6
Technical ^c	8 312	22.5	6 089	29.6	2 222	2.9
Non-technical ^d	6 376	27.7	5 184	32.5	1 192	6.8
Administrative	34 193	23.6	27 916	28.3	6 274	2.7
Unemployed	12 796	18.1	9 948	22.2	2 848	3.7
Education						
Illiterate	44 875	10.5	11 188	22.7	33 685	6.5
Read & write	13 790	13.1	5 043	25.8	8 745	5.9
Primary	28 332	20.8	14 934	34.5	13 396	5.6
Intermediate	26 811	23.4	17 727	33.5	9 081	3.7
Secondary	41 074	20.5	27 128	29.9	13 943	2.2
University	35 218	13.9	20 160	23.2	15 056	1.4
Higher degree	1 889	17.0	1 419	21.6	470	3.0
Income (Saudi riyals/month)						
< 2000	35 917	14.1	12 904	29.0	23 012	5.7
2000–< 5000	50 332	20.0	28 141	32.1	22 188	4.6
5000–< 7000	35 946	19.5	22 466	29.5	13 474	2.9
≥ 7000	47 273	17.1	29 843	25.6	17 428	2.4

^aTotals vary due to missing data; ^bAll occupations requiring university bachelor or higher degree; ^cGraduates from health, technical or commercial institutes; ^dNo academic studies.

All differences were statistically significant $P < 0.001$.

n/a = not applicable.

Table 2 Prevalence of current smoking by sex and health sectors (districts) of Eastern province of Saudi Arabia

Health sector	Total ^a		Men		Women	
	No. of respondents	% smoking	No. of respondents	% smoking	No. of respondents	% smoking
Dammam	30 356	16.5	15 547	30.4	14 802	2.0
Khober	30 430	17.1	16 588	30.6	13 840	1.0
Qateif	30 673	22.8	14 151	28.7	16 522	17.8
Al-Hassa	57 337	13.6	29 146	26.1	28 183	0.8
Hafr Albatan	11 562	17.7	5 393	36.4	6 168	1.4
Ras Tanura	5738	15.9	3 130	28.6	2 607	0.8
Bqaiq	4 753	12.6	2 378	24.8	2 372	0.4
Safwa	4 454	25.8	1893	29.6	2 561	23.1
Jubail	6 649	18.6	3 909	30.7	2 740	1.4
Khafji	4 148	15.5	2 090	30.0	2 058	0.7
Oraera	864	4.9	394	10.4	470	0.2
Nuaeria	3 841	18.0	2 757	24.8	1 084	0.6
Sarar	2 221	12.5	1 029	25.3	1 191	1.3
Qaria Olaya	1 897	14.3	1 037	25.7	860	0.6
Rafeia	1 338	10.9	597	22.6	741	1.5

^aTotals vary due to missing data.All differences were statistically significant $P < 0.001$.

were studied separately to identify their sociodemographic characteristics. It was found that the highest rate of female smokers in Qateif was among the illiterate (35.5%), widows (35.1%), the self-employed (28.6%), those with lower income (27.7%) and in women older than 50 years (36.0%) ($P < 0.001$). In other sectors, the highest rate of female smokers was among the divorced (1.6%) and the self-employed (12.3%). Smoking was significantly higher among those with a higher degree of education (2.5%) ($P < 0.001$), and the rate was almost the same in all age groups.

Regression analysis

The regression analysis showed the factors independently associated with smoking were male sex, with the risk of being a smoker almost 13 times higher in men than women (OR = 13.2; 95% CI: 12.9–15.3, $P < 0.001$). The risk was significantly higher at younger ages in men and older ages in women (Table 3). The smoking rate was higher among divorced people, although it was statistically significant in the case of women only. Among women, the

self-employed were more than 5 times more likely to be smokers compared to other occupations. Higher education and income were negatively correlated with smoking in both sexes.

Regarding the geographical distribution of smoking in women, the odds ratios for being a smoker were 24.6 (95% CI: 19.5–31.0) and 13.7 (95% CI: 10.1–18.7) in Qateif and Safwa respectively ($P < 0.001$) compared with Hafr Albatan. The OR for women were greater than 2 in Dammam and Ras Tanura while in men the risk of smoking was significantly higher in Hafr Albatan (OR = 1.12, 95% CI: 1.05–1.21, ($P < 0.001$)) than other sectors.

Discussion

The reported prevalence of current smoking was 16.9% overall (28.7% among men and 4.5% among women), which is higher than the prevalence of 12.9% (24.7% among men and 1.4% among women) reported previously for Saudi Arabia [15]. This difference could be attributed to a large extent to the

lower rate of smoking reported among females in that study. Worldwide, the prevalence of smoking is much higher in men than in women [16]. Our results are consistent with this, although the difference between the sexes was especially large in our study (men were 13 times more likely to be smokers than women), which could be attributed to the social stigma attached to women being smokers in Saudi Arabia. However, it is also possible that our study underestimated the rate of female smoking, as there may have been under-reporting in spite of assurances to participants about the confidentiality of the data. The validity of self-reporting in determining the rate of smoking is often questioned [17]. A study in New England in the United States compared self-reported smoking behaviour by men and women and showed credibility in the use of self-reports of smoking in both sexes [18]. The situation may be different in our more socially conservative community, however, and this needs to be addressed in further research.

There was a wide range of smoking rates across the 15 geographical sectors

Table 3 Multiple logistic regression models of variables associated with smoking in men and women in Eastern province of Saudi Arabia

Variable	Logistic regression coefficient	Men OR	95% CI	Logistic regression coefficient	Women OR	95% CI
Age	-0.028	0.97	0.97-0.97	0.018	1.02	1.01-1.02
Marital status						
Single		1 ^a			1 ^a	
Married	-0.399	0.67	0.63-0.72	0.481	1.62	1.29-2.03
Widowed	-0.343	0.71	0.53-0.96	0.432	1.54	1.19-1.99
Divorced	0.277	1.26	0.93-1.69	0.629	1.88	1.36-2.59
Occupation						
Self-employed		1 ^a			1 ^a	
Housewife	n/a	n/a	n/a	-2.065	0.13	0.09-0.18
Military	-0.130	0.88	0.83-0.93	n/a	n/a	n/a
Professional	-0.309	0.73	0.69-0.78	-1.427	0.24	0.16-0.36
Technical	-0.115	0.89	0.83-0.96	-1.450	0.24	0.15-0.36
Non-technical	-0.015	0.99	0.92-1.06	-1.901	0.15	0.10-0.23
Administrative	-0.141	0.87	0.82-0.92	-0.942	0.39	0.27-0.57
Unemployed	-0.130	0.88	0.82-0.94	-1.678	0.19	0.12-0.28
Education						
Illiterate		1 ^a			1 ^a	
Read & write	-0.038	0.96	0.88-1.05	-0.159	0.85	0.74-0.98
Primary	0.142	1.15	1.08-1.23	-0.395	-0.67	0.59-0.77
Intermediate	0.002	1.00	0.93-1.08	-0.852	0.43	0.36-0.51
Secondary	-0.206	0.81	0.76-0.88	-1.543	0.21	0.18-0.26
University	-0.522	0.59	0.55-0.64	-2.246	0.11	0.08-0.14
Higher degree	-0.584	0.56	0.48-0.65	-0.852	0.43	0.21-0.88
Income (Saudi riyals/month)						
< 2000		1 ^a			1 ^a	
2000-< 5000	0.014	1.01	0.96-1.07	-0.263	0.77	0.70-0.85
5000-< 7000	-0.080	0.92	0.87-0.98	-0.509	0.60	0.52-0.69
≥ 7000	-0.031	0.97	0.91-1.03	0.530	0.59	0.51-0.68

^aReference category.

n/a = not applicable; OR = odds ratio; CI = confidence interval.

studied, and this was especially marked for women. For example, although the overall prevalence of smoking in women was low, the rate in Qateif sector was more than 10 times higher than in other sectors. This has not been documented before, and the fact that the highest rate was among older, illiterate women could be explained by their habit of smoking *qedow* (a tobacco-smoking habit similar to the *shisha*), which is considered a community norm in older women and it is part of the local culture. It is hoped that this practice will decline over time, as the rate of smoking in the younger

generation of women was similar to other regions in the Eastern province.

Generally, younger people have a greater tendency to be smokers than older people [10]. In our study the prevalence of smoking by age showed opposite trends in men and women, as we found the highest rate of smoking in men among the younger groups and the lowest rate among the older ages, while in women the lowest rate was in the younger group and it increased as they got older. However, it may be difficult to generalize from these data for women

because most of the reported cases were among women from one region that has unique cultural habits. When Qateif region was excluded from the analysis, we found that smoking was more common among younger, better educated women, and this could be explained by the influence of the mass media in a previously closed community. A study conducted in Hong Kong has shown that one of the strongest risk factors for smoking by youths was their perception of cigarette advertisements as attractive [19]. Smoking initiation in young people and the factors contributing to it

are well established [20] and constitute one of the main challenges for tobacco control programmes [21].

Similar to other studies [22,23], our findings revealed that smoking tended to be more prevalent among military personnel and blue-collar workers and those with lower education and income, and this can be explained by stressful working environments [24] and peer influences in some occupations [19,20]. These are factors which needed to be addressed in order to focus on an effective strategy for smoking cessation and prevention in these groups.

It is important to recognize the limitations of this study. Our questionnaire did not address ex-smokers, the type and intensity of smoking or a history of passive smoking; it also depended on self-reported smoking behaviour and it did not involve school-age subjects. On other hand it had its strengths; the response rate among the subjects participating in the campaign was high (99.3%), presumably due to the efforts of quality control supervision, and almost one-third of the population was involved in this study. In addition, the close comparability of the proportion of our participants by age and sex

compared with the latest census in the Eastern province of Saudi Arabia [25] makes this study a representative estimate of the prevalence of smoking in Eastern province.

Conclusions

The results of this large community-based study showed a high prevalence of smoking in Saudi Arabia and that age, sex, education and occupation were important demographic factors predicting the likelihood of tobacco consumption.

References

1. Liu BQ et al. Emerging tobacco hazards in China: retrospective proportional mortality study of one million deaths. *British medical journal*, 1998, 317:1411–22.
2. Doll R et al. Mortality in relation to smoking: 40 years' observation on male British doctors. *British medical journal*, 1994, 309:901–11.
3. Gupta PC et al. Tobacco associated mortality in Mumbai (Bombay) India. Results of the Bombay Cohort Study. *International journal of epidemiology*, 2005, 34(6):1395–402.
4. *Smoking and health in the Americas*. Atlanta, Georgia, Centers for Disease Control, US Department of Health and Human Services, 1992 (DHHS publication No, CDC 928419).
5. Achievements in public health, 1990–1999. Tobacco use—United States, 1990–1999. *Morbidity and mortality weekly reports*, 1999, 48(43):986–93.
6. *The economics of tobacco in the Eastern Mediterranean Region*. Cairo, World Health Organization Regional Office for the Eastern Mediterranean, 2004.
7. Al-Bedah AM. *The economics of tobacco in GCC countries*. Riyadh, Saudi Arabia, Technical Office of the Arab Health Minister's Council for GCC States, 2001.
8. Jarallah JS et al. Predictors of smoking among male junior secondary school students in Riyadh, Saudi Arabia. *Tobacco control*, 1996, 5:26–9.
9. Al-Damegh SA et al. Cigarette smoking behavior among male secondary school students in the Central region of Saudi Arabia. *Saudi medical journal*, 2004, 25(2):215–9.
10. Siddiqui S, Ogbeide DO, Al Khalifa I. Smoking in a Saudi community: prevalence, influencing factors, and risk perception. *Family medicine*, 2001, 33(5):367–70.
11. Al-Faris EA. Smoking habits of secondary school boys in rural Riyadh. *Public health*, 1995, 109(1):47–55.
12. Al-Yousaf MA, Karim A. Prevalence of smoking among high school students. *Saudi medical journal*, 2001, 22(10):872–4.
13. Siddiqui S, Ogbeide DO. Profile of smoking amongst health staff in a primary care unit at a general hospital in Riyadh, Saudi Arabia. *Saudi medical journal*, 2001, 22(12):1101–4.
14. Al-Ghamdi A et al. A community-based screening campaign for the detection of diabetes mellitus and hypertension in the eastern province, Saudi Arabia: methods and participation rate. *Journal of family & community medicine*, 2007, 14(3):91–7.
15. *STEPwise surveillance program for KSA: preliminary report*. Riyadh, Saudi Arabia, Ministry of Health, General Directorate of Non-Communicable Disease, 2005.
16. Grunberg NE, Winders SE, Wewers ME. Gender differences in tobacco use. *Health psychology*, 1991, 10:143–53.
17. Patrick DL et al. validity of self-reported smoking: a review and meta-analysis. *American journal of public health*, 1994, 84(7):1086–93.
18. Assaf AR et al. Are there gender differences in self-reported smoking practices? Correlation with thiocyanate and cotinine levels in smokers and nonsmokers from the Pawtucket Heart Health Program. *Journal of women's health*, 2002, 11(10):899–906.
19. Lam TH et al. Tobacco advertisement: one of the strongest risk factors for smoking in Hong Kong students. *American journal of preventive medicine*, 1998, 14(3):217–23.
20. Gritz ER et al. Predictors of susceptibility to smoking and ever smoking: a longitudinal study in a triethnic sample of adolescents. *Nicotine and tobacco research*, 2003, 5(4):493–506.
21. Cigarette smoking among adults—United States, 1998. *Morbidity and mortality weekly reports*, 2000, 49:881–4.
22. Patterson JM et al. Associations of smoking prevalence with individual and area level social cohesion. *Journal of epidemiology and community health*, 2004, 58:692–7.
23. Shohaimi S et al. Residential area deprivation predicts smoking habit independently of individual educational level and occupational social class. A cross sectional study in the Norfolk cohort of the European Investigation into Cancer (EPIC-Norfolk). *Journal of epidemiology and community health*, 2003, 57(4):270–6.
24. Patterson JM et al. Associations of smoking prevalence with individual and area level social cohesion. *Journal of epidemiology and community health*, 2004, 58:692–7.
25. *Population and housing characteristics in the Kingdom of Saudi Arabia demographic survey 1428 H (2007)*. Riyadh, Saudi Arabia, Ministry of Economy and Planning, Central Department of Statistics and Information Population and Vital Statistics, 2007.

Burden of smoking in Moroccan rural areas

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عبء التدخين في أرياف المغرب

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الخلاصة: هدفت هذه الدراسة إلى التعرف على تقديرات انتشار التدخين في الوقت الحالي وخصائصه في الأرياف المغربية. وشملت الدراسة 3438 شخصاً تزيد أعمارهم عن 15 عاماً من الجنسين، وبلغ معدل الانتشار الخام للتدخين في الوقت الحالي (التدخين في الوقت الحالي والسابق الأكثر من مئة سيجارة خلال فترة الحياة) 16.9% لدى المراهقين والبالغين في سكان الأرياف، و31% لدى الرجال منهم و1.1% لدى النساء منهم. وقد بدأ التدخين (74.4% من الرجال و68.8% من النساء) قبل سن العشرين عاماً مع المدخنين. وأوضح التحليل المتعدد للمتغيرات اللوجستي أن العمر والجنس والحالة الزوجية والمهنة ومنطقة السكن هي أقوى المحددات للتدخين في الوقت الحالي. كما أوضحت هذه النتائج معدلاً مرتفعاً للتدخين بين الذكور في أرياف المغرب.

ABSTRACT The aim of this study was to estimate the prevalence and characteristics of current smoking among rural Moroccans. The population study included 3438 individuals aged 15 years and above from both sexes. The crude prevalence of current smoking (currently smoked and had smoked > 100 cigarettes in lifetime) was 16.9% in the adolescent and adult rural population: 31.0% among men and 1.1% among women. The majority of smokers (74.4% of men and 68.8% of women) began smoking before age 20 years. Multiple logistic regression analysis showed that age, sex, marital status, occupation and region of residence were the strongest determinants of current smoking. These results showed a high prevalence of smoking among males in the rural population of Morocco.

