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Hospitals are an essential element of health services but often health systems are not set up to or neglect evaluation of the quality of hospitals. Accreditation is a valuable strategy for improving the quality of health care structures, including hospitals, and WHO aims to assist countries in promoting suitable accreditation. To that end, the Regional Office developed a model for hospital accreditation appropriate for the Region and flexible enough to be adapted at the country level. There are three papers related to hospitals and hospital management in the current issue. One study compared the unit-dose drug dispensing system and the ward-stock system in hospitals in Gaza and concluded that the unit-dose system was safer, regarded more favourably by staff and better allowed good clinical pharmacy practice. Another study assessed medical waste management in 5 government and 12 private hospitals in Yemen through interview and observation of relevant staff. The study found that knowledge and practices of medical waste handling were not adequate; there was a high rate of injuries among waste-workers and staff and visitors were at risk of exposure to hazardous waste. A third paper explored, through key-informant interviews and focus group discussions, the views of healthcare stakeholders on strategies to encourage health-promoting hospitals in Pakistan.

Also included in this issue are two papers evaluating possible assay tools. One study from the Islamic Republic of Iran assessed the use of plasma haemocrit cut-off level to make an early diagnosis of pre-eclampsia. The other from Egypt reports on an interferon gamma assay to detect latent tuberculosis infection. Any diagnostic tool must be safe, reliable and appropriate and the WHO Diagnostics and Laboratory Technology unit aims to promote and facilitate access to such diagnostic technologies and laboratory services by providing appropriate technical support, tools and guidance on the provision of diagnostics and laboratory services.

The Fifty-eighth Session of the WHO Regional Committee for the Eastern Mediterranean is being held in Cairo from 2 to 5 October 2011. On the agenda is a technical paper on research for health and strategies for scaling up such research in the Region. One of WHO’s core functions is ‘stimulating the generation, translation and dissemination of valuable knowledge’. Therefore, the theme of the World Health Report for 2012 is the impact of health research and it will focus on real-life stories to convey the message that research helps. For the first time, members of the public are invited to help develop the World Health Report and are encouraged to send in their views on health research and the personal experiences where research affected their life. Information about the Report and submitting input can be found at: http://www.who.int/rpc/whr2012/en/index.html.
Drug dispensing systems in Gaza hospitals: a comparative study

M. Al Adham¹ and B. Abu Hamad²

ABSTRACT Implementing an appropriate drug dispensing system in hospitals is essential to ensure the safe and rational use of drugs. This study aimed to assess the unit-dose drug dispensing system (DDS) and the ward-stock DDS utilized in Gaza hospitals to ascertain which system is more beneficial. The quantitative, comparative cross-sectional design utilized structured interviews with pharmacists and head nurses, missing drug registration sheets and drug administration observation checklists. The number of missing units per drug item dispensed (mean 3.4 and 1.8 respectively) and medication administration errors per patient (mean 1.8 and 0.9 respectively) were statistically significantly lower in the hospital using the unit-dose DDS than the ward-stock DDS. The unit-dose DDS appeared to be safer, with fewer missing drugs, was more positively perceived by staff and was more supportive of good clinical pharmacy practice. Its use in other hospitals in the Gaza Strip is recommended.

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Introduction

The pharmacy sector is important in any country because it consumes a high proportion of health system expenditure [1]. Therefore, it is a challenge for governments to ensure easy access to a safe and stable supply of pharmaceuticals at the lowest possible cost [2]. A high expenditure on drugs is notable in the Palestinian health system where it reached 22.6% of the Ministry of Health (MOH) running costs in 2005 [3]. Hospital pharmacies are the largest consumers in the pharmacy sector, so it is important for policy-makers to be aware of the importance of providing effective pharmacy services with rational and safe use of medications [1]. Clinical pharmacy services are the building blocks of modern hospital pharmacy, and hospital pharmacists are a vital part of the clinical team, helping to ensure that drugs are used in the best way from the safety, efficacy and economic points of view [4].

Adoption of a proper drug dispensing system (DDS) is a top priority for any hospital to ensure an effective drug management cycle in that hospital [5,6]. There are many types of DDS. In a ward-stock DDS, drugs are dispensed from the pharmacy to the hospital departments and stored in the departments’ stocks and then used by nurses according to physicians’ orders. In a unit-dose DDS, drugs are dispensed in amounts that fulfil the needs of each individual patient for only 24 hours [5]. The unit-dose DDS was developed in the 1960s to support nurses in administration of medication, to provide nurses and pharmacists with more time for patient care and to reduce wastage of increasingly expensive medications. Now unit-dose dispensing of medications is standard practice in many hospitals around the world [6].

The aim of this study in Gaza, Palestine, was to assess which DDS was more appropriate based on a comparison between a hospital using the unit-dose DDS and another using a ward-stock DDS. The study explored the percentage of missing drugs in both systems and which system was safer by calculating the rates of medication administration errors and it also assessed the level of clinical pharmacy interventions and staff perceptions about the 2 systems.

Methods

Study design and setting

This was a quantitative, comparative cross-sectional study comparing 2 hospitals that used different DDSs for their pharmaceutical services for patients. Al-Shifa hospital was the largest hospital in the Palestinian Territory and like most hospitals in Gaza used the ward-stock DDS. The European Gaza hospital was a large hospital in Gaza which used the unit-dose DDS. The study was carried out in the 2 main departments of both hospitals (medical and surgical).

Study population

The study sample included all the medical records (n = 327) of patients who were hospitalized in the 4 selected departments of the 2 hospitals in July 2008. In addition, 1096 observations were made of drug administration by nurses in the selected departments. To explore users’ perceptions about the different systems all pharmacists and head nurses working in the target hospitals (n = 92) were asked to participate in structured interviews. The total number of pharmacists at both hospitals was 36 (22 in Al-Shifa hospital and 14 in European Gaza hospital). At each site, there was a pharmacy director and deputy pharmacy director who performed managerial tasks while the other pharmacist performed the other hospital pharmacy activities.

Data collection

The researcher and a trained assistant (pharmacist) collected the data. The structured interview consisted of 61 close-ended questions that were mainly concerned with assessing participants’ perceptions and practices in reference to drug dispensing and management, and was administered by the principal researcher. Names and quantities of drugs prescribed and dispensed to hospitalized patients during the study period (July 2008) were obtained from the medical records and documented in a drug registration sheet and then compared with the amounts of drugs dispensed from the pharmacy to the same departments (obtained from pharmacy records) over the same period. Any drug that was dispensed from the pharmacy and neither registered in the medical records nor added to the stock was considered a missing drug. An observation checklist for medication administration errors was used to check the number of drug administration errors out of the total number of administration processes that took place in the study period. Nurses administering medications were classified according to the ‘5 wrongs’ of medication errors (i.e. the opposite of the ‘5 rights’ [7]): wrong drug (administration of medication other than the one prescribed); wrong dose (amount of medication given was greater or less than the prescribed dose); extra dose and formulation errors were included; wrong time (administration of medication to the patient 30 minutes before or after the prescribed time); wrong route (administration of medication via a different route than the prescribed one); and wrong patient (administration of medication for a patient other than for whom it was prescribed).

The study followed standard research ethical principles, and approval from the National Committee on Research Ethics was obtained. Administrative approval from the general directorate of hospitals was obtained before starting data collection. Participation was voluntary and consent was obtained from all pharmacists and head nurses before administration of the structured interviews.
Data analysis

The data were analysed using SPSS, version 13. Frequency tables were done to illustrate the main characteristics of the study respondents. Cross-tabulations and chi-squared tests were carried out to examine the differences between the 2 hospitals. Student t-tests were done to compare the means of the missing drugs and the medications administration errors between the 2 hospitals. A P-value < 0.05 was considered statistically significant.

Results

Subjects’ characteristics

Out of the 92 pharmacists and head nurses, 87 (94.6%) responded. Of the respondents 40% were pharmacists while 60% were head nurses. Males represented 63% of subjects. The age distribution was 16.1% ≤ 30 years, 50.6% 31–40 years and 33.3% ≥ 41+ years. Two-thirds of the respondents (67.7%) were working in Al-Shifa hospital and 33.3% in European Gaza hospital.

Respondents’ perceptions and practices

In general, the unit-dose DDS implemented at European Gaza hospital was more positively perceived by the respondents than the ward-stock DDS implemented at Al-Shifa hospital (Table 1). Most respondents at both hospitals had experienced drug shortages, mainly due to shortages at the Gaza central drug stores. However, this shortage of drugs was mainly a problem for newly admitted patients at the European Gaza hospital, while it was faced for both newly and previously admitted cases at Al-Shifa hospital, a difference that was statistically significant (χ² = 15.9, P = 0.001).

The need for extra staff to deal with pharmaceuticals was more evident at Al-Shifa hospital, where nearly 58.6% of the respondents reported that they needed more employees to meet the system requirements compared with only 37.9% at the European Gaza hospital.

Significantly more positive perceptions were held among respondents implementing the unit-dose DDS than their counterparts implementing the ward-stock DDS regarding the time needed to manage medications; 100.0% of nurse at the European Gaza hospital reported normal time scales (i.e. their perception of the time needed to manage the medications at their departments) while 69.0% at Al-Shifa hospital reported long time scales (χ² = 19.8, P = 0.001). The great majority of the respondents at the European Gaza hospital (86.2%) were returning unused drugs to the pharmacy, while only 36.2% of respondents at Al-Shifa hospital did that (χ² = 10.8, P = 0.002). Almost all respondents at the European Gaza hospital and only half of respondents at Al-Shifa hospital reported checking the ward-stocks of drugs for expiry, which was a positive point at the European Gaza hospital (χ² = 8.1, P = 0.044). Furthermore, satisfaction about the DDS in their department and the desire to continue its use was statistically significantly higher at the European Gaza hospital than Al-Shifa hospital (93.1% and 60.3% of respondents respectively) (χ² = 10.1, P = 0.001).

Clinical pharmacy-related activities

As illustrated in Table 2, more than 90% of the pharmacists at both hospitals were visiting the hospital wards 1–3 times per month, with no clear differences between the hospitals in this regard. Surprisingly, 72.8% of Al-Shifa hospital pharmacists reported never checking the patients’ charts for the congruency between drugs prescribed and disease conditions. In contrary, at the European Gaza hospital, around half of the pharmacists reported often checking patients’ charts for conformity of the drugs with the diagnosis, and the difference between the hospitals in this regard was statistically significant (χ² = 15.8, P = 0.003). In addition, most pharmacists at the European Gaza hospital (92.9%) reported that they often checked the patients’ charts for suitability of the drug dose, while at Al-Shifa hospital only 59.1% of them reported performing that (χ² = 21.3, P = 0.001). Although checking drug–drug interactions was not performed well at either of the hospitals, it was carried out significantly more often at the European Gaza hospital than at Al-Shifa hospital (χ² = 14.2, P = 0.007). Table 2 shows that the percentage of pharmacists who did not check the ward stocks before dispensing the medication order was higher in Al-Shifa hospital (72.7%) than the European Gaza hospital (42.9%). The majority of pharmacists at Al-Shifa hospital (91.0%) reported that they had never prepared any written guidelines about drug use, while only 7.1% of the European Gaza hospital pharmacists had not done this (χ² = 26.2, P = 0.001). Regarding supervising the pharmacy work of less experienced staff, a good percentage of pharmacists at both hospitals reported performing this as part of the routine work of the hospital. The level of pharmacists’ participation in training activities about drugs at both hospitals was very low (90.9% and 71.4% respectively had never done this).

Record reviews

The percentage of missing drugs at Al-Shifa hospital which was utilizing the ward-stock DDS was which higher (5.0%) than at the European Gaza hospital utilizing the unit-dose DDS (2.9%). Table 3 shows that the mean number of missing units of drug type per month (i.e. dispensed from the pharmacy to the nursing departments during the study period but not found either in the patients files or in the departments stock) was higher overall at Al-Shifa hospital (3.4) than at the European Gaza hospital (1.8). The difference between the 2 hospitals was statistically significant (t = 2.5, P =
The mean number of missing drugs in the medical department of Al-Shifa hospital was significantly higher than in the European Gaza hospital (3.8 and 1.4 respectively) (t = 2.1, P = 0.038), but in the surgical departments the means of missing drugs were 2.8 and 2.3 respectively, which was not significantly different. The main types of missing drugs were diclofenac sodium (75 mg ampoules) and amoxycillin (500 mg capsules) at Al-Shifa hospital, while they were antacid tablets and cephalexine (500 mg capsules) at the European Gaza hospital. At both sites, the drugs most often missing corresponded to the drugs most often dispensed during the study period.

