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Goal 4 (two-thirds reduction by 2015 of the 1990
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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

As revealed earlier, with this issue of the Eastern Mediterranean Health Journal (EMHJ), we are very pleased to announce the launch of the Journal with a new and fresh look. The newly-formed Editorial Board of EMHJ decided in its first meeting in September 2009 that from January 2010 the Journal will be published monthly in a new design and size. The new format of EMHJ was selected by the Board from a number of designs received in response to an announcement for open competition for the design of the Journal as approved by the Regional Director.

Publication of EMHJ was initiated by the WHO Regional Office for the Eastern Mediterranean in 1995 to provide a forum for the publication of research papers on a diverse range of medical topics, to present and promote new policies and initiatives in health services, and to exchange ideas, concepts, epidemiological data, research findings, and other information with special reference to the WHO Eastern Mediterranean Region. Additionally, the Journal seeks to enable health professionals in all fields to remain informed of developments in the many areas of medicine and public health. The target audience of EMHJ includes health professionals, medical and other health educational institutes, governmental and nongovernmental organizations in the area of public health, and interested individuals within and outside the Region. Papers published by the Journal should pertain to public health-related biomedical or technical subjects within the field of work of WHO, with particular relevance to the Eastern Mediterranean Region.

Since its inception, EMHJ has gone from 2 issues per year to 6, and from very few submissions to over 500 hundred per year in recent years. The Journal has been published in single issues, combined issues and special issues. In the past several years, 170–180 papers have been published per year in 6 bi-monthly issues. However, since its first issue, the Journal had not changed at all in format and only minimally in content in order to accommodate more papers. In its new form, EMHJ will continue its distinct role in bringing a multitude of health research fields together, with a common focus on research for health. Owing to a high submission rate and in order to assure good quality, EMHJ has made its peer-review process more stringent, with rigorous initial screening of the articles and expert review by at least by two qualified referees. Therefore, future acceptance of articles submitted to EMHJ will depend strictly on the vision, quality of research, creativity and collaborative nature of the research topics. EMHJ welcomes innovative, interdisciplinary research for health that is reliable as well as useful. Furthermore, the Journal envisages new sections for advocacy and policy papers, as strongly recommended by the Editorial Board.

رسالة من المحرر

يسعدنا مع هذه الإصدار للـمجله الصحية لشرق المتوسط، كما سبق وأوضحنا سلفاً، أن نعلن عن إطلاق المجلة بشكلها الجديد. فقد قرر مجلس تحرير المجلة الجديد والمُشكّل مؤخراً في اجتماعه الأول والذي عُقد في أيلول/ سبتمبر 2009، أنه اعتباراً من كانون الثاني/ يناير 2009، سنُنشر المجلة شهرياً بشكل جديد وحجم جديد. وقد وقع اختيار المجلس على هذا الشكل الجديد للمجلة من بين عدد من التصميمات المتلقاة بناءً على موافقة المدير الإقليمي على الإعلان عن منافسة مفتوحة لتصميم المجلة. وقد بدأ المكتب الإقليمي لشرق المتوسط لمنظمة الصحة العالمية في نشر المجلة الصحية لشرق المتوسط في عام 1995، لتوفير منتدى لنشر الأوراق البحثية حول طيف متنوع من الموضوعات الطبية بغية عرض وتعزيز السياسات والمبادرات الجديدة في مجال الخدمات الصحية، ولتبادل الآراء والمفاهيم والمعطيات الوبائية والنتائج البحثية، وغيرها من المعلومات الأخرى المتعلقة بشكل خاص بإقليم شرق المتوسط لمنظمة الصحة العالمية. بالإضافة إلى ذلك تسعى المجلة إلى تمكين المهنيين الصحيين في كل المجالات من الإحاطة المستمرة بالتطورات التي تطرأ على مجالات الطب والصحة العمومية المتعددة. ويشمل الجمهور المستهدف للمجلة الصحية المهنيين الصحيين، والمؤسسات الطبية، وسائر معاهد التعليم الصحي، والمنظمات الحكومية واللاحكومية في مجال الصحة العمومية، وسائر الأفراد المهتمين بهذه القضايا داخل الإقليم وخارجه. ويتعين أن ترتبط الأوراق المنشورة في المجلة بالموضوعات الطبية البيولوجية المرتبطة بالصحة العمومية أو الموضوعات التقنية الخاصة بمجال عمل المنظمة مع إيلاء اهتمام خاص لإقليم شرق المتوسط. وقد زادت أعداد المجلة الصحية لشرق المتوسط منذ إطلاقها من عشرين في العام إلى 6 أعداد، ومن تقديم موضوعات قليلة إلى ما يربو على 500 ألف موضوع في العام في السنوات الأخيرة. وتصدر المجلة في شكل أعداد فردية، وأعداد مجمعة، وأعداد خاصة. وفي السنوات الأخيرة المصروفة، كان يتم نشر ما بين 170 و180 ورقة كل عام على مدى ستة أعداد كل شهرين، بيد أنها لم يطرأ عليها أي تغيير من حيث الشكل وكذلك المضمون الذي شهد تغييرات طفيفة منذ بدء صدورها لتستوعب المزيد من الأوراق البحثية. وستواصل المجلة الصحية في شكلها الجديد الاضطلاع بدورها المتميز في التطرق إلى عدد من مجالات البحوث الصحية وربطها سوياً مع التركيز بشكل خاص على البحوث الصحية. ونظراً للمعدل الكبير من المقالات المقدمة، ورغبة في توكيد الجودة العالية، حرصت المجلة الصحية لشرق المتوسط على جعل عملية مراجعة الأقران لديها أكثر صرامة، حيث يتم إجراء تحريري بالغة الدقة للمقالات، كما تتم مراجعة الخبراء من قبل محكمين اثنين مؤهلين على الأقل. ومن ثمّ فإن قبول المقالات المقدمة للمجلة الصحية لشرق المتوسط سيعتمد في المستقبل بشدة على الرؤية، وجودة البحث، والطبيعة الابتكارية والتعاونية للموضوعات البحثية. وتعد المجلة الصحية لشرق المتوسط آمالاً عريضة شأنها شأن أي من المجالات المعروفة جيداً والمحددة التخصص، فهي ترحّب بالبحوث المبتكرة المفيدة المتخصصة من أجل الصحة والتي يمكن التعويل عليها. بالإضافة إلى ذلك فإن المجلة تضع تصوراً لإضافة أقسام جديدة للتوعية، والأوراق المتعلقة بالسياسات وفقاً لتوصيات مجلس التحرير والذي أكد بشدة على هذا الأمر.

Case-control study to evaluate risk factors for acute hepatitis B virus infection in Egypt

M. Talaat,¹ E. Radwan,² N. El-Sayed,² T. Ismael,¹ R. Hajjeh³ and F.J. Mahoney³

دراسة للحالات والشواهد لتقييم عوامل اختطار عدوى التهاب الكبد البائي الحاد في مصر

مها طلعت، إيمان رضوان، نصر السيد، ثروت إسماعيل، رنا حاجي، فرانك جاسم ماهوني

الخلاصة: تشكل عدوى التهاب الكبد البائي مشكلة صحية عمومية كبرى في مصر. ولتحديد أكثر دقة لعوامل الاختطار المرتبطة بانتقال العدوى بفيروس التهاب الكبد البائي، أجرى الباحثون دراسة للحالات والشواهد بين المرضى المصابين بالتهاب الكبد الحاد الذين أدخلوا في إحدى مستشفيات الأمراض المعدية في القاهرة. وأجريت مقابلات لـ 60 حالة و 120 شاهداً لسؤالهم عن مختلف التعرضات التي جرت لهم خلال 6 شهور قبل إدخالهم المستشفى. وأظهر تحليل المتغير الأحادي أن الأكثر ترجيحاً أن تبلغ حالات التهاب الكبد البائي المرضية عن انتقال العدوى إليها عن طريق الأقارب أو الأصدقاء، وتعاطي المخدرات حقناً، والمخالطة المنزلية للمصابين بالتهاب الكبد، والتعرض لإجراءات طبية باضعة، والخدمة في القوات المسلحة. ويتعين بذل الجهود لتطبيق معايير مكافحة العدوى بصرامة في مصر.

ABSTRACT Hepatitis B virus (HBV) infection is a significant health problem in Egypt. To better define risk factors associated with HBV transmission, we conducted a case-control study among patients admitted with acute hepatitis to an infectious disease hospital in Cairo. A total of 60 cases and 120 controls were interviewed about various exposures within 6 months prior to admission. Univariate analysis revealed HBV case-patients were more likely to report providing injections to relatives or friends, injecting drug use, exposure to a household contact with hepatitis, exposure to invasive medical procedures and being in the military. Efforts should be made to implement strict infection control standards in Egypt.

Étude cas-témoin visant à évaluer les facteurs de risque d'infection aiguë par le virus de l'hépatite B en Égypte

RÉSUMÉ L'infection par le virus de l'hépatite B (VHB) est un important problème sanitaire en Égypte. Afin de mieux définir les facteurs de risque associés à la transmission du virus de l'hépatite B, nous avons réalisé une étude cas-témoin parmi des patients admis pour une hépatite aiguë dans un hôpital pour maladies infectieuses du Caire. Au total, 60 patients atteints par la maladie et 120 témoins ont été interrogés sur les différents types d'exposition au cours des six mois précédant l'hospitalisation. L'analyse univariée a révélé que les sujets contaminés par le VHB avaient davantage tendance à déclarer avoir administré des injections à des parents ou à des amis, être consommateurs de drogues injectables, avoir été exposés à un contact avec une personne atteinte d'hépatite au domicile ou à des procédures médicales invasives et à servir dans l'armée. Des efforts devraient être faits pour mettre en œuvre des normes strictes de lutte contre les infections en Égypte.

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Introduction

Hepatitis B virus (HBV) infection is a serious global public health problem with an estimated 2 billion people infected worldwide and 350 million persons with chronic HBV infection. The World Health Organization estimates that 500 000 to 1.2 million deaths occur each year due to HBV-related chronic liver disease, and that cirrhosis of the liver and primary hepatocellular carcinoma associated with HBV infection is the 10th leading cause of death worldwide [1,2].

The epidemiology of HBV transmission is complex. Transmission occurs in all age groups associated with percutaneous and permucosal exposure to infectious body fluids from persons with acute or chronic HBV infection. The highest concentrations of HBV occur in blood and serous fluids, and infection most frequently occurs through direct inoculation of the virus through unsafe injections or reuse of contaminated medical equipment. Other common modes of transmission include sexual contact with infected persons and births from HBV-infected mothers [3,4].

The epidemiology of HBV infection in Egypt has not been well characterized. Cross-sectional studies indicate that HBV is of intermediate endemicity, with 3% to 5% of the population having chronic HBV infection [4,5]. Hospital-based data indicate that HBV is a common cause of disease, accounting for approximately 30% of patients with acute viral hepatitis [6]. Most studies characterizing risk factors for HBV infection in Egypt are cross-sectional studies among patients with prevalent disease. These studies have implicated a variety of exposures associated with infection, including unsafe injections, unsafe medical care, community-acquired practices and others. For patients with acute HBV disease, there are no published studies to identify risk factors to help define intervention strategies.

During 2002–03, we conducted a case–control study to determine current preventable risk factors associated with transmission of acute HBV infection in Egypt, and to explore the epidemiological characteristics of patients with acute disease.

Methods

Selection of cases and controls

Case-patients and controls were recruited from Abbassia Infectious Disease Hospital, the largest infectious disease hospital in Cairo, Egypt. Cases enrolled in the study included patients evaluated in a sentinel surveillance system for acute viral hepatitis. Cases of acute hepatitis were defined as patients > 12 months of age, with discrete onset of jaundice (or elevated serum aminotransferase levels, if performed), and no underlying medical conditions associated with acute or chronic liver disease. Cases of acute HBV infection were defined as cases of acute hepatitis with detection of IgM-class antibody to hepatitis B core antigen (anti-HBc) following serological testing. Controls were identified from the hospital log books of patients admitted to the same hospital with any diagnosis other than hepatitis and with no jaundice on the same day of confirmation of diagnosis of the HBV case patients. Cases were recruited consecutively and no patients refused to participate in the study. Two controls were selected for each case and were matched by age (to within 5 years) and sex.

The Institutional Review Board of the US Naval Medical Research Unit No. 3 (NAMRU-3) approved the study procedures. The attending physicians explained the study procedures and obtained informed consent/assent from all study subjects or their guardians.

Data collection

Sample size calculations used to estimate the appropriate size of the study population suggested 60 cases and 120 controls to achieve a confidence level of 95% and a power of 80%. The risk of exposure to injections among cases was calculated as 28%, whereas the risk of exposure to injections among controls was estimated as 10%.

Cases and controls were interviewed by trained social workers using a standard questionnaire. Information was collected on demographic characteristics, history of vaccination and risk factors for exposure to HBV that occurred within 6 months prior to the onset of disease, including invasive health care procedures, blood transfusions, frequency and types of injections, injecting drug use, contact with infected persons and sexual practices. In addition, community-acquired risk factors were explored, such as sharing toothbrushes or razors and household contact with hepatitis patients. Information on other community exposures, such as circumcision, tattooing and acupuncture, was also collected.

Laboratory tests

Acute HBV infection was identified by the presence of hepatitis B surface antigen (HBsAg) in serum and the development of anti-HBc [7]. HBsAg antibodies to hepatitis B surface antigen (anti-HBs) and anti-HBc (immunoglobulin IgM) were detected by enzyme-linked immunoassay (ELISA) (Abbott Murex Biotech, UK).

Data analysis

Risk factors were grouped into 4 categories based on exposure patterns. The first group included exposures associated with health care, such as visiting an outpatient clinic, receiving a blood transfusion, receiving an injection, visiting a dentist and exposure to any invasive procedure during the last 6 months, including surgery, dialysis, insertion of

intravenous (IV) cannula, wound and abscess treatment and stitches. The second group of exposures included personal practices that might be associated with infection, such as providing injections, being shaved at a community barber, having household contacts with hepatitis and using recreational drugs. The third group of risk factors included high-risk sexual practices, defined as having multiple sexual partners or engaging in homosexual activity. The final group of risk factors included military service or being imprisoned during the previous 6 months.

The data were entered into an inhouse computerized database. Univariate and multivariate analyses were conducted and logistic regression was performed to identify risk factors independently associated with the risk of acquiring disease. The model included variables significant on univariate analysis. For variables that might influence the occurrence of acute HBV, we calculated odds ratios (OR) and the *P*-value. *P* < 0.05 was considered statistically significant.

Results

Among 2416 patients with acute hepatitis evaluated during the sentinel surveillance at the Abbassia Infectious Disease Hospital from 2002 to 2004, 515 (21.3%) were diagnosed with acute HBV infection based on the case definition above. The mean age of patients with acute disease was 32 years with a range of 2–85 years; 62% of patients were males. Among the 515 patients with acute HBV infection, 497 were born after integration of HBV vaccine into the Expanded Programme on Immunization (EPI) in Egypt. From these 515 patients, 60 were recruited from the 2002–03 time period to participate in the case–control study and were matched with 120 controls.

Demographic characteristics

Case-patients with acute HBV infection were matched with controls with respect to age (median 25 years for cases versus 27 years for controls) and sex. They were also similar with regard to job category, marital status, illiteracy and history of hepatitis B vaccination (Table 1).

Risk factors

Health care-related risk factors

Of the various health care-related risk factors explored, the only one found to be associated with increased risk of disease was exposure to invasive medical procedures (insertion of IV line, surgery, wound or abscess treatment and suturing) [odds ratio (OR) = 2.2] (Table 2). Health care exposures not associated with acute HBV infection included receiving blood transfusions, visiting a dentist, being hospitalized,

receiving injections and visiting a physician clinic.

Personal behaviour and household exposures

Personal behaviour and household exposures significantly associated with infection included injecting drug use (OR = 9.2), exposure to a household contact with hepatitis (OR = 3.9) and providing injections to relatives or friends (OR = 5.4) (Table 2). A number of personal behaviours were not associated with infection, such as being shaved by a public barber, receiving tattoos, having pierced ears and sharing toothbrushes. Cases were more likely to report high-risk sexual activity (OR = 2.5), incarceration (OR = 3.9) and military service (OR = 3.5) in the 6 months prior to admission when compared with the control group, although only the association with military service was statistically significant.

Table 1 Demographic characteristics of case-patients with acute hepatitis B virus (HBV) infection and controls attending Abbassia Infectious Disease Hospital, Egypt

Demographic characteristic	HBV cases (<i>n</i> = 60)		Controls (<i>n</i> = 120)	
	No.	%	No.	%
Median age (years)	25.5		27.5	
Sex				
Male	49	81.7	98	81.7
Female	11	18.3	22	18.3
Marital status				
Married	27	45.0	70	58.3
Single	33	55.0	50	41.7
Education				
Illiterate	24	40.0	35	29.9
Basic education	36	60.0	82	70.1
Occupation				
Housewife or not working	10	16.9	23	19.2
Handicraft	15	25.4	20	16.7
Government employee	3	5.1	21	17.5
Manual labourer	27	45.7	54	45.0
Health professional	4	6.8	2	1.7
History of HBV vaccination				
Vaccinated	2	3.3	3	2.5
Not vaccinated	58	96.7	117	97.5

Data were not recorded in some categories.

Table 2 Univariate analysis for risk factors of acute hepatitis B virus (HBV) infection, Abbassia Infectious Disease Hospital, Egypt

Risk factor	HBV cases		Controls		OR (95% CI)	P-value
	No.	%	No.	%		
<i>Health care-related</i>						
Receiving blood transfusion	5/58	8.6	4/118	3.4	2.7 (0.6–12.5)	0.1
Exposure to invasive medical procedure ^a	16/60	26.7	17/120	14.2	2.2 (0.9–5.1)	0.04
Visiting a dentist	12/59	20.3	27/120	22.5	2.7 (1.1–6.9)	0.3
Receiving injections	40/60	66.7	81/120	67.5	0.9 (0.5–2.0)	0.9
Hospitalization	6/60	10.0	16/120	13.3	0.7 (0.2–2.1)	0.7
Visiting a doctor	22/59	37.3	53/119	44.5	0.7 (0.3–1.5)	0.4
<i>Personal behaviour</i>						
Injecting drug use	8/59	13.6	2/119	1.7	9.2 (1.7–65.0)	0.003
Contact with hepatitis case in household	13/59	22.0	8/120	6.7	3.9 (1.4–11.3)	0.005
Providing injections	8/42	19.0	4/95	4.2	5.4 (1.3–22.9)	0.007
Shaving at barber (for males)	36/47	76.6	61/97	62.9	1.9 (0.8–6.4)	0.1
<i>Unsafe sexual practices</i>						
Multiple partners/homosexuality	11/60	18.3	10/120	8.3	2.5 (0.9–6.8)	0.08
<i>Other exposure</i>						
Being imprisoned	5/44	11.4	3/93	3.2	3.9 (0.8–21.6)	0.07
Military service (for males)	9/48	18.8	6/97	6.2	3.5 (1.1–12.0)	0.04

^aIncludes surgery, insertion of intravenous cannula, wound or abscess treatment and stitches; injections were excluded.
OR = odds ratio; CI = confidence interval.

Multivariate analysis

The multivariate model included variables significant on univariate analysis: military service, providing medical injections, injecting drug use, exposure to invasive procedures and contact with a household member with hepatitis. Three factors remained independently associated with increased risk of HBV infection: military service (OR = 19.2; 95% CI: 2.7–135.6), providing injections (OR = 8.7; 95% CI: 1.1–72.1) and exposure to invasive medical procedures (OR = 5.6; 95% CI: 1.1–27.2).

Discussion

Prevention of bloodborne pathogen transmission is a high priority for the Ministry of Health and Population (MOHP) in Egypt. While the modes of transmission of human immunodeficiency virus (HIV), hepatitis C virus (HCV) and HBV infection are similar, the contribution of different exposures to overall disease burden varies significantly in different countries and regions. Identifying specific risk factors for bloodborne pathogen transmission

of public health importance is a challenging but important step in the development of prevention strategies. Epidemiological studies suggest that the prevalence of HIV infection is low in Egypt and there are few studies characterizing behaviours associated with transmission. HCV infection on the other hand is highly endemic in Egypt where 10%–15% of the population has evidence of chronic HCV infection [8]. Chronic liver disease associated with HCV infection is one of the major causes of death in Egypt. Numerous studies have identified diverse risk factors associated with HCV transmission [9,10]; however, none of these has evaluated patients with acute disease. It is challenging to identify patients with acute HCV infection due to the lack of a diagnostic marker (IgM antibody) that can differentiate patients with acute versus chronic infection. Similar to HIV and HCV, there are few studies evaluating the risks associated with HBV transmission in Egypt.

Table 3 Multivariate analysis for risk factors of acute hepatitis B virus (HBV) infection, Abbassia Infectious Disease Hospital, Egypt

Risk factor	OR (95%CI)
Military service	19.2 (2.7–135.6)
Providing injections	8.7 (1.1–72.1)
Exposure to invasive medical procedure	5.6 (1.1–27.2)
Injecting drug use	6.9 (0.5–83.4)
Contact with household hepatitis case	3.8 (0.9–14.6)
Unsafe sexual practices	1.2 (0.2–6.1)

OR = odds ratio; CI = confidence interval.

HBV exists in high titres in blood and infectious body fluids among persons with chronic infection and is more easily transmitted than other blood-borne pathogens [11]. With the introduction of the hepatitis B vaccine in 1992, it is unlikely that early childhood transmission continues to contribute to overall disease burden. Indeed, the sentinel surveillance system identified few cases who were born since the introduction of vaccines and found that most transmission occurred among young adult males. This age coincides with the onset of high-risk behaviours, such as unsafe sexual practices and injecting drug use. Thus, we hypothesized that these high-risk behaviours are key risk factors for infection. The findings of our study suggested that military service, exposure to invasive medical procedures, injecting drug use, contact with an infected household member and providing injections to others contributed to the transmission of acute HBV infection in Egypt. Few of these exposures were identified in a large proportion of patients with acute HBV infection, thus making the identification of risk groups for prevention difficult. The lack of a significant association with high-risk sexual behaviours was somewhat surprising and may reflect difficulties in eliciting information on these exposures within the cultural context of Egypt.

The finding that exposure to unsafe invasive medical procedures contributes to HBV transmission is consistent with other studies, indicating deficiencies in standard infection control precautions in the local health care setting [8–10]. The MOHP started to implement a national infection control programme in 2001 and has adopted a comprehensive strategy to implement practices to prevent transmission of bloodborne pathogens in health care settings [12]. However, performance of some invasive procedures through the informal sector remains a risk, and awareness campaigns directed towards the public

need to be launched to raise public demand for safety.

The lack of association between HBV and receipt of injections, with the exception of injecting drug use, was surprising, based on data from other studies suggesting that reuse of needles is relatively common in Egypt [13]. It is estimated that unsafe injections may cause 8–16 million HBV infections each year worldwide, most of which occur in developing countries [14]. The similar proportions who received injections among cases and controls might be the reason for this lack of association. Community-based studies reveal a much lower frequency of receiving injections in the general population when compared to our control population, thus it is possible that the control population (hospitalized patients) may have introduced a bias against demonstrating an association of unsafe injections and HBV infection.

The association of serving in the military with HBV infection has not been reported in other studies. Military recruits in Egypt are housed in compounds where sharing of personal hygiene materials, such as razors or toothbrushes, is relatively common. Presumably such unapparent exposures would promote HBV transmission that has been observed among household contacts of persons with acute or chronic HBV infection.

Our findings also revealed that those imprisoned within the last 6 months had higher odds of being infected by HBV than controls, consistent with studies in other countries [15,16], although it was not statistically significant on univariate or multivariate analysis. For example, Macalino et al. reported that the prevalence of HBV infection among prisoners was 20.2% and was associated with injecting drug use (OR = 10). Their study revealed that high-risk practices, such as injecting drug use, homosexuality or unsafe medical procedures, might be risk factors associated with

transmission. The restrictive nature of the prison environment and the probable reuse of syringes heighten the hazards associated with high-risk activities [16]. General disease prevention efforts must include prevention within high-risk facilities, such as prisons, military facilities and others.

While it is likely that risk factors for HIV, HCV and HBV infection may vary, particularly in relation to attributable risk, it is anticipated that the identification of risk factors and development of prevention strategies based on the findings of this study and others can form the basis for developing a comprehensive prevention strategy to prevent bloodborne pathogen transmission in Egypt. The strategy should include a programme targeting HBV prevention efforts, including vaccination for high-risk groups and raising public awareness and demands for safety and promotion of infection control standards in the health care setting.

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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.

Hepatitis B and C viral infection: prevalence, knowledge, attitude and practice among barbers and clients in Gharbia governorate, Egypt

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التهاب الكبدى B والعدوى بفيروس C: الانتشار، والمعرفة، والتوجهات، والممارسات بين الحلاقين والزبائن في محافظة الغربية، مصر
صافي ناز شلبي، إبراهيم علي كباش، جهالات السليط، نديرة منصور، أسماء عمر، علي النواوي

الخلاصة: أجريت الدراسة في مصر لتحديد انتشار التهاب الكبدى B والعدوى بفيروس C بين الحلاقين (وعددهم 308)، وزبائنهم (وعددهم 308) في محافظة الغربية، وجرى تقييم للمعرفة، وللتوجهات، وللممارسات أثناء قص الشعر والحلاقة. واكتشف المستضد السطحي للفيروس الكبدى HBsAg بين 4.2% من الحلاقين، و3.9% من الزبائن (في المدن أكثر من الأرياف). واكتشف الضد للفيروس C في 12.3% من الحلاقين، و12.7% من الزبائن. وكان معدل HCV-RNA هو 9.1% بين كل من الحلاقين والزبائن (وفي المدن أكثر من الأرياف). وكان لدى غالبية المشاركين معرفة ولوحظ على غالبية الحلاقين اتباع ممارسات جيدة أثناء الحلاقة وقص الشعر. ويبدو أن الحلاقين ليس لديهم تأمين من الخطر الوظيفي بالتعرض للإصابة بالتهاب الكبدى.

ABSTRACT A study in Egypt determined the prevalence of hepatitis B and C virus infections among barbers ($n = 308$) and their clients ($n = 308$) in Gharbia governorate, and assessed knowledge, attitude and practices during hair-cutting and shaving. HBsAg was detected among 4.2% of barbers and 3.9% of clients (more urban than rural). Anti-HC antibodies were detected in 12.3% of barbers and 12.7% of clients. HCV-RNA prevalence was 9.1% among both barbers and clients (more rural than urban). Knowledge was high among the majority of participants and good practices during shaving and hair-cutting were observed for the majority of barbers. Barbers appeared to have no job-related risk of acquiring viral hepatitis.

Infection par les virus de l'hépatite B et de l'hépatite C : prévalence, connaissances, attitudes et pratiques chez les coiffeurs pour hommes et leurs clients dans le gouvernorat de Gharbia (Égypte)

RÉSUMÉ Une étude réalisée en Égypte a déterminé la prévalence des infections par les virus de l'hépatite B (VHB) et de l'hépatite C (VHC) chez les coiffeurs pour hommes ($n = 308$) et leurs clients ($n = 308$) dans le gouvernorat de Gharbia, et évalué les connaissances, les attitudes et les pratiques pendant la coupe de cheveux et le rasage. L'antigène de surface (Ag HBs) du VHB a été détecté chez 4,2 % des coiffeurs et 3,9 % des clients (plutôt citadins que ruraux). Des anticorps anti-HC ont été trouvés chez 12,3 % des coiffeurs et 12,7 % des clients. La prévalence de l'ARN du VHC était de 9,1 % chez les deux groupes (plutôt ruraux que citadins). Les connaissances étaient élevées chez la plupart des participants et de bonnes pratiques ont été observées lors du rasage et de la coupe des cheveux chez la plupart des coiffeurs. Ceux-ci ne semblaient pas courir de risque de contracter une hépatite virale dans le cadre de leur travail.

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Introduction

Bloodborne diseases impose heavy burdens on national economies and individual families due to costs arising from acute and chronic morbidity and mortality. Globally, 2 billion people are infected with hepatitis B virus (HBV). An estimated 170 million persons are chronically infected with hepatitis C virus (HCV) and 3–4 million persons are newly infected each year [1,2].

The highest HCV prevalence in the world is in Egypt, where the prevalence of infection increases steadily with age. High rates of infection are observed among all age groups although there are regional differences in the average overall prevalence [3–5]. The prevalence ranges from 10% to 20% of the general population, and rural populations show a higher prevalence than urban ones. This difference has been attributed to past infection and treatment of schistosomiasis [6–8].

The barber shop is a place where hair-cutting, shaving and hair reforming for men are practised. Negligence during the use of sharp instruments may be a risk factor for bloodborne infections, causing serious health problems for both the barber and the clients [9]. Razor sharing and shaving in barber shops has been identified as a key risk factor for HBV infection in Italy [10]. It has also been identified as a risk factor for HCV among institutionalized patients [11].

The objectives of this study were to determine the prevalence of both HBV and HCV infections among barbers and a sample of their clients in Gharbia governorate, Egypt, and to assess the knowledge and attitude of the study population regarding viral hepatitis and their practices during hair cutting and shaving.

Methods

Study setting

This study was carried out during the year 2007 in Gharbia governorate, one of the governorates of the Nile Delta

area. Two out of 8 administrative areas of the governorate were randomly chosen as the study location (Tanta and Mahalla El-Koubra). The 2 cities (Tanta and Mahalla El-Koubra) were included to represent urban localities, while 3 villages (from 42 villages related to Tanta and 55 villages related to Mahalla) were selected randomly from the list of total villages to represent rural localities. Gharbia governorate has a population of nearly 3 million, with an urban to rural ratio of residents of 1:2.

Sample

The target population of the study was people working in barber shops and practising hair-cutting and shaving and 1 regular client from each shop who had attended for at least 1 year.

Based on the lowest reported prevalence of 3% for hepatitis B surface antigen (HBsAg), the sample size that could detect a prevalence ranging from 1%–5%, at a 95% confidence level, was estimated as 280 in each group (barbers and clients). In fact 616 subjects (308 barbers and 308 clients) were enrolled as follows. All barbers in the chosen 6 villages who agreed to participate in the study were included (a total of 147 barbers out of 159 barbers) and the same number of clients, plus a total of 161 barbers from urban areas in both Tanta and Mahalla cities and the same number of clients. The proportion of individuals who refused to participate ranged from 4% to 8% at different localities of the study. Efforts were made to explain the objectives of the study and its benefits to the participating person and the whole community in order to minimize refusals, which were mainly due to fears about discovering their serostatus or giving a blood sample.

A block sampling technique with a map was used. Regarding the urban areas, a multistage random sample was used. Both Tanta and Mahalla El-Koubra cities were classified into 2 large strata, based on the socioeconomic

standard of the dwellings (high and medium-low). Each stratum was further divided into clusters and 5 clusters were chosen randomly from each stratum. A list of barber shops in the study areas was prepared with the help of senior barbers living in the study area. Direct personal communication with barbers in their working shop was made to get their consent and cooperation before being enrolled in the study. While collecting data from the barber, one of the attending clients at that time was approached and invited to participate in the study after the purpose of the study was explained. In case of refusal by the client another person was chosen in the same setting.

Data collection

A pre-designed, structured questionnaire sheet was filled inside the barber shop through direct personal interview with both the barber and the client. Direct observation of the place and the practice of the barber during his work were also carried out. The questionnaire sheet included the following data: sociodemographic data; knowledge, awareness and beliefs related to HBV and HCV infection; attitude to HBV and HCV; risky behaviours that might contribute to infection with both types of hepatitis; and an observational checklist for barbers' practice during hair-cutting/shaving. The cut-off for a high level knowledge was defined as > 50% of questions correct.

Before starting data collection the research team reviewed thoroughly the questionnaire and received an orientation training on communication skills and were trained on the methods of data collection. The validity of the questionnaire was tested by expert and peer review and the reliability was tested by the test–retest method in a pilot study including 30 barbers and 30 clients not included in the study sample.

A blood sample (5 mL) was taken from each study subject through

venepuncture using a vacutainer device. The sample was allowed to clot naturally to separate the serum for analysis and was stored upright in an ice box/refrigerator at a temperature of 2–8 °C (for up to 3 days) until it was sent to the laboratory for analysis.

For diagnosis of HBV infection, an *in vitro* diagnostic kit for the detection of HBsAg in human serum was used (Biorex Diagnostics, UK). This test is an enzyme-immunoassay based on a “sandwich” principle.

For diagnosis of HCV, a 3rd-generation enzyme-linked immunosorbent assay (ELISA) kit for qualitative detection of antibodies to HCV in human serum or plasma was used (Biorex Diagnostics, UK). Samples found to be negative on the preliminary screening were considered HCV-seronegative. Initially positive and borderline samples were confirmed by qualitative HCV-RNA detection assays using classic polymerase chain reaction using a commercial kit (HEPA-Check-C, Nuclear Laser Medicine, Italy).

Standard techniques were applied according to the manufacturer's guidelines. Laboratory investigations were carried out in a specialized private laboratory (Al-Ahram Laboratory, Tanta).

Ethical considerations

The people recruited to the study were informed about the objectives of the study and that they were free to refuse participation. A verbal witnessed consent was obtained from each study participant. Clients or barbers < 18 years old were not included in the study as they were unable to give legal consent. The confidentiality of collected data and for the results of investigations was assured. Only the principal investigator held the results of blood samples tested. The participants were informed about their HBV/HCV test results if they expressed a desire to be informed. These results were delivered in person in a sealed envelope.

Statistical analysis

The collected data were organized, tabulated and statistically analysed using SPSS, version 12. The chi-squared test was used for testing the significance of differences between the study groups. When the chi-squared test was not appropriate, Fisher exact test was used. The level of significance was 5%.

Results

A total of 616 subjects (308 pairs of barbers and clients) were included: 322 from urban areas (161 pairs) and 294 from rural settings (147 pairs).

The majority of the study subjects (64.3% of barbers and 59.4% of clients) were aged 20–40 years. Nearly one-half of barbers (49.7%) and 41.2% of clients had intermediate education. About one-third of clients (36.7%) were highly educated compared with only 7.8% of barbers.

HBsAg was detected in 25 individuals (13 barbers and 12 clients), an overall prevalence of 4.1%. The rate was similar among barbers and clients (4.2% versus 3.9%) (Table 1). The prevalence of HBsAg among urban barbers and clients was higher than that among rural ones (6.2% versus 2.0%), although not significantly so. Anti-HCV antibodies were detected in 77 individuals with an overall prevalence of 12.5%. Again, the rate was almost the same among barbers and their clients (12.3% versus 12.7%). The infection rate was highest among rural clients (13.6%) followed by rural barbers (12.3%). The prevalence of anti-HCV was equal among urban barbers and their clients (11.8%). Detection of HCV-RNA revealed similar figures among both barbers and clients (9.1%). The prevalence in rural subjects was higher than that of urban subjects (10.2% and 8.1% respectively). Double infection was detected in 3 subjects (1 barber and 2 clients). There was no statistically significant difference between

barbers and clients in the rate of HBV or HCV infection (Table 1).

The level of knowledge about modes of transmission was high among the majority of the study participants (over 80% for most questions). Knowledge about the existence of protective drugs and vaccines was too low; about 40% knew about the presence of an HBV vaccine and around one-quarter claimed to know about a protective vaccine for HCV. Friends and relatives were the main source of information for both barbers (46.1%) and clients (49.7%), followed by television, newspapers and doctors (Table 2).

About two-thirds of the barbers (67.9%) and more than half of the clients (55.5%) were concerned about the status of shaving blades used ($P = 0.002$) (Table 3). Positive attitudes towards antiseptic use after shaving and safe injections was found among 55.8% and 49.0% of barbers compared with 70.5% and 66.9% of clients respectively ($P < 0.001$). It was also found that 217 (70.5%) of the barbers would not mind being tested for viral hepatitis and 145 (47.1%) would be willing to have periodic screening for viral hepatitis and other bloodborne diseases.

The practice of barbers during shaving showed that changing the blade for each client was the practice of 291 barbers (94.5%); 93.2% of urban and 95.9% of rural ones. Disinfection of used instruments was practised by 76.9% and washing hands by 63.0% of them. Wearing protective clothes, especially gloves, was practised by 52.8% of urban barbers and only 9.6% of rural ones. The difference between rural and urban barbers regarding these practices was not statistically significant, except for wearing protective clothes/gloves and washing used instruments ($P < 0.001$) (Table 4).

The shaving practices of the clients revealed that the practice of urban clients was better than that of rural ones regarding verification of the status of

Table 1 Prevalence of hepatitis B (HBV) and C virus (HCV) infection among barbers and their clients

Hepatitis infection	Barbers						Clients						Total (n = 616)			Statistics					
	Urban (n = 161)			Rural (n = 147)			Total (n = 308)			Urban (n = 161)			Rural (n = 147)				Total (n = 308)				
	No.	%		No.	%		No.	%		No.	%		No.	%			No.	%			
Uninfected	133	82.6		125	85.0		258	83.8		133	82.6		126	85.7		259	84.1		517	83.9	$\chi^2 = 0.000$
Infected	28	17.4		22	15.0		50	16.2		28	17.4		21	14.3		49	15.9		99	16.1	$\chi^2 = 1.000$
HBV +ve (HBsAg)	10	6.2		3	2.0		13	4.2		9	5.6		3	2.0		12	3.9		25	4.1	$\chi^2 = 0.04; P = 0.838$
HCV +ve (anti-HCV)	19	11.8		19	12.9		38	12.3		19	11.8		20	13.6		39	12.7		77	12.5	$\chi^2 = 0.01; P = 0.903$
HCV +ve (HCV-RNA)	13	8.1		15	10.2		28	9.1		13	8.1		15	10.2		28	9.1		56	9.1	$\chi^2 = 0.04; P = 0.839$

1 barber and 2 clients were infected with both types of hepatitis.
HBsAg = hepatitis B surface antigen.

used instruments before shaving ($P < 0.001$), bringing their own instruments ($P = 0.019$) and asking the barber to wash his hands before shaving ($P = 0.012$). The practice of rural clients was better regarding refusing shaving with used instruments ($P < 0.001$) and asking the barber to disinfect used instruments (but not statistically significant) (Table 5).

On observing barber's shops and their practice during shaving it was found that, in general, the majority of shops were well-equipped, clean and neat. Rural shops were significantly better than urban shops regarding the electric supply and ventilation while urban shops were better regarding the presence of washing facilities and good decoration. Observations during shaving revealed that using a razor machine, throwing used blades in the waste bin and disinfection of skin cuts were practised by more than three-quarters of barbers with a significantly higher rate of use of a razor machine among urban compared with rural barbers ($P < 0.001$). Using alum as antiseptic for skin cuts was practised by a higher percentage of urban than rural barbers, while rural clients were more likely to change the blade for each client ($P < 0.001$) (Table 6).

Discussion

The prevalence of HBV and HCV infection has been widely investigated in many occupational groups, but few data are available on the prevalence in barber shops. Therefore, this study may fill a gap.

The prevalence of HBsAg has been reported to range from 3% to 11% in Egypt [12]. In the present study, the total prevalence of HBsAg detected was 4.1%, which is near the lower limit of the recorded national range. This rate is lower than that reported among barbers in Turkey (8.5%) [13], but higher than among barbers in Morocco where HBV was found in only 2% of 150 barbers [14].

Qirbi et al. stated that HBV is generally associated with poor socioeconomic conditions [15]. However, the present study revealed that HBsAg was more prevalent among urban barbers and clients, who may be assumed to be of higher social class, than rural subjects. In contrast, our study revealed a higher prevalence of HCV infection among barbers and clients of rural areas than urban ones. These results are similar to the findings of previous studies among the general population that attribute the higher figures in rural areas to the endemicity of schistosomiasis and the use of glass syringes for parenteral treatment in the past decades. In addition, these studies observed that the seroprevalence rates of HCV were much higher in villages in the Nile Delta region compared with Upper Egypt and this was correlated with the difference in schistosomiasis infection rates in both regions [16,17]. Other workers assume that schistosomiasis-induced immune

Table 2 Knowledge of barbers and clients about hepatitis B (HBV) and C virus (HCV) infection

Knowledge item	Barbers (<i>n</i> = 308)		Clients (<i>n</i> = 308)		Total (<i>n</i> = 616)		χ^2 -value	<i>P</i> -value
	No.	%	No.	%	No.	%		
<i>General awareness</i>								
Ever heard about liver diseases	268	87.0	284	92.2	552	89.6	3.92	0.048*
Ever heard about viral hepatitis B & C	265	86.0	250	81.2	515	83.6	2.32	0.128
Knew modes of transmission								
Blood transfusion	285	92.5	290	94.2	575	93.3	0.42	0.518
Reusing needles	279	90.6	289	93.8	568	92.2	1.83	1.176
Dental procedures	261	84.7	275	89.3	536	87.0	2.43	0.119
IV drug use	271	88.0	262	85.1	533	86.5	0.89	0.345
Scissors/surgical instruments	256	83.1	271	88.0	527	85.5	2.57	0.109
Barbers shaving instruments	239	77.6	254	82.5	493	80.0	1.99	0.158
Ear/body piercing	205	66.6	230	74.7	435	70.6	4.51	0.034*
Sexual contact	203	65.9	217	70.5	420	68.2	1.26	0.261
Tattooing	196	63.6	223	72.4	419	68.0	5.04	0.025*
Sharing utensils	150	48.7	167	54.4	317	51.5	1.66	0.197
Food	114	37.0	126	40.9	240	39.0	0.83	0.363
Water	78	25.3	104	33.8	182	29.5	4.87	0.027*
Others	103	33.4	56	18.2	159	25.8	17.94	0.001*
<i>Complications/treatment of viral hepatitis</i>								
On liver	43	14.0	64	20.8	107	17.4	4.52	0.033*
On general health	32	10.4	33	10.7	65	10.6	0.02	0.895
Presence of HBV treatment	55	17.9	57	18.5	112	18.2	0.01	0.917
Presence of vaccine for HBV	125	40.6	138	44.8	263	42.7	0.96	0.328
Presence of HCV treatment	111	36.0	89	28.9	200	32.5	3.27	0.071
Presence of vaccine for HCV	81	26.3	73	23.7	154	25.0	0.42	0.515
<i>Source of information</i>								
Friends & relatives	142	46.1	153	49.7	295	47.9	0.650	0.420
Television	148	40.1	117	38.0	265	43.0	5.960	0.014*
Newspapers	99	32.1	127	41.2	226	36.7	5.090	0.024*
Doctors	76	24.7	109	35.4	185	30.0	7.910	0.005*
Radio	61	19.8	74	24.0	135	21.9	1.370	0.245
Health care workers	16	5.2	44	14.3	60	9.7	13.46	0.001*
Others	47	15.2	15	4.9	62	10.1	17.12	0.001*

* $P < 0.05$.

More than 1 answer was reported.

IV = intravenous.

Table 3 Attitude of barbers and clients towards risk factors for hepatitis

Attitude item	Barbers (n = 308)		Clients (n = 308)		Total (n = 616)		χ^2 -value	P-value
	No.	%	No.	%	No.	%		
Concerned about status of used blades	209	67.9	171	55.5	380	61.7	9.40	0.002*
Concerned about using antiseptics	172	55.8	217	70.5	389	63.1	13.51	0.001*
Concerned about using disposable syringes	151	49.0	206	66.9	357	58.0	19.43	0.001*

* $P < 0.05$.

Table 4 Shaving practices of barbers in their shops by residence

Practice item	Barbers' residence				Total (n = 308)		χ^2 -value	P-value
	Urban (n = 161)		Rural (n = 147)					
	No.	%	No.	%	No.	%		
Changes the blade for each client	150	93.2	141	95.9	291	94.5	0.650	0.420
Disinfects the instruments	117	72.7	120	81.6	237	76.9	2.990	0.084
Only washes the used instruments	103	64.0	69	46.9	172	55.8	8.370	0.004*
Washes hands	104	64.6	90	61.2	194	63.0	0.240	0.621
Wears protectiveclothes/or gloves	85	52.8	14	9.6	99	32.1	64.00	0.001*
Disinfectant used								
Perfume	82	50.9	46	31.3	128	41.6	11.41	0.001*
Savlon®	79	49.1	47	32.0	126	40.9	8.60	0.003*
Alcohol	61	37.9	50	34.0	111	36.0	0.35	0.556
Talcum powder	34	21.1	7	4.8	41	13.3	16.42	0.001*
Povidone/iodine	14	8.7	15	10.2	29	9.4	0.07	0.797
Hydrogen peroxide	17	10.6	2	1.4	19	6.2	9.70	0.002*
Dettol®	8	5.0	9	6.1	17	5.5	0.04	0.847
Water	4	2.5	5	3.4	9	2.9	FE	0.741
Alum crystals (shaba)	1	0.6	4	2.7	5	1.6	FE	0.196
None	3	1.9	3	2.0	6	1.9	FE	1.000
Changes disinfectant frequently	91	56.5	89	60.5	180	58.4	0.36	0.549

* $P < 0.05$.

More than 1 answer was reported.

FE = Fisher exact test.

suppression could increase the persistence of viraemia following acute infection with both HBV and HCV and this could partly explain the high prevalence of HCV infection in Egypt [18,19]. However, no association was observed between HCV and *Schistosoma mansoni* infection in endemic areas in either Egypt or Brazil [20,21].

Many workers consider infection with HBV and HCV to be an

occupational hazard for barbers [10,22]. Other researchers consider barbers a source of infection to their clients, especially when there is reuse of razor blades that may transmit infection through micro-trauma [23,24]. However, others found no relation between shaving by community barbers and infection with viral hepatitis [5]. Özdemir et al. concluded that HBV and HCV infections are not occupational risks

for barbers and hairdressers [24]. The same can be concluded from the results of the present study, as the rate of viral hepatitis infection among barbers was the same as that among their regular clients and was similar to the prevalence in the general population in Egypt [4,5,16]. This is consistent with our finding that barbers and their clients were not generally being exposed to risk factors for HBV and HCV infection

Table 5 Shaving practices of clients at barber shops by residence

Practice item	Clients' residence				Total (n = 308)		χ^2 -value	P-value
	Urban (n = 161)		Rural (n = 147)					
	No.	%	No.	%	No.	%		
Verifies the status of instruments	130	80.7	89	60.5	219	71.1	14.29	0.001*
Asks if the instruments has been disinfected	58	36.0	65	44.2	123	39.9	1.82	0.177
Asks barber to disinfect the instruments	72	44.7	74	50.3	146	47.4	0.76	0.383
Refuses shaving with used instruments	53	32.9	106	72.1	159	51.6	45.70	0.001*
Brings his own instruments	44	27.3	23	15.6	67	21.8	5.49	0.019*
Asks barber to wash his hands before shaving	30	18.6	12	8.2	42	13.6	6.29	0.012*

* $P < 0.05$.

Table 6 Observations of conditions in barber shops and barbers' shaving practices

Observation items	Urban (<i>n</i> = 161)		Rural (<i>n</i> = 147)		Total (<i>n</i> = 308)		χ^2 -value	<i>P</i> -value
	No.	%	No.	%	No.	%		
<i>Barber shop</i>								
Has adequate electric supply	116	72.0	127	86.4	243	78.9	8.65	0.003*
Has adequate ventilation	112	69.6	130	88.4	242	78.6	15.15	0.001*
Has ceiling fans/airconditioning	112	69.6	123	83.7	235	76.3	7.70	0.005*
Is clean and neat	110	68.3	110	74.8	220	71.4	1.29	0.256
Has adequate sinks for washing hands and face	109	67.7	110	74.8	219	71.1	1.57	0.210
Has good washing facilities	89	55.3	65	44.2	154	50.0	3.33	0.068
Is decorative/attractive	97	60.2	56	38.1	153	49.7	14.21	0.001*
Situated on main road	67	41.6	61	41.5	128	41.6	0.01	0.924
Situated in internal market area	44	27.3	31	21.1	75	24.4	1.30	0.253
<i>Barber's practices during shaving</i>								
Uses razor machine	154	95.7	119	81.0	273	88.6	15.06	0.001*
Throws used blades in waste bin	137	85.1	126	85.7	263	85.4	0.02	0.877
Properly disinfects skin cuts	123	76.4	119	81.0	242	78.6	0.70	0.404
Washes razor with antiseptic	122	75.8	95	64.6	204	66.2	4.07	0.044*
Sterilizes the razor before use for each client	85	52.8	89	60.5	174	56.5	1.58	0.209
Causes cuts from razor machine	118	73.3	56	38.1	174	56.5	37.31	0.001*
Uses alum as antiseptic for skin cuts	99	61.5	61	41.5	160	51.9	11.52	0.001*
Uses new razor for each client	86	53.4	118	80.3	135	43.8	23.59	0.001*
Puts used blades in the box	62	38.5	33	22.4	95	30.8	8.55	0.003*
Washes razor with tapwater only	23	14.3	16	10.9	39	12.7	0.53	0.468

* $P < 0.05$.

and that knowledge and practices were good among a considerable percentage of barbers.

In our study, the level of knowledge among barbers and their clients was relatively high, especially regarding modes of transmission. But there were information deficits about the complications and treatment of hepatitis, perhaps because friends and relatives were an important source of information. Studies carried out in Morocco, Ethiopia and Pakistan showed that the level of knowledge and awareness of barbers about the concept of infectious risk associated with blood was generally very low, especially for HBV and HCV [14,25,26]. Poor knowledge and lack of awareness of the general public about HBV and HCV is the main cause of the rapid spread of these infections in

developing countries compared with developed ones [26,27].

In previous studies, it was found that the proportion of barbers with a positive attitude to the risk of virus transmission was greater than the proportion of those with good knowledge and good practice [22,25]. The present study showed that there were positive attitudes towards safe injections and use of antiseptics, especially among clients. The practices of barbers were also generally sound, as similarly documented in Pakistan [27]. However, the practice of throwing used blades in the waste bin poses a major risk to garbage handlers and waste scavengers, who in Egypt and other developing countries commonly search the waste dumps for valuable items and metals and are also likely to be children.