Poids du tabagisme dans les zones rurales marocaines

RÉSUMÉ Le but de cette étude était d'estimer la prévalence et les caractéristiques du tabagisme actif chez les ruraux marocains. La population étudiée comptait 3 438 individus âgés de 15 ans et plus, hommes et femmes. La prévalence brute du tabagisme actif (consommation actuelle ou antérieure de tabac supérieure à 100 cigarettes dans la vie) était de 16,9 % au sein de la population rurale adulte et adolescente : 31,0 % chez les hommes et 1,1 % chez les femmes. La majorité des fumeurs (74,4 % des hommes et 68,8 % des femmes) commençaient à fumer avant 20 ans. Une analyse de régression logistique multiple a démontré que l'âge, le sexe, le statut matrimonial, la profession et la région de résidence sont les principaux facteurs déterminants liés au tabagisme actif. Ces résultats mettent en avant la forte prévalence du tabagisme chez les hommes issus de la population rurale marocaine.

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Introduction

Smoking is an established risk factor for many diseases and is one of the most important public health problems worldwide [1–4]. It is a major cause of death in Morocco, where there is a high rate of tobacco-associated diseases, particularly ear, nose and throat cancers, lung cancer and cardiovascular and respiratory diseases. By 1990 there were an estimated 1309 deaths per 100 000 males aged over 45 years from cancers of the trachea, lung and bronchus and 328 deaths per 100 000 from lip, oral cavity and pharynx cancer. By comparison, the rates for women aged over 45 years were 178 per 100 000 for lung cancers and 44 per 100 000 for oral cancers [5].

The World Health Organization report on the global tobacco epidemic in 2008 (the MPOWER package) reported a current prevalence of smoking among Morocco adults of 14.2%, with a rate of 29.5% for males and 0.3% for females [4]. It also stated that there was no clear policy for tobacco control at the national level. Although tobacco advertising and promotion are prohibited in the local media, and smoking is not allowed in government buildings and in public transport, there is no close monitoring for noncompliance. Morocco signed the Framework Convention on Tobacco Control in 16 April 2004, but has not yet ratified it [4].

The rural population in Morocco numbers 13.5 million people, representing 44.6% of the country's inhabitants [6,7]. No nationwide studies on tobacco smoking have been performed in Moroccan rural areas. The only study was conducted in 2000 by Tazi et al., which focused on cardiovascular risk factors and showed that the smoking prevalence in rural areas was 31.5% in men and 0.6% in women [8].

A nationwide survey (the MARTA survey) was undertaken to estimate the prevalence and socioeconomic and

demographic correlates of current tobacco consumption among individuals 15 years and older in the Moroccan population. This report looks at the results from rural areas.

Methods

Sample

A cross-sectional survey based on a representative sample of the Moroccan population was conducted in 2005–06. The sample for the survey ($n = 9195$) was selected to be representative of the nation as a whole. The survey adopted a multi-stage, stratified probability sampling design. In the first stage, 7 regions representing 43.8% of the total population were selected to be representative of the ethnic and sociodemographic characteristics of all 16 Moroccan regions, and the sample was distributed according to proportional allocation of the Moroccan population. In each region, 1 district (*wilaya*) was randomly chosen according to the size of the population. Then, each *wilaya* was grouped into 2 strata; the first stratum was the *wilaya* centre, covering the urban area, and the second stratum was the villages or remote areas surrounding the centres, called rural areas.

Questionnaire

The questionnaire collected data on sociodemographic characteristics (age, sex, marital status, family income, place of residence, educational level, occupation) and smoking status. Respondents were asked, "Have you smoked at least 100 cigarettes or more during your entire life?" Those who replied "yes" were asked, "Do you smoke now?" The definitions of smoking were as follows: current smoker (currently smoked and had smoked at least 100 cigarettes or more during their lifetime); exsmoker (smoked more than 100 cigarettes in their lifetime but had stopped smoking for more than 3 months at the time of the survey), never smoker (never

smoked a cigarette or had smoked less than 100 cigarettes in their lifetime). The questionnaires were administered by trained interviewers.

Analysis

The data were entered into a personal computer using *Epi-Info*, version 3.3.2. The chi-squared test was used to compare current smokers and never smokers for the categorical variables and the *t*-test was used to compare the means and standard deviation (SD) of quantitative data. For the multivariate analysis, a stepwise logistic regression was used. Odds ratios (OR) with 95% confidence intervals (CI) for each variable were calculated as an estimate of the likelihood of smoking, and probability values were determined. Interactions among the determinant variables were assessed.

Results

Prevalence of smoking

A total of 3438 respondents aged 15 years and over [mean age 31.8 (SD 13.9) years], participated in the study: 1819 males (52.9% of the sample) [mean age 31.8 (SD 14.5) years] and 1619 females [mean age 31.7 (SD 13.2) years].

Overall, 16.9% of the respondents were classified as current smokers, 11.8% as exsmokers and 71.3% as never smokers. Self-reported smoking status for men was: current smoking 31.0%; exsmoking 21.7%, never smoking 47.3%. Among women, the rates were: current smoking 1.1%, exsmoking 0.7%, never smoking 98.2%. Among current smokers, 65.4% had a history of attempted smoking cessation, half (54.0%) of whom had tried to stop in the previous 12 months and 31.1% had stopped smoking for 3 months or more.

Table 1 shows the prevalence of current smoking according to demographic variables. Among males smoking prevalence was highest in the age group 30–39 years (42.3%) ($P < 0.001$), while

Table 1 Prevalence of current smoking among rural Moroccans by selected demographic characteristics and by sex

Variable	Males			Females			Total		
	No. of respondents	% smoking	P-value	No. of respondents	% smoking	P-value	No. of respondents	% smoking	P-value
Age (years)			< 0.001			–			
15–19	465	18.5		366	1.4		831	11.0	
20–29	479	35.5		429	1.6		908	19.5	
30–39	376	42.3		374	0.8		750	21.6	< 0.001
40–49	234	35.9		253	0.8		487	17.7	
50–59	154	27.9		123	0.8		277	15.9	
≥ 60	106	20.8		64	0.0		170	12.9	
Marital status			< 0.001			–			
Single	1054	30.0		680	2.1		1734	19.0	
Married	711	31.9		828	0.0		1539	14.8	< 0.001
Divorced	16	68.8		39	7.7		55	25.5	
Widowed	20	10.0		67	1.5		87	3.5	
Education level			< 0.001			–			< 0.001
Koranic school	304	40.5		633	1.3		937	14.0	
Illiterate	208	28.9		63	0.0		271	22.1	
School	607	34.4		437	0.7		1044	20.3	
Secondary	509	23.6		392	1.5		901	14.0	
University and above	187	27.3		87	1.2		274	19.0	
Occupation			< 0.001			–			
Farmer worker or manager	174	31.6		10	0.0		184	29.9	
Trade professional, shopkeeper	193	34.7		37	0.0		230	29.1	
Housewife	–	–		749	0.0		749	0.0	
No occupation	219	41.6		279	0.7		498	18.7	< 0.001
Public or private white-collar worker	93	26.9		53	0.0		146	17.1	
Public or private executive	30	20.0		5	0.0		35	17.1	
Blue-collar worker, service employee	588	40.3		166	3.0		754	32.1	
Police, army or security	34	29.4		15	40.0		49	32.7	
Craftsman	372	10.2		297	1.7		669	6.4	
Student	34	50.0		–	–		34	50.0	
Other	44	25.0		1	0.0		45	24.4	
Income (dirhams/month)									
< 1000	243	38.3		165	1.2		408	23.3	< 0.001
1000–2000	491	31.8	< 0.001	320	1.9	–	811	20.0	
2000–4000	434	32.0		277	0.7		711	19.8	
4000–6000	120	23.3		78	0.0		198	14.1	
> 6000	50	28.0		28	0.0		78	18.0	
Unknown	405	25.2		701	0.7		1106	9.7	
Family size			0.92			0.11			0.85
≤ 6	995	31.7		925	1.5		1920	17.2	
> 6	677	31.0		555	0.4		1232	17.2	

Table 1 Prevalence of current smoking among rural Moroccans by selected demographic characteristics and by sex (concluded)

Variable	Males			Females			Total		
	No. of respondents	% smoking	<i>P</i> -value	No. of respondents	% smoking	<i>P</i> -value	No. of respondents	% smoking	<i>P</i> -value
Region			< 0.001			–			< 0.001
Agadir	316	31.3		299	1.3		615	16.8	
Casablanca	249	38.6		178	5.1		427	24.6	
Fez	273	23.4		206	0.0		479	13.4	
Marrakech	36	33.3		36	2.8		72	18.1	
Oujda	403	25.1		393	0.3		796	12.8	
Laayoun	84	25.0		57	0.0		141	14.9	
Tangier	458	37.3		450	0.7		908	19.2	

among females smoking prevalence was highest in the age group 20–29 years (1.6%). For education, the highest prevalence of smoking was reported by men who had only Koranic school education (40.5%) and by women who had attained secondary education (1.5%). The highest prevalence by profession was for “soldier/policeman/security” among males (50.0%) and for “other” among females (40.0%) (this category comprised mainly sex workers). The highest prevalence of smoking by income was for the lowest household income category of < 1000 dirhams per month (about US\$ 125) among males (38.3%) and for the second lowest income category of 1000–2000 dirhams per month among females (1.9%). Of all marital status possibilities, those who were divorced had the highest prevalence of smoking among males and females (42.3% and 1.6% respectively). By region, the highest prevalence was observed in the region of Casablanca in both men and women (respectively 38.6% and 5.1%).

In summary, for males a high rate of smoking was significantly associated with middle age, being divorced, Koranic or primary school education level, blue-collar profession or unemployed, low household income and living in the Casablanca region ($P < 0.05$). Statistical tests were not performed on the female group due to the very low prevalence of smoking.

Multivariate logistic regression

Table 2 gives the adjusted ORs from multivariate logistic regression models to differentiate the adjusted association between different socioeconomic and demographic characteristics and the risk of cigarette smoking. Compared with the youngest group (15–19 years), respondents aged 40–49 years had a greater likelihood of smoking tobacco (OR 4.2; 95% CI: 2.3–7.9). Males were 55.9 times more at risk of being smokers than females (95% CI: 29.9–104.8). Compared with married subjects, divorced subjects had a greater likelihood of smoking (OR 17.2; 95% CI: 2.6–0.03). People working in the police, army or security service had the highest risk of smoking (OR 3.7; 95% CI: 1.2–11.4) and students had the lowest risk compared with those without employment (OR 0.2; 95% CI: 0.1–0.4). The differences by region persisted even after adjusting for all other cofactors. No significant association with smoking was observed for education level or income after controlling for other characteristics.

The majority of male and female current smokers (74.4% and 68.8% respectively) started before the age of 20 years; 22.1% started smoking before the age of 15 years. The mean age of starting smoking was 17.4 (SD 4.3) years

for males and 17.9 (SD 2.9) years for females ($P < 0.29$) (Table 3).

Of the current male smokers, 43.1% smoked ≤ 10 cigarettes/day and 45.0% smoked 11–20 cigarettes/day. Of the current female smokers, 56.3% smoked ≤ 10 cigarettes/day (Table 4). The mean number of cigarettes smoked/day was 14.0 (SD 8.4) for males and 10.6 (SD 7.1) for females ($P < 0.01$).

The mean duration of smoking was 14.04 (SD 11.04) years for men and 7.87 (SD 9.15) years for women ($P < 0.01$).

Discussion

The MARTA study is the first large survey to provide nationally representative aggregate prevalence estimates of tobacco consumption by different socioeconomic and demographic characteristics in the rural Moroccan population aged 15 years and over. The study showed that 16.9% of the adolescent and adult population in rural Morocco were classified as current smokers. Since smoking status was determined by interview without any biochemical validation the figure should be considered approximate in view of the likelihood of under-reporting, particularly by women and children [9]. To remedy this problem, further studies can be conducted using biochemical validation of smoking with recruitment of subjects outside

Table 2 Multiple logistic regression analysis comparing current and never smokers for variables significantly associated with current smoking

Variable	Adjusted OR	95% CI	P-value	P-value (all variables)
Age (years)				
15–19	1	–	–	
20–29	1.9	1.3–2.8	< 0.01	
30–39	3.1	1.9–5.1	< 0.001	< 0.01
40–49	4.2	2.3–7.9	< 0.001	
50–59	2.6	1.3–5.1	0.1	
≥ 60	1.4	0.6–3.1	0.49	
Sex (males vs females)	55.9	29.9–104.8	< 0.01	< 0.01
Marital status				
Single	1.4	0.9–2.1	0.12	
Married	1	–	–	< 0.01
Divorced	17.2	2.6–104.8	< 0.01	
Widowed	1.4	0.3–6.5	0.69	
Education level				
Koranic school	0.9	0.6–1.4	0.70	
Illiterate	1	–	–	0.08
School	1.3	0.9–2.0	0.19	
Secondary	1.1	0.7–1.8	0.63	
University and above	1.5	0.8–2.6	0.19	
Occupation				
Farmer worker or manager	0.8	0.4–1.3	0.30	
Trade professional, shopkeeper	0.8	0.5–1.3	0.39	
Housewife	< 0.0	–	0.96	
No occupation	1	–	–	
Public or private white-collar worker	0.5	0.2–0.9	0.048	< 0.001
Public or private executive	0.3	0.1–1.1	0.06	
Blue-collar worker, service employee	0.9	0.6–1.4	0.68	
Police, army or security	3.7	1.2–11.4	0.02	
Craftsman	1.3	0.6–3.1	0.51	
Student	0.2	0.1–0.4	< 0.001	
Other	2.1	0.7–6.3	0.19	
Income (dirhams/month)				
< 1000	1	–	–	
1000–2000	0.9	0.6–1.3	0.52	
2000–4000	0.7	0.5–1.1	0.10	0.11
4000–6000	0.4	0.2–0.8	0.01	
> 6000	0.5	0.2–1.3	0.18	
Unknown	0.7	0.5–1.1	0.09	
Region				
Agadir	0.6	0.4–0.9	0.02	
Casablanca	1	–	–	
Fez	0.3	0.2–0.5	< 0.001	< 0.001
Marrakech	0.9	0.3–2.4	0.84	
Oujda	0.3	0.2–0.5	< 0.001	
Laayoun	0.5	0.2–0.9	0.04	
Tangier	0.7	0.4–1.1	0.08	

OR = odds ratio; CI = confidence interval.

of their domicile or school. Comparing the overall rate of smoking in rural areas in other Arab and Muslim states, the prevalence of smoking in our study was higher than that reported from Pakistan 14.6% [10], Saudi Arabia 11.6% [11] and Oman 6.9% [12], but lower than that reported from Algeria 19.9% (non-representative sample) [13].

In general, a much higher proportion of men (40%–60%) than women (2%–10%) smoke in developing countries [14]. Comparing with data from other Arab Muslim states, the prevalence of smoking among men in rural Morocco (31.0%) was higher than that reported from Oman 13.8% [12], but lower than that reported from Tunisia 48.7% [15] and from Algeria 39.4% (nonrepresentative sample) [13]. Comparing the rate of smoking in rural areas with that of women in some other Arab states, the prevalence in rural Morocco (1.1%) was higher than 0.2% reported from Oman [12], 0.4% from Algeria [13] and 0.7% from Tunisia [15]. The gender difference in this and other studies may be because smoking by women is not perceived as socially acceptable in Morocco and there may be religious and economic arguments against it [16]. There may also have been under-reporting by some women for sociocultural or religious reasons.

In our study, the highest prevalence of smoking was observed among men aged 30–39 years and women aged 20–29 years. Smoking rates were very high among men and women of the most productive age group (20–59 years). Of Morocco's rural population of 13.5 million, 5.87 million people (3.18 million men and 2.69 million women) are in this age group [7]. Extrapolating from these data we can estimate that around 1.2 million people in this age group are current smokers. This high prevalence calls for immediate targeted smoking cessation programmes.