Table 1 Practices and perceptions of pharmacists and head nurses in hospitals with different drug dispensing systems (DDS)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Al-Shifa (ward-stock) (n = 58)</th>
<th>European Gaza (unit-dose) (n = 29)</th>
<th>X²-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug shortages experienced in the last year</td>
<td></td>
<td></td>
<td>8.2</td>
<td>0.084</td>
</tr>
<tr>
<td>Seldom</td>
<td>3</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td>44</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Often</td>
<td>11</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients most affected by drug shortages</td>
<td></td>
<td></td>
<td>15.9</td>
<td>0.001</td>
</tr>
<tr>
<td>Newly admitted cases</td>
<td>18</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previously admitted cases</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td>37</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DDS requires extra staff</td>
<td></td>
<td></td>
<td>3.6</td>
<td>0.301</td>
</tr>
<tr>
<td>Disagree</td>
<td>16</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neither agree nor disagree</td>
<td>8</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>34</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time needed for nurses to manage medications</td>
<td></td>
<td></td>
<td>19.8</td>
<td>0.001</td>
</tr>
<tr>
<td>Long</td>
<td>40</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>18</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of dealing with unused drugs on the wards</td>
<td></td>
<td></td>
<td>10.8</td>
<td>0.002</td>
</tr>
<tr>
<td>Returned to pharmacy</td>
<td>21</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remain in ward</td>
<td>37</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perception of presence of high number of missing</td>
<td></td>
<td></td>
<td>15.3</td>
<td>0.002</td>
</tr>
<tr>
<td>drugs (irrational use)</td>
<td>Disagree</td>
<td>26</td>
<td>24</td>
<td>82.8</td>
</tr>
<tr>
<td></td>
<td>Neither agree nor disagree</td>
<td>13</td>
<td>4</td>
<td>13.8</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>19</td>
<td>1</td>
<td>3.4</td>
</tr>
<tr>
<td>Perception of rate of medication errors in hospital</td>
<td></td>
<td></td>
<td>1.7</td>
<td>0.63</td>
</tr>
<tr>
<td>Low</td>
<td>32</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very low</td>
<td>26</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report medication errors that may happen</td>
<td></td>
<td></td>
<td>2.31</td>
<td>0.315</td>
</tr>
<tr>
<td>Never</td>
<td>49</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seldom</td>
<td>9</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the ward-stock drugs for expiry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>32</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>26</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied with the DDS and wish to continue using</td>
<td></td>
<td></td>
<td>10.13</td>
<td>0.001</td>
</tr>
<tr>
<td>it</td>
<td>Yes</td>
<td>35</td>
<td>27</td>
<td>93.1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>23</td>
<td>2</td>
<td>6.9</td>
</tr>
</tbody>
</table>

Note: n = number of pharmacists and head nurses.
Field observations

The percentage of medication administration errors at Al-Shifa hospital (9.7%) was higher than at the European Gaza hospital (6.0%). As illustrated in Table 4, the mean number of medication administration errors (per patient) was significantly higher at Al-Shifa hospital using the ward-stock DDS (1.8) than at the European Gaza hospital using the unit-dose DDS (0.9) \((t = 2.1, P = 0.038)\). “Wrong time” errors were the most frequently observed (mean 1.5 and 0.7 respectively) followed by “wrong dose” errors and “wrong drug” errors. However, “wrong patient” and “wrong route” errors were negligible. Most error types were greater in the hospital using the ward-stock DDS than the hospital using the unit-dose DDS, except for the “wrong drug” errors, but the differences between the 2 hospitals regarding specific types of drug error did not reach statistical significance.

### Table 2: Practices of pharmacists in hospitals with different drug dispensing systems (DDS)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hospital (DDS system)</th>
<th>(\chi^2)-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Al-Shifa (ward-stock)</td>
<td>European Gaza (unit-dose)</td>
<td></td>
</tr>
<tr>
<td>Frequency of visits to wards per month</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>1-3</td>
<td>21</td>
<td>95.5</td>
<td>13</td>
</tr>
<tr>
<td>4-6</td>
<td>1</td>
<td>4.5</td>
<td>1</td>
</tr>
<tr>
<td>Check prescriptions for conformity of drug therapy with diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>16</td>
<td>72.8</td>
<td>1</td>
</tr>
<tr>
<td>Sometimes</td>
<td>3</td>
<td>13.6</td>
<td>7</td>
</tr>
<tr>
<td>Often</td>
<td>3</td>
<td>13.6</td>
<td>6</td>
</tr>
<tr>
<td>Check prescriptions for suitable drug dose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>4</td>
<td>18.2</td>
<td>1</td>
</tr>
<tr>
<td>Sometimes</td>
<td>5</td>
<td>22.7</td>
<td>0</td>
</tr>
<tr>
<td>Often</td>
<td>13</td>
<td>59.1</td>
<td>13</td>
</tr>
<tr>
<td>Check prescriptions for drug-drug interactions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>17</td>
<td>77.4</td>
<td>2</td>
</tr>
<tr>
<td>Seldom</td>
<td>3</td>
<td>13.6</td>
<td>11</td>
</tr>
<tr>
<td>Often</td>
<td>2</td>
<td>9.0</td>
<td>1</td>
</tr>
<tr>
<td>Check ward-stock before dispensing the order</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>16</td>
<td>72.7</td>
<td>6</td>
</tr>
<tr>
<td>Seldom</td>
<td>6</td>
<td>27.3</td>
<td>8</td>
</tr>
<tr>
<td>Prepare guidelines about drugs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>20</td>
<td>91.0</td>
<td>1</td>
</tr>
<tr>
<td>Sometimes</td>
<td>1</td>
<td>4.5</td>
<td>10</td>
</tr>
<tr>
<td>Often</td>
<td>1</td>
<td>4.5</td>
<td>3</td>
</tr>
<tr>
<td>Check and supervise the pharmacy work of less experienced pharmacists</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>1</td>
<td>4.5</td>
<td>2</td>
</tr>
<tr>
<td>Sometimes</td>
<td>4</td>
<td>18.1</td>
<td>5</td>
</tr>
<tr>
<td>Often</td>
<td>9</td>
<td>40.9</td>
<td>6</td>
</tr>
<tr>
<td>Always</td>
<td>8</td>
<td>36.5</td>
<td>1</td>
</tr>
<tr>
<td>Participate in teaching programmes in the hospital about drugs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>20</td>
<td>90.9</td>
<td>10</td>
</tr>
<tr>
<td>Seldom</td>
<td>2</td>
<td>9.1</td>
<td>4</td>
</tr>
</tbody>
</table>

Always = 91%-100% of occasions; often = 42%-71% of occasions; sometimes = 11%-33% of occasions; seldom = 7%-8% of occasions; never 0%-2% of occasions.  
\(n\) = number of pharmacists.
Discussion

In this study males were more involved in the workforce than their female counterparts, which corresponds with the level of men’s involvement in the workforce in the Gaza Strip [8] and implies that greater enrolment of women needs be promoted. Most head nurses and pharmacists were below the age of 40 years and this reflects the trend towards expansion in the health services in Palestine which took place after the establishment of the Palestinian National Authority in 1994. The expansion in the health services was associated with the recruitment of a relatively young workforce. This young generation provides an opportunity for the health care system in term of investment in capacity-building. More respondents were from Al-Shifa hospital and this corresponds with the size of the 2 hospitals [9].

This study showed that positive perceptions and appropriate practices of nurses and pharmacists were more common in the hospital using the unit-dose DDS than the ward-stock DDS. Hence, the unit-dose DDS meets the 2 important dimensions of quality (quality of facts and quality of perceptions) and this justifies its universal use. The literature indicates that the unit-dose DDS is safer, more economic and more positively perceived by staff [6].

Our study showed that the level of clinical pharmacy-related activities was slightly better at the European Gaza hospital than it at Al-Shifa hospital. Collectively, the level of clinical pharmacy-related activities in both hospitals was low. Checking prescriptions for the suitability of the drug to the disease condition and checking the suitability of drug dose was done better in the hospital with the unit-dose DDS than the ward-stock DDS. It suggests that the unit-dose DDS gives pharmacists a better chance to carry out clinical pharmacy-related activities such as reviewing patients’ charts for drug history, suitability of drugs, suitability of dose and possible drug interactions,

| Table 3 Drug items dispensed and missing in different departments of hospitals with different drug dispensing systems (DDS) |
|-------------------------------|----------------|----------------|---------|--------|
| Hospital (DDS system)        | No. of dispensed drug items | Mean (SD) no. of missing units per drug item | t-value | P-value |
| Both wards                   |                             |                           |         |        |
| Al-Shifa (ward-stock)         | 162                        | 3.4 (3.7)                  | 2.45    | 0.015  |
| European Gaza (unit-dose)    | 202                        | 1.8 (4.3)                  |         |        |
| Medical ward                 |                             |                           |         |        |
| Al-Shifa (ward-stock)         | 91                         | 3.8 (8.6)                  | 2.1     | 0.038  |
| European Gaza (unit-dose)    | 114                        | 1.4 (3.5)                  |         |        |
| Surgical ward                |                             |                           |         |        |
| Al-Shifa (ward-stock)         | 71                         | 2.8 (5.2)                  | 0.672   | 0.503  |
| European Gaza (unit-dose)    | 88                         | 2.3 (5.2)                  |         |        |

SD = standard deviation.

| Table 4 Medication administration errors in different departments of hospitals with different drug dispensing systems (DDS) |
|-----------------------------------------------|----------------|----------------|---------|--------|
| Hospital (DDS system)                        | No. of observations | Mean (SD) no. of errors per patient | t-value | P-value |
| All types                                    |                 |                           |         |        |
| Al-Shifa (ward-stock)                        | 600             | 1.8 (1.3)                  | 2.127   | 0.038  |
| European Gaza (unit-dose)                   | 496             | 0.9 (0.6)                  |         |        |
| Wrong drug                                   |                 |                           | -0.64   | 0.524  |
| Al-Shifa (ward-stock)                        | 1               | 0.03 (0.2)                 |         |        |
| European Gaza (unit-dose)                   | 2               | 0.07 (0.3)                 |         |        |
| Wrong dose                                   |                 |                           | 1.43    | 0.158  |
| Al-Shifa (ward-stock)                        | 9               | 0.3 (0.5)                  |         |        |
| European Gaza (unit-dose)                   | 4               | 0.1 (0.4)                  |         |        |
| Wrong time                                   |                 |                           | 1.82    | 0.073  |
| Al-Shifa (ward-stock)                        | 48              | 1.5 (2.2)                  |         |        |
| European Gaza (unit-dose)                   | 22              | 0.7 (0.7)                  |         |        |

SD = standard deviation.
which are among their main clinical pharmacy activities [10]. Other clinical pharmacy-related activities were regarded as weak points in both systems and require strengthening by increasing the frequency of pharmacists’ visits to the wards. In modern pharmacy practice, specialized pharmacists are advised to visit each hospital ward daily to maximize the benefits of the medications and also to promote the pharmacists’ role in direct patient care [11].

The results of this study illustrated that the percentage of missing drugs in the hospital with the ward-stock DDS was higher than at the hospital using the unit-dose DDS. Our results are consistent with those of a study in Croatia which found that implementation of a unit-dose DDS contributed to rationalization of drug consumption and reductions in missing drugs [12]. They also agree with a study in the United States that found that drug losses were higher in ward-stock DDSs than in unit-dose DDSs [13]. The consistency between the results of different studies highlights the importance of adopting the unit-dose DDS in other Palestinian hospitals. Health planners and policymakers need to take active steps towards standardizing DDSs at the Palestinian hospitals to increase drug safety and rational drug use.

The results of this study showed that the rate of medication administration errors was greater in the hospital using ward-stock dispensing than in the hospital using unit-dose dispensing. It can be concluded that the unit-dose DDS is more beneficial to patient safety than the ward-stock DDS. This result agrees with many studies reported in the literature [14–16]. However, our results contradict those of a study that compared the rate of medication errors at an American hospital using the unit-dose DDS and a British hospital using the traditional ward-stock DDS, and found that the rate of medication errors was higher in the American hospital [17]. The study results also clarified that time errors were the most frequently observed type of medication administration errors in both DDSs. Although time errors in particular and medication administration errors in general are minor and may have few consequences, some serious errors may be life-threatening. Therefore greater follow-up and attention should be paid to reducing medication errors, including the most commonly found time-related errors.

There were some limitations to the study including the unsettled general political situation in the Gaza Strip, the limited scientific resources and literature review about DDSs, and the long distance between the 2 study sites which contributed to the relatively high research budget.

**Conclusion and recommendations**

This study typifies the operational research approach, which aims to support evidence-based decision-making. In the Palestinian health system, both the unit-dose DDS and ward-stock DDS are still in use. Although many international studies showed that the unit-dose DDS is safer, more effective and more efficient than other systems in general and the ward-stock DDS in particular, the debate about the appropriate DDS is still ongoing in the Palestinian MOH. This study has contributed to the evidence that the unit-dose DDS is associated with more rational drug use, better patient safety, more clinical pharmacy-related interventions and better perceptions and practices by nurses and pharmacists. This implies that the unit-dose DDS is appropriate and needs to be adopted as the standard dispensing practice in all Palestinian hospitals.

**References**


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**Third International Conference for Improving Use of Medicines**

The Third International Conference for Improving Use of Medicines: Informed Strategies, Effective Policies, Lasting Solutions will be held from 14 to 18 November, 2011 in Antalya, Turkey.

The conference will focus on use of medicines in low- and middle-income countries, and will be highly interactive and designed to produce actionable results. It aims to present and summarize knowledge about ways to improve medicines use and health, especially for vulnerable populations. Participants will help to shape evidence-based policy recommendations and a future research agenda on these topics.

Half-day conference sessions will cover major focus areas in the health care system where changes to improve medicines use take place at the global, regional, national, institutional, health provider, consumer and community levels. These areas include:

- Access (public and private sector, production, intellectual property, generics)
- Policy, regulation, governance (guidelines, essential medicines lists, health reform, drug quality, promotion, transparency)
- Economics, financing, insurance systems (cost, affordability, incentives, medicines coverage)
- Maternal and child health (IMCI, paediatric medicines)
- Chronic care (diabetes, hypertension, mental health, adherence)
- HIV/AIDS, TB
- Malaria
- Drug resistance (surveillance, containment, drug development)

Further information about the conference can be found at: [http://www.inrud.org/ICIUM/Conference-Overview.cfm](http://www.inrud.org/ICIUM/Conference-Overview.cfm)
Assessment of medical waste management in the main hospitals in Yemen

A.A. Al-Emad

ABSTRACT No previous studies about the management of medical waste have been published in Yemen. This research in 5 government and 12 private hospitals in Sana’a aimed to evaluate waste-workers’ and hospital administrators’ knowledge and practices regarding medical waste handling. Interviews and observations showed that the waste-workers were collecting medical and nonmedical wastes together manually in all hospitals without receiving adequate training and without using proper protection equipment. There was poor awareness about medical waste risks and safe handling procedures among hospital administrators, and most hospitals did not differentiate between domestic and medical waste disposal. Budgets were not allocated for waste management purposes, which led to shortages in waste handling equipment and an absence of training programmes for staff. Poor knowledge and practices and a high rate of injuries among waste-workers were noted, together with a risk of exposure of staff and visitors to hazardous waste.