The majority of barber shops in Gharbia governorate had good hygiene conditions, whereas Zahraoui-Mehadij et al. reported that hygienic conditions were deficient among barbers in Morocco [15].

There were some limitations to the study. The sample size of barbers was chosen to be representative of all barbers in the studied areas. However, the sample size of clients was small and not fully representative of all clients. Thus the study gives only a general picture of the situation among clients.

Conclusions

This study revealed a very similar infection rate of HBV and HCV among barbers and their clients to that reported nationally. The prevalence of HBV and

HCV among barbers was similar to that among clients. Barbers appeared to have no job-related risk of acquiring viral hepatitis. This may be due to the relatively good knowledge among barbers about modes of transmission and positive attitude towards protecting themselves and their clients and also due to good practices by the majority of

the studied barbers and good hygiene conditions in barber shops.

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HIV/AIDS knowledge, attitudes and beliefs among a group of Iraqis

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المعرفة والتوجهات والمعتقدات الخاصة بمرضى الإيدز والمعايشين لفيروسه بين مجموعة من العراقيين

علي حسن حياوي، عفراء يوسف المراتي، وسام شاكر سلمان، وضاح حامد عبود

الخلاصة: تهدف هذه الدراسة إلى بناء المرتسم القاعدي للمعرفة والتوجهات والمعتقدات بين العراقيين حول مرضى الإيدز والمعايشين لفيروسه. وقد أجريت مقابلات باستخدام استمارة استبيان في عام 2006 مع 335 شخصاً من المراجعين لمراكز فحص فيروس الإيدز في مدينة بغداد. وقد سمع أغلب المراجعين (بنسبة 82.7%) عن الإيدز، وأغلب المعلومات التي حصلوا عليها عن طريق وسائل الإعلام العامة (بنسبة 71.0%)، ويعرف 91.9% منهم بأن الإيدز مرض معد، وأنه غالباً ما ينتقل عن طريق العلاقات الجنسية (74.9%). ولم يوجد ارتباط بين مستوى المعرفة وقبول رعاية المعاشين للإيدز أو الزواج منهم، ولكن كان هناك ارتباط يعتد به إحصائياً بين مستوى المعرفة والتوجهات السلبية نحو مشاركة الطعام، أو الجلوس في الحافلات، أو العمل في نفس الموقع مع المعاشين لفيروس الإيدز.

ABSTRACT This study aimed to build a baseline profile of knowledge, attitudes and beliefs of Iraqis toward HIV/AIDS. Questionnaire interviews were conducted in 2006 with 335 people attending HIV testing centres in Baghdad. Most respondents (82.7%) had heard about AIDS, mainly from the mass media (71.0%), and 91.9% knew that AIDS is an infectious disease, most commonly via sexual relationships (74.9%). There was no association between knowledge level and acceptance of caring for an HIV-positive relative or marrying an HIV-positive partner, but there was a significant association between low knowledge level and negative attitudes towards sharing food, sitting on the bus and working at the same place with an HIV-positive individual.

Connaissances, attitudes et croyances en matière de VIH/sida dans un groupe d'Iraqiens

RÉSUMÉ Cette étude visait à élaborer un profil de référence des connaissances, des attitudes et des croyances des Iraqiens concernant le VIH/sida. Des entretiens par questionnaire ont été réalisés en 2006 auprès de 335 personnes fréquentant des centres de dépistage du VIH à Bagdad. La plupart des personnes interrogées (82,7 %) avaient entendu parler du sida, principalement par le biais des médias (71,0 %), et 91,9 % d'entre elles savaient que le sida est une maladie infectieuse qui se transmet le plus souvent lors de relations sexuelles (74,9 %). Il n'existait pas d'association entre le niveau de connaissances et le fait d'accepter de s'occuper d'un membre de la famille séropositif ou de se marier avec une personne séropositive, mais il existait une association significative entre un faible niveau de connaissances et des attitudes négatives concernant le fait de partager la nourriture d'une personne séropositive, de s'asseoir dans un bus avec elle ou de travailler au même endroit qu'elle.

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Introduction

Acquired immunodeficiency syndrome (AIDS) is one of the most complex health problems of the 21st century [1]. The AIDS epidemic is in its 3rd decade and has become a pandemic disease that threatens the world population [2]. Moreover, it continues to spread at an alarming rate [3]. Human immunodeficiency virus (HIV) is present in the blood and body fluids of infected individuals, whether symptomatic or asymptomatic. The main modes of transmission are sexual contact, exposure to infected blood or blood products and perinatal transmission [4].

In the absence of a vaccine or cure for HIV/AIDS, public health education is still the best means of combating the pandemic [5]. Public understanding of the virus is growing but many behavioural aspects of the epidemic remain incompletely documented and poorly understood. The impact of prevention programmes on behaviour remains uncertain because they frequently lack complementary information on changes in behaviour or because behavioural data are not collected or are incomplete [6].

Several studies conducted in countries in Asia and North Africa have evaluated HIV/AIDS knowledge, attitudes and practice of certain target populations such as university students [3,5,7], army students [8], soldiers [9], street children/youth [10] and nurses [11]. Young people are particularly at risk of HIV infection because they are in the transition phase of their life, experimenting with sexual experiences and drug use [3]. The present study in Baghdad, Iraq covered a non-homogenous sector of the community (people attending HIV testing centres) and aimed to build a baseline profile of knowledge, attitudes and beliefs regarding HIV/AIDS among the study group. The study was also seen an opportunity to distribute correct information and

to correct misconceptions about different aspects of HIV/AIDS among this group.

Methods

Setting and sample

A cross-sectional study was conducted in the Al-Risafa area of Baghdad. The area has 4 HIV testing centres that perform premarital counselling and testing, testing for Iraqis returning from other countries and voluntary counselling and testing. One centre also issues international health certificates on request.

A convenience sample of 335 subjects from both sexes attending the 4 HIV testing centres from April to June 2006 constituted the study group.

Questionnaire

A questionnaire was constructed to meet the purpose of the study based on similar studies of knowledge and attitudes in different countries [1,3,12,13]. The questions were modified according to Iraqi culture and social norms. The questionnaire included data related to personal information, knowledge and beliefs about HIV/AIDS, sources of knowledge, and attitudes toward HIV patients. The questionnaire was filled through a direct interview.

The possible responses to each question were yes, no or don't know, and items were scored as 2 (correct), 1 (don't know) or 0 (incorrect), with a maximum score of 17. The median score (14) was calculated and the subjects were categorized into high knowledge level (> 14) and low knowledge level (≤ 14) groups.

A pilot study was done on a sample of 25 individuals drawn from the same testing centres. According to their responses, some questions were modified to make them more applicable. The pilot sample was not included in the study.

Ethical issues

Written permission for the study was obtained from the appropriate local authority health manager. The questionnaire was administered to those who gave their verbal consent to participate. Participation was voluntary after explaining the purpose of the study to each individual. The questionnaire was anonymous and participants were assured of the confidentiality of their responses.

Statistical analysis

The data were analysed using SPSS, version 12. The data were expressed as frequencies and percentages. The chi-squared test was used and a P -value of ≤ 0.05 was considered as significant.

Results

A total of 335 respondents were included in the study: 196 (58.5%) males and 139 (41.5%) females. The mean age was 28 (standard deviation 9) years and 94.0% of the respondents were aged 44 years or less (Table 1).

Of the study group 79.1% were unmarried, 83.0% had secondary or higher education and 36.4% were employees. The proportion of respondents with high knowledge increased significantly with increasing educational status ($P < 0.001$) (Table 2). There was no significant association between knowledge level and marital status ($P = 0.16$) but the association with occupation was significant ($P = 0.021$); employees had the greater knowledge than other occupation groups. Couples attending for premarital testing constituted 69.0% of the study group, followed by those attending for international health certificates (19.7%) and people returning from travel abroad (11.3%). Higher knowledge was significantly associated with attending for travel-related reasons compared with premarital testing ($P = 0.012$) (Table 2).

A high proportion of the study group (277, 82.7%) reported having heard about HIV/AIDS. Mass media was the main source of knowledge for 238 respondents (71.0%), principally local television and satellite channels (49.3%), followed by newspapers and magazines (7.2%), folders/leaflets (3.6%), radio broadcasts (3.0%) or all of these (8.1%). People were the second source of information (145, 43.3%), mainly medical staff (28.7%), followed by friends (7.5%), relatives (6.3%) or all of these (0.9%). Educational programmes were the lowest source of information (31, 9.3%).

The majority of the study group (308, 91.9%) knew that AIDS was an infectious disease (Table 3). A high proportion (72.7%) reported the possibility of transmission of the virus from the infected mother to her infant, while 11.5% denied this possibility while only

Table 1 Age and sex distribution of respondents attending an HIV testing centre in Baghdad

Age group (years)	Female		Male		Total	
	No.	%	No.	%	No.	%
15-24	76	54.7	52	26.2	128	38.2
25-34	47	33.8	91	46.4	138	41.2
35-44	10	7.2	39	19.9	49	14.6
45-54	4	2.9	10	5.1	14	4.2
55+	2	1.4	4	2.0	6	1.8
Total	139	41.5	196	58.5	335	100.0

37.5% reported the possibility of transmission of HIV through breastfeeding with 26.0% denying this as a method of transmission (Table 3). Just over half of the respondents (54.9%) thought that AIDS was not a curable disease while 26.6% thought that it was curable and 18.5% did not know. Similar proportions had incorrect and correct knowledge about the existence of a vaccine (34.9% and 39.4% respectively) and 25.7% admitted they did not know

about the presence of a vaccine. A majority of the study group knew that sexual relationships were a method of transmission (251, 74.9%) and a high percentage gave a correct response about blood transfusion (71.6%) and sharing syringes and sharp instruments (68.7%) as methods of transmission. On the other hand, more than half of the sample believed incorrectly that HIV was transmitted by sharing food (56.7%), shaking hands and social

Table 2 Distribution of HIV/AIDS knowledge level according to marital status, educational level, occupation and reason for attendance at centre among respondents attending an HIV testing centre in Baghdad

Variable	HIV/AIDS knowledge level						Statistical tests
	Low (n = 173)		High (n = 162)		Total (n = 335)		
	No.	%	No.	%	No.	%	
Marital status							
Single	144	83.2	121	74.7	265	79.1	$\chi^2 = 1.96, df = 1, P = 0.16$
Married	28	16.2	37	22.8	65	19.4	
Separated	1	0.6	4	2.5	5	1.5	
Educational status							
Illiterate	10	5.8	1	0.6	11	3.3	$\chi^2 = 19.65, df = 3, P < 0.001$
Primary	29	16.8	17	10.5	46	13.7	
Secondary	82	47.4	62	38.3	144	43.0	
Higher	52	30.1	82	50.6	134	40.0	
Occupation							
Housewife	41	23.7	27	16.7	68	20.3	$\chi^2 = 9.72, df = 3, P = 0.021$
Employee	48	27.7	74	45.7	122	36.4	
Manual worker	60	34.7	41	25.4	101	30.2	
Student	24	13.9	20	12.3	44	13.1	
Reason for attendance							
Premarital test	131	56.7	100	43.3	231	69.0	$\chi^2 = 8.82, df = 2, P = 0.012$
International health certificate	24	36.4	42	63.6	66	19.7	
Back from travel	18	47.3	20	52.7	38	11.3	

df = degrees of freedom.

Table 3 Knowledge and beliefs about HIV and its modes of transmission among respondents attending an HIV testing centre in Baghdad (*n* = 335)

Item	Yes		No		Don't know	
	No.	%	No.	%	No.	%
AIDS is infectious	308	91.9	27	8.1	0	0.0
Possible to transmit AIDS from mother-to-child	249	72.7	34	11.5	52	15.8
Possible to transmit AIDS through breastfeeding	125	37.5	89	26.0	121	36.5
AIDS is curable	89	26.6	184	54.9	62	18.5
Vaccine against AIDS exists	117	34.9	132	39.4	86	25.7
Modes of transmission of HIV						
Sexual relationship	251	74.9	84	25.1	–	–
Blood transfusion	240	71.6	95	28.4	–	–
Sharing syringes & sharp instruments	230	68.7	105	31.3	–	–
Sharing food	190	56.7	145	43.3	–	–
Shaking hands & social relations	188	56.1	147	43.9	–	–
Sharing bathroom & toilet	181	54.0	154	46.0	–	–
Insect bite	169	50.4	166	49.6	–	–

relationships (56.1%), sharing a bathroom and toilet (54.0%) and insect bites (50.4%).

Table 4 shows the attitude of the individuals in the study group toward HIV-positive relatives and shows that there was no significant association between knowledge level and acceptance of caring for an HIV-positive relative ($P = 0.11$) or not changing marriage plans if the partner was found to be HIV positive ($P = 0.53$). However, respondents with a lower knowledge level were significantly more likely to have negative attitudes towards sharing food with an HIV-positive individual, sitting beside an HIV-positive individual in a bus or working with an HIV-positive individual in the same work place ($P = 0.003$, $P < 0.001$ and $P < 0.001$ respectively) (Table 4).

Discussion

The majority of the study group attending for HIV testing were in the reproductive age group, showing that the surveillance activities are properly targeting the at-risk group who are sexually active [3,14,15].

In our study high educational level was associated with higher knowledge about AIDS, which agrees with the findings of a study in Turkey in 2005 [12], presumably as those with higher education can utilize written mass media channels that are not accessible to those with lower educational status. The significant association between non-manual occupation and knowledge level can be explained by the relationship that exists between occupation and educational status.

Mass media, especially the visual, is an accessible, widespread and effective means of knowledge dissemination. Local television and satellite channels represented the main source of information about HIV/AIDS in this study, while people, including medical staff, ranked second. The role of television channels should be emphasized in distributing accurate, active and effective messages to the population, especially the younger age groups, about sexually transmitted diseases. These messages should match our social norms and religious values. Our results agree with the findings of studies conducted in Bangladesh and Thailand [16,17], but disagree with a study conducted in Saudi Arabia in which friends were the

main source of information for males and booklets for females [13].

A majority of respondents gave correct responses about the methods of transmission of HIV, especially regarding sexual relationships, sharing of syringes and sharp instruments and blood transfusion. There were misconceptions about the risk from insect bites and routine daily activities, such as sharing food with HIV/AIDS patients or sharing toilets and bathrooms, which agrees with the findings of other studies [13,18,19].

The majority of the study group accepted being a care provider for an HIV-positive relative, which can be explained by the strong family and social links in our society. The results of this study agree with those of a Ugandan study in 2000 which showed that 86.2% would provide care for relatives with HIV/AIDS [20], but disagrees with a study conducted in Kuwait during 1995 in which 72% were unwilling to take care of AIDS patients [21], and another study conducted in Sana'a, Yemen, which showed that only 21% thought that family members should provide care for HIV/AIDS patient and 51% thought that this care should be the responsibility of specialized staff in specialized centres [22].

Table 4 Distribution of HIV/AIDS knowledge level according to attitudes towards HIV-positive individuals among respondents attending an HIV testing centre in Baghdad

Variable	HIV/AIDS knowledge level						Statistical tests
	Low (n = 173)		High (n = 162)		Total (n = 335)		
	No.	%	No.	%	No.	%	
Agree to care for HIV-positive relative							
Yes	119	68.8	125	77.2	244	72.8	$\chi^2 = 4.303$, df = 2, $P = 0.116$
No	21	12.1	19	11.7	40	11.9	
Don't know	33	19.1	18	11.1	51	15.2	
Continue with marriage plan if partner is found to be HIV positive							
Yes	59	34.1	46	28.4	105	31.3	$\chi^2 = 1.274$, df = 2, $P = 0.529$
No	83	48.0	85	52.5	168	50.1	
Don't know	31	17.9	31	19.1	62	18.5	
Eating with an HIV-positive individual							
Continue eating	35	20.2	56	34.6	91	27.2	$\chi^2 = 11.79$, df = 2, $P = 0.003$
Shift to other table	35	20.2	38	23.5	73	21.8	
Leave the place	103	59.5	68	42.0	171	51.0	
Sitting beside an HIV-positive individual in a bus							
Stay in place	39	22.5	58	35.8	97	29.0	$\chi^2 = 16.66$, df = 2, $P < 0.001$
Change place	37	21.4	49	30.2	86	25.7	
Leave the bus	97	56.1	55	34.0	152	45.4	
Working with an HIV-positive individual							
Stay in work	36	20.8	59	36.4	95	28.4	$\chi^2 = 13.57$, df = 2, $P < 0.001$
Ask to shift to another department	71	41.0	66	40.7	137	40.9	
Leave work	66	38.2	37	22.8	103	30.7	

df = degrees of freedom.

Over a quarter of the study group (26.6%) thought that AIDS was a curable disease, which is close to the results of a Turkish study (30%) conducted during 2005 [12]. More than one-third of the respondents (34.9%) thought that there was a vaccine against the disease which is higher than the results of an Iranian study (11%) conducted during 2004 [3]. These false beliefs reflect risky misconceptions which need to be corrected by effective educational information.

Respondents' knowledge level was associated with negative attitudes towards HIV-positive individuals in public places and at work, since the group with higher knowledge level were more

accepting towards contact with HIV-positive individuals than those with low knowledge level. This agrees with the results of the Turkish study where people with good knowledge about AIDS were more tolerant of people with AIDS [12]. However, more than half of our study sample overall would avoid HIV-positive individuals at work or in public.

Conclusion

The sample in this study may not necessarily represent the population of Baghdad but it does represent an important subgroup of Baghdadis for

evaluating knowledge and attitudes towards HIV/AIDS individuals. The study identified many misconceptions and negative attitudes that need to be addressed. A nationwide health education programme through mass media campaigns and introduction of HIV/AIDS education into the secondary school curriculum are recommended to overcome misconceptions, spread awareness and, hopefully, modify behaviour.

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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.

Seroprevalence of *Toxoplasma gondii* in unmarried women in Qazvin, Islamic Republic of Iran

H. Jahani Hashemi¹ and M. Saraei²

الانتشار المصلي للمقوسة العونية *Toxoplasma gondii* بين النساء غير المتزوجات في قازفين، جمهورية إيران الإسلامية
حسن جهاني هاشمي، مهرزاد سرايي

الخلاصة: في دراسة مقطعية عرضية، قيم الباحثان الانتشار المصلي للمقوسة العونية *Toxoplasma gondii* بين 400 امرأة جرى إحالتهم إلى مختبر مركز قازفين لصحة المجتمع لإجراء الفحوص السابقة للزواج. وأجري لهن اختبار التآلق المناعي غير المباشر للأضداد، وذلك لاكتشاف الغلوبين المناعي G المضاد للمقوسة. واعتبر العيار يساوي أو يزيد عن 20:1 نتيجة إيجابية. وكانت الحساسية المصلية الإجمالية 34%. ومتوسط العمر كان أعلى على نحو يُعتدُّ به إحصائياً في النساء الإيجابيات للمصل (p أقل من 0.05). وكانت الحساسية المصلية أعلى ما تكون بين النساء غير العاملات (38.3%) وكانت أقل ما تكون بين التلميذات (22.6%). وحيث أن ثلثي النساء غير المتزوجات كن سليات للمصل، فهن يشكلن مجموعة عالية الخططار في الحمل، وتحتاج هؤلاء النساء إلى التثقيف لمنع الإصابة بداء المقوسات الخلقي.

ABSTRACT In a cross-sectional study, we evaluated the seroprevalence of *Toxoplasma gondii* among 400 women referred to Qazvin community health centre laboratory for pre-marriage examinations. Indirect immunofluorescent antibody test was used to detect IgG anti-toxoplasma. Titres $\geq 1:20$ were considered positive. The overall seropositivity was 34%. Mean age was significantly higher in seropositive women ($P < 0.05$). Seropositivity was highest among unemployed women (38.3%) and lowest among students (22.6%), and was significantly higher in women with less than high-school education ($P < 0.05$). With two-thirds of these unmarried women seronegative, they represent a high-risk group in pregnancy. Such women need to be educated to prevent congenital toxoplasmosis.

Séroprévalence de *Toxoplasma gondii* chez les femmes non mariées à Qazvin (République islamique d'Iran)

RÉSUMÉ Dans une étude transversale, nous avons évalué la séroprévalence de *Toxoplasma gondii* chez 400 femmes adressées au laboratoire du centre de santé communautaire de Qazvin en vue d'examens prénuptiaux. La détection des anticorps anti-toxoplasmose de type IgG a été réalisée grâce à la technique de l'immunofluorescence indirecte. Les titres supérieurs ou égaux à 1/20 ont été considérés comme positifs. La séropositivité globale s'élevait à 34 %. L'âge moyen était significativement plus élevé chez les femmes séropositives ($P < 0,05$). La séropositivité la plus élevée se trouvait chez les femmes sans emploi (38,3 %) et la plus faible, chez les étudiantes (22,6 %) ; elle était significativement plus élevée chez les femmes qui avaient arrêté leur scolarité avant le secondaire ($P < 0,05$). Les deux tiers de ces femmes non mariées étant séronégatives, elles pourraient représenter un groupe à haut risque au moment de la grossesse. Une action éducative doit être menée auprès d'elles afin de leur éviter de contracter une toxoplasmose congénitale.

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Introduction

When seronegative women are infected with *Toxoplasma gondii* during pregnancy, the parasite may be congenitally acquired through the placenta. The rate of fetal transmission during first infection is 10%–25% in the first trimester, 30%–54% in the second and 60%–65% in the third [1]. Congenital toxoplasmosis can have serious consequences and may result in mental retardation, blindness and death [2].

Seroepidemiology of *T. gondii* has been reported in many countries. A high seroprevalence has been found in developed countries, such as France, where undercooked meat is commonly eaten [3], and in tropical areas where cats are abundant and the climate favours survival of oocysts [4].

In the Islamic Republic of Iran, at least 30% of people are seropositive for *T. gondii* immunoglobulin G (IgG) in most regions, with the highest reported prevalences being in Gilan and Mazandran provinces (north of the country) [5,6]. Since seronegative pregnant women are at high risk for congenital toxoplasmosis, studies on *T. gondii* have focused on such women [7]. However, there is no national programme for the prevention of congenital toxoplasmosis in the Islamic Republic of Iran.

The aim of this study was to conduct a toxoplasmosis serosurvey among pre-marriage women to provide data for an educational programme that will be designed to prevent *T. gondii* infection in women of childbearing age.

Methods

Climatic conditions of the studied area

The study was carried out in Qazvin province, which is located about 120 km north-west of Tehran. The average temperature is 24–27 °C with a maximum of 40 °C in summer and a minimum of

–10 °C in winter. Rainfall varies from zero mm rainfall in August to 106.2 mm in December. The mean relative humidity is 16%–65% in summer and from 40%–86% in the winter.

Sample size determination

Using the formula:

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 P(1 - P)}{d^2}$$

where $\alpha = 0.05$, $\beta = 0.2$, $P = 0.4$, $d = 0.07$, the sample size was determined to be 384, so 400 women who referred to the laboratory were selected.

Subjects and collection of sera

The 400 women were selected from those referring to the laboratory of the Qazvin community medicine centre between January and March 2004 for screening for thalassaemia prior to marriage (a requirement in the Islamic Republic of Iran). All the women who referred to the laboratory over this period were included in the study; there were no exclusions. The sera were kept at –20 °C until testing. The age range of the women was 13–39 years with a mean of 20 years (the legal age of marriage in the country is 18 years; for marriage under this age a court certificate is required).

Data on age, occupation and education of the women were obtained by interview questionnaire.

Preparation of antigen

The antigen was prepared according to the method of Goldman [8] used by Ghorbani et al. [5] using *T. gondii* RH strain. Smears with approximately 30–40 tachyzoites per power field of microscope ($\times 400$) were dropped on a glass slide and air dried (12 uniform thick smears). The slides were stored at –20 °C until testing and used as antigen.

Immunofluorescence test

The immunofluorescence test (IgG-IFA) tests of sera samples were carried

out according to the procedure used by Ghorbani, Edrissian and Assad [5]. Briefly, each serum sample was first examined at dilutions of 1:20 and 1:400; if the latter dilution gave a positive result, 2-fold serial dilutions were made in order to determine the end point. Fluorescein isothiocyanate-conjugated rabbit anti-human IgG immunoglobulin (Daru Pakhash, Islamic Republic of Iran) was used at dilution of 1:50 in phosphate buffered saline with 1% Evans blue. The slides were examined under a Leitz fluorescence microscope, equipped with a Philips CS 200 W-4 mercury lamp, and a combination of exciter filters BG12 and BG3 and 570 mμ barrier filter.

Statistical analysis

Statistical analysis was performed using chi-squared test, *t*-test and analysis of variance (ANOVA) with $P < 0.05$ considered statistically significant.

Results

The overall, *T. gondii* seropositive rate (SPR) was 34%. IgG titres $< 1:20$, 1:20, 1:400, 1:800, 1:1600, 1:3200 and 1:6400 were observed in 264 (66%), 63 (15.8%), 39 (9.8%), 27 (6.8%), 3 (0.8%), 3 (0.8%) and 1 (0.3%) of the women respectively. IgG titres $\geq 1:1600$ were observed in 1.9% of the women.

With regard to occupation, no significant difference in SPR was observed between unemployed women living with their families (38.3%) and government employees (32.6%), but SPR in students (22.6%) was significantly lower than the unemployed women ($P < 0.05$) (Table 1). Mean ages of the unemployed women, government employees and students were 20 [standard deviation (SD) 0.6], 25.14 (SD 3.8) and 17.4 (SD 2.2) years respectively. Difference of mean ages was significant between the groups ($P < 0.001$) and, on post hoc comparison, this was due

Table 1 Distribution of IFA antibodies to *Toxoplasma gondii* in women referred for pre-marriage examinations according to occupation

Occupation	IgG < 1:20		IgG ≥ 1:20		Total	
	No.	%	No.	%	No.	%
Unemployed out side the home	153	61.7	95	38.3	248	100
Government officer	29	67.4	14	32.6	43	100
Student	48	77.4	14	22.6	62	100
Other	26	68.4	12	31.6	38	100
Total	256 ^a	65.5	135 ^b	34.5	391	100

^aWith 8 missing; ^bwith 1 missing.
IFA = immunofluorescence.

to the student and government officer groups.

As shown in Table 2, SPR of *T. gondii* in women with less than high-school education was significantly higher than in women with higher education ($P < 0.05$). The mean age of women with less than high-school education, high-school and higher than high school were 19.8 (SD 5.1), 20.6 (SD 2.9) and 23.1 (SD 3.7) years respectively. The difference in mean ages was significant between the 3 groups ($P < 0.001$) and, on post hoc comparison, this was due to subjects with higher than high-school education.

The SPR was not significantly different between urban and rural residents; SPR was 32% and 39.4% respectively. Mean age of urban residents was 20.7 (SD 4.1) years which was significantly higher than that of rural women [19.1 (SD 4)] years ($P < 0.001$).

Discussion

In the present study, 66% of pre-marriage women were seronegative. This figure is very close to the Daryani and Saghar study [9] that reported 65.3% in same group in Ardabil (north-west of the Islamic Republic of Iran). Such women will usually become pregnant early in marriage in our country. Therefore, they are considered a high-risk group for congenital toxoplasmosis, if they seroconvert in the pregnancy period.

Traditionally, screening for toxoplasmosis has been carried out in France [3] and Austria [10] as a mandatory part of prenatal care. Prenatal screening has also been carried out in pilot projects in countries such as Finland [11], Sweden [12] and Brazil [13]. The screening programmes have revealed congenital toxoplasmosis prevalence values varying from 1 per 1000 [10] to 1 per 10 000 [14] live births in Austria and the United States of America (Massachusetts) respectively. In the Islamic Republic of Iran, frequency of susceptible pregnant women in the first prenatal consultation (being seronegative) is not known. However, pregnant women at high risk of fetal transmission of toxoplasmosis at the beginning of pregnancy could be identified during this consultation.

It is generally accepted that the prevalence of antibodies in human populations depends on geographic, climatic, hygiene and socioeconomic conditions, as well as on the lifestyle of the population [15]. Studies have indicated that

the prevalence of *T. gondii* varies greatly in different areas of the Islamic Republic of Iran. The highest prevalence has been reported from Gilan and Mazandran provinces (in the north of the country) [5,6] where the environmental conditions are more favourable for maturation and survival of oocysts than other regions. Qazvin is a southern neighbour of Gilan and Mazandran provinces and it is a region with moderate *T. gondii* seroprevalence in comparison to them.

In our study, mean ages of the seropositive women were significantly higher than the seronegative ones. Seroprevalence of *T. gondii* is known to increase by age [2,15]; we assume that the increase is a reflection of increasing exposure years of women to *T. gondii*. Infection with *T. gondii* starts with a short acute phase and proceeds to a latent phase when cysts are formed; these survive for the rest of the host's life, mainly in neural and muscular tissues. Data suggest that toxoplasma infection in humans is life-long, namely: there is a slow decrease in specific antibodies to *T. gondii* in an infected individual [16]; the frequency of seroconversion (loss of specific antibodies) among seropositive subjects is extremely low [17]; and there is a high frequency of reactivation of toxoplasmosis in seropositive AIDS patients [18]. IgG antibodies to *T. gondii* usually appear within 1 to 2 weeks of acquisition of the infection and peak within 1 to 2 month, then fall at variable rates, and usually persist for life [1].

Our results show that SPR in the unemployed women was significantly

Table 2 Distribution of IFA antibodies to *Toxoplasma gondii* in women referred for pre-marriage examinations according to education

Education	IgG < 1:20		IgG ≥ 1:20		Total	
	No.	%	No.	%	No.	%
< High school	80	56.7	61	43.3	141	100
High school	139	72.0	54	28.0	193	100
> High school	45	68.2	21	31.8	66	100
Total	264	66.0	136	34.0	400	100

IFA = immunofluorescence.

higher than students. The difference is probably due to age; mean ages of the unemployed women were significantly higher than the students. Toxoplasma prevalence in women with less than high-school education was significantly higher than in women with higher education. Lower levels of education are usually associated with lower socio-economic status and may be related to employment in jobs with greater soil exposure. We found no significant difference in seroprevalence between urban and rural residents. Some studies showed higher *T. gondii* seropositivity among people who live in rural areas, but other studies have failed to show any difference [15,19–22].

Predicting future trends in *T. gondii* prevalence in the Islamic Republic of Iran is difficult because we do not have

a national estimate of what proportion of *T. gondii* infections are attributable to undercooked meat exposure, cat faeces, soil or water exposure. Currently, there are no tests that can discriminate between oocyst ingestion and tissue cyst ingestion as the infection route. Considering the abundance of domestic and stray cats in the country, the consumption of uncooked vegetables and the suitable climatic conditions for sporulation of *T. gondii* oocysts, it seems that exposure to cat faeces is the principal route for *Toxoplasma* infection in the most parts of the country. Consumption of undercooked meat (kebabs) could be a second possible means for acquiring Toxoplasma infection in the area studied.

These data suggest that two-thirds of pre-marriage women in Qazvin are

susceptible to acute toxoplasma infection. For this reason, it is important that women of childbearing age, especially pregnant women, be educated about the risk factors for *T. gondii* infection such as the danger of eating raw or undercooked meat, soil-related hygiene and handling of cats.

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Regional workshop on the implementation of best practices in family planning

The World Health Organization (WHO) organized the Regional Workshop on the Implementation of Best Practices in Family Planning, in Amman, Jordan, from 27 to 30 September 2009

The objective of the Workshop is to build capacity in data collection and analysis. Experts from all countries of the Region, as well as from the United States and the United Kingdom, representatives of UNRWA, IPPF, UNFPA, UNICEF, USAID and the Population Council in Jordan, as well as WHO concerned staff, participated in the Workshop.

The Workshop covered, inter alia: Implementing best practices initiative for improving family planning; Reproductive health programme in the Eastern Mediterranean Region; Commodity security for ensuring sustainable family planning service delivery; Information, education and communication for promoting family planning practices; The ten elements of successful family planning; Mapping the implementation of best practices in family planning in the Eastern Mediterranean Region; Promoting family planning through community-based interventions; and Successful national family planning programme experiences in Egypt, Iran and Tunisia.

Comparison of pregnancy and implantation rates in zygote intrafallopian transfer and uterine embryo transfer for nontubal infertility

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مقارنة الحمل ومعدلات انغراس البويضة في العقم غير الأنبوبي بين نقل الزيجوت (اللاقحة) إلى أنبوب فالوب، ونقل الجنين إلى الرحم

مرضيه آقا حسيني، أشرف آل ياسين، سبيده بيوندي، لادن كاشاني

الخلاصة: أجرى الباحثون تجربة معشاة استباقية على 220 زوجاً يعانون من العقم غير الأنبوبي لمقارنة معدلات الحمل ومعدلات انغراس البويضة بعد نقل الزيجوت (اللاقحة) إلى أنبوب فالوب (ZIFT) وبعد نقل الجنين إلى الرحم (UET). وجرى نقل الزيجوت (اللاقحة) إلى أنبوب فالوب عن طريق تنظير البطن بعد 24 ساعة من الحصول على البويضة المتكيسة. وجرى نقل الجنين داخل الرحم بعد 72 ساعة من الحصول عليه بمساعدة التخطيط الصوتي البطني. وجرى نقل الزيجوت إلى أنبوب فالوب في 102 دورة، بينما جرى نقل الجنين إلى الرحم في 100 دورة. كانت معدلات الحمل وانغراس البويضة أعلى في مجموعة نقل الزيجوت إلى أنبوب فالوب (42.1%) مقارنة بمجموعة نقل الجنين إلى الرحم (21.0%) (UET) (7.8%) (فاصلة الثقة P أقل من 0.05). وبذلك يمكن الأخذ في الاعتبار إجراء نقل الزيجوت إلى أنبوب فالوب للزوجين اللذين لديهم وقت محدود ولديهم دعم مالي كافٍ.

ABSTRACT We carried out a prospective randomized trial on 220 couples with nontubal factor infertility to compare pregnancy rates and implantation rates after zygote intrafallopian transfer (ZIFT) and uterine embryo transfer (UET). The zygote was transferred by laparoscopy into the fallopian tube 24 hours after oocyst retrieval. UET was performed 72 hours after retrieval with abdominal sonography guide. Transfer was performed in 102 cycles in the ZIFT and 100 cycles in the UET group. The pregnancy and implantation rates were significantly higher in the ZIFT group (42.1% and 11.7%) than in the UET group (21.0% and 7.8%) ($P < 0.05$). ZIFT could be considered for couples who have limited time and adequate financial support.

Comparaison des taux de grossesse et d'implantation après un transfert intra-tubaire de zygote et un transfert intra-utérin d'embryon en cas de stérilité non tubaire

RÉSUMÉ Nous avons réalisé un essai prospectif randomisé sur 220 couples présentant une stérilité due à un facteur non tubaire afin de comparer les taux de grossesse et les taux d'implantation après un transfert intra-tubaire de zygote (ZIFT) et un transfert intra-utérin (TIU) d'embryon. Le zygote a été transféré par coelioscopie dans l'une des trompes de Fallope 24 heures après le prélèvement d'ovocytes, tandis que le transfert intra-utérin d'embryon a été réalisé 72 heures après le prélèvement par voie vaginale avec guidage échographique. Le transfert a été effectué sur 102 cycles dans le groupe ZIFT et sur 100 cycles dans le groupe TIU. Les taux de grossesse et d'implantation étaient significativement plus élevés dans le groupe ZIFT (42,1 % et 11,7 %) que dans le groupe TIU (21,0 % et 7,8 %) ($P < 0,05$). La méthode ZIFT pourrait être envisagée pour les couples disposant d'un temps limité et de ressources financières suffisantes.

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Introduction

The ability of tubal transfer of an embryo to produce pregnancy and live birth was first demonstrated in a non-human primate model [1]. Soon afterwards the first successful zygote intrafallopian transfer (ZIFT) in humans was described [2]. Initial reports showed superior results using ZIFT rather than uterine embryo transfer (UET) [3–6].

Subsequent prospective clinical trials failed to support the improved efficacy in nontubal infertility [7–10]. Nevertheless, due to heterogeneity of study populations and differences in sample size and treatment protocols in these clinical trials, the efficacy of ZIFT over UET has not been evaluated critically.

Each technique has advantages and disadvantages. Clinical experience has shown that transcervical UET is a relatively simple and safe procedure which does not have the risks and complications associated with general anaesthesia and laparoscopy. It is a cost-effective technique and permits the selection the best cleaving embryo for transfer.

ZIFT allows confirmation of fertilization before transfer as well as exclusion of polyploid embryos. There are several additional advantages of ZIFT over UET. Early cleavage and development occur in the natural and physiological environment of the fallopian tube. The tubal environment may be potentially superior to the suboptimal conditions in artificial culture media and incubators. With ZIFT, there is better synchronization between embryonic and endometrial development. In addition, the highly favourable clinical pregnancy and live birth rates per cycle commenced and per embryo transfer, all in the range of 40%, show ZIFT to be a powerful clinical tool for management of patients with repeated IVF failure [11].

Embryos have been found in the vagina after UET and some transfer

procedures are more frequently associated with ectopic pregnancy [11,12]. However, the ZIFT procedure requires general anaesthesia and laparoscopy, increasing the cost and the risk of complications.

The aim of this study was to compare pregnancy and implantation rates after ZIFT and UET for the treatment of nontubal factor infertility.

Methods

This study was approved by Research Committee of Tehran University of Medical Sciences.

Study design

This was randomized clinical trial conducted in the infertility centre of Dr Shariati Hospital, Tehran University of Medical Sciences from January 2005 to February 2006.

Participants

Women with normal hysterosalpingography and/or normal laparoscopy who been candidates for embryo transfer (ET) and had easy mock ET were invited to participate in this prospective randomized trial of ZIFT versus standard UET. Exclusion criteria were: contraindications for laparoscopy; repeated implantation failure in previous cycles; azoospermia; and difficult transfer in mock ET.

Informed consent was obtained from all the couples and the advantages and disadvantages of each protocol were fully explained to the couple before entering the study. The protocol was approved by the ethics committee of Tehran University of Medical Sciences.

Sample size calculations were based on a previous report [6] that the clinical pregnancy rate in tubal transfer was 40% and in UET was 20%. Considering these pregnancy rates, and with $\alpha = 0.05$ and $\beta = 20\%$, a sample size of 90 patients in each group was calculated. As some

patients do not respond to ovarian stimulation or fertilization failure may occur, we increased the sample to 110 patients in each group. The patients knew that they would be randomized to either tubal transfer or uterine transfer of embryo.

Randomization was performed after the decision to enter into the study was made and mock ET was done. A woman's age is the most important factor influencing pregnancy rates after transfer [4]. Therefore, to obtain similar demographic characteristics in the 2 groups, women were stratified by age < 35 or 35–40 years. After this, randomization was carried out by opening a sequentially numbered sealed envelope to allocate women into the treatment protocol groups.

Treatment protocol

Ovarian stimulation was achieved with long-luteal GnRH-agonist down-regulation and human menopausal gonadotrophin (HMG) or HMG + metrodine from day 3 of the menstrual cycle. For all patients oral contraception was administered on days 3–23 of the cycle preceding stimulation with doxycycline 100 mg twice per day from day 3 for 10 days only.

The GnRh-agonist buserelin acetate (Suprefact) 500 µg subcutaneous was administered from day 21 of the cycle preceding stimulation until day 3 of the menstrual cycle. The dose was then reduced to 250 µg/day until the day of human chorionic gonadotropin (HCG) administration.

Follicular development was stimulated with HMG or metrodine + HMG from day 3 of the menstrual cycle. The starting dose for gonadotrophins was determined by age, body mass index and ovarian response in previous stimulation cycles. Cycle monitoring was achieved by transvaginal sonography from day 10 of the stimulation cycle and repeated every 48–72 h until the day of HCG administration.

Human chronic gonadotropin (10 000 U) was given when at least 2 follicles were > 18 mm and other follicles were > 15 mm. The oocytes were aspirated using an ultrasound guided transvaginal approach 34–36 hours after HCG administration. Preparation of sperm for oocyte insemination was carried out using the swim-up technique. Intracytoplasmic sperm injection was achieved for all patients. The ovarian stimulation protocol, criteria for HCG administration and laboratory handling in ZIFT and UET groups were similar.

Fertilization of recovered oocytes was assessed 14–18 hours after insemination with visualization of a 2-pronuclear stage embryo. We performed ZIFT under general anaesthesia 24 h after oocyte retrieval using a 3 puncture video laparoscopic technique.

After introducing the umbilical trocar and optical equipment the abdominal cavity was surveyed. After aspirating sanguineous fluid from the pelvic cavity a maximum of 5 2-pronuclear embryos were placed 4–5 cm into the most accessible fallopian tube (Cook catheter).

In the UET cycles, transfer was performed 72 h after retrieval of the embryo at the 4–8-cell stage (grade I, grade II) using a Wallace catheter guided by transabdominal sonography to place the tip 1.5 cm proximal to the fundus.

The luteal phase was supported in all cycles by cyclogest suppositories 400 g every 8–12 h. Serum level of β -human chorionic gonadotropin was determined 12–14 days after ET and if positive, measured again after 48 h. If the titre had increased, the use of cyclogest was continued until 12 weeks of pregnancy.

At 5 weeks after transfer, the intra-uterine gestational sac and fetal heart beat were demonstrated by vaginal sonography. The patients were followed until 12 weeks pregnancy. Clinical pregnancy was defined by the presence of gestational sac 5–6 weeks after transfer.

Ongoing pregnancy was defined as a pregnancy of > 12 weeks gestation. The implantation rate was calculated by dividing the total number of gestation sacs by the total number of transferred embryos.

Statistical analysis

Statistical comparisons were performed with the unpaired Student *t*-test and chi-squared test.

Results

There were 110 couples in each group: with 78 women < 35 years and 32 women 35–40 years in each. There was no significant difference between the 2 groups regarding baseline data including duration of infertility, etiology, body mass index or number of previous assisted reproduction technology cycles (Table 1).

Clinical data and treatment cycle characteristic were similar in the ZIFT and UET groups and are presented in Tables 1 and 2. In the ZIFT group, 6 patients did not respond to ovarian stimulation and in 2 patients fertilization failure occurred. In the UET group 5 patients were poor responders and in 5 patients fertilization failure occurred. So analysis was performed in 102 cycles in the ZIFT and 100 cycles in the UET.

There was no significant difference between the 2 groups regarding treatment protocol, stimulation duration, number of HMG ampoules, number of oocytes retrieved and number of embryos transferred. Serum estradiol level and endometrial thickness on the day of HCG injection was similar in the 2 groups.

Clinical pregnancy rate per transfer, 42.1% (43/102); ongoing pregnancy rate per transfer, 35.3% (36/102); and

Table 1 Clinical characteristics of women undergoing zygote intrafallopian transfer (ZIFT) and uterine embryo transfer (UET)

Characteristic	ZIFT		UET		P
	No.	%	No.	%	
Number of patients	110		110		
History of:					
Previous ART cycle	47		53		
IVF or ICSI + ET	21	44.7	31	58.5	NS
ZIFT	26	55.3	22	41.5	
Type of infertility					
Primary	94	85.3	92	83.6	NS
Secondary	16	14.7	18	16.4	
Infertility diagnosis					
Anovulation	14	12.7	24	21.8	NS
Male factor	53	48.2	38	34.5	NS
Unexplained	8	7.3	7	6.4	NS
Endometriosis	4	3.6	5	4.5	NS
Male factor + anovulation	31	28.2	36	32.7	NS
	Mean	SD	Mean	SD	
Age (years)	30.9	5.3	30.4	4.8	NS
BMI (kg/m ²)	22.9	2.3	22.8	2.5	NS
Duration of infertility (years)	8.3	4.4	8.6	4.7	NS
No. of previous ART cycles	1.29	0.54	1.30	0.46	NS

ART = assisted reproduction technology; IVF = in vitro fertilization; ICSI = intracytoplasmic sperm injection; BMI = body mass index; SD = standard deviation.
NS = not significant ($P > 0.05$).

Table 2 Stimulation cycles characteristic in the zygote intrafallopian transfer (ZIFT) and uterine embryo transfer (UET) groups

Characteristic	ZIFT		UET		P
No. of patients	110		110		
No. of cycles with transfer	102		100		
No. (%) of cycles cancelled	8 (7.2)		10 (9.0)		NS
	Mean	SD	Mean	SD	
No. gonadotropine ampoules	16.38	7.13	36.88	12.06	NS
Stimulation duration (d)	10.7	1.79	10.8	1.78	NS
Serum E ₂ on HCG day (pg/ml)	2279.1	1199.0	2296.5	7209.0	NS
Endometrial thickness on HCG day (mm)	10.59	2.07	10.48	2.25	NS
No. oocytes retrieved	7.22	3.00	6.65	3.17	NS
No. oocytes fertilized	4.07	2.30	3.82	2.14	NS
No. embryos transferred	4.06	2.02	3.87	1.61	NS

E₂ = estradiol; HCG = human chorionic gonadotrophin; SD = standard deviation.
NS = not significant ($P > 0.05$).

implantation rate, 11.7% (57/488) were significantly higher in the ZIFT group than the UET group [21% (21/100), 20% (20/100) and 7.8% (27/343) respectively] ($P < 0.05$). Abortion occurred in 7 (6.9%) women in the ZIFT group and 1 (1%) woman in the UET group. In those in whom abortion occurred, 2 had triplet pregnancy and 5 had twin pregnancy.

Ectopic pregnancy occurred in 1 patient in the ZIFT group; no ectopic pregnancy occurred in the UET group. The data regarding pregnancies that went to term are presented in Table 3. No triplet pregnancies went to term in the either group. There was no significant difference between the 2 groups in terms of multiple pregnancies (Table 3).

Discussion

This prospective randomized study demonstrated higher rates for clinical pregnancy, ongoing pregnancy and implantation with ZIFT than with UET. These findings agree with those of Pool et al. [6]. In our study, clinical pregnancy rate per transfer was 42.1% in ZIFT and 21% in UET. Ongoing pregnancy rate per transfer was 35.3% in ZIFT versus 20% in UET. In the first prospective

study of this issue, reported pregnancy rate per transfer was 47.7% for *in vitro* fertilization and 37.9% for ZIFT [7]. The difference between their results and ours may be related to differences in sample size and treatment protocol [7].

A Canadian study failed to demonstrate any obvious benefit of tubal transfer compared to uterine transfer [8]. Clinical pregnancy per retrieval was 12% with ZIFT and 26.5% with UET [8] although the treatment protocol was not comparable for all patients. Ovarian stimulation was achieved with clomiphen + HMG, HMG or GnRH-agonist in short protocol. Meta-analysis of prospective clinical trials did not demonstrate any differences in clinical pregnancy rate per transfer and implantation rate between ZIFT and UET (36.5%, 15% in ZIFT versus 31.4%, 12%

in UET), although there was a tendency towards a higher pregnancy rate with ZIFT [10].

In our study, there were no differences between the 2 groups regarding demographic and baseline data.

Our findings suggest that the difference in clinical pregnancy between the 2 groups is due to differences in the transfer techniques. One of the factors that most affected UET cycles was quality of transfer. Clinical pregnancy and implantation rates were significantly higher with ZIFT than with UET.

It has been reported that UET with a transabdominal sonography guide is superior to blind catheter placement [13]. With sonography we can ensure that the catheter passes the internal os and placement is 1–1.5 cm under the fundus.

Clinical experience demonstrates that UET is a safe technique but a report of mock ET showed that in 23% of transfers, expulsion of catheter contents occurred or increased junctional zone contraction may decrease the pregnancy rate [14]. Transmission of vaginal microorganisms to the uterus via the transfer catheter may also decrease the pregnancy rate. All of these factors may be prevented by tubal transfer.

In the Van Voorhis et al. study comparing pregnancy rates after tubal and uterine transfer of cryopreserved embryos, tubal transfer improved the pregnancy rate. They reported clinical pregnancy rate of 68% and ongoing pregnancy rate of 58% per transfer with ZIFT compared with 24% and 19% respectively with UET [15]. They

Table 3 Pregnancies that went to term and multiple pregnancies in the zygote intrafallopian transfer (ZIFT) and uterine embryo transfer (UET) groups

Variable	ZIFT		UET		P
	No.	%	No.	%	
Pregnancies that went to term	25/36	69	13/20	65	NS
Multiple pregnancies	20/43 ^a	46	9/21 ^b	42	NS

^aTwin 15; triplet 5.

^bTwin 7; triplet 2.

NS = not significant ($P > 0.05$).

suggested that tubal transfer of the cryopreserved embryo mimics a natural conception cycle in terms of early embryo development and implantation.

It has been reported that zygote intrafallopian transfer is a beneficial mode for treatment for patients with repeated failure of implantation in IVF and UET [16]. Pregnancy rates and

implantation rates were significantly higher in the ZIFT group than in the UET group. They showed that patients in whom only low quality embryos are achieved in repeated IVF attempts can also benefit from the ZIFT procedure].

The limitations of this study include the small sample size and the fact that it was carried out in a single centre.

In summary, our results demonstrate a significant advantage of tubal over uterine transfer. Although the ZIFT approach involves greater cost and complexity, the greater pregnancy rate per cycle is one of the most important reasons for suggesting ZIFT to couples who have limited time and adequate financial support.