The majority of regular smokers begin smoking in early adolescence. In our study 74.4% of the male smokers and

Table 3 Age at starting smoking and number of cigarettes smoked per day for current smokers by sex

Variable	Males		Females		Total	
	No.	%	No.	%	No.	%
<i>Age at starting smoking (years)</i>						
≤ 10	17	3.1	0	0.0	17	3.0
11–14	105	19.1	3	18.8	108	19.1
15–19	288	52.3	8	50.0	296	52.2
20–29	130	23.6	5	31.3	135	23.8
30–39	9	1.6	0	0.0	9	1.6
≥ 40	2	0.4	0	0.0	2	0.4
Mean (SD)	17.4 (4.3)		17.9 (2.9)		17.6 (4.4)	
<i>No. of cigarettes/day</i>						
≤ 10	239	43.1	9	56.3	248	43.5
11–20	249	45.0	7	43.8	256	44.9
21–30	52	9.4	0	0.0	52	9.1
31–40	11	2.0	0	0.0	11	1.9
> 40	3	0.5	0	0.0	3	0.5
Mean (SD)	14.0 (8.4)		10.6 (7.1)		13.9 (8.4)	

SD = standard deviation

68.8% of female smokers had started smoking before they reached age 20 years. International research suggests that early initiation of smoking predicts longer duration, heavier daily consumption and increased chances of nicotine dependence [17,18]. Considering Morocco's high rate of population growth and its young population (44.9% of Moroccans are aged 20 years or younger) [7], a major effort should be directed to influence the choices that children and adolescents make about tobacco use.

Low education level has been associated with a risk of smoking in many populations [19–21]. This is important as many studies, including the European Community Respiratory Health Survey

(14 countries), have demonstrated that subjects with a lower education level were less likely to quit smoking [22]. Our results showed that smoking prevalence was significantly higher among Moroccan men with a lower level of education. There was also a relatively high rate among men with university education and above; this may indicate a situation similar to that of industrialized countries where, before the advent of antismoking campaigns, smoking was popular among the higher social classes because it had connotations of elevated social status and prestige. Among women, a higher prevalence of smoking was recorded for those with only Koranic school, secondary school

and university level education and above. Thus, for both men and women, interventions need to be targeted at those with lower education [23].

The prevalence of tobacco consumption varied significantly across different Moroccan rural regions even after controlling for individual socioeconomic and demographic characteristics. The highest prevalence was observed in the region of Casablanca in both males and females. This regional level variation may reflect distinct regional sociocultural patterns. Casablanca is the economic capital of Morocco and even the rural surroundings are affected by some of the lifestyle options available to the

Table 4 Number of cigarettes smoked per day for current smokers by sex

No. of cigarettes/day	Males		Females		Total	
	No.	%	No.	%	No.	%
≤ 10	239	43.1	9	56.3	248	43.5
11–20	249	45.0	7	43.8	256	44.9
21–30	52	9.4	0	0.0	52	9.1
31–40	11	2.0	0	0.0	11	1.9
> 40	3	0.5	0	0.0	3	0.5
Mean (SD)	14.0 (8.4)		10.6 (7.1)		13.9 (8.4)	

SD = standard deviation.

urban population, with higher incomes and wider range of educational levels.

This study has also shown that smoking prevalence varied with marital status in Moroccan rural areas. A higher prevalence of smoking was observed for divorced subjects in both sexes. Divorced people may suffer more sociocultural and financial stress than others, which may lead them to smoke. The high smoking prevalence among married men raises a concern about the health effects of passive smoking among those in the same household [24], and may also increase the risk of smoking initiation among children [25].

With a daily average for men of 14.0 cigarettes smoked and 13.9 in the total

sample, tobacco consumption among smokers in this study was similar to the average of 13 cigarettes/day reported for the Eastern Mediterranean region [9] and the 14 cigarettes/day for less developed countries. Moreover, it was lower than the average of 22 cigarettes tabulated for more developed countries. In addition to the significantly low prevalence of smoking among women, consumption was significantly lower than among men for cigarettes/day.

Our findings indicate that tobacco use in rural areas of Morocco is high, and concerted efforts are needed to curb the epidemic. Cross-sectional studies should be conducted regularly to monitor changes in prevalence,

knowledge, attitudes, behavioural and socioeconomic determinants of starting, continuing and quitting smoking. These studies would provide baseline data for antismoking interventions and allow evaluation of these programmes.

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References

1. 2004 Surgeon General's report: the health consequences of smoking. Atlanta, Georgia, Centers for Disease Control and Prevention, 2004.
2. Controlling the smoking epidemic. Geneva, World Health Organization, 1979. (WHO Technical Report Series, No. 636).
3. What in the world works? International consultation on youth and tobacco, Singapore, 28-30 September 1999. Final conference report. Geneva, World Health Organization, 2000 (WHO/NMH/TFI/00.1).
4. WHO report on the global tobacco epidemic. The MPOWER package. Geneva, World Health Organization, 2008.
5. Ferlay J, Parkin DM, Pisani P. GLOBOCAN 1: cancer incidence and mortality worldwide [CD-ROM]. Lyon, International Agency for Research on Cancer, 1998.
6. Santé en chiffre. [Health statistics.] Rabat, Maroc, Ministère de la Santé Maroc, 2006.
7. Caractéristiques démographiques et socio-économiques de la population. Recensement général de la population et de l'habitat [Demographic and socio-economic characteristics of the population. General Census of Population and Housing]. Rabat, Maroc, Haut-Commissariat au Plan, 2004.
8. Tazi MA et al. Prevalence of the main cardiovascular risk factors in Morocco: results of a National Survey, 2000. *Journal of hypertension*, 2003, 21:897-903.
9. Tobacco or health: a global status report. Geneva, World Health Organization, 1997.
10. Ahmad K et al. Prevalence and predictors of smoking in Pakistan: results of the National Health Survey of Pakistan. *European journal of cardiovascular prevention and rehabilitation*, 2005, 12:203-8.
11. Jarallah JS et al. Prevalence and determinants of smoking in three regions of Saudi Arabia. *Tobacco control*, 1999; 8:53-6.
12. Al Riyami AA, Afifi M. Smoking in Oman: prevalence and characteristics of smokers. *Eastern Mediterranean health journal*, 2004, 10:600-9.
13. Mesure des facteurs de risque des maladies non transmissibles dans deux wilayas pilotes en Algérie (Approche Stepwise de l'OMS). Rapport final. [Measurement of risk factors for noncommunicable diseases in two pilot wilaya in Algeria (WHO Stepwise approach). Final report. Algeria 2005.] Alger, Algérie, Ministère de la Santé, de la Population et de la Réforme Hospitalière, Direction de la Prévention, 2005.
14. Women and tobacco. The first worldwide survey. Geneva, World Health Organization, 1992.
15. Fakhfakh R et al. Tobacco use in Tunisia: behaviour and awareness. *Bulletin of the World Health Organization*, 2002, 80:350-6.
16. Tessier JF, Nejari C, Bennani-Othmani M. Smoking in Mediterranean countries: Europe, North Africa and the Middle-East. Results from a co-operative study. *International journal of tuberculosis and lung disease*, 1999, 3:927-37.
17. Breslau N, Peterson EL. Smoking cessation in young adults: age at initiation of cigarette smoking and other suspected influences. *American journal of public health*, 1996, 86:214-20.
18. D'Avanzo B, La Vecchia C, Negri E. Age at starting smoking and number of cigarettes smoked. *Annals of epidemiology*, 1994, 4:455-9.
19. Pierce JP. International comparisons of trends in cigarette smoking prevalence. *American journal of public health*, 1989, 79:152-7.
20. Jenkins CN et al. Tobacco use in Vietnam. Prevalence, predictors, and the role of the transnational tobacco corporations. *Journal of the American Medical Association*, 1997, 277:1726-31.
21. Koong SL et al. Smoking prevalence in the United States and Taipei city, Taiwan. *American journal of preventive medicine*, 1991, 7:161-5.
22. Janson C et al. Changes in active and passive smoking in the European Community Respiratory Health Survey. *European respiratory journal*, 2006, 27:517-24.
23. Huisman M, Kunst AE, Mackenbach JP. Inequalities in the prevalence of smoking in the European Union: comparing education and income. *Preventive medicine*, 2005, 40:756-64.
24. Fielding JF, Phenon KJ. Health effects of involuntary smoking. *New England journal of medicine*, 1988, 319:1452-60.
25. Lopez AD, Collishaw NE, Piha T. A descriptive model of the cigarette epidemic in developed countries. *Tobacco control*, 1994, 3:242-7.

Implementing a gatekeeper system to strengthen primary care in Egypt: pilot study

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تنفيذ نظام البواب لتعزيز الرعاية الصحية الأولية في مصر، دراسة ارتيادية

توماس وارد

الخلاصة: إن فرط استخدام عيادات المرضى الخارجيين في المستشفيات جراء فقدان نظام البواب الفعّال، يهدد استدامة خدمات الرعاية الصحية الأولية المحسّنة. وفي هذا المشروع الريادي في المنوفية، في منطقة دلتا النيل، زيدت الرسوم المفروضة على زيارات المرضى الخارجيين للمستشفى، لتشجيع المرضى على البدء بزيارة عيادات الرعاية الصحية الأولية. ونتيجة لذلك، فقد نقص استخدام المرضى الخارجيين للمستشفى بمقدار 63% في منطقة المشروع، مقارنة بزيادة مقداره 4% في المنطقة الشاهدة. وقد كان معظم النقص يعود إلى أن المرضى يراجعون عيادات الرعاية الصحية التابعة للقطاع العام أو العيادات الخاصة. لقد كان زيادة الرسوم المفروضة على زيارات المرضى الخارجيين المباشرة للمستشفى طريقة فعّالة لتأسيس دور البواب لعيادات صحة الأسرة.

ABSTRACT Overuse of hospital outpatient clinics in Egypt, due to lack of an effective gatekeeper system, has threatened the sustainability of improved primary care services. In this pilot project in Menoufia in the Nile delta region, the price of direct hospital outpatient visits was increased, encouraging patients to attend primary care clinics first. As a result, direct hospital outpatient utilization decreased by 63% in the project area compared with a 4% increase in a control district. The majority of this reduction was accounted for by patients attending either public primary care clinics or private clinics. Increasing the price of direct hospital outpatient visits was an effective way to establish a gatekeeper role for family health clinics.

Mise en œuvre d'un système de filtrage pour renforcer les soins de santé primaires en Égypte : étude pilote

RÉSUMÉ La surutilisation des structures hospitalières de soins externes en Égypte due à l'absence d'un système de filtrage efficace, menace la durabilité de l'amélioration des services de soins primaires. Dans ce projet pilote conduit à Ménoufia, dans la région du delta du Nil, le prix des consultations hospitalières externes directes a été augmenté, encourageant les patients à se diriger d'abord vers des établissements de soins de santé primaires. De ce fait, le recours aux soins hospitaliers externes directs a chuté de 63 % dans la région concernée par le projet, alors qu'une augmentation de 4 % a été constatée dans une autre région, servant de témoin. Cette diminution s'explique en grande partie par le fait que les patients se sont rendus soit dans des établissements publics de soins de santé primaires, soit dans des structures privées. L'augmentation du prix des consultations hospitalières externes directes s'est avéré un moyen efficace de mettre en place un filtrage pour les orienter vers les établissements de soins de santé de la famille.

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Introduction

Egypt has improved its health outcomes over the past 4 decades, with life expectancy increasing from 44.9 years in 1960 to 68.8 years in 2005 [1]. However, with the health profile beginning to resemble that of more affluent nations in the region [2], it is important that Egypt strengthen its primary care system to manage the increasing prevalence of chronic diseases [3]. This is a challenge not only for Egypt but for all countries in the Eastern Mediterranean Region, where the burden of chronic disease is high [4].

One way to develop primary care is to establish a gatekeeper system that eliminates direct patient access to hospitals and specialists for all but emergency treatment [5]. In the Middle East and surrounding region, few countries have implemented an effective gatekeeper role within their health systems [6,7], despite evidence that gatekeepers reduce the overall cost of health care and provide other benefits. These include strengthening the position of primary care within the health system, making health care more geographically and financially accessible [8], promoting co-ordinated and ongoing care for complex chronic diseases such as diabetes [9], enhancing patient satisfaction and improving overall health outcomes, such as all-cause mortality [10–13].

International donors have invested heavily in reforming Egypt's primary care system over the past decade, resulting in the family health model (FHM), which currently exists in 5 of Egypt's 27 governorates, and is being rolled out across the country [14]. The FHM delivers curative and preventive care services, with a performance-based incentive scheme for staff and an accreditation programme to ensure quality is maintained. Although the FHM helps improve the quality of care [15], it costs approximately twice the amount contributed by the government. The additional cost is currently covered by

international donors, a situation that is unsustainable. Early attempts to improve the sustainability of the clinics through small patient co-payments reduced utilization by 50%–70% [A. Dorghamy, personal communication, 2006], partly because patients started seeking primary care from hospital outpatient clinics, where a lower price was charged. As a result, hospital utilization increased dramatically.

The objective of this study was to implement and evaluate a pilot project to encourage patients to attend FHM clinics instead of seeking primary care from hospitals. The rationale for increasing utilization of FHM clinics was to improve their sustainability by boosting revenues and to enhance the effectiveness of public health programmes conducted there.

Methods

Overview of health care facilities

Various health facilities were investigated in this study. FHM clinics provided preventive and basic curative care, including immunizations, family planning, primary care consultations, minor procedures such as wound management, and investigations such as urinalysis. General public hospitals provided both inpatient and outpatient services across a range of specialties including but not limited to: cardiology, dermatology, orthopaedics and internal medicine. Specialist public hospitals provided care in a single field, such as ophthalmology. Private clinics were not investigated in this study, but were staffed by specialists and/or primary care physicians, and offered a range of services which varied from clinic to clinic. Private clinics did not provide preventive care.

Changes to the system

For the pilot project, beginning mid-July to 1 August 2006, 3 main changes were made to the system to encourage patients to attend FHM clinics.

Changes to hospital pricing

Prior to the pilot programme, patients who chose to use FHM clinics paid an annual registration fee of 10 Egyptian pounds (LE), with 3 LE for each curative primary care visit and 33% of the retail price for prescribed pharmaceuticals. Preventive care visits were free. The pricing at FHM clinics remained unchanged during the pilot study.

Before the programme, patients paid only 1 LE for a hospital specialist visit (US\$ 0.17), around 0.04% of average annual per capita expenditure in Menoufia [16]. Prescribed pharmaceuticals were free. During the pilot project the cost of direct visits to hospitals were increased as follows. All non-emergency patients who attended hospitals without a referral were required to pay 10 LE (US\$ 1.70), plus the full retail price of pharmaceuticals (Table 1). Those who attended hospital via a referral from the FHM clinic, paid a 10 LE annual registration fee at the hospital, plus 2 LE for each referred hospital visit and 50% of the price of pharmaceuticals at the hospital. Patients insured with the national health insurance organization (HIO) were exempt from paying the referral fees, as the HIO was responsible for paying on their behalf.

Changes to clinic operations

A marketing campaign was conducted to increase awareness of the services offered at FHM clinics and to attract more patients. Marketing methods included door-to-door visits, flyers, posters and announcements in mosques. The evening opening hours were shifted so that FHM clinics closed at 22:00 hours instead of 20:00 hours. Doctors' payments were linked to the number of patients who attended their FHM clinics, creating an incentive for them to boost utilization.

Implementation of an exemption policy

A house-to-house survey was conducted to identify the poorest 10% of the population, who were given a card

Table 1 Cost to patients of treatment at hospitals and family health model (FHM) clinics before and after the price changes in the pilot project

Variable	Cost of service (LE) ^a			
	Before pilot: direct hospital visit	During pilot: direct hospital visit	During pilot: hospital visits via primary care referral	Before & during pilot: FHM clinic visit
Annual registration fee	0	0	10	10
Fee per visit	1	10	2	3
Pharmaceuticals fee	0	100% of retail price (approx. 9–30)	50% of retail price (approx. 5–15)	33% of retail price (approx. 3–10)
Total cost (1st visit)	1	19–40	17–27	16–23
Total cost (subsequent visits)	1	19–40	7–17	6–13

^aAll prices in Egyptian pounds (LE). 1 LE = 0.04% of the average annual per capita expenditure in Menoufia [16].

which exempted them from FHM clinic fees and from hospital fees if they were referred via an FHM clinic. The criteria for exemption were based on proxies for wealth, such as employment status and material possessions, and the presence of any chronic illness within the family, such as permanent disability (e.g. quadriplegia, blindness, cerebral palsy), malignancies (e.g. haematological), genetic

illnesses (e.g. cystic fibrosis or muscular dystrophy) or chronic disabling conditions (e.g. diabetes, liver failure, kidney failure or asthma).