Évaluation de la gestion des déchets médicaux dans les principaux hôpitaux du Yémen

RÉSUMÉ Aucune étude de la gestion des déchets médicaux n’a été publiée précédemment au Yémen. La présente recherche conduite dans cinq hôpitaux publics et douze hôpitaux privés de Sanaa visait à évaluer les connaissances des agents de collecte des déchets et des administrateurs des hôpitaux concernant la manipulation des déchets médicaux et leurs pratiques en la matière. Des entretiens et des observations ont permis de révéler que les agents collectaient les déchets médicaux et non médicaux à la main dans tous les hôpitaux sans avoir reçu de formation adéquate ni utilisé les outils de protection adaptés. Les connaissances en termes de risques représentés par les déchets médicaux et de procédures de manipulation étaient faibles parmi les administrateurs des hôpitaux, et la plupart des hôpitaux ne séparaient pas les déchets ménagers des déchets médicaux. L’absence d’allocation de budgets à la gestion des déchets a conduit à l’insuffisance des équipements de manutention des déchets et à l’absence de programmes de formation pour le personnel. Des connaissances faibles, des mauvaises pratiques ainsi qu’un taux élevé de blessures chez les agents de collecte ont été observés, mais aussi un risque d’exposition du personnel et des visiteurs aux déchets dangereux.
Introduction

Over the last few decades, progress in medical science and technology and expansion in the number of health institutions worldwide has been accompanied by increasing quantities of potentially hazardous medical waste [1,2]. The risks include occupational exposure of health workers and waste-handlers and environmental exposure of the public caused directly by illegal or careless management and disposal practices or indirectly through emissions and ash handling from medical waste incinerators [3]. In 2002 the World Health Organization (WHO) reported that underdeveloped countries suffer the greatest burden of risk from medical waste due to the high costs of proper disposal procedures. The spread of bloodborne pathogens in health care waste [4] motivated the WHO in 2004 to call for the development of national policies, guidance and plans for health care waste management [5].

Although a number of studies have been made of medical waste handling [6–8], research in the Arab region is limited. A study in Palestine of medical waste management in hospitals found that there was insufficient separation between hazardous and non-hazardous wastes, an absence of necessary rules and regulations for collection, transport and treatment of waste and a lack of training and protective equipment [9]. Another study in Palestine comparing the management of medical waste in primary health care centres and private clinics showed that most workers in the public sector did not follow correct methods of handling medical waste [10]. In Yemen, no published studies can be found and no protocols exist for the management of medical waste, although a report about the cleaning of medical facility waste in the capital was issued in 2006 [11].

The present study aimed to evaluate the management of medical waste in the largest hospitals in Yemen. The specific objectives were to: identify the types of medical waste produced, identify and evaluate collection procedures, assess waste-workers’ knowledge and practices, identify and evaluate disposal and clearance procedures and assess hospital administrators’ knowledge regarding medical waste.

Methods

Setting and sample

This descriptive study was carried out in Sana’a, the capital of Yemen, which has the majority of large hospitals in Yemen. The study sample was the departments and waste-workers in hospitals larger than 50 beds. The study included 5 government hospitals (Al-Thowra, Kuwait, Republican, Al-Sabieen, Police) and 12 private hospitals (Saudi-German, Science University, Azaal, Yemeni-German, Modern-German, Ibn Cynaa, Al-Ahly, Al-Motawakil, Al-Om, Al-Horabi, Tiabah, Al-Amal). The literature was reviewed, the research framework was designed, the questionnaire was prepared and the fieldwork was completed from August 2007 to December 2008. The fieldwork was achieved after notices were made through direct observations were made through direct personal interviews with 211 workers. Translators were used as many of the waste-workers were from countries located in the Horn of Africa (Somalia, Ethiopia) and lacked mastery of Arabic or English languages.

Practices of workers in handling medical waste

Actual practices were assessed using a form which included knowledge about the importance of medical waste and their management role. Forms were filled through personal interviews with the official responsible for waste at each hospital. The form contained 13 items and was administered to the 17 hospital administrators, 1 at each hospital.

Knowledge and practices of waste-workers

This was assessed using a special form which included knowledge about the risks of and proper disposal procedures for medical waste and the collection practices followed. The form contained 19 items in 5 categories: nature of wastes; collection, separation and packaging; transportation and disposal; risks; and administrative issues. Forms were filled through personal interviews with 211 workers (87 workers at government hospitals and 124 workers at private hospitals). At least half of the employees in each hospital were included.

The number of active workers in all the hospitals was estimated to be about 300 cleaning workers, taking into account possible inaccuracies in the reported numbers of workers in most hospitals. Translators were used as many of the waste-workers were from countries located in the Horn of Africa (Somalia, Ethiopia) and lacked mastery of Arabic or English languages.

Knowledge and practices of hospital administrators

Table 1 illustrates the self-reported knowledge and practices of hospital administrators in relation to medical waste. Only 20.0% of administrators in government hospitals confirmed the importance of having specialized waste-workers available, while none of those in
private hospitals did so. Personal safety tools were provided to waste-workers by 20.0% of government hospitals and 33.2% of private hospitals, and their use was monitored in 80.0% and 91.7% of government and private hospitals respectively. None of the government hospitals, and very few private hospitals, had waste user manuals. All government hospitals claimed to be raising awareness of workers about dealing with medical waste, while three-quarters of the private hospitals reported this. Only one-fifth of the government hospitals and two-thirds of the private hospitals supervised their workers during waste collection.

None of the hospitals had a dedicated budget for waste handling, but many hospitals had an allocation for waste management within the hospital cleaning budget. Two-thirds of the private hospitals had a department responsible for waste collection, whereas none of the government hospitals did.

All government hospitals reported that they collected waste 3 times or more per day while less than half of the private hospitals were doing so (Table 1).

<table>
<thead>
<tr>
<th>Item</th>
<th>Government hospitals</th>
<th>Private hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knows importance of availability of specialized waste-workers</td>
<td>20.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Provide personal protection tools for workers</td>
<td>20.0</td>
<td>33.2</td>
</tr>
<tr>
<td>Monitor usage of personal protection tools</td>
<td>80.0</td>
<td>91.7</td>
</tr>
<tr>
<td>Train workers in dealing with medical waste</td>
<td>80.0</td>
<td>74.7</td>
</tr>
<tr>
<td>Medical waste user manual available</td>
<td>0.0</td>
<td>8.3</td>
</tr>
<tr>
<td>Raise workers awareness about knowing and dealing with medical waste</td>
<td>100.0</td>
<td>75.1</td>
</tr>
<tr>
<td>Workers supervised during waste collection</td>
<td>20.0</td>
<td>66.8</td>
</tr>
<tr>
<td>Medical waste budget available</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Adequate waste allocation within hospital cleaning budget</td>
<td>100.0</td>
<td>83.0</td>
</tr>
<tr>
<td>Department responsible for waste available within hospital management</td>
<td>0.0</td>
<td>66.8</td>
</tr>
<tr>
<td>Adequate number of workers collecting waste</td>
<td>60.0</td>
<td>83.0</td>
</tr>
<tr>
<td>Collect waste 3 or more times per day</td>
<td>100.0</td>
<td>41.5</td>
</tr>
</tbody>
</table>

n = number of hospitals.

**Table 1: Administrators’ self-reported knowledge and practices about dealing with medical waste in government and private hospitals**

**Waste-workers’ knowledge of dealing with medical waste**

Table 2 shows the waste-workers' knowledge about dealing with medical waste. It was found that 11.5% and 45.9% of workers in government and private hospitals respectively were able to identify the types of medical waste they were collecting. Few of the government hospitals workers (19.5%) and more than half of the private hospitals workers (61.3%) considered it necessary to sort medical waste. Only 11.5% of the workers in government hospitals and 44.4% of the workers in private hospitals could understand the reasons behind sorting medical waste. Consequently none of the government hospitals workers and only 25.0% of the private hospitals workers knew the adequate quantities for packing medical waste.

Concerning risks that workers could be exposed to during handling medical waste, 68.9% of government and 70.9% of private hospitals workers seemed to be aware of these. Regarding knowledge of adequate disposal procedures of liquid waste, expired blood units, human tissue remains and expired medicines, the percentages were 12.6%, 7.0%, 4.5% and 4.0% respectively for government hospitals workers, and 37.1%, 8.8%, 6.5% and 0.0% respectively for private hospitals workers. The percentages of workers who believed that throwing expired blood units, human tissue remains and expired medicines into the normal domestic rubbish collection was an adequate disposal procedure were 69.0%, 43.7% and 39.5% respectively for government hospitals, whereas for private hospitals these were 65.3%, 13.7% and 65.5% respectively (Table 2).

**Actual practices of workers in handling medical waste**

Table 3 presents the results of the assessment of the actual practices of workers in handling medical waste. None of the government hospitals were sorting their medical waste and 20.0% of them were only separating sharps from blunt instruments, whereas 16.7% of the private hospitals were sorting waste and half of them were separating sharps from blunt ones. None of the government hospitals and 8.3% of the private hospitals had workers filling wastes sacks to two-thirds or less.
For government hospitals, 60.0% were using trolleys to move medical waste, and none of them were cleaning trolleys after each collection process. For private hospitals, 25.0% were using trolleys and 8.3% of them were cleaning trolleys after each collection.

Workers in 20.0% of the government hospitals and 33.3% of the private hospitals were using personal protection tools. Those who were not using protection claimed that the tools were not provided by their supervisors.

None of the government hospitals were using the waste bags only once, and only 8.3% of the private hospitals were using them once. Workers were collecting liquid waste, blood waste and human tissue remains in separate bags in 8.3%, 16.7% and 25.0% respectively of private hospitals, while none of the government hospitals were doing any of these. On the other hand, for hospitals where workers were using the same bags for collecting liquid waste, blood waste, human tissue remains and expired medicines with other wastes, the percentages for private hospitals were 50.0%, 83.3%, 75.0% and 41.7% respectively, while for government hospitals these were 20.0%, 100%, 100% and 100% respectively.

Workers were disposing liquid waste directly into the sewage system without any processing (dilution and/or sterilization) in 20.0% and 50.0% of government and private hospitals respectively, and were disposing of liquid wastes into the sewage after processing (dilution and/or sterilization) in 60.0% and 25.0% of these hospitals respectively. None of the government hospitals were sending expired medicines back to importers, while 58.3% of the private hospitals were doing so. None of the government or private hospitals had a furnace for destroying medical waste.

In 80.0% of the government hospitals and 75.0% of the private hospitals, visitors were exposed to medical waste in one way or another. All government hospitals and 83.3% of the private hospitals were depending on the city cleaning authorities for transporting and disposing of medical wastes outside hospitals. None of the government hospitals and only 8.3% of private hospitals were moving and disposing of medical wastes outside hospitals using their own vehicles (Table 3).

**Workers’ injuries caused by medical wastes**

Table 4 gives an indication of workers’ injuries caused by medical waste in government hospitals and private hospitals and administration responses. The rate of injuries during the previous 12 months in government and private hospitals were 28.7% and 27.4%, respectively according to workers’ reports. Administrators ignored 16.1% of reported injuries in government hospitals and 7.3% in private ones.

**Discussion**

**Knowledge and practices of hospital administrators**

It was concerning to realize that administrators of the majority of government hospitals and private hospitals in this study in Sana’a did not see the necessity of having specialized waste-workers within the hospital. This indicates...
insufficient awareness about the risks to public health and the environment that medical waste could cause or about the importance of its regular and proper collection and clearance. This is similar to what was founded in Palestinian hospitals and medical centres [10,13]. Private hospital companies may be reluctant to invest or spend money to prevent or to control pollution levels that are causing potential damage to the environment. This may be because they do not wish to reduce their profit margins or due to lack of knowledge, information and awareness about the

Table 3 Waste-workers’ actual practices in dealing with medical waste in government and private hospitals

<table>
<thead>
<tr>
<th>Item</th>
<th>Government hospitals (n = 5)</th>
<th>Private hospitals (n = 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers sort medical waste during collection</td>
<td>0.0</td>
<td>16.7</td>
</tr>
<tr>
<td>Workers separate sharp waste is from blunt waste</td>
<td>20.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Workers fill sacks with medical waste to two-thirds or less</td>
<td>0.0</td>
<td>8.3</td>
</tr>
<tr>
<td>Workers move medical waste using trolleys</td>
<td>60.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Workers clean waste trolleys directly after each collection</td>
<td>0.0</td>
<td>8.3</td>
</tr>
<tr>
<td>Workers use personal protection tools</td>
<td>20.0</td>
<td>33.3</td>
</tr>
<tr>
<td>Workers are using special plastic bags once for collecting medical waste</td>
<td>0.0</td>
<td>8.3</td>
</tr>
<tr>
<td>Workers collect liquid waste in bags that prevent leakage</td>
<td>0.0</td>
<td>8.3</td>
</tr>
<tr>
<td>Workers collect blood waste in separate bags that prevent leakage</td>
<td>0.0</td>
<td>16.7</td>
</tr>
<tr>
<td>Workers collect human tissue remains in separate bags that prevent leakage</td>
<td>0.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Workers collect liquid wastes together with other wastes</td>
<td>20.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Workers collect blood waste together with other waste in ordinary bags</td>
<td>100.0</td>
<td>83.3</td>
</tr>
<tr>
<td>Workers collect human tissue remains together with other wastes in ordinary bags</td>
<td>100.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Workers collect expired medicines together with other wastes</td>
<td>100.0</td>
<td>41.7</td>
</tr>
<tr>
<td>Workers dispose of liquid waste directly into sewage system without any processing (dilution and/or sterilization)</td>
<td>20.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Workers dispose of liquid waste into sewage system after processing</td>
<td>60.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Hospital sends expired medicines back to the importer</td>
<td>0.0</td>
<td>58.3</td>
</tr>
<tr>
<td>Hospital has furnaces for internal destruction of medical waste</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Hospital visitors are exposed to medical waste</td>
<td>80.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Workers gather medical wastes in open areas within the hospital for temporary storage before being transferred outside hospitals</td>
<td>100.0</td>
<td>83.3</td>
</tr>
<tr>
<td>Hospital has standard stores for temporary storage of medical wastes</td>
<td>0.0</td>
<td>8.3</td>
</tr>
<tr>
<td>Hospital depends on city cleaning authorities in moving and disposing medical wastes outside hospitals</td>
<td>100.0</td>
<td>83.3</td>
</tr>
<tr>
<td>Hospital moves and disposes of medical wastes outside hospital using own vehicles</td>
<td>0.0</td>
<td>8.3</td>
</tr>
</tbody>
</table>

n = number of hospitals.