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Perinatal outcomes of singleton term breech deliveries in Basra

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نتائج الفترة المحيطة بالولادة للولادات المقعدية في البصرة

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الخلاصة: تهدف هذه الدراسة إلى تقييم المراضة والوفيات في الفترة المحيطة بالولادة في الولادات المقعدية، ودراسة العلاقة بين عدد ولادات الأم ووزن المولود مع الوفيات في الفترة المحيطة بالولادة وطراز الولادة. ومن بين 210 امرأة ولدت في مستشفى البصرة للولادة والأطفال، أجرت 97 امرأة ولادة مهبلية مقعدية، وولدت 113 امرأة ولادة قيصرية. واقتصرت رضوح الولادة على الولادات المهبلية (8.2%) مقارنة بالولادات القيصرية (0.9%). وسجلت وفيات أكثر في الولادات المهبلية في الفترة المحيطة بالولادة بين الأطفال أكبر من وزن الولادة 3500–4000 غرام. وقللت الولادة القيصرية من الوفيات في الفترة المحيطة بالولادة في النساء اللاتي لم يلدن من قبل، وفي الولادات المقعدية للنساء اللاتي ولدن من قبل.

ABSTRACT This study aimed to assess the perinatal morbidity and mortality in breech deliveries, to study the correlation of parity and birth weight with perinatal mortality by mode of delivery. Of 210 women in labour in Basra maternity and child hospital, 97 underwent vaginal breech deliveries and 113 delivered by caesarean section. Birth trauma was restricted to vaginal deliveries. The perinatal mortality was significantly higher in vaginal deliveries (8.2%) compared with caesarean deliveries (0.9%). A higher perinatal mortality was recorded among infants > 3500–4000 g birth weight in vaginal deliveries. Caesarean section reduced the perinatal mortality in both nulliparous and parous women in term breech infants.

Issue périnatale d'accouchements par le siège d'enfants uniques nés à terme à Bassora (Iraq)

RÉSUMÉ Cette étude visait à évaluer la morbidité et la mortalité périnatales associées aux accouchements par le siège afin d'étudier la corrélation entre d'une part, le nombre d'enfants nés vivants et le poids à la naissance et d'autre part, la mortalité périnatale selon le type d'accouchement. Sur 210 femmes en travail à la maternité-hôpital pour enfants de Bassora, 97 ont eu un accouchement par voie basse par le siège et 113 ont accouché par césarienne. Les traumatismes obstétricaux étaient limités aux accouchements par voie basse. La mortalité périnatale était significativement plus élevée pour les accouchements par voie basse (8,2 %) que pour les accouchements par césarienne (0,9 %). Une mortalité périnatale plus élevée a été enregistrée chez les nourrissons nés par voie basse et pesant plus de 3,5 kg à 4 kg à la naissance. La césarienne réduisait la mortalité périnatale des nourrissons nés à terme par le siège chez les femmes nullipares et multipares.

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Introduction

It has long been thought that vaginal delivery of breech infants is associated with increased neonatal morbidity and mortality compared with elective caesarean delivery [1]. This observation has been a topic of considerable debate over the past few years, and retrospective studies of the subject have yielded conflicting data [2–6]. The frequency of breech presentation is approximately 3% of term all term deliveries, according to a large population-based study in the United States [7]. The controversy over appropriate management of breech presentation, as well as considerable disagreement regarding appropriate candidates for a trial of vaginal breech delivery, has made it a difficult phenomenon to study prospectively.

Only 3 prospective, randomized controlled studies have examined maternal and newborn outcomes associated with breech vaginal delivery [8–10]. The first 2 were published more than 20 years ago and found minimal increased risk to the fetus in a carefully selected group of vaginal breech deliveries [8,9]. In these 2 older studies, however, maternal morbidity was significantly increased (49%) with caesarean delivery, thus influencing decisions to undergo a trial of labour for breech presentation [8,9]. More recently, in the Term Breech Trial, Hannah et al. conducted a large, multicentre, prospective, randomized controlled trial of vaginal breech delivery as compared with planned caesarean delivery [10]. They found a lower rate of perinatal and neonatal mortality and serious neonatal morbidity (1.6% for planned caesarean delivery compared with 5.0% in planned vaginal birth) with no significant differences in maternal morbidity or mortality. This study prompted the American College of Obstetricians and Gynecologists to recommend planned caesarean delivery for term singleton breech presentation [11]. Some workers, however,

have argued that the design of the Term Breech Trial is flawed, and the debate continues [12].

The aim of this study was to assess the perinatal outcome in singleton term infants delivered in breech presentation in Basra maternity and child hospital and to study the correlation of parity and birth weight with perinatal mortality by mode of delivery.

Methods

This prospective study was conducted over a 12-month period (from 1 September 2005 to 31 August 2006) on women attending the delivery room with a live singleton term breech presentation at the maternity and child hospital in Basra, Iraq. Of the 10 215 deliveries during the study period, 259 were breech presentation. Only women who delivered during the researchers' visits (3–4 times per week) were included in the study ($n = 210$). Women with obstetric problems and medical illnesses were excluded from the study.

All women were examined by the same obstetrician, and medical and neonatal data were obtained, including maternal age, parity, educational level, date of last menstrual period, previous caesarean section, previous admission to neonatal intensive care unit (NICU), history of infertility and maternal illnesses. All women were informed about the study before they gave consent to participate. All of the women who were eligible for the study consented to participate.

Abdominal examination was performed for fetal presentation, engagement and fetal size. Pelvic examination was performed under full aseptic techniques, to assess cervical dilatation, type of breech and state of amniotic membranes, to exclude cord prolapse or presentation and to assess the pelvis. Ultrasound was done to confirm gestational age, estimate fetal weight,

exclude congenital malformations of the fetus, exclude twin pregnancy and locate the placenta. Abdominal X-ray was performed only to women who were in the early stages of labour ($n = 156$) to diagnose extended head. This was standard practice in our hospital.

All women chose trial of labour, no woman requested caesarean section. When caesarean section was performed it was clinically indicated by the judgement of the attending obstetricians and after discussion with the patient. A trial of breech vaginal delivery was done only for those patients who had the inclusion criteria for breech vaginal delivery. Those who did not meet these criteria delivered by caesarean section without trial of labour.

The inclusion criteria for a trial breech delivery were: a clinically adequate pelvis, a frank or complete breech with estimated fetal weight < 4 kg with a flexed head and the informed consent of the mother. Labour was allowed to progress and the fetal heart rate was continuously monitored by electronic fetal heart monitoring with regular abdominal and pelvic examination. The method of delivery was assisted or spontaneous breech delivery by the most experienced obstetrician. Conversion to caesarean section was considered appropriate whenever the need arose, e.g. lack of progress of labour and fetal distress. The indications for caesarean section were: primigravida aged > 35 years, conception after infertility, previous difficult vaginal delivery, macrosomia, cephalopelvic disproportion and breech with footling presentation.

All neonates were examined following delivery by the paediatric resident. Body weight was recorded and gestational age was assessed using Dubowitz criteria [13]. Perinatal outcome was assessed including Apgar scores at 1 minute and 5 minutes, admissions to NICU, as well as birth traumas and deaths.

The overall perinatal mortality rate was calculated according to the formula: [no. of still births + no. of 1st-week neonatal deaths]/no. of total births] × 100. Perinatal mortality in relation to parity and birth weight were compared by route of delivery.

Statistical analysis was done using the chi-squared test, with *P*-value < 0.05 considered to be significant. It was not used in samples of less than 5.

Results

A total of 210 women were included in this study, 97 (46.2%) who delivered vaginally and 113 (53.8%) who had an emergency caesarean section.

The maternal and birth characteristics of the women are presented in Table 1. There were 104 nulliparas and 106 paras. There were statistically significant differences in the age and parity of women who delivered vaginally and those who delivered by caesarean section. There was higher incidence of caesarean deliveries among the nulliparous group (*P* < 0.05). A significantly higher percentage of caesarean deliveries were among well-educated women (*P* < 0.05). There was a significant difference in infant's birth weight between the 2 groups, with a higher rate of caesarean deliveries among women who gave birth to infants weighing 3500–4000 g.

Neonates of vaginal deliveries had a higher incidence of Apgar score < 7 at 1 and 5 minutes (both *P* < 0.05). NICU admittance was significantly higher in the vaginal compared with the caesarean delivery group (*P* < 0.05) (Table 2). All the cases of birth trauma were in vaginally-delivered infants. There were 3 (3.1%) infants with brachial plexus lesion, 2 (2.1%) with birth asphyxia and 1 (1.0%) with a fractured clavicle (Table 3).

The overall perinatal mortality rate was 4.3% (9/210). Neonatal deaths in the first week occurred significantly

Table 1 Maternal and infant characteristics by mode of delivery

Maternal factors	Vaginal delivery (<i>n</i> = 97)		Caesarean section (<i>n</i> = 113)		Total (<i>n</i> = 210)		<i>P</i> -value
	No.	%	No.	%	No.	%	
<i>Age (years)</i>							
17–30	50	51.5	74	65.5	124	59.0	< 0.01
31–45	47	48.5	39	34.5	86	41.0	
<i>Parity</i>							
Nulliparous	21	21.6	83	73.5	104	49.5	< 0.01
Parous	76	78.4	30	26.5	106	50.5	
<i>Educational level</i>							
Illiterate	40	41.2	20	17.7	60	28.6	< 0.01
Primary	37	38.0	29	25.7	66	31.4	
Secondary	15	15.5	54	47.8	69	33.0	
Higher	5	5.2	10	8.8	15	7.0	
<i>Occupation</i>							
Housewife	87	89.7	93	82.3	180	85.7	> 0.05
Employed	10	10.3	20	17.7	30	14.3	
<i>Infant's birth weight (g)</i>							
2500–3500	81	83.5	82	72.6	163	77.6	< 0.01
> 3500–4000	16	16.5	31	27.4	47	22.4	

n = number of women/births.

Table 2 Apgar scores and neonatal intensive care unit (NICU) admittance by mode of delivery

Variable	Vaginal delivery (<i>n</i> = 97)		Caesarean section (<i>n</i> = 113)		Total (<i>n</i> = 210)		<i>P</i> -value
	%	No.	%	No.	%	No.	
Apgar score < 7 at 1 min	10	10.3	3	2.7	13	6.2	< 0.05
Apgar score < 7 at 5 min	10	10.3	2	1.8	12	5.7	< 0.05
NICU admittance	8	8.2	2	1.8	10	4.8	< 0.05

Table 3 Fetal morbidity by mode of delivery

Variable	Vaginal delivery (<i>n</i> = 97)		Caesarean section (<i>n</i> = 113)	
	No.	%	No.	%
Brachial plexus lesion	3	3.1	0	–
Birth asphyxia	2	2.1	0	–
Fracture clavicle	1	1.0	0	–
Meconium aspiration	0	–	1	0.9
Total	6	6.2	1	0.9

more often among infants delivered vaginally (8/97, 8.2%) than by with caesarean delivery (1/113, 0.9%) (*P* < 0.05). There were no stillbirths in either group (Table 4). The cause

of 1st-week neonatal death was birth asphyxia in both vaginal and caesarean deliveries.

Neonatal mortality was higher in both nulliparous and parous women

Table 4 Perinatal mortality by mode of delivery

Variable	Vaginal delivery (n = 97)		Caesarean section (n = 113)		Total (n = 210)		P-value
	No.	%	No.	%	No.	%	
Stillbirths	0	–	0	–	0	–	–
1st-week neonatal deaths	8	8.2	1	0.9	9	4.3	< 0.05
Overall perinatal deaths	8	8.2	1	0.9	9	4.3	< 0.05

when comparing vaginal and caesarean deliveries (Table 5). Among the nulliparas, a higher rate of neonatal mortality was recorded for vaginal deliveries (23.8%) compared with caesarean deliveries (1.2%). For the parous, there were 3/76 neonatal deaths in the vaginal delivery group (3.9%) while there were no neonatal deaths in the caesarean delivery group. Among the infants with birth weight 2500–3500 g, there were 6 neonatal deaths (7.4%) for those delivered vaginally while there were no neonatal deaths among caesarean deliveries (Table 6). In the infants with birth weight 3500–4000 g, the neonatal death

rate was 12.5% for vaginal deliveries and 3.2% for those delivered by caesarean.

Discussion

According to Cheng and Hannah who reviewed 24 studies in 1993, vaginal delivery is associated with higher perinatal morbidity and mortality rates than planned caesarean delivery [14]. They suggested that, until more evidence was available, a planned caesarean delivery should be strongly considered for persistent breech presentation at term. A study by Bingham et al. concluded that a

policy of selected vaginal delivery will result in 4 perinatal deaths for every 1000 patients delivered [15]. Other studies suggested a potential increased risk of neonatal morbidity and mortality after a trial of labour and vaginal delivery and that there was greater neonatal survival in association with caesarean section [16–18].

Although there is a growing tendency worldwide to perform elective caesarean section for infants presenting in the breech position, a trial of vaginal delivery is still allowed in selected breech cases in our main maternity centre in Basra. In this prospective study the perinatal outcomes of 113 women delivered by emergency caesarean section were compared with those of 97 women delivered vaginally. We found that, even applying appropriate inclusion criteria for a trial of labour, vaginal breech deliveries seemed to be associated with significantly greater neonatal risks. The overall neonatal outcomes were better in the caesarean section group compared with the vaginal delivery group.

In this study, the rate of caesarean section for term breech presentation was 53.8%; this finding is lower than that reported by Diro et al. [19]. Maternal educational level was inversely proportional to the rate of vaginal breech birth. This study has confirmed that illiterate women were more likely to deliver a breech infant vaginally than were educated women. This finding is similar to that of Gilbert et al. [1]. This may indicate that illiterate women have inadequate information about the adverse perinatal outcome of vaginal breech delivery due to inadequate or no antenatal care. Mothers who were better educated were more likely to have caesarean section for their breech birth. It should be noted that caesarean section was clinically indicated and not on the patient's request. This can be explained by better educated women having adequate antenatal care and

Table 5 Perinatal mortality by mode of delivery and parity

Variable	Nulliparous				Parous			
	Vaginal delivery (n = 21)		Caesarean section (n = 83)		Vaginal delivery (n = 76)		Caesarean section (n = 30)	
	No.	%	No.	%	No.	%	No.	%
Stillbirths	0	–	0	–	0	–	0	–
1 st -week neonatal deaths	5	23.8	1	1.2	3	3.9	0	–
Overall perinatal deaths	5	23.8	1	1.2	3	3.9	0	–

Table 6 Perinatal mortality by mode of delivery and birth weight

Variable	Birth weight 2500–3500 g				Birth weight 3500–4000 g			
	Vaginal delivery (n = 81)		Caesarean section (n = 82)		Vaginal delivery (n = 16)		Caesarean section (n = 31)	
	No.	%	No.	%	No.	%	No.	%
Stillbirths	0	–	0	–	0	–	0	–
1st-week neonatal deaths	6	7.4	0	–	2	12.5	1	3.2
Overall perinatal deaths	6	7.4	0	–	2	12.5	1	3.2

being assigned to planned caesarean section by their obstetrician. Therefore, when labour started earlier with persistent breech, the caesarean section was performed immediately on admission.

Parity and birth weight were also evaluated. There were more nulliparas in the caesarean section (73.5%) than the vaginal delivery (21.6%) group, which is similar to the results of Gilbert et al. [1]. Birth weight is an important factor affecting the caesarean section rate in breech delivery, with more infants weighing > 3500–4000 g in the caesarean section (27.4%) than vaginal delivery (16.5%) groups in our study. This finding is in agreement with the studies of Doyle et al. and Koo et al. [20,21].

The present study confirmed that Apgar score < 7 at 5 minutes occurred significantly more often among vaginal deliveries. This finding is in contrast to that of Doyle et al. [20]. Also, our study documented a significantly higher rate in NICU admission for vaginal breech deliveries (8.2% versus 1.8%). This rate is lower than that of Koo et al. which may be due to the large sample in their study [21].

Our results indicate that major neonatal morbidity was increased with

vaginal breech deliveries. The most striking was risk of brachial plexus injury; this was a major cause of injury associated with breech vaginal deliveries in our study (3.1%). This is in agreement to that reported by Collea et al. who found that 3.3% of births with brachial plexus injury in the vaginal delivery group [8]. Clearly our study supports the view that vaginal breech delivery is associated with birth trauma more often than caesarean deliveries [22].

When comparing vaginal and caesarean deliveries, the present study has confirmed a significant association between mode of delivery and neonatal mortality. A significantly higher neonatal death was reported among vaginal breech deliveries. Our neonatal mortality rate of 8.2% for vaginal breech delivery is greater than that previously reported in a meta-analysis by Cheng and Hannah [14].

Our study sustains the general opinion that nulliparous women are at greater risk than parous women in vaginal breech delivery. In those who delivered vaginally, the neonatal mortality rate was higher in nulliparous women compared with that in parous women. This is in agreement Diro et

al. [19]. It suggests that the firmer tissues of primigravidas present greater hazards of trauma and asphyxia to the fetus. It is important to inform nulliparous patients who refuse elective caesarean section and undergoing a trial breech vaginal delivery that morbidity and mortality seems to be increased in women in their first pregnancy. The neonatal mortality following vaginal breech delivery increased when fetal weight was 3500–4000 g. This is in agreement to that of Jones et al. [23]. This is explained that macrocosmic baby is more liable to birth trauma and asphyxia and such infants should be delivered by caesarean section to avoid these adverse perinatal outcomes.

In conclusion, vaginal breech delivery is associated with significantly increase in perinatal morbidity and mortality (more evident in nulliparous women and in infants with expected birth weight 3500–4000 g), when compared with caesarean breech delivery. Caesarean section for singleton term breech is recommended as a mode of delivery in all nulliparas and for those infants with expected birth weight 3500–4000 g.

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Monitoring emergency obstetric care

Monitoring emergency obstetric care is an update of an earlier publication on monitoring the availability and use of obstetric services, issued by UNICEF, WHO and UNFPA in 1997. The indicators defined within the publication have been used by ministries of health, international agencies and programme managers in over 50 countries around the world. This revision incorporates changes based on monitoring and assessment conducted worldwide and the emerging evidence on the topic over the years, and has been agreed by an international panel of experts. It includes two new indicators and an additional signal function, with updated evidence and new resources.

This handbook aims to describe the indicators and to give guidance on conducting studies to people working in the field. It includes a list of life-saving services, or signal functions, that define a health facility with regard to its capacity to treat obstetric emergencies. The emphasis is on actual rather than theoretical functioning. The emergency obstetric care indicators described in this handbook can be used to measure progress in a programmatic continuum: from the availability of and access to emergency obstetric care to the use and quality of those services.

Nosocomial infections in a neonatal intensive care unit in south-western Saudi Arabia

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عدوى المستشفيات في وحدة الرعاية المركزة للولدان في جنوب غرب السعودية

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الخلاصة: قاست دراسة أترابية وقوع عوامل الاختطار لعدوى المستشفيات في وحدة الرعاية المركزة للولدان في مستشفى الباحة العام، بالمملكة العربية السعودية. ومن بين 401 مولود بقوا في الوحدة 48 ساعة على الأقل، أصيب 77 منهم بالعدوى، وكان معدل الانتشار في الفترة 19.2٪، ومعدل الوقوع 13.7 عدوى لكل 1000 مريض-أيام. وكانت أكثر العدوى انتشاراً هي: الالتهاب الرئوي (50٪)، والعدوى الأولية المنقولة بالدم (40.9٪)، والجلد والأنسجة الرخوة (6.5٪). وفي تحليل تحوّل لجستي، جرى تحديد التهوية الميكانيكية (نسبة أرجحية = 2.69، وفاصلة ثقة 95٪: 1.39-5.19) والتغذية الكاملة بالحقن (نسبة أرجحية = 5.62، وفاصلة ثقة 95٪: 2.78-11.35) كعوامل اختطار يُعتدُّ بهما إحصائياً. ويتعرض الولدان المصابون بعدوى المستشفيات لثلاثة أضعاف خطر الموت مقارنة بالولدان غير المصابين بعدوى المستشفيات.

ABSTRACT A cohort study measured the occurrence and risk factors of nosocomial infections in the neonatal intensive care unit of Abha general hospital, Saudi Arabia. Of 401 neonates who stayed at least 48 hours in the unit, 77 developed infections, a period prevalence of 19.2% and an incidence of 13.7 infections per 1000 patient-days. The most frequent infections were: pneumonia (50.0%), primary bloodstream (40.9%) and skin and soft tissues (6.5%). In logistic regression analysis, mechanical ventilation (OR = 2.69, 95% CI: 1.39-5.19) and total parenteral nutrition (OR = 5.62, 95% CI: 2.78-11.35) were identified as significant risk factors. Neonates suffering from nosocomial infections had more than 3 times the risk of dying compared to neonates free of infection.

Infections nosocomiales dans un service de soins intensifs néonataux du sud-ouest de l'Arabie saoudite

RÉSUMÉ Une étude de cohorte a mesuré la fréquence des infections nosocomiales et leurs facteurs de risque dans le service de soins intensifs néonataux de l'hôpital général d'Abha (Arabie saoudite). Sur 401 nouveau-nés ayant séjourné au moins 48 heures dans le service, 77 ont contracté des infections, avec une prévalence de 19,2 % au cours de la période et une incidence de 13,7 infections pour 1 000 jours-patient. Les infections les plus fréquentes étaient la pneumonie (50,0 %), les bactériémies primaires (40,9 %) et les infections de la peau et des tissus mous (6,5 %). Dans l'analyse de régression logistique, la ventilation artificielle (OR = 2,69, IC 95 % : 1,39-5,19) et l'alimentation parentérale totale (OR = 5,62, IC 95 % : 2,78-11,35) ont été identifiées comme facteurs de risque significatifs. Les nouveau-nés souffrant d'infections nosocomiales avaient plus de 3 fois plus de risques de mourir que les autres.

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Introduction

Neonatal deaths account for over a third of the global burden of child mortality [1]. In many developing countries neonatal mortality rates (deaths in the first 28 days of life) are as high as 40–50 per 1000 live births [2,3], with infections being the major cause of death [4,5]. Unfortunately, hospitals in developing countries are at high risk of infection transmission, and improvements in neonatal outcomes are subverted by hospital-acquired infections and their associated morbidity, mortality and cost [6–9]. These infections can be attributed to lack of knowledge and training about basic infection control processes, coupled with inadequate infrastructure, systems of care and resources. This has serious consequences when devices such as intravenous catheters and ventilators are introduced without sufficient attention to the substantial risk of infection they entail [10–12].

The Asir region (population of 1 200 000) is located in the south-west of Saudi Arabia covering an area of more than 80 000 km². Primary health care (PHC) services in Abha health district, the capital of Asir, are provided through a widespread network of 36 urban and rural health centres, providing services to a population of 129 465. Each PHC centre has well-defined catchment area and population. Secondary care is provided at Abha general hospital where almost all deliveries are performed.

Our objective was to study the occurrence and risk factors of nosocomial infections (NIs) at Abha general hospital neonatal intensive care unit (NICU).

Methods

Abha general hospital is a 100-bed general hospital with an average of 300 births a month and a 15-bed NICU. The NICU consists of 4 rooms with a capacity of 15–30 hospital-born neonates. The NICU was staffed with 22 registered nurses/nurse assistants, 5 per

shift, a ratio of nurses/nurse assistants to NICU patients of 1:5. The registered nurses supervised the team and were directly responsible for the care of the most severely ill patients. The medical staff included neonatologists, 1 on call every 24 hours and 4 who worked on a daily basis. One of these neonatologists was responsible for the NICU for 24-hour periods. A chief physician and a registered nurse were responsible for the neonatal unit as a whole. Consultant support was available when necessary from nearby Asir central tertiary hospital. A physical therapist was also present in the unit for 8-hour periods. There were 5 hand-washing sinks in the NICU, 1 at the entrance, 1 at the nurse's station, and 1 sink for each 10 m². Six conventional ventilators provided assisted ventilation on a conventional basis.

A cohort of all neonates attending Abha NICU from 1 January 2004 to 31 March 2005 and who remained at least 48 hours were followed up and evaluated. All neonates were examined at the time of admission and the following information was recorded: gestational age, birth weight, Apgar score at 1 and 5 minutes, maternal predisposing factors, mode of delivery, length of stay and exposure to vascular catheter, endotracheal intubation, mechanical ventilation, antibiotic therapy and total parenteral nutrition. Surveillance for development of NI, death and transfer to other units was conducted 2–3 times a week and recorded using a manual

spreadsheet. The outcome variable was acquisition of a NI, assessed and classified using Centers for Disease Control and Prevention definitions [13].

Data were analysed using SPSS, version 12.0. Univariate analysis methods were used at 5% level of significance. Multivariate logistic regression analysis was used to identify potential risk factors.

Results

During the study period, 401 neonates were admitted to Abha NICU and remained at least 48 hours. There were 233 males (58.1%) and 168 females (41.9%). The 5 primary reasons for admission to the NICU were preterm and hyaline membrane disease (50.5%), transient tachypnoea of newborn (8.2%), meconium asphyxia syndrome (6.2%) and birth asphyxia (4.1%). There were 54 neonates with a congenital anomaly (13.7%). Half the neonates were born through unassisted vaginal delivery (50.3%) and half by caesarean section (47.7%) or instrumental delivery (2.0%). The mean length of stay was 14.0 (SD 19.5) days and median 8 days.

In all, 77 neonates developed a NI, a period prevalence of 19.2% and incidence of 13.7 NIs per 1000 patient-days observation. The commonest sites of infection were: lungs (pneumonia) (50.0%), blood (primary bloodstream infection) (40.9%), skin and soft tissues (6.5%) and urinary tract (2.6%). Table 1 shows the

Table 1 Distribution of isolated pathogens related to nosocomial infections in Abha neonatal intensive care unit (n = 77 infants)

Isolated organisms	No. of infants	%
Coagulase-negative <i>Staphylococcus</i> spp.	18	23.4
<i>Klebsiella</i> spp.	17	22.1
<i>Enterobacter cloacae</i>	16	20.8
Methicillin-resistant <i>Staphylococcus aureus</i>	8	10.4
Group B <i>Streptococcus</i>	1	1.3
<i>Serratia</i> spp.	5	6.5
<i>Escherichia coli</i>	6	7.8
<i>Staphylococcus aureus</i>	1	1.3
Other Gram-negative bacilli	5	6.5

distribution of isolated pathogens related to NIs. The most frequently isolated organisms were coagulase-negative *Staphylococcus* spp. (23.4%), *Klebsiella* spp. (22.1%) and *Enterobacter cloacae* (20.8%).

Using logistic regression analysis to identify risk factors associated with NIs (Table 2) the following significant risk factors were identified: mechanical ventilation (adjusted OR = 2.69, 95% CI: 1.39–5.19) and total parenteral nutrition (adjusted OR = 5.62, 95% CI:

2.78–11.35). Sex, birth weight, method of delivery, gestational age and intravenous line were not associated with development of NIs.

During the study period 87 neonates died (21.7%). Mortality among neonates suffering from NIs (40.3%) was significantly higher compared with neonates free from NIs (17.3%) ($\chi^2 = 19.33$, $P < 0.05$). Neonates suffering from NIs had 3 times the risk of dying compared with neonates free from NIs (crude OR = 3.23, 95% CI = 1.80–5.70).

Discussion

Babies are born without an endogenous microbial flora and rapidly become colonized with microbes encountered in the maternal genital tract and their immediate postnatal environment [14]. Since their immature immune systems are unable to provide a robust defence against virulent pathogens, neonates are at high risk of developing invasive infections if exposed to pathogenic microorganisms. Premature neonates

Table 2 Multivariate analysis of potential risk factors determining nosocomial infections in Abha neonatal intensive care unit (n = 401 infants)

Variable	Nosocomial infections		Adjusted OR	95% CI
	No.	%		
<i>Sex</i>				
Male	44	18.9	0.80	0.45–1.42
Female	33	19.9		
<i>Mode of delivery</i>				
Caesarean	39	19.5	1.02	0.58–1.80
Vaginal	38	19.0		
<i>Presence of congenital anomalies</i>				
Yes	9	18.0	1.06	0.45–2.46
No	68	16.8		
<i>Low birth weight (< 1500 g)</i>				
Yes	25	27.8	0.68	0.43–1.17
No	52	16.7		
<i>Gestational age</i>				
Preterm	62	27.4	0.58	0.32–1.03
Term	15	8.6		
<i>Mechanical ventilation</i>				
Yes	39	35.8	2.69*	1.39–5.19
No	38	13.0		
<i>Intravenous line</i>				
Yes	70	18.1	0.07	0.18–2.52
No	7	50.0		
<i>Total parenteral nutrition</i>				
Yes	31	57.4	5.62*	2.78–11.35
No	46	13.3		
<i>Endotracheal intubation</i>				
Yes	2	33.3	0.96	0.14–6.84
No	75	19.0		

* $P < 0.05$

OR = odds ratio; CI = confidence interval.

are at especially high risk of infection because of their lack of protective maternal antibodies, underdeveloped innate immunity and their fragile, easily damaged skin. However, while the newborn intrinsically faces an increased risk of infection, failures at critical points in the system of care can greatly increase this risk. The rapid development of medical technology has enhanced our ability to improve the quality and length of life of neonates, particularly infants born with congenital defects or extreme prematurity. This growing population of fragile patients is often dependent for survival on therapeutic interventions that are associated with complications of infections that can result in neonatal morbidity and mortality [15,16].

The present study showed a relatively high prevalence of NIs in Abha NICU of 19.2% with an incidence rate of 13.7 infections per 1000 patient-days observation. Previous studies have documented widely varying infection rates between individual institutions. A prospective multicentre study conducted by the European Study Group found an infection rate of 7% in 7 NICUs [17]. The USA national point prevalence survey, a collaborative study in 29 hospitals representing 19 states, found a NICU infection rate of 11.4% [18]. In Spain a study found an incidence rate of 1.6 NIs per 100 patients-day observation in the NICU [19]. In developing countries, investigators in Brazil and Indonesia have reported rates of hospital-acquired infections to be as high as 51%–52% among all NICU admissions [12,16]. Although the Centers for Disease

Control and Prevention definitions are usually used in these studies, it may be difficult to make direct comparisons with these data because of inconsistencies in surveillance or study methods, such as intensity of surveillance, prospective versus retrospective data collection, infection detection methods and the populations included.

Bacteraemia, pneumonia, urinary tract infections and sensory organ infections are the most common NIs reported in the literature, with 40% to 70% for bacteraemia and 15% to 30% for respiratory infection [16,19,20]. These are in agreement with our results.

The present study showed that the most frequently isolated organisms were coagulase-negative *Staphylococcus* spp., *Klebsiella* spp. and *Ent. cloacae*. In developing countries Gram-negative rods are major pathogens of NIs in NICUs. Gram-negative rods were isolated from at least 60% of positive blood cultures in developing regions of the world [16]. *K. pneumoniae* is the major pathogen, responsible for 16%–28% of blood-culture-confirmed sepsis in different regions of the world. Africa and South Asia also have high rates of *Sta. aureus* infections, whereas Latin America, South-East Asia and the Middle East have high reported rates of coagulase-negative staphylococcal infections that might be due to their adoption of sophisticated tertiary neonatal care with a high rate of invasive device use [16].

Neonates in Abha NICU on mechanical ventilation had significantly 2.7 times higher risk of developing NIs compared with other neonates.

Similarly, in Riyadh, Saudi Arabia the mean ventilator-associated pneumonia rate in the paediatric ICU was 8.87 per 1000 ventilation-days with a ventilation utilization rate of 47% [21].

Neonates in Abha NICU on total parenteral nutrition had a significantly 5.6 times greater risk of developing NIs compared with other neonates. Similarly, in Riyadh, a study showed that in paediatric ICUs, patients who had total parenteral nutrition infused through the line had 8.6 times greater risk of developing NIs [22]. This may be due to the severity of illness or a deficiency in adhering to parenteral fluid infusion guidelines. Standard infection-control practices—hand hygiene, isolation, aseptic techniques, cleaning and disinfection or sterilization of reused equipment and elimination of point sources of contamination—minimize many such hazards. Alcohol-based antiseptics for hand hygiene are an appealing innovation because of their efficacy in reducing hand contamination and their ease of use, especially when sinks and supplies for hand-washing are limited [23].

The results of this study will assist in developing intervention strategies for the prevention of NIs in NICUs in the region. Interventions should target the use of total parenteral nutrition (indications, preparation, storage, administration and time of use) and mechanical ventilation. More continuing medical education programmes are needed for the health care team to improve their competence.

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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.

Antibiotic resistance trends in paediatric community-acquired first urinary tract infections in the United Arab Emirates

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اتجاهات مقاومة المضادات الحيوية في العدوى الأولية للجهاز البولي المكتسبة في المجتمع في دولة الإمارات العربية المتحدة

حسيب نارشي، مهند الحمدي

الخلاصة: قام الباحثون بتحليل اتجاه نشأة المقاومة للمضادات الحيوية بالنسبة للجراثيم المسببة للأمراض البولية المكتسبة مجتمعياً خلال فترة أربع سنوات في دراسة أترابية لأطفال أصيبوا بأول نوبة من عدوى الجهاز البولي المؤكدة بزراعة هذه الجراثيم، والذين قدموا إلى قسم الأطفال في مستشفى عام كبير للرعاية الثانوية في دولة الإمارات العربية المتحدة. وأجريت المقارنات بين فترتين زمنيتين هما 2003/2004 و 2005/2006 لـ 145 طفلاً في عمر شهرين إلى 12 عاماً. وبالرغم من وجود بعض التغيرات في المقاومة إلا أنها لا يُعتدُّ بها إحصائياً، وكذلك الاتجاهات، ماعدا حدوث زيادة يُعتدُّ بها في المقاومة للنيتروفورانتوين (زادت من 5.4% إلى 35.6%)، مع زيادة في اتجاه المقاومة يُعتدُّ بها خلال الأربع سنوات.

ABSTRACT We analysed the trend of antibiotic resistance of community-acquired uropathogens over a 4-year period in a cohort of children with a first episode of culture-proven urinary tract infection presenting to the department of paediatrics at a large general secondary care hospital in the United Arab Emirates. Comparisons were made between 2 time periods: 2003–04 versus 2005–06 for 145 children aged 2 months to 12 years of age. Although some changes in resistance were observed for some antibiotics between the 2 time periods, the differences were not significant, nor were the trends, except for a significant increase in resistance to nitrofurantoin (from 5.4% to 35.6%), with a significant increasing trend over the 4 years.

Tendances de la résistance aux antibiotiques chez des patients pédiatriques lors d'un premier épisode d'infection urinaire communautaire aux Émirats arabes unis

RÉSUMÉ Pendant quatre ans, nous avons analysé l'évolution de la résistance aux antibiotiques d'agents pathogènes urinaires communautaires dans une cohorte d'enfants connaissant un premier épisode d'infection urinaire confirmé par culture et dirigés vers le service pédiatrique d'un grand hôpital général de niveau secondaire aux Émirats arabes unis. Des comparaisons ont été effectuées entre deux périodes, de 2003 à 2004 et de 2005 à 2006, sur 145 enfants âgés de 2 mois à 12 ans. Bien que l'on ait observé quelques changements sur le plan de la résistance à certains antibiotiques pendant les deux périodes, ni les différences ni les tendances n'étaient significatives, à l'exception d'une nette augmentation de la résistance à la nitrofurantoïne, qui est passée de 5,4 % à 35,6 % et a montré une importante tendance à la hausse sur la période de quatre ans.

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Introduction

Urinary tract infections (UTI) are common in the paediatric age group and may be associated with a risk of renal scarring which may lead to hypertension and/or renal damage [1]. To minimize this risk, prompt and appropriate antibiotic therapy is imperative, and is usually initially started empirically before the results of urine culture and bacterial susceptibility are available. Many guidelines exist to recommend the choice of empirical antibiotic treatment, usually based on the knowledge of which organisms are commonly involved and on their antibiotic susceptibility. However, as the latter is known to change over time with the development of antimicrobial resistance, a regular evaluation of the pattern of antibiotic sensitivities is imperative to facilitate the choice of treatment [2–4].

This study assessed the trend of antibiotic resistance of urinary pathogens over a 4-year period in an unselected cohort of children with a first episode of community-acquired UTI, with the aim of improving the choice of initial empirical therapy. We believe that the findings, whether showing a positive or negative or no trend at all in antibiotic resistance, will be of interest to the physician deciding how to treat such infections.

Methods

The study was undertaken in the department of paediatrics at a large general secondary care hospital in the United Arab Emirates.

Sample size

Based on prior audit in our institution, the resistance of uropathogens to commonly used antibiotics ranged from 10% to 70%. As we planned to study several antibiotics with different patterns of resistance, we estimated that for a 95% confidence level, 5% significance level and 80% power to detect an average

change of antibiotic resistance from an average of 30%–50% to 60%–75% (or vice versa) between the 2 periods, a minimum a sample size of 49 to a maximum of 66 urine samples in each period (minimum of 98 to a maximum of 132 in total) was needed (*Epi-Info* statistical software). Assuming that incomplete data may occur in 10% of these episodes, we decided to analyse a total of 145 UTIs.

Patients

The inclusion criteria were all children between the age of 2 months and 12 years who had a first episode of culture-proven UTI between 1 January 2003 and 31 December 2006, diagnosed in our institution. The absence of a prior UTI (documented by culture or not), whether in or outside our institution, was specifically ascertained from the child or the parents by history.

The patients were identified from the log books in inpatient wards and outpatient clinics, as well as the microbiology laboratory log book. As per department guidelines, the data collected from all children with UTI (and their parents) is entered on a specifically designed UTI form. This form contained detailed information on the past history, current symptoms and signs, prior relevant investigations or therapy and comorbidity.

We excluded comorbidity or underlying factors shown to be associated with different resistance patterns to antibiotics or a predisposition to recurrent infections which may be associated with a modified resistance profile in view of multiple and/or prolonged courses of antibiotics. Thus the exclusion criteria were: recurrent UTIs (documented or by history, whether in our institution or any other), urine collected by bag specimen, nosocomial UTI, primary or secondary immunosuppression, glucocorticoid therapy, diabetes mellitus, malnutrition, recent urological

surgery (within 1 month) or presence of indwelling urinary catheter.

The children were treated with appropriate antibiotics as per antimicrobial sensitivities and underwent appropriate imaging studies as defined in our hospital clinical guidelines.

Urine collection

The standard departmental protocol for urine collection to diagnose UTI was followed for this study. The mode of urine collection was documented in the microbiology request form and also in the report of urine culture for interpretation purposes.

In children of either sex, under 2 year of age or not yet continent, urine was collected by suprapubic aspiration or catheterization if immediate antibiotic therapy was deemed necessary. Otherwise, or if the parents refused the procedure, 2 samples of urine were collected aseptically by the clean-catch method which, when performed adequately, is as reliable as suprapubic aspiration or catheterization. After cleansing of the genitalia and perineum, the clean catch was collected either by a trained and experienced paediatric nurse, or by the child's mother after appropriate explanation and training by the nurse. UTI was diagnosed by the clean-catch method only if both samples had significant colony counts as defined below. For older and continent children of either sex, urine was collected by the midstream method. The child and/or parents were instructed how to clean the genitalia, retract the foreskin in boys and allow urination to start prior to collecting the midstream in an aseptic manner.

Microbiology

UTI was defined as the growth of a single pathogen of $> 10^5$ colony-forming units (CFU)/mL of urine collected by clean catch in infants or from midstream in older children with bladder control, or $> 10^3$ CFU/mL if obtained by bladder

catheterization, or any growth in urine obtained by suprapubic aspiration.

Antimicrobial susceptibility of the isolates was tested by the disk diffusion technique, according to the National Committee for Clinical Laboratory Standards [5]. For the purpose of analysis in this study, organisms with intermediate susceptibility were considered resistant.

Data collection

The information analysed in the study was derived from the specific UTI form, the case notes and included demographic data, mode of presentation, results of urine cultures and antimicrobial susceptibility. As, for several years, these forms have been prospectively filled on all children with a UTI when they first presented, with excellent completeness of information shown in audits, we believe that their retrospective review for the purpose of this study remains associated with a high level of completeness.

Once the data were entered in a computer file and after checking for completeness and consistency, any information which could allow identification of the participants was removed.

Ethical approval was granted by the Al Ain medical district human research ethics committee (protocol No. 07/116) and no patient consent was required as it was a retrospective observational case notes review.

Analysis

As the antibiotic resistance pattern was identical between ampicillin and amoxicillin, they were analysed as a single group (aminopenicillins), so too for cefotaxime and ceftriaxone (3rd-generation cephalosporins).

The data were divided into 2 time periods for analysis: period 1 (years 2003 and 2004) and period 2 (years 2005 and 2006). We used the chi-squared

test or Fisher exact test for small numbers (when appropriate) to compare the resistance for each antibiotic between the 2 periods and to look for any association with clinical factors such as age, sex or presence of fever. In addition, we also tested for trend in that change throughout the 4 years of the study. For all the results, statistical significance was defined as P -value < 0.05 .

Results

Clinical descriptive data

A total of 145 episodes of UTI were diagnosed during the study period. All the information required for the study was present in the UTI form and case notes and there were no relevant missing data. Children under the age of 4 years developed 67.6% of the episodes (38.6% under 1 year and 15.2% between 1 and 2 years of age) and 71.0% of all infections occurred in females. In period 1, there were significantly more females (84.0% versus 61.0%, $P < 0.001$) than in period 2, and there were more younger children aged < 4 years (61.9% versus 71.9%) but this was not statistically significant.

Fever was present in 97.2% of episodes with no difference in the rate between periods 1 and 2, between the sexes or between the 2 age groups (< 4 and $4+$ years). Of all the episodes, 94.0% were managed as inpatients, with a significantly higher proportion in children < 4 years old (97% versus 86%, $P < 0.05$), but no difference between the sexes.

Urine was collected by clean catch in 46%, midstream in 41%, suprapubic aspiration in 8% and bladder catheterization in 5%. Midstream and catheterization were significantly more frequently performed in females ($P < 0.01$). There was no significant difference in the rates of different collection methods between periods 1 and 2.

Only 2 children (1.4%) had received antibiotics (amoxicillin) within 30 days of the diagnosis of UTI; cultures in 1 child were resistant to the same medication while in the other child they still showed sensitivity.

Bacteriology

Escherichia coli were found in 86.0% of urine cultures overall (87.3% in period 1 and 85.4% in period 2), *Klebsiella* spp. in 6.2% (4.7% in period 1 and 7.3% in period 2); the remainder were other organisms. There was no significant difference in the proportion of organisms between the 2 periods, nor by age group or sex, nor between first and recurrent episodes (data not shown). Bacteraemia (with the same organism as in the urine) occurred in 2 of the episodes (both with *E. coli*) and all in children under 1 year of age (1 male and 1 female).

Antibiotic resistance and trends

In the study of the association between clinical data and antibiotic resistance, only resistance to gentamicin was found to be significantly lower ($P = 0.05$) in the absence of fever (5/133, 4%) compared with febrile episodes (1/4, 25%). Resistance to the other antibiotics was not associated with age, sex or the presence of fever.

The specific resistance pattern to each organism is shown in Table 1. There was no significant change in the overall antibiotic resistance between periods 1 and 2, except for a significant 6-fold increase in resistance to nitrofurantoin (from 5.4% to 35.6%, $P < 0.001$) with a significant increasing trend ($P < 0.001$). There was also a significant decrease in resistance to nalidixic acid ($P < 0.05$) but the test for trend was not significant over the 4 years. Some changes in resistance were observed for some other antibiotics, such as a decrease in resistance to aminopenicillins (from 78.0% to 72.0%), co-amoxiclav (from 62.0% to 48.6%), cefalexin (from 50.0% to 40.6%), and an increase in resistance

Table 1 Antibiotic resistance profile of urinary pathogens collected from children in period 1 (2003–04) and period 2 (2005–06)

Antibiotic	<i>Escherichia coli</i>			<i>Klebsiella</i> spp.			All organisms		
	Period 1 %	Period 2 %	P-value	Period 1 %	Period 2 %	P-value	Period 1 %	Period 2 %	P-value for trend
	(n = 87)	(n = 122)		(n = 6)	(n = 8)		(n = 103)	(n = 147)	
Aminopenicillins ^a	82.7	85.4	NS	100.0	75.0	NS	78.0	72.0	NS
Co-amoxiclav	66.7	51.7	NS	33.3	16.7	NS	62.0	48.6	NS
Cefalexin	60.0	41.4	NS	0.0	0.0	NS	50.0	40.6	NS
Cefuroxime	12.2	20.8	NS	0.0	25.0	NS	13.5	22.6	NS
3rd-generation cephalosporins ^b	14.3	25.0	NS	0.0	0.0	NS	11.1	16.7	NS
Gentamicin	3.6	5.9	NS	0.0	0.0	NS	3.3	5.2	NS
Co-trimoxazole	55.5	52.4	NS	33.3	50.0	NS	52.5	50.7	NS
Nitrofurantoin	3.8	35.8	< 0.001	0.0	20.0	NS	5.4	35.6	< 0.001
Nalidixic acid	25.5	23.5	NS	100.0	0.0	< 0.05	27.8	21.0	NS

^aAmpicillin and amoxicillin; ^bCefotaxime and ceftazidime.
NS = not significant; n = number of isolates.

to cefuroxime (from 13.5% to 22.6%), 3rd-generation cephalosporins (from 11.1% to 16.7%) and gentamicin (from 3.3% to 5.2%); however, the differences were not significant, nor were the trends. The strains resistant to 3rd-generation cephalosporins were sensitive to penicillins, 1st-generation cephalosporins, ceftazidime and aztreonam, and were not considered to be extended-spectrum beta lactamase (ESBL) producers.

Discussion

As most microbiological surveillance systems lack epidemiological and clinical data to differentiate between first or recurrent episodes of UTI, community- or nosocomially-acquired UTI, complicated or uncomplicated UTI and presence or absence of comorbidity, they may incorrectly estimate the rates of resistance of uropathogens in the community [6]. We aimed to remedy this difficulty by selecting exclusively symptomatic children with a bacteriologically proven community-acquired UTI, excluding all children with asymptomatic bacteriuria or indwelling bladder catheters, all hospital-acquired UTIs and all urine specimens collected by bag where the risk of contamination is very high. The proportion of isolated organisms was similar to other studies, suggesting that the profile of uropathogenic flora in our region is not unusual [7]. Another strength of our study was the completeness of the information available for analysis since we prospectively used standardized data collection forms; this is reflected by the absence of missing data. The study period was restricted to 4 years to coincide with the use of our prospective standardized data collection form for children with UTI (which started in 2003) in order to maximize completeness and accuracy of the data to be analysed. In our community the majority of first UTI in young children are referred to hospital for management and further evaluation; therefore, although the study was carried out in one centre, we believe it to be representative of the general population in this region. However, as we cannot entirely exclude the possibility that some cases of community-acquired UTI may not have been referred, we caution that our results, although representative of hospital data, may not necessarily be generalized to the community.

It is reassuring that resistance to antibiotics of urinary pathogens in community-acquired first UTI has not increased significantly over the 4-year study, with the exception of resistance to nitrofurantoin which has increased 6-fold. As none of these children with a first UTI had ever been on nitrofurantoin prophylaxis,

long-term exposure to it cannot explain the increase in resistance. In addition, as nitrofurantoin is almost exclusively used in paediatrics for UTI prophylaxis, acquired resistance cannot be blamed on its use in other paediatric conditions. Furthermore, when we analysed the rate of its use as a prophylactic antibiotic for another group of children with recurrent UTI, it was used in less than 5% of them (the majority were either on co-trimoxazole or a cephalosporin). We therefore could find no support for the theory of an association between antibiotic susceptibility and antibiotic prescribing for the treatment of UTIs, nor can we provide an explanation for the increase in resistance for that antibiotic [8–10]. Reassuringly, we also found a marked decrease in resistance to nalidixic acid in the second period. The reasons are not clear but it could be speculated that the very rare use of that particular antibacterial in our community could explain the increasing sensitivity of uropathogens to it.

The study results differ from a previous study where a tendency for increased resistance to several antibiotics was demonstrated [7]. However, that study compared the resistance pattern between 2 years, 1991 and 1999, and focused exclusively on oral antibiotics, while our study covers a more recent period, which started 4 years later, compared the trend over 4 years instead of 8, and included parenteral as well as oral antibiotics. It is interesting that the rate of resistance to aminopenicillins, cefalexin, nitrofurantoin and nalidixic acid in that study was fairly similar to our results, except that resistance to co-amoxiclav,

cefuroxime and co-trimoxazole were higher in our study and others [11,12].

We found no significant difference in resistance to a specific antibiotic and risk factors such as young age (below 4 years), sex or the presence of fever at presentation, except for resistance to gentamicin which was significantly lower in the absence of fever ($P < 0.05$). This is unlike other studies where female sex was associated with resistance to co-trimoxazole [7]. This may also be explained by the differences in the design of the 2 studies as mentioned above.

In our setting, the most common empirically prescribed antibiotics for UTI (prior to the laboratory sensitivities results) were 1st-, 2nd- and 3rd-generation cephalosporins, co-amoxiclav and co-trimoxazole. Although it is reassuring that resistance to the 3 generations of cephalosporins and to gentamicin remained below 50% on average, it was above 50% to aminopenicillins and co-amoxiclav and around 50% to co-trimoxazole, similar to other reports [12,13]. If these latter antibiotics are empirically selected to treat a UTI instead of cephalosporins, our findings confirm that addition of gentamicin is still required [14]. Empirical therapy with gentamicin, when parenteral treatment is required, is associated with the lowest resistance (less than 5%). For empirical oral therapy, except for nitrofurantoin and nalidixic acid which still have the lowest resistance (below 50%), all other choices are associated with resistance above 50%, including co-trimoxazole, as shown in other studies [14,15].

For the treatment of UTI, our findings reinforce the recommendation that cephalosporins (any of the 3 generations) or gentamicin (alone or in combination with aminopenicillins) should be the first choice for empirical therapy [13,14,16]. The choice of which of these antibiotics and its route of administration would of course depend on the age of the child, the presence of toxicity or the suspicion of pyelonephritis.

For oral antibiotic prophylaxis, nitrofurantoin and nalidixic acid remain the antibiotics with the lowest resistance rate, while, similar to other studies, we found co-trimoxazole, aminopenicillins, co-amoxiclav and cephalosporins to have more than 50% resistance [14].