Study design

Study area

The pilot study was conducted in 25 FHM clinics in Menouf district of Menoufia governorate (Figure 1), which is

situated between Cairo and Alexandria, in the Nile delta, and has a population of around 391 000. Menouf was chosen as the pilot district because it is in an 'average' Egyptian governorate, ranking 12th out of 27 according to the United Nations Development Programme development index [16], which accounted for factors such as life expectancy, adult literacy and real gross domestic product per capita. Menouf was also chosen because it was one of the few districts in which all clinics had implemented the FHM, and it had a reliable data collection system. The district had 4 hospitals serving its population: general, ophthalmology, fever and chest hospitals.

In 5 adjacent districts the same changes were implemented as in Menouf, so as to limit the number of patients who might travel to districts which had not implemented changes. The only adjacent district in which the changes were not implemented was Al Sadat, but it is separated from Menouf by the river Nile, making travel between the 2 districts difficult.

A control district was established in Quwesna, where there were 23 FHM clinics, 1 small general hospital and a population of 294 000. Additional hospital services for Quwesna residents were obtained from a university hospital in an adjacent district. No changes were applied in Quwesna during the pilot. It was selected as the control because it was not adjacent to Menouf, so leakage

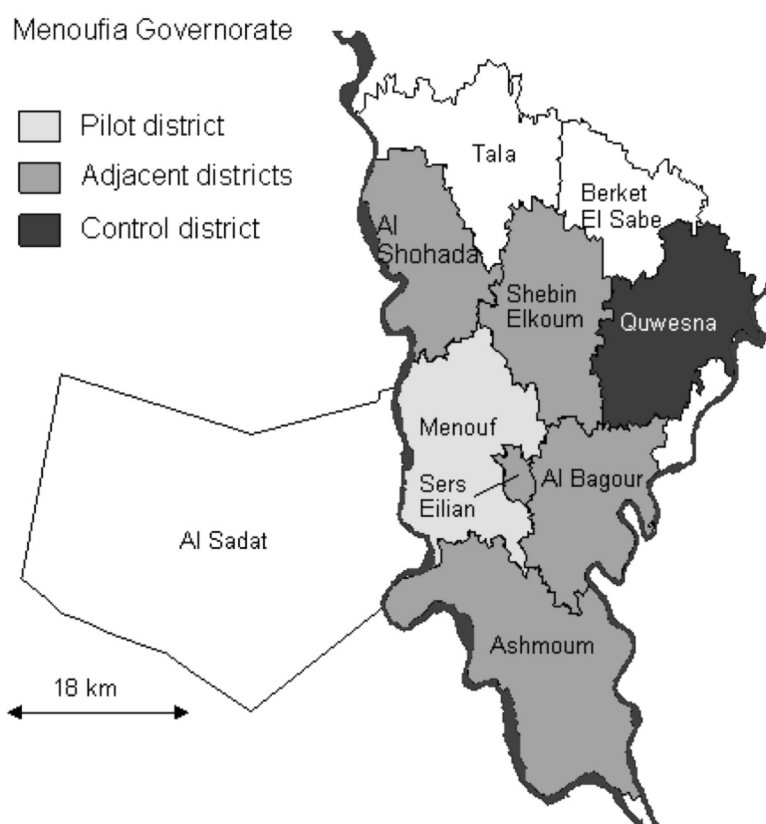


Figure 1 Map of the study area, showing Menouf (pilot project district) and Quwesna (control district)

of patients was limited, and it had reliable data collection systems.

Data collection

The study was conducted by staff and consultants of the Egyptian Ministry of Health and Population who had extensive experience in administering pilot programmes of health system reform.

Utilization data

FHM clinics and public hospitals in Menouf and Quwesna collected daily utilization data. In FHM clinics, this was measured as the total number of patient visits each day. In limited cases where data were not available, the clinic was assigned the district average. In hospitals, daily utilization was measured as the number of visits to hospital outpatient clinics. Monthly utilization was calculated for FHM clinics and hospitals by aggregating the daily utilization data. Average utilization in the baseline period before the changes were implemented (April–June 2006) was compared with the utilization in the 4 months following the changes (August–November 2006).

Household survey

In addition to collecting hospital and clinic utilization data, a survey of households in Menouf was conducted to determine how patients had altered their care-seeking behaviour as a result of the changes made to the system. To have adequate power, the survey required at least 384 subjects who had needed medical treatment within the previous 3

months to achieve a 5% margin of error (α level 95%). It was assumed that at least 1 in 3 households had a member who required medical treatment during the past 3 months. Therefore, almost 3 times the required number of households were sampled ($n = 1106$).

A social worker in each clinic was giving training and then surveyed approximately 40 households in each village. Every 10th house along the major roads of each village was surveyed. The researcher completed a structured survey form which contained 3 questions about demographics for each member of the household (name, age, address), plus 13 questions about illnesses, care-seeking behaviour and attitude towards and awareness of the changes implemented during the pilot programme. Each household was asked if a family member had required medical treatment during the previous 3 months (during the pilot project, September–November 2006), how many times they were sick, where they sought care and where they would have sought care before the changes to the system. Respondents who had chosen not to use a public hospital after the pilot project commenced were asked to give reasons.

Statistical analysis

Data were analysed in Microsoft *Excel*. Complete utilization datasets for FHM clinics and public hospitals were obtained for both Menouf and Quwesna,

eliminating the need for sampling and further statistical analysis.

Results

Utilization data

The period during which hospital fees were increased corresponded to a decrease in outpatient visits in Menouf by between 44% (at the general hospital) and 86% (at the chest hospital) relative to the average of the baseline period (April–June). The overall reduction in visits to the 4 Menouf hospitals was 63% in August relative to the baseline period and decreased further in September and October, compared with a slightly increased utilization in the Quwesna general hospital of 4% (Table 2).

In contrast, utilization at FHM clinics in Menouf increased by 25% in August relative to the baseline, and was still 18% above the baseline in November (Table 3). Patients who were exempted from paying fees (10% of the population) accounted for 12% of FHM clinic visits. In Quwesna, utilization at FHM clinics decreased relative to the baseline, reaching 23% below baseline in November.

Despite the increase in utilization at FHM clinics in the control district between the baseline and August (approximately 6150 visits), this did not account for the total reduction in hospital visits (approximately 16 800 visits). The household survey therefore investigated

Table 2 Hospital outpatient clinic visits to Menouf and Quwesna hospitals in 2006 before (baseline, April–June) and during the pilot project (August–November)

District	Total clinic visits				
	Baseline	August	September	October	November
Menouf^a					
No.	26 846	10 031	8 652	8 882	10 156
Compared to baseline (%)	–	–63	–68	–67	–62
Quwesna^b					
No.	3 074	4 258	4 037	3 192	4 383
Compared to baseline (%)	–	+39	+31	+4	+43

^aPilot district; ^bcontrol district.

Table 3 Total visits to family health model clinics in Menouf and Quwesna in 2006 before (baseline, April–June) and during the pilot project (August–November)

District	Total clinic visits				
	Baseline	August	September	October	November
Menouf^a					
No.	24 933	31 076	24 411	25 535	29 480
Compared to baseline (%)	–	+25	–2	+2	+18
Quwesna^b					
No.	27 419	21 111	17 949	17 769	21 085
Compared to baseline (%)	–	–23	–35	–35	–23

^aPilot district; ^bcontrol district.

changes in care-seeking behaviour of a sample of patients during the project.

Household survey

Of 1106 households surveyed, a total of 680 households reported that at least 1 person in the house had required medical treatment during the previous 3 months. Of these patients 437 reported that they would have sought treatment at the hospital prior to the pilot programme. After the intervention was implemented (September–November), only 155 (35.5%) of these patients had chosen to use a hospital [95% confidence interval (CI) 31.0%–39.9%], 25.4% of patients (95% CI: 21.3%–29.5%) had attended an FHM clinic instead of a hospital, 23.1% (95% CI: 19.2%–27.1%) had chosen a private clinic, while 3.9% (95% CI: 2.1%–5.7%) had not sought care from any of the

different providers listed and possibly had not received any care (Table 4). Of the 282 patients who had not visited a hospital as they normally would, 62.0% (95% CI: 57.5%–66.6%) cited the price increase at hospitals as the main reason for their change in behaviour, while a further 19.0% (95% CI: 15.3%–22.7%) cited quality issues. Other reasons (less than 5% each) included: distance to the hospital too far; preferred to go to a private physician; and having to wait too long at the hospital.

Discussion

Primary care reform programmes in developing countries generally focus on improving quality, but at a higher cost, which raises the issue of sustainability. At first, the higher cost is absorbed by

donor funds, but these are generally finite, and must eventually be covered either through patient or government contributions. When patients are asked to pay more for treatment, they are likely to alter their behaviour if cheaper options are available. Therefore, it is important to coordinate the pricing of primary care clinics and hospitals to ensure primary care physicians act as gatekeepers.

During this pilot project when hospital fees were increased, there was a substantial 63% reduction in visits to the 4 Menouf hospitals relative to the baseline period, compared with a 4% increased utilization in the control general hospital in Quwesna. The slight increase in utilization in Quwesna may indicate a spillover effect from Menouf to Quwesna, as despite the distance, a few patients may have travelled to the Quwesna hospital to avoid paying higher hospital fees in Menouf and surrounding districts. There was a corresponding increase in utilization of the FHM clinics in Menouf and a decrease in Quwesna during the pilot project. Part of the decrease in utilization at FHM clinics in Quwesna may have been due to reductions in utilization around the holy month of Ramadan, which occurred during October. Considering the large reduction in the control district, the more modest increases in the pilot district may disguise a more significant upward trend.

Before this pilot study, utilization of hospital outpatient clinics in Menouf

Table 4 Types of health care providers used during the pilot project by patients who would have attended public hospital before direct hospital fees were increased in Menouf

Health care provider	No. of patients	%
Public hospital	155	35.5
FHM clinic	111	25.4
Private clinic	101	23.1
Private pharmacy	18	4.1
Private clinic (referred from FHM clinic)	13	3.0
NGO clinic	11	2.5
HIO hospital	6	1.4
Private hospital	5	1.1
Other	17	3.9
Total	437	100.0

FHM = family health model; NGO = nongovernmental organization; HIO = health insurance organization.

(0.85 visits *per capita* per year) was higher than in a selection of other countries including England (0.76), Spain (0.55), France (0.44) and the United States (0.29) [17–19]. However, up to 60% of Egypt's population is reported to use private clinics [20], suggesting that overuse was even greater within the subset of the population using public hospitals. During this pilot study, annual hospital outpatient visits *per capita* reduced to approximately 0.29 in Menouf, which was lower than in European countries and about the same as in the United States.

Considering that access to hospital outpatient facilities was almost free before the pilot study, it is not surprising that FHM clinics were not fulfilling a gatekeeper role, with an average of 1.24 hospital visits for each visit to the FHM

clinic. In England, where a gatekeeper system is well established, widely accepted and enforced, a mere 0.17 visits are made to the hospital per visit to the GP [17]. After the pilot study in Menouf, approximately 0.34 hospital visits were made for each visit to the FHM clinic. Hence, despite not emulating the UK's gatekeeper system, the pilot system in Menouf was successful in directing patients away from hospitals towards primary care.

No other studies were found in the literature that quantify the effect of a newly implemented gatekeeper system on the utilization of primary and secondary care. Hence the current study will provide comparative data for future studies.

It should be noted that the observation period of 4 months was quite short,

so caution should be applied before extrapolating these results, especially since other experiments with gatekeeper systems did not reveal their full effects within the first year [21].

Conclusions

Increasing the price of direct hospital outpatient visits was an effective way to establish a gatekeeper role for FHM clinics and discourage overuse of hospital outpatient clinics. Patients who altered their care-seeking behaviour predominantly chose FHM and private clinics instead of hospitals. The increase in FHM clinic utilization, and likely increase in revenues, may improve their sustainability.

References

1. Saleh WF. Reforming Egypt's health system: is it that simple? *British medical journal*, 2006, 333:859–60.
2. *World health report: reducing risk, promoting healthy life*. Geneva, World Health Organization, 2002.
3. Nishtar S. Lessons in tackling chronic disease. *British medical journal*, 2006, 333:820.
4. *Preventing chronic disease—a vital investment*. Geneva, World Health Organization, 2005.
5. Willems DL. Balancing rationalities: gatekeeping in health care. *Journal of medical ethics*, 2001, 27(1):25–9.
6. Siegel-Itzkovich J. Israel moves to GP gatekeeper system. *British medical journal*, 1998, 317:432.
7. Tabenkin H et al. Patients' views of direct access to specialists: an Israeli experience. *Journal of the American Medical Association*, 1998, 279(24):1943–8.
8. Ferrer RL, Hambidge SJ, Maly RC. The essential role of generalists in health care systems. *Annals of internal medicine*, 2005, 142(8):691–9.
9. Al-Khaldi YM, Khan MY. Impact of a mini-clinic on diabetic care at a primary health care center in southern Saudi Arabia. *Saudi medical journal*, 2002, 23(1):51–5.
10. Macinko J, Starfield B, Shi L. The contribution of primary care systems to health outcomes within Organization for Economic Cooperation and Development (OECD) countries, 1970–1998. *Health services research*, 2003, 38(3):831–65.
11. Martin DP et al. Effect of a gatekeeper plan on health services use and charges: a randomized trial. *American journal of public health*, 1989, 79(12):1628–32.
12. Etter JF, Perneger TV. Health care expenditures after introduction of a gatekeeper and a global budget in a Swiss health insurance plan. *Journal of epidemiology and community health*, 1998, 52(6):370–6.
13. Starfield B. Is primary care essential? *Lancet*, 1994, 344:1129–33.
14. Boker J et al. An international physician education program to support the recent introduction of family medicine in Egypt. *Family medicine*, 2004, 36(10):739–46.
15. Zaki B et al. Patient satisfaction with primary health care services in two districts in lower and upper Egypt. *Eastern Mediterranean health journal*, 2003, 9(3):422–9.
16. *Egypt human development report*. New York, United Nations Development Programme, 2005.
17. Outpatient data 2005. *Hospital episode statistics* [website] (<http://www.hesonline.nhs.uk>, accessed 15 January 2010).
18. *Encuesta de morbilidad hospitalaria 2004 [Hospital morbidity survey 2004]*. Madrid, Spain, Spanish National Statistical Institute, 2004.
19. Middleton K, Hing E. National Hospital Ambulatory Medical Care Survey: 2002 outpatient department summary. *Advance data from vital and health statistics*, 2004, 345.
20. El-Henawy A. Current situation, progress and prospects of health for all in Egypt. *Eastern Mediterranean health journal*, 2000, 6(4):816–21. Coulter A, Bradlow J. Effect of NHS reforms on general practitioners' referral patterns. *British medical journal*, 1993, 306:433–7.

Review

Triage systems: a review of the literature with reference to Saudi Arabia

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نظم الفرز: مراجعة للأدبيات حول المملكة العربية السعودية نسيم أختر قريشي

الخلاصة: تقيّم هذه المراجعة بعض الأدبيات العالمية حول الفرز بُغْيَةَ الحصول على معطيات مُسَنَدَة بالبيّنات حول المجتمع الطبي في المملكة العربية السعودية خاصةً، وإقليم شرق المتوسط عامةً. وكان هدف المراجعة تشجيع المسؤولين عن التخطيط الصحي الوطني وعن اتخاذ القرارات على تطبيق نُظُم رسمية للفرز في أقسام الطوارئ في المستشفيات العامة والمستشفيات المتخصصة وفي المواقع الصحية الأخرى ومنها مرافق الرعاية الصحية الأولية والرعاية النفسية. إن التدريب والبحوث حول الفرز محدود حالياً في المملكة العربية السعودية وفي الإقليم، وتلقي هذه المراجعة الضوء على الحاجة لإجراء المزيد من البحوث حول نُظُم الفرز وعلى إدخال التدريب على الفرز ضمن برامج التعليم الطبي.