Table 4 Distribution of workers injured by medical wastes according to hospital response

<table>
<thead>
<tr>
<th>Variable</th>
<th>Government hospitals (n = 87)</th>
<th>Private hospitals (n = 124)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Worker did not report injury</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Worker reported injury but ignored by administration</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Worker sought treatment at own expense</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Worker received checkup and treatment from administration</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>34</td>
</tr>
</tbody>
</table>

n = number of waste workers interviewed.
can improve this situation by establishing their own waste departments and employing qualified personnel. In general, the establishment of standard operating procedures is regarded as an effective way to ensure the proper handling, storage and transportation of medical wastes [3]. Obviously this requires each hospital to have a budget for waste management. In fact, field observations revealed that the money spent on waste collection and disposal was only a small allocation under a general purpose cleaning budget for hospitals, and was far from sufficient to cover the expenses of handling waste. A similar result was found in Lebanon, where 93% of the hospitals had no budget for waste management or a budget that was judged to be insufficient [15].

To ensure continuity and clarity in these management practices, clear plans and policies for proper wastes management and disposal are needed. These need to be integrated into routine employee training, continuing education and hospital management evaluation processes. Governments could require waste management plans from all hospitals as a condition for licensing [16].

Knowledge of waste-workers

Workers lacked adequate training in safe handling of medical waste. Therefore they had little knowledge regarding identification of types of medical waste, the necessity of sorting waste and adequate quantities for packing waste. Our field surveys showed that ignorance about medical waste disposal was at an alarming level, as many of the workers believed that disposing of waste in the normal domestic waste collection was the best method. On the other hand, disposing of medical waste by incineration can create additional pollution problems, because incineration releases toxic materials into the surrounding environment and it is more expensive to clean up emissions after burning than to prevent pollution in the first place [17].

Actual practices of waste-workers

None of the hospitals had special workers for collecting medical waste since workers were responsible of collecting all types of waste in addition to all other cleaning tasks. Therefore, workers were not giving much care to the nature and types of waste they were collecting as all waste was collected into the same bags. This complicated the sorting processes, exposed transport workers to infection risks and caused leakage of liquid wastes and possible pollution. The United Nations Environmental Programme has established that only 10% of health care waste is considered to be "potentially infectious" [18]. The proportion can be further reduced to 1%–5% with proper segregation practised at source. Based on epidemiological and microbiological data, only 2 types of medical waste would require special handling and treatment: sharps and microbiological waste [19]. Only 2 out of the study hospitals were collecting different types of waste in separate bags, whereas the rest were collecting all types of waste together, and about half of them were separating only sharp items from the rest. One reason was the unavailability of bags other than those for regular waste, and these bags were overfilled, thus escalating the problem further. Only 3 study hospitals were using bags that complied with international standards for collecting medical waste. Unfortunately these bags were being reused in 1 of the 3 hospitals, exposing a focus on short-term cost over the long-term costs of clearing up pollution.

Another serious problem prevailing in hospitals was the improper internal transportation of medical wastes, as some hospitals were doing it manually while others were doing it by overloading trolleys. These practices were causing bags to drop and be torn, thus polluting the surroundings and possibly harming workers, patients and visitors. Such risks were increased by practices...
such as continuous use of waste trolleys without rinsing. In this regard, the situation was worse in government than private hospitals.

Another dangerous practice followed by some study hospitals was the disposal of liquid medical wastes directly into the city sewage system without sterilization or dilution. Concerning expired medicines the situation was even worse, since more than half of the study hospitals dumped them with other wastes, adding to the hazards to public health and the environment. A common unsafe practice in most study hospitals was collecting and piling up medical waste uncovered in open areas within hospitals. In most cases, it would be a long period before this waste was transferred by city cleaning authorities to the final disposal destination outside hospitals, giving an opportunity for animals such as cats and even visitors to come into contact with the waste, as was the case in many hospitals. This was reported from a previous study in private health care centres in Palestine, which showed that almost all centres disposed of their medical waste in a random way [13].

Waste-worker' injuries & the administrations’ responses

High proportions of waste-workers in the hospitals in this study were injured by medical waste, highlighting the unfavourable situation in both government hospitals and private hospitals (28.7% and 27.4% of workers respectively had been injured). These rates of injuries were unacceptable when compared with the rates recorded in developed countries which have been reported to range between 1.8% and 8% annually for health workers including cleaning staff [20]. On the other hand the rates were lower than the rate in Palestine (around 40% injured), which could be because of a high turnover of workers in the Yemeni hospitals, most of whom are temporary workers [13]. The injuries could be attributed to a lack of training in procedures of collecting and disposing of medical wastes and an absence of supervision. Similarly, a previous study concluded that operating without waste management authority and failing to give adequate warning signals were considered as unsafe acts, whereas developing pictorial training manuals was an essential part of the training component for raising awareness of risks [21].

Study limitations

A number of limitations to the study can be identified. There was anecdotal evidence that some departments of the hospitals or the private companies exaggerated their answers in order to improve their image. There were also large discrepancies between the reported and actual numbers of workers; for example, in the statements of the cleaners in 1 of the hospitals, we found that they contain 80 names while the actual number was only 20 workers. Moreover, the workers’ supervisors may have adversely influenced workers’ responses. Finally, the lack of a special medical waste department in many hospitals meant that waste management was not the responsibility of a specific person.

Conclusions

There was poor awareness about medical waste risks and safe handling procedures among hospital administrators, and most hospitals were not differentiating between domestic and medical waste. Budgets were not allocated for waste management purposes, which caused shortages in waste facilities handling equipment and supplies and absence of training programmes for staff, resulting in poor knowledge and practices of waste-workers, a high rate of injuries and possible exposure of staff and visitors to hazardous waste.

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Wastes from health-care activities

Although treatment and disposal of health-care wastes aim at reducing risks, indirect health risks may occur through the release of toxic pollutants into the environment through treatment or disposal.

- Landfilling can potentially result in contamination of drinking water. Occupational risks may be associated with the operation of certain disposal facilities. Inadequate incineration, or incineration of materials unsuitable for incineration, can result in the release of pollutants into the air.

- Only modern incinerators are able to work at 800–1000 °C, with special emission-cleaning equipment, can ensure that no dioxins and furans (or only insignificant amounts) are produced. Smaller devices built with local materials and capable of operating at these high temperatures are currently being field-tested and implemented in a number of countries.

- At present, there are practically no environmentally-friendly, low-cost options for safe disposal of infectious wastes. Incineration of wastes has been widely practised, but alternatives are becoming available, such as autoclaving, chemical treatment and microwaving, and may be preferable under certain circumstances.

The absence of waste management, lack of awareness about the health hazards, insufficient financial and human resources and poor control of waste disposal are the most common problems connected with health-care wastes. Improvements in health-care waste management rely on the following key elements:

- Building a comprehensive system, addressing responsibilities, resource allocation, handling and disposal;
- Raising awareness and training about risks related to health-care waste, and safe and sound practices;
- Selecting safe and environmentally-friendly management options, to protect people from hazards when collecting, handling, storing, transporting, treating or disposing of waste.

Government commitment and support are needed to reach an overall and long-term improvement of the situation, although immediate action can be taken locally.

Source: WHO Fact sheet, No. 253
Transition towards health promoting hospitals:
adapting a global framework to Pakistan

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ABSTRACT The World Health Organization encourages hospitals to become Health Promoting Hospitals (HPH) but adapting this concept to Pakistan has not been investigated. We explore perceptions of healthcare stakeholders about strategies and a priority action-plan to encourage HPHs in Pakistan. We conducted a qualitative study in 2007 where key-informant interviews and focus group discussions were held with healthcare stakeholders in Karachi. Thematic analysis was done and emerging themes were categorized. The HPH core components were perceived as the "standard framework"; however more emphasis was placed on priority actions as to satisfy "basic needs" of patients, staff and the community. This included basic facilities of comfort, health, hygiene, safety, security and emotional support. A change in the traditional mindset from cure to care and identification of key personnel, awareness-raising and cooperation would strengthen advocacy efforts for HPH in Pakistan.

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Introduction

Today, the World Health Organization (WHO) encourages and inspires hospitals to embrace the ideology of health promoting hospitals (HPHs) globally [1]. A HPH is defined as, “a hospital that develops a corporate identity, embraces the aims of health promotion and demonstrates a healthy culture and structure within the hospital” [2]. Hospitals have great potential to influence health at large given their reach and services provided [3].

The Ottawa Charter was the first declaration on health promotion made in 1986; and the concept of health promotion at hospital evolved as the fifth strategy of the same charter [4]. Although the initial efforts to institutionalize evidence-based HPH settings were in Europe, this approach is now internationally recognized and recommended for other regions. In this regard, an international HPH network has been gaining popularity, as more regions are now taking interest in adapting HPH standards and getting their hospitals internationally accredited [5,6]. Similarly, the evolving emphasis on disease prevention and health promotion within the developing world provides an opportunity to apply health promotion in the hospital setting [7].

Developing countries, including Pakistan, face considerable public health challenges as politically driven healthcare plans have led to clinical services consistently taking a bigger chunk of the healthcare budget, leaving meagre resources for disease prevention and health promotions [8]. Given the dynamic role of HPH in providing holistic care under one roof and benefiting patients, care-takers, hospital staff and community at large, transition towards HPH would seem an appealing, cost-effective, needed approach for Pakistan at this time [9].

WHO provided the international core components and standards for HPH, however, certain scepticism and dilemma prevailed among various European countries when it came to institutionalizing the idea [1,5]. There is a paucity of information about strategies and a coherent roadmap for our local context in order to adapt internationally endorsed HPH settings to Pakistan. Therefore, the objective of this study was to explore perceptions of healthcare stakeholders about context-specific strategies and a priority action-plan to encourage and adapt health promotion activities in hospital settings in Pakistan.

Methods

This study involved qualitative research to explore context-specific strategies regarding institutionalizing HPH in Pakistani settings. A qualitative research design was used in order to explore subjectivity of the theme under study so as to generate hypotheses for further studies [10].

This study was conducted between July and August 2007. The study participants were purposively selected from:

- Public and private health sector to represent administration and healthcare providers (doctors and nurses) at 2 tertiary care hospitals (Aga Khan University, Hospital and Jinnah Postgraduate & Medical College Hospital representing the private and public sector respectively)
- Health decision/policy-makers at selective health departments of Sindh province
- Representatives from the Federal Ministry of Health
- Representatives in Karachi, Pakistan of United Nations organizations (UNFPA, UNICEF and WHO) and the donor agency (US-AID).

This study received approval from the ethical review committee of the Aga Khan University, and participation was on voluntary basis, upon obtaining written consent.

Key informant interviews were held with 11 participants as well as 2 focus group discussions (1 at each public and private hospital) with 6 participants (3 nurses and 3 doctors who met the eligibility criteria and consented to participate). The participants for the key informant interviews and focus group discussions were chosen based on their knowledge or expertise on the topic being studied (WHO’s 5 core components of HPH) [5,11] with at least one year of full-time experience in the relevant field.

A semi-structured questionnaire was developed using WHO’s 5 core components of HPH, i.e. hospital’s management policy, patient assessment, patient information and intervention, promoting a healthy workplace and continuity and cooperation [5]. The questionnaire was piloted on a similar group of participants before administering to the study participants in the key informant interviews and focus group discussions. The interviews and focus group discussions were taped, and notes and observations were recorded.

The thematic analysis was done using qualitative research software QSR NVivo, 2.0 (QSR International, Melbourne, Australia). Perceptions were coded on free nodes, which were later categorized to hierarchical tree, as parent, child and sibling nodes to develop emerging themes and sub-themes [12]. These themes and sub-themes were elaborated, interpretations were made and data triangulation was done between key informant interviews and focus group discussions.

Results

The participants’ perceptions highlighted various strategies to promote health promotion activities in hospitals and revealed strategic steps to encourage and sustain transition towards HPH in Pakistan. The following themes and sub-themes emerged from the key informant interviews and focus group discussions...
discussions under the 5 core components for health promotion activities at hospital.

**Hospital’s management policy on health promotion**

The hospital management policy on health promotion was perceived as the “founding stone”. The roles of the hospitals managers and those working with the social sectors were very much highlighted in this regard. Although distinctive hospital policy on health promotion was largely perceived to influence staff practices, the need to draft a national health promotion policy in Pakistan was stressed.

**Health promotion for patients and their attendants**

The study participants perceived patients as “external customers” and care-takers as “ambassadors” to carry a generic message of health promotion to their immediate community. The participants interchangeably used the term “health education” as the “traditional approach” to refer to health promotion for patients and attendants at the hospital. The participants also emphasized the lack of a healthy structure and participatory health promotion activities as the challenges for health promotion activities.

**Healthy physical structure: basic facilities of comfort, patient safety & support**

The participants largely perceived that a healthy hospital environment would leave a “first and ever-lasting impression” on patients and attendants. The perceived needs were further elaborated as: availability of purified drinking water, clean washrooms, ventilated inpatient area, comfortable beds, clean linen, hygienic food, stretchers for safe inpatient transfer, proper disposal of sharp objects and needles to prevent accidental injuries. The key informants also reported emotional support for patients as integral to early recovery, and therefore recommended the establishment of integrated patient support departments, such as patient complaints, patient counselling, patient welfare, quality assurance and patient referral departments.