As this study only included children with a first UTI, its findings may not be applicable to recurrent urinary infections, where underlying urinary tract anomalies and the role of antibiotic prophylaxis may lead to different results. This should be studied separately before any recommendations can be made for the choice of empirical antibiotics in children with recurrent UTIs.

Conclusion

There has been no significant increase in antibiotic resistance to urinary pathogens in community-acquired infections presenting to our hospital between 2003 and 2006, except for nitrofurantoin. There was a decrease in the resistance to nalidixic acid. Continuing surveillance of antibiotic resistance remains essential and requires the incorporation of epidemiological and clinical data into the analysis [6,17,18].

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Handbook: Good Laboratory Practice (GLP). Second Edition

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National survey of the oral health of 5-year-old children in the United Arab Emirates

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المسح الوطني لصحة الفم للأطفال أقل من عمر خمس سنوات في الإمارات العربية المتحدة

مي النضيف، هبة حساب، عيسى الحوسني

الخلاصة: جرى فحص 1340 طفلاً في عمر أقل من خمس سنوات كجزء من المسح الوطني الأول لصحة فم الأطفال في الإمارات العربية المتحدة. وكان الهدف هو تحديد حالات تسوس الأسنان، ومقارنة التباين في التسوس بين المناطق الصحية التسع. وقد جرى اختيار العينة وفحص التسوس حسب الدلائل الإرشادية ومعايير منظمة الصحة العالمية. وتبين أن 17٪ فقط من الأطفال كانوا غير مصابين بتسوس الأسنان، وكان متوسط مؤشر النخر وفقد الأسنان وحشو الأسنان 5.1، وتراوح بين 3.8 في إمارة عجمان، إلى 6.6 في إمارة دبي. وكان لدى أكثر من نصف الأطفال (52٪) مؤشر النخر وفقد الأسنان وحشو الأسنان أكبر من 4. وإجمالاً، كان التسوس واسع الانتشار في الأسنان الأولية للأطفال أقل من عمر خمس سنوات، وأغلبهم لم يعالجوا.

ABSTRACT A total of 1340 5-year-old children were examined as part of the first national survey of the oral health of children in the United Arab Emirates. The objective was to determine dental caries status and compare variations in caries experience in all 9 medical districts. Sampling and examination for caries was done following World Health Organization guidelines and criteria. Only 17% of the children were caries-free. The mean decayed/missing/filled teeth (dmft) index was 5.1, ranging from 3.8 in Ajman to 6.6 in Dubai. More than half (52%) had > 4 dmft teeth. Overall, caries is highly prevalent in the primary dentition of 5-year-old children and mostly untreated.

Enquête nationale sur la santé bucco-dentaire des enfants de cinq ans aux Émirats arabes unis

RÉSUMÉ Une population de 1 340 enfants âgés de cinq ans a été examinée dans le cadre de la première enquête nationale sur la santé bucco-dentaire des enfants aux Émirats arabes unis. L'objectif était de constater la situation des caries dentaires et de comparer les différentes expériences en la matière dans la totalité des neuf districts médicaux. L'échantillonnage et l'examen des caries ont été réalisés sur la base des directives et des critères de l'Organisation mondiale de la Santé. Seuls 17 % des enfants ne présentaient pas de caries. L'indice CAO moyen (nombre de dents cariées, absentes ou obturées) était de 5,1, avec des valeurs allant de 3,8 à Ajman à 6,6 à Dubaï. Plus de la moitié (52 %) des enfants avaient un indice CAO supérieur à 4. Dans l'ensemble, la prévalence des caries sur les dents de lait des enfants de cinq ans est élevée ; ces caries sont rarement traitées.

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Introduction

Over the past 20 years, information on dental caries among children in the United Arab Emirates (UAE) has been collected from pathfinder surveys but these did not represent all 7 Emirates. Reports on dental caries experience in the primary dentition were mainly from Abu Dhabi. In 1991 there were 3 reports on caries in the primary dentition of 5–6-year-olds: mean number of decayed, missing or filled primary teeth (dmft) was reported as 5.1 for 5-year-old children in Abu Dhabi city [1]; the second study reported 6.3 dmft for 6-year-olds in 3 cities in the UAE [Unpublished report, K. Cowles, E. Beltran, 1991]; and the third reported an average dft of 6.8, 4.0, 3.0 and 6.2 for Abu Dhabi, Dubai, Sharjah and Fujairah respectively [Unpublished report, P. Leous, 1991]. In 1998, a mean dmft of 7.7 for was reported 5-year-olds in Abu Dhabi [2]. These reports suggested an increasing trend of dental caries in the primary dentition of children in the UAE.

Primary teeth begin to shed from about the age of 5 years onwards. If children are examined after this age, the record of primary teeth will be incomplete. For countries such as the UAE, where children are mostly attending school at 5 years of age, this is a better age group to survey than 6 years, which is commonly used in surveys in some countries.

Three age groups of children, 5, 12 and 15 years, were covered in the national survey of the oral health of children in the UAE. Recognizing the importance of reliable information on the oral health problems and trends, the Preventive Dentistry Section or the Ministry of Health took the initiative in conducting the first national survey of the oral health of 5-year-old children in the UAE. The findings for the other 2 age groups have been described elsewhere [3].

The objective of this survey was to determine the status of dental caries in the primary dentition of 5-year-old children and to compare variations in caries experience among the 7 Emirates as well as differences according to sex and nationality.

Methods

Approval for conducting the survey was obtained from the Ministry of Health, Ministry of Education and appropriate authorities in each medical district. Written consent was sought from parents prior to the child's examination. Only children whose parents consented were examined. The dental survey was conducted during 2001/2002.

Sampling

The sampling methods followed the guidelines for oral health surveys published by the World Health Organization (WHO) [4]. The size of the sample was determined according to the guidelines which state that the smallest cell size should be ≥ 40 . It was decided to sample about 150 children in each of the 9 medical districts to allow for some non-participation. Thus the sample size was 1350 children altogether. As the size of the population within each of the medical districts differs, the proportion of children who were sampled differed accordingly. Therefore, the mean scores for each district had to be weighted appropriately.

Five-year-old children in private and state schools in all medical districts were included. Only a few community schools were excluded. Sampling was done in 2 stages: by school within the medical district and by child within schools. Schools were selected using random number tables unless the number of schools in a district was small, in which case all schools were included. Within each school, children were randomly selected with frequency according to the size of the school. This meant that

each child within each district had an equal chance of being chosen. No replacement was made for children who were not examined.

Standardization of examiners

Nine dentist examiners, 1 in each district, examined the children. Training sessions were conducted and each examiner re-examined a 10% sample of children in order to assess examiner reproducibility; this was expressed as the reliability coefficient for the dmft index [5]. This was calculated for each examiner.

Examination of children

The children were examined in a supine position on a flat table. All examinations were carried out under natural and artificial room light, but without a spotlight. No special tooth-cleaning was done before examination. A plane mouth mirror (number 4) and a blunt explorer (0.5 mm diameter tip) were used. The examination was principally visual. The explorer was used for removal of plaque and debris, and as a diagnostic aid for proximal and fissure sites. Diagnosis of dental caries followed WHO criteria and the recording was done on a modified WHO form [4].

Data handling

The numeric information entered on the recording form was checked for completeness before being entered into a computer file. SPSS, version 7.5, data files were created and data were subjected to checks for completeness. Missing data were recorded as such. We calculated decayed teeth (dt), missing teeth (mt), filled teeth (ft) and dmft for each child. Descriptive statistics expressed as percentage prevalence of dental caries and mean number of teeth affected by dental caries per mouth (as a measure of caries severity) were calculated according to sex, medical district and nationality.

Table 1 Distribution of the sample of children aged 5 years in each medical district in the United Arab Emirates (UAE)

Medical district	Total	Examined		Males		Females		UAE nationals		Non-nationals	
	No.	No.	%	No.	%	No.	%	No.	%	No.	%
Abu Dhabi	6 639	150	2	75	50	75	50	119	79	31	21
Al Ain	5 432	149	3	79	53	70	47	123	83	26	17
Western Region	444	151	34	77	51	74	49	85	56	66	44
Dubai	1 339	151	11	65	43	86	57	151	100	0	0
Sharjah	2 014	151	7	69	46	82	54	151	100	0	0
Ajman	1 713	161	9	86	53	75	47	110	68	51	32
Umm Al Quwain	488	150	31	73	49	77	51	137	91	13	9
Ras Al Khaima	1 640	150	9	79	53	71	47	149	99	1	0
Fujairah	1 233	127	10	75	59	5	41	127	100	0	0
Total	20 942	1340	6	678	51	662	49	1152	86	188	14

Results

The total number of children aged 5 years at school in the UAE was 20 942. The total number of children examined was 1382 (Table 1), representing 6% of 5-year-olds in school. There was a high response rate, 96.7% of those selected were examined; the number of boys and girls was approximately equal. Non-nationals constituted 14% of the number of children examined (Table 1), and the most common countries of origin were Egypt, Palestine, Syrian Arab Republic and Jordan.

Examiner reproducibility was measured by the reliability coefficient calculated for re-examination of 10% of children. The data obtained indicated high reliability (average 0.97).

The proportion of 5-year-olds who had caries experience in the primary dentition was 83% overall; this varied from 71% in Ajman to 93% in the Western Region (Table 2). A high proportion (52% overall) had > 4 teeth with decay experience; 10% had had teeth extracted due to caries and 13% had had teeth filled. Most of the teeth with decay, however, were unfilled (Table 3).

The mean dmft was 5.1, varying from 3.8 dmft in Ajman to 6.6 dmft in Dubai

(Table 3). The filled component of the dmft values was only 0.3 ft overall, highest in Abu Dhabi medical district (0.6 dmft). Caries experience was similar in boys (5.1 dmft) and girls (4.9 dmft) both overall and within each medical district. There was also little difference between the sexes in the mt and ft components. Likewise, there was little difference in dmft values between nationals and non-nationals, although non-nationals in Ras Al Khaima medical district had very high caries experience (10.0 dmft) with no teeth extracted or filled. For UAE nationals, caries experience was highest in

Dubai (6.6 dmft) and Western Region (6.5 dmft).

In our sample of 5-year-olds, the first permanent molars had erupted in 18% of the children and 11% of these already had dental caries experience.

Discussion

In our study, the mean dmft was 5.1, which varied from 3.8 dmft in Ajman to 6.6 dmft in Dubai; there was no significant difference between boys and girls in dmft values. Although previous studies

Table 2 Caries status of 5 year old children in each medical district in the United Arab Emirates

Medical district	Caries status of children (%)		
	Free (dmft 0)	Moderate (dmft 1-4)	High (dmft > 4)
Abu Dhabi	18	36	46
Al Ain	22	39	39
Western Region	7	28	65
Dubai	11	27	62
Sharjah	15	27	58
Ajman	29	39	32
Um Al Quwain	21	29	50
Ras Al Khaimah	19	25	56
Fujairah	13	30	57

dmft = delayed, missing and filled teeth.

Table 3 Distribution of 5-year-old children in each medical district in the United Arab Emirates with experience of decayed, missing or filled teeth

Medical district	dt	mt	ft	Mean dmft
Abu Dhabi	77	9	22	4.9
Al Ain	78	9	9	4.4
Western Region	91	0	19	6.4
Dubai	88	11	9	6.6
Sharjah	83	23	7	6.1
Ajman	68	14	14	3.8
Um Al Quwain	77	5	19	5.3
Ras Al Khaimah	80	13	5	6.2
Fujairah	86	7	9	6.1

dt = decayed teeth; mt = missing teeth; ft = filled teeth.

in the UAE were limited in size (sample size < 500) and geographical coverage, it appears that that caries experience in the primary dentition has been high (> 5 dmft) for at least 12 years [1,2, K. Cowles, E. Beltran, unpublished report, 1991]. In other countries in the region, caries experience is also reported to be high. For example, over the same time period, in Kuwait, values of 6.2 dmft and 4.6 dft in 6-year-olds have been reported [6,7]; in Saudi Arabia, a value of 7.3 dmft in 6–7 year olds [8]; in Bahrain, a value of 7.1 dmft in 5-year-olds [WHO Data Bank]; in Oman, a value of 4.6 dft in 6-year-olds has been reported [9] and in Iraq, values of 4.8 in 6-year-olds

and 2.3 dmft in 7-year-olds [10]. These values are much higher than those now recorded (of under 2 dmft) in Northern Europe [11].

The value of dmft has been reported to range from 0.94 to 2.55 in the United Kingdom [12]. However, dmft values were just as low in Sudan, 1.68 [13] and Tunisia, 0.1 [14] and in the Libyan Arab Jamahiriya dft was 1.1 and 2.7 in children of comparable age [15] (Table 4).

In spite of remarkable progress in the provision of dental health services in the UAE, dental caries remains a considerable public health problem in young children. To avoid a further

increase in the prevalence of decay, we recommend treatment be given in parallel with intensive promotion of oral health and disease prevention, targeting young children and expectant mothers.

The current mother and child preventive programme should be encouraged and reinforced in all maternity health centres. There is a large body of evidence that supports the importance of the implementation of caries preventive and management measures as early as possible before birth as well as during postnatal care [13]. Fluoride use and dietary counselling for mothers during pregnancy and after birth for their young children have been shown to be effective in preventing and reducing the risk of dental caries in infants and preschool children [11,16].

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Table 4 Caries experience in primary dentition for children in the Middle East

Survey year	Age (years)	Country	No.	Mean dmft	Reference
1993	6	Kuwait	–	6.2	[6]
2001	6	Kuwait	–	4.6 dft	[7]
2002	6–7	Saudi Arabia (Riyadh)	602	7.3	[8]
1994	6	Oman	–	4.6 dft	[8]
1989	6–7	Iraq	–	4.8	[10]
1995	6–7	Iraq	1047	2.3	[10]
1990	4–5	Sudan	275	1.68	[13]
1994	6	Tunisia	600	0.1	[14]
1994	6	Libyan Arab Jamahiriya, rural	–	1.1 SVD dft	[15]
1994	6	Libyan Arab Jamahiriya, Benghazi	–	2.7 dft	[15]

dmft = decayed, missing and filled teeth; dft = decayed and filled teeth.

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Milk fluoridation for the prevention of dental caries

Around the globe, dental caries is a public health problem and the disease burden is particularly high among underprivileged groups. In several low-income countries, the WHO anticipates that the incidence of dental caries will increase as a result of growing consumption of sugars and inadequate exposure to fluorides.

The good news is that dental caries is preventable through the effective use of fluoride. WHO emphasizes the importance of automatic administration of fluoride as part of public health programmes. Substantial research has provided evidence of the effectiveness of milk fluoridation in the prevention of dental caries. As milk fluoridation mostly targets the child population, such schemes have been established within the context of school health programmes and programmes for healthy diet and nutrition. This publication, *Milk fluoridation for the prevention of dental caries*, describes the justification of milk fluoridation as an effective public health measure and experiences from community health programmes are highlighted.

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Pattern and prevalence of smoking among students at King Faisal University, Al Hassa, Saudi Arabia

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نمط وانتشار التدخين بين طلبة جامعة الملك فيصل، الأحساء، السعودية

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الخلاصة: وصفت الدراسة انتشار الأنماط المختلفة للتدخين، وعلاقات التدخين الحالي، بين الطلبة الذكور في جامعة الملك فيصل، السعودية. وقد اختيرت عينة عشوائية مكونة من 1382 طالباً، في تسع كليات، ليجيبوا على استبيان يدار ذاتياً حول المسح العالمي للتدخين بين الشباب إضافة إلى اختبار فاغرس تورم المعدل للاعتماد على النيكوتين. وكان معدل انتشار التدخين الحالي 28.1% (21.6% للسجائر؛ 14.6% للشيشة). ومن بين المدخنين الحاليين كان 41.4% يعيشون في منازل حيث يعيش معهم مدخنون آخرون، وبدأ 17% منهم التدخين في عمر أقل من 12 سنة. وفي تحليل تحوف لوجستي تضمنت متغيرات التدخين الحالي: الأكبر سناً، والذين يعيشون بعيداً عن منازلهم، ووجود مدخنين في الأسرة وبين الأصدقاء المقربين، والتعرض لإعلانات التبغ.

ABSTRACT The study describes the prevalence of different forms of smoking, and the correlates of current smoking, by male students of King Faisal University, Saudi Arabia. A random sample of 1382 students at 9 colleges answered a self-administered questionnaire based on the Global Youth Tobacco Survey plus the modified Fagerström Test for Nicotine Dependence. The prevalence of current smoking was 28.1% (21.6% for cigarettes, 14.6% for waterpipe). Of current smokers, 41.4% were living in homes where others smoke and 17.0% initiated smoking below age 12 years. In logistic regression analysis older age, living away from home, smoking by family and close friends and exposure to tobacco promotion were predictors of current smoking status.

Caractéristiques et prévalence du tabagisme chez les étudiants de l'université Roi Fayçal d'Al Ahsa (Arabie saoudite)

RÉSUMÉ Cette étude décrit la prévalence des différentes formes de tabagisme et les corrélats du tabagisme au moment de l'étude chez des étudiants de sexe masculin de l'université Roi Fayçal (Arabie saoudite). Un échantillon aléatoire de 1382 étudiants inscrits dans 9 facultés a répondu à un autoquestionnaire fondé sur l'enquête mondiale sur le tabagisme chez les jeunes et sur le test de Fagerström modifié sur la dépendance à la nicotine. La prévalence du tabagisme au moment de l'étude était de 28,1 % (21,6 % pour les cigarettes ; 14,6 % pour la pipe à eau : parmi ces fumeurs, 41,4 % vivaient avec d'autres fumeurs et 17,0 % avaient commencé à fumer avant l'âge de 12 ans. Dans l'analyse de régression logistique, l'âge, le fait de vivre loin de chez soi, le tabagisme chez les membres de la famille et les amis proches, et l'exposition à la publicité en faveur du tabac étaient des facteurs prédictifs du tabagisme au moment de l'étude.

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Introduction

Smoking has been identified as the single most important cause of preventable morbidity and premature death [1]. Although many of the adverse health effects of tobacco occur later in life, smoking has health implications for young people [2] and is associated with other high-risk behaviours among young people including abuse of other drugs, fighting and high-risk sexual behaviour [3]. Each day, nearly 4800 adolescents smoke their first cigarette; of these, nearly 2000 will become regular smokers [4]. Smoking-related health problems are a function of the duration (years of smoking) and intensity (number of cigarettes/day); most adult smokers began to smoke or were already addicted before the age of 18 years [5]. While many adolescents want to quit smoking, only a small number of them succeed [6].

There has been a dramatic increase over the past decade in the numbers of college-age smokers [7]. Several studies report that the prevalence of smoking increases from the first year to the final year among university students, which underlines the fact that the early years at university are important for targeting anti-smoking activities [8,9]. Students who enter college as non-smokers are 40% less likely to begin smoking if they live in a smoke-free campus [10].

The World Health Organization has reported widely differing prevalences of smoking among young people in the Arab countries: 7% in Oman, 18% in Kuwait, 23% in Iraq, 25% in Saudi Arabia and Jordan, 31% in Syrian Arab Republic, 43% in Yemen and 53% in Lebanon [11]. However, the trend and pattern of smoking as well as the quitting rate especially among college students are largely unknown in many of these countries. The objectives of the present study were to describe the pattern and prevalence of different forms of smoking among male students at King Faisal

University, Al Hassa, Saudi Arabia and to explore the possible correlates and/or predictors of current smoking status.

Methods

This was a cross-sectional descriptive study.

Setting and sample

King Faisal University in Al-Hassa is located at the Eastern province of Saudi Arabia. The campus contains 9 colleges and the total population enrolled in the University according to registries for the academic year 2006–07 was 12 400; the male population was 8200.

A sampling frame of all students at the different colleges, of all grades and with male sex only was used for the purpose of sampling. Females were not included due to the traditions of Saudi Arabian society which restricts access to females by male researchers and the lack of female researchers at the time of the study. Using *Epi-Info* 2002 software, a total population of 8200, assuming the prevalence of smoking from a similar study of 18% [12] and the worst acceptable prevalence was 16%, applying a confidence level of 95%, the total number of subjects required for our study was 1209; taking into consideration a non-response rate of about 15%, the final sample size was estimated as 1390 students (16.9% of the enrolled students at the University).

A multistage proportionate sampling method was applied. The colleges were stratified according to the scope of specialty and number of enrolled students. A sampling fraction was calculated to select participants in relation to the population in each college. For each college the students were chosen using a systematic random sampling technique from the available registries.

Data collection

Data were collected using an anonymous self-administered, modified Arabic version of the Global Youth Tobacco Survey questionnaire [13], with the addition of the modified Fagerström Test for Nicotine Dependence [14]. The final form of the questionnaire was field tested on 100 students from the medical college who were not part of the sample.

The questionnaire included the following items: sociodemographic data (age in years, college, year, current and permanent residence, living with parents or not); smoking within the household (who smoked, for how long, extent of smoking and quitting, if any); current smoking status; opinions about smoking behaviour; previous smoking experience; and pattern of smoking (type, age at initiation, duration in years, frequency of smoking and average cost per month). The modified Fagerström test is a widely used and validated 6-item questionnaire to assess severity of nicotine dependence [14], with scores ranging from 0 to 10. A score ≤ 4 suggests a low level of nicotine dependence, and a score ≥ 6 usually indicates high dependence. Those who had not smoked in the previous 12 months or longer were asked to consider themselves as ex-smokers.

For each college, a series of visits was carried out by the investigators for selection of participants and orientation regarding the objectives, contents and confidentiality of data collection. Lecture halls in each college were used to deliver the necessary orientation session on the objectives and contents of the questionnaire while assuring the participants of the anonymity of their responses. The confidentiality of data was preserved according to the Helsinki declaration of bioethics.

Data processing and analysis

The data were revised and validated according to certain pre-determined

criteria. Questionnaires with more than 2 items missing were discarded, a total of 69 forms. The response rate was 100% in the different colleges with the exception of the college of education (84.3%), agriculture (89.8%) and management science (96.5%). A pre-designed SPSS, version 12.0, file was used for data entry and data analysis. The following tests of significance were used as appropriate: chi-squared test of independence, Kruskal–Wallis and analysis of variance and Spearman rank order correlation coefficient. A logistic regression model was applied to determine the possible predictors and/or correlates of current smoking status of the respondents. $P \leq 0.05$ was considered statistically significant.

Results

A total of 1382 male students were included, with age range 18–29 years and mean age 20.9 [standard deviation (SD) 2.0] years (Table 1). Nearly one-quarter of the students (23.5%) were living away from home, the reasons for which were: education (95%), marriage (4%) or social reasons (1%).

Smoking prevalence and sociodemographics

The prevalence of smoking among the students is shown in Table 2. For any type of tobacco 28.1% of respondents were current smokers, 37.4% ever smokers and 62.6% never smokers. For cigarettes, 21.6% were current smokers and 28.4% ever smokers, while for *sheesha* (traditional Arabic waterpipe) the corresponding prevalences were 14.6% and 16.7%. Of the current smokers, 77.1% smoked cigarettes and 52.1% waterpipes.

Table 1 shows the sociodemographic characteristics of the respondents in relation to their current smoking status. Significantly more current smokers were in older age groups 20–< 24

years (67.5%) and 24+ years (15.7%) compared with the total sample and with the never smokers and ex-smokers ($P < 0.001$). Students at the colleges of education, community services and agriculture had the highest prevalence of smoking compared with those at other colleges; the lowest prevalences were at the colleges of medicine and clinical pharmacy ($P < 0.001$). A significantly higher proportion of ever smokers (current and ex-smokers) (30.0%) were living away from their parents compared with the never smokers (19.7%) ($P < 0.001$).

Environmental tobacco smoke

Of the total respondents, 41.4% lived in homes where others smoked (Table 1); this was higher for current smokers (57.5%) compared with ex-smokers (42.6%) and never smokers (34.0%) ($P < 0.001$). Over half of all respondents (58.2%) were exposed to tobacco in places other than home such as colleges, cafés and social gatherings (76.3% among current smokers, 33.6% of ex-smokers and 26.2% of never smokers) ($P < 0.001$). The prevalence of smoking among any parents or relatives was also different (57.5% of current smokers versus 41.1% and 33.6% for ex-smokers and never smokers respectively) ($P < 0.001$). Current smokers had more close family members (father or brothers or both) who smoked (205/388 (53.4%) than did ex-smokers (53/129, 41.1%) and never smokers (274/865, 31.7%) ($P < 0.001$).

Smoking among close friends was also different as 63.9% of current smokers reported that all or most of their friends were smokers compared with 24.8% and 15.8% of ex-smokers and never smokers respectively ($P < 0.001$).

Patterns of smoking

The duration of smoking among respondents ranged from 2 to 19 years, with a mean of 7.45 (SD 3.17) years. As regards the age of initiation of smoking

among current smokers, 17.0% started below age 12 years (4.6% at 10–11 years, 6.7% at 8–9 years and 5.7% at 7 years), 13.9% at 12–13 years, 23.2% at 14–15 years and 45.9% at 16+ years. The age of initiation was significantly lower for those who smoked only cigarettes compared with those who smoked both cigarettes and waterpipe; 9.9% of them started at age 12–13 years, 24.0% at 14–15 years and 76.1% at 16+ years ($P = 0.012$).

For cigarette smokers the mean monthly cost was 165.7 (SD 75.1) Saudi Arabian riyals (SR) (median 150 SR) and for waterpipe smokers it was 104.3 (SD 69.9) SR (median 100.0 SR). Home and college were the usual places for cigarette smokers to smoke (46.0%), while waterpipe smokers smoked at special places such as cafés and restaurants.

Nicotine dependence

Of the current cigarette smokers, 47.0% had a nicotine dependence score of ≥ 6 (high), 33.8% scored 4–6 (moderate) and 19.2% scored < 4 (minimal). The overall mean score on the modified Fagerström Test for Nicotine Dependence out of a maximum of 10 was 4.13 (SD 2.55) [95% confidence interval (CI): 3.84–4.39] (Table 3, available in online version). Students at the colleges of computer science, community services and agriculture had the highest nicotine dependence scores, while the college of medicine students had the lowest score (Table 3). The mean number of cigarettes smoked per day was the highest among students of computer science and veterinary colleges ($P = 0.029$). There were significant differences between students in the different colleges in all the questions except about the item for the most difficult cigarette of the day to give up.

Quitting behaviour

Among the current smokers, about 60% had tried quitting, with a median of 3

Table 1 Sociodemographic characteristics of the students by current smoking status

Variable	Total (n = 1382)		Smoker (n = 388)		Current smoking status		Never smoker (n = 865)		Statistics
	No.	%	No.	%	Ex-smoker (n = 129)	%	No.	%	
College									$\chi^2 = 38.24; df = 14; P < 0.001$
Education	429	31.0	151	39.0	48	37.2	230	26.6	
Agriculture	268	19.4	78	20.1	26	20.2	164	19.0	
Management	191	13.8	51	13.1	20	15.5	120	13.9	
Science	162	11.7	35	9.0	13	10.1	114	13.2	
Community services	100	7.2	31	8.0	7	5.4	62	7.2	
Medicine	94	6.8	11	2.8	8	6.2	75	8.7	
Veterinary	60	4.3	16	4.1	5	3.9	39	4.5	
Computer	54	3.9	14	3.6	1	0.8	39	4.5	
Pharmacy	24	1.7	1	0.3	1	0.8	22	2.5	
Age group (years)									$\chi^2 = 33.62; df = 4; P < 0.001$
< 20	371	26.8	65	16.8	42	32.6	264	30.5	
20- < 24	820	59.3	262	67.5	73	56.6	485	56.1	
24+	191	13.8	61	15.7	14	10.9	116	13.4	
Mean age (years) (SD)	20.89 (2.03)		21.50 (2.10)		20.60 (2.20)		20.74 (1.93)		$F = 22.05; P < 0.001$
Year of enrolment									$\chi^2 = 29.54; df = 8; P = 0.002$
1st year	371	26.8	114	29.4	48	37.2	209	24.1	
2nd year	374	27.1	93	24.0	27	21.0	254	29.4	
3rd year	385	27.9	106	27.3	39	30.2	261	30.2	
4th year	195	14.1	63	16.2	12	9.3	136	15.7	
5th year	20	1.4	12	3.1	3	2.3	5	0.6	
Current residence									$\chi^2 = 36.01; df = 4; P < 0.001$
Urban	873	63.2	265	68.3	71	55.0	537	62.1	
Rural	317	22.9	63	16.2	24	18.6	230	26.6	
Hostel/other	192	13.9	60	15.5	34	26.4	98	11.3	
Permanent residence									$\chi^2 = 6.63; df = 2; P = 0.041$
Urban	979	70.8	293	75.5	93	72.1	593	68.6	
Rural	403	29.2	95	24.5	36	27.9	272	31.4	

Table 1 Sociodemographic characteristics of the students by current smoking status (concluded)

Variable	Total (n = 1382)		Smoker (n = 388)		Current smoking status		Never smoker (n = 865)		Statistics
	No.	%	No.	%	No.	%	No.	%	
<i>Living with parents</i>									
Yes	1057	76.5	281	72.4	81	62.8	695	80.3	$\chi^2 = 24.18$; df = 2; $P < 0.001$
No	325	23.5	107	27.6	48	37.2	170	19.7	
<i>Smokers at home</i>									
Yes	572	41.4	223	57.5	55	42.6	294	34.0	$\chi^2 = 60.99$; df = 2; $P < 0.001$
No	810	58.6	165	42.5	74	57.4	571	66.0	
<i>Smokers among relatives</i>									
Father only	239	17.3	68	17.5	14	10.9	157	18.2	$\chi^2 = 112.87$; df = 10; $P < 0.001$
Brothers only	163	11.8	73	18.8	22	17.1	68	7.9	
Father + brothers	132	9.6	66	17.0	17	13.2	49	5.7	
Father + brothers + others	23	1.7	14	3.6	0	0.0	9	1.0	
Others only	10	0.7	2	0.5	0	0.0	8	0.9	
None	815	59.0	165	42.5	76	58.9	574	66.4	
<i>Smokers among close friends</i>									
All	74	5.4	48	12.4	6	4.7	20	2.3	$\chi^2 = 347.28$; df = 6; $P < 0.001$
Most	342	24.7	200	51.5	25	19.4	117	13.5	
Some	616	44.6	133	34.3	69	53.5	414	47.9	
None	350	25.3	7	1.8	29	22.5	314	36.3	

df = degrees of freedom.

Table 2 Prevalence of current smoking, ever smoking and never smoking among the students (n = 1382)

Type of tobacco	Current smoker			Ever smoker			Never smoker		
	No.	%	(95% CI)	No.	%	(95% CI)	No.	%	(95% CI)
Any	388	28.1	(25.8–30.5)	517	37.4	(34.6–39.7)	865	62.6	(60.0–65.1)
Cigarettes	299	21.6	(19.5–23.9)	392	28.4	(26.1–30.8)	–	–	–
Waterpipe	202	14.6	(12.9–16.6)	234	16.7	(15.0–19.0)	–	–	–

CI = confidence interval.

attempts, and 78% planned to quit in the near future. The primary motives for quitting were health, family pressure and restrictions, and other social reasons. Out of 388 current smokers 138 (35.6%) had stopped smoking in the past, 76.1% for a period from 1–3 months, 16.0% for 4–11 months and 7.9% for 1 year or more.

Knowledge and beliefs

There were significant differences between smokers and non-smokers as regards their knowledge about the harms of both smoking and passive smoking and the effect of smoking on body weight ($P < 0.001$) (Table 4, available in online version). In addition, there was a significant difference between smokers and non-smokers as regards receiving advice from family members on the harms of smoking. Concerning the participants' beliefs, there were significant differences between smokers and non-smokers that smokers have more friends and that smoking should be banned in public places ($P < 0.001$), but no difference in the belief that it was easy to quit smoking ($P = 0.061$); only about 25% of participants in both groups thought it was not easy to quit.

There were statistically significant differences between smokers and non-smoker as regards having received free cigarettes or gifts during tobacco company promotions ($P < 0.001$). As regards students exposure to anti-smoking messages or smoking advertisements, 27.5% had seen anti-smoking messages in the media in the previous 30 days, while 54.2% had seen posters against smoking on several occasions at cultural and sports activities. However, 24.6% had seen cigarette promotion advertisements in newspapers and magazines during the previous month.

Smoking predictors

Table 5 illustrates the logistic regression model of current smoking status against the possible correlates. The model

explained 79.9% of cases. Older age was a risk factor for current smoking (OR = 2.57 for age 20–< 24 years). Urban residence was also a risk factor. While residing in hostels/other residence was significant on univariate analysis it became insignificant in the multivariate model. Living with parents was protective against the adoption of smoking (OR = 0.53); so too was having received parental and family advice against the hazards of smoking (OR = 0.07). Having parents and other family members who smoked was a risk factor for smoking (OR = 2.52), while having all or most close friends as smokers was an even greater risk (OR = 6.86). Receiving free cigarettes through promotional campaigns of cigarettes companies was associated with smoking (OR = 2.82); so too was receiving gifts with tobacco company logos (OR = 2.28). Finally, exposure to high intensity media messages against smoking was protective of current smoking (OR = 0.59).

Discussion

Although Saudi Arabia does not grow tobacco or manufacture cigarettes, an average of 600 million SR (approximately US\$ 150 millions) are spent annually on tobacco [15]. No nationwide studies on the prevalence of tobacco have been performed and this, coupled with a lack of data regarding the pattern of smoking, may conceal serious tobacco-related problems [16]. The prevalence of current tobacco smoking in our students (28.1%) was higher than rates reported in a previous study of students in Saudi Arabia (13.6% among medical and 17.5% among students of education) [12], while a study conducted on male secondary school students in the central region of Saudi Arabia reported a similar prevalence (29.8%) [17]. The reported prevalence among university/college students was 34.4% in Kuwait [18], 24.8% (males) in Syrian Arab Republic [19] and 22.1% (males) in Turkey [8].

These figures can be compared with prevalences ranging from 5.5% to 20% among adolescents in some countries of the European Union and Canada [20].

Many people consider that waterpipe smoking is less harmful than cigarettes because they believe that the water filters out harmful substances. Waterpipes do not contain less nicotine than cigarette smoke and have more carbon monoxide [21]. Our study revealed a higher percentage of current smokers used waterpipes (52.1%) than male students in other countries in the region (43.6% in Saudi Arabia [12], 24.6% in Kuwait [22] and 25.5% in Syrian Arab Republic [23]). This could be explained by the increasing popularity of waterpipe smoking. The widespread attention focused on the dangers of cigarette smoking, coupled with the stigma associated, might unintentionally encourage waterpipe smoking [22].

Data show that the proportion of adolescents who smoke increases with age [24,25]. Also, adolescents who start to smoke early are more likely to continue smoking as adults [26]. We found a negative association between smoking status and age which contradicts the first statement, probably because the age range of the study sample was too narrow to demonstrate such an association. Age at initiation in our study (66.5% initiated below age 16 years) was lower than in another similar study in Saudi Arabia where about 59% started smoking at or above the age of 18 years [12], whereas in another study in secondary schools 83.7% of the current smokers started at age 15 years or below [17]. A study in the USA reported the mean age of initiation to be 18.3 years among medical and nursing students [27].

Our results show that the prevalence of smoking varied across students at different colleges within the same university, which is consistent with other studies in Saudi Arabia [12] and

Table 5 Logistic regression model between the current smoking status and possible predictors of current smoking among the students

Covariates	Smoking status		Multivariate logistic regression model			
	Current smoker (<i>n</i> = 388)	Non-smoker ^a (<i>n</i> = 994)	β	SE	OR (95% CI)	<i>P</i> -value
Age group (years)						
< 20	65	306			1 ^b	< 0.001
20–< 24	262	558	0.945	0.260	2.57 (1.56–4.28)	< 0.001
24+	61	130	0.406	0.224	1.50 (0.97–3.38)	0.070
Current residence						
Urban	265	608			1 ^b	0.004
Rural	63	254	–0.735	0.293	0.48 (0.27–0.86)	0.013
Hostel/other	60	132	–0.236	0.315	0.61 (0.31–0.80)	0.454
Living with parents						
Yes	281	776	–0.632	0.237	0.53 (0.33–0.85)	0.008
No	107	218				
Smokers at home						
Yes	223	344	–0.923	0.147	2.52 (1.89–3.36)	< 0.001
No	165	650				
Smokers among close friends						
All/most	248	150	1.926	0.147	6.86 (5.14–9.16)	< 0.001
Few/none	140	826				
Received parental advice against smoking						
Yes	285	634	–0.358	0.158	0.70 (0.51–0.95)	0.024
No	103	360				
Received free cigarettes from tobacco company promotion						
Yes	156	40	1.038	0.157	2.82 (2.12–3.76)	< 0.001
No	232	954				
Received gift with tobacco company logo (wallet, pens, shirts)						
Yes	252	315	0.824	0.266	2.28 (1.35–3.84)	0.002
No	136	679				
Exposed to media messages against smoking						
Many	120	261	–0.534	0.158	0.59 (0.43–0.80)	< 0.001
Few or did not follow	268	733				

^aEx-smokers + never smokers; ^bReference group.

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

the USA [27]. Gliksman et al. found that students in arts and social sciences programmes were 2–3 times more likely to be current daily smokers than were students enrolled in a science programme [28]. We found higher rates of smoking by students at the colleges of education, community services and agriculture. The intensity of physical addiction to nicotine as measured by the Fagerström test [28] also showed higher dependency among students at these colleges.

The mean Fagerström score among all medical students in our study [2.90 (SD 1.97)] was higher than among medical students in a study in the USA [2.3 (SD 0.8)] [27].

Smoking by parents and sibling seems to be important in the initiation as well as the continuation of smoking. Bauman et al. found that 12–14-year-olds whose parents currently smoked were almost twice as likely to smoke as those whose parents had never smoked

[29]. Kandel and Wu found that both maternal smoking and the quality of parent–child interaction influenced the current smoking status among adolescents [30]. These findings are consistent with our study as current smokers had twice the risk when relatives, especially parents and siblings, were smokers.

Friends' behaviour and attitudes have also been shown in a large number of studies to be a particularly powerful force in shaping behaviour [31]. Peer

smoking seemed to be the most important factor influencing smoking behaviour of our respondents. Bawazeer et al. [32] and Botvin et al. [33] reported similar findings in younger populations. A study in the Syrian Arab Republic demonstrated that about half of male current smokers were introduced to smoking by a friend and they smoked because their friends did so [23]. Hahn et al. found that 60% of adolescent aged 11–17 years had first smoked, and 72% had most recently smoked, with a close friend [34]. Mohammed et al. in Kuwait found that about half of male waterpipe smokers and 70% of female waterpipe smokers reported that waterpipe smoking was either accepted or very much accepted by their friends, and both males and females tended to have friends whose behaviour and attitudes reflected their own behaviour [22].

Parental guidance and living with parents was protective against taking up smoking in our study. Gfroerer et al. also showed that among a sample of USA college students, those who lived with their parents were less likely to have smoked in the last month compared to students who did not [35]. These findings are further supported by Adlaf et al. who found that post-secondary

students who resided off campus without their family had a higher rate of daily smoking than those living in university housing and those living with their parents [36].

It has been hypothesized that the tobacco industry's targeted marketing strategies have contributed to the observed increase in cigarette use among post-secondary students [37]. In Saudi Arabia, tobacco advertising and promotion are prohibited in the local media and smoking is not allowed in government buildings or on domestic flights. However, there is no close monitoring of compliance [38] and in our study 24.6% of respondents had seen cigarette promotion advertisements in newspapers and magazines during the previous month. Another study among secondary-school students in Saudi Arabia revealed that about 66% had seen pro-cigarette advertisements on billboards, 73% had seen advertisements in magazines or newspaper, 12% had an object with cigarette logo and 28% had been offered free cigarettes by company representatives [17]. Promotional events reinforce brand visibility, allow the industry to reach specific target groups and generate names for future marketing efforts [39]. In addition,

Rigotti et al. found that the distribution of free cigarettes and attendance of tobacco company sponsored events was strongly associated with current smoking after adjusting for demographic factors (OR = 1.75) [40].

There were some limitations to the study. Only male students were included in the study as the access to females was difficult. Although anonymity was guaranteed for data collection, smoking is socially unacceptable in the Saudi Arabian community, and therefore the prevalence of smoking by self-reporting may have been underestimated.

Conclusion

Smoking among students in Saudi Arabia seems to be higher in terms of prevalence and intensity as compared to those in developed countries. Most of the current smokers in our study were highly nicotine dependent with significant variation across colleges. Parents, siblings and peers were the most important predictors of smoking behaviour among the students. Concerns are raised about role of promotional strategies and the media in the initiation and progression of smoking behaviour among this group.

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Diabetes mortality and causes of death in Benghazi: a 5-year retrospective analysis of death certificates

R.B. Roaaid¹ and A.A. Kablan¹

معدلات الوفيات الناجمة عن السكري وأسباب الوفاة في بنغازي: تحليل استعادي لشهادات الوفاة لمدة خمس سنوات
رجب أبو عجيبة الرعيض، عبد الحميد علي كبلان

الخلاصة: أجريت دراسة استعادية لشهادات الوفاة من عام 2000 حتى 2004 لتقدير تأثير داء السكري على مجمل الوفيات في مدينة بنغازي، بالجمهورية العربية الليبية، ولدراسة أسباب الوفاة لدى مرضى السكري (باستخدام كود التصنيف الدولي للأمراض). من جميع شهادات الوفاة وعددها 12237، وجد أن داء السكري قد ذكر في 1482 شهادة وفاة (12.1٪). ومن هذه الشهادات، سُجل أن داء السكري كان سبباً دفيناً في 5.1٪ من الوفيات وسبباً مشاركاً في 94.9٪. وكانت أكثر الأسباب الفردية للوفاة تكررًا بالنسبة لمرضى السكري هي: مرض الشريان التاجي (32.7٪)، والإصابات الدماغية الوعائية (20.1٪)، والعداوى (14.0٪)، والأورام السرطانية (7.7٪)، والمضاعفات الحادة للسكري (7.3٪)، والفشل الكلوي المزمن (6.6٪). ومن بين الأسباب المتعددة للوفاة، ذكرت أمراض الدوران في 46.2٪ من شهادات الوفاة.

ABSTRACT A retrospective study of death certificates from 2000 to 2004 was made to estimate the contribution of diabetes to total mortality in Benghazi, Libyan Arab Jamahiriya, and to study the causes of death among diabetics (coded using the International Classification of Diseases). Of 12 237 death certificates, 1482 (12.1%) mentioned diabetes. Of these, diabetes was recorded as the underlying cause in 5.1% of deaths and a contributory cause in 94.9%. The most frequent single causes of death for diabetics were: coronary artery disease (32.7%), cerebrovascular accident (20.1%), infections (14.0%), malignancies (7.7%), acute complications of diabetes (7.3%) and chronic renal failure (6.6%). Among multiple causes of death, circulatory diseases were mentioned on 46.2% of death certificates.

Mortalité due au diabète et causes des décès à Benghazi : une analyse rétrospective des certificats de décès sur cinq ans

RÉSUMÉ Une étude rétrospective des certificats de décès délivrés entre 2000 et 2004 a été réalisée afin d'estimer la part du diabète dans la mortalité totale à Benghazi (Jamahiriya arabe libyenne) et d'examiner les causes de décès chez les sujets diabétiques (sur la base des codes de la Classification internationale des maladies). Sur 12 237 certificats de décès, 1 482 (12,1 %) mentionnaient le diabète. Parmi ceux-ci, le diabète figurait comme cause initiale dans 5,1 % des décès et comme cause ayant contribué au décès dans 94,9 % d'entre eux. Les causes de décès uniques les plus fréquentes chez les diabétiques étaient : les coronaropathies (32,7 %), les accidents vasculaires cérébraux (20,1 %), les infections (14,0 %), les cancers (7,7 %), les complications aiguës du diabète (7,3 %) et l'insuffisance rénale chronique (6,6 %). Parmi les causes de décès multiples, les maladies circulatoires figuraient sur 46,2 % des certificats de décès.

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Introduction

Despite improvements in the prognosis of individuals with diabetes, mortality is still 2 to 4 times higher for this group compared with the general population, with life expectancy reduced by up to one-third [1]. They have a significantly higher mortality than controls both from all causes and from circulatory diseases [2]. The excess global mortality attributable to diabetes in the year 2000 was estimated to be 2.9 million, equivalent to 5.2% of all deaths [3]. Yet mortality attributable to diabetes is underestimated due to under-reporting of diabetes on death certificates [4]. Although figures obtained from death certificates have limited use in research or health planning [5], they do provide comprehensive data, making them useful for studying long-term trends [6].

Benghazi is the second largest city in the Libyan Arab Jamahiriya, situated along the Mediterranean seaboard, with a population that increased from 575 900 in 1991 to 803 300 in 2000 [National Census and Statistics Department, personal communication]. The prevalence of diabetes in a community study in Benghazi in 2001 was found to be 14.1% [7]. A 5-year study of diabetes mortality was carried out in Benghazi in 1986–90 [8], but since then no further studies have been undertaken. The aim of this study was to update the data on diabetes mortality and causes of death in Benghazi.

Methods

Benghazi municipality covers all 51 districts (communes) of the city. All home deaths and all deaths in Benghazi hospitals are registered in the Benghazi central office for deaths. Non-Libyans have a separate register.

All death certificates of Libyan citizens registered during the 5-year period 1 January 2000 to 31 December 2004

were examined and data on age, sex and cause(s) of death were collected from certificates that mentioned diabetes. For analysis, the causes of death recorded on the death certificate were coded to the nearest code of the International Classification of Diseases, 10th revision (ICD-10) [9]. Diabetes as an underlying cause of death was defined if death was due to diabetic ketoacidosis, hypoglycaemia, or hyperosmolar nonketotic hyperglycaemia. Total mortality during the study period was obtained from the register of deaths.

Results

During the study period there were 12 237 deaths recorded in Benghazi: 7071 males and 5166 females. A total of 1482 (12.1%) death certificates mentioned diabetes: 758 (51.1%) females and 724 (48.9%) males. The mean age at death of this group was 63.8 years (65.4 years for males and 62.3 years for females), and 82 (5.5%) were < 45 years old at death.

Of all death certificates mentioning diabetes, 1038 (70.0%) recorded a single cause of death, 153 (10.3%) 2 causes and 291 (19.7%) 3 or more causes. Diabetes (ICD-10: E10–E14) as the underlying cause of death was recorded in 76 certificates (5.1%) and as a contributory cause of death in 1406 (94.9%).

Coronary artery disease was recorded on 32.7% of 1038 death certificates with a single cause of death (Table 1): 25.1% due to acute myocardial infarction and 7.5% due to ischaemic heart disease. Cerebrovascular diseases were the next most common cause of death (20.1%). Therefore circulatory diseases (ICD-10: I00–I99) were the most frequently reported single cause of death in people with diabetes (52.8%).

Infections (excluding tuberculosis) (14.0%) were the next most common single cause of death (Table 1). Acute

metabolic complications of diabetes (diabetic ketoacidosis, hypoglycaemia and hyperosmolar nonketotic hyperglycaemia) accounted for 7.3% of total deaths due to a single cause. Chronic renal failure was mentioned on 6.6% of death certificates with a single cause of death, malignancies on 7.7% and tuberculosis on 0.5%.

Circulatory diseases were also included as the cause of death on 136 death certificates for the 444 cases with 2 or more causes. Aggregating the multiple causes of death, circulatory diseases were mentioned on 684/1482 (46.2%) of death certificates.

Among the 82 diabetics aged < 45 years at death, acute diabetic complications accounted for 35.1% of deaths, chronic renal failure for 18.9%, coronary artery disease for 8.1% and infections for 13.5%.

Discussion

Diabetes accounted for 12.1% of total deaths in Benghazi from 2000 to 2004, which is almost double the figure of 6.4% recorded in the previous study in Benghazi 14 years earlier (1986–90) [8]. This increase might be explained by the high prevalence of diabetes in the Libyan Arab Jamahiriya (14.1%) [7] or because certifying physicians have become more aware of the importance of reporting diabetes on death certificates. However, in view of the fact that diabetes is known to be under-reported on death certificates [10,11], the magnitude of the problem might be even greater than this. Certainly, our figure is considerably lower than that of 38% reported from France [12] and 24% from Western Australia [13]. It is comparable to 9.3% from Singapore [10] but higher than figures from other developing countries: 2.7% from north India [14], 2.8% from Kashmir [15] and 6.5% from Jamaica [16].

Table 1 Single causes of death recorded on death certificates of 1038 Libyan diabetics, coded by *International Classification of Diseases, 10th revision (ICD-10)*

Cause of death (ICD-10 code)	Males	Females	Total	
	No.	No.	No.	%
Coronary artery disease	175	164	339	32.7
Acute myocardial infarction (I21)	137	124	261	–
Ischaemic heart disease (I25)	38	40	78	–
Cerebrovascular diseases (I60–I69)	106	103	209	20.1
Infection	70	75	145	14.0
Septicaemia (A02.1)	34	42	76	–
Pneumonia (J15)	30	26	56	–
Meningitis (G00)	8	5	13	–
Malignancy	46	34	80	7.7
Lung (C34)	23	0	23	–
Gastrointestinal tract (C16, C18)	10	18	28	–
Prostate (C61)	5	0	5	–
Other	8	16	24	–
Diabetes mellitus	46	30	76	7.3
Diabetic ketoacidosis (E10)	25	14	39	–
Hypoglycaemia (E16.0)	20	13	33	–
Hyperosmolar nonketotic hyperglycaemia (E11)	1	3	4	–
Chronic renal failure (N18)	38	31	69	6.6
Chronic obstructive pulmonary disease (J40–J46)	25	15	40	3.9
Liver cirrhosis (K72.1)	18	20	38	3.7
Acute renal failure (N17)	5	9	15	1.4
Gastrointestinal haemorrhage (K92)	6	5	11	1.1
Other endocrine disease (E03.5, E05.5, E23, E27.2)	2	9	11	1.1
Tuberculosis (A15)	3	2	5	0.5
Total	540	497	1038	100.0

The mean age at death of people with diabetes (63.8 years) was lower than in New Zealand (78 years) [17]. In our study, a single cause of death was mentioned on 70.0% of death certificates, 2 causes on 10.3%, and 3 or more causes on 19.3%, compared with 60.2%, 26.4% and 6.0% respectively from Kashmir [15].