ABSTRACT This review evaluates some of the international literature on triage in order to provide evidence-based data for the medical community in Saudi Arabia specifically and the Eastern Mediterranean Region in general. The aim is to encourage national health planners and decision-makers to apply formal triage systems in the emergency departments of general and specialist hospitals and other relevant health settings, including primary and psychiatric care. Research and training on triage is extremely limited in Saudi Arabia and the Region and this review highlights the need for more research on triage systems and for the inclusion of training on triage in medical education programmes.

Systèmes de triage : revue de la littérature et référence à l'Arabie saoudite

RÉSUMÉ Cette revue évalue une partie de la littérature internationale concernant le triage afin de fournir des données factuelles à la communauté médicale saoudienne en particulier et de la Région de la Méditerranée orientale en général. Le but est d'encourager les planificateurs sanitaires et les décideurs nationaux à mettre en place des systèmes de triage formels dans les services des urgences des hôpitaux généraux et spécialisés, ainsi que dans d'autres structures sanitaires qui en ont besoin, notamment les unités de soins de santé primaires et de soins psychiatriques. La recherche et la formation en matière de triage sont extrêmement limitées en Arabie saoudite et dans la région, et cette revue met en avant la nécessité d'une intensification de la recherche sur les systèmes de triage et de l'intégration d'une formation sur le triage dans les programmes d'enseignement médical.

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Introduction

The hospital emergency department (ED) is one of the most important components of the health delivery system. EDs worldwide are reportedly serving increasing numbers of patients who have a range of problems of variable urgency, from life-threatening to mild. Studies have found that around 50% of ED visits are for nonurgent reasons, leading to unnecessary costs and multiple adverse consequences [1–5]. All patients arriving for emergency care need to be assessed and classified to prioritize those who have the most urgent medical problems and are in need of immediate care. This classification process is termed triage and it is usually performed by an ED nurse. The aim of triage is to distribute the workload of the ED for better utilization of resources.

In Saudi Arabia, as elsewhere, improving the utilization of EDs is the subject of research and debate [6,7]. This review evaluates some of the international literature on triage in order to provide evidence-based data for the medical community in Saudi Arabia specifically and the Eastern Mediterranean region (EMR) in general. The aim is to encourage national health planners and decision-makers to apply formal triage systems in the EDs of general and specialist hospitals and other relevant health settings, including primary and psychiatric care. Research and training on triage is extremely limited in Saudi Arabia and the Region and this review hopes to stimulate more research on triage systems and to make the case for the inclusion of training on triage in medical education programmes.

Definition of triage

Triage is the process of categorizing ED patients according to their need for medical care, irrespective of their order of arrival or other factors including sex, age, socioeconomic status, insurance

status, residential status, nationality, race, ethnicity or religion. Triage involves an assessment to prioritize ED patients in need of immediate care, in accordance with clinical severity and time urgency, compared with patients with nonurgent illnesses who can wait longer to be seen or who need referral to a more appropriate health care setting [8].

Different methods of triage are practised; in-person triage (direct) has been shown to be preferable to telephone triage (indirect) [9], because the latter involves imaginary picture building or “visualization work” [10]. One study, however, has shown that telephone triage by nurses did not delay treatment interventions when compared to triage by doctors in a paediatric setting [3]. Telephone triage is commonly used in psychiatric settings [11].

The process of triage decision-making is influenced by 3 interrelated factors: the characteristics of the patient, the triage decision-maker and the health care setting [12]. Triage is important for redistributing and reducing waiting times and admission rates, increasing the efficiency and effectiveness of the ED, enhancing patient and family satisfaction, improving the quality of health care, managing funding and assessing the effectiveness of ED activities [12].

While the importance of triage in the ED has been recognized for some time in developed countries, less developed countries, including those of the EMR, are not utilizing the full potential of this health developmental trend. The EDs of psychiatric hospitals especially have much progress to make to realize the benefits of triage.

Triage and health professionals

Triage is usually performed in the ED by nursing staff who allocate a triage designation and initiate emergency care before the patient is examined by a doctor. Triage may be done by ED

physicians as well. In prehospital disaster sites, ambulance personnel also need to use triage to prioritize multiple cases for immediate mass evacuation for emergency medical help in nearby hospitals.

Triage nurses usually have advanced training in decision-making. They have been shown to have the necessary skills to make appropriate triage decisions and provide a highly effective service to ED patients in health care settings [13–16]. Many patients arriving at the ED have complex problems that need several investigations, procedures or consultations. Triage nurses can validly and reliably estimate the complexity of such cases, guide ED workflow and casemix system analysis [17].

In a study of decisions about appropriate care provider, priority rating and preliminary investigations for ambulatory patients the level of agreement between the triage nurses and physician observers was 81% and between the triage nurses and treating physicians was 94% [18]. Triage nurses identified a greater number of patients (19%) as having emergency problems (17%), and fewer patients (45%) as having problems of a non-urgent nature compared with physician observers (47%). The study concluded that experienced emergency nurses in the role of triage were safe, efficient and cost-effective, with statistically significant levels of safety and accuracy of priority rating when compared to triage physicians and treating physicians.

The increasing use of triage and the increasing numbers of ED visits by patients raises the important issue of a parallel need to increase the number of triage nurses in EDs [19,20].

Triage scales

Different triage scales have been developed to help health professionals to classify ED patients consistently and to achieve acceptable health outcomes.

Triage scales usually have 3 to 5 categories, with algorithms or protocols or sentinel diagnoses as the anchor points for making decisions, supported by triage guidelines and procedures. They are now generally supported by computer-based programs and web-sites which are faster and more effective aids to prioritization and decision-making.

The most commonly used scale is the Australian Triage Scale (ATS), which has 5 categories with their corresponding level of treatment acuity (Table 1). The ATS is derived from the National Triage Scale for Australasian Emergency Departments (NTS), the 2 scales differing in the description and allocation of the 5 categories. In a study in Belgium, the NTS was reported to have good predictive validity [21]. Yousif et al. reported that use of the ATS had a significant impact on the triage distribution of ED patients compared with the NTS, with 28% and 24% increases in patients with categories 2 and 3 respectively and 15% and 67% decreases in patients with categories 4 and 5, respectively. The ATS is therefore better suited to meet performance criteria and casemix assessment [22].

Another scale from Australia is the Toowoomba Adult Triage Trauma Tool (TATTT), which is a computerized algorithmic clinical-decision support tool designed for use on a handheld personal computer. It is well accepted by users and is seen as a viable alternative to current triage practice [23]. The TATTT incorporates ATS categories but largely replaces the associated

clinical indicators and provides an evidence-based valid and consistent method of triage assessment and categorization of trauma patients.

The other international triage scales in common use are the Manchester Triage System (MTS) with its new updated version, the Emergency Severity Index (ESI) used in the United States of America and the Canadian Emergency Department Triage and Acuity Scale (CTAS) and its web-based triage tool (eTRIAGE) [24–26].

Ambulance personnel use disaster triage based on the Homebush Triage Standard Taxonomy in prehospital settings, which includes battlefields, accident and trauma sites and places of massive fires [27,28].

Mental health triage scales have also been developed for triaging ED patients with mental disorders because the triage scales mentioned above have little capacity for triaging mental patients. Psychiatric nurses have been shown to use these scales effectively in the EDs of psychiatric hospitals [29,30].

More detailed information on triage scales including digital-reference triage scales can be found in the literature [12,26–32].

Triage outcomes

There are 2 stages to the nurse triage process: first, the triage assessment which leads to allocation of a triage category and the subsequent processing of the patient; and secondly, the initiation

of nursing interventions to facilitate emergency care with a possible reduction in the patient's discomfort. These triage decisions are linked with 3 types of outcome: "correct" or "expected" triage, "over-triage" and "under-triage". Correct triage by a nurse is associated with a positive health outcome because the patient is evaluated by a doctor within a suitable timeframe. Over-triage and under-triage indicate that triage nurse allocated a triage category of a higher or lower acuity than required respectively. Outcomes associated with over- or under-triage result in inappropriate allocation of ED resources, prolonged waiting times for patients, and development of dangerous complications or prolonging suffering. Notably, funding models or incentive programmes for triage are considered unethical [33,34].

Effect of triage on waiting times

Nurse triage aims to redistribute the workload of the ED. The key issue is not increasing or reducing waiting times overall but the effectiveness with which triage nurses allocate shorter waiting times to the highest priority patients, thus redistributing patient waiting times according to need. Waiting times in the ED affect patients' satisfaction with care but may also have serious complications that adversely affect health outcomes [33,34]. Prolonged waiting times at triage sites are the most common reason for patients' and families' dissatisfaction with ED care [35]. Accordingly

Table 1 Australian Triage Scale (ATS) categories, their descriptors and treatment acuity

ATS category	Description of category	Treatment acuity
1	Immediately life-threatening	Immediate
2	Immediately life-threatening	Minutes (< 10 min)
3	Important time-critical intervention; potentially life-threatening; situational urgency	0.5 hours
4	Potentially serious; situational urgency; significant complexity or severity	1 hour
5	Less urgent; clinic-administrative problems	2 hours

patients need to understand, perhaps via educational campaigns, which medical problems are appropriate to present to the ED and also be informed about the waiting times that correspond to the category of urgency they are allocated.

Factors influencing triage decisions

Triage decisions are governed by 6 steps: step 1, visual cues, step 2, chief complaints, step 3, focused assessment, step 4, hypothesis construction, step 5, acuity determination and step 6, reassessment of the acuity [36].

The assessment of patients in the ED by triage nurses has been the focus of a study that used in-person triage and telephone triage for allocating patients to categories [36]. The results of this 2-phase research indicated that with regard to triage decisions, agreement among triage-certified nurses was poor (43% to 49%) and a knowledge of patients' vital data and the use of triage protocols did not further improve the level of agreement (44% to 46%).

There is converging evidence that the level of activity in the ED does not impact greatly on triage decisions [37]. Triage decisions have been shown to be affected principally by patients' clinical characteristics and the number and combination of clinical features and to a lesser extent by other factors such as the skill mix of the nursing and medical staff, staff intuition and triage guidelines [12,37,38] (Table 2). Triage protocols for specific medical problems such as musculoskeletal problems have also been developed that impact on triage decision-making [39]. However, the triage decision-making process is also affected by factors such as interruptions to the triage process, time constraints and high workload, nurse skills and lack of formal staff training in triage, personal capacity (internal factors) and types of examinations and tests used [25,38,40].

Table 2 Factors influencing triage decisions according to emergency department (ED) staff

Studied factor	Influence on triage decisions (% of participants)	Remarks
Clinical condition of the patient	98	Yes
Significance of patient history	49	Yes
Potential for treatment	28	Yes
Mechanism of injury	15	Yes
Potential for self-discharge	2	Yes
Operational factors in ED	2	Yes
ED activity levels	3	Equivocal
Medical skill mix	2	Yes
Nursing skill mix	1	Yes
Other factors		
Type of hospital ^a	0	No effect
Triage nurse experience	0	No effect
ED activity	0	No effect

^aTeaching, non-teaching, rural, private.

Sources: Richardson, 1998 [38]; Whitby et al., 1997 [39].

Psychometrics of triage scales

Studies of the reliability and validity of triage scales have reported that they have poor (< 0.2) to substantial (0.61–0.80) to very good (0.81–1.00) inter- and intra-rater reliability, attributable both to the structure of the scales and factors influencing the decisions [12,31–33,36,41–44]. Triage scales with 5 categories have better reliability than those with only 3 [45].

Training on the use of triage scales has a variable role in increasing the reliable use of scales. In one study, training effected moderate to good agreement between study nurses and duty triage nurses, with a trend toward improvement in the reliability of use of triage scales with additional training [24].

The clinical characteristics of ED patients also contribute to the variable reliability of triage. Research shows that some clinical features are associated with lower agreement while others show higher agreement among triage nurses in the allocation of triage category (Table 3) and this issue has been explored extensively [12].

Triage of patients with aggressive behaviour and threats to others, which are major components of psychiatric emergencies, have a good level of agreement ($\kappa > 0.8$), whereas triage of patients with anxious behaviour has a low level of agreement ($\kappa < 0.4$) between triage nurses and allocation of triage category [12].

Uses of triage scales

Triage scales were developed initially to allow ED patients to be prioritized reliably and to enhance uniform delivery of health services across EDs of all hospitals, including psychiatric settings. Other uses of triage scales include assessment of the performance of the ED and the quality of health care and allocation of funds.

Prolonged waiting times indicate failure of both access and quality. Reduced patient waiting times can be used as an indicator of good quality care and better performance by the ED [12,46].

Nurse triage has been found to enhance patient satisfaction, which is another measure of health care quality [46,47]. Even telephone-based nurse

Table 3 Level of agreement between triage nurses and allocation of triage category

Clinical characteristic	% agreement	Kappa statistic
Lower levels of agreement ($\kappa < 0.4$)		
Sweaty skin	30.0	0.259
Dry skin	28.8	0.224
Anxious behaviour	47.7	0.395
Normal speech	64.2	0.282
Irritability (paediatric)	33.3	0.277
Crying (paediatric)	50.0	0.327
Dull pain	46.0	0.379
Crushing pain	0.0	-0.004
Good levels of agreement ($\kappa > 0.8$)		
Aggressive behaviour	100.0	1.0
Threat to others	100.0	1.0
Lethargy (paediatric)	100.0	0.875
Abdominal pain	87.8	0.822
Pregnancy	85.3	0.921
Haematemesis	100.0	1.0
Melaena	100.0	1.0
Overdose, ingestion	100.0	1.0
Eye presentation	100.0	1.0
Seizures	100.0	1.0

Source: Whitby et al., 1997 [39].

triage services have high patient satisfaction that did not vary substantially by caller characteristics [48]. In another study using retrospective data, patients' satisfaction with telephone-based nurse triage services was very high in psychiatric nurse triage [11].

Triage scales can also be a tool for developing strategies such as bonus payments to departments or hospitals for improving the performance of ED. Some hospitals set standards that require EDs to provide medical care to 100% of category 1 patients, 80% of category 2 patients, 75% of category 3 patients, and 70% of category 4 and 5 patients within their requisite timeframes. Studies have concluded that EDs should triage patients to lower triage categories to meet hospital waiting time targets [12,49].

Education for triage

According to many studies, specialty education and continuing training in

triage are the cornerstones of the triage system and contribute considerably to the correct triage decisions that are essential for good health outcomes [24,50,51]. Continuing training but not experience was found to influence triage decision-making [13,14,40].

Prior to adopting a triage role, nurses should have both adequate specialist training and experience in the triage system [14]. Studies in the United States and Australia concluded that triage nurses have wide variability in their degree of experience, preparation and orientation for the triage role, and insufficient education and training. Hospitals also vary in their requirements for training and experience before triage duties are performed [50,52]. The researchers recommended that a triage nurse should fulfil several conditions: a minimum of 3 months' experience in the ED; educational preparation; Advanced Cardiac Life Support certification; certificate in emergency or critical care nursing; completion of training workbooks;

in-service education sessions; unit-based orientation programmes; competency assessment programmes; and triage guidelines [50,52].

The EDs of general hospitals receive patients with mental problems and likewise the EDs of psychiatric hospitals receive patients with physical diseases and injuries and in these contexts triage nurses need appropriate training and skills both in physical and psychiatric emergencies. General hospital triage nurses identified the following learning areas in mental health: customer focus, workplace aggression and violence, psychiatric theory, mental health assessment and chemical dependence [53]. Researchers have recommended collaboration between an adult mental health programme and an adult emergency programme [54].

In view of the variability in triage training and experience, there is a worldwide need to develop uniformly tailored triage education curricula and triage guidelines, as well as continuing training and research in triage systems [24]. Triage guidelines coupled with triage education and training helps triage nurses to prioritize ER patients in all health care settings including psychiatric EDs [11,55]. No triage guidelines, however, are perfect in predicting which patients are true emergencies [56].

Triage quality improvement

The quality measures for triage systems that have been explored in several studies include the reliability of triage rating scales, waiting times, admission rates, accuracy of allocation of categories and rates of sentinel events/diagnoses (outcomes unrelated to the natural course of the patient's illness or underlying condition). Notably each quality indicator has some disadvantages, such as the use of sentinel diagnosis, which can be made only after extensive interviewing and evaluation, which adversely

affects waiting times [12,26,33,57,58]. Inconsistency in application of various triage scales is another concern for quality improvement in triage systems [33]. Quality standards in ED can be maintained and enhanced by audits of the triage system. Notably, a study of the resource implications of nonurgent patients in the ED showed that 7.3% of all patients requiring admission came from the group identified as nonurgent by the CTAS triage system and hence strategies diverting them elsewhere might be unsafe and were unlikely to improve access for more urgent patients [59].