**Health promoting activities: participatory health education, patients’ rights and empowerment**

The “participatory approach” was perceived to bring significant change in the behaviour to promote health. The focus group discussions reported, “While treating a female patient with a family history of breast cancer, the health-care provider should also assess and counsel her for early screening”. The participants further recommended hospital staff to communicate with patients and attendants respectfully and involve them in patient care plan and decision-making so that they feel empowered. In order to ensure health education for patients and families as a compulsory component of care, the participants recommended the development of health education indicators and standard protocols, and the conduct of surprise audits as part of the routine services. The “sharing of the right information at the right time” was considered an integral factor to increase self-reliance and achieve compliance with care and promotion of healthy living.

**Making hospital a healthy workplace for staff**

Staff members were largely perceived as “internal customers” at the hospital; therefore, their satisfaction with the work place and their good health were considered equally important in order to satisfy the patients.

**Hospitals’ physical structure: basic facilities of comfort, safety and security**

The study participants at the public hospital perceived that female staff (both medical and paramedical) constitute a large proportion of the workforce at any hospital; therefore, provision of their basic needs, most importantly safety and security, was much needed. These facilities include having staff common rooms, clean female toilets, a staff cafeteria, transport facilities, and the availability of universally recommended safety measures to protect them from physical or emotional hazards. A focus group discussion participant noted, “There has to be hand washing facilities in each ward, availability of soap, gloves, face masks, needle cutter, dustbin and other safety measures”.

**Health promoting activities: health screening, recreational activities & empowerment**

All study participants perceived the need for periodic health screenings for staff, flexible working hours for lactating mothers and recreational activities to sustain the health of the staff. Moreover, staff members could be empowered by involving them in decisions that indirectly influence the scope of their work at the hospital. A key informant revealed, “Hospitals should promote a democratic or participatory environment, where staff could comfortably discuss their issues, concerns, and needs with the hospital management”.

**Health promotion for the community: thinking outside the box & capacity building**

The participants revealed that hospitals should “broaden the scope of services beyond the four walls” of the hospital and adopt a ‘holistic approach’ to promote the health of the community. The common health problems encountered at hospital were perceived as an opportunity to roll-out public health strategies to prevent further associated morbidity and mortality among the target population in the community. One key informant revealed, “When there are any crises such as floods, we send our hospital staff out to provide healthcare services. Then why not to send staff into the community for health promotion?” The outreach efforts by hospitals, such as, interactive health awareness sessions for community people, school health and industrial health programs were perceived to build local capacity.
Hospital collaboration with other social sectors

All participants recommended multisectoral collaboration as "the key" to achieve health for all and hospitals can act as a "change catalyst". Health promotion interventions were also recommended through establishment of small health committees at the community level, networking with nongovernmental organizations, United Nations donor agencies and the local media. A focus group participant noted, "Everybody might be willing to cooperate, but it is the initiative that matters!"

Strategic steps for transition towards HPH

The participants’ perceptions were organized as to form strategic steps towards adapting HPH in Pakistan. Figure 1 presents levels as to where to start and roadmap for HPH.

Identification of "key personnel" and representation from all levels (health care staff/administration staff at the hospital, health committee members at the community level, health decision/policy-makers and donor agency representatives) was considered crucial to start with. The participants recommended mass awareness of stakeholders about the need for health promotion in order to change the mindset from cure to care. Such mass awareness would further strengthen advocacy efforts, which indirectly creates "demand" for health promotion. A key informant noted, "We go with demand, and this translates our priorities". The motivation among healthcare stakeholders by means of a "recognize and incentivize approach" was also perceived to go side by side to meet the "demand and supply" for health promotion. The study participants also reported that transition to HPH primarily requires "collaborative efforts" among all key personnel. A key informant noted, "One person cannot do anything, but collectively they can make a difference". Nevertheless, a common notion prevailed that a positive trend towards HPH can be initiated and sustained only when there is "local role model" for others hospitals, "political will and policy support" in Pakistan.

Discussion

Health promotion at hospitals introduces an opportunity for hospitals to broaden the scope of their work and have a positive impact on the health of the population by addressing social determinants of health. Research findings have shown HPH to benefit all its stakeholders, patients, their attendants, hospital staff, proprietors of hospitals and health regulatory agencies [13]. The transition to HPHs is historically linked to achieving health for all and there have been a series of influential movements in the developed world including the Budapest Declaration in 1991 and the Vienna Recommendation in 1997 [2,14].

Our study underscores context-specific strategies, and provides hospitals a framework of priority actions and strategic steps for adapting international components of HPH to Pakistan. The perceptions of study participants were in line with the 5 core components of HPH [5,15]. A factor considered important was the basic need to make the hospital environment healthy both for internal and external customers. A study in 2003 endorses this point reporting that a that nurses’ work on health promotion was often made more difficult by the lack of staff, space, equipment and cleanliness [16]. This finding raises a critical concern: how can staff incorporate health promotion activities as part of their practices when their basic needs (health, hygiene, safety, security) are not adequately addressed? Our study uncovered priority actions needed to meet basic needs, which required neither sophisticated technology nor lavish facilities to create a healthy workplace. The concept of basic needs can be related to the Maslow hierarchy of physiological needs, in order to motivate the staff and create a healthy workplace [17].

Figure 1 Operational steps for transition towards Health Promoting Hospitals (HPH) in Pakistan
When participants expressed their views about HPH core components, the theme of hospital/national policy was emphasized only by the donor agency representatives. However, the focus group participants (doctors and nurses) were concerned more about the operational aspects than the policy agenda, such as inclusion of patients in decisions about quality and the approach to the delivery of the health care from the hospital. This finding could be attributed to the limited exposure of doctors and nurses to health policy matters; however, this assumption was not supported by any literature. Our study also indicated certain operational challenges related to human resources, a need for a shift in focus and clarification of roles in order to fully adapt to the notion of HPHs in Pakistan. A lack of clear strategies, inadequate resources, lack of training facilities and a lack of priority for health promotion were reported as major challenges when HPH was introduced in developed countries [1].

The strategic steps that evolved from the participants envisaged representation of key personnel at each level, with focus on community and hospital staff. A study from Denmark suggested that nurses play an important role in incorporating health promotion practices at the hospital [18].

An important finding from this study was the urgent need for advocacy to create a ‘demand and supply’ for primary healthcare by sensitizing the community and stakeholders. The literature suggests that a health devolution plan to the district level is imperative, and crucial, if primary health care is to be improved in Pakistan [19]. It was recommended that hospital administrators think outside the box and start liaison with collaborative partners (civil society organizations) and those working in the social sector. This finding coincide the literature that hospitals exist as a ‘whole organization’, focusing on health promotion right from the small unit to a wider public health role, appreciating the responsibility of managers and decision-makers [20,21].

Our study was an effort to explore operational aspects using the global HPH framework with context-specific priority actions and strategic steps to adapt such an initiative to Pakistan. Our results are replicable to hospitals both in the public and private sector that are willing to adapt to the internationally recognized concept of HPH in Pakistan. The scope of our study was limited to healthcare stakeholders only; however, we recognize the perspective of the community and the social sector are equally important for advocating demand for health promotion at hospitals. Nevertheless, this study paves the way for future case-based studies to highlight the roles and responsibilities of each stakeholder, and to pilot suggested strategies for health promotion at hospitals in Pakistan.

## Conclusion

Transition from cure to care by adapting internationally recognized HPH settings can be achieved in Pakistan using the global framework with our context-specific priority actions. Pakistan. Integrated efforts are required to adapt to HPH to the Pakistan setting; this will only be possible when healthcare providers and policy decision-makers start realizing the need for such initiative. Hospitals need to work closely with collaborative partners in line with new policies addressing health promotion priorities. Social mobilization and awareness programmes for the community will intensify the demand for such a transition and strengthen advocacy arguments overall.

### References

Safe hospitals in emergencies and disasters

Hospitals are one of the essential institutions that must continue to function when an emergency event occurs. In spite of its importance, health facilities are themselves vulnerable to disasters and can get damaged, risking the lives of patients and health workers.

Safe hospitals in emergencies and disasters presents structural, non-structural and functional elements that must be considered in order to ensure that the health facility can withstand and remain operational in emergencies. It forms an essential reference for hospital administrators and planners including architects, engineers, safety officers, management, and emergency managers. It enumerates indicators in the form of a checklist that can be easily used in planning for construction, retrofitting, renovation, and assessment of damages.

Further information about this and other WHO publications is available at: http://www.who.int/publications/en/
Predictive value of plasma haematocrit level in early diagnosis of pre-eclampsia

F. Golboni, S. Heydarpour, Z. Taghizadeh and A. Kazemnezhad

ABSTRACT While pre-eclampsia is the most common complication of pregnancy, a definitive screening test for early diagnosis is still elusive. In this study, haematocrit value was assessed as a screening test for pre-eclampsia in 660 women at 24–28 weeks of pregnancy attending a hospital in Tehran, Islamic Republic of Iran. Mean haematocrit values were significantly higher in pre-eclamptic than non-pre-eclamptic women: 37.7% (SD 2.0%) and 35.9% (SD 1.7%) respectively. The receiver operating characteristics curve showed that the most appropriate cut-off point for the haematocrit test in this sample of women was 38%; at this value the sensitivity was 58.6% and specificity was 88.9%; positive and negative predictive values were 33.7% and 95.7% respectively. The haematocrit, done as a routine screening test for anaemia at 24–28 weeks of pregnancy, may also be useful as a screening test for early diagnosis of pre-eclampsia.

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Introduction

Pre-eclampsia is the most common complication of pregnancy and, together with bleeding and infection, is one of the 3 main causes of death in mothers. It has been notified as a global health problem of women by the World Health Organization (WHO) [1,2]. Pre-eclampsia is a pregnancy-specific syndrome of unknown aetiology and diagnosed by systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg and proteinuria ≥ 300 mg/24 h or dipstick 1-plus after 20 weeks of pregnancy. Despite proper care during pregnancy and delivery, pre-eclampsia is still a major health threat, even in developed countries [3,4].

The prevalence of this disease in the world has been estimated at 5%–7% and in the Islamic Republic of Iran in Tehran at 6.5% [4–6]. A reliable criterion for early diagnosis of pre-eclampsia does not exist. Many clinical, biophysical and biochemical tests exist for the diagnosis of high-risk women, but the results of studies indicate they had little predictive value in early diagnosis. Furthermore, some of these screening tests are expensive and invasive [3,6–8]. Some researchers have indicated that haemodynamic changes in normal pregnancy, such as the increase of maternal plasma volume in the second trimester, do not occur in pre-eclampsia. This may, therefore, be an indicator for pre-eclampsia in future weeks [1,3,4,9,10]. Due to vasospasm and absence of hyperfibrinolysis in these patients the haematocrit value may increase [1,9,11]. In some studies serum haematocrit has been reported as an early diagnostic test for pre-eclampsia [1,10,12].

This study aimed to determine the predictive value of maternal haematocrit value at 24–28 weeks of pregnancy in the early diagnosis of pre-eclampsia. Maternal haematocrit is measured routinely in our hospital in the Islamic Republic of Iran for the diagnosis of anaemia at this stage of pregnancy and if the predictive value of this test is appropriate it may be recommended as a screening test for pre-eclampsia.

Methods

Sample

Sampling and follow-up of cases took 8 months from February 2006 to September 2007. The sample was selected from pregnant women attending the prenatal care clinic at Maryam hospital in Tehran, Islamic Republic of Iran. Women with underlying diabetes, chronic hypertension, symptomatic infectious disease, renal disease, pulmonary disease, rheumatologic disease or thyroid disease were excluded from the study. Women with multiple pregnancies, antiphospholipid syndrome, anaemia, polycythaemia, body mass index (BMI) ≥ 30 kg/m² and history of recurrent pregnancy loss were also excluded.

The sample size was estimated with a 95% level of significance and \( P < 0.05 \) and assuming a positive predictive value of the test of 30%–40%, as reported in various studies. Thus 323 cases were estimated to be required. Taking into account possible losses, sample size was increased to 330 per category (330 women with 24–26 weeks gestational age and 330 with 27–28 weeks gestational age). Thus over the study period 660 pregnant women with a fetus at gestational age 24–28 weeks were enrolled. All gave informed consent for participation in the study. Three months after starting the sampling 52 women dropped out because of non-attendance at the clinic or refusal to participate and resampling was continued until the sample of 660 was completed. All women were taking regular ferrous sulfate supplements. Gestational age was estimated from the last menstrual period and confirmed by sonography in the first trimester of pregnancy.

Data collection

All the women were interviewed to record demographic data (age, marital status, education, employment) and information about number of pregnancies, history of labour, history of abortion, history of pre-eclampsia and BMI in the first trimester of pregnancy.

Blood pressure was measured using a stethoscope and sphygmomanometer. Pre-eclampsia was defined as blood pressure of 140/90 mmHg or greater obtained on 2 consecutive measurements 6 h apart, with proteinuria ≥ +1 on 2 random urine samples or urine total protein > 300 mg in 24 h. All measurements were done on one of 2 identical sphygmomanometers, whose accuracy was determined by the medical engineer of Maryam hospital.

Blood and urine samples were taken for routine screening tests. Haematocrit was measured once in each woman by centrifugation (Sysmex). The reliability of the centrifuge was checked by calibration daily in the hospital laboratory. Other tests, including measurements of platelet count, prothrombin time, partial thromboplastin time, serum urate and diagnostic parameters of liver and kidney function, were done to diagnose pre-eclampsia. All women were followed-up for the remainder of their pregnancy for the occurrence of pre-eclampsia.