Considering the cases of multiple causes of death, circulatory diseases were recorded in 46.2% of death certificates of diabetics, which is comparable to 50% reported from the 1986–90 Benghazi study [8], 48.0% from north India [14], 50% from Otago [17], 35.0% from Japan [18], 49.1% and 46% from the United Kingdom (UK) [19,20]. Higher

rates have been reported in Western Australia (63%) [13] and in another UK study (71%) [21], while lower rates were found in Kashmir (30.1%) [15] and among Oklahoma Indians (38%) [22]. Libyans now have a more sedentary lifestyle, with consumption of high fat, high carbohydrate foods and lack of exercise, mimicking the lifestyles of more developed countries.

Among the 1038 death certificates with a single cause of death, coronary artery disease was the most frequently mentioned cause of death in diabetics (32.7%), compared with 34% in a hospital-based study in Benghazi [23] and 36% in the United States of America (USA) [24], but higher than the

13.8% for aboriginal Australians [25], 17.4% from north India [14], 16.4% from Kashmir [15] and 20.5% from Japan [18]. Among those with vascular diseases, 261 (38.2%) deaths were due to myocardial infarction compared with 28% from Benghazi in the 1986–90 study of death certificates [8], and 19% from a 1-year hospital study in Benghazi in 2002 [23]. Diabetes is known to accelerate the onset of cardiovascular disease. Changes in diet and physical activity in the Libyan Arab Jamahiriya (the traditional Libyan nomadic life no longer exists) may contribute to an increased incidence of cardiovascular disease. Increased life expectancies and improved health care facilities for acute

diabetic complications may add to increasing life expectancy among diabetics and hence a greater risk of dying from cardiovascular disease.

Acute cerebrovascular accident was the second leading single cause of death in 20.1% of cases, compared with 22% from the hospital study in Benghazi [23] and 38.6% from the 1986–90 record study from Benghazi [8]. This is higher than the 14.5% from Japan [18], 13.8% from Kashmir [15] and 6% in Mexican, Puerto Rican and Cuban Americans [26], 10.5% from Taiwan [27] and 6% in the USA [24], but lower than 30.6% from north India [14].

We found that infections, excluding tuberculosis, are still an important cause of death among diabetics (14.0%), a figure that is comparable to earlier reports from Benghazi of 12.0% and 11% [8,23]. However, much higher figures have been reported among aboriginal Australians (20.8%) [25], in Kashmir (33.8%) [15] and in north India (46.5%) [14]. Tuberculosis was reported on 0.5% of death certificates compared with 1.7% [8], and 1% [23] from Benghazi.

Malignancies were recorded on 80 (7.7%) death certificates with a single cause of death, similar to 8.4% from the Benghazi 1986–90 study [8], and 8% among Mexican, Puerto Rican and Cuban Americans [24], but lower than 18.5% from Taiwan [27], 12.0% among Oklahoma Indians [22], and 21% in the TRIAD study [24]. This is probably related to a lack of proper diagnostic facilities for malignancies so many cases might have been missed.

Chronic renal failure was reported on 6.6% death certificates of diabetics with a single cause of death, a decline from the figure of 14.5% in 1986–90 in Benghazi [8]. This is probably due to the recently developed nephrology centres in Benghazi. Studies in other countries show 9.7% from north India [14], 22.3% among aboriginal Australians [25] and 30.9% from Kashmir [9].

Diabetes was recorded as the cause of death for 5.1% of deaths. This is comparable to the rate from death certificates in Benghazi 14 years earlier (6.4%) [8], but lower than the hospital-based study in Benghazi (9%) [23]. Other international figures are: 6.2% from north India [14], 10% from USA [16], 16.7% from Kashmir [15], 24% from Western Australia [10], 28.8% from Taiwan [25], and 44% in Cuban Americans [26]. Low diabetes-related mortality agrees with our previous report and may be related to earlier diagnosis and the availability of treatment facilities.

Among those diabetics aged < 45 years at death, acute diabetic complications accounted for 35.1% of deaths, compared with 32% from Sweden [28], 32% from Norway [29], 9% from Ukraine [30] and 2% from France [4]. Mortality due to chronic renal failure in this age group was 18.9% compared with 69% from Ukraine [30]. Infections were the cause of death in 13.5%. Coronary artery disease was the cause of death in 8.1% compared to 9% from Ukraine [30]. The high mortality among those aged < 45 years due to metabolic complications of diabetes and chronic renal failure reflects poor control. This is not due to lack of treatment, which is

free of charge in our country, but probably due to lack of health education and of certain specific diagnostic tools that help in detecting those who are at risk and educating them properly. These facilities are now becoming available.

The study had some limitations. No distinction between type 1 and type 2 diabetes was recorded; however, since 3.7% of diabetics in Benghazi were assessed as having type 1 diabetes [31], we can assume that the majority of deaths in this study occurred in type 2 diabetics. Since underreporting of diabetes on death certificates is well known, ranging from 35% to 55% [10,11], we can assume that many cases were not reported. Finally many undiagnosed diabetics might have been missed.

Conclusions

Diabetes is a major health problem in Benghazi and an important cause of mortality. The mortality from diabetes appears to have nearly doubled over almost 15 years. Deaths from chronic renal failure have declined in this period. Circulatory diseases were still the main causes of death in diabetics, with acute myocardial infarction at the top of the list.

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Ketosis-onset diabetes in Tunisian adults: immunological markers and β -cell function

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بدء فرط كيتون الجسم لدى مرضى السكري البالغين في تونس: الواسمات المناعية ووظيفة الخلايا β
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الخلاصة: تهدف هذه الدراسة التي أجريت في تونس إلى تصنيف بدء فرط كيتون الجسم لدى مرضى السكري البالغين. وجميع المرضى كانت أعمارهم 30 سنة أو أكثر، ويعانون من فرط كيتون الجسم، وأدخلوا إلى القسم الذي يعمل فيه الباحثون للدراسة. واستبعد المرضى المصابون بالسكري الثانوي أو سكري الحمل، وكذلك الذين يعالجون بالكورتيكوستيرويدات، أو المصابون بعدوى مترافقة. وتضمنت البيانات السمات الإكلينيكية، والواسمات المناعية، ووظيفة الخلايا β . ومن بين 63 مريضاً، كانت أضداد خلايا الجزر البنكرياسية islet-cell موجودة لدى 27.0% من المرضى، ووجدت أضداد نازعة كربوكسيل حمض الغلوتاميك (إنزيم) في 25.4% من المرضى، وأضداد فسفاتاز الثيروزين (إنزيم) في 19.0%. وكانت وظيفة الخلايا β محفوظة عليها في 54.0% من المرضى. وتؤكد نتائج الدراسة أن مرضى السكري البالغين الذين لديهم بدء حدوث فرط الكيتون مجموعة متغيرة المنشأ.

ABSTRACT The aim of this study in Tunisia was to classify ketosis-onset diabetes in adult patients. All patients aged ≥ 30 years without known diabetes, presenting with ketosis and admitted to our department were studied. Patients with secondary or gestational diabetes and those on corticoid therapy or with coinciding infection were excluded. The data included clinical characteristics, immunological markers and β -cell function. Of the 63 patients, islet-cell antibodies were present in 27.0%, glutamic acid decarboxylase antibodies in 25.4% and thyrosin phosphatase antibodies in 19.0%. β -cell functional reserve was preserved in 54.0%. Our results confirm that patients with ketosis-onset diabetes mellitus in adulthood are a heterogeneous group.

Diabète débutant par une cétose chez des adultes tunisiens : marqueurs immunologiques et fonction de la cellule β

RÉSUMÉ L'objectif de cette étude menée en Tunisie était de classer le diabète débutant par une cétose chez des patients adultes. Tous les patients âgés de 30 ans ou plus sans diabète connu, présentant une cétose et admis dans notre service ont été étudiés. Nous avons exclu ceux atteints d'un diabète secondaire ou gestationnel et ceux sous corticothérapie ou présentant une co-infection. Les données comprenaient les caractéristiques cliniques, les marqueurs immunologiques et la fonction de la cellule β . Des anticorps anti-îlots de Langerhans étaient présents chez 27,0 % des 63 patients, des anticorps anti-acide glutamique décarboxylase chez 25,4 % d'entre eux et des anticorps anti-thyrosine phosphatase chez 19,0 % d'entre eux. La masse fonctionnelle des cellules β était préservée chez 54,0 % des patients. Nos résultats confirment que les patients atteints d'un diabète sucré débutant par une cétose à l'âge adulte constituent un groupe hétérogène.

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Introduction

Despite the difference in physiopathological mechanisms of type 1 and type 2 diabetes, the distinction between the 2 types can be notoriously difficult at the time of diagnosis, particularly in atypical presentations [1].

Ketosis-onset diabetes is the most common presentation of adult patients in our department [2] and it can lead to a problem of classification. Acute onset, particularly with ketosis, was previously considered to be a characteristic feature of type 1 diabetes [3]. However, descriptions of atypical presentations, characterized by a prolonged remission after acute need for insulin, demonstrate that type 2 diabetes may start with ketosis without any known precipitating factor [4]. Ethnic differences in initial presentation of type 2 diabetes are well documented and seem to be a consequence of a predominant insulin secretory defect in people of African ancestry and a potential difference in ketogenesis among ethnic groups [5,6].

The Tunisian population has a growing epidemic of diabetes [7]. The aim of this study in Tunis, the capital city of Tunisia, was to classify newly diagnosed diabetes in adult patients who presented initially with ketosis.

Methods

We included in this case series study all adult patients aged ≥ 30 years with newly diagnosed diabetes who presented with an acute-onset ketosis to the emergency department and were admitted to our department between July 2003 and July 2005. Ketosis onset was defined as the presence of hyperglycaemia (> 2 g/L), ketonuria and immediate need for insulin without previously known diabetes. Patients with secondary or gestational diabetes and those on corticoid therapy or with an infectious disease were excluded. A total

of 63 consecutive, unrelated Tunisian patients were investigated.

Data were collected on clinical characteristics (family history of diabetes, associated diseases, age, symptoms and anthropometric features), biological parameters [glycaemia, total and high-density lipoprotein (HDL)-cholesterol and triglycerides performed once at the time of the study in a fasting state], immunological markers and β -cell function.

Islet-cell antibodies (ICA) were detected by indirect immunofluorescence using monkey pancreas sections (The Binding Site, UK). Glutamic acid decarboxylase (GADA) and thyrosin phosphatase antibodies (IA-2A) were detected by radio-immunoprecipitation (Euroimmun, Germany). β -cell function was assessed at least 1 week after the acute episode, when patients were in a nearly normoglycaemic state. C-peptide levels were assessed at fasting state and 6 minutes after intravenous administration of 1 mg glucagons by the radio-immunological method using a commercial kit (Immunotech, France). β -cell functional reserve was considered preserved if the fasting C-peptide level was > 1 ng/dL or glucagon-stimulated C-peptide > 1.5 ng/dL.

Data were analysed using *Epi-Info*, version 6. Results are expressed as mean and standard deviation (SD). Analysis of variance or the Kruskal-Wallis tests were used to compare means and the chi-squared test to compare proportions. Pair-wise comparisons were made when there were significant differences between groups.

Results

A total of 63 patients (23 women) aged ≥ 30 years presenting with ketosis were investigated. Among them, 36 (57.1%) reported a family history of diabetes. All patients complained of polyuria and polydipsia, with a median duration of 30

days (range: 2 days to 1 year), and 80% reported weight loss. Four patients had associated autoimmune disease. The mean age of our patients was 46.0 (SD 11.6) years and the mean body mass index (BMI) was 26.0 (SD 5.4) kg/m². BMI was ≥ 25 kg/m² in 52.4% of cases.

ICA were present in 17 (27.0%), GADA were detected in 16 (25.4%) and IA-2A were positive in 12 (19.0%) of patients. At least 1 immunological marker was detected in 23 cases (36.5%). The mean C-peptide level was 1.07 (SD 0.80) ng/mL at fasting and 1.42 (SD 1.07) ng/mL after glucagon. β -cell functional reserve was preserved in 54.0% of patients.

According to immunological markers (present A+ or absent A-) and β -cell functional reserve (present β + or absent β -), our patients were divided into 4 groups: 14 patients (22.2%) were A+ β -; 15 (23.8%) were A- β -; 9 (14.3%) were A+ β +; and 25 (39.7%) were A- β +.

Among the 14 patients who were A+ β -, 12 (86%) were positive for GADA, 9 (64%) for IA-2A and 6 (43%) for both antibodies. In the group who were A+ β +, positive antibodies were mainly ICA, detected in 7 (78%) of the 9 patients.

There were no significant group differences in the sex ratio and in the proportions of patients with a family history of diabetes. Mean BMI and waist circumference increased significantly from group A+ β - to A- β + ($P < 0.01$) (Table 1).

The A+ β - group, i.e. patients with immunological markers and β -cell deficiency, was the youngest group, with the lowest means of BMI, waist circumference, total cholesterol and triglycerides. The HDL level was the highest in the A+ β - group (Tables 1 and 2).

The 2 groups with preserved β -cell function (A+ β + and A- β +) were similar in most clinical features and biological parameters.

Table 1 Clinical characteristics of the 4 groups, classified according to immunological markers (present A+ or absent A-) and β -cell functional reserve (present β + or absent β -)

Characteristic	Group 1 A+ β - (n = 14)	Group 2 A- β - (n = 15)	Group 3 A+ β + (n = 9)	Group 4 A- β + (n = 25)	P-value
Mean (SD) age (years)	39 (7)	50 (13)	47 (10)	47 (12)	< 0.07 ^a
Sex (no. of male:female)	10:4	10:5	6:3	14:11	NS
Family history of diabetes (%)	64	60	67	48	NS
Associated autoimmune disease (no.)	3	0	1	0	NS
Mean (SD) waist circumference (cm)	80 (10)	90 (12)	93 (12)	100 (12)	< 0.001 ^c
Mean (SD) BMI (kg/m ²)	22.6 (3.7)	24.8 (3.7)	26.6 (6.4)	28.3 (6.4)	< 0.01 ^b
Weight group (no.)					NS
Lean (< 25 kg/m ²)	10	9	4	7	
Overweight (< 30 kg/m ²)	4	4	4	12	
Obese ($\geq$ 30 kg/m ²)	0	2	1	6	

Pair-wise significant differences between: ^agroups 1 & 2, groups 1 & 3, groups 1 & 4; ^bgroups 1 & 3, groups 1 & 4; ^cgroups 1 & 2, groups 1 & 3, groups 1 & 4, groups 2 & 4. SD = standard deviation; BMI = body mass index; NS = not significant.

Discussion

These results demonstrate that patients with ketosis-onset diabetes in adulthood are a heterogeneous group in which type 2 diabetes is the most frequent cause.

Despite the fact that we included all patients presenting with an acute onset ketonuria and not exclusively patients with acidosis, the proportion of typical type 1 diabetes with immunological markers and low β -cell functional reserve was relatively high (22.2%), slightly more than reported by Maldonado (17%) in a multi-ethnic study with younger patients [8]. It may suggest that autoimmune type 1 diabetes contributes to the increasing incidence of diabetes in the Tunisian adult population.

Ketosis-prone diabetes with remission is a well-known sub-type of type 2 diabetes rather than type 1. The acute presentation at diagnosis or sometimes later is explained by a functional and partially reversible β -cell deficiency [8,9]. This subtype was the most frequent in our study (39.7%) and to our knowledge this is the first time that such presentation has been documented in a North African population. Ketosis-prone type 2 diabetes, first reported

in black populations [10,11], is distinguishable from other subtypes by clinical and biological features of the metabolic syndrome [12]. Indeed, mean BMI, waist circumference and triglycerides were the highest in this group in our study. However, the mean BMI as well as the triglycerides were lower in our patients than levels reported in other studies [13,14], probably because of a lower rate of insulin resistance in our population. Moreover, the presence of the metabolic syndrome is more frequently associated with preserved β -cell function, and consequently a better glycaemic control after the acute episode and long-term remission [14,15]. In this kind of type 2 diabetes, the acute β -cell failure inducing ketosis [15] seems to be linked to a genetic propensity to glucotoxicity and lipotoxicity [16–18].

Diabetes in patients with β -cell deficiency and without immunological markers may belong to type 1A, since it is well demonstrated that auto-antibodies may be absent even when the initial process of diabetes is an autoimmune reaction [19]. Our patients in this group were the oldest and leanest and 2 scenarios may be possible: the disappearance of autoantibodies with evolution of type 1 diabetes or a

decline in β -cell function some years after the hyperglycaemic state that initiated authentic type 2 diabetes [20]. The presence of diabetes-associated autoantibodies confirm the process leading to β -cell alteration and, as expected, they were detected in our 4 patients with associated autoimmune disease. In type 1A diabetes, the frequencies of ICA and IA2 positivity decreased with increasing age, whereas the frequency of GADA positivity increased [21]. The absence of all 3 tested immunological markers and the clinical features, mainly age and BMI, in our A- β -group argue in favour of the latter hypothesis. However, the possibility of idiopathic type 1 diabetes cannot be excluded. This type, classified as 1B, is frequent in Japanese adults [22] and reported to be around 12% among young typical type 1 Italian patients [21]. The relationship between β -cell function and autoantibodies varies between studies, but the presence of immunological markers is mostly associated with greater decline in insulin secretion [21,23]. The patients with ketosis-prone type 2 diabetes and permanent insulin dependence represented about 25% in a cohort of patients of sub-Saharan African origin [16]. They were different from type 1 diabetic patients

Table 2 Biochemical parameters in the 4 groups, classified according to immunological markers (present A+ or absent A-) and β -cell functional reserve (present β + or absent β -)

Parameter	Group 1 A+ β - (n = 14) Mean (SD)	Group 2 A- β - (n = 15) Mean (SD)	Group 3 A+ β + (n = 9) Mean (SD)	Group 4 A- β + (n = 25) Mean (SD)	P-value
Glycaemia (g/L)	2.95 (0.72)	3.16 (0.68)	3.10 (0.89)	3.39 (0.98)	NS
Total cholesterol (g/L)	1.45 (0.33)	1.79 (0.35)	2.06 (0.40)	1.90 (0.28)	< 0.001 ^a
Triglycerides (g/L)	1.02 (0.30)	1.35 (0.43)	1.72 (0.79)	1.84 (0.79)	< 0.005 ^b
HDL cholesterol (g/L)	0.45 (0.09)	0.41 (0.11)	0.37 (0.06)	0.37 (0.10)	< 0.07 ^c
Fasting C-peptide (ng/dL)	0.39 (0.29)	0.48 (0.27)	1.42 (0.45)	1.68 (0.76)	< 0.001 ^d
Stimulated C-peptide (ng/dL)	0.55 (0.31)	0.71 (0.35)	2.07 (1.03)	2.10 (1.04)	< 0.001 ^e

Pair-wise significant differences between: ^agroups 1 & 2, groups 1 & 3, groups 1 & 4; ^bgroups 1 & 2, groups 1 & 3, groups 1 & 4; ^cgroups 1 & 3, groups 1 & 4; ^dgroups 1 & 3, groups 1 & 4, groups 2 & 3, groups 2 & 4; ^egroups 1 & 3, groups 1 & 4, groups 2 & 3, groups 2 & 4. SD = standard deviation; NS = not significant; HDL = high-density lipoprotein.

mainly because of maintenance of residual β -cell function some years after the diagnosis. In our study, C-peptide levels in this group (A- β - group) were similar to autoimmune type 1 diabetic patients (A+ β - group).

The most difficult patients to classify are those represented by the A+ β + group with immunological markers and preserved β -cell function. These features may lead to the diagnosis of latent autoimmune diabetes in adults (LADA), which is defined as adult-onset diabetes with circulating islet antibodies but not requiring insulin therapy initially [24]. It may not seem appropriate to consider this condition—revealed by an acute onset and

temporary need for insulin—as latent diabetes. However, this kind of diabetes is characterized by features of type 2 diabetes and the autoimmune markers and so transient insulinopenia may occur as in ketosis-prone type 2 diabetes, leading to an acute onset and then followed by remission until progression to insulin dependence. The acute β -cell dysfunction is probably linked to an autoimmune process, which induces initially only functional alteration, without massive destruction of islet cells, as observed in type 1 diabetes [25]. Ketonuria was present at the moment of the diagnosis in about 30% of patients with slow type 1 diabetes in a French study [26].

In summary, the classification of diabetes using insulin secretion evaluation and immunological markers, which seems to be the most effective scheme [27], allowed us to distinguish 4 subgroups of patients. In more than half of the cases (autoimmune type 1 and ketosis-prone type 2 diabetes), patients may be diagnosed by classical characteristics. However, the 2 other subgroups may require further investigations, such as repeat testing of β -cell cell function or genetic studies.

In conclusion, ketosis-onset diabetes is in the majority of Tunisian adults a presentation of type 2 diabetes. However, autoimmune type 1 was more frequent than expected in this population.

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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.

Corrected QT dispersion improves diagnostic performance of exercise testing in diagnosing coronary artery disease

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تصحيح تشتت QT يحسن الأداء التشخيصي لاختبار التمرين في تشخيص مرض الشريان التاجي

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الخلاصة: لتحديد أفضل مزيج من العوامل الثابتة التي تحسن الأداء التشخيصي لاختبار التمرين، أُجري تصوير الأوعية التاجية واختبار التمرين لـ 112 مريضاً مصابين بالذبحة الصدرية وكان مخطط كهربية القلب لديهم سليماً. وتضمنت المتغيرات الأحادية المتغيرة لمرض الشريان التاجي: العمر أكبر من يساوي 40 عاماً، الجنس الذكري، فرط ضغط الدم، التدخين، نشأة ألم صدري نتيجة لبذل المجهود، انخفاض ضغط الدم الانقباضي أكبر من أو يساوي 10 ملميمتر زئبقي، أو يكون ضغط الدم الانقباضي بعد 3 دقائق من أداء التمرين أعلى من 90٪ من الذروة، وانخفاض معدل نبض القلب لأقل من 120 نبضة في الدقيقة بعد دقيقة من أداء التمرين، أو ظهور انخفاض في ST بسبب التمرين بعد دقيقة أو أكثر. وأظهر تحليل التحوف اللوجستي العديد المتغيرات أن استخدام أي من انخفاض ST أكثر من أو يساوي ملميمتر واحد أو زيادة QTDC في ذروة التمرين أكثر من 70 ملي ثانية سيحسن بدرجة ملموسة قيمة الحساسية والتنبؤ السلبي للاختبار بدون زيادة ملموسة في النوعية.

ABSTRACT To determine the best combination of parameters that would improve the diagnostic performance of exercise testing, coronary angiography plus exercise testing were done on 112 patients with angina pectoris and normal electrocardiogram. The univariate predictors of coronary artery disease included: age ≥ 40 years, male sex, hypertension, smoking, development of exertional chest pain, decrease in systolic blood pressure (BP) ≥ 10 mmHg or systolic BP 3 min post-exercise $> 90\%$ of peak, heart rate drop < 12 beats/min 1 min post-exercise, exercise-induced ST-segment depression ≥ 1 mm. Multivariate logistic regression analysis showed that using either ST depression ≥ 1 mm or peak exercise QTDC > 70 ms significantly improved sensitivity and negative predictive value of the test without a significant decrease in specificity.

Amélioration de la performance diagnostique de l'épreuve d'effort aux fins du diagnostic de coronaropathie grâce à la dispersion du QT corrigée

RÉSUMÉ Afin de déterminer la meilleure combinaison de paramètres permettant d'améliorer la performance diagnostique de l'épreuve d'effort, une angiographie coronarienne et une épreuve d'effort ont été pratiquées sur 112 patients présentant un angor et un électrocardiogramme normal. Les facteurs prédictifs univariés de la coronaropathie étaient les suivants : âge supérieur à 40 ans, sexe masculin, hypertension, tabagisme, apparition de douleurs thoraciques à l'effort, baisse de la tension artérielle (TA) systolique supérieure à 10 mmHg ou de la TA systolique trois minutes après l'effort de plus de 90 % de la valeur maximale, chute de la fréquence cardiaque à moins de 12 pulsations/min une minute après l'effort, et dépression du segment ST induite par l'effort de plus de 1 mm. L'analyse de régression logistique multivariée a montré que l'utilisation de la dépression du ST de plus de 1 mm ou de la dispersion du QT corrigée à l'acmé de l'effort de plus de 70 ms améliorerait significativement la sensibilité et la valeur prédictive négative de l'épreuve d'effort, sans baisse sensible de la spécificité.

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Introduction

The exercise electrocardiogram (ECG) is used in the evaluation of symptomatic patients to predict the presence and extent of coronary artery disease (CAD) [1,2]. Although a large number of non-invasive stress testing modalities are currently available, the ECG is still used as standard because it is the least costly of all provocative non-invasive tests [3]. The conventional criterion for designating an exercise test abnormal is demonstration of > 1 mm of slow upsloping or horizontal or downsloping ST-segment. However, when exercise-induced ST-segment change is used as a single criterion for ischaemia, its value is limited by low sensitivity and specificity [1–4]. An alternative to using more expensive tests would be the more efficient use of available low cost data. Several parameters have been studied in a number of reports to improve the sensitivity, specificity and predictive value of the exercise stress test [4–18].

This study was designed to determine the best combination of parameters, clinical and exercise-induced haemodynamic and electrocardiographic, that would improve the capacity of exercise testing in diagnosing CAD with best sensitivity and specificity.

Methods

The study group comprised all 112 patients presenting to our hospital during the period February 2006–October 2006 with typical (definitive) or atypical (probable) angina associated with normal or non-conclusive electrocardiographic changes for the diagnosis of CAD and who gave informed consent to participate in the study. The protocol of the study was fully explained to all participants.

Chest discomfort was classified as follows:

- typical angina (definitive) which meets all the 3 of the following criteria: substernal chest discomfort with characteristic quality and duration; provoked by exertion or emotional stress; and relieved by rest or nitroglycerine;
- atypical angina (probable), which meets 2 of the above 3 criteria; non-cardiac chest discomfort which meets ≤ 1 of the above criteria [19].

Patients were excluded if they had current unstable angina, documented previous myocardial infarction, a prior revascularization procedure, ejection fraction $< 50\%$, valvular or congenital heart disease or haemoglobin level < 8 mg/dL. Patients were also excluded if they were unable to exercise due to a non-cardiac illness, they had an uninterpretable electrocardiogram (ECG) (such as in Wolf–Parkinson–White syndrome or bundle branch block) and they could not achieve $> 85\%$ of age-predicted heart rate (HR) during the test without evidence of positivity in their exercise ECG (inadequate test).

Exercise stress test

Before the test the patients had to be free of chest discomfort for at least 1 week, stop anti-anginal, anti-arrhythmic and antipsychotic drugs (each drug according to its half-life), and fasting (with no cigarette smoking) in the previous 3 hours. Standard Bruce protocol was used for all patients [20]. The test was stopped if the target heart rate (HR) was achieved or on the occurrence of any of the following: exertional hypotension, limiting symptoms (chest pain, evidence of poor peripheral perfusion, dyspnoea, fatigue or leg cramps); ST-depression > 3 mm; bundle branch block; or serious arrhythmias (multiform complexes, couplets, triplets, salvos or ventricular tachycardia).

The following variables were measured during the stress test:

- Basic data: resting HR, resting systolic blood pressure (BP), maximum HR

achieved, duration of exercise, peak systolic blood pressure, and chest pain with exertion.

- Abnormal BP response (either systolic BP fails to increase > 130 mmHg or decreases by > 10 mmHg in response to exercise) [5]; systolic BP at 3 minutes post exercise; $> 90\%$ of peak exercise systolic BP [6].
- Abnormal HR response (either HR at peak exercise < 100 beats/min [3] or failure of HR to drop > 12 beats at 1 minute post exercise from peak exercise value [7]).
- ST segment changes (measured in ≥ 6 leads) occurring peak exercise and/or during recovery; > 1 mm horizontal or downsloping depression measured 80 ms from the J-point, > 1.5 mm upsloping depression measured 80 ms from the J-point, or > 1 mm elevation in > 2 contiguous leads except aVR [3].
- ST/HR index > 1.6 $\mu\text{V}/\text{beats}/\text{min}$ (measured in the lead with the maximum ST depression, in ≥ 6 leads) as ST depression at peak stress divided by the difference between the peak exercise HR and resting HR [8–10].
- ST/HR slope: a linear regression-based computed measurement [ST depression = dependent variable; HR = independent variable. Both are measured in each lead (excluding aVR, aVL and V_1) at the end of each stage and at peak exercise]. A linear regression analysis is made for each lead: the maximal ST/HR slope is recorded and the highest ST/HR slope with a statistically significant correlation coefficient among all leads is taken as the final result. ST/HR slope ≥ 2.4 $\mu\text{V}/\text{beats}/\text{min}$ is considered an indicator of the presence of CAD [9,10].
- Abnormal T-wave response (measured in ≥ 6 leads); increased T-wave amplitude in V_2 > 2.5 mm [11] or T-wave inversion with exercise in V_5 (< 5 mm or ≥ 5 mm) [12].

- Lengthening or no change in P-wave duration in V_2 at peak exercise (measured in ≥ 6 beats) is considered positive, while shortening is considered negative [13].
- Q-wave depth in lead V_5 (measured in > 6 beats). This is considered positive if absent both at rest and at peak exercise, present at rest but with no change with exercise, or present at rest but decreases or disappears with exercise. It is considered negative if absent at rest but appears with exercise, or present at rest and increased by exercise [14].
- Decreased R-wave amplitude > 1 mm [4] or increased ≥ 2 mm [15] at V_5 at peak exercise compared to resting value (measured in ≥ 6 beats) is considered positive.
- QT dispersion (QTD): QT interval was measured manually in as many pericardial and limb leads as possible (≥ 8 leads) after being magnified on a Cannon photocopier ($\times 3$). It is measured from the onset of Q-wave to the end of T-wave. If the end of T-wave is not seen, for example when it is fused with the U-wave or P-wave as in the setting of rapid HR, a straight line is drawn tangential to the down stroke of the T-wave till it meets the base line (identified from level of PR segment) and this is taken as the end of the T-wave. QTD is the difference between the highest and the lowest QT. The test is considered positive if QTD at peak exercise is > 60 ms [16].
- Delta QTD (from rest to peak exercise) > 16 ms. [17].
- Corrected QT dispersion (QTDc) at peak exercise: QT interval (QT) is measured in as many pericardial and limb leads as possible (≥ 8 leads) as mentioned. Corrected QT (QTc) is calculated from Bazett's equation: $QTc = QT / (\sqrt{RR \text{ interval}})$. QTDc is the difference between the highest and the lowest QTc. The test is considered positive if QTDc > 70 ms [16].
- Q-X/QT ratio > 0.5 measured in V_5 in ≥ 6 beats (Q-X measured from the beginning of QRS to crossing of ST) [18].

Coronary angiography

Coronary angiography was carried out within a maximum of 90 days from the exercise test. Multiple views were taken for both the left and right coronary arteries to achieve complete visualization of all coronary segments from ≥ 2 orthogonal planes. The coronary artery was considered diseased if stenosis was $\geq 50\%$ diameter.

Statistical analysis

All data were analysed using SPSS, version 11. Continuous variables were expressed as mean and standard deviation (SD) and discrete variables were presented as frequencies and percentages. Continuous variables were compared between the 2 groups (with and without CAD) using the unpaired Student *t*-test for normally distributed data and the Mann–Whitney U-test for non-normally distributed data. Discrete variables were compared using the chi-squared test with Fisher exact correction. Statistical significance was set at $P < 0.05$.

Variables with a significant difference between the ischaemic and non-ischaemic groups were considered univariate predictors of the presence of CAD. Validation of these variables was tested by computing the sensitivity, specificity and positive and negative predictive values.

The categorical univariate predictors of CAD were entered into multivariate, stepwise, logistic regression analysis to identify independent predictors. Only variables with $P < 0.05$ were eligible to enter the stepwise analysis and be retained in the final model. Validation of the model was also tested using the Holmer–Lemeshow goodness-of-fit statistics across groups of risk. To determine the cut-off point for a positive test according to the above model, a receiver-

operating-characteristic (ROC) curve was plotted for the predicted probability of each case in the study group. Sensitivity, specificity and positive and negative predictive values were compared using the McNemar test.

Results

The mean age of the patients was 46 (SD 9) years. There were 81 (72%) males, 47 (42%) participants with hypertension, 26 (23%) with diabetes, 60 (54%) smokers and 85 (76%) who had had typical chest pain. Based on coronary angiography, significant CAD ($> 50\%$ stenosis) was present in 57 (51%) participants: 21 (19%) had single vessel, 8 (7%) had 2-vessel, 28 (25%) had 3-vessel disease. The remaining 55 participants (49%) did not have significant CAD.

All those with a negative test achieved $\geq 85\%$ of the age-predicted HR with exercise. We were able to measure V_5 variables in 110 (98%) participants; peak exercise QT, QTD, QTc, QTDc was measured in 109 (97%) patients. All missing values were from those in the non-CAD group.

Predictors of CAD

Compared to those without CAD, patients with CAD had higher mean peak exercise QT interval [327 (SD 40) versus 272 (SD 28)] ($P < 0.001$), QTD [61 (SD 21) versus 38 (SD 10)] ($P < 0.001$), QTc interval [485 (SD 36) versus 435 (SD 29)] ($P < 0.001$), QTDc [52 (SD 47) versus 33 (SD 30)] ($P < 0.001$). The univariate predictors of CAD are shown in Table 1.

The statistically significant univariate predictors of CAD were entered into a multivariate, stepwise, logistic regression analysis to determine the best diagnostic model. The independent predictors of CAD were horizontal or downsloping ST depression ≥ 1

Table 1 Univariate predictors of coronary artery disease (CAD)

Predictor	With CAD (n = 57) ^a		No CAD (n = 55) ^a		PPV %	NPV %
	No.	%	No.	%		
Age ≥ 40 years	57	100	24	44	100	75
Male sex	53	93	28***	51	65	87
Hypertension	33	58	14***	25	70	63
Diabetes	18	32	8*	15	67	52
Smoking	40	70	20***	36	67	67
Typical ischaemic chest pain	53	93	32***	58	62	58
Chest pain with exertion	56	98	24***	44	70	94
Abnormal BP response with exercise:	20	35	4***	7	83	53
Peak systolic BP < 130 mmHg	4	7	0	0		
Decrease systolic BP ≥ 10 mmHg	8	14	1*	2	89	52
Systolic BP 3 min post-exercise > 90% peak	16	28	1***	2	94	57
HR at peak exercise < 100 b/m	0	0	0	0		
HR failed to drop ≥ 12 b/m at 1 min post-exercise	16	28	6*	11	73	54
ST-segment shift with exercise:	49	86	24***	44	86	80
≥ 1 mm horizontal or downsloping depression	40	70	5***	9	89	75
≥ 1.5 mm upsloping depression	9	16	15	27		
≥ 1 mm elevation	0		0			
Peak exercise ST/HR index ≥ 1.6 µV/b/m	25	44	16	29		
Peak exercise ST/HR slope ≥ 2.4 µV/b/m	30	53	15**	27	67	59
Increased T amplitude ≥ 2.5 mm in V ₂	33	58	8	15	81	66
T-wave inversion with exercise	1	2	0			
Lengthened or no change in P-wave duration in V ₂	49	86	35***	64	58	71
Decrease or no change in Q-wave depth in V ₅	50	88	39*	71	56	70
R amplitude in V ₅ increase ≥ 2 mm or decrease ≥ 1 mm	45	79	20***	36	69	73
Peak exercise QTD > 60 ms	37	65	4***	7	90	71
Delta QTD rest to peak exercise ≥ 16 mm	26	46	10**	18	72	58
Peak exercise QTDC > 70 ms	45	80	4***	7	92	80
Peak exercise Q-X/QT ratio in V ₅ > 0.5	28	49	16*	29	64	56
Axis shift with exercise	2	4	1	2		
Transient bundle branch block with exercise	0	0	1	2		
Exercise-induced ventricular ectopics	12	21	4	7		

*P < 0.05; **P < 0.01; ***P < 0.001.

^a% within the group with CAD is equivalent to sensitivity while % within the group with no CAD is equivalent to 1 - specificity.

HR = heart rate; b/m, beats per minute; BP = blood pressure; QT = QT interval; QTD = QT dispersion; QTDC = corrected QT dispersion; PPV, positive predictive value; NPV = negative predictive value.

mm and peak exercise QTDC > 70 ms (Table 2).

The Holmer–Lemeshow goodness-of-fit statistic across groups of risk was not statistically significant ($P = 0.89$) indicating little departure from a perfect fit. The area under the ROC curve for the predicted probability of each case in the study group from this multivariate model was 0.94. The cut-off point of the

predicted probability for a positive test according to the above model was obtained from the ROC curve. The cut-off point of the predicted probability of the model was 0.39 with the best sensitivity (93%) and specificity (85%) (Table 3). The predicted probability from the above model was computed from the following equation:

$$Probability = \frac{e^{\alpha + B_1 X_1 + B_2 X_2}}{1 + e^{\alpha + B_1 X_1 + B_2 X_2}}$$

where, α is the constant (intercept) of the regression model, B is the B coefficient of the variables, X is the value of the variable (0 when absent, 1 when present).

This predicted probability ≥ 0.39 can be achieved when ≥ 1 variables in

Table 2 Multivariate stepwise logistic regression analysis for prediction of coronary artery disease (CAD)

Variable	β coefficient (SE)	OR (95% CI)	P-value
ST depression ≥ 1 mm ^a	3.3 (0.8)	27.3 (6.2–60.2)	< 0.001
Peak exercise QTDC > 70 ms	3.8 (0.7)	43.6 (10.3–84.9)	< 0.001
Constant	–9.6 (1.7)	–	< 0.001

^aHorizontal or downsloping.

QTDC = corrected QT dispersion; SE = standard error; OR = odds ratio; CI = confidence interval.

the equation are positive. So, according to the above model, the presence of horizontal or downsloping ST depression ≥ 1 mm and/or peak exercise QTDC > 70 ms is an indication of a positive test.

To study the additive effect of both independent variables in the model, 3 logistic regression models were created, 1 for each independent variable alone and 1 using either or both variables as an indication of a positive test. The discriminative ability of the 3 models was compared by computing the area under the ROC curve for each. Sensitivity, specificity, positive and negative predictive values were computed for each and compared to those of ST depression to make a simple numerical comparison (Table 4). Adding peak exercise QTDC > 70 ms to horizontal or downsloping ST depression ≥ 1 mm in the diagnosis of CAD during the interpretation of the exercise test significantly improved the sensitivity (70% to 93%; $P < 0.001$) and the negative predictive value of the test (75% to 92%; $P < 0.01$) with no significant decrease in the specificity.

The validity indices were higher for the peak exercise QTDC compared to ST depression but the differences were not statistically significant.

The additive effect of the independent variables in the model was re-tested in the detection of single vessel disease as well as multi-vessel disease (Table 4). ST depression had a lower sensitivity in single vessel (57%) than in multi-vessel disease (78%; $P < 0.01$), with specificity 91% for both. Similarly, peak exercise QTDC had sensitivity 81% for single

and 78% for multi-vessel, with specificity 92% for both. The diagnostic accuracy was even better than ST depression in single vessel disease, as indicated from the greater area under the ROC curve (0.87 versus 0.74) and higher sensitivity (81% versus 57%; $P < 0.001$). Although the specificity and predictive values were higher, the differences were not statistically significant. In single vessel disease, adding peak exercise QTDC to ST depression offered advantages over QTDC alone. In multi-vessel disease the diagnostic accuracy of the test improved (area under ROC curve 0.97, which is higher than either alone). The sensitivity and negative predictive value in multi-vessel disease increased significantly to 100% with no significant decrease in specificity.

Discussion

The exercise test has a reported sensitivity of 50%–70% and specificity of 70%–90% using conventional ST depression criteria with exercise [3]. In a meta-analysis, mean sensitivity was 68% (range 23%–100%) and mean specificity 77% (range 17%–100%) [1]. In our study, sensitivity was 86% and specificity

44%. This relatively high sensitivity is attributed to the use of 50% angiographic stenosis as a reference standard for the presence of CAD and measurement of ST depression at peak exercise and/or during recovery, which improves test sensitivity. Recovery-onset ST depression has been reported to represent about 30% of ischaemic ECG response with exercise [21].

Another explanation could be referral bias as the participants included patients with typical and probable ischaemic chest pain. Referral bias was reported to be the most important factor increasing sensitivity and decreasing specificity [2]. This referral bias is ethically unavoidable as coronary angiography could not be done for patients with atypical, likely non-ischaemic, chest pain and negative exercise test. Horizontal or downsloping ST depression > 1 mm had a significantly lower sensitivity (70%) and a higher specificity (91%). Sansoy Watson and Beller similarly reported that adding upsloping ST-segment depression increased sensitivity at the expense of specificity and a significant decrease in the positive predictive value of the test [22]. Also, in a more recent report, both rapid and slow upsloping ST depression were found to be associated with very low likelihood of CAD compared to horizontal or downsloping ST depression [23]. Similar to previous reports [1,2], we found that in single vessel disease, ST depression had a lower sensitivity than in multi-vessel disease, with a similar specificity.

Normally, the QT interval (corrected for HR) shortens with exercise [24].

Table 3 Sensitivity and specificity of the predicted model at different predicted probabilities

Positive if predicted probability $\geq$:	Sensitivity	Specificity
0.00	1.00	0.00
0.39	0.93	0.85
0.74	0.79	0.92
0.89	0.57	1.00
1.00	0.00	1.00

Table 4 Validity of the additive effect of the 2 variables in the logistic regression model for the detection of coronary artery disease (CAD), single vessel disease (SVD) and multi-vessel disease(MVD)

Measure	Horizontal or downsloping ST depression ≥ 1 mm	Peak exercise QTDC > 70 ms	Either or both positive
Detection of CAD			
Area under ROC curve (SE)	0.80 (0.04)	0.86 (0.04)	0.94 (0.02)
Sensitivity (%)	70	80	93***
Specificity (%)	91	92	85
PPV (%)	89	92	87
NPV (%)	75	80	92***
Detection of SVD			
Area under ROC curve (SE)	0.74 (0.07)	0.87 (0.06)	0.88 (0.06)
Sensitivity (%)	57	81***	81***
Specificity (%)	91	92	85
PPV (%)	71	81	68
NPV (%)	85	92	92
Detection of MVD			
Area under ROC curve (SE)	0.84 (0.05)	0.85 (0.05)	0.97 (0.02)
Sensitivity (%)	78	78	100***
Specificity (%)	91	92	85
PPV (%)	85	86	82
NPV (%)	86	86	100***

*** $P < 0.001$ (compared with ST depression).

ROC = receiver operating characteristics; PPV = positive predictive value; NPV = negative predictive value; QTDC = corrected QT dispersion; SE = standard error.

Some investigators have found that this interval fails to shorten, or lengthens, when ischaemia is present [18,25]. They have also reported a higher Q-X/QT ratio in CAD patients with no additive value to ST segment criteria in terms of sensitivity and specificity [18,25]. QT interval difference with age and sex is not thought to affect its usefulness in exercise ECG. This is based on previous findings that sex differences in QT disappear at HR ≥ 110 beats/min, whereas age differences are smaller but are present throughout exercise, with no significant age–sex interaction [26]. Moreover, QTD, QTDC and/or their differences between rest and peak exercise have emerged as useful additional diagnostic criteria in the interpretation of the exercise test, irrespective of sex [16,17,26,27].

Exercise QTD > 60 ms has been found to be a clinically useful indicator of significant coronary stenosis

independent of sex or the presence or absence of significant exercise-induced ST-segment depression [26] and in patients who do not have exercise-induced chest pain or significant ST-segment depression [27]. It has been reported in a study on female patients to have a significantly higher sensitivity and specificity for the diagnosis of CAD compared with 1-mm ST-segment depression. When a QTD > 60 ms was added to ST-segment depression as a condition for a positive test, the specificity increased to 100% [16]. Also, it has been reported to have a greater sensitivity and specificity than ST depression in the detection of restenosis after percutaneous coronary angioplasty at ≥ 50 ms [28]. Adding QTD ≥ 60 ms to ST depression improved the diagnostic value of the exercise test in diagnosing restenosis after percutaneous coronary angioplasty [29]. A rise of QTD with exercise ≥ 16 mm was another predictor of CAD [17]. Exercise QTDC of > 70

ms significantly increased the sensitivity of exercise testing for CAD; in addition, combining with ST-segment depression gave a specificity of 100%. Both QTD and QTDC were measurable with an acceptable reproducibility [16]. Similarly Ozdemir et al., in a study of a series of female patients, have reported that QTDC with a different cut-off point of a positive test (> 60 ms) had a greater sensitivity and specificity than ST-depression [30].

In our study, peak exercise QTD > 60 ms, delta QTD rest to peak exercise ≥ 16 mm, QTDC > 70 ms and Q-X/QT ratio in $V_5 > 0.5$ were significantly higher in CAD patients. Q-X/QT ratio in $V_5 > 0.5$ had the lowest sensitivity and specificity. The other 3 parameters had high specificity but differed in sensitivity, high for QTDC > 70 ms and low for QTD > 60 ms and delta QTD.

Peak exercise QTDC and horizontal or downsloping ST depression were the

only variables found to be independent predictors of CAD in multivariate analysis. The validity indices, despite being higher for peak exercise QTDC compared to ST depression, were not statistically significant. The diagnostic accuracy of QTDC was even better than ST depression in single vessel disease, as indicated by the greater area under

the ROC curve and better sensitivity. We showed that using either variable as a marker of a positive exercise test significantly improved the sensitivity and negative predictive value of the test without a significant decrease in the specificity.

In conclusion, clinical and exercise-induced haemodynamic and ECG

changes could provide additional information that could increase the ability of the exercise test to diagnose CAD. Using either horizontal or downsloping ST depression ≥ 1 mm or QTDC peak exercise > 70 ms as a marker of a positive exercise test significantly improves the diagnostic value of the test.

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Biological activity resulting from exposure to aquatic environmental genotoxic pollutants in northern Egypt

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النشاط البيولوجي الناتج عن التعرض للملوثات البحرية البيئية السامة للجينات في شمال مصر
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الخلاصة: قاس الباحثون في بحيرة إدكو والبحر المتوسط، في منطقة المعديّة، ثلاثة مركبات أمينية أروماتية هي (1-naphthylamine, 2-naphthylamine, benzidine) في أنسجة عضلات السمك. وكان هناك تباين موسمي واضح في مستويات المركبات الأروماتية. كما حدد الباحثون الإجهاد التأكسدي (غلوتاثيون الدم، ونشاط إنزيم الكاتالاز) والتأثيرات السامة على الجينات (تغير المتقدرات، والمستقبلات البولية) لدى الصيادين في كلا المنطقتين. وتبين أن الصيادين عانوا من إجهاد تأكسدي ومستويات مرتفعة من المستقبلات البولية للسلفانيلاميد (المتوسط 14.5 و 20.7 ميكروغرام لكل ملي غرام مقارنة بـ 5.3 ميكروغرام لكل ملي غرام لدى الشواهد). وارتفع تكرار إجمالي تغيرات المتقدرات على نحو يُعتدُّ به إحصائياً في خلايا لمفاويات الدم الطرفية بين الصيادين في كلتا المنطقتين (67 و 45 لكل 100 طور تالٍ مقارنة بـ 14 لكل 100 طور تالٍ لدى الشواهد).

ABSTRACT We estimated pollution in Lake Edku and the Mediterranean Sea, El-Maadiya Region, with 3 aromatic amines (1-naphthylamine, 2-naphthylamine and benzidine) in the muscle tissue of fish. There were marked seasonal variations in the aromatic amine levels. We also determined oxidative stress (blood glutathione, and catalase activity) and genotoxic effects (chromosomal aberrations and urinary metabolites) in fishermen from each area. The fishermen suffered from oxidative stress and had high levels of the urinary metabolite sulfanilamide [mean ($\mu\text{g}/\text{mg}$ creatinine): Lake Edku 20.7, Mediterranean 14.5, controls 5.3]. Frequencies for total chromosomal aberrations were significantly raised in the peripheral blood lymphocytes of fishermen in both areas [frequency (per 100 metaphases): Mediterranean 67, Lake Edku 45, controls 14].

Activité biologique résultant de l'exposition à des polluants génotoxiques en milieu aquatique dans le nord de l'Égypte

RÉSUMÉ Nous avons réalisé une estimation de la pollution dans le lac Edkou et en Méditerranée (région d'El-Maadiya), sur la base de trois amines aromatiques (1-naphthylamine, 2-naphthylamine et benzidine) dans les tissus musculaires de poissons. Nous avons constaté de fortes variations saisonnières des niveaux d'amines aromatiques. Nous avons également déterminé le stress oxydatif (glutathion sanguin et activité de la catalase) et les effets génotoxiques (aberrations chromosomiques et métabolites urinaires) chez les pêcheurs de chaque région. Ces pêcheurs souffraient de stress oxydatif et présentaient des niveaux élevés de sulfanilamide, un métabolite urinaire [moyenne ($\mu\text{g}/\text{mg}$ de créatinine) : lac Edkou 20,7, Méditerranée 14,5, témoins 5,3]. La fréquence des aberrations chromosomiques totales était significativement plus élevée dans les lymphocytes circulants des pêcheurs des deux régions [fréquence (pour 100 métaphases) : Méditerranée 67, lac Edkou 45, témoins 14].