Triage in Saudi Arabia

The Ministry of Health (MOH) in Saudi Arabia has compiled a manual for organizing nursing services in the country with nursing triage guidelines that are to be used across all MOH EDs [unpublished document, General Administration for Nursing, 2003].

This document specifies nursing functions and duties together with comprehensive policies and procedures. With regard to specialized emergency nursing care, the manual defines triage, highlights its objectives and policies, defines 3 levels of triage activity and specifies the required manpower, materials, equipment and procedures. Psychiatric triage is not specifically mentioned in the manual but these guidelines are applicable to psychiatric EDs. The 3 levels of triage activity defined are:

- Emergent (I): patients require immediate medical intervention for conditions such as compromised airway problems, cardiac arrest, severe shock, cervical spine injury, multisystem trauma, altered level of consciousness and eclampsia.
- Urgent (II): patients are stable and there is no immediate threat to the patient's life or limbs but associated conditions require medical intervention within a few hours.

- Management (III): patients present with chronic or minor injuries with no danger to life or limb together with no distress or discomfort and may wait hours before being seen by an ED doctor. Conditions include chronic low back pain, routine medication refills, dental problems and missed menses.

In the field triage of disasters such as major fires, road traffic accidents, wars and explosions, patients are to be categorized as follows; red, emergent; yellow, immediate; green, urgent; blue, fast track or psychological support needed; and black, dead or progressing rapidly towards death.

The manual outlines emergency procedures for stabilizing patients, checking and monitoring for vital signs plus neurological assessment with the Glasgow coma scale. After prioritization, an ED nurse is expected to do the following; history taking and head-to-toe assessment; diagnostic and laboratory tests; ECG monitoring; cleansing and dressing of wounds; looking for suspected fractures; documenting all procedures in nurses' notes; and finally expedite admission or surgery if required. In psychiatric ED, many of these procedures are not required.

The document does not mention adaptation of any international triage scale to be used in Saudi health settings apart from the 3-level system outlined above. However, some tertiary MOH hospitals such as Riyadh Medical Complex and King Fahad Medical City already use the CTAS system. Likewise some non-MOH hospitals such as King Faisal Specialist Hospital and Research Center, National Guard Hospital and Armed Forces Hospital and private hospitals use CTAS in their EDs. Triage is yet to be used in psychiatric settings in Saudi Arabia. The effectiveness of triage systems in these hospitals has not been evaluated. To our knowledge there is no published study that has systematically explored triage in the EMR and surrounding countries, although studies

in Turkey, Saudi Arabia and Bahrain have evaluated the use of ED services, waiting times in the triage area, cost-effectiveness, workload reduction and resource utilization of intensive care units [7,60,61].

Discussion

Triage, applied strictly using standard principles in EDs, psychiatric settings and health disaster situations, remains a complex issue. Primary and secondary decisions by triage nurses and physicians and related health outcomes are influenced by a variety of internal factors related to triage personnel and external factors related to the operational mechanisms of the ED. Triage nurses use a constellation of factors to make triage decisions and initiate emergency care, including personal capacity, experience, intuition, prehospital information and communication with colleagues. In Saudi Arabia, nurses mostly have no involvement in triage decision-making. Yet the time has now come for health policy-makers to reflect seriously on the phased application of a nurse triage system across EDs in all health settings.

Many studies have shown that prioritization of ER patients is influenced by the clinical characteristics of patients, vital signs, severity of the condition and emerging complications [31,36,42]. The issue of frequent ED visits by patients might be solved, and patients' satisfaction improved, by managing patient waiting times better and briefing patients at presentation and at discharge [62]. Auditing triage decisions and consequent health outcomes is a useful activity as it addresses an important quality indicator of health care in ED settings [58]. Studies should also explore patients' perceptions of the triage system [63]. Patients' contribution to the triage decision is another area for research: a study in Saudi Arabia investigated the ability of adult patients to predict the presence or absence of

fever in an ED triage clinic [64]. Mobile emergency triage and telephone-based triage, if applied in ED, could reduce the workload in EDs in a cost-effective way [65]. Internet “chat” as a triage method has been under evaluation in the United Kingdom [66]. Many researchers have advocated that available triage scales need to be improved with regard to their inter- and intra-rater reliability [12,36,42] and computer-supported and web-based triage might overcome the psychometric weaknesses of the available scales [23].

Triage is a highly important activity and solves many problems of emergency services, such as overcrowding by patients, and improves the quality of health outcomes cost-effectively. Rising health care costs, poor quality of care and patient dissatisfaction are evident in settings where EDs are not applying triage [46]. Therefore triage needs to be applied in all EDs in Saudi Arabia and other EMR countries where there are adequate staff and other required resources [19,20]. Training of nurses in triage and continuous training for capacity-building has been repeatedly emphasized in the international research [24,50,51]. Use of triage in mental health delivery systems would also enhance consumers’ satisfaction and solve the problem of aggressive and violent patients [43,67,68]. Nurse triage in mental health is less well researched.

Challenges

There are many challenges to introducing and developing ED triage in Saudi Arabia and elsewhere in the EMR.

- Developing public trust in the system. The sociocultural traditions of Saudi Arabia and other EMR countries do not conflict with the triage model. However, public awareness programmes about triage, compatible with social and cultural values, are needed. These need to promote the advantages including its vital role in improving patient survival and other health-related outcomes, satisfaction of patients and families and the cost-effectiveness and quality of health care.
- Capacity-building and recruitment of nurses. Recruiting qualified nurses with special training in triage can solve the initial problem of applying triage across entire nations. Such nurses have a role not only in the triage process but also in training other nurses for continuing capacity-building in the system. Achieving uniformity with regard to education and training of triage nurses is a constant challenge for health authorities and academics in different health settings even in high-income countries.

- Infrastructural developments in the ED. Applying triage may require additional equipment and space in the ED. This may not be a major issue in high-resource countries such as Saudi Arabia. Nevertheless it is advisable that triage should be applied to EDs in phases over a stipulated period of time. This should be accompanied by audits of health outcomes in EDs with and without triage.

Future directions

- Future research focussed on this region should assess how triage nurses prioritize ED patients, designate categories to individual patients and what criteria and information they use in doing so.
- Continuing training on triage systems for nurses and physicians will improve staff capacity-building in Saudi Arabia and elsewhere in the EMR. There should be continuing evaluation of the effectiveness of triage training programmes on the perceptions, practice and knowledge of triage nurses.
- Public campaigns are needed to build up public trust in the triage system with the emphasis on how patients are prioritized based on the severity of the problem at hand rather than other factors.

References

1. Baker LC, Baker LS. Excess cost of emergency department visits for nonurgent care. *Datawatch*, 1994, 13(5):162–71.
2. Doobinin KA et al. Nonurgent pediatric emergency department visits: care-seeking behavior and parental knowledge of insurance. *Pediatric emergency care*, 2003, 19:10–4.
3. Lee TJ et al. Does telephone triage delay significant medical treatment? Advice nurse service vs on-call pediatricians. *Archives of pediatrics & adolescent medicine*, 2003, 157:635–41.
4. Kalemoglu M et al. Non-urgent patients in an emergency medical service. *Revista medica de Chile*, 2004, 132:1085–9.
5. Carter AJE, Chochinow AH. A systematic review of the impact of nurse practitioners on cost, quality of care, satisfaction and wait times in the emergency department. *Canadian journal of emergency medicine*, 2007, 9:286–95.
6. Qureshi NA et al. A study of utilization pattern of psychiatric emergency services (PES) in Al-Qassim Region, Saudi Arabia. *Saudi medical journal*, 1997, 18:137–43.
7. Al-Arabi Y, Al-Shimemen A. Improving resource utilization in intensive care units, a challenge for Saudi hospitals. *Saudi medical journal*, 2003, 24:131–7.
8. Porter JE. Nurse triage. *British medical journal*, 1993, 306:208–9.
9. Nakagawa J et al. Interobserver agreement in emergency department triage. *Annals of emergency medicine*, 2003, 41:191–5.
10. Edwards B. Seeing is believing—picture building: a key component of telephone triage. *Journal of clinical nursing*, 1998, 7:51–7.
11. Morrison A, Hull A, Shepherd B. Triage in emergency psychiatry. *Psychiatric bulletin*, 2000, 24:261–4.

12. Whitby S et al. *Analysis of the process of triage: the use and outcome of the National Triage Scale*. Liverpool, Liverpool Health Service, 1997.
13. Cioffi J. Triage decision making: educational strategies. *Accident and emergency nursing*, 1999, 7:106-11.
14. George S et al. Nurse triage in theory and in practice. *Archives of emergency medicine*, 1993, 10:220-8.
15. Chorzempa A, LaMotte A. The role of the triage nurse practitioner in general medical practice: an analysis of the role. *Journal of advanced nursing*, 1998, *Clinical excellence for nurse practitioners*, 1999, 3(3):189-90.
16. Chan JN, Chau J. Patient satisfaction with triage nursing care in Hong Kong. *Journal of advanced nursing*, 2005, 50:498-507.
17. Vance J, Sprivulis P. Triage nurses validly and reliably estimate emergency department patient complexity. *Emergency medicine Australasia*, 2005, 17:382-6.
18. Zwicke DL, Bobzien WF, Wagner EF. Triage nurse decisions: a prospective study. *Journal of emergency nursing*, 1982, 8:132-8.
19. Aiken LH, Havens DS, Sloane DM. Magnet nursing services recognition programme. *Nursing standard*, 2000, 14:41-7.
20. O'Brien-Pallas L, Irvin D, Peereboom E. Measuring nursing workload: understanding the variability. *Nursing economics*, 1997, 15:171-82.
21. Van Gerven R, Dellos H, Sermeus W. Systematic triage in the emergency department using the Australian National triage Scale: a pilot project. *European journal of emergency medicine*, 2001, 8:3-7.
22. Yousif K, Bebbington J, Foley B. Impact on patients triage distribution utilizing the Australasian Triage Scale compared with its predecessor the National Triage Scale. *Emergency medicine Australasia*, 2005, 17:429-33.
23. Dann E, Jackson R, Mackway-Jones K. Appropriate categorization of mild pain at triage: a diagnostic study. *Emergency nurse*, 2005, 13:28-32.
24. Dong SL et al. The effect of training on nurse agreement using an electronic triage system. *Canadian journal of emergency medicine*, 2007, 9:260-6.
25. Pomerantz J. Factors Influencing digital reference triage: a think-aloud study. *The library quarterly*, 2004, 74:235-64.
26. Cooke M, Jinks S. Does the Manchester Triage System detect the critically ill? *Journal of accident and emergency medicine*, 1999, 16:179-81.
27. Nocera A, Garner A. An Australian mass casualty incident triage system for the future based upon triage mistakes of the past: the Homebush Triage Standard. *Australian New Zealand journal of surgery*, 1999, 69:603-8.
28. Cavallini M et al. Fire disasters in the twentieth century. *Annals of burns and fire disasters*, 2007, 20(2).
29. Sinclair L et al. How effective are mental health nurses in A&E departments? *Emergency medicine journal*, 2006, 23:687-92.
30. Broadbent M, Moxham L, Dwyer T. The development and use of mental health triage scales in Australia. *International journal of mental health nursing*, 2007, 16:413-21.
31. Wuerz R et al. outcomes are predicted by a new five-level triage algorithm. *Academic emergency medicine*, 1999, 6:389.
32. Beveridge R et al. Reliability of the Canadian Emergency Department Triage and Acuity Scale: interrater agreement. *Annals of emergency medicine*, 1999, 34:155-9.
33. Wuerz R, Fernandes C, Alarcon J. Inconsistency of emergency department triage. *Annals of emergency medicine*, 1998, 32:431-5.
34. Gerdzt M, Bucknall T. Australian triage nurses' decision making and scope of practice. *Australasian journal of advanced nursing*, 2000, 18:24-33.
35. McMillan JR, Younger MS, DeWine LC. Satisfaction with hospital emergency department as a function of patient triage. *Health care management review*, 1986, 11:21-7.
36. Salk E et al. Effect of visual cues, vital signs and protocols on triage: a prospective randomized crossover trial. *Annals of emergency medicine*, 1998, 32:655-64.
37. Richardson D. No relationship between emergency department activity and triage. *Academic emergency medicine*, 1998, 5:141-5.
38. Andersson A-K, Omberg M, Svedlund M. Triage in the emergency department: a qualitative study of the factors which nurses consider when making decisions. *Nursing critical care*, 2006, 11:136-45.
39. Wong EML et al. The effect of a triage pain management protocol for minor musculoskeletal injury patients in a Hong Kong emergency department. *Australasian emergency nursing journal*, 2007, 10:64-72.
40. Chung JYM. An exploration of accident and emergency nurse experiences of triage decision making in Hong Kong. *Accident and emergency nursing*, 2005, 13:206-13.
41. Fernandez C, Wuerz R, Clark S et al. How reliable is emergency department triage? *Annals of emergency medicine*, 1999, 34:141-59.
42. Considine J, Ung L, Thomas S. Triage nurses' decisions using the National Triage Scale for Australian emergency departments. *Accident and emergency nursing*, 2000, 8:201-9.
43. Wuerz R et al. Pilot phase reliability of a new five-level triage algorithm. *Academic emergency medicine*, 1999, 6:398-9.
44. Wuerz R et al. Reliability and validity of a new five-level triage instrument. *Academic emergency medicine*, 2000, 7:236-42.
45. Travers DA et al. Five-level triage system more effective than three-level in tertiary emergency department. *Journal of emergency nursing*, 2002, 28:395-400.
46. Elder R et al. Patient satisfaction with triage nursing in a rural hospital emergency department. *Journal of nursing quality*, 2004, 19:263-8.
47. Raper J, Davis BA, Scott L. Patient satisfaction with emergency department triage nursing care: a multicenter study. *Journal of nursing care and quality*, 1999, 13:11-24.
48. O'Connell JM, Stanley JL, Malakar CL. Satisfaction and patient outcomes of a telephone-based nurse triage services. *Managed care*, 2001, 10:55-60.
49. Cameron P, Kennedy M, McNeil J. The effects of bonus payments on emergency service performance in Victoria. *Medical journal of Australasia*, 1999, 171:243-6.
50. Kelly A, Richardson D. Training for the role of triage in Australasia. *Emergency medicine*, 2001, 13:230-2.
51. Ehrenberg G, Ehufors M. Triage in emergency departments: national survey. *Journal of clinical nursing*, 2005, 14:1067-74.
52. Purnell L. A survey of the qualifications, special training, and levels of personell working emergency department triage. *Journal of nursing staff development*, 1993, 9:223-6.
53. Kerrison SA, Chapman R. What general emergency nurses want to know about mental health patients presenting to their emergency department. *Accident and emergency nursing*, 2007, 15:48-55.
54. Clarke DE et al. Education to improve the triage of mental health patients in general hospital emergency departments. *Accident and emergency nursing*, 2006, 14:210-8.
55. Happell B, Summers M, Pinikahana J. Measuring the effectiveness of the national mental health triage scale in an emergency

- department. *International journal of mental health nursing*, 2003, 12:288–92.
56. Bindman A. Triage in accident and emergency departments. *British medical journal*, 1995, 311:404.
 57. Brillman JC et al. Triage: limitations in predicting need for emergent care and hospital admission. *Annals of emergency medicine*, 1996, 27:493–500.
 58. Goodacre S et al. Consistency of retrospective triage decisions as a standardized instrument for audit. *Journal of accident and emergency medicine*, 1999, 16:322–4.
 59. Vertesi L. Does the Canadian Emergency Department Triage and Acuity Scale identify non-urgent patients who can be triaged away from the emergency department? *Canadian journal of emergency medicine*, 2004, 6:337–42.
 60. Oktay C et al. Appropriateness of emergency department visits in a Turkish University Hospital. *Croatian medical journal*, 2003, 44:585–91.
 61. Fateha BEA, Hamza AY. Impact of triage in accident and emergency departments in Bahrain. *Eastern Mediterranean health journal*, 2001, 7:790–8.
 62. Huang JA et al. Determining factors of patient satisfaction for frequent users of emergency services in a medical center. *Journal of the Chinese Medical Association*, 2004, 67:403–10.
 63. Miles JA, Naumann SE. The English patient: a model of patient perceptions of triage in an urgent care department in England. *Management*, 2004, 7:1–11.
 64. Al-Almaie SM. Ability of adult patients to predict absence or presence of fever in an emergency department triage clinic. *Journal of family and community medicine*, 1999, 6(1):29–34.
 65. Richards DA et al. Nurse telephone triage for same day appointments in general practice: multiple interrupted time series trial of effect on workload and cost. *British medical journal*, 2002, 325:1214–9.
 66. Eminovic N et al. First evaluation of the NHS Direct online clinical enquiry service: a nurse-led web chat triage service for the public. *Journal of medical internet research*, 2004, 6:e17.
 67. Wynaden D et al. Emergency department mental health triage consultancy service: a qualitative evaluation. *Accident and emergency nursing*, 2003, 11:158–65.
 68. Kevin J. An evaluation of telephone triage in mental health nursing. *Australasian e-journal for the advancement of mental health*, 2002, 1:2–12.