Analysis

For classifying and summarizing data, descriptive statistics were used. For the comparison of haematocrit results at 24–28 weeks in women with and without pre-eclampsia, the chi-squared test was used. The sensitivity and specificity of the haematocrit test were assessed using standard equations. For determining an appropriate cut-off point for the test, a receiver operating characteristic (ROC) curve was used. SPSS software, version 15, was used for analysis. \( P \)-values < 0.05 were considered significant.

Results

The majority (91.7%) of the subjects were aged 19–35 years old. Their
mean age was 25.7 (SD 4.9) years. Most women (66.7%) had secondary education, 98.5% were married once and 91.5% were housewives. Pregnancy history showed that 462 (70.0%) of women were primigravids, 73.9% had no history of delivery and 93.3% had no history of abortion. In the 198 multigravidas, 93.4% had no history of pre-eclampsia in previous pregnancies. BMI was normal (19.8–26 kg/m²) in two-thirds (65.5%) of the women.

Of the 660 pregnant women, 58 (8.8%) had a diagnosis of pre-eclampsia and 602 had no signs of pre-eclampsia. The mean haematocrit values were significantly higher in pre-eclamptic than non-pre-eclamptic women: 37.7% (SD 2.0%) and 35.9% (SD 1.7%) respectively (chi-squared $P < 0.001$).

The ROC curve of sensitivity and specificity of the test showed that the optimal cut-off point for the haematocrit test in this sample of women at 24–28 weeks of pregnancy was 38% (Figure 1). Using this haematocrit cut-off 65.8% of women with a diagnosis of pre-eclampsia had a haematocrit above the cut-off compared with 11.1% of women without pre-eclampsia (Table 1). The difference between the 2 groups was statistically significant ($\chi^2 = 92.05, P < 0.001$). The sensitivity of the test using the 38% cut-off was 58.6% and specificity was 88.9% (Table 1). Positive predictive value was 33.7% and negative predictive value of the test was 95.7%.

**Discussion**

The pathogenesis of pre-eclampsia has not been well understood. In fact, the phenomenon may be silent from some time (2–3 months) before hypertension is expressed and the diagnosis of pre-eclampsia can be made [13]. Some evidences suggests that plasma volume in pre-eclampsia is lower than normal. Decreased plasma volume induces high haemoglobin concentration that leads to decreased placenta circulation that plays a pathogenic role in the development of pre-eclampsia [14].

Mello et al. assessed biochemical patterns in the early diagnosis of pre-eclampsia. They showed that the sensitivity of the haematocrit test in early diagnosis of pre-eclampsia was 63% and its specificity was 90%. Its positive predictive value was 36% and the negative predictive value of the test was 92% [15]. Their results are in accordance with ours. In Mello’s research, the haematocrit was measured every 4 weeks from the 8th week of pregnancy and the results were compared between the

<table>
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Figure 1 Receiver operating characteristics curve showing optimal cut-off point for haematocrit value in early diagnosis of pre-eclampsia in women at 24–28 weeks of pregnancy
2nd and 3rd trimesters. Mello’s methods were different from ours because we measured the haematocrit only at 24–28 weeks of pregnancy. Our results showed that it may be possible to get the same predictive value by measuring haematocrit only once.

Our results are also in accordance with those of Hilmann et al., who assessed the relationship between haemoglobin and haematocrit value in pregnancy outcome. The results of that cohort study showed that high haemoglobin and haematocrit values in the 2nd trimester have a relationship with pre-eclampsia in the following weeks [16]. They studied the relationship between haemoglobin and haematocrit value with high blood pressure in pregnancy, including transient hypertension, pre-eclampsia, eclampsia and pre-eclampsia superimposed on chronic hypertension. We only investigated the relationship between haematocrit and pre-eclampsia.

In the Islamic Republic of Iran Goudarzi et al. found a statistically significant relationship between the haematocrit value in the 1st and 3rd trimester and development of pre-eclampsia [14]. Another study in our country showed that the haematocrit value was significantly higher in pre-eclamptic women [17]. Other studies in other countries also found a relationship between an increased haematocrit and pre-eclampsia [18–21]. Other studies have shown varying results, however. In Siba’s study the haematocrit was reported as only a weak test for the diagnosis of pre-eclampsia. The sensitivity of the haematocrit in early diagnosis of pre-eclampsia in their study was 20%, specificity was 42%, positive predictive value was 6% and negative predictive value was 50% [22]. In complete contrast, Sherbiny et al. reported no significant difference in haemoglobin concentration and haematocrit value between pregnant women with pre-eclampsia (mild and severe pre-eclampsia) and a normotensive matched control group [23].

### Conclusion

Haematocrit, which is routinely done as a screening test for anaemia in 24–28 weeks of pregnancy, may be useful as a screening test for early diagnosis of pre-eclampsia in health centres. Women with haematocrit above the cut-off of 38% should be monitored carefully for the signs of pre-eclampsia.

### References

17. Ensafgo M. [Relationship between hemoglobin and hematocrit with outcome of pregnancy in pregnant women reffering to Shariati hospital]. [MSc thesis]. Department of Obstetrics and Gynaecology, Tehran, Medical Sciences Faculty, Tehran University of Medical Sciences, 1998 [in Farsi].


**WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia**

Hypertensive disorders of pregnancy are an important cause of severe morbidity, long-term disability and death among both mothers and their babies. Among the hypertensive disorders that complicate pregnancy, pre-eclampsia and eclampsia stand out as major causes of maternal and perinatal mortality and morbidity.

The majority of deaths due to pre-eclampsia and eclampsia are avoidable through the provision of timely and effective care to the women presenting with these complications. Optimizing health care to prevent and treat women with hypertensive disorders is a necessary step towards achieving the Millennium Development Goals.

WHO has developed the above-mentioned evidence-informed recommendations with a view to promoting the best possible clinical practices for the management of pre-eclampsia and eclampsia. The final recommendations were formulated and approved by an international group of experts who participated in the WHO Technical Consultation on the Prevention and Treatment of Pre-eclampsia and Eclampsia, held in Geneva, Switzerland, on 7–8 April 2011. The recommendations are available at: http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241548335/en/
Interferon-gamma release assay for detection of latent tuberculosis infection in casual and close contacts of tuberculosis cases

A.M.F. Abu-Taleb, R.H. El-Sokkary and S.A. El Tarhouny

ABSTRACT The tuberculin skin test (TST) has many limitations for the diagnosis of latent tuberculosis (TB) infection. The aim of this study in Egypt was to estimate the usefulness of an interferon-gamma release assay (IFN-γ) assay for the detection of latent TB infection in contacts of active TB cases. A total of 116 participants were enrolled and divided into 3 groups: community controls, casual (laboratory and clinic) contacts and close (household) contacts. Subjects diagnosed with latent TB infection by TST were 11.5% of controls, 71.1% of casual contacts and 29.6% of close contacts. Subjects diagnosed as latent TB infection by IFN-γ assay (QuantiFERON®-TB Gold In-Tube) were 5.9% of controls, 31.0% of casual contacts and 33.3% of close contacts. The overall agreement between TST and IFN-γ was 66.7% (κ=0.28). The IFN-γ method could be more helpful than TST for detection of latent TB infection in contacts.

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Introduction

Globally, about 2 billion people are infected with Mycobacterium tuberculosis; 8 to 10 million develop active disease and 2 million die from tuberculosis (TB) every year [1]. In Egypt, the incidence of TB is estimated at 21 per 100,000 population per year [2]. One of the first priorities of TB control programmes is the identification of people with latent TB infection [3] in order to prevent development of active disease [4]. Accurate diagnosis of latent TB infection is scientifically challenging, however, because of the low burden of dormant tubercle bacilli, which are not directly detectable or quantifiable. Besides, latent TB infection is asymptomatic, with patients having no clinical or radiographic signs of active TB yet carrying a small but significant risk of progression to active TB [5].

Until recently, the tuberculin skin test (TST), which uses purified-protein derivative (PPD), was the only method available for the diagnosis of latent TB infection [5]. The TST has many limitations, including the need for at least 2 patient visits, problems in administration, problems in interpretation and difficulty in separating true infection from the effects of prior bacille Calmette-Guérin (BCG) vaccination and infection by non-tuberculous Mycobacteria spp. [6]. Despite these drawbacks, TST remains in widespread use because of its advantages, being inexpensive, simple and practical in many settings [7].

Advances in genomics and immunology have led to a promising alternative to TST: in vitro interferon-gamma (IFN-γ) release assays. These tests are based on the principle that T-cells of individuals infected with Mycobacterium tuberculosis bacilli release IFN-γ when they re-encounter TB-specific antigens [8]. The Quantiferon®-TB assay is of these tests. The latest generation of these tests—the QuantiFERON-TB Gold In-Tube method (QFT Gold-IT)—has increased specificity for detection of Mycobacterium tuberculosis infection due to the use of 3 specific antigens. It requires a single patient visit, the interpretation is less subjective than the TST and the test is not affected by prior BCG vaccination or infection by most non-TB Mycobacteria [9].

The aim of this study was to estimate the usefulness of an IFN-γ assay for the detection of latent TB infection in contacts of active TB cases.

Methods

This was a comparative cross-sectional study conducted in the Department of Medical Microbiology and Immunology, Faculty of Medicine, University of Zagazig, Egypt. The study was conducted over 7 months from August 2008 to February 2009.

Participants

Clinically suspected TB patients were selected by systemic random sampling from those attending outpatient clinics in Zagazig Chest Hospital and Chest Department in Zagazig University Hospitals during the study period. All those with bacteriological confirmation of the diagnosis were used as the index cases. Three groups of people were selected for the study according to their degree of exposure to the index cases (on the assumption that contact either directly with TB patients or with specimens is a risk factor [10,11]).

- Close contacts: healthy individuals with a history of close contact with a TB patient for more than 8 hours per day, i.e. household contacts. We selected 2 contacts by systemic random sampling from all household contacts of confirmed TB cases.
- Casual contacts: health care workers with a history of casual contact with TB cases or specimens. They were recruited from among medical staff members and laboratory technicians who were on duty during the study period. Employees with a history of TB were excluded.
- Community controls: healthy individuals without an identified risk for Mycobacterium tuberculosis exposure. These were recruited from employees in other departments of the Faculty of Medicine.

By using data from the records, people were excluded if they had symptoms suggestive of active TB, showed abnormal chest radiographs or had history of active TB. All participants were selected by simple random sampling.

The sample size was determined assuming a prevalence of TB infection in Egypt of 27 per 100,000 per year (based on World Health Organization data [2]) and non-response rate of 20% (based on previous studies in the same locality and the same population [12]) and using k coefficient > 0.75; α-error = 0.05 and β-error = 0.20. Using these parameters and assumptions, and Epiinfo, version 9 software, the minimum sample size for each group was estimated to be 25.

Data collection

After giving their informed written consent, participants were interviewed and asked about their age, sex, history of prior TB disease and history of exposure to TB cases.

All groups were subjected to TST and INF-γ assay as follows. TST was performed by using 0.1 mL of tuberculin units PPD (Vaccera), and interpretation of the results was done according to American Thoracic Society guidelines [6]. For the INF-γ assay a blood sample was collected into 3 evacuated tubes, the first tube coated with TB-specific antigens (ESAT-6, CFP10 and TB7.7), the second tube coated with heparin-negative control and the third tube coated with mitogen (phytohaemagglutinin) as positive control. Blood was incubated overnight at 37 °C. Plasma was then separated to measure the concentration of IFN-γ by enzyme-linked immunosorbent assay using the QFT-
Gold IT assay (Cellestis) following the manufacturer’s instructions. The cut-off value for positive findings was ≥ 0.35 IU/mL [13]. Any cases of latent TB diagnosed were referred to the corresponding clinician for further management.

Statistical analysis

Concordance between the test results from the TST and the QFT-Gold IT assay was assessed using kappa coefficients (κ = 0.75 excellent agreement; κ = 0.40–0.75 fair to good agreement). We measured the correlation of the 2 tests with the risk of latent TB infection by estimating the odds ratio (OR) and 95% confidence intervals (CI) relating the test results to the likelihood of TB infection. Data were analysed using SPSS, version 11 software package.

Results

A total of 116 participants were included in this study: 28 household contacts of TB cases (12 males and 16 females); 48 health care workers (16 males and 32 females) comprising 30 medical staff members and 18 laboratory technicians; and 40 controls (13 males and 27 females). The median and range of ages of the groups are shown in Table 1.

A documented TST result was obtained in 91 (78.5%) of the 116 participants; 8 did not attend the follow-up reading of the test, 5 refused to perform it fearing pain and 12 refused to be injected by foreign material. There were no significant differences in the personal and medical characteristics of the refusals and active participants. Of the 91 participants tested, 38 (41.8%) were positive for TST. In the close contacts group there were 8/27 (29.6%) positive cases (4 males and 4 females, age range 15–60 years). In the casual contacts group there were 27/38 (71.1%) positive cases (11 males and 16 females, age range 2–55 years). In the control group there were 3/26 (11.5%) positive cases (1 male and 2 females, age range 28–70 years) (Table 2).

A valid QFT-Gold IT assay result was obtained in 100 of the 116 participants; 16 readings were indeterminate and were excluded from further analysis. Among the 100 valid results, there were 23 (23.0%) positive cases. In the close contacts group there were 8/24 (33.3%) positive cases (4 males and 4 females, age range 2–55 years) and in the casual contacts group there were 13/42 (31.0%) positive cases (4 males and 9 females, age range 20–55 years). In the control group there were 2/34 (5.9%) positive cases (1 male and 1 female, age range 33–70 years) (Table 2).

There were 75 subjects with valid (i.e. determinate) results for both TST and QFT-Gold IT. They were distributed as follows: 20 controls, 32 casual contacts and 23 close contacts. The concordance between both tests within different subgroups is shown in Table 3. Using the TST, the risk of infection appeared to be greatly increased in the casual contacts group (OR = 18.8, 95% CI: 4.1–99.5, P < 0.001) compared with the close contacts group (OR = 3.2, 95% CI: 0.6–8.1, P = 0.1). With the QFT-Gold IT assay, the increased the risk of infection with exposure was similar in the casual contacts group (OR = 7.2, 95% CI: 1.4–50.5, P = 0.006) and close contacts group (OR = 8.0, 95% CI: 1.3–62.4, P = 0.01) (Table 2).