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Introduction

The development of modern industry causes increasingly serious pollution in the environment where we live, constituting a catastrophic health risk, including for cancer [1]. Pollution of the aquatic environment is one of the worst legacies of development of the 20th century [1] and marine coastal areas are particularly impacted by human activities [2]. Aquatic ecosystems serve as a sink for pollutants, which bind to sediment and tend to accumulate in the tissues of aquatic organisms [3]. The concentrations of these compounds in the fresh tissues of aquatic organisms are several orders of magnitude higher than those found in the environment. Moreover, due to their lipophilic nature, organic compounds tend to bioaccumulate in fatty tissues [2].

Aromatic amines are environmental pollutants found in lakes, rivers and soil; they represent one of the most important classes of industrial and environmental chemicals. Many have been reported to be powerful carcinogens and/or haemotoxicants [4]. Their metabolites, N-hydroxy arylamines and nitrosoarenes, react with DNA, proteins and glutathione; the resulting damage to biomolecules is often responsible for the toxic or genotoxic effects [5].

In Egypt the coastal areas around El-Maadiya and Lake Edku are the main recipients for a number of pollutants from agriculture as well as industrial drainage.

The biomarker of exposure to these pollutants is the measurement of urinary metabolites. This enables the determination of the internal dose of pollutants and provides important information for biomonitoring of occupational and environmental human exposure [6].

Living beings are protected from reactive oxygen species (ROS) by several defence mechanisms, including glutathione, which has many antioxidant

functions, such as control of the protein redox status and defence against free radicals and oxygen toxicity [7]. Most of these functions oxidize reduced glutathione (GSH) to the disulfide form (GSSG), the concentration of which is an index of oxidative stress [8]. Catalase is a haeme-containing enzyme which is localized in most mammalian cells exclusively in peroxisomes [9]. Human erythrocytes with a high catalase content provide a general defence against toxic concentrations of hydrogen peroxide, while the lower the catalase activity in red cells, the more effective the action of the oxidizing agents [10]. Oxidative stress may result in damage to critical cellular macromolecules, including DNA, lipids, and proteins [11]. Oxidative DNA damage may participate in ROS-induced carcinogenesis [12]. A common form of damage is the formation of hydroxylated bases of DNA, which is considered an important event in chemical carcinogenesis [12]; this adduct formation interferes with normal cell growth by causing genetic mutations and altering normal gene transcription [12].

According to INCHEM guidelines, "Somatic mutations, either genetic or chromosomal, are not transmitted to the offspring of an exposed individual. However, increases in the frequency of these mutations may contribute to an increase in the frequency of acquired disorders, for example, cancer. There is, therefore, a clear need to develop and apply methods to study exposed populations at risk of increased levels of somatic or germinal mutations" [13].

Thus, the aim of this study was to estimate some aromatic amines in the flesh of fish taken from Lake Edku and the Mediterranean Sea at El-Maadiya and to investigate oxidative stress and chromosomal aberrations as biological markers reflecting the genotoxic effects of aquatic environmental pollutants in local fishermen.

The Mediterranean coastal area of the north-eastern Egypt was selected for this study because it is the recipient of extensive agricultural and industrial wastes. The fresh water lake, Lake Edku, lies in the north of the Nile Delta, west of the Rosetta branch of the Nile between long 30° 8' 30" N and 30° 23' 100" E and is connected to the Mediterranean Sea through Boughaz El-Maadiya, a narrow, shallow channel. The hydrographic and biological characteristics of the water in El-Maadiya connection depend on the water exchange between Abu-Qir Bay and Lake Edku. Great amounts of industrial wastes are discharged into the bay through Tabia pumping station. These wastes come from about 36 factories in a cultivated area extending from Kafr El-Dawar to Alexandria. Tabia pumping station pumps the highly polluted water of El-Amia Drain, which receives the drainage from El-Behira district as well as the industrial wastes of the factories. These waste discharges originate from 5 main activities: the fertilizer industry, the pesticides industry, textile manufacturing, the paper industry and food processing and canning.

Methods

This study was carried out over the period 2002–2004. Males living in El Maadiya region were invited to take part in the study and about 60% of those we contacted agreed to participate. The study group comprised 102 male subjects with an average age of 38 (standard deviation 13) years; they were classified into 2 groups: non-fishermen, ($n = 20$) with low fish eating habits (healthy control group) and fishermen ($n = 82$). The fishermen were divided into 2 groups: Mediterranean Sea fishermen ($n = 55$) and Lake Edku fishermen ($n = 27$).

Determination of aromatic amines in fish flesh

We followed the method of Diachenko [14] for the determination of selected industrial aromatic amines in fish. Samples of *Tilapia* sp. and *Claris* sp. were collected from Lake Edku, and samples of *Mugil* sp. and *Siganus rivulatus* from the Mediterranean Sea in El-Maadiya region during the 4 seasons (winter, spring, summer and autumn). The flesh of the fish was separated and the skin removed. The fish flesh was dried in an incubator at 37–40 °C for 2–7 days depending on the size of the fish. After drying, a mechanical grinder was used to grind the fish to powder form.

The fish powder was digested with aqueous NaOH and extracted with benzene. The extract was washed with diluted acid and cleaned up using silica gel column chromatography. The amines were separated, and quantitatively determined by gas chromatography–mass spectrometry using a fully automated mass spectrometer (Agilent model HP6890) equipped with HP-data system to acquire and process all GC-MS data. A gas chromatograph (Agilent) was interfaced to the mass spectrometer and fitted with a capillary column (model HP19091S-433) with HP-5 on 5% phenyl methyl siloxane, with nominal length 30 m, nominal diameter 250 µm and nominal film thickness 0.25 µm.

Blood analyses

The participants were requested to fast for 6 hours. Samples of peripheral blood (10 mL) were collected by a physician by venepuncture in heparinized tubes at the Medical Research Institute in Alexandria. The blood samples were processed immediately.

Blood glutathione content was determined using 0.2 mL of whole blood according to the method of Beutler E, Duron O, Kelly BM [15]. DTNB reagent was obtained from Sigma Chemical Company and optical density was

measured at 412 nm using a PRIME automatic photometer (BPC BioSED srl, Italy).

Erythrocyte catalase activity was determined according to the method of Donald and Hugo [16]. The concentrated haemolysate was diluted 500 times (v/v) with phosphate buffer immediately before carrying out the assay (in duplicate) to determine haemoglobin content using the method of Drabkin [17]. The enzyme activity level was measured at 412 nm.

Determination of urinary sulfanilamide

Early morning urine samples were collected from those participants who had abnormal levels of blood glutathione (< 35 mg/dL) and/or erythrocyte catalase activity (< 805 U/g Hb) to detect urinary metabolites of aromatic amines (sulfanilamides) according to the method of Hayashi M, Amino G, Uchida MS [18].

Cytogenetic analysis

Blood culture for chromosome aberrations was carried out according to the methods described by Smerhovsky Z et al. [19]. One hundred metaphases were counted and scored for structural chromosomal aberrations according to the International System for Human Cytogenetic Nomenclature (ISCN).

Statistical analysis

The data obtained were statistically analysed using SPSS, version 10. One way analysis of variance was used to compare between the levels of the different parameters in the study groups. A difference was considered significant at $P < 0.05$.

Results

Oceanographic data

The pollution status of Lake Edku and the Mediterranean Sea (El-Maadiya region) was studied by estimating the

levels of 1-naphthylamine, 2-naphthylamine and benzidine in the muscle tissue of 4 types of fish: *Tilapia* sp. and *Claris* sp. from Lake Edku and *Mugil* sp. and *Siganus rivulatus* from the Mediterranean Sea.

High concentration of 1-naphthylamine and benzidine were found in *Tilapia* sp. in summer (Table 1) while high concentrations of 2-naphthylamine were found in spring. In *Claris* sp. the concentration of 1-naphthylamine was high in all seasons except spring, and high concentrations of 2-naphthylamine and benzidine were found in spring and summer (Lake Edku).

Elevated levels of all 3 aromatic amines were found in autumn in *Mugil* sp., the 3 aromatic amines were found in elevated levels in *Siganus rivulatus* in all 4 seasons (Mediterranean Sea).

Biochemical data

Statistical analysis between groups (1-way ANOVA) showed a significantly lower blood glutathione level in both groups of fishermen compared with the control group ($P < 0.001$) (Table 2). Erythrocyte catalase activity was significantly lower in both the fishermen groups compared with the control group ($P < 0.001$) (Table 2). Significantly higher urinary sulfanilamide levels were seen in both fishermen groups compared with the control group ($P < 0.001$) (Table 2).

There was a significant negative correlation between urinary sulfanilamide (µg/mg creatinine) and blood glutathione (mg/dL) content in the studied groups ($r = -0.549$, $P = 0.004$) (Figure 1, available in online version). There was also a significant negative correlation between urinary sulfanilamide (µg/mg creatinine) and erythrocyte catalase enzymatic activity (U/g Hb) ($r = -0.523$, $P = 0.006$) (Figure 2, available in online version).

Table 1 Concentration of aromatic amines in flesh of 4 fish species from Lake Edku and the Mediterranean Sea according to season

Species & season	1-Naphthylamine (µg/kg dry weight)	2-Naphthylamine (µg/kg dry weight)	Benzidine (µg/kg dry weight)
<i>Tilapia</i> sp.^a			
Winter	–	–	–
Spring	–	932	–
Summer	2801	–	934
Autumn	–	–	–
<i>Claris</i> sp.^a			
Winter	1060	–	–
Spring	–	3476	2812
Summer	4019	3221	952
Autumn	3480	–	–
<i>Mugil</i> sp.^b			
Winter	–	–	–
Spring	–	–	–
Summer	–	–	–
Autumn	1713	1286	650
<i>Siganus revulatus</i>^b			
Winter	3213	2048	1347
Spring	3765	953	618
Summer	2742	2989	1185
Autumn	5541	2148	975

^aFrom Lake Edku. ^bFrom the Mediterranean Sea, El-Maadiya region.**Table 2 Oxidative stress markers in the blood of a healthy control group and 2 groups of fishermen from El-Maadiya region**

Oxidative stress marker	Controls (n = 20)	Mediterranean Sea fishermen (n = 55)	Lake Edku fishermen (n = 27)
Glutathione (mg/dL whole blood)			
Mean	39.95	34.36	34.41
SD	2.96	5.63	6.16
SE	0.66	0.76	1.19
Range ^a	35–44	25–46	19–45
Erythrocyte catalase activity (U/g Hb)			
Mean	974.00	661.00	589.30
SD	92.20	146.90	117.12
SE	20.62	19.81	22.54
Range ^b	1163–805	933–352	858–329
Urinary sulfanilamide (µg/mg creatinine)	(n = 9)	(n = 13)	(n = 6)
Mean	5.3	14.5	20.7
SD	3.1	9.4	9.65
SE	1.0	2.5	3.9
Range ^c	0.5–9.9	4.1–35.1	6.1–33.1

^aF = 8.634, P < 0.001; ^bF = 56.294, P < 0.001; ^cF = 4.278, P = 0.024 (1-way analysis of variance).
SD = standard deviation; SE = standard error; Hb = haemoglobin.

Cytogenetic results

Table 3 compares the frequencies of different types of chromosomal aberrations in each group. Chromosome-type exchanges, chromosome-type breaks plus exchanges, chromosome-type aberrations, total breaks plus exchanges as well as total chromosomal aberrations were significantly increased in both fishermen's groups compared with the control group ($P = 0.003$, $P = 0.001$, $P < 0.001$, $P = 0.001$, $P = 0.001$ respectively). There was a highly significant negative correlation between total chromosomal aberrations "excluding gaps" (/100 metaphases) and blood glutathione content in the studied groups ($r = -0.648$, $P < 0.001$) (Figure 3, available in online version). There was also a significant negative correlation between total chromosomal aberrations excluding gaps and erythrocyte catalase enzymatic activity ($r = -0.672$, $P < 0.001$) (Figure 4, available in online version). Finally, there was a significant positive correlation between total chromosomal aberrations excluding gaps and urinary sulfanilamide in the 3 groups ($r = 0.488$, $P = 0.011$) (Figure 5, available in online version).

Discussion

Concentrations of the 3 studied aromatic amines were highly elevated in *Claris* sp. compared with *Tilapia* sp. Additionally, *Tilapia* sp. was free from all 3 aromatic amines in winter and autumn, while *Claris* sp. was free from 2-naphthylamine and benzidine in winter and autumn. The variation may be related to the feeding habits or the greater body size and body fat content of *Claris* sp. [20].

In addition, a marked elevation in concentrations of the 3 studied aromatic amines was detected in *Siganus revulatus*, while in *Mugil* sp., the pollution occurred only in autumn. This may be due to the feeding habits and species

differences. These findings are in agreement with the results of other studies which found that the mean concentration of pollutants in the sea animals varied according to species, season and area [21,22]. High levels of genotoxic elements in fish can confirm the pollution of sea water and the possibility of the presence of genotoxic elements [23].

The biochemical results of this study shows that the fishermen groups of Lake Edku and El-Maadiya region of the Mediterranean Sea were suffering from oxidative stress, which manifested in a significant decrease in the levels of both whole blood glutathione and erythrocyte catalase enzymatic activity compared with the control group. A significantly high level of the urinary metabolite sulfanilamide was found in both fishermen groups in comparison with the control group. Sulfanilamide stimulates the formation of methaemoglobin in red blood cells; this may be a result of exposure to pollutants such as aromatic amines and pesticides during recreational activities as well as high consumption of polluted fish [24].

Oxidative stress may result in damage to critical cellular macromolecules,

including DNA, lipids, and proteins [11]. Oxidative DNA damage may participate in ROS-induced carcinogenesis [12]. A common form of damage is the formation of hydroxylated DNA bases, which are considered an important event in chemical carcinogenesis [12,25]. This adduct formation interferes with normal cell growth by causing genetic mutations and altering normal gene transcription.

To counteract oxidative stress, the human body has evolved various defence mechanisms [26]. Antioxidants, which scavenge the reactive oxygen species prior to their interaction with cellular components are the first line of defence against exogenous oxidative stress [26]. If a large amount of the toxic substance is present then the detoxication mechanisms are overwhelmed. Excess superoxide is produced, reduced glutathione and NADPH are depleted and hydroxyl radicals and singlet oxygen are formed [27].

Chromosomal analysis of peripheral human lymphocytes is the most widely used method for biomonitoring human exposure to genotoxic chemicals. In our study, the frequency of chromosomal aberrations in fishermen

exposed to benzidine was significantly higher than in the control group. Data on the chromosomal effect of human exposure to benzidine is, however, scarce. Mirkova and Lalchev observed a statistically significant increase in frequency of chromosome aberrations in lymphocytes of workers exposed to benzidine compared to a control group [28], an observation in accordance with our own findings. In contrast to our study, the main type of aberration observed in the Mirkova and Lalchev study [28] was chromatid breaks, whereas the main type of aberrations we observed was chromosome exchanges. The presence of dicentric, rings and chromatid exchanges in our study confirms the very high dose of benzidine to which these fishermen have been exposed, and demonstrates the mutagenic effect of benzidine on the lymphocytes.

The chromosomal aberration assay has also been shown to be a convenient test for somatic risk assessment. Clear evidence has been presented that an enhanced frequency of chromosomal aberrations correlates with an increased incidence of cancer in epidemiological

Table 3 Chromosomal aberrations in a healthy control group and 2 groups of fishermen from El-Maadiya region

Chromosomal aberration	Controls (n = 6)		Mediterranean Sea fishermen (n = 13)		Lake Edku fishermen (n = 7)		ANOVA	
	Freq ^a	Mean (SD)	Freq ^a	Mean (SD)	Freq ^a	Mean (SD)	F	P
Chromosome-type gap	0	0	2	0.002 (0.004)	3	0.004 (0.005)	2.13	0.141
Chromosome-type break	0	0	6	0.005 (0.008)	6	0.010 (0.011)	1.94	0.167
Chromosome-type exchange	4	0.007 (0.008)	39	0.030 (0.014)	27	0.040 (0.020)	7.79	0.003
Chromosome-type break + exchange	4	0.007 (0.008)	45	0.035 (0.016)	33	0.047 (0.023)	9.95	0.001
Chromosome-type aberration	4	0.007 (0.008)	47	0.036 (0.016)	38	0.051 (0.022)	12.11	< 0.001
Chromatid-type gap	10	0.017 (0.010)	19	0.015 (0.011)	7	0.010 (0.010)	0.69	0.512
Chromatid-type break	0	0	0	0	0	0	-	-
Chromatid-type exchange	0	0	1	0.001 (0.003)	0	0	0.48	0.625
Chromatid-type break + exchange	0	0	1	0.001 (0.003)	0	0	0.48	0.625
Chromatid-type aberration	10	0.020 (0.010)	20	0.015 (0.012)	7	0.010 (0.010)	0.72	0.499
Total breaks + exchanges	4	0.007 (0.008)	46	0.035 (0.015)	33	0.047 (0.023)	10.74	0.001
Total aberrations	14	0.023 (0.005)	67	0.052 (0.020)	45	0.061 (0.002)	8.86	0.001

^a Freq = frequency of chromosomal aberrations/100 metaphases.
ANOVA = analysis of variance; SD = standard deviation.

surveys and is of predictive value for subsequent cancer risk [29–32]. We found an elevated level of the herbicide metabolite sulfanilamide in the urine of both groups of fishermen. There was a negative correlation between sulfanilamide and both glutathione and catalase activity.

Our study also demonstrated a high frequency of chromosomal aberrations in the peripheral blood lymphocytes of both fishermen groups. There was a positive correlation between sulfanilamide and chromosomal aberrations,

and a negative correlation between chromosomal aberrations and both glutathione and catalase activity were found. Therefore, it may be considered that oxidative stress and sulfanilamide contribute to the induction of chromosomal aberrations, and a consequential serious effect on human health.

Conclusion

Our findings emphasize that the pollution of El-Maadiya region induces

a panic oxidative stress in fishermen in the vicinity of this area. The risk will persist because of the decrease in the levels of antioxidant glutathione and catalase enzyme activity in the blood of fishermen.

These findings indicate that oxidative biomarkers in combination with other types of biomarkers (chromosomal aberrations) can be useful in the large scale for environmental monitoring.

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Principles for modelling dose-response for the risk assessment of chemicals

This volume, *Principles for modelling dose-response for the risk assessment of chemicals*, is part of the ongoing review of the underlying scientific bases for decision-making in chemical risk assessment by International Programme on Chemical Safety. It involves specific consideration of the area of dose–response assessment in the evaluation of information from toxicological studies in animals and from human clinical and epidemiological studies. It covers toxicants with threshold effects and those for which there may be no practical threshold, such as substances that are genotoxic and carcinogenic. The discussions are concerned with that subset of cause–effect relationships commonly referred to as dose–response models, which are typically used to characterize the biological effects of intentional (e.g. drugs and nutrients) and unintentional (e.g. contaminants) exposure to chemicals.

This report is intended primarily to provide descriptive guidance for risk assessors in using dose-response modelling in hazard characterization. It will also provide mathematical modellers with an appreciation of issues to be considered when modelling in the context of the risk assessment process. Risk managers will be able to obtain a general understanding of the applications and limitations of dose-response modelling. For both risk assessors and risk managers, some considerations for communicating the results of risk assessments that use dose-response modelling are presented

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Evaluation of intralesional 0.2% ciprofloxacin as a treatment for cutaneous leishmaniasis

K.I. Al Hamdi,¹ A.H. Awad² and H.M. Moker³

تقييم المعالجة الداخلية لآفات الليشمانيا الجلدية بالسيروفلوكساسين 0.2%

خليل اسماعيل الحمدي، عبد الحسين حبش عواد، هنادي مهدي موكر

الخلاصة: بالرغم من أن آفات الليشمانيا الجلدية تشفى في العادة تلقائياً إلا أنها تسبب ندبة سيئة المنظر. وتقيم هذه الدراسة علاجاً جديداً محتملاً لـ 38 مريضاً لديهم 70 آفة، اختيروا عشوائياً لتجربة الحقن الداخلي بالسيروفلوكساسين 0.2%، أو معالجة الآفات داخلياً بمحلول كلوريد الصوديوم المفرط التوتر (7%). وبعد استبعاد المرضى الذين لم يواظبوا على العلاج، شفيت تماماً الآفات التي تلقت العلاج بمحلول كلوريد الصوديوم (وعدددها=21) في 76.2% من الحالات، وعندما استمر وجود الندبة فإن حجمها قد انخفض بنسبة 66.0% مقارنة بحجم الآفة الأصلي. أما الآفات التي عولجت بالسيروفلوكساسين (وعدددها=27) فكان معدل الشفاء فيها 81.5%، وكان متوسط انخفاض حجم الندبة 68.6%. إن العلاج الداخلي بالسيروفلوكساسين 0.2% كان فعالاً مثل العلاج بالمحلول الملحي المفرط التوتر بالنسبة لآفات الليشمانيا الجلدية.

ABSTRACT Although cutaneous leishmaniasis lesions usually heal spontaneously they cause unsightly scarring. This study evaluated a possible new therapy in 38 patients, with 70 lesions, randomly assigned to intralesional injection of ciprofloxacin (0.2%) or intralesional sodium chloride hypertonic solution (7%). After excluding patients who defaulted on treatment, lesions assigned to sodium chloride treatment ($n = 21$) were completely healed (with or without scarring) in 76.2% of cases, and, when a scar remained, the scar size was reduced 66.0% compared with the original lesion. Lesions assigned to ciprofloxacin ($n = 27$) showed an 81.5% healing rate with an average scar size reduction of 68.6%. Intralesional 0.2% ciprofloxacin was as effective as hypertonic saline in the treatment of cutaneous leishmaniasis infection.

Évaluation de la ciprofloxacine en injection intralésionnelle à 0,2 % comme traitement de la leishmaniose cutanée

RÉSUMÉ Bien que les lésions causées par la leishmaniose cutanée guérissent en général spontanément, elles laissent une cicatrice disgracieuse. Cette étude a évalué une possible nouvelle thérapie chez 38 patients présentant 70 lésions, soumis de façon aléatoire à une injection intralésionnelle de ciprofloxacine (0,2 %) ou à l'administration intralésionnelle d'une solution de chlorure de sodium hypertonique (7 %). Après exclusion des patients qui n'avaient pas suivi le traitement, les lésions soumises au traitement par le chlorure de sodium ($n = 21$) avaient complètement guéri (avec ou sans cicatrice) dans 76,2 % des cas et lorsqu'il restait une cicatrice, sa taille avait diminué de 66,0 % par rapport à la lésion d'origine. Les lésions soumises à la ciprofloxacine ($n = 27$) montraient un taux de guérison de 81,5 % avec une réduction moyenne de la taille de la cicatrice de 68,6 %. L'administration intralésionnelle de ciprofloxacine à 0,2 % était aussi efficace que le soluté salin hypertonique dans le traitement de la leishmaniose cutanée.

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Introduction

Cutaneous leishmaniasis is a parasitic disease transmitted by biting insects (sandflies) [1,2]. The disease is endemic in Iraq [3] and in other neighbouring countries such as Kuwait, Saudi Arabia and the Islamic Republic of Iran [4]. In Iraq there are 2 main species of the genus *Leishmania* causing the infection: *L. tropica* and *L. major* [5].

Lesions usually heal spontaneously within several weeks or months [6], but it is reasonable to treat the lesions since they may persist for a long time leaving unsightly scars on healing [7,8]. Although antimony is the first choice of treatment, it is an unstable and toxic drug [9]. This has led many workers to try other drugs, such as sodium chloride hypertonic solution, zinc sulfate and metronidazole in local studies [5,10,11]. Good results were also obtained with ciprofloxacin, a wide-spectrum antibiotic, used topically in an experimental study on BALB/c mice infected with *L. major* [12].

The aim of this study was to evaluate intralesional ciprofloxacin (0.2%) as a new therapy for cutaneous leishmaniasis in humans and compare its efficacy with sodium chloride hypertonic solution (7%).

Methods

The study sample was all patients with cutaneous leishmaniasis who were diagnosed clinically by the same dermatologist in the outpatient clinic of Basra teaching hospital, south Iraq, from April 2004 to March 2005.

Information was taken from each patient, including the number of lesions, sites, history of infections and whether lesions had been treated previously or not. Thin blood films were made from the edge of the lesion and stained by Giemsa stain [13] and then examined microscopically. Exudates from lesions

were also sampled and injected into semi-solid culture medium which was incubated at 26 °C and examined after 5–6 days to detect parasites.

The 38 patients had a total of 70 cutaneous leishmaniasis lesions. The patients were randomly divided into 2 groups with equal numbers of lesions in each: group 1 lesions ($n = 35$) were treated with hypertonic sodium chloride solution (7%) (7 g dissolved in 100 mL distilled water and autoclaved) and group 2 lesions ($n = 35$) were treated with ciprofloxacin solution (2 mg/mL). Both drugs were injected into the lesions in amounts of 0.1–0.5 mL according to the size of the lesion.

In order to measure the effect of each treatment, the diameter, erythema and induration of the lesions were assessed at the start and again at 2-week intervals after treatment for 8 weeks. A scoring system was specially designed as follows. The diameter of lesions was recorded in millimetres using a ruler and scored as: 0 (total healing); 1 (0–< 0.5 cm); 2 (0.5–< 1 cm); 3 (1–< 1.5 cm); 4 (1.5–< 2 cm); 5 (2–< 2.5 cm); or 6 ($\geq$ 2.5 cm). The degree of induration was assessed by palpation in comparison with the patient's normal skin and given the following scores: 0, 0.5, 1, 1.5, 2 or 3. The degree of erythema was assessed by naked eye and scored as: 0, 0.5, 1, 1.5, 2 or 3. Ulceration was scored as: 1 (present) or 0 (absent). All parameters scores were converted to percentages, and then the mean and standard deviation (SD) % score were calculated. The scores of these 4 parameters were added to give a total score for each lesion.

The changes in total score between weeks 0–2, weeks 2–4, weeks 4–6 and weeks 6–8 were compared. Follow-up continued for 8 weeks until complete healing took place (i.e. resolution of active lesion with or without scarring). After healing, the scar size for each group was recorded and compared with the original lesion size to evaluate the efficacy of drugs in reducing scar size.

Statistical analysis was done by analysis of variance (ANOVA) and Student *t*-test test with significance at $P < 0.05$.

Results

A total of 38 patients with 70 cutaneous leishmaniasis lesions were treated and followed up during this study. The lesions were on different parts of the body but predominantly on the upper and lower extremities. The age of patients ranged from 1.5 to 64 years (1.5–45 years in group 1 and 3–64 years in group 2) with a mean of 21.1 years. There was no significant difference in the sex of the patients (52.5% males, 47.5% females). The duration of lesions before the study started ranged from 1 month to 5 years (Table 1).

Group 1 lesions were treated with hypertonic sodium chloride solution while group 2 lesions were treated with ciprofloxacin. After excluding patients who defaulted on treatment, a total of 21 lesions were analysed in group 1 and 27 in group 2. In both groups 1 and 2 marked reductions were seen in the total % scores of lesions after 2, 4, 6 and 8 weeks of treatment, with significant improvements within each group in the % scores between weeks 0–2 and weeks 2–4 (ANOVA test, $P < 0.05$) but not between weeks 4–6 and 6–8 (Table 2). After 8 weeks there was no significant difference in the mean total % scores between groups 1 and 2 (1.8% versus 5.4%).

At the end of the 8 weeks follow-up the mean % scores for diameter, induration and erythema separately showed some differences between the 2 groups but none were significant (Table 3).

After 8 weeks, 16/21 (76.2%) lesions were completely healed (with or without scarring) in group 1 and 22/27 (81.5%) in group 2 (Table 4). Healing was mostly achieved by 6 weeks. There were 5 lesions in both groups that showed no response. One lesion had been treated previously with pentostam

Table 1 Characteristics of cutaneous leishmaniasis lesions in each treatment group before the start of the study

Variable	Group 1 Sodium chloride	Group 2 Ciprofloxacin
<i>No. of lesions treated at start of study</i>	35	35
<i>No. of lesions/patient</i>		
1	7	7
2	5	8
3	1	2
> 3	7	5
<i>No. of lesions by site</i>		
Face and neck	8	3
Upper limbs	19	10
Lower limbs	7	18
Trunk	1	4
<i>Mean lesion size before study (cm)</i>	1.74	1.70
<i>Range of lesion duration before study</i>	1 month–1 year	1 month–5 years

Table 2 Total lesion scores during the 8 weeks of treatment

Time (weeks)	Group 1 Sodium chloride (21 lesions) Mean (SD) % score	Group 2 Ciprofloxacin (27 lesions) Mean (SD) % score
0	100.0	100.0
2	70.2 (17.3)	62.1 (20.4)
4	33.3 (25.3)	39.3 (29.2)
6	9.5 (15.6)	9.3 (19.0)
8	1.8 (4.9)	5.4 (12.9)

SD = standard deviation.

Table 3 Mean percentage reduction in parameter scores after 8 weeks of treatment

Parameter	Group 1 Sodium chloride (n = 21 lesions) Mean (SD) % score	Group 2 Ciprofloxacin (n = 27 lesions) Mean (SD) % score
Diameter	31.1 (35.9)	37.1 (36.4)
Induration	30.3 (29.7)	30.8 (30.1)
Erythema	44.9 (38.0)	32.7 (34.2)

SD = standard deviation.

with no healing but, when treated with the hypertonic solution, healed within 4 weeks.

In group 1, 4/21 (19.0%) lesions healed without scarring and 7/21 (33.3%) left a scar of < 40% of the original lesion size. In group 2, 5/27 (18.5%) of the lesions left no scar on healing

while 13/27 (48.2%) lesions were < 40% of the original. No significant differences in scar size were recorded between the groups.

Table 4 summarizes the outcome of treatment. Scar size at the end of the study for lesions which healed with a scar was greatly reduced in comparison

with the original size of the lesion: in group 1 the mean reduction in scar size was 66.0%, while in group 2 the mean reduction was 68.6%.

Discussion

Treatment of cutaneous leishmaniasis lesions is recommended since their duration cannot be predicted in an individual case [14] and in order to ameliorate ugly scars left after healing. Many drugs have been tried for treating the infection, but most are not available in our country, in addition to their high cost and side-effects that may result when they are used systemically [8].

Intralesional injection of leishmaniasis sores is a traditional method of treatment recommended by the World Health Organization in endemic areas, where many drugs have been tried by this method [5,10,15–17]. It is reasonable to treat these infections individually since the lesions persist locally and the parasite does not migrate [15]. Only a small amount of the drug is used but the effect is local and direct with slow absorption [15].

To evaluate the efficacy of the drugs in this study, 2 weeks were left between each visit, as was done in other studies with local therapy [5,18,19]. The follow-up scoring system depended on 4 parameters (diameter, erythema, induration and ulceration) and a final total score was devised and used for the first time in this study. Using multiple parameters is a good feature in any study, where it minimizes mistakes in measurement and gives a more precise assessment of the lesion. Other studies estimated only lesion diameter and erythema, depending mainly on the reduction in size as a sign for healing [5] or depended on the area of ulceration multiplied by the area of induration for evaluation during the treatment and followed cases until re-epithelialization

Table 4 Summary of outcome of treatment after 8 weeks of treatment

Variable	Group 1 Sodium chloride (n = 21 lesions)	Group 2 Ciprofloxacin (n = 27 lesions)
Lesions unhealed [No. (%)]	5 (23.8)	5 (18.5)
Lesions healed, with or without scarring [No. (%)]	16 (76.2)	22 (81.5)
Lesions healed, without scarring [No. (%)]	4 (19.1)	5 (18.5)
Healing time (weeks) (No.)		
2	1	2
4	5	8
6	7	9
8	3	3
Mean reduction in lesion size (%)	66.0	68.6

occurred [20]. The cases were followed up mostly for 8 weeks.

Al-Shaikhly and Sayidmarie used hyperthermia for treating cutaneous leishmaniasis [18] and, as in the present study, most lesions were healed by 6 weeks. Najim recorded cure in 6 weeks also with local application of zinc sulfate and hypertonic saline solution [5]. Hypertonic sodium chloride solution has not been previously evaluated in south Iraq. In the present study, hypertonic saline showed a 76.2% healing rate after 8 weeks, mostly by 6 weeks after 2–3 injections, while Najim in Iraq

recorded 85% cure (mean time 4 weeks) with zinc sulfate [5]. Ciprofloxacin showed a cure rate of 81.5%. The results are difficult to compare, however, as there are different species or strains of the parasite present in south Iraq as well as differences in host reaction, immune status of patients and age of lesions that may affect treatment.

Both the antibiotic and hypertonic solution were effective in reducing scar size after healing. Hypertonic saline gave an average 66.0% reduction, while the ciprofloxacin gave an average 68.6% reduction compared with the original

size of the lesions. If lesions are left to heal spontaneously, we would expect a scar that is similar in size to the original lesion [14].

Ciprofloxacin is effective against intracellular pathogens such as *Bruceella* and *Legionella* spp., where it inhibits the enzyme DNA gyrase which is responsible for DNA replication [21]. Ciprofloxacin was also found to be active against some protozoa including *L. donovani*. Others have recorded a reduction in lesion size and induration of *L. major* lesions after treatment with ciprofloxacin as a topical paste (250 mg) [12,22]. The mode of action of ciprofloxacin in the treatment of *Leishmania* infection is not well established, but it may exert its effect by the same mechanism mentioned above, and local injection leaves the drug in contact with the pathogen for as long as possible where it may act directly.

In conclusion, intralesional 0.2% ciprofloxacin was as least as effective as hypertonic sodium chloride solution in the treatment of cutaneous leishmaniasis infection. Further studies using this drug on a large sample and for other clinical forms of infection are suggested.

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Innovative and Intensified Disease Management (IDM)

Innovative and Intensified Disease Management (IDM) focuses on diseases for which cost-effective control tools do not exist and where large-scale use of existing tools is limited. The diseases include Buruli ulcer, Chagas disease, human African trypanosomiasis and leishmaniasis and they share the following characteristics:

- they are difficult and costly to manage – diagnosis, treatment and follow up;
- the burden is poorly understood;
- there is a lack of appropriate control tools;
- there has been relatively lower investment in research and development;
- people affected often live in remote rural areas with limited access to diagnosis and treatment.

The goal of IDM is to allow these diseases to be easily managed within the primary health-care system and ultimately eliminated as a public health problem. The objectives are to: intensify disease management using existing tools; encourage the rapid development and implementation of better control tools and to ensure the full involvement of national control programmes; and advocate for health service development in affected areas.

Further information about IDM can be found at: http://www.who.int/neglected_diseases/disease_management/en/index.html

Musculoskeletal disorders among bank office workers in Kuwait

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الاضطرابات العضلية الهيكلية بين عاملي البنوك في الكويت

قاسم أكرووف، جوان كراوفورد، أحمد خضر الشطي، محمد إبراهيم كامل

الخلاصة: تقم هذه الدراسة المقطعية العرضية نمط الاضطرابات الهيكلية العضلية التي يعاني منها العاملون في البنوك في الكويت. وقد استخدم استبيان موثوق يعبأ ذاتياً يحتوي على الاستبيان الهيكلية العضلي لشمال أوروبا، واستبيان صحي عام مكون من 12 بنداً. ومن بين 750 موظفاً، عانى 80٪ منهم من نوبة على الأقل من الاضطرابات العضلية الهيكلية خلال السنة السابقة، وعانى 42٪ من نوبة على الأقل من العجز. وكانت أكثر أماكن الجسم المتضررة هي العنق (53.3٪)، وأسفل الظهر (51.1٪)، والكتفين (49.2٪)، وأعلى الظهر (38.4٪). وعلى الصعيد الوطني، كانت درجات (أحراز) الاستبيان الصحي العام المكون من 12 بنداً، والتدخين، والجنس منبئات يعول عليها للاضطرابات العضلية الهيكلية خلال العام السابق، وكان شرب الخمر، والحالة الزوجية، ودرجات (أحراز) الاستبيان الصحي العام المكون من 12 بنداً، والجنس، والسنوات في الكويت منبئات يعول عليها للاضطرابات العضلية الهيكلية المسببة للعجز خلال السنة السابقة.

ABSTRACT This cross-sectional observational study assessed the pattern of musculoskeletal disorders (MSDs) suffered by bank office workers in Kuwait. A self-administered validated questionnaire was used that included the Nordic musculoskeletal questionnaire and 12-item general health questionnaire (GHQ12). Of 750 employees, 80% suffered at least 1 episode of MSD during the previous year and 42% suffered at least 1 disabling episode. The most affected body parts were the neck (53.5%), lower back (51.1%), shoulders (49.2%) and upper back (38.4%). Nationality, GHQ12 score, smoking and sex were significant predictors of MSDs during the previous year, while alcohol drinking, marital status, GHQ12 score, years in Kuwait and sex were significant predictors of disabling MSDs during the previous year.

Troubles musculosquelettiques chez des employés de banque au Koweït

RÉSUMÉ Cette étude transversale d'observation a évalué les caractéristiques des troubles musculosquelettiques (TMS) chez des employés de banque au Koweït. Nous avons utilisé un autoquestionnaire validé comprenant le questionnaire « nordique » sur les TMS et le questionnaire GHQ12 (questionnaire général de santé en 12 questions). Sur 750 employés, 80 % d'entre eux avaient connu au moins un épisode de TMS au cours de l'année précédente et 42 %, au moins un épisode invalidant. Les parties du corps les plus touchées étaient le cou (53,5 %), le bas du dos (51,1 %), les épaules (49,2 %) et le haut du dos (38,4 %). La nationalité, le score au GHQ12, le tabagisme et le sexe étaient des facteurs prédictifs significatifs de TMS au cours de l'année précédente, alors que la consommation d'alcool, l'état matrimonial, le score au GHQ12, les années passées au Koweït et le sexe étaient des facteurs prédictifs significatifs de TMS invalidants au cours de l'année précédente.

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Introduction

Rapid technological developments, especially in the use of electronic data, have affected both workers and the workplace. Electronic data are mainly displayed on visual display terminals. Improper body posture and long hours in front of these terminals can result in many health hazards, including eye strain and fatigue and musculoskeletal disorders (MSDs) [1]. It has been stated that MSDs are the most common occupational health problem [2]. Around 1.1 million people in the United Kingdom suffered from MSDs caused by or made worse by work in 2001–02 [2] and MSDs accounted for 11.6 million working days lost during 2006 [3]. In the United States, MSDs constituted 41.4% of all adult disabilities (41.2 million) during 1990 [4].

Work-related MSDs can affect shoulders, arms, elbows, wrists, hands, back, legs and feet. They are caused by forceful or repetitive movements or a poor working posture. Symptoms include tenderness, aches and pains, tingling, stiffness and swelling. Lower and upper back pain and muscle spasm could be due to incorrect seating, which also affects the cervical spine and neck muscles leading to pain [5,6]. Crawford et al. concluded that physical and psychosocial risk factors are implicated in the etiology of MSDs especially those affecting the neck and shoulder regions [7]. Jensen et al. showed that neck symptoms were the most common (53%) among female call-centre workers, followed by shoulder (42%) and hand/wrist (30%) symptoms [1].

Although many studies have dealt with MSDs among office workers in other countries, the exact nature and prevalence of this important health problem has not been studied before in Kuwait. This study was formulated to fill the gap of knowledge in this area. The aims of the study were to assess the pattern of MSDs among

bank office workers and to identify the impact of demographic, occupational, psychological and social factors on MSDs.

Methods

This study was carried out during 2006 in the 36 branches of one banking company in Kuwait, randomly selected from among the major banks in the country. An observational cross-sectional study design was adopted. All bank workers ($n = 800$) using visual display units were recruited for the study. A self-administered questionnaire was distributed personally to each employee.

Tools

A specially designed self-administered questionnaire included the following: sociodemographic characteristics (age, sex, nationality, marital status, level of education, years in Kuwait and smoking history) and occupational history (type of job and duration in that job). The modified 12-item Goldberg general health questionnaire (GHQ12) was used [8]. This questionnaire assesses psychiatric morbidity or the "inability to carry out one's normal 'healthy' functions and the appearance of new phenomena of a distressing nature". Each question is scored from 0 (better than normal) to 3 (much less than normal). The short version of the standardized Nordic musculoskeletal questionnaire was used to evaluate MSDs [6]. This questionnaire deals with the occurrence of MSDs during the previous 7 days and 12 months as well as their severity. It also deals with the distribution of these disorders by body organ. An Arabic translation of the questionnaire was prepared. Back translation was used to ensure correct translation. The questionnaire was assessed by a jury of 6 occupational and psychiatrist consultants to ensure its validity.

A pilot study was carried out on 15 workers to assess the suitability of the questions in Kuwaiti culture and to reveal any defects in the administrative plan for data collection. Reliability of the questionnaire was studied through repeating the same questionnaire on the 15 workers included in the pilot study. The Cronbach reliability coefficient was more than 0.87 for the questionnaire.

Approval to carry out the study was obtained from the headquarters of the bank. Oral consent was also obtained from workers before filling the questionnaire. All collected data were handled confidentially.

Data analysis

The pre-coded questionnaire facilitated data entry. The Microsoft *Excel* program was used for data entry and *Epi-Info* for statistical analysis of the data. The quality of data was assured by meeting with the workers and their supervisors to explain the purpose of the study and the nature of the questionnaire, and by checking the completeness of data in the field. After data entry, both manual and electronic (frequency analysis and cross-tabulation) revisions were performed to verify data entry.

The prevalence of MSDs during the previous 12 months or attacks occurring during 7 days were calculated if any part of the body was affected. Also the mean GHQ12 score and the number of body parts affected by MSDs were calculated.

Statistical analysis of the results included both descriptive and analytic techniques. Statistical tests used for analysis of the results included the chi-squared and Fisher exact test for qualitative data and Mann–Whitney and Spearman coefficients for non-parametric data. Odds ratio (OR) and multiple logistic techniques were used to determine risk factors. The level of significance adopted for this study was $P \leq 0.05$.

Table 1 Characteristics of the sample of bank workers in Kuwait (n = 750)

Characteristic	No.	%
Sex		
Male	356	47.5
Female	394	52.5
Mean (SD) age (years)	33.2 (9.1)	
Nationality		
Kuwaiti	404	53.9
Non-Kuwaiti	346	46.1
Marital status		
Married	472	62.9
Single	278	37.1
Education level		
Secondary or less	67	8.9
Post-secondary institute	256	34.2
University	387	51.6
Higher university	40	5.3
Mean (SD) time in Kuwait (years)	19.1 (11.8)	
Smoker		
Yes	193	25.7
No	557	74.3
Alcohol drinker		
Yes	73	9.7
No	677	90.3
Job		
Clerical	43	5.7
Public relations	69	9.2
Customer services	377	50.3
Supervisor	18	2.4
Assistant manager	46	6.1
Manager	95	12.7
Other	102	13.6
Mean (SD) job duration (years)	7.6 (7.5)	
GHQ12 score		
Normal (0–12)	472	62.9
Mild distress (13–24)	263	35.1
Moderate to severe distress (25–36)	15	2.0
Mean (SD) score	11.5 (5.4)	

SD = standard deviation; GHQ12 = 12-item general health questionnaire.

Results

The questionnaire was completed and returned by 750 of the 800 bank workers, giving a response rate of 93.8%. Their mean age was 33.2 (SD 9.1) years (Table 1) and over half the respondents were females (52.5%). The predominant nationality was Kuwaiti (53.9%). Almost

all the respondents (90.2%) had higher than secondary education. A majority were married (62.9%). Only one-quarter were smokers (25.7%), while alcohol drinkers were only 9.7%. The mean duration in their job was 7.6 (SD 7.5) years. The mean score on the GHQ12 was "upper normal" [11.5 (SD 5.4)] and only a minority (2.0%) were rated

as having moderate to severe psychological distress (score 25–36).

Of all bank workers, 57% reported suffering from MSDs during the previous week, while 80% suffered such disorders during the previous year. A total of 42% of the bank workers had suffered disabling attacks of MSDs in the previous year. Table 2 shows that lower back (30.3%), shoulders (29.5%) and neck (28.0%) were the most affected body parts during the previous week. Elbow (5.1%), hips (7.5%) and ankles/feet (9.5%) were the least affected. For MSDs occurring during the previous year, the affected body parts showed a slightly different priority, as neck (53.5%), lower back (51.1%) and shoulders (49.2%) topped the list, and elbows (11.5%), hips (13.3%) and ankles/feet (16.8%) respectively had the lowest prevalence. The most disabling MSDs affecting bank workers were in the wrists/hands (28.3%) and lower back (24.5%).

Table 3 portrays the univariate analysis of factors associated with MSDs among bank workers. Factors positively associated with the occurrence of MSDs during the previous week were: being female, having Kuwaiti nationality and scoring high on the GHQ12; while factors positively associated with the occurrence of MSDs during the previous year were: being female, having Kuwaiti nationality, being younger, holding more than a secondary education certificate and having a high GHQ12 score. Factors associated with disabling MSDs were: being female, drinking alcohol, being married, longer job duration and a higher GHQ12.

Table 4 shows the significant predictors of MSDs using multiple logistic regression models. Female sex and high GHQ12 score were significantly associated with all forms of MSDs, while Kuwaiti nationality was significantly associated with attacks, whether occurring during the previous week or year. Older age, longer job duration, drinking alcohol and being married were

Table 2 Prevalence of musculoskeletal disorders (MSDs) by affected body part among bank workers in Kuwait during the previous week or year and prevalence of disabling disorders ($n = 750$)

Body part affected by MSD	Previous 7 days		Previous 12 months		Disabling attack	
	No.	%	No.	%	No.	%
Neck						
No	540	72.0	349	46.5	642	85.6
Yes	210	28.0	401	53.5	108	14.4
Shoulder						
No	529	70.5	381	50.8	622	82.9
Yes	221	29.5	369	49.2	128	17.1
Right	82	10.9	139	18.5	-	-
Left	34	4.5	57	7.6	-	-
Both	105	14.0	173	23.1	-	-
Elbow						
No	712	94.9	664	88.5	727	96.9
Yes	38	5.1	86	11.5	23	3.1
Right	14	1.9	33	4.4	-	-
Left	11	1.5	18	2.4	-	-
Both	13	1.7	35	4.7	-	-
Hand/wrist						
No	641	85.5	538	71.7	538	71.7
Yes	109	14.5	212	28.3	212	28.3
Right	69	9.2	140	18.7	-	-
Left	16	2.1	30	4.0	-	-
Both	24	3.2	42	5.6	-	-
Upper back						
No	580	77.3	462	61.6	640	85.3
Yes	170	22.7	288	38.4	110	14.7
Lower back						
No	523	69.7	367	48.9	566	75.5
Yes	227	30.3	383	51.1	184	24.5
Hips						
No	694	92.5	650	86.7	716	95.5
Yes	56	7.5	100	13.3	34	4.5
Knees						
No	649	86.5	578	77.1	674	89.9
Yes	101	13.5	172	22.9	76	10.1
Foot/ankle						
No	680	90.7	624	83.2	700	93.3
Yes	70	9.3	126	16.8	50	6.7

additional risk predictors for disabling MSDs among these bank workers.

Discussion

The increased use of computer screens, keyboards and mice in recent years

has been associated with an increased prevalence of disorders in the neck and upper extremities [9]. Poor workstation design, continuous computer use for the entire workday and repetitive computer work, such as data entry, have been associated with an increased

risk of developing symptoms related to musculoskeletal disorders [10,11].

Musculoskeletal disorders are highly prevalent and potentially disabling conditions that undermine the available health resources [4] and impose heavy costs on employers and society [2,3,12,13]. In industrialized societies,

Table 3 Relationship between characteristics of bank workers and prevalence of musculoskeletal disorders (MSDs) during the previous week or year and prevalence of disabling disorders

Characteristic	MSD in previous 7 days			Previous 12 months			Disabling attack		
	No MSD (n = 322)	MSD (n = 428)	Statistics OR (95% CI)	No MSD (n = 152)	MSD (n = 598)	Statistics OR (95% CI)	No MSD (n = 436)	MSD (n = 324)	Statistics OR (95% CI)
Female	44.7	58.4	1.74* (1.29–2.32)	39.5	55.9	1.94* (1.35–2.79)	47.2	59.9	1.67* (1.24–2.23)
Non-Kuwaiti	56.2	38.6	0.49* (0.36–0.66)	65.8	41.1	0.36* (0.25–0.53)	48.9	42.4	0.77 (0.57–1.03)
Above secondary education	90.6	91.4	1.06 (0.76–1.49)	87.5	92.1	1.72* (1.16–2.54)	90.8	91.4	1.07 (0.76–1.51)
Single	34.8	38.8	1.19 (0.88–1.60)	36.8	37.1	1.01 (0.70–1.46)	40.8	31.8	0.68* (0.50–0.92)
Smoker	26.4	25.2	0.94 (0.68–1.31)	20.4	27.1	1.45 (0.94–2.24)	23.2	29.3	1.38 (0.99–1.91)
Alcohol drinker	10.6	9.1	0.85 (0.52–1.38)	7.2	10.4	1.48 (0.76–2.89)	6.9	13.7	2.15* (1.31–3.51)
	Mean (SD)	Mean (SD)	Test (P-value)	Mean (SD)	Mean (SD)	Test (P-value)	Mean (SD)	Mean (SD)	Test (P-value)
Age (years)	33.8 (9.5)	32.8 (8.7)	t = 0.73 (0.468)	34.7 (10.4)	32.8 (8.7)	t = 2.06* (0.041)	33.4 (9.4)	33.0 (8.5)	t = 0.60 (0.546)
Job duration (years)	7.9 (7.8)	7.5 (7.2)	Z = 0.19 (0.848)	7.6 (8.1)	7.7 (7.3)	Z = 0.68 (0.495)	6.9 (7.5)	8.7 (7.3)	Z = 4.64* (< 0.001)
GHQ12 (score)	10.0 (5.0)	12.6 (5.4)	Z = 6.73* (< 0.001)	8.5 (4.8)	12.2 (5.3)	Z = 8.25* (< 0.001)	10.2 (4.9)	13.2 (5.6)	Z = 7.88* (< 0.001)

*P < 0.05.