The World Health Report 2008 - primary Health Care (Now More Than Ever)

Why a renewal of primary health care (PHC), and why now, more than ever? Globalization is putting the social cohesion of many countries under stress, and health systems are clearly not performing as well as they could. Few would disagree that health systems need to respond better and faster to the challenges of a changing world. PHC can do that.

As nations seek to strengthen their health systems, they are increasingly looking to PHC to provide a clear and comprehensive sense of direction. The World Health Report 2008 analyses how primary health care reforms, that embody the principles of universal access, equity and social justice, are an essential response to the health challenges of a rapidly changing world and the growing expectations of countries and their citizens for health and health care.

The Report identifies four interlocking sets of PHC reforms that aim to: achieve universal access and social protection, so as to improve health equity; re-organize service delivery around people's needs and expectations; secure healthier communities through better public policies; and remodel leadership for health around more effective government and the active participation of key stakeholders.

The current report is available in 6 languages, including Arabic, and can be ordered from WHO Publications or downloaded at <http://www.who.int/whr/2008/en/index.html>.

Case report

Pseudo-Bartter as an initial presentation of cystic fibrosis. A case report and review of the literature

M.A. Marah¹

Introduction

Cystic fibrosis (CF) is an autosomal recessive condition caused by the mutation of the cystic fibrosis transmembrane regulator gene (*CFTR*) on chromosome 7. Although it primarily affects the respiratory and gastrointestinal tracts, it can also involve other organs. It may also cause electrolyte and acid base disturbances, rarely the mode of presentation. This can result in difficulty in making an early diagnosis in the absence of other characteristic clinical features.

We report here such a case which presented in infancy.

Case report

A 6-month old Yemeni infant presented with an 8-day history of diarrhoea and vomiting. He was born at full term with an uneventful prenatal, perinatal and postnatal history. His parents, who are first-degree cousins, and his 4-year-old sister were healthy.

On presentation, he was febrile and had moderate dehydration (< 10%). His weight was 7.8 kg (just above the 5th percentile), length 69 cm (on the 10th percentile) and head circumference 43.8 cm (on the 5th percentile). His blood pressure fluctuated between 70/50 mmHg and 100/80 mmHg. The rest of his examination was unremarkable.

Analysis of serum electrolytes gave the following results: sodium 124 mmol/L, potassium 4 mmol/L,

chloride 84 mmol/L, bicarbonate 29 mmol/L and creatinine 0.4 mg/dL. He required intravenous fluid therapy and was discharged after correction of his biochemical abnormalities.

He was readmitted 5 more times over a 2-year period with episodes of diarrhoea and vomiting associated with similar biochemical abnormalities (Table 1). He never had significant respiratory problems throughout that period. The possibility of Bartter syndrome was raised, but the diagnosis was dismissed as his blood pressure was initially high, urinary chloride excretion was low with only slightly elevated levels of serum renin (320 ng/dL at rest and standing) and aldosterone (195 ng/dL at rest and 206 ng/dL while standing).

Further evaluation, around the age of 1 year and while he was clinically stable, revealed a thriving child with the following serum biochemical results: sodium 133 mmol/L, potassium 3.4 mmol/L, chloride 100 mmol/L and bicarbonate 22 mmol/L. The serum levels of aldosterone (99 ng/dL) and renin (84 ng/dL) were normal, so was urinary chloride excretion (20 mg/dL) but the fractional excretion of potassium was elevated at 67%. Hyponatraemia was interpreted as being secondary to prolonged diarrhoea and vomiting, hypokalaemia to stool losses, metabolic alkalosis to extra cellular compartment contraction and the initial but transient rise in blood pressure to secondary hyperaldosteronism. Tubulopathy was excluded in view of the absence

Table 1 Biochemical results of the patient at various admissions

Biochemical measure	Date				
	24/4/99	09/5/99	25/9/99	04/7/99	03/9/01
Plasma Na (mEq/L)	117	131	125	127	126
Plasma Cl (mEq/L)	84	88	85	82	89
Serum K (mEq/L)	3.1	3	4	3.2	2.7
Plasma HCO ₃ (mEq/L)	30	28	28	28	29
Blood Urea (mg/dL)	8	6	25	34	23
Serum Creatinine (mg/dL)	–	0.4	0.6	0.7	0.9
Plasma pH	7.54	–	7.5	7.55	7.56
HCO ₃	31	–	29	30.3	31
Base excess	4	–	2	4	5
Urinary Na (mEq/L)	–	10	<10	–	< 10
Urinary K (mEq/L)	–	43	–	–	54.7
Urinary Cl (mEq/L)	–	<10	<10	–	< 10
Serum aldosterone (ng/dL)	99.2	–	–	–	–
Serum renin (ng/dL)	84	–	–	–	–

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of hypercalciuria, hypocalcaemia, hypomagnesaemia, hypermagnesuria or significant hypokalaemia. The patient was discharged on sodium chloride and potassium chloride supplementation.

After being lost to follow-up for several years, he was seen again at the age of 8 years when he presented with severe gastroenteritis, hypovolaemic shock and chest infection. His height and weight were below the 3rd percentile, temperature was 38.7 °C, heart rate 98/min, respiratory rate 30/min, blood pressure 70/50 mmHg, O₂ saturation 88% in room air and capillary refill 4 seconds. He had marked finger and toe clubbing, with bilateral crepitations heard on auscultation.

He underwent fluid resuscitation and investigations showed the following results: serum sodium 128 mmol/L, chloride 76 mmol/L, potassium 3.3 mmol/L, bicarbonate 28 mmol/L, anion gap 15.6 mmol/L, urea 35 mg/dL, creatinine 1.3 mg/dL, calcium 10.5 mg/dL, phosphorus 7.6 mg/dL and magnesium 2.3 mg/dL. Blood gas results were: pH 7.51, pCO₂ 48.4 mmHg, pO₂ 65 mmHg, base excess 6.1 mmol/L, bicarbonate 31.6 mmol/L. Urinary electrolytes results were: sodium < 10 mmol/L, chloride < 15 mmol/L, potassium 117 mmol/L, calcium excretion < 2 mg/day and magnesium excretion 2.3 mg/day. Bilateral streaky infiltrates were seen on chest radiography. Sputum culture grew *Pseudomonas aeruginosa* and blood and urine cultures revealed no bacterial growth. Fluid therapy led to gradual biochemical correction over 3 days.

The suspected diagnosis of cystic fibrosis was confirmed with a sweat chloride level of 120 mmol/L and homozygosity for the Delta F 508 gene on genetic studies. The child was started on standard CF therapy. He is currently doing well regarding weight gain and his blood chemistry remains normal.

Discussion

CF is an inherited disorder affecting most organs, especially the exocrine glands. It is associated with a large number of mutations affecting the chloride channel, the commonest being mutation of the delta F508 on chromosome 7. The manifestation of the disease can appear at birth or later in the life according to the type of mutation, which also predicts the severity of the disease [1]. The most common systems affected are respiratory (where the typical presentation includes recurrent pneumonia and obstructive lung disease) and digestive (secondary to pancreatic insufficiency) leading to growth failure [1]. Other manifestations include renal agenesis [2] and absence of vas deferens [1,2]. Uncommonly, it can present as an acid-base and electrolyte imbalance, such as hypokalaemia, hyponatraemia and metabolic alkalosis.

Most children with CF presenting as hyoelectrolytaemia and metabolic alkalosis (so-called pseudo-Bartter) were under the age of 6 months [3,4]. Multiple inter-related factors have been incriminated in its pathophysiology. Normally, with the cystic fibrosis transmembrane regulator (*CFTR*) gene regulating sweat production, normal sweat glands produce iso-osmotic primary sweat, partly by chloride secretion across the apical *CFTR* [5]. The water-impermeable sweat duct reabsorbs sodium chloride transcellularly, leading to the excretion of hypotonic sweat, enabling the body to regulate its temperature with minimal loss of electrolytes [5]. The volume of sweat in CF patient is different from that in healthy people [6]. Although the production of primary sweat is relatively normal in CF patients [5], the dysfunctional *CFTR* in the sweat duct results in excessive sodium and chloride loss in the final sweat [5,6]. This loss in sodium chloride is more marked in hot weather where the rate of sweat production may reach up to 2 litres/hour [5–7], leading to

massive sodium chloride loss which results in significant extracellular volume contraction and secondary hyperaldosteronism. This hyperaldosteronism will lead to increased potassium losses both in the sweat and the urine, resulting in hypokalaemia [3,8–14].

The pathophysiology of metabolic alkalosis includes: volume depletion leading to a relatively high bicarbonate level in the contracted extracellular volume (haemoconcentration) [3,8,9,15], and low extracellular chloride leading to increased reabsorption of bicarbonate to replace the lost extracellular anions (chloride and bicarbonate) [3,9]. In addition, the extracellular volume depletion leads to decreased filtered load of bicarbonate in the urine due to decreased Glomerular filtration rate (GFR) [3,8] and the hypokalaemia itself can maintain and generate metabolic alkalosis [3,8,15,16]. The effect of these electrolyte losses is the activation of the renin–angiotensin system and stimulation of sodium cation (hydrogen, potassium) exchange, with resulting alkalosis and potassium depletion. Although hyperaldosteronism without distal sodium delivery will not cause alkalosis, an increase in mineralocorticoid with distal proton delivery would, as in the case of Bartter syndrome and chronic diuretic use. Studies have shown that some changes in renal sodium handling [17] and free water clearance [18] occurs in CF patients. Furthermore, the *CFTR* (or *CFTR*-like) gene or protein has been located in the proximal tubules of rabbits [19,20], rats [21], mice [20] and also in human distal tubules [22]. Thus, a volume-depleted CF patient can still maintain distal sodium delivery due to dysfunctional *CFTR*.

Gastrointestinal losses act as contributory factors, accentuating an underlying salt depletion and metabolic alkalosis. In all CF infants with acute or chronic fluid and electrolyte losses with sweating, their metabolic abnormalities and condition are aggravated by acute intercurrent episodes of vomiting,

diarrhoea, or respiratory symptoms [3,7,10]. These intercurrent illness acts as a precipitating event aggravating the underlying metabolic alkalosis and hyponatraemia. In addition, infants with CF are prone to develop episodes of hyponatraemic hypochloaemic dehydration with metabolic alkalosis, due to excess salt loss with sweating, especially in regions with a hot, dry climate, during the warmer months [3,7,10]. Breastfed infants are more prone to have such electrolyte derangement especially in hot weather due to low salt content in the breast milk [10].

In our patient, the volume depletion was most likely secondary to many factors including: hot climate, episodes of gastroenteritis, recurrent vomiting and intercurrent infections. It led to contraction alkalosis due to the relative increase in serum bicarbonate concentration

and decrease in filter load of bicarbonate secondary to decreased GFR. This volume depletion led to activation of the renin-angiotensin system and secondary hyperaldosteronism (Table 1) with enhanced urinary and sweat potassium excretion. This resulted in hypokalaemia, which by itself could aggravate and maintain the metabolic alkalosis.

Hypochloaemic metabolic alkalosis with increased serum aldosterone and renin levels occurs in both Bartter and in CF (pseudo-Bartter) [12,13,15] syndrome. The main difference is that urinary chloride losses in Bartter syndrome are high, while they are low in CF (with elevated sweat chloride losses).

When faced with a child with hypochloaemic hypokalaemic metabolic alkalosis, causes other than Bartter syndrome need also to be considered. They include persistent vomiting (as in pyloric

stenosis), congenital chloride-losing diarrhoea, Gittelmann syndrome, diuretic use and primary hyperaldosteronism [1,3,8,10,15]. A practical approach to deal with hypochloaemic metabolic alkalosis is suggested. First, urinary chloride level should be measured: if very high, Bartter syndrome is very likely. If it is not elevated, other non-urinary chloride losses, such as stool losses (congenital chloride diarrhoea or laxative abuse) or excessive losses in sweat (CF) should be considered.

Conclusion

When confronted with hypochloaemic hypokalaemic metabolic alkalosis, the possibility of CF must always be considered, even in the absence of characteristics clinical features.

References

- Kliegman RM, Behrman RE, Jenson HB, eds. *Nelson textbook of pediatrics*, 17th ed. Burlington Massachusetts, 2003.
- Gervais R et al. High frequency of the R117H cystic fibrosis mutation in patients with congenital absence of the vas deferens. *New England journal of medicine*, 1993, 328:446-7.
- Bates CM, Baum M, Quigley R. Cystic fibrosis presenting with hypokalemia and metabolic alkalosis in a previously healthy adolescent. *Journal of the American Society of Nephrology*, 1997, 8:352-5.
- Sojo A et al. Chloride deficiency as a presentation or complication of cystic fibrosis. *European journal of paediatrics*, 1994, 153:825-8.
- Quinton PM. Physiology of sweat secretion. *Kidney international supplement*, 1987, 21:S102-8.
- Bijman J. Transport processes in the eccrine sweat gland. *Kidney international supplement*, 1987, 21:S109-12.
- Ruddy R, Anolik R, Scanlin TF. Hypoelectrolytemia as a presentation and complication of cystic fibrosis. *Clinical pediatrics*, 1982, 21(6):367-9.
- Ozçelik U et al. Sodium chloride deficiency in cystic fibrosis patients. *European journal of pediatrics*, 1994, 153:829-31.
- Halperin ML, Goldstein MB, Halperin ML. *Fluid, electrolyte and acid-base physiology: a problem-based approach*, 3rd ed. Philadelphia, WB Saunders, 1999.
- Fustik C et al. Metabolic alkalosis with hypoelectrolytemia in infants with cystic fibrosis. *Pediatrics international*, 2002, 44:289-92.
- Oztürk Y, Soyulu OB, Arslan N. Prevalence and clinical features of cystic fibrosis with pseudo-Bartter syndrome. *Annals of tropical paediatrics*, 2006, 26:155.
- Sauter R, Will M, Helwig H. Schwere Hyponatriämie als diagnoseweisendes Symptom der cystischen Fibrose [Severe hyponatremia as diagnostic symptom of cystic fibrosis]. *Klinische pädiatrie*, 1997, 209:361-3.
- Yalçın E et al. Clinical features and treatment approaches in cystic fibrosis with pseudo-Bartter syndrome. *Annals of tropical pediatrics*, 2005, 25:119-24.
- Forsyth JS, Gillies DR, Wilson SG. Cystic fibrosis presenting with chronic electrolyte depletion, metabolic alkalosis and hyperaldosteronism. *Scottish medical journal*, 1982, 27:333-5.
- Kennedy JD et al. Pseudo-Bartter's syndrome in cystic fibrosis. *Archives of disease in childhood*, 1990, 65:786-7.
- Galla JH, Bonduris DN, Luke RG. Effects of chloride and extracellular fluid volume on bicarbonate reabsorption along the nephron in metabolic alkalosis in the rat. Reassessment of the classical hypothesis of the pathogenesis of metabolic alkalosis. *Journal of clinical investigation*, 1987, 80:41-50.
- Stenvinkel P et al. Decreased renal clearance of sodium in cystic fibrosis. *Acta paediatrica Scandinavica*, 1991, 80:194-8.
- Donckerwolcke RA et al. Impaired diluting segment chloride reabsorption in patients with cystic fibrosis. *Child nephrology and urology*, 1992, 12:186-91.
- Seki G et al. Activation of the basolateral Cl conductance by cAMP in rabbit renal proximal tubule S3 segments. *Pflügers archiv*, 1995, 430:88-95.
- Todd-Turla KM et al. CFTR expression in cortical collecting duct cell. *American journal of physiology*, 1996, 270:F237-44.
- Husted RF et al. Anion secretion by the inner medullary collecting duct. Evidence for involvement of the cystic fibrosis transmembrane conductance regulator. *Journal of clinical investigation*, 1995, 95:644-50.
- Davidow CJ et al. The cystic fibrosis transmembrane conductance regulator mediates transepithelial fluid secretion by human autosomal dominant polycystic kidney disease epithelium in vitro. *Kidney international*, 1996, 50:208-18.