Discussion

In high-burden countries, the diagnosis and treatment of active TB receives greater priority; testing for latent TB infection is usually done only in selected high-risk groups. Traditionally, latent TB infection has been diagnosed with a TST. However, the TST has limitations. The antigens present in PPD and used for the TST are also present in the BCG vaccine strain and therefore false positive tests are common. This has led to the development of novel tests of latent TB infection that use M. tuberculosis SPECIFIC antigens [14]. So in the present study we aimed to estimate the usefulness of an IFN-γ assay for the rapid detection of mycobacterial TB infection in individuals in contact with TB cases or specimens.

In the control group, participants diagnosed as latent TB infection were 11.5% by TST and 5.9% by IFN-γ. Our findings agree with those of Porsa et al. in the United States, who found latent

Table 1: Demographic characteristics of the 3 groups of participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>Community controls (n = 40)</th>
<th>Casual contacts (n = 48)</th>
<th>Close contacts (n = 28)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>41.9 (16.2)</td>
<td>36.4 (9.2)</td>
<td>22.5 (16.7)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Median (range)</td>
<td>33.5 (25–76)</td>
<td>36.0 (18–55)</td>
<td>19.5 (2–55)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Sex [no. (%)]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>13 (32.5)</td>
<td>16 (33.3)</td>
<td>12 (42.9)</td>
<td>&gt; 0.5</td>
</tr>
<tr>
<td>Female</td>
<td>27 (67.5)</td>
<td>32 (66.7)</td>
<td>16 (57.1)</td>
<td></td>
</tr>
</tbody>
</table>

SD = standard deviation.
TB in 9.0% and 5.4% of subjects by TST and IFN-γ respectively [15].

In our casual contacts group, 71.1% of subjects were diagnosed as latent TB infection by TST and 31.0% by IFN-γ assay. This discrepancy might be explained by a high rate of false positives for the TST. Health care workers in our faculty receive repeated BCG vaccination and also repeat TSTs during their employment. These 2 factors may further boost their reaction to the TST and thus lead to a false positive TST result [16]. This hypothesis is supported by the results of many previous studies [17].

In our close contacts group, 29.6% of subjects were diagnosed as latent TB infection by TST and 33.3% by IFN-γ assay. This disagrees with the Korean study of Kang et al., in which 71% of subjects were diagnosed as latent TB infection by TST and 44% by IFN-γ assay. This difference might also be explained by a higher rate of false positive results in their study for TST than in ours due to different vaccination schedules. In Korea, BCG vaccination is given at birth and again at age 12 or 13 years if the child proves to be a TST non-responder [18]. In Egypt, on the other hand, BCG vaccination is given in infancy, which is unlikely to affect TST reactions in adolescence or adult life [19].

Our study showed a poor correlation between TST and IFN-γ among the investigated groups. The overall agreement was 66.7% (κ = 0.28), which is similar to the findings of Mahomed et al. in South Africa, who found agreement of 69% (κ = 0.32) [9].

Table 2: Comparison of tuberculin skin test (TST) and QuantiFERON-TB® Gold In-Tube (QFT-Gold IT) assay results

<table>
<thead>
<tr>
<th>Group</th>
<th>Observed agreement</th>
<th>P-value for trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community controls</td>
<td>95.0</td>
<td>0.006</td>
</tr>
<tr>
<td>Casual contacts</td>
<td>40.6</td>
<td>0.007</td>
</tr>
<tr>
<td>Close contacts</td>
<td>78.2</td>
<td>0.004</td>
</tr>
<tr>
<td>All</td>
<td>66.7</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Table 3: Concordance between tuberculin skin test and QuantiFERON-TB® Gold In-Tube assay results

<table>
<thead>
<tr>
<th>Group</th>
<th>Observed agreement</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community controls</td>
<td>95.0</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Casual contacts</td>
<td>40.6</td>
<td>0.56</td>
</tr>
<tr>
<td>Close contacts</td>
<td>78.2</td>
<td>0.007</td>
</tr>
<tr>
<td>All</td>
<td>66.7</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Although our study showed better results with the IFN-γ assay, we should consider the relatively higher costs, practical inconvenience and the presence of indeterminate test results. By conducting a preliminary estimation of the cost of QFT-Gold IT to process a sample from 1 patient, the cost would be between 250 and 300 EGP (Egyptian pounds) while the cost of the TST is as low as 15 and 20 EGP (US$ 1 = 6 EGP). In addition, for the QFT-Gold IT, at least 22 patients should be analysed per run so as not to waste wells and therefore the minimum sample costs will only be achieved when all wells are used.

In conclusion, the IFN-γ assay showed better performance than the TST in subjects with latent TB infection and it correlated better with exposure to M. tuberculosis. An IFN-γ assay might help to avoid the limitations of
the TST in BCG-vaccinated populations as it uses antigens more specific to *M. tuberculosis* than the PPD used in the TST, and prior BCG vaccination does not affect the results. We recommend that the QFT-Gold IT could be more helpful than the TST for the detection of latent TB infection despite the risk of underestimation of cases.

**Acknowledgements**

The authors are grateful to Professor Ahmed-Refat Refat, Professor of Occupational Medicine, Faculty of Medicine, University of Zagazig for his helpful remarks and valuable assistance.

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### References

Age-specific seroprevalence of hepatitis A in Sari, northern Islamic Republic of Iran

S. Alian,1 A. Ajami,2 R. Ghasemian1 and D. Yadegarinia3

ABSTRACT The declining incidence of hepatitis A virus (HAV) infection in the Islamic Republic of Iran may be reducing the population’s natural immunity. This was the first systemized, population-based survey of the seroprevalence of HAV antibodies in urban and rural inhabitants of Sari, Mazandaran province. Serum from 1034 individuals aged 1–25 years in 2007 were tested for anti-HAV IgG antibody using a commercial enzyme immunoassay kit. The overall seroprevalence was 38.9%. The lowest prevalence (5.2%) was among the younger age group (1–5 years) from urban areas and the highest prevalence (82.0%) in the older age group (15–25 years) from rural areas. Seropositivity was significantly higher at higher age, among females and in rural areas. Sari is no longer classified as an area of high endemicity, and immunization against HAV may be needed in our population in the future.

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Séroprévalence de l’hépatite A en fonction de l’âge à Sari (nord de la République islamique d’Iran)

RÉSUMÉ La baisse de l’incidence de l’infection par le virus de l’hépatite A en République islamique d’Iran pourrait être en train d’affaiblir l’immunité naturelle de la population. Il s’agit de la première enquête systématique en population sur la séroprévalence des anticorps du virus de l’hépatite A chez les habitants des zones urbaines et rurales de Sari, dans la province de Mazandaran. Un échantillon de sérum prélevé chez 1034 personnes âgées d’un an à 25 ans en 2007 a été analysé à la recherche d’anticorps IgG du virus de l’hépatite A à l’aide d’une trouss commerciale pour épreuve immuno-enzymatique. La séroprévalence globale était de 38.9 %. La prévalence la plus faible (5.2 %) a été observée dans la tranche d’âge la plus jeune (1 à 5 ans) dans les zones urbaines et la prévalence la plus élevée (82.0 %) dans la tranche d’âge la plus âgée (15 à 25 ans) dans les zones rurales. La séroréactivité était significativement plus élevée à un âge plus avancé, chez les femmes et dans les zones rurales. Sari n’est plus classée comme une zone à forte endémicité, et la vaccination contre le virus de l’hépatite A pourrait s’avérer nécessaire dans notre population à l’avenir.
**Introduction**

Hepatitis A virus (HAV) is an epidemiologically important virus, responsible for about 1.4 million new infections worldwide each year. Most HAV infections occur through fecal–oral transmission, either by direct contact with an infected person or by ingestion of contaminated food or water [1]. Low socioeconomic status, high density housing and inadequate water treatment contribute to a pattern of high endemicity in developing countries in which more than 90% of the population has acquired natural immunity before the age of 10 years often from an asymptomatic infection.

The epidemiological pattern of HAV infection is currently changing in many developing countries, where improved sanitary conditions, urbanization and hygiene practices have reduced the incidence of infection [2]. This decrease in the infection rate has a paradoxical effect. As socioeconomic conditions improve, individuals become infected at a later age when the disease is more severe. HAV infection in children is often asymptomatic, whereas most infected adults present with jaundice and other potentially severe symptoms. Thus, HAV morbidity may increase as the incidence of infection decreases [3].

Because infection with HAV generally confers lifelong immunity to all strains of HAV, age-specific seroprevalence rates are indicators of the level of susceptibility to severe disease in a population. The epidemiology of HAV in any sub-group of the Iranian population is not properly known due to the lack of seroprevalence studies. HAV is an endemic infection in our country, so there has been no need for prevention until recent years. However, reports of a growing number of cases of fulminant hepatitis A in our region during recent years are prompting a debate over whether or not the Islamic Republic of Iran is experiencing an epidemiology shift in HAV infection.

This study in 2007 examined the seroprevalence of hepatitis A in Sari city and surroundings. The aims of this study were to determine the age-specific seroprevalence of HAV in a young population (between 1 and 25 years) in urban and rural areas. It was hoped that the results would provide useful epidemiological information on which to plan HAV prevention efforts.

**Methods**

**Study design and population**

This was a descriptive study of HAV seroprevalence in individuals aged between 1 and 25 years from Sari during May and September 2007.

Sari is the capital of Mazandaran province located on the south side of the Caspian sea in the north of the Islamic Republic of Iran. Sari city consists of administrative, commercial, industrial and residential areas, with large areas of agricultural land that are mostly rice fields.

Multistage random sampling was used. According to previous data [4] with 80% estimated seroprevalence at 95% confidence level, the calculated sample size was 1034 people. According to the population distribution we took 60% of samples from the town and 40% from the rural areas of Sari. After division of Sari city into 4 geographical regions, we selected 2 healthcare centres in each region. In the next step we choose our samples randomly from family files in each health centres (78 cases in each part). For sample recruitment we invited the selected people to health centres and for children we used schools and kindergarten in every region. In the rural areas we choose 6 villages randomly in the north, south and east of Sari. In every selected village we invited the selected people to health centres and for children we used schools and kindergarten in every region. The overall prevalence of anti-HAV antibody was 38.9% (402/1034). Table 1 shows the age-specific prevalence of anti-HAV antibodies (IgG) in the population studied. Only 13.8% of subjects under 15 years old had immunity against HAV. The lowest prevalence (5.2%) was in the younger age group (1–5 years) from the urban area and the highest prevalence (82.0%) in the

**Results**

**Study population**

Anti-HAV antibody status was studied in all 1034 subjects enrolled. There were 192 subjects aged 1–5 years, 330 aged 5–15 years and 512 aged 15–25 years (Table 1). Of the 1034 serum samples analysed for the anti-HAV (IgG) antibody, 620 samples were from urban and 414 from rural areas in Sari.

According to previous data [4] with 80% estimated seroprevalence at 95% confidence level, the calculated sample size was 1034 people. According to the population distribution we took 60% of samples from the town and 40% from the rural areas of Sari. After division of Sari city into 4 geographical regions, we selected 2 healthcare centres in each region. In the next step we choose our samples randomly from family files in each health centres (78 cases in each part). For sample recruitment we invited the selected people to health centres and for children we used schools and kindergarten in every region. In the rural areas we choose 6 villages randomly in the north, south and east of Sari. In every selected village we invited the selected people to health centres and for children we used schools and kindergarten in every region.
older age group (15–25 years) from the rural area. Anti-HAV seropositivity increased significantly with increasing age, independent of area of residence (OR = 1.89, 95% CI: 1.07–3.30 for age group 5–15 years and OR = 17.5, 95% CI: 10.4–29.4 for age group 15–25 years) (P < 0.001) (Table 2).

The overall rate of anti-HAV seropositivity was significantly higher in the samples from rural than urban areas (52.4% versus 29.8%) (P < 0.018) (Table 2) (OR = 1.39, 95% CI: 1.06–1.83). The same pattern of urban/rural differences was found in each age group (data not shown).

Overall, there was a significant difference in the probability of being anti-HAV seropositive between females and males (46.0% versus 29.6%) (OR = 2.02, 95% CI: 1.50–2.60) (P = 0.001) (Table 2). This difference was not significant in urban areas [35.9% (147/410) in females versus 28.6% (60/210) in males] (P = 0.072) but was significant in rural areas [73.5% (194/264) in females versus 15.3% (23/150) in males] (P < 0.0001).

Discussion

Epidemiological data on HAV infection are limited in the Islamic Republic of Iran and this was the first systematized population-based survey of immunity to HAV infections by age (1–25 years) in urban and rural inhabitants in Sari/Mazandaran. The overall prevalence of anti-HAV in those aged under 25 years in Sari was 38.9%.

Only 13.8% of the inhabitants under 15 years old had immunity against hepatitis A. The seroprevalence of anti-HAV in individuals younger than 25 years in 2007 was 38.9%, which is considerably lower than that of a corresponding study in 1997 in this city (90.6% in those aged > 5 years old) [4]. This finding implies that hepatitis A is no longer hyperendemic in Sari. This has led to a shift in hepatitis A patients in Sari towards older age groups, in which clinical illness is likely to be more frequent and severe [3,5,6].