OR = odds ratio; CI = confidence limits of odds ratio; SD = standard deviation.
GHQ12 = 12-item general health questionnaire.

MSDs are one of the most common causes of temporary work disability and the main cause of permanent work disability, accounting for high productivity losses [14,15].

The current study was formulated to assess the prevalence of MSDs among bank workers and reveal the impact of personal and psychological factors on such disorders. To achieve such aims an observational cross-sectional study was carried out in branches of one of the major banks in Kuwait. The study comprised 800 bank workers with a response rate of 93.5%. The short version of the Nordic questionnaire was used to analyse MSDs and a modified GHQ12 self-administered questionnaire was used for assessment of psychiatric disorders. The large number of studied workers and high response rate can be considered as a good representation of bank workers. However, the differences in the design of workstations in the studied branches of the bank could form one source of bias. Although in cross-sectional design only survivors are studied, the mild nature of MSDs rarely leads to high rates of turnover among bank workers.

Our study showed that 80% of workers suffered from at least 1 attack of a MSD in the previous year, while 57% suffered from attacks during the previous week. Disabling MSDs were suffered by 42%. Using the same questionnaire Woods reported the following corresponding proportions: 86%, 56% and 30% respectively [16]. The 2 studies agree with regard to ranking of commonly affected organs. Our study revealed that neck (53.5%), lower back (51.1%) and shoulders (41.6%) were the most commonly affected body parts during the previous year. Similar results were also found for MSDs occurring in the previous week. Several studies have shown an increased risk of neck disorders among office workers [17–19]. There is strong evidence supporting static or maintained postures as a risk factor for MSDs of the neck and shoulders [20] and a positive relationship has been identified with the

Table 4 Significant risk predictors of musculoskeletal disorders (MSDs) among bank workers using multiple logistic regression

Factor	Previous 7 days		Previous 12 months		Disabling attack	
	β	OR (95% CI)	β	OR (95% CI)	β	OR (95% CI)
Age	–	–	–	–	–0.062	0.94 (0.91–0.97)
Sex	0.335	1.40 (1.03–1.90)	0.477	1.63 (1.09–2.45)	0.409	1.51 (1.09–2.09)
Nationality	–0.593	0.55 (0.41–0.75)	–0.919	0.40 (0.27–0.59)	–	–
Marital status	–	–	–	–	–0.523	0.59 (0.41–0.85)
Job duration	–	–	–	–	0.079	1.08 (1.05–1.21)
Smoker	–	–	0.639	1.90 (1.18–3.06)	–	–
Alcohol drinker	–	–	–	–	0.877	2.40 (1.42–4.06)
GHQ12 score	0.09	1.09 (1.06–1.13)	0.153	1.16 (1.11–1.22)	0.101	1.11 (1.07–1.14)
Constant	–0.359	–	0.377	–	–0.617	–

Age, job duration and GHQ12 scales were quantitative variables; sex was coded: male = 1, female = 2; nationality: Kuwaiti = 1, Non-Kuwaiti = 2; marital status: married = 0, currently single = 1; smoker and alcohol drinker: yes = 1, no = 0.

OR = odds ratio; CI = confidence interval; GHQ12 = 12-item general health questionnaire.

duration of fixed sedentary posture at work [21]. Also limited breaks are a significant risk factor for neck disorders [22,23].

The current study showed that women were more likely to suffer from MSDs than men, either during the previous year (84.8% compared with 74.2%) or the previous week (63.5% compared with 50%). Furthermore they also tended to suffer more disabling attacks (47.7% compared with 35.4%). Many studies revealed a gender difference with more women being affected [7,24,25]. These gender differences could be attributed to differences in workloads or

biological and anthropometric measurements [25].

Gender differences in addition to psychological status proved to be significant predictors of all forms of MSDs detected by this study. Psycho-social status was found to be consistently related to MSDs by other workers [3,7,26].

Smoking was also shown to be a significant predictor for MSDs occurring during the previous 12 months, while drinking alcohol, duration at work and age could predict disabling attacks of MSDs.

The high prevalence of MSDs may be a symptom of “system failure” that should be addressed to improve both quality and productivity. Programmes for prevention of MSDs should be incorporated within a wider ergonomic approach to promote the health of workers. Also, a comprehensive approach including system goals, task allocation, work organization and job design is needed. Further studies are required to elaborate the relation between job demands and loads as well as other organizational and social factors on occurrence of MSDs

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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.

An analysis of carbon monoxide poisoning cases in Bursa, Turkey

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تحليل حالات التسمم بأول أكسيد الكربون في بورسا بتركيا

شولا ألكوسا، نورسال توركمين، مهتاب بولوت، سمرا أكوز، رمزي اشجيان، بولنت آران

الخلاصة: يثير التسمم بأول أكسيد الكربون الناجم عن أجهزة التدفئة التي تعمل بالفحم والغاز قلقاً في تركيا. وتسعى هذه الدراسة إلى تقدير معدل انتشار الوفيات والمؤشرات الدالة على شدة حالات التسمم بأول أكسيد الكربون التي عولجت في وحدة الطوارئ في كلية الطب بجامعة أولداغ، بمدينة بورسا من عام 1996 حتى 2005. ومن بين 305 مرضى عولجوا خلال فترة تزيد عن عشر سنوات، سُجِّلَت حالة واحدة على أنها حالة انتحار. وكان مصدر غاز أول أكسيد الكربون في 85.9% من الحالات هو أجهزة التدفئة التي تعمل بالفحم. وبلغ متوسط أحراز غلاسغو للغيبوبة للمرضى عند إدخالهم المستشفى 12.8 (والانحراف المعياري 0.2)، ومتوسط مستوى كربوكسي هيموغلوبين 21.6% (والانحراف المعياري 0.92%). واكتُشِفَ ترابطاً يُعْتَدُّ به إحصائياً بين زيادة أحراز غلاسغو للغيبوبة، وكبر السن، والمستويات الأعلى من كربوكسي هيموغلوبين. وتعتبر توعية عامة الناس ضرورة لا تتقاء هذه الإصابات.

ABSTRACT Carbon monoxide (CO) poisoning from coal and gas heaters is a public health concern in Turkey. This study estimated the prevalence, mortality rate and clinical predictors of severity of CO poisoning cases treated at the emergency unit of the Uludağ University Medical School, Bursa from 1996 to 2006. Of 305 patients treated over a 10-year period, only 1 case was recorded as suicide. The CO source was a coal heater in 85.9% of cases. Mean Glasgow coma score (GCS) on admission was 12.8 (SD 0.2) and mean carboxyhaemoglobin level was 21.6% (SD 0.92%). There were statistically significant associations between higher GCS score, older age and higher HbCO level. Better education of the public is vital for the prevention of these injuries.

Analyse des cas d'intoxication au monoxyde de carbone à Bursa (Turquie)

RÉSUMÉ L'intoxication au monoxyde de carbone (CO) due à des appareils de chauffage au charbon et au gaz est un problème de santé publique en Turquie. Cette étude a estimé la prévalence, le taux de mortalité et les facteurs cliniques prédictifs de la gravité des cas d'intoxication au CO traités au service des urgences de l'hôpital de la faculté de médecine de l'université Uludağ de Bursa entre 1996 et 2005. Sur 305 patients traités au cours des dix années, un seul cas a été enregistré comme étant un suicide. Le CO était émis par un appareil de chauffage au charbon dans 85,9 % des cas. Le score de Glasgow moyen au moment de l'admission était de 12,8 (E.T. 0,2) et le niveau moyen de carboxyhémoglobine (HbCO), de 21,6 % (E.T. 0,92 %). Il existait des associations statistiquement significatives entre un score de Glasgow élevé, l'âge et un niveau de carboxyhémoglobine élevé. Il est indispensable de mieux informer le public si l'on veut éviter ce type de traumatisme.

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Introduction

Carbon monoxide (CO) is a colourless, odourless, tasteless and nonirritant gas. The major source of CO in the environment is incompletely burned organic material. Common exposures include smoke from fires and barbecues, wood or coal heaters that burn with inadequate oxygen, incomplete burning of butane or methane used in lighting and heaters, exhaust gases from motor vehicles and cigarette smoke [1,2].

While CO inhalation is a common method of suicide in some countries, in Turkey most deaths caused by CO poisoning result from accidents. Especially in the winter months, leaks from coal heaters are the major culprits [3–6]. Although these deaths can be prevented with simple measures, they still persist.

CO poisoning is a serious concern in Bursa, which is located in the north-west part of Turkey in the southern Marmara region where approximately 4 million people reside [7]. Bursa, with a population of 2.2 million, is the largest city in the region [7]. Especially during periods of south-east wind in the winter months, coal heaters become instruments of death. Every year, approximately 900 people suffer CO poisoning. Approximately 80% of these patients are treated at outpatient clinics, the rest are hospitalized [8]. According to the records of the Bursa Forensic Institute, in the last 10 years, 211 patients died of CO poisoning due to accidents in the home or workplace.

This study was carried out to reveal the prevalence, mortality rate and clinical predictors of the severity of CO poisoning in patients treated at the emergency unit of the Uludağ University Medical School.

Methods

This study was a retrospective review of records of cases of CO poisoning treated between 1 January 1996 and 1 January 2006 at the emergency unit of the Uludağ University Medical School in Bursa, Turkey. Not all poisonings occurring in Bursa are referred to Uludağ Medical School Hospital for treatment; the intensive care unit (ICU) of the Uludağ Medical School Hospital has a limited number of beds and 3 public hospitals in Bursa also receive poisoning cases. The study was originally planned as a collaborative project, but the records of the public hospitals were incomplete and they were not included.

A data collection form was designed and data were compiled retrospectively. The admission records of the emergency unit, the ICU files and the patient charts were examined. There are 2 separate emergency units in our hospital: paediatric and adult. During the period of the study patients aged 14 years and over were treated in the adult emergency unit and it was decided to exclude younger patients. The following data were collected for patients: age; sex; source of CO; Glasgow coma score (GCS) at admission [9]; symptoms at admission; and blood carboxyhaemoglobin (HbCO) level at admission measured using a blood gas analyser (Omni S, Roche Diagnostics, Indianapolis, USA). The severity of CO poisoning was graded with respect to the GCS as: mild (GCS 15), moderate (GCS 13–14) and severe (GCS $\leq$ 12). Outcome variables collected were: whether treated in emergency unit or admitted to ICU; duration of stay in the ICU (days); need for and duration of mechanical ventilation (days); and death.

It should be noted that the HbCO levels were not evaluated properly in the initial years of the study and thus records for this period were incomplete. Also the central record office in the hospital was not established until 2006.

Statistical analysis

Statistical analysis was performed using SPSS, version 11.0 for Windows. The results were expressed as mean and standard deviation (SD), median (interquartile range; 25th–75th percentiles) and frequency, as appropriate. One-sample chi-squared test and Pearson chi-squared test were used in the comparison of categorical variables. The Kruskal–Wallis test and the Mann–Whitney U-test were used for comparison of the distributions of continuous variables. Correlations were determined by Spearman rank correlation analysis. The clinical predictors of the severity of CO poisoning were identified by multivariate logistic regression analysis. All statistical analyses were performed according to 2-sided hypothesis tests and a P -value < 0.05 was considered statistically significant.

Results

Characteristics of patients and poisonings

The total number of patients in the 10-year period was 305. Their mean age was 36.8 (SD 16.2) years (range 14–79 years) and approximately half of the patients (152, 49.8%) were between 20 and 40 years old; 174 patients (57.0%) were women and 131 (43.0%) were men ($P = 0.014$) (Table 1).

Except for 1 suicide attempt, all poisonings (304 patients, 99.7%) were reported as being due to accidents. The source of CO was a coal heater in 262 patients (85.9%), a liquefied gas heater in 41 (13.4%) and motor vehicle exhaust in 2 (0.7%) (Table 1).

The main symptoms at admission in the mild poisoning cases ($n = 180$) were headache (32.9%), fatigue (30.6%), nausea (19.1%) and dizziness (13.3%) (Table 1).

The mean GCS at admission was 12.8 (SD 0.2) (range 3–15). According to our GCS classification, 180

Table 1 Demographic and clinical characteristics of patients with carbon monoxide (CO) poisoning (n = 305)

Characteristic	No.	%
Sex		
Male	131	43.0
Female	174	57.0
Age group (years)		
14–19	37	12.1
20–29	88	28.9
30–39	64	21.0
40–49	46	15.1
50–59	33	10.8
≥ 60	37	12.1
Cause		
Accident	304	99.7
Suicide	1	0.3
Source of CO		
Coal heater	262	85.9
Liquefied gas heater	41	13.4
Motor vehicle exhaust	2	0.7
Glasgow coma score		
Severe (≤ 12)	83	27.2
Moderate (13–14)	42	13.8
Mild (15)	180	59.0
Blood HbCO level (%) (n = 188)		
0–9	33	17.6
10–19	62	33.0
20–29	54	28.7
30–39	21	11.1
40–49	11	5.9
50–59	5	2.7
≥ 60	2	1.0
Symptoms at admission (n = 173)^a		
Headache	57	32.9
Fatigue	53	30.6
Nausea	33	19.1
Dizziness	23	13.3
Syncope	15	8.7
Blurred vision	6	3.5
Urinary incontinence	1	0.6

^aOnly for patients with mild symptoms (Glasgow coma score 15); there was more than 1 symptom for some patients.

HbCO = carboxyhaemoglobin.

patients (59.0%) had mild CO poisoning (GCS 15), 42 (13.8%) had moderate poisoning (GCS 13–14) and 83 (27.2%) had severe poisoning (GCS ≤ 12) (Table 1).

Records of HbCO level were available for 188 of the 305 patients (61.6%). The mean HbCO level among was 21.6% (SD 0.92%) (range 1%–63%).

As to seasonal distribution, 197 (64.6%) poisonings occurred in the winter, 75 (24.6%) in spring, 29 (9.5%) in autumn and 4 (1.3%) in the summer. The number of cases increased significantly after 2001 ($P < 0.001$) with the majority occurring in the winter ($P < 0.001$) (Figure 1).

Outcome

One-quarter of the patients (74, 24.3%) were admitted to the ICU and 46 of them (62.2%) required mechanical ventilation. The mean duration of ICU stay was 11.2 (SD 15.8) days (range 1–79 days). The mean duration of mechanical ventilation was 8.5 (SD 10.5) days (range 1–57 days). Of the 231 patients not admitted to the ICU, 180 (77.9%) were treated at the emergency unit and discharged and 44 (19.0%) were referred to another hospital. Poisoning was graded severe in 41 (89.1%) of the 46 patients who required mechanical ventilation and 57 (77.0%) of the 74 patients admitted to the ICU. A total of 10 patients died (3.3%), all were cases of severe poisoning: 7 in the ICU and 3 patients after treatment in the emergency unit.

Risk factors

When the association of the GCS with the duration of mechanical ventilation, ICU stay and HbCO levels were investigated highly significant but weak negative correlations were found. As GCS decreased, there was longer duration of mechanical ventilation, longer ICU stay and higher HbCO levels ($r = -0.499$, $r = -0.452$ and $r = -0.260$ respectively, $P < 0.001$) (Table 2). There was a statistically significant but weak negative association between age and HbCO level ($r = -0.147$, $P < 0.045$) (Table 2).

Of patients aged ≥ 60 years, 54.1% (20/37) had severe CO poisoning; in the other age groups, the frequency of mild poisoning varied between 54.1% and 69.6% ($P < 0.001$). The source of mild CO poisoning was a coal heater in

Table 2 Spearman correlations (*r*) of age, Glasgow coma score, duration of mechanical ventilation, duration of stay in intensive care unit (ICU) and blood carboxyhaemoglobin (HbCO) level

Variable	Glasgow coma score	Duration of mechanical ventilation	Duration of stay in ICU	Blood HbCO level
	<i>r</i>	<i>r</i>	<i>r</i>	<i>r</i>
Age	NS	NS	NS	-0.147*
Glasgow coma score	-	-0.499**	-0.452**	-0.260**
Duration of mechanical ventilation	-	-	0.795**	NS
Duration of ICU stay	-	-	-	NS

* $P < 0.05$; ** $P < 0.001$.

NS = not significant.

62.2% of patients ($P < 0.05$). The HbCO level was significantly higher ($P < 0.01$) and the duration of ICU stay significantly longer ($P < 0.01$) in severe poisoning cases compared with mild and moderate poisoning cases (Table 3).

Although more cases were due to coal-fired heaters, the poisoning was more severe in terms of GCS in patients poisoned by liquefied gas sources than by coal heaters (Table 3).

Regression analysis

In univariate logistic regression analysis where CO poisoning (severe versus moderate/mild) was the dependent variable, age ≥ 60 years old significantly increased the likelihood of having severe CO poisoning compared with age ≤ 19 years (OR = 4.3; 95% CI: 1.5–11.8).

In multivariate logistic regression analysis, where CO poisoning (severe versus moderate/mild) was the dependent variable and age group, HbCO

level and interaction term (age groups $\times$ HbCO level) were independent variables, a 1% increase in HbCO slightly increased the odds of having severe CO poisoning (adjusted OR = 1.05; 95% CI: 1.02–1.08).

Discussion

CO poisoning from heaters is a serious risk of death and disability in Turkey

Table 3 Evaluation of patients according to the severity of carbon monoxide (CO) poisoning using Glasgow coma scores (GCS)

Variable	Severe (GCS ≤ 12)		Moderate (GCS 13–14)		Mild (GCS ≥ 15)		P-value
	No.	%	No.	%	No.	%	
Source of CO							
Coal heater	66	25.2	33	12.6	163	62.2	0.042 ^a
Liquefied gas heater	16	39.0	8	19.5	17	41.5	
Age group(years)							
14–19	8	21.6	9	24.3	20	54.1	0.001 ^a
20–29	19	21.6	16	18.2	53	60.2	
30–39	18	28.1	4	6.3	42	65.6	
40–49	12	26.1	2	4.3	32	69.6	
50–59	6	18.2	7	21.2	20	60.6	
≥ 60	20	54.1	4	10.8	13	35.1	
	No.	Median (i/q range)	No.	Median (i/q range)	No.	Median (i/q range)	
Blood HbCO level (%)	42	27.5 (16.5–39.0)	24	23.0 (14.3–28.8)	122	18.0 (12.8–26.0)	0.002 ^b
Duration of ICU stay (days)	57	7.0 (2.5–16.0)	10	2.5 (2.0–4.3)	7	3.0 (2.0–6.0)	0.004 ^b

^aPearson chi-squared test.^bKruskal–Wallis test.

HbCO = carboxyhaemoglobin; i/q = interquartile; ICU = intensive care unit.

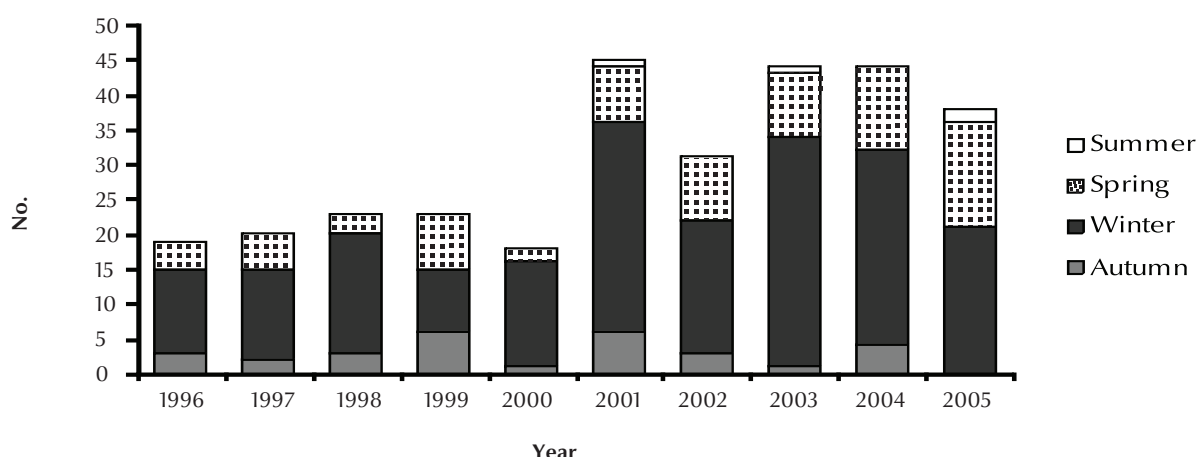


Figure 1 Annual and seasonal distribution of cases of carbon monoxide (CO) poisoning ($n = 305$)

especially in the winter months. Incomplete burning of coal, for example in small heaters with an inadequate chimney system, results in the formation of CO which can cause poisoning. Lack of public safety information and inadequate regulations are responsible for CO poisoning from heaters [3–6]. In our country, CO poisoning occurs in particular cities including Bursa [8,9]. In Bursa, south-east winds, which are particularly strong in late December, January and February, blow through the chimneys and cause regurgitation of the exhaust gases into the houses.

The majority of the CO poisoning cases in our study occurred in the winter (64.6%). This is in accordance with the literature [10–12]. The use of coal heaters in the winter months and the strong south-east winds contribute to the increased number of cases.

Our study covered a 10-year period. The number of recorded admissions increased every year, despite the serious efforts in public education, particularly in the last 5 years. The Department of Health, Uludağ University Medical School and various nongovernmental organizations issue warnings, in the form of public meetings, reports in the written and visual media and websites,

especially in the winter months and days of the strong south-east wind. However, the apparent increase in cases in recent years may be an artefact due to the inadequacy of the older records, the development of intensive care facilities in our institutions and increased referral of the poisoning cases to the university hospital.

The present study included 305 patients. The proportion of women (57.0%) was significantly higher than men (43.0%). Other published studies reported equal frequencies or a predominance of men [10–16]. A predominance of men may be due to the workplace fires and suicide attempts. In our study, the majority of the CO poisonings (99.3%) occurred at home.

CO poisoning is ubiquitous worldwide. It is a commonly encountered poison in accidents, such as smoke from fires, vehicle exhaust fumes in closed garages and generators used in poorly ventilated areas, and in suicide attempts [11,12,14,16,17]. Operation of vehicles in closed garages is a method of suicide in some countries [16,18]. In the present study, almost all the patients were accident victims and there was only 1 known case of suicide. It is possible that other methods are used more

frequently in suicide attempts in this region (e.g. ingestion of poison) [7].

According to the GCS at admission, 59.0% had mild CO poisoning, 13.4% had moderate and 27.2% had severe poisoning. In a 5-year study in France, 80.9% of patients had mild poisoning, 14.4% moderate poisoning and 34.7% had severe poisoning [11]. Of our 305 patients with CO poisoning, 10 (3.3%) died. The mortality reported in other studies varied between 2.6% and 9.8% [1–3,9], so our rate is in the same range.

The affinity of CO to haemoglobin is approximately 240 times that of oxygen. Consequently, CO blocks transport of oxygen by haemoglobin to the tissues by inducing a state of asphyxia. Symptoms such as fatigue and headache typically occur when the HbCO level exceeds 20%; levels above 40% cause loss of consciousness and convulsions, while levels above 60% may be lethal [19,20]. Nevertheless, the effects of particular levels are subject to variation due to personal and environmental factors such as haemoglobin level, age, physical activity, metabolic rate, history of cardiovascular and/or systemic disease, and degree and duration of exposure to CO [13,19,20]. The HbCO level was measured in 61.6% of our CO poisoning cases ($n = 188$).

Intermittent equipment failure is the reason for the missing measurements. There was a statistically significant but weak negative relationship between the HbCO level and age.

The GCS showed statistically highly significant but weak negative relationships with duration of mechanical ventilation, ICU stay and HbCO levels. Patients with lower GCS had longer periods of mechanical ventilation, ICU stay and higher HbCO levels. Among patients aged 60+ years, 54.1% suffered severe CO poisoning, whereas in other age groups this ranged from 18.2% to 28.1%. The determinants of severity, morbidity and mortality in CO

poisoning in other studies were patient's age, cardiovascular co-morbidity and duration of exposure [13,19,20]. Our study confirmed a statistically significant association between age and severity of CO poisoning. After the effect of age was controlled for in multivariable analysis, a higher HbCO level was associated with more severe CO poisoning.

Liquefied gas sources were more dangerous than coal heaters in relation to the severity of the CO poisoning. This may be explained by the fact that in those instances, victims are exposed to higher concentrations of CO in a shorter period. Because the half-life of carboxyhaemoglobin is approximately 250 minutes,

breathing for a few minutes in an atmosphere containing 0.1% CO, will lead to the formation of 50% HbCO in the blood [13,19]. In coal heater poisonings, victims are exposed to lower concentrations of CO for longer periods.

Poisoning due to CO leaks from coal heaters is a common problem in our country and surrounding regions. The elderly population is at a higher risk. Various institutions are expending efforts to educate the public and prevent CO poisoning. However, these are inadequate. Extensive use of CO detectors, widespread intensive education and monitoring of equipment that may emit CO will prevent most of these poisonings.

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Les nouveaux critères et la qualité des services de soins de santé dans le gouvernorat de Monastir (Tunisie)

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معايير جديدة لجودة خدمات الرعاية الصحية في محافظة المنصورية في تونس

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الخلاصة: في عام 2005، أدخلت معايير جديدة (مكونة من 7 بنود) للخدمات المقدمة للأمهات والأطفال ضمن برنامج الرعاية الصحية الوطني للفترة المحيطة بالولادة. وقَّيم الباحثون هذه النسخة الجديدة في دراسة وصفية أُجريت على عينة عشوائية ضمت 400 امرأة حامل من محافظة المنصورية. كان متوسط عمرهن 29.3 سنة (والانحراف المعياري 5 سنوات)، وكانت 42٪ منهن تحمل لأول مرة (بكرية). بالرغم من ملائمة الرعاية في الفترة المحيطة بالولادة من حيث عدد زيارات الحمل التي غطت 82.5٪ من النساء، إلا أن 21٪ فقط منهن استوفين جميع البنود السبعة لمعايير الجودة. وكانت معدلات الجراحة القيصرية وولادة الخدج أعلى على نحو يُعَدُّ به إحصائياً بين النساء اللاتي تلقين رعاية عالية الجودة ($p < 0.05$). وفي تحليل تحوُّف لوجستي، كان العمر وعدد مرات الولادة هما العاملان الوحيدان المستقلان المتعلقان بجودة الرعاية. هناك حاجة لبذل المزيد من الجهد لضمان جودة عالية لرعاية الأمهات والأطفال.

New criteria and quality of health care services in the governorate of Monastir, Tunisia

ABSTRACT In 2005 new quality criteria (7 items) were introduced for services provided to mother and child under the national perinatal programme. We evaluated this new version in a descriptive study conducted among a random sample of 400 parturient women from Monastir governorate. Mean age was 29.3 (SD 5) years and 42% were primipara. Although prenatal care was adequate in terms of number of antenatal visits for 82.5% of women, for only 21% were all 7 quality criteria fulfilled. The rates of caesarean section and premature birth were significantly higher in women who received quality care ($P < 0.05$). In logistic regression analysis, age and parity were the only factors independently associated with the quality of care. Additional efforts are needed to ensure good maternal and infant quality of care.

RÉSUMÉ En 2005, de nouveaux critères (7) portant sur la qualité des prestations offertes au couple mère-enfant ont été introduits dans le programme national de périnatalité. Dans le cadre d'une évaluation de cette nouvelle version, nous avons réalisé une étude descriptive auprès d'un échantillon aléatoire de 400 parturientes originaires du gouvernorat de Monastir. L'âge moyen des parturientes était de 29,3 ans (ET 5) et 42 % étaient des primipares. Bien que le suivi prénatal ait été adéquat en termes de nombre de consultations pour 82,5 % des femmes, l'ensemble des sept critères de qualité ont été satisfaits pour 21 % d'entre elles seulement. Le taux de césariennes et d'accouchements prématurés était significativement plus élevé chez les femmes ayant eu un suivi prénatal de qualité ($p < 0,05$). Dans l'analyse de régression logistique, l'âge et la parité étaient les seuls facteurs indépendamment associés à la qualité du suivi prénatal. Des efforts supplémentaires sont nécessaires pour assurer des soins maternels et infantiles de qualité.

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Introduction

Le suivi prénatal est une activité de dépistage des complications maternelles et fœtales. En Tunisie, cette activité a débuté dans les années 1960. Elle a connu plusieurs améliorations et a été érigée en programme national de périnatalité (PN-PRN) depuis 1990, fondé sur la conformité du nombre des visites prénatales aux recommandations : un minimum de quatre visites avec un contenu spécifique était préconisé. Actuellement, et depuis l'année 2005, les taux de conformité de ces visites ont dépassé les 90 % à l'échelle nationale [1]. Cette performance a amené les responsables du programme à se focaliser sur la qualité de ce suivi par l'introduction de nouveaux critères visant la santé du couple mère-enfant.

Notre travail vise l'évaluation de ce programme dans sa nouvelle version au niveau de la région sanitaire de Monastir.

Méthodes

Il s'agit d'une étude descriptive rétrospective réalisée au niveau de la région sanitaire de Monastir qui compte, selon le dernier recensement de 2004, 127 162 femmes en âge de procréer (15-50 ans), soit 27,8 % des habitants de cette région [2].

Notre population d'étude était composée de l'ensemble des femmes ayant accouché au niveau des structures sanitaires publiques de la région de Monastir du 1^{er} janvier 2006 au 31 mars 2006 ($n = 400$).

Le suivi prénatal, assuré par le médecin et la sage-femme, est réalisé au niveau des centres de santé de base de la région d'étude.

Les informations ont été obtenues à partir d'un entretien avec la parturiente, après son consentement verbal lors de la présentation de l'étude, couplé à une revue de son dossier de suivi

prénatal. L'entretien était fondé sur un questionnaire préalablement testé explorant les dimensions suivantes :

- identification de la parturiente et caractéristiques socio-économiques ;
- antécédents personnels et profil obstétrical ;
- caractéristiques de la grossesse actuelle ;
- contenu des consultations prénatales ;
- caractéristiques de l'accouchement et du nouveau-né ;
- critères de qualité : examen médical systématique, dépistage des grossesses à haut risque, etc. (Tableau 1).

Les données recueillies sont légalement couvertes par le secret professionnel dans notre pays, ce qui leur assure la confidentialité requise pour ce genre de travaux [3].

Analyse statistique

Cette analyse s'est intéressée à la recherche des facteurs associés à un suivi de qualité en se basant sur les tests statistiques appropriés (test t de Student pour la comparaison des moyennes et test de χ^2 pour la comparaison des effectifs). Nous avons également procédé à une étude multivariée pour identifier les facteurs indépendamment associés à un suivi prénatal de qualité. Cette étude était fondée sur un modèle de régression logistique incluant les variables significatives au seuil de 20 % dans l'étude univariée. Les variables retenues dans le modèle final sont celles significatives au seuil de 5 %. Les intervalles de confiance au seuil de 5 % ont été utilisés pour l'estimation et la généralisation des différentes fréquences.

Résultats

Profil des parturientes

L'âge moyen de nos parturientes est de 29,3 ans (ET 5) avec des extrêmes allant

de 19 à 42 ans. Leur niveau scolaire et socio-économique est moyen : ainsi 51 % ($n = 204$) d'entre elles n'ont pas dépassé l'enseignement secondaire et 50 % étaient des femmes au foyer.

Le passé obstétrical de ces femmes a montré que 42 % d'entre elles étaient des primipares et 10 % des multipares (parité ≥ 4). Dix-sept pour cent de l'ensemble des femmes et 31 % des primipares étaient âgées de 35 ans et plus.

Étude de la qualité du suivi prénatal

Le suivi prénatal était jugé adéquat dans 82,5 % des cas ($n = 330$), et la première visite était réalisée au cours du premier trimestre pour 90 % des parturientes. Cependant et selon les nouvelles recommandations, pour être considéré de qualité, le suivi prénatal doit satisfaire en plus à un ensemble de sept critères (voir annexe) ajoutés au PN-PRN.

L'étude de la réalisation de ces différents critères a montré que sur les sept critères de qualité, trois étaient inférieurs à 26 % (Tableau 2). La notification de l'âge, de la taille et du groupe sanguin (critère 1) était satisfaite dans 98 % des cas. L'examen médical avec auscultation cardio-pulmonaire (critère 3) et la conclusion générale de l'état de chaque parturiente (critère 4) étaient notifiés dans 70 % et 65 % des cas respectivement. Cependant, la détermination du poids, de la tension artérielle, de la protéinurie et de la glycosurie (critère 2) lors des quatre consultations n'était réalisée que dans 26 % des cas.

La notification du niveau de risque de la grossesse (critère 5) n'a été faite que pour 84 parturientes (21 %) ; 34 d'entre elles étaient classées comme étant à haut risque.

Ainsi seulement 21 % ($IC_{95\%} [18,97-23,03]$) des femmes peuvent être considérées comme ayant eu un suivi prénatal de qualité conforme aux

Tableau 1 Définitions opérationnelles

Suivi prénatal adéquat : grossesse ayant bénéficié de quatre visites prénatales et plus, conformément au PN-PRN.

Suivi prénatal inadéquat : grossesse ayant bénéficié de moins de quatre visites prénatales.

Suivi prénatal de qualité : un suivi est considéré de qualité lorsque, d'une part, les quatre consultations prénatales sont réalisées au cours du 1^{er} trimestre, 6^e, 8^e et 9^e mois et d'autre part, le suivi répond aux sept critères cliniques et paracliniques suivants.

Critère 1 : le groupe sanguin, l'âge et la taille de la femme ont été enregistrés dans le dossier.

Critère 2 : à chacune des quatre consultations prénatales, le poids, la tension artérielle, la glycosurie et l'albuminurie ont été enregistrés sur la fiche de consultations prénatales.

Critère 3 : la femme a bénéficié d'au moins un examen médical avec une auscultation cardio-pulmonaire durant sa grossesse.

Critère 4 : une conclusion générale sur la grossesse figure sur la fiche prénatale.

Critère 5 : en cas de présence d'un facteur de risque, la femme est répertoriée dans le « cahier des grossesses à risque ».

Critère 6 : en cas de facteur de risque dépisté, la conduite à tenir qui lui a été appliquée est conforme aux recommandations du programme national de périnatalité.

Critère 7 : l'enfant à naître a été notifié EP (enfant protégé contre le tétanos néonatal) sur le registre.

Prématurité : naissance d'un enfant avant le terme de 37 semaines d'aménorrhée (SA), calculé à partir du premier jour des dernières règles.

Post-maturité : naissance survenue après la 41^e SA, calculée à partir du premier jour des dernières règles.

Faible poids de naissance : poids du nouveau né < 2500 g.

Anémie : taux d'hémoglobine inférieur à 8 g/dl.

nouvelles recommandations du PN-PRN (Tableau 2).

Suivi prénatal de qualité et profil des parturientes

Une étude de la qualité du suivi prénatal selon le profil des parturientes a montré qu'il était significativement associé à l'âge : plus la femme est jeune, plus le suivi est de qualité ($p = 0,03$). Au niveau scolaire, le taux est passé de 50 % chez les femmes scolarisées à 91 % pour celles ayant un niveau universitaire ; par contre, les multipares ont un suivi de qualité significativement plus faible ($p = 0,04$) (Tableau 3).

Suivi prénatal de qualité et issue de la grossesse

L'étude de l'issue de la grossesse en fonction de la qualité du suivi prénatal a montré que les césariennes et les accouchements prématurés étaient significativement plus fréquents chez les parturientes ayant un suivi prénatal de qualité ($p = 0,002$ et $p = 0,005$, respectivement), alors que les complications (rupture prématurée des membranes, hémorragie, pré-éclampsie, etc.) étaient significativement plus

fréquentes dans le groupe du suivi non-qualité. Ce taux a diminué de 23,6 % dans le groupe du suivi non-qualité à 18 % dans le groupe du suivi de qualité ($p = 0,03$) (Tableau 4).

Concernant le nouveau-né, aucune relation statistiquement significative n'a été observée entre le suivi prénatal de qualité d'une part, et le poids de naissance et le transfert en néonatalogie d'autre part (Tableau 4).

Étude multivariée

Les variables qui étaient incluses dans le modèle étaient l'âge, la parité, la profession et le niveau scolaire ; seuls l'âge et la parité ont été identifiés comme facteurs indépendamment

associés au suivi prénatal de qualité (Tableau 5).

Discussion

En Tunisie, les activités du programme national de santé maternelle et infantile ont débuté en 1966, puis ont été spécifiées en PN-PRN en 1992. Ces activités ont abouti à des résultats appréciables en matière de diminution de la morbi-mortalité maternelle et fœtale [4]. Actuellement, depuis l'année 2005, le PN-PRN a été enrichi par l'introduction de sept nouveaux critères visant l'amélioration de la qualité du suivi prénatal en couplant le nombre de

Tableau 2 Les différents critères d'un suivi prénatal de qualité

Critère de qualité	Nbre	%
Critère 1	392	98
Critère 2	104	26
Critère 3	280	70
Critère 4	260	65
Critère 5	84	21
Critère 6	15	44
Critère 7	96	24
Suivi de qualité	84	21

Tableau 3 Suivi prénatal et profil des parturientes

Variable	Suivi prénatal de qualité		p
	Nbre	%	
Âge (ans)			
< 35	71	21,3	0,006
≥ 35	13	18,9	
Parité			
Primipares et paucipares	79	22,3	0,001
Multipares	5	11,4	
Niveau scolaire			
Non scolarisées et niveau primaire	17	13,5	0,005
Secondaire	48	25,0	
Universitaire	19	46,4	
Profession			
Oui	57	28,9	0,035
Femmes au foyer	27	13,5	

visites à leur contenu. Tous ces critères doivent être satisfaits pour parler d'un suivi prénatal de qualité. Cette nouvelle démarche est devenue impérative au vu de l'actuel profil épidémiologique des femmes qui se présentent pour accouchement dans nos structures de soins [5]. En effet, notre échantillon, qui était composé de 42 % de femmes primipares dont 31 % avaient un âge supérieur ou égal à 35 ans confirme ce profil épidémiologique.

Profil des parturientes

Actuellement, partout dans le monde, les grossesses à un âge avancé sont de plus en plus fréquentes, exposant à plusieurs complications [6]. En Tunisie, ce nouveau profil des parturientes est lié à la transition sociale que vit notre pays, marqué par le travail des femmes et le retard de l'âge au mariage. L'orientation vers une prise en charge de qualité est donc devenue une nécessité.

Concernant la parité, 42 % des femmes de notre série étaient des primipares et 10 % des multipares. D'autres études ont montré des taux plus importants de multiparité [7]. Cette parité relativement faible de notre série est en partie le reflet de l'adoption par notre pays d'une politique de

contrôle des naissances depuis les années soixante.

Qualité du suivi prénatal

Dans notre contexte tunisien, le suivi prénatal est assuré par le couple médecin - sage-femme. Le rôle de cette dernière, surtout dans le suivi des grossesses à faible risque, est bien établi par la littérature [8].

Le nombre de consultations prénatales constitue un dilemme à travers le monde. En Tunisie, quatre consultations étaient préconisées. Dans notre étude, le taux de couverture est de 82,5 %. Il est supérieur au chiffre national (54,8 %) et à d'autres séries régionales [9,10]. Cependant, le nombre de consultations à lui seul ne suffit pas.

En effet, la répartition temporelle de ces consultations constitue un critère de qualité du suivi prénatal, surtout la première consultation qui doit être faite le plus tôt possible lors du premier trimestre. Cette première visite est l'occasion de juger l'aptitude de la mère à bien mener sa grossesse en recherchant par un examen physique et des examens complémentaires appropriés d'éventuelles tares pouvant nuire au déroulement normal de cette grossesse.

Depuis 2005, afin de promouvoir la qualité de ce suivi, un certain nombre de critères supplémentaires tels qu'énumérés par le PN-PRN doivent être réalisés. Parmi ces examens, la prise de la tension artérielle est indiquée au cours des quatre consultations, afin de dépister une hypertension artérielle préexistante ou une toxémie gravidique [11], de même que la recherche d'une protéinurie dont le rôle dans le dépistage de l'hypertension gravidique demeure controversé [12,13]. La pratique de ces deux examens (critère 2) s'élève à 26 % dans notre étude. Ce faible taux pourrait s'expliquer soit par la non-réalisation de ces examens, soit par la non-notification sur le dossier médical de la femme, reflétant l'absence d'une culture écrite.

L'auscultation cardio-pulmonaire, au même titre que le reste de l'examen clinique, était réalisée dans 70 % des cas.

Tableau 4 Suivi prénatal de qualité et issue de la grossesse

Issue de la grossesse	Suivi prénatal de non-qualité		Suivi prénatal de qualité		p
	Nbre	%	Nbre	%	
Accouchement par césarienne	24	7,7	11	13,5	0,002
Complications	20	6,3	3	4,0	0,005
Prématurité	25	8,0	10	11,5	0,03
Transfert en néonatalogie	25	8,2	5	5,8	NS
Faible poids naissance	35	11,2	6	6,1	NS

NS : non significatif.

Tableau 5 Étude multivariée des facteurs associés à un suivi prénatal de qualité

Variable	Odds ratio (exp β)	IC _{95 %}	p
Âge	2,1	1,03-3,02	0,03
Parité	3,2	2,02-5,27	0,04
Niveau scolaire	1,16	0,3-1,59	0,08
Profession	1,2	0,87-1,98	0,1

IC : intervalles de confiance.

Parmi les autres critères de qualité figure la vaccination antitétanique au cours de la grossesse, dont l'efficacité en termes de réduction de la survenue du tétanos néonatal [14] n'est plus à démontrer. Cet acte n'a été notifié que chez 30 % des femmes. Ce chiffre est inférieur à la réalité de la protection contre cette affection dans notre pays, protection qui dépasse les 90 % [9]. L'absence d'intégration entre le programme national de vaccination et le PN-PRN pourrait expliquer le faible de taux de couverture par le vaccin antitétanique rapporté dans notre travail. Ces résultats confirment la nécessité de l'intégration et de l'horizontalisation des soins, et d'éviter les programmes verticaux ne tenant pas compte des autres actions réalisées.

Selon plusieurs études, le profil des parturientes est un facteur déterminant de la qualité du suivi prénatal [15]. En effet, une revue de la littérature [16] a

montré que le statut des femmes (âge, parité, origine géographique, éducation, etc.) devrait être considéré dans la qualité du suivi prénatal dans les pays en développement. Ces résultats ont été confirmés dans notre travail, et un modèle de régression logistique a permis d'identifier l'âge et la parité comme facteurs indépendamment associés au suivi prénatal de qualité. Ces facteurs peuvent s'expliquer par une sorte de *fausse sécurité* liée aux grossesses antérieures chez les parturientes âgées et multipares.

Concernant l'issue de la grossesse, les résultats de la littérature ont montré qu'un suivi prénatal de qualité permet d'identifier les facteurs de risque et de prévoir l'issue de la grossesse [17], de même qu'il permet d'éviter les issues défavorables et les différentes complications [18]. Ces résultats ont été retrouvés dans notre étude. Ainsi, un suivi de qualité a permis d'identifier des

taux significativement plus importants d'accouchements prématurés et par césarienne. Ces constatations peuvent être en rapport avec la qualité du suivi qui a permis d'identifier précocement les complications nécessitant un arrêt prématuré de la grossesse ou d'indiquer un accouchement par césarienne. Hormis la prématurité, les autres complications étaient significativement influencées par la qualité du suivi prénatal dans plusieurs études [19,20]. Dans notre cas, ces complications étaient plus fréquentes dans le groupe non-qualité, ce qui prouve l'intérêt d'une prise en charge de qualité des femmes enceintes et d'un dépistage précoce des facteurs de risque.

Conclusion

L'introduction dans le PN-PRN, depuis 2005, de nouveaux critères portant sur l'amélioration de la qualité du suivi prénatal dans notre pays a montré des niveaux élevés de couverture pour certains d'entre eux, alors que d'autres restent en deçà des attentes. Un effort de sensibilisation et de formation nous paraît nécessaire dans notre région afin de réaliser les attentes d'un programme de PN-PRN de qualité.

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Manuel de suivi et d'évaluation des ressources humaines pour la santé

Dans bon nombre de pays, le manque de personnel est l'un des obstacles majeurs au renforcement de la prestation des services de santé primaires et des autres services de santé, qu'il s'agisse des services curatifs, des services de promotion de la santé, de prévention ou de réadaptation. Nombreux sont les pays qui ne disposent pas des capacités techniques nécessaires pour assurer un suivi précis de leur propre personnel de santé : les données sont souvent peu fiables et obsolètes ; il n'y a pas de définitions communes ni d'outils d'analyse reconnus, et les compétences et l'expérience permettant d'évaluer des questions politiques cruciales font défaut.

Le présent guide vise à renforcer ces capacités techniques. Il offre aux gestionnaires de la santé, aux chercheurs et aux responsables politiques un outil de référence global, normalisé et convivial leur permettant de suivre et d'évaluer les ressources humaines pour la santé. Il comporte un cadre analytique proposant différentes options stratégiques pour améliorer l'information et la base de connaissances relatives au personnel de santé, et présente en outre les expériences des pays pour mettre en lumière les approches qui ont été fructueuses.

Il convient de considérer la présente publication comme un travail appelé à évoluer qui aboutira à une meilleure compréhension des ressources humaines pour la santé et représentera une contribution notable à l'ensemble des outils et travaux de recherche appliquée conçus pour relever le défi qui consiste à mesurer et à améliorer les résultats du personnel de santé, à renforcer les systèmes de santé et, finalement, à améliorer la santé de la population.

Review

Gender inequity in Saudi Arabia and its role in public health

A.E.H. Mobaraki¹ and B. Söderfeldt²

عدم العدالة بين الجنسين في السعودية وتأثيره على الصحة العمومية

عبد الله حسين مبركي، بيورن سوديرفلت

الخلاصة: في السعودية، يكون للتفسيرات المحلية للشريعة الإسلامية والعادات المجتمعية تأثير سلبي على صحة وعافية النساء. والهدف من هذه المقالة هو مراجعة ومناقشة عدم العدالة بين الجنسين في السعودية وعلاقة ذلك بالصحة العمومية. وبالرغم من ندرة الإحصائيات والمعلومات الخاصة بعدم العدالة بين الجنسين في السعودية، إلا أن هذه المقالة تحاول الكشف عن حساسية القضية في هذا البلد الفريد. وجرى تفقد دور وحقوق المرأة في المجتمع السعودي، بما في ذلك التعليم، والزواج، وتعدد الزوجات، والإنجاب، وفرص العمل، وقيادة السيارات، وبطاقات الهوية. ويوصى بالمزيد من البحث لتقييم المعرفة والتوجهات والممارسات حول الرعاية الصحية للسعوديين والسعوديات.

ABSTRACT In Saudi Arabia, local interpretations of Islamic laws and social norms have a negative impact on the health and well-being of women. The objective of this literature review was to discuss gender inequity in Saudi Arabia and its relation to public health. Despite the scarcity of recent statistics and information regarding gender inequity in Saudi Arabia, this review is an attempt to explore this sensitive issue in this country. Women's roles and rights in Saudi society were examined, including education, marriage, polygamy, fertility, job opportunities, car driving and identification cards. Further research to assess knowledge, attitudes and practices towards health care of Saudi men and women is recommended.

L'inégalité entre hommes et femmes en Arabie saoudite et ses conséquences sur la santé publique

RÉSUMÉ En Arabie saoudite, les interprétations locales des lois islamiques et des normes sociales ont des effets négatifs sur la santé et le bien-être des femmes. L'objectif de cette revue de la littérature était d'étudier l'inégalité entre hommes et femmes en Arabie saoudite et le rapport de cette dernière avec la santé publique. Malgré la rareté des statistiques et des informations récentes sur ce sujet dans le pays, notre revue tente d'explorer cette question sensible. Nous avons examiné le rôle et les droits de la femme dans la société saoudienne, notamment sous l'angle de l'éducation, du mariage, de la polygamie, de la fertilité, des possibilités d'emploi, de la conduite automobile et des documents d'identité. Nous recommandons de poursuivre le travail de recherche afin d'évaluer les connaissances, les attitudes et les pratiques en matière de soins de santé des hommes et des femmes saoudiens.

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Introduction

Inequity based on gender exists to a varying extent in all societies and varies over time and across social and ethnic groups [1]. Within every community, nationality and class, the burden of hardship often falls disproportionately on women [2–4]. “Inequality” and “inequity” are different concepts; the former applies to any variation, while the latter applies to both avoidable and unjust causes [5]. There are many different kinds of gender inequity in, for example, mortality rates, natality rates, basic facilities such as schooling, special opportunities for training, professional aspects such as employment, ownership of property and land, and household duties [6]. Gender inequity is usually translated into a power imbalance with women being more vulnerable. This vulnerability is more precarious in traditional patriarchal societies.

Saudi Arabia has a population estimated to be about 23 million in 2006 including 27.1% foreigners [7]. Of the Saudi citizens, 90% are Arabs and all are Muslims. Annual *per capita* income is about US\$ 13 600 [8]. The system of government in Saudi Arabia is a monarchy, with the constitution governed by a strict interpretation of Islamic law [9]. The Council of Ministers is nominated by the King. The media (print and visual) are government owned. Policies are formulated and implemented by the government. There are no people's representatives or independent interest groups to represent health concerns to the government. The government ran municipal elections for the first time in 2005, although women were not allowed to vote [8].

In this unique country, local interpretations of Islamic laws and social norms can have a negative impact on the health and well-being of women. The objective of this literature review was to discuss gender inequity in Saudi Arabia and its relation to public health. Women's

roles and rights in Saudi society were examined, including education, marriage, polygamy, fertility, job opportunities, car driving and identification cards.