Case report

First report on *Leishmania major*/HIV coinfection in a Sudanese patient

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Introduction

Leishmania/HIV coinfection is a new clinical form of leishmaniasis that has been reported in more than 35 countries [1,2]. The World Health Organization (WHO) estimates that 39.5 million people are infected by HIV worldwide and that one-third of them live in *Leishmania*-endemic regions [1,2]. Most of the reported *Leishmania*/HIV coinfections were among patients infected with viscerotropic parasites, but few data are available on *L. major*/HIV coinfection [2]. Coinfection of HIV patients with *Leishmania* spp. can occur naturally through infected vectors or artificially among intravenous drug users and recipients of blood transfusion. The coinfection modulates the severity of the clinical presentation of leishmaniasis and interferes with proper diagnosis. *Leishmania*/HIV coinfection of patients can result in the emergence of diverse *Leishmania* parasite clones; suppresses the host immune response; and increases blood parasitaemia, hence enhancing transmission. The coinfection also reduces the response of patients to antileishmanial drugs [3].

Cutaneous leishmaniasis is a neglected clinical form of leishmaniasis in Sudan. It is endemic in the north, central and western regions of the country. Cutaneous leishmaniasis in Sudan is thought to be caused by *Leishmania major* and transmitted by *Phlebotomus papatasi*. Recently *L. donovani* has been

identified as a cause of cutaneous leishmaniasis in Sudan, although the vector has not yet been identified [4].

HIV is a growing health problem in Sudan with an increasing prevalence in most regions of the country. In this manuscript we report the first patient diagnosed with *L. major*/HIV coinfection in Sudan.

Case report

This case report emerged from a large study on biotechnological typing of leishmania parasites in Sudan. The typing study was approved by the National Ethical Committee of the Federal Ministry of Health, Sudan. The approved protocol included obtaining consent of the participants for sample collection and HIV testing for unusual and severe clinical presentations to assist effective treatment and control. The patient in this case report gave written consent for HIV testing and enrolment in the typing study. Based on the severity of the presenting lesions he was suspected of HIV coinfection and was referred to the national HIV control programme for pre-counselling and HIV testing. Following the diagnosis of *Leishmania*/HIV coinfection, the patient was provided with HIV counselling and free treatment by the national HIV control programme according to the national guidelines.

A 38-year-old Sudanese male was referred to our laboratory at the Institute of Endemic Diseases during the last week of December 2007 for diagnosis of persistent ulcers. On clinical examination, the patient presented with 5 ulcers on his right arm, 3 on his left arm and a single lesion on his back. The ulcers were large, with necrotic and haemorrhagic zones (Figure 1). The patient had no fever or enlarged lymph nodes. The spleen and the liver were normal.

Tissue aspirates were collected from the periphery of the ulcers for preparation of smears and parasite culture. The parasite was typed based on the size of the amplified kDNA band using the method described by Smyth et al. [5].

The Leishmanin skin test was done as described by Sokal [6] but was found to be negative. The presence of anti-HIV antibodies was determined using an enzyme-linked immunosorbent assay (ELISA) and Western blotting.

Leishmania/HIV coinfection was confirmed in the second week of January 2008. The patient was referred to the national HIV control programme for counselling and treatment.

Discussion

Our patient presented with unusually large multiple ulcers on both arms and his back. The ulcers had persisted for more than 3 months and were unresponsive to antibiotics. The patient lived

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Figure 1 Multiple ulcers on the right arm of the patient with necrotic and haemorrhagic surfaces and raised margins

in an area in central Sudan endemic for cutaneous leishmaniasis, which is about 100 km south of the capital, Khartoum. He had no history of travel to other parts of the country. Cutaneous leishmaniasis was confirmed by demonstration of the parasite in the lesion aspirates, which showed high parasitaemia. Furthermore, the parasite was successfully cultured in NNN media within 48 hours of inoculation of the media. The parasite was identified as *L. major* based on the amplification of a kDNA band of 700 bp identical to the reference strain [5].

In Sudan, both *L. major* and *L. donovani* parasite complexes have been reported to cause cutaneous leishmaniasis in central, north and western Sudan [4]. The patient was confirmed with HIV infection based on the detection of significant anti-HIV antibodies using ELISA and Western blotting. The high parasite load and the lack of response to the Leishmanin skin test could be due to the immunodeficiency caused by HIV infection. Interestingly, no evidence of visceralization of the parasite was detected. The patient did not have

a fever; he had a normal spleen and liver and no lymphadenopathy, which are the clinical signs of visceral leishmaniasis [7,8]. The finding indicates a restricted dermal-tropism of *L. major* isolates in Sudan.

Leishmania/HIV coinfection is a growing, serious health problem. Besides their resistance to conventional treatment, coinfecting patients are a rich source for the transmission of the parasite. To our knowledge, this is the first report on *L. major*/HIV coinfection in Sudan and such coinfection should be considered in the management and control of cutaneous leishmaniasis in Sudan given the current surge of HIV infection.

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References

1. Report on the consultative meeting on *Leishmania*/HIV co-infection, Rome 6–7 September 1994. Geneva, World Health Organization, 1995:1–14.
2. Alvar J et al. The relationship between leishmaniasis and AIDS: the second 10 years. *Clinical microbiological reviews*, 2008, 21(2):334–59.
3. Lopez-Velez R. Clinico-epidemiologic characteristics, prognostic factors, and survival analysis of patients coinfecting with human immunodeficiency virus and *Leishmania* in an area of Madrid, Spain. *American journal of tropical medicine and hygiene*, 1998, 58:436–43.
4. Elamin EM et al. Identification of *Leishmania donovani* as a cause of cutaneous leishmaniasis in Sudan. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2008, 102(1):54–7.
5. Smyth AJ et al. Rapid and sensitive detection of *Leishmania* kinetoplast DNA from spleen and blood samples of kala azar patients. *Parasitology*, 1992, 105:183–92.
6. Sokal JE. Measurement of delayed skin test responses. *New England journal of medicine*, 1975, 293:501–2.
7. Russo R. Visceral leishmaniasis in those infected with HIV: clinical aspects and other opportunistic infections. *Annals of tropical medicine and parasitology*, 2003, 1:S99–105.
8. Zijlstra E, Elhassan AM. Leishmaniasis in Sudan: visceral leishmaniasis. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2001, 95(Suppl. 1):S1/27–1/58.

Obituary

The public health community and the World Health Organization (WHO) have lost an exceptional colleague, Dr Abdel-Monem M. Aly, who passed away on Friday 16 April 2010 at the age of 85 years.

Dr Aly had a long and distinguished career in public health, spanning over 50 years. He was born in Egypt and graduated from the Faculty of Medicine of Alexandria University in 1952. He held diplomas in surgery from Cairo University, in orthopaedics from Ains Shams University, Cairo and a Masters in Public Health from Johns Hopkins University, USA.

In his early career he worked with the Ministry of Health in Egypt and then in the Kingdom of Yemen until 1961. Thereafter he worked within the Egyptian Air Force, first as general surgeon and then orthopaedic surgeon. In 1962 he was deployed to the newly established Republic of Yemen, where he served until 1967 as personal medical adviser to the President of the Republic, technical adviser to the Ministry of Health and head of the Egyptian Medical Mission to Yemen. He was instrumental in the formulation of the first five-year health plan for Yemen and was the chief delegate of Yemen at the 1964 World Health Assembly.

Following his successful years in Yemen, Dr Aly worked within the Egyptian Ministry of Health from 1970 to 1976 as Head of the Technical Office, Chief of the International Health Department and Chief of the Minister's Office for Constitutional and Parliamentary Affairs. During this time, he played a key role in the introduction of Arabic as a working language in the WHO.

In 1976, he was recruited to WHO headquarters in Geneva to establish the Arabic language unit and a WHO programme for Arabic publications. In 1980 he took over as the Chief Officer of Language Services, where he served until his retirement in 1984. Under Dr Aly's direction, the Arabic language unit and programme for Arabic publications grew to become a dynamic and productive endeavour.

Even in retirement, Dr Aly continued to work tirelessly both for the Egyptian Ministry of Higher Education and WHO. In the WHO Regional Office for the Eastern Mediterranean (EMRO) he managed the Health and Biomedical Information Unit, established and managed the AIDS Information Centre and, in 1995, launched the Eastern Mediterranean Health Journal (EMHJ), serving as its Executive Editor from 1995 to 2002.

From its inception, Dr Aly expertly and effectively steered EMHJ through seven years of publication. Under his guidance, what started as a little-known journal with few submissions and two issues a year grew to become a premier journal in the Region with over 300 submissions and six issues per year. It remains one of the few regional journals indexed on PubMed. All this could not have been achieved without Dr Aly, whose vast breadth of knowledge, dedication and indefatigable efforts not only ensured that the Journal flourished but also were critical to maintaining its high standards. The continued success and evolution of the EMHJ are a testament to him.

Dr Aly's long and valuable contribution to public health in the Region, to the promotion of Arabic and the dissemination of public health information in Arabic was prodigious and will not be forgotten. His devotion to duty was unparalleled and his phenomenal knowledge and memory made him a recognized institutional memory of WHO. But beyond that he will be remembered for his kindness, decency and integrity.

Dr Aly inspired great respect and affection and he will be much missed by all those who were privileged to know and work with him.

May his soul rest in peace.

رثاء الفقيد العزيز

يعزّ على منظمة الصحة العالمية ومجتمع الصحة العمومية فقد أحد الرواد الذين يندر أن يجود الزمان بأمثالهم: الدكتور عبد المنعم محمد علي، الذي تغمدته الله برحمته في 16 نيسان/ أبريل 2010 بعمر ناهز الخامسة والثلاثين.

لقد أمضى المرحوم الدكتور عبد المنعم محمد علي حياةً مهنيةً حافلةً بالعطاء للصحة العمومية، استمرت زهاء خمسين عاماً، فقد ولد رحمه الله في مصر، وتخرج من كلية الطب، جامعة الإسكندرية عام 1952، وحصل على دبلوم في الجراحة من كلية الطب، جامعة القاهرة، وفي تقويم العظام من كلية الطب، جامعة عين شمس في القاهرة، ثم على الماجستير في الصحة العمومية من جامعة جونز هوبكنز في الولايات المتحدة الأمريكية.

استهلّ المرحوم الدكتور عبد المنعم محمد علي حياته المهنية بالعمل في وزارة الصحة في مصر، ثم في اليمن حتى عام 1961، ثم انتقل للعمل مع سلاح الجو المصري طبيباً في الجراحة العامة، ثم جراحاً لتقويم العظام. استدعي عام 1962 للعمل في الجمهورية اليمنية الفتية، فواصل خدمته فيها حتى عام 1967 بصفته المستشار الطبي الشخصي لرئيس الجمهورية، والمستشار الفني لوزارة الصحة، ورئيس البعثة الطبية المصرية إلى اليمن. وقد أدى دوراً حاسماً في صياغة الخطة الصحية الخمسية الأولى في اليمن، وكان يرأس الوفد اليمني إلى جمعية الصحة العالمية عام 1964.

وبعد انقضاء سنوات من النجاح المنقطع النظير في اليمن، عمل المرحوم الدكتور عبد المنعم محمد علي في وزارة الصحة المصرية في المدة من 1970 حتى 1976 رئيساً للمكتب الفني، ورئيساً للإدارة الصحية الدولية، ورئيساً لمكتب الوزير للشؤون الدستورية والبرلمانية. وخلال هذه الفترة، أدى دوراً محورياً في إدخال اللغة العربية ضمن لغات العمل في منظمة الصحة العالمية عام 1976. وفي عام 1976، عمل المرحوم الدكتور عبد المنعم محمد علي في المقر الرئيسي لمنظمة الصحة العالمية في جنيف، سويسرا، ليؤسس وحدة القسم العربي فيها، وبرنامج منظمة الصحة العالمية للمطبوعات العربية. وفي عام 1980 أصبح الرئيس للخدمات اللغوية، وواصل أداءه لعمله حتى تقاعده عام 1984. وقد حظيت وحدة اللغة العربية، ومن بعدها برنامج المطبوعات العربية، بإدارة المرحوم الدكتور عبد المنعم محمد علي، بالنمو والازدهار حتى أصبحت من المشاريع المنتجة التي تفيض بالحيوية.

ولم يُثن التقاعد المرحوم الدكتور عبد المنعم محمد علي عن مواصلة عمله بجهد واجتهاد في وزارة التعليم العالي المصرية، وفي منظمة الصحة العالمية؛ حيث أدار بتميز وكفاءة واقتدار وحدة الإعلام الطبي والصحي، ثم أسس وأدار مركز المعلومات حول الإيدز، ثم أطلق المجلة الصحية لشرق المتوسط، وعمل فيها مديراً للتحرير منذ تأسيسها عام 1995 وحتى عام 2002. وقد قاد المرحوم الدكتور عبد المنعم محمد علي مسيرة المجلة الصحية لشرق المتوسط منذ اليوم الأول لولادتها بخبرة وفعالية، طيلة سبع سنوات، فنقلها من مجلة لا يكاد يُسمع باسمها، ولا تتلقّى إلا عدداً قليلاً من المقالات للنشر، وتصدر مرتين كل عام، إلى المجلة الأولى في الإقليم، وزاد عددًا تتلقاه من طلبات النشر عن 300 طلب، وأصبحت المجلة تصدر كل شهرين؛ واحتلت مكانها اللائق بها بين المجلات القليلة المفهرسة ضمن موقع استرجاع النشريات الطبية PubMed. ولم يكن تحقيق أي من هذه الإنجازات ممكناً دون الجهود المخلصة التي بذلها الدكتور عبد المنعم محمد علي، بما حباه الله من معرفة موسوعية، ومن إخلاص وتفان في ما يُقدم عليه من أعمال. فجهود المرحوم الدكتور عبد المنعم محمد علي أثمرت ازدهاراً للمجلة، ومحافظةً على المعايير الرفيعة التي خطتها لها، وهما أمران بالغ الأهمية، ولا مراء بأن المجلة الصحية لشرق المتوسط تدين بوجودها وبنجاحها وباستمرارها لهذا الرجل العظيم.

أما ما قدّمه المرحوم الدكتور عبد المنعم محمد علي من مساهمات قيّمة في الصحة العمومية على صعيد إقليم شرق المتوسط، وفي تعزيز ونشر المعلومات حولها باللغة العربية، فأمر جدير أن يضمن للمرحوم الدكتور عبد المنعم محمد علي البقاء في ذاكرة الأجيال المتتالية، لقد كان إخلاصه في أداء ما يتصدى له من واجبات لا يجارى، إذ أتاحت له معارفه المستفيضة وذاكرته الواسعة أن يكون بجدارة واستحقاق ذاكرةً مؤسسية لمنظمة الصحة العالمية، إلا أننا جميعاً سنذكر أولاً وقبل كل شيء في الدكتور عبد المنعم علي الإنسان الدائم الابتسامة، والطلق المحيا، والمكتمل النزاهة، والطيب السيرة.

أجل، سيكون المرحوم الدكتور عبد المنعم محمد علي على الدوام مصدر إلهام لمعاني الاحترام والمودة والتعاطف بين جميع من حظي بالتعرف عليه أو بالعمل معه.

رحم الله الدكتور عبد المنعم محمد علي وتغمدته بواسع رحمته ورضوانه، وأسكنه بفسيح جناته.

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