A seroprevalence study in 2005 in Zabol (a city in the south-east of the Islamic Republic of Iran) revealed a 100% seropositive rate in people aged 15–19 years old [7]. This means that Zabol is a hyperendemic region of hepatitis A. Other studies carried out in Shiraz and Tehran (the 2 largest cities in the country), where the seroprevalence of HAV in 1997 was 33%–37% in the age group < 5 years and 68%–76% in age group 10–14 years, confirm our results [8]. Results of a recent study in Tehran in 2004 found a lower rate of HAV seroprevalence (22.5% in the

<table>
<thead>
<tr>
<th>Variable</th>
<th>No.</th>
<th>HAV positive</th>
<th>OR (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5 (n = 192)</td>
<td>18</td>
<td>8.9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5-15 (n = 330)</td>
<td>54</td>
<td>15.8</td>
<td>1.89 (1.07–3.30)</td>
<td>0.001</td>
</tr>
<tr>
<td>15-25 (n = 512)</td>
<td>330</td>
<td>64.3</td>
<td>17.50 (10.4–29.4)</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban (n = 620)</td>
<td>185</td>
<td>29.8</td>
<td>1.39 (1.06–1.83)</td>
<td>0.018</td>
</tr>
<tr>
<td>Rural (n = 414)</td>
<td>217</td>
<td>52.4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (n = 452)</td>
<td>134</td>
<td>29.6</td>
<td>2.02 (1.50–2.60)</td>
<td>0.001</td>
</tr>
<tr>
<td>Female (n = 582)</td>
<td>268</td>
<td>46.0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

OR = odds ratio; CI = confidence interval.
The seroprevalence of HAV in our study was lowest in the first decade of life and the highest in the age group over 15 years old. The present study showed that rural regions had the highest seroprevalence of HAV infection, with an estimated rate of 47.1% compared with 33.8% in urban areas. These results suggest that, as shown in other studies, exposure to HAV in Sari was probably earlier in rural areas than in urban areas [16–18].

Regarding sociodemographic variables, our findings are consistent with several previous studies showing a clear inverse correlation between exposure to HAV and socioeconomic level [19–21]. It is well known that HAV infection is strongly correlated with poverty and inadequate sanitation. Increasing household income, education, water quality and quantity, sanitation and hygiene lead to decreased HAV prevalence. Indeed, the prevalence of HAV infection could even be used as an index of the level of development in a given country.

HAV is a health problem in countries where the seroepidemiology is changing from hyperendemicity to intermediate endemicity [22,23]. In these cases there are different patterns, with pockets of low prevalence; studies have found a decline of anti-HAV prevalence among urban children, which leads to a risk of outbreaks of HAV infection among this population [21–23]. The infection is predicted to shift to adulthood with more severe clinical manifestations in the future. Then it is important to determine the pattern of HAV infection in each community in order to optimize vaccination strategies by identifying high-risk populations for vaccination.

This study showed that HAV infection had intermediate endemicity in Sari. So we have a large group of susceptible people who are at risk for acquisition of acute infection. In recent years there have been several case reports of fulminant hepatitis in 18–25-year-olds in our area and also several reports of acute HAV infection outbreak among families. In our sample 47.5% of 15–25-year-olds in urban areas had HAV susceptibility, which means that preventive methods such as anti-HAV Ig or HAV vaccination need to be considered.

The existence of some hyperendemic areas in our country such as in Zabol [7] suggests that there is a great need to establish a preventive strategy against hepatitis A in our area, especially for travellers to endemic areas. Similar seroprevalence studies need be conducted to detect shifts in HAV endemicity in Islamic Republic of Iran in order to plan vaccination strategies.

Conclusion

In conclusion, the decreasing HAV seroconversion observed in our study suggests Sari is no longer classified among areas of high endemicity. Inhabitants appear to have acquired a lifelong immunity as a result of natural infection during childhood. These findings support the implementation of vaccination in high-risk groups. The surveillance of the epidemiological trend of HAV infection will contribute to the definition of endemicity in Islamic Republic of Iran for implementing preventive measures and for controlling the disease.

Acknowledgements

This work was supported by Mazandaran University of Medical Sciences. We would like to thank Dr Noorani and Dr Farahanian for providing serum specimens, Mr Mirabi who performed the enzyme immunoassay and Ms Masoomian and everyone who assisted with the study.
References

8. Alborzi P. Age group who need gamma globulin in contact with hepatitis A. Proceedings of the 7th Iranian Congress on Infection Disease and Tropical Medicine, Babolsar, Islamic Republic of Iran, 6–8 October, 1998.
Prevalence of hepatitis B and C among students of health colleges in Saudi Arabia

A. Al-Ajlan

ABSTRACT This study determined the prevalence of hepatitis B surface antigen (HBsAg) and antibody to hepatitis C virus (anti-HCV) among students at health colleges in Saudi Arabia from 2000 to 2007. Data were obtained from student records. A total of 16,570 (9,852 male and 6,718 female) students were included. Their mean age was 21 years and they were divided in 2 age groups of 18–21 and 22–30 years. Residence (rural or urban) was recorded. The prevalence of HBsAg for males and females was 0.17% and 0.78% respectively in the 18–21-year-olds and 0.39% and 0.90% in the 22–30-year-olds. The prevalence of anti-HCV for males and females was 0.03% and 0.07% respectively in the 18–21-year-olds and 0.31% and 0.40% in the 22–30-year-olds. There was a statistically significant relationship between age and rural/urban background and HBsAg and anti-HCV positivity (P < 0.005).

Prévalence de l’hépatite B et C chez des étudiants en faculté de santé en Arabie saoudite

RÉSUMÉ La présente étude a déterminé la prévalence de l’antigène de surface de l’hépatite B (HBsAg) et des anticorps du virus de l’hépatite C chez des étudiants en faculté de santé en Arabie saoudite entre 2000 et 2007. Les données ont été collectées à partir des dossiers des étudiants. Au total, 16,570 étudiants (9,852 hommes et 6,718 femmes) ont participé à l’étude. Leur âge moyen était de 21 ans et ils ont été répartis dans deux groupes d’âge de 18 à 21 ans et de 22 à 30 ans. Le lieu de résidence, rural ou urbain, a été noté. La prévalence de l’antigène de surface de l’hépatite B chez les hommes et les femmes était de 0,17 % et 0,78 % respectivement dans la tranche d’âge de 18 à 21 ans et de 0,39 % et 0,90 % dans la tranche d’âge de 22 à 30 ans. La prévalence des anticorps du virus de l’hépatite C chez les hommes et les femmes était de 0,03 % et 0,07 % respectivement dans la tranche d’âge de 18 à 21 ans et de 0,31 % et 0,40 % dans la tranche d’âge de 22 à 30 ans. Un lien statistiquement significatif a été établi entre l’âge, l’origine rurale ou urbaine, et la positivité de l’antigène de surface de l’hépatite B ou des anticorps du virus de l’hépatite C (P < 0,005).
Introduction

Approximately 350 million people are infected by Hepatitis B virus (HBV) globally. A large number become positive for hepatitis B surface antigen (HBsAg) but they remain asymptomatic. They are known as silent carriers of HBV [1] and may act as a source of transmission of hepatitis B. In high and moderate prevalence zones of HBV, like South Asia and the Middle East, many silent carriers are young people [2,3].

The prevalence of HBV has declined considerably in Saudi Arabia since the introduction of immunization in 1989. According to one study, it fell from 7% in 1989 to 0.3% in 1997 [4]. A study 8 years after the introduction of hepatitis B vaccination reported seroconversion of 77% in children vaccinated at birth and 71% in those vaccinated at school entry [5]. Jaber reported in 2006 [6] that 98% of schoolchildren in Jeddah, Saudi Arabia were covered by HBV vaccination; however 14% of students tested negative for anti-HB, antibodies, suggesting that the efficacy of HBV vaccination is diminishing with increasing age [6]. It has been reported that the prevalence of HBV among blood donors in Saudi Arabia decreased from 2.7% in 1993 to 0.28% in 2003 [4,7,8].

Hepatitis C virus (HCV) infection affects around 170 million people worldwide [3,4,9]. The prevalence of hepatitis C is lower than hepatitis B but in certain regions, for example Egypt, the prevalence of hepatitis C is much higher than hepatitis B [10–12]. Carriers of hepatitis C have antibodies to the virus (anti-HCV). Although the number of HCV carriers is small compared to the total number of people infected with HCV, they can still transmit the virus [11,12].

The prevalence of HBV varies significantly across the world, being the lowest in Western European countries and the United States with a range of 0.1%–2.4% and highest in Africa with a range of 2.2%–22.6% [13–21]. It has been observed that hepatitis B is more prevalent among the young population compared to hepatitis C [22].

Many studies have been carried out in Saudi Arabia on the prevalence of hepatitis B among children in the age group 1–10 years, and hepatitis B and C among the general population and healthy blood donors [4,5,11,12,23–28], but none has targeted college and university students. However, the prevalence of HBV and HCV in college students may give and indication of the effectiveness of the measures and the prophylactic programmes applied to younger age groups. Therefore, this study concentrated on the determining the prevalence of hepatitis B and C among students admitted to the health colleges of Saudi Arabia.

Methods

Data were collected from the files of newly admitted students (freshmen) from the colleges and health institutes located in different regions of Saudi Arabia. Thus 9852 male and 6718 female students (total 16 570) admitted to 12 male and 17 female health colleges and institutes from 2000 to 2007 were included in the study. Data on students’ age, place of birth, rural or urban background, and the results of serological testing done for hepatitis B and C at the time of admission were retrieved from the files of students at the colleges. As a policy in Saudi Arabia all new students admitted to health colleges have undergone a thorough medical check-up and serological testing for HBsAg, anti-HCV and anti-HIV. All the serological tests for HBsAg, anti-HCV tests are done with second and third generation ELISA kits (Roche laboratories).

Students who test positive for either hepatitis B or C are admitted only onto courses, such as administration or pharmacy, where they will not come in direct contact with patients.

Ethical issues

Each student was given a leaflet explaining the purpose of the research and stating that all the names and personal data would be decoded and participation was voluntary. Written consent was obtained from every student; 11 students declined to participate.

Statistical analysis

Regression analysis was carried out, with age group/residential background (urban/rural) as independent variables and HBsAg/Anti-HCV status as dependent variables. The regression coefficient and 95% confidence intervals are presented. The z test was applied to compare the sex ratio of male and female positive cases for HBsAg and anti-HCV.

Results

The total number male and female students admitted during the period was 9852 and 6718 respectively, in spite of the fact more female colleges (17) were included than male colleges (12).

The mean age of male students was 21.1 years and of females was 21.3 years. The students were divided into 2 age groups: 18–21 years and 22–30 years. There were 6268 (63.6%) male and 4486 (66.8%) female students in the 18–21-year-old age group, and 3584 (36.4%) male and 2232 (33.2%) female students in the 22–30-year-old age group.

Table 1 shows the distribution of the HBsAg and HCV-positive students by sex and age group. There were significantly higher proportions of HBsAg-positive and anti-HCV-positive cases in the 22–30-year-old age group than the younger age group for both males and females (P < 0.005).

Furthermore, a significantly greater proportion of female students were positive in both age groups and for both markers of HBsAg and anti-HCV compared to males (P < 0.001) (Table 1).

Regression analysis demonstrated a declining trend of HBsAg carrier state in
the younger age group. Among males and females, 0.17% and 0.78% respectively were HBAg-positive in the 18–21-year-old age groups, while 0.39% and 0.90% respectively were HBAg-positive in the 22–30 year-old age group. The proportion of anti-HCV positive cases was higher in the older age group of 22–30 years. There was no significant difference in the proportion of anti-HCV positive cases between males and females.

Table 2 shows the distribution of hepatitis B and C positive cases by sex and urban or rural background. Data were missing for 3 males and 5 females positive for HBAg and 1 female anti-HCV positive about their place of origin. The number of positive cases for hepatitis B and C among males was significantly higher in students from rural background compared to urban ($P < 0.001$). The proportion of female students positive for hepatitis B did not differ significantly by background ($P < 0.004$), but the proportion of hepatitis C-positive females students from rural background (58.3%) was almost double that of hepatitis C-positive females students from urban areas (33.3%) ($P < 0.001$).

### Discussion

The present study was carried out with the same method as the previous ones from Saudi Arabia, Italy, Taiwan, Poland and Egypt [4,13–16,20,21]. The mean age for males and females was almost the same (about 21 years) so we divided the students in two study groups of 18–21 years and 22–30 years. The percentage of male students in the older age group of 22–30 years was higher than female students, possibly because women are married at a much younger age in Saudi Arabia and only a few join college at a later age.

The present study shows that the prevalence of hepatitis B and C markers in both sexes among the students admitted in the health colleges and institutes in Saudi Arabia is lower than the general population (1.4% for hepatitis B and over 1.5% for hepatitis C) [28].

The correlation with age and positivity for HBAg and anti-HCV in our study is similar to other studies carried out in different parts of the world [13,15,16]. Although the vaccination programme against hepatitis B in Saudi Arabia is quite comprehensive, it has been observed that seronegativity for anti-HB increases with age. The higher number of HBAg-positive cases in the older age group (22–30 years) in the present study suggests that the older students entered school before 1990, when the hepatitis B immunization was first introduced at the school entry level, and they were not covered under the Expanded Programme on Immunization (EPI). A study carried out by Al Faleh et al. [5] assessed the efficacy of hepatitis B vaccination 8 years after EPI was launched but the test for anti-HB, and its titre was not included in the panel of screening tests for the newly admitted students or for the general population. No records were available in the college files about the vaccination status of the students and results of anti-HB, so the efficacy of hepatitis B vaccination in the student population could not be assessed.

The higher prevalence of hepatitis B carrier state in the female students compared to the male students in our study is in contrast to the findings of Su et al. [15] Due to some sociocultural factors of Saudi society, the girls may not have benefited properly from the anti-hepatitis B vaccination programme.

Saudi Arabia is considerate to have a moderate to low prevalence of hepatitis
In contrast to previous reports from Saudi Arabia [5], the relationship shown for place of origin (rural or urban) with HBV and HCV infection is quite strong in the present study. More HBsAg-positive cases were from rural areas suggesting of poorer vaccination coverage of the rural population. The higher prevalence of anti-HCV in students from a rural background is similar to the findings of El-Gilany et