Methods

The *PubMed* online database and the *Google* search engine were used for the literature review. The inclusion criteria were based on scope, content, accuracy, authority, currency, purpose, workability, searching, connectivity and cost of the chosen journals and web-based information [10]. Most of the sources were articles in peer-reviewed journals, websites of reputable organizations and national official websites. The *WHOIS* tool was used to check the ownership of the domain names.

A *PubMed* database search were made using the phrases “gender inequity”, “Saudi women” and “Muslim women”. The search was limited to English language articles and the period from 1985 to the present. A *Google* search was made for “Saudi women health” and out of 16 000 hits, the top 50 items were scanned. Related books were accessed through the general library at the University of Lund, Sweden. The Islamic holy book, the *Quran*, was an important source for this review. To draw some comparisons with a European country, a *Google* search for “Swedish health” found 99 900 hits and the top 150 items were scanned. Unpublished data, predominantly theses, were searched at the University of Lund, Sweden, the University of Leeds, United Kingdom, and the University of Gunma, Japan, but no relevant information was found.

Health care in Saudi Arabia

The health care system in Saudi Arabia is mostly owned and handled by the Ministry of Health (MOH), and health care expenditure accounted for

5.9% of the 2006 government budget. The MOH goal is to provide universal free medical care for Saudi citizens and also for the millions of international pilgrims undertaking the *hajj* to the holy city of Mecca. The MOH is supported directly by the government and has good infrastructures and administrative structures. About 60% of health services are provided by the MOH and 18% by other government hospitals such as universities and military hospitals which are open to the public. In the last decade more private hospitals have been established, financed by some medical companies and by self-payment. These private hospitals cover the remaining 22% of health services which are monitored by the MOH [7]. Due to the rapid increase in the population, the government has planned to adopt a health insurance policy [11] to reduce its financial burden and to improve health standards [12].

In 2006, the ratio of doctors in Saudi Arabia was 20 and of dentists was 2.14 per 10 000 inhabitants [7]. In comparison, the ratios of doctors and dentists in Sweden in 2003 were about 44.4 and 15.6 per 10 000 inhabitants respectively [13]. The infant mortality rate in Saudi Arabia was high in the early 1980s, with an estimated 118 deaths per 1000 live births [14]. By contrast, based only on deliveries of infants in hospitals of the MOH, the infant mortality rate was 18.6 per 1000 in 2006 [15]. Despite the dramatic progress in health care in the last 3 decades, the high birth rate [7] and other factors have left Saudi Arabia a country where only 70% of females are literate [8] and the child mortality rate was 20 per 1000 children in 2006 [7]. In comparison, Sweden had an estimated child mortality rate of 4 per 1000 children in 2005 [16].

Women's education

Although at present there are more female graduates than males in Saudi Arabia [9], statistics reveal that about 30% of Saudi women are still illiterate [8]. This might be because opening schools for girls initially met with strong opposition in some parts of Saudi Arabia, where nonreligious education was regarded as unsuitable for girls [17]. Moreover, coeducation is not allowed and the curriculum in girls' schools has long been a less comprehensive version of that taught in boy's school [9].

There is no sports education in girls' school and it is prohibited by social norms for females to practise physical activities in public. Lack of exercise is a known cause of obesity. It is not surprising therefore that the prevalence of obesity (body mass index > 30 kg/m²) for 30–70-year-old Saudi females was 44.0% compared with only 26.4% in males [18]. In comparison the prevalence of obesity for 25–64-year-old Swedes was 11.0% for females and 14.8% for males [19].

Saudi women cannot study engineering, law or journalism. According to the latest official figures, 49.9% of the Saudi population are female [7] and barely 21% of them contribute to the social development, because it is socially unacceptable for women to work in fields other than teaching and medicine [9].

Even though Saudi Arabian women work in the medical field and have achieved good success at junior levels, they are exposed to some degree of discrimination at higher levels [20]. Furthermore, due to contact with male medical staff and patients and night shift-work, medical employment for women is not always welcomed by Saudi society and may be an obstacle to future marriage for a woman. This could explain the low level of satisfaction among Saudi female nurses [21].

Marriage

In Saudi Arabian personal status law an unmarried adult woman is the ward of her father, a married woman is the ward of her husband and a widowed woman is the ward of her sons. In a male-dominated and tribal community with a high social coherence, it is not unusual for a woman to be forced to marry a relative. More than 50% of marriages in Saudi Arabia are consanguineous [22]. The infant mortality rate is high (18.5 per 1000 in 2006) despite good health care facilities and an effective vaccination programme, and genetic diseases are probably a contributory factor [17]. Roughly 1.5 million Saudi Arabians suffer from or are carriers of inherited blood diseases and this constitutes a heavy burden to families and the nation. For instance, in a single region the prevalence of beta-thalassaemia trait alone was found to be 3.4% [23].

The law affects women's health care at many levels. There is a MOH law preventing a woman being admitted to a government hospital unless she is accompanied by her male guardian [24]. Furthermore, especially in rural areas, a male relative may prevent a woman being treated by a male gynaecologist or obstetrician even in an emergency. An adult woman cannot herself sign the consent for an invasive medical procedure which might be urgently required [25].

Due to the fact that there is no legal minimum age for marriage in Saudi Arabian society, females can be forced by tradition to marry under the age of 16 years [26]. Early teenage marriage was found in 27.2% of Saudi Arabian women. Most of these were illiterate (57.1%), housewives (92.4%) and grand multiparae (66.7%) [27]. Thus teenage pregnancy may be a factor behind the high maternity mortality rate of 12 per 100 000 live births in 2006 [7]. In contrast, Sweden had a maternal death rate of 2.4 per 100 000 live births during 1991–93 [28].

Abortion is forbidden according to the Saudi Arabian interpretation of Islamic law and is only allowed when a medical committee decides there is a risk to the mother if she continues her pregnancy [22]. Therefore, although genetic haematological disease is common due to consanguineous marriages, antenatal screening programmes for incurable genetic diseases have no practical use. Consequently primary prevention programmes such as premarital genetic screening tests are the only option [23]. A study has shown that a majority of Saudi Arabian mothers were unaware of the increased risks of haemoglobinopathies from consanguinity. However, the women accepted the general idea of prenatal screening with the option of abortion, presumably because most of the burden and stress of taking care of a child with a genetic disease falls on the woman [29].

An additional burden on Saudi Arabian women is the high fertility rate. It has led to a high prevalence of low bone density and osteoporosis among postmenopausal Saudi Arabian women and its complications, such as bone fractures [30]. In fact, high fertility is encouraged by society and government health policy. Like abortion, female permanent sterilization is permitted under only very restricted circumstances and both potential parents must agree [31]. Contraceptives can have an impact on better spacing between children, better child care, improvement of children's health and preservation of the mother's health [32]. Yet, while most Islamic scholars do not expressly forbid contraception, there is no effective family planning programme supported directly by the Saudi Arabian government.

Because of high fertility and the inaccessibility of contraception, it is the norm in Saudi Arabian society that women continue giving birth late into their reproductive life, which increases the risk of having children with congenital and genetic abnormalities

such as Down syndrome. There is a relation between Down syndrome and advanced maternal age or increased maternal parity. Thus, the incidence of the Down syndrome in a 9-year period study in Riyadh was 1.8 per 1000 live births [33]. In comparison, the actual live birth prevalence of Down syndrome during the same period in Sweden was 1.3 per 1000 [34,35].

Male polygamy is another issue for women in Saudi Arabian culture. In Islam polygamy is neither mandatory, nor encouraged, but is permitted [36]. It is obligatory, however, to treat one's wives justly; this applies to housing, food, clothing, kind treatment, etc., for which the husband is fully responsible. All wives have the same status and are entitled to identical rights and claims over their husband [37]. However, polygamy can have negative impacts on the family's physical and mental health. Wives in polygamous marriages experience higher levels of psychological distress and more problems in family functioning, marital relationship and life satisfaction than monogamous marriages, while children in polygamous families have a higher rate of school conflicts and lower school achievement compared with children from monogamous families [38–40].

Other social issues

Local interpretations of Islamic law affect women's legal and social status in Saudi Arabia. For example, women in Saudi Arabia are forbidden to drive. Local custom is that male relatives drive females to their segregated schools or hospitals and collect them later on. This makes it hard for women to accept job opportunities in locations far from their families and homes. Consequently, non-Saudi Arabian female health workers cannot easily be replaced with Saudi Arabian women [14].

In the past, Saudi Arabian women were only named, and not pictured, on family identity (ID) cards which identify them as dependants of their husbands or fathers. This means that women's rights can be abused by their male guardians. For instance, in banks, courts and hospitals, with her face covered and without a photo-ID, the woman's identity cannot be confirmed. If a wife delivers, the newborn could be registered under another female's name especially if the Saudi Arabian father has more than one wife. Thus birth, marriage and death records are not reliable [9]. Recently, after a long debate with religious scholars about the permissibility of photographs of the female face, the government has allowed photo-ID cards to be issued to women. Nevertheless, as the male guardian's consent is obligatory, many Saudi Arabian females are still unable to obtain an individual ID [9].

Discussion

The distribution of power and resources in society is a key issue for public health policy and practice [41]. The World Health Organization has stated that gender inequity is not only a threat to economic development but also to population health, including that of future generations [42]. Gender inequity in health still exists even in developed countries of the world. For example, women in the United Kingdom report more problems with access to diabetes care than men [43]. Canadian women experience higher levels of distress (depression, anxiety, poor quality of life) than men after myocardial infarction [44]. Swedish women earn 10%–20% less than men at the same occupational level and with the same level of educational achievement; this has public health implications, as 90% of Swedish single parents of children below school aged 1–6 years are women [45]. In the United States of America female gender is associated with lower annual incomes

among general practitioners [46], anaesthetists [47] and psychiatrists [48].

The traditional Arab family affects women's health in multiple ways. Finances are strictly the man's obligation. Young women are assigned the toughest household tasks. Marriage and motherhood are highly valued, but the pressure to produce sons is strong [49]. Women can be victims of "honour crimes" [50]. Poor relationships with fathers and history of abuse during adolescence can lead to depressive symptoms in girls [51]. There is an inverse relationship between the number of children a woman has and her education, income and age at marriage [52]. Education and employment status are good predictors of birth spacing preference and the health of mothers and children. The highest proportion of women with birth intervals < 3 years are reported from the Middle East (in Jordan, Yemen and Saudi Arabia) [53,54]. Consanguinity—which is associated with women's lower education, lower socioeconomic status, younger age at marriage and higher fertility rate—remains high in many Middle Eastern countries. The prevalence of consanguinity varies from 68.0% in rural areas of Egypt to 57.7% in Saudi Arabia, 58.1% in southern Jordan, 50.5% in United Arab Emirates, 40%–47% in Yemen, 54.4% in Kuwait and 35.9% in Oman [55–63]. Literacy levels are low: for example, 68% of Yemeni females are illiterate [64]. For half of Qatari women, the husband decides whether contraception is used or not [55] and half of Saudi Arabian women have a short birth interval (< 2 years) because of the husband's wish [53].

Only the Islamic Republic of Iran, Saudi Arabia and Sudan apply Islamic law to all matters of jurisprudence. However, different religious leaders interpret Islamic religious texts differently, particularly regarding women's issues such as wife abuse [65] and abortion. Hessini believes that the arguments of some conservative religious leaders, who

are all men, are still being used to legitimize patriarchal practices [22]. Hassan argues that "The Qur'anic description of marriage suggests closeness, mutuality, and equality, but tradition defines a husband as his wife's god in earthly form (despite the Qur'an prohibition against human deification as the one unpardonable sin), her gateway to heaven, and the arbiter of her final destiny" [66]. In other verses, the *Quran* has indicated indirectly the optimum birth interval by specifying a suggested time of 24 months for breastfeeding (*Quran* 2:233; 31:14; 46:15) but there is a mistaken belief that family planning is anti-Islam [53]. Customs that were originally intended to protect women and even guarantee women's autonomy (polygamy, inheritance rights, *purdah* and veiling) have, according to Hassan [66], become instead instruments of oppression.

Social norms and conservative religious beliefs have a powerful effect on women's lives and health in Saudi

Arabian society. The Saudi Arabian government issues ID cards to women but only if her male guardian allows it [9]. The government does not forbid females to practice sport in public or in segregated private places but societal norms limit females' outdoor exercise [18]. The government has implemented a compulsory national premarital screening programme for common inherited haematological diseases. However, the purpose of the health programme is abused since the final result does not affect the validity of the marriage [23]. The same applies to female medical education, which is encouraged by the government, but can be socially unacceptable and can be an obstacle to women's marriage [19]. There is a MOH law that permits adult woman to sign consent for some invasive radiological procedures but it is not always applied by medical employees [25]. A Saudi Arabian woman cannot be admitted to hospital without

her male guardian and is not allowed to give her own consent for an invasive medical procedure [25]. Saudi Arabian law requires a male relative's agreement before seeking work, education, travel or issuing an identity card or passport [9]. The high prevalence of obesity among Saudi Arabian females can be attributed to social restrictions that prevent women participating in exercise in schools or in public [18].

The major limitation of this review was the scarcity of recent data and information about gender inequity, particularly about health care in Saudi Arabia. Nevertheless, to our knowledge this review is the first attempt to explore this sensitive issue in this unique country. In general, there is little available research that addresses knowledge, attitudes and practices towards the health care of Saudi Arabian women and men. These may represent important areas for future research.

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Report

Supporting the Saudi e-health initiative: the Master of Health Informatics programme at KSAU-HS

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دعم المبادرة السعودية للصحة الإلكترونية: برنامج درجة الماجستير في المعلومات الصحية في جامعة الملك سعود للعلوم الصحية

ماجد بن محمد التويجري

الخلاصة: أحرز القطاع الصحي في السعودية تقدماً ملحوظاً في العقود الأخيرة حيث تلقت بعض المستشفيات اعترافاً دولياً. إلا أن هذا التقدم لم يصاحبه تقدم في مجال المعلومات الصحية، الضرورية للمستشفيات كي تحقق أهدافها المحددة مثل الارتقاء بجودة الرعاية الصحية، والحد من وقت وتكاليف إيتاء الرعاية الصحية. وفي هذا الورقة العلمية يصف الباحث حالة الصحة الإلكترونية في السعودية، ويستعرض بعض المبادرات الوطنية للصحة الإلكترونية مثل إنشاء البرنامج الجديد لدرجة الماجستير في المعلومات الصحية والجمعية السعودية للمعلومات الصحية. كما ناقش مقترحاً لخطة الصحة الإلكترونية في السعودية.

ABSTRACT The health sector in Saudi Arabia has made significant progress in recent decades with some hospitals receiving international recognition. However, this has not been accompanied by advancements in the field of health informatics, which are necessary for hospitals to achieve certain objectives such as enhancing the quality of health care and reducing the time and cost of health care delivery. In this paper we describe the status of e-health in Saudi Arabia, along with some of the national e-health initiatives such the establishment of a new Master of Health Informatics degree programme and the Saudi Association for Health Informatics. A proposal for an e-health plan in Saudi Arabia is also discussed.

Promotion de l'initiative saoudienne en matière de cybersanté : le programme de master en informatique médicale de la Faculté de médecine de l'université des sciences de la santé Roi Saoud ben Abdelaziz

RÉSUMÉ Le secteur de la santé en Arabie saoudite a fait d'importants progrès au cours des dernières décennies et plusieurs hôpitaux ont acquis une reconnaissance internationale. Pour autant, ces progrès ne se sont pas accompagnés d'avancées dans le domaine de l'informatique médicale, sans lesquelles les hôpitaux ne sauraient atteindre des objectifs tels que l'amélioration de la qualité des soins et la diminution des délais et des coûts de la prestation de soins de santé. Dans cet article, nous décrivons la situation de la cybersanté en Arabie saoudite, ainsi que certaines des initiatives nationales menées dans ce domaine, par exemple la création d'un programme de master en informatique médicale et de la *Saudi Association for Health Informatics* [Association saoudienne d'informatique médicale]. Une proposition de plan pour la cybersanté en Arabie saoudite est également examinée.

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Introduction

The health care industry has become increasingly reliant upon information and communication technology (ICT). This has resulted in a significant technology gap between those professionals entrusted to provide clinical care and those who are in charge of managing the complex information systems required to operate modern health care systems. Such a gap threatens the effective and efficient management of health care information. The need to use ICT in health care has resulted in a new science called health informatics which is a socio-technical discipline concerned with the use of ICT to support the delivery of health care [1]. Health informatics is a broad discipline which includes many subjects such as bio-informatics, electronic patient records, telemedicine and clinical decision-making support [2].

The International Medical Informatics Association (IMIA) has made significant efforts to promote and enhance health informatics education worldwide. IMIA suggested that proper education is essential for health care professionals to meet the increasing demand for health informatics or e-health [3]. Such education would enable health professionals to take full advantage of ICT. A special issue of the *International journal of medical informatics* (volume 73, 2004) was dedicated to health informatics education and comprised papers presented at the 2003 meeting of the IMIA working group on education which was attended by 80 educators from all over the world.

The aim of the current paper is to introduce the status of e-health initiatives in Saudi Arabia, including the new Master of Health Informatics degree programme at King Saud bin Abdulaziz University for Health Sciences (KSAU-HS). The programme was designed following the recommendations presented by IMIA [3]. It was established in 2005 as the first programme in health

informatics in Saudi Arabia. No known programme in health informatics is available in neighbouring countries. This paper also introduces other e-health initiatives in Saudi Arabia, including the establishment of the Saudi Association for Health Informatics (SAHI) which organized the first e-health conference in Riyadh 2006. A proposal for a master e-health plan in Saudi Arabia is presented.

Why e-health?

Over the past 4 decades, Saudi Arabia has spent billions of dollars in improving the quality of its health care and in expanding its scope and coverage in the country. Due to this rapid expansion, the range of health care providers in Saudi Arabia is diverse. While the Ministry of Health provides around 60% of the health care services, the remaining portion is provided by other government bodies such as the National Guard, the Ministry of Defence and Aviation, the Ministry of Interior and university hospitals plus the rapidly growing private sector. This variation in health service providers has led to variations in the way health care facilities are administered and managed, with significant variation in the information systems used.

As a result, patient information records have become scattered in different health care facilities with no one provider having the complete patient record, except in very rare cases where the patient chooses to receive health care from one provider at all times. One additional negative impact of varied health care systems is the great waste of effort and money resulting from treating patients repeatedly for the same health problems in several medical centres. Patients may at times be asked to repeat X-rays and other laboratory tests and may be given different medications which may compromise patient safety.

In the year 2000, the government of Saudi Arabia formed a health reform committee to conduct a comprehensive review of the health care services provided to its citizens. The committee highlighted that a lack of proper health informatics applications was one of the top challenges facing the Saudi health sector, in addition to health services financing, health services management and health service distribution. As a result of the health reform committee's recommendations, a special taskforce was formed in 2002 to develop an information technology (IT) strategic plan for health care in Saudi Arabia. The main objective of the strategic plan was to build a national electronic health record. The highest priority recommendations made by the taskforce were as follows (Figure 1):

- To build cadres specialized in the field of health informatics.
- To establish an association or society for health informatics in Saudi Arabia.
- To establish centres of excellence in health informatics in Saudi Arabia.
- To design the specifications of the electronic health records.
- To expand the telemedicine network in the country.

Health informatics is of particular importance in Saudi Arabia for the following reasons:

- Most hospitals and medical centres in Saudi Arabia still rely on paper records.
- The amount of health information is increasing. However, different health sectors use disparate systems with little interoperability between these systems, thus creating unconnected islands of information.
- Most of the existing information systems are administrative in nature rather than patient-care focused.
- There is a serious lack of people qualified in health informatics in Saudi

Arabia and neighbouring countries which means that many health organizations find it difficult to identify and recruit health informatics professionals. As a consequence, many organizations invest unproductively in ICT.

- Some literature has shown that taking advantage of ICT in health care will have significant economic benefits and will enhance quality and patient safety [4].
- The growth rate of the Saudi population is one of the highest in the world, which dictates the need for proper utilizations of resources. The use of ICT is essential to achieve that objective.

Master of Health Informatics at KSAU-HS

As a result of the e-health needs assessment, KSAU-HS developed a Master of Health Informatics degree in order to provide advanced health informatics education and to prepare health informatics specialists who would be able to participate in research and in the advancement of the health informatics field. The programme provides graduates with the technical, human and practical skills in health informatics to meet the increasing demand on ICT use in health care.

The 2-year programme was designed following the recommendations of the IMIA on education in health and medical informatics [3]. However, the emphasis is on applied health informatics which highlights the need for health informatics specialists to deploy ICT to support health systems.

The programme started in September 2005 with a group of 25 students (16 female and 9 male students). The students came from different education backgrounds, including medicine, health, IT and biomedical engineering, and from different health organizations

such as the National Guard, the Ministry of Defence and Aviation, the Ministry of Interior, university hospitals and private hospitals. Twenty more students were accepted the following year.

About KSAU-HS

KSAU-HS is a newly founded university, established in early 2004, specializing in health sciences. It is housed within King Abdulaziz Medical City of the National Guard Health Affairs, a large health organization which provides modern medical care to National Guard employees and their dependents, as well as to Saudi Arabian nationals. Under the umbrella of the National Guard Health Affairs, there are 4 hospitals and 60 primary and secondary health centres around Saudi Arabia having 2000 inpatient beds in total. The University comprises the Colleges of Medicine, Nursing, Allied Medical Sciences and Public Health and Health Informatics.

IMIA recommendations for health and medical informatics education

The IMIA has made significant efforts to promote and enhance health informatics education worldwide. IMIA has proposed a set of recommendations on education [3], which provide an excellent foundation for health informatics education. They have evolved from 7 conferences organized by the working group for health and medical informatics education. Such recommendations are not only important in providing an education framework but also as a basis for establishing international collaboration

which enables international exchange of standards and teachers.

The IMIA recommendations identified 2 learning objectives:

- Enabling health care professionals to become good IT users.
- Preparing graduates to become health and medical informatics specialists.

The recommendations identified the level of knowledge and skills required for each learning outcome. The knowledge and skills are classified into 3 domains:

- Health informatics.
- Medicine, health, and health services management.
- Informatics, mathematics and biometry.

As per the IMIA recommendations, the Master of Health Informatics degree should be at least 1 year full-time corresponding to at least 60 credits as defined by the European credit transfer system (ECTS [5]) (Table 1).

Programme mission

The mission of the programme is to advance the quality and efficiency of the Saudi health care system through improved information management.

Programme objectives and target students

The programme aims to provide a scientific education that includes theory, specialized knowledge, and practical skills. Graduates should be able to: apply practice-oriented methods and tools

Table 1 Recommended student workload in European credit transfer system (ECTS) for the Master of Health Informatics degree at King Saud bin Abdulaziz University for Health Sciences

Knowledge and skills area	ECTS workload (credit hours)
Health and medical informatics	40
Medicine, health and health systems organization	10
Informatics, computer science, mathematics, and biometry	10
Total ECTS workload	60

from health and medical informatics; and participate in research and in methodological advancement within the field of health and medical informatics.

As per the IMIA recommendations, the master degree programme accepts students with a bachelor degree in health information management, in medicine or health sciences or in computer science.

Programme infrastructure

The programme depends on the following infrastructure: a Centre for Health Informatics and director with strong academic credibility in health informatics; faculty members with a clear vision and philosophy; and effective collaborations with internal and external academic institutions. Some of these will be able to provide part-time teaching, research and project mentoring opportunities.

Programme structure

The Master of Health Informatics is a dedicated full-time 2-year programme. It is organized in modules (courses) consisting of 3 hours of lectures per week, excluding the time spent for exercises, seminars and practicums. It requires a minimum of 14 courses totalling 42 semester credit hours (a credit hour is equivalent to 1-hour lecture per week for a semester of 16 weeks, i.e. 3 semester credit hours may be equivalent to 6 ECTS of course work [5]). The programme of study includes a variety of graduate level foundation and required health informatics courses as well as elective health management courses. The master degree is conferred upon the successful completion of 42-semester credits towards the degree. Students must complete 2 foundation courses (which depend on the student's background); 7 courses from the health informatics knowledge area; 2 courses from the knowledge area of medical, health sciences, and health sys-

tem organization; and 3 courses from informatics knowledge (Table 2).

Students' evaluation of the programme

In order to verify whether KASU-HS succeeded in fulfilling the aims we set in developing the master degree programme, an evaluation was conducted in using a questionnaire survey sent to the first group of graduates of the programme. The 23 graduates who graduated in May 2007 were 15 female students and 8 male students. The questionnaire was returned by 22 students, a response rate of 96%.

The evaluation was concerned with student's personal opinions of the Master programme. Students were asked about their opinion about the overall programme, faculty and staff, topics and knowledge, teaching environment, library, student group coherence, educational tools, interrelation of subjects and the significance of the programme to government and private health sectors. A rating scale of 1–5 was used from: (1) totally disagree to (5) totally agree. Table 3 shows the students' mean scores. The students were satisfied with the outcomes of the programme in general, and believed that the programme was important for both government and private health sectors. The students

Table 2 Master of Health Informatics degree at King Saud bin Abdulaziz University for Health Sciences: structure of courses (each course is 3 semester credit hours)

Study core areas and course titles
Required foundation courses (6 credit hours) <i>Students are required to complete 2 courses from the following:</i> <ul style="list-style-type: none"> Foundation of medicine & medical terminology^a Introduction to information technology^b Statistical analysis
Health informatics courses (21 credit hours) <i>Students are required to complete the following 6 courses:</i> <ul style="list-style-type: none"> Introduction to health informatics Health information systems Electronic health records & standards Legal, ethical, and social aspects of health informatics Decision support in health care & knowledge management Health informatics project <i>Students are required to select 1 course from the following:</i> <ul style="list-style-type: none"> Topics in health informatics Directed study in health informatics
Health sciences courses (6 credit hours) <i>Students are required to take research methodologies and select 1 course from the other courses:</i> <ul style="list-style-type: none"> Research methodologies in health care Health services administration International health systems Financial management of health organization Organizational behaviour in health care
Informatics courses (9 credit hours) <i>Students are required to complete the following 3 courses:</i> <ul style="list-style-type: none"> Web technology Database design & management Information technology project management in health care

^aRequired course for students from non-health sciences background.

^bRequired course for students from non-information technology background.

Table 3 Students' opinions of the first Master of Health Informatics degree programme at King Saud bin Abdulaziz University for Health Sciences (n = 22)

Question	Mean score	SD
Programme met student's expectation	3.73	0.85
I would recommend the programme to others	4.32	0.64
My colleagues from other fields appreciated health informatics	4.09	0.75
My employer appreciated health informatics	3.95	1.00
Satisfied with the programme staff and faculty	4.04	0.65
Satisfied with topics and knowledge covered in the programme	4.23	0.67
Satisfied with library	3.09	1.11
Satisfied with the group (students coherence)	4.59	0.50
Found the educational tools useful	4.27	0.80
Satisfied with interrelations between subjects	4.18	0.59
I think the programme is significant to the public health sector	4.64	0.65
I think the programme is significant to the private health sector	4.45	0.86
Attained more insight about health informatics	4.90	0.29

SD= standard deviation.

had some concerns regarding the quality of reading materials in the library.

We recommend an evaluation of the future performance of these graduates based on the set of skills and knowledge as suggested by IMIA. We suggest conducting a formal interview with the employers of these graduates to ask them about the changes that have taken place in the skills, knowledge and attitudes of these graduates as a result of their

2-year study programme. If employers, paymasters and possibly peers and colleagues can identify areas of change and improvement in the course, it would be a successful exercise. Another suggestion is to plan a follow-up study with these graduates about career development and change, continuous education, regular meetings and formation of a community of practice and research on their performance.

Saudi Association for Health Informatics

As per the recommendation of the taskforce formed in 2002 (Figure 1), SAHI was established in 2005 under the direct supervision of KSAU-HS. SAHI aims to develop and promote health informatics knowledge by organizing scientific and professional conferences, seminars, workshops and exhibitions. SAHI also aims to provide a forum for the exchange of ideas and experience in health informatics among its members.

One of the most important activities of SAHI is the Saudi e-health conference which was held over 2 days in 2006 in Riyadh, Saudi Arabia. The main topics addressed in the conference were: hospital information systems; picture archiving and communications systems; enterprise resource planning for health care; emerging technologies in health care; and telemedicine and medical e-learning. The main recommendation of the conference emphasized the importance of building a national e-health strategy for the country.

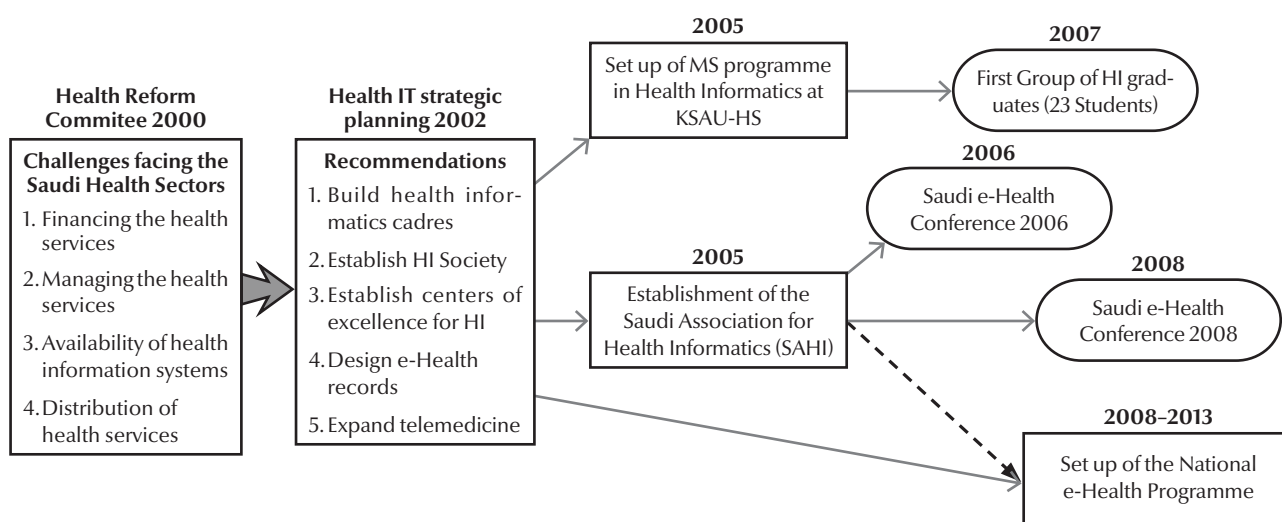


Figure 1 e-health initiatives in Saudi Arabia

Proposed project for e-health in Saudi Arabia

In order to achieve the main recommendation of the Saudi e-health conference in 2006, a new proposal for a master plan for e-health in Saudi Arabia is proposed.

Problem statement

Most health systems are still paper-based, and those that are electronic have poor capability to share information. Hence, communication with the wider health information environment is severely limited, which fragments patient information and results in duplication of procedures and data entry. The lack of integration also has a negative impact on health service planning.

The e-health programme objectives

The main goal of the e-health programme is to develop an e-health strategy for Saudi Arabia which, through better use of ICT, aims to:

- Increase the efficiency and effectiveness of health organizations.
- Help provide better patient care that is continuous, integrated, closer to patient homes and well coordinated.
- Increase the return on investment of health assets and resources.
- Reduce duplicate records.

Project stakeholders

- The Health Services Council: the project sponsor, who will authorize the setting up of the project, secure the necessary funds required and manage the progress of the project.
- Citizens: the main beneficiaries of implementing e-health initiatives.
- The Ministry of Finance: to fund the project.
- The e-government programme: to support the e-health initiatives and recognize this project as an important initiative in e-services.
- Telecommunication companies: to provide the major networking infrastructure that can only be done by major telecommunication companies.
- Major IT companies: to provide the IT infrastructure.
- IT departments in hospitals.
- The SAHI.

Scope of work

The proposed project has 2 main phases:

Phase I: Development of the required strategy, plans, policies, procedures, standards, design and training materials. This phase has a number of sub-phases and sub-tracks as well. The detailed action plan spans 5 years (2008–13) and includes, at least, the following components:

- The Saudi e-health vision.

- The specific goals and priorities for the coming 5 years.
- The e-health projects that must be implemented within the coming 5 years.
- Estimation of the budget required for implementing the proposed detailed action plan.

Phase II: Provide project management services. The services of this phase will start after completion of phase I.

Health organizations need to suggest the team structure, team members and expertise required for these activities. This team must work on a full-time basis.

Conclusion

There are already some initiatives with regard to e-health in Saudi Arabia, such as the establishment of a new Master of Health Informatics degree programme and of the SAHI. Moreover, an e-health conference was organized in 2006 to address e-health topics. The conference presented some recommendations to promote e-health in Saudi Arabia. However the e-health movement is still very slow.

The proposal definition for e-health in Saudi Arabia starts with strategic planning which should tie the projects and programmes resulting from the plan to the national strategies of the country.

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Eastern Mediterranean Health Journal reviewers' panel, 2009¹

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Al-Hamza B, Smith A. *The fifth sign of identity*. Cairo, American University Press, 1990.
Journal article:
Jones A et al. One day in Tibet. *Journal of tautology*, 1993, 13(5):23-7.
Document:
Al-Itnen M, ed. *The principles of uncertainty*. Geneva, World Health Organization, 1985 (WHO/DOC/537).
Web text:
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دلائل إرشادية للمؤلفين

ذات أهمية خاصة لموضوعات الصحة العمومية في الإقليم يتم من حين لآخر دراسة إمكانية نشرها. ويتعين ألا يزيد النص عن 1500 كلمة (ولا يتضمن ذلك الملخص المرفق، والمراجع، والجداول، والأشكال) وأن يصحبها ملخص لا يزيد عن 150 كلمة. ويجب ألا يزيد عدد الجداول والأشكال عن واحد لكل 1000 كلمة. ١٢. الاعتبارات الأخلاقية: متى وجب ذلك، يرفق بيان بموافقة لجنة الأخلاقيات ومجلس المراجعة في المؤسسة المعنية. ويتعين على المؤلفين إثبات أن جميع الأشخاص الذين شملهم البحث، قد وافقوا موافقة واعية كتابية وطوعية، وإذا لم يتمكن المشاركون (أحياءاً كانوا أم أمواتاً) من إعطاء هذه الموافقة، يتم الحصول على موافقة أوليائهم. وقد يطلب من المؤلفين تقديم نماذج الموافقة هذه، وحتى في حالة عدم إلمام المشاركين بالقراءة والكتابة، فقد تقبل الموافقة الشفهية.

١٣. تضارب المصالح: ينبغي أن يقدم المؤلفون بياناً يوضح أي تضارب في المصالح بالتفصيل. يرجى الرجوع إلى الدلائل الإرشادية للجنة الدولية لمحوري المجالات الطبية.

١٤. تقديم المخطوطات في شكل إلكتروني (يُجَدَّ استخدام برنامج مايكروسوفت وورد) مع ترك مسافات بين السطور. وأن يكون مقاس الورقة A4. أما بالنسبة للمخطوطات التي تُقدَّم في شكل ورقي فيجب أيضاً ترك مسافات بين السطور، وأن يكون حجم الورقة A4 على أن تتم الطباعة على وجه واحد من الصفحات.

١٥. المراجع: ينبغي أن يقتصر الاستشهاد من نصوص أي أعمال منشورة على المراجع الحديثة الأساسية. ويلزم تقييم المراجع، كلما ظهرت في النص، وأن يليها إعداد عربية بين أقواس مربعة مثل: 1. 8-15. كما ينبغي تدوين هذه المراجع في قائمة مرفقة، في صفحة منفصلة، في نهاية الورقة، وأن تتضمن المعلومات التالية إن أمكن: اسم المؤلف، أو أسماء المؤلفين، والأحرف الأولى من أسائهم، وعنوان الورقة البحثية أو الكتاب في اللغة الأصلية، إضافة إلى ترجمتها؛ وبالنسبة للمقالات البحثية، يتم ذكر الاسم الكامل للمجلة بالإضافة إلى رقم المجلد، وعدد الصفحات؛ وبالنسبة للكتب وسائر النصوص، يتم ذكر مكان النشر (البلد والمدينة) واسم الناشر (التجاري أو المؤسسة) وتاريخ النشر؛ وبالنسبة للنصوص التي تنشر حصراً على الإنترنت، يتم ذكر العنوان الإلكتروني للرابطة (URL) الخاص بالصفحة المستشهد بها وتاريخ آخر وصول لها. بالنسبة للنصوص التي يشترك فيها أكثر من ثلاثة مؤلفين، يذكر اسم المؤلف الأول فقط يتبعه كلمة "وزملائه". وفي ما يلي أمثلة للأسلوب الذي تفضل المجلة الصحية لشرق المتوسط أن يتبع:

Book: Al Hamza B, Smith A. The fifth sign of identity. Cairo, American University Press, 1990. Journal article: Jones A et al. One day in Tibet. *Journal of tautology*, 1993, 13(5): 23-7
Document: Al-Itneen M, ed. *The principles of uncertainty*. Geneva, World Health Organization, 1985 (WHO/DOC/537)
Web text: *Child growth standards*. Geneva, World Health Organization, 2006 (<http://www.who.int/childgrowth/en/>, accessed 8 October 2008)

١٦. وفي ما يتعلق بالرسومات والجداول، المشفوعة بالشروح الملائمة، فإنه ينبغي أن ترد كل منها في صفحة منفصلة، ومرفقة على التوالي بالأعداد العربية، وملحقة في نهاية الورقة. كما ينبغي الإشارة إلى كل رسم وكل جدول يشار إليه في النص، وحجباً لو أمكن تحديد مصدر كل رسم وكل جدول. وفي حالة نقل أي رسومات أو جداول من مواد أخرى، فإنه تقع على عاتق المؤلف أو المؤلفين المسؤولية الكاملة عن الحصول على الأذن اللازمة. وبُغْيَة تجنب أي مشكلات في طريقة تنسيق المنتج النهائي، فإنه يتعين الاقتصاد قدر الإمكان في إدراج الجداول والرسومات. وينبغي تقديم الأشكال بالشكل الذي يسمح بتفقيحها، ويحدد برنامج ميكروسوفت إكسيل. وبالنسبة للأشكال المستندة إلى بيانات، فيجب أن ترفق بها هذه البيانات، مثل قوائم بيانات إكسيل على سبيل المثال لتيسير عملية إعادة الرسم إذا لزم الأمر. أما بالنسبة للصور والإيضاحات فينبغي إرسالها كملفات منفصلة، ويحدد في صورة JPG أو TIFF وألا يقل وضوح الصورة عن 300 dpi. بالنسبة للمخطوطات المقدمة بشكل ورقي، فينبغي إرفاق مجموعتين من الصور والأشكال الأصلية مع المعطيات الأساسية.

١٧. سيتم إعادة الأوراق المقدمة والتي لا تلتزم بهذه الدلائل الإرشادية إلى المؤلف للتصويب قبل دراسة نشرها.

١٨. عند النشر، يحصل المؤلفون على نسخة من العدد الذي ترد فيه المقالة، بينما يحصل المؤلف الرئيسي على 50 نسخة من البحث المنشور. وتقدم الطلبات للحصول على المزيد من النسخ، أو على معلومات حول الأسعار إلى رئيس التحرير.

١. إن الأوراق البحثية المقدمة للمجلة الصحية لشرق المتوسط للنشر يجب ألا يكون قد تم نشرها من قبل، أو تم قبول نشرها، أو أنها قيد الدراسة بغرض النشر في أي مكان آخر (نرجو الرجوع إلى السياسة الخاصة بأخلاقيات النشر الخاصة بنا). ويحتفظ المكتب الإقليمي لمنظمة الصحة العالمية لشرق المتوسط بالحق في إعادة نشر وطباعة أي مادة علمية تظهر في المجلة الصحية لشرق المتوسط.

٢. إن الأوراق البحثية المقدمة للنشر في المجلة الصحية لشرق المتوسط يجب أن تتوافق مع المتطلبات الموحدة للمخطوطات المقدمة للمجلات الطبية البيولوجية التابعة للجنة الدولية لمحوري المجالات الطبية.

٣. التقديم: تقدم الأوراق البحثية الأصلية المكتوبة باللغة العربية أو الإنكليزية أو الفرنسية للدراسة عن طريق البريد الإلكتروني EMHJ@emro.who.int كما يمكن إرسال الأوراق البحثية لرئيس تحرير المجلة الصحية لإقليم شرق المتوسط، بالمكتب الإقليمي لشرق المتوسط، صندوق بريد 7608، مدينة نصر: (11371)، القاهرة، مصر. ويتم ترجمة ملخصات الأوراق البحثية التي يتم قبول نشرها إلى اللغات الثلاث. ولضمان كتابة أساء المؤلفين المرفق أسائهم بالمخصصات العربية كتابة صحيحة، فإنه يتعين على المؤلفين الذين تكون العربية هي لغتهم الأم، ويكتبون بالإنكليزية أو الفرنسية، أن يرفقوا أساءهم بالكامل بالعربية، بالإضافة إلى كتابة الحروف العربية باللغة الإنكليزية أو الفرنسية.

٤. تخضع كل الأوراق البحثية المقترحة نشرها لمراجعة الزملاء. ويحتفظ مجلس التحرير بالحق في قبول أو رفض أي ورقة بحثية استناداً إلى تعليقات المراجعين، والدقة العلمية ومدى الملائمة للمجلة. ويتم قبول الورقة البحثية على أساس أنها تخضع للمراجعة الإحصائية والتحريرية إذا لزم الأمر، بما في ذلك تلخيص النص وحذف الجداول أو مادة الرسم البياني.

٥. الموضوعات: يتعين أن يرتبط موضوع الورقة البحثية بالصحة العمومية، أو موضوع طبي بيولوجي متعلق بها، أو موضوع تقني يرتبط بمجالات المنظمة، وذو أهمية خاصة لإقليم شرق المتوسط.

٦. يتعين أن يكون عنوان الورقة مختصراً قدر الإمكان، ويحدد ألا يزيد على 15 كلمة، على أن يرسل الاسم الكامل للمؤلف، والمؤسسات التي يكون عضواً فيها، وأعلى درجة علمية حصل عليها. لذا نرجو إرسال عنوان البريد الإلكتروني، والمعلومات الأخرى اللازمة للاتصال بالكتاب (العنوان البريدي، الفاكس، الهاتف). ويتعين ألا يزيد عدد المؤلفين على سبعة، على أن يسهم جميع المؤلفين بشكل مادي في تصميم أو تحليل أو كتابة الدراسة، والموافقة على النسخة الأخيرة. ولن يسمح بإجراء أي تغيير يتعلق بالتأليف بعد قبول الورقة للنشر، وأي تغيير قبل ذلك يجب أن يقره جميع المؤلفين المدرجين. وقد يطلب من المؤلفين تأكيد مساهمتهم. كما يمكن تضمين أساء أي مساهمين آخرين في الشكر والتقدير. نرجو الرجوع إلى الدلائل الإرشادية للجنة الدولية لمحوري المجالات الطبية فيما يتعلق بالتأليف والمساهمة.

٧. التقارير والمقالات البحثية: وينبغي في الأوراق التي تدون النتائج البحثية الأصلية اتباع الشكل الخاص: المقدمة والطرق والنتائج والمناقشة، على ألا يزيد نص التقارير والمقالات البحثية عن 3000 كلمة (ولا يتضمن ذلك الملخص المرفق، والمراجع، والجداول، والأشكال). ويتعين تقديم ملخص لا يتعدى 150 كلمة ليوضح الأغراض والسياق والنتائج والخلاصة بشكل مختصر وواضح، بالإضافة إلى أن أقصى عدد للمراجع يجب ألا يتجاوز 25 مرجعاً، وكذلك عدد الجداول والأشكال يجب ألا يتجاوز واحداً لكل 1000 كلمة.

٨. مقالات حول المراجعات بمعنى التقييم النقدي للبحوث حول الموضوعات ذات الصلة بالصحة العمومية في الإقليم. ويتعين أن تتضمن قسماً يتناول الأغراض، والمصادر، وطرق الاختيار، والتجميع وتفسير المعطيات والاستنتاجات. ويتعين ألا يتعدى النص 3000 كلمة (ولا يتضمن ذلك الملخص المرفق، والمراجع، والجداول، والأشكال). وعلى أن يصحبها ملخص لا يزيد عن 150 كلمة؛ وألا يتجاوز عدد الجداول والأشكال واحداً لكل 1000 كلمة.

٩. تقارير الحالات: يتم دراسة نشر التقارير الخاصة بالحالات ذات الطبيعة غير المعتادة فقط. ويتعين أن يشمل النص مقدمة، وتقرير الحالة، والمناقشة، وألا يتجاوز النص 3500 كلمة مع إيراد أقل عدد من المراجع. ولا يلزم في هذه الحالة تقديم ملخص.

١٠. رسالة إلى المحرر: يُرَحَّب بتلقي الرسائل والملاحظات حول المقالات المنشورة في المجلة، وسترسل هذه الرسائل إلى مؤلفي المقالات الأصلية، للتعليق عليها. وينشر التعليق مصاحباً للرسالة، على أن يكون نص الرسائل موجزاً قدر الإمكان.

١١. الاتصالات الموجزة: إن المقالات التي لا تشكل دراسة بحثية مكتملة، ولكنها

Directives à l'intention des auteurs

1. Les articles soumis pour publication à La Revue de Santé de la Méditerranée orientale ne doivent pas avoir été publiés, être en cours d'examen par d'autres revues, ou avoir été acceptés pour publication dans d'autres revues (veuillez vous reporter à notre Politique en matière d'éthique). Le Bureau régional de l'Organisation mondiale de la Santé (OMS) pour la Méditerranée orientale se réserve tous les droits de reproduction et de republication des matériels qui paraissent dans La Revue de Santé de la Méditerranée orientale.
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3. **Soumission :** Les articles originaux rédigés en anglais, arabe ou en français peuvent être soumis pour examen par courrier électronique à l'adresse suivante : EMHJ@emro.who.int. Les articles peuvent aussi être envoyés au Rédacteur en chef, La Revue de Santé de la Méditerranée orientale, Bureau régional de l'OMS pour la Méditerranée orientale, BP 7608, Cité Nasr (11371), Le Caire (Égypte). Les résumés des articles acceptés pour publication seront traduits dans les trois langues. Pour assurer que les noms des auteurs soient correctement écrits dans les résumés en arabe, les auteurs rédigeant en anglais ou en français mais dont la langue maternelle s'écrit en caractères arabes doivent fournir leur nom complet en écriture arabe et une translittération de leur nom en anglais ou en français.
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5. **Sujets :** Le sujet de l'article doit concerner la santé publique ou un autre sujet biomédical ou technique connexe faisant partie du champ d'intérêt de l'OMS, et se rapporter plus particulièrement à la Région de la Méditerranée orientale.
6. Le titre de l'article doit être aussi concis que possible, et de préférence ne pas dépasser 15 mots. Le(s) nom(s) complet(s) du ou des auteur(s), leur(s) affiliation(s) institutionnelle(s) et l'intitulé de leur plus haut diplôme scientifique doivent être indiqués. Une adresse électronique et toute autre information permettant de contacter le ou les auteurs(s) (adresse postale, numéro de télécopie, numéro de téléphone) devront aussi être mentionnées. Le nombre des auteurs ne devrait pas être supérieur à sept. Tous les auteurs devraient avoir apporté une contribution importante à la conception, à l'analyse ou à la rédaction de l'étude et avoir approuvé la version finale soumise. Aucun changement dans les noms des auteurs ne sera autorisé après l'acceptation de l'article pour publication ; avant cette acceptation, tout changement doit être accepté par l'ensemble des auteurs figurant dans la liste. Une vérification de leur contribution peut être demandée aux auteurs. Les noms d'autres contributeurs peuvent être inclus dans les remerciements. À ce sujet, veuillez vous reporter aux ICMJE guidelines for authorship and contributorship [Directives de l'ICMJE relatives à la qualité d'auteur et de contributeur].
7. **Articles et rapports de recherche :** Les articles présentant des résultats de recherche originale devront suivre le format IMRAD : introduction, méthodes, résultats, analyse et discussion. Le texte des articles et des rapports de recherche ne doit pas excéder 3000 mots (résumé, références, tableaux et figures exclus). Un résumé de 150 mots maximum sera fourni et mentionnera clairement et brièvement les objectifs, le contexte, les résultats et les conclusions. Le nombre maximal de références autorisées est de 25. Il ne faut pas inclure plus d'un tableau ou d'une figure tous les 1000 mots.
8. **Articles d'analyse** (évaluations critiques d'études de recherche sur des sujets pertinents concernant la santé publique dans la Région). Ils doivent être composés de paragraphes traitant des objectifs, des sources, des méthodes de sélection, de la compilation et de l'interprétation des données et des conclusions. Le texte ne doit pas excéder 3000 mots (résumé, références, tableaux et figures exclus) et doit être accompagné d'un résumé de 150 mots au maximum. Il ne faut pas inclure plus d'un tableau ou figure tous les 1000 mots.
9. **Études de cas :** Seules les études de cas inhabituels seront examinées pour publication. Le texte doit comprendre une introduction, un exposé du/des cas et une discussion. Il ne doit pas excéder 3500 mots et le nombre de références doit être minimal. Il n'est pas nécessaire de fournir un résumé.
10. **Lettres à la rédaction :** Les lettres commentant des articles publiés sont les bienvenues. Elles seront envoyées aux auteurs de l'article afin qu'ils fournissent leurs commentaires, qui seront publiés aux côtés de la lettre. Le texte des lettres doit être aussi court que possible.
11. **Communications brèves :** Les articles ne constituant pas une étude de recherche complète, mais présentant un intérêt ou revêtant une importance particulière pour les questions de santé publique dans la Région sont occasionnellement examinés pour publication. Le texte ne doit pas excéder 1500 mots (résumé, références, tableaux et figures exclus) et doit être accompagné d'un résumé de 150 mots au maximum. Il ne faut pas inclure plus d'un tableau ou d'une figure tous les 1000 mots.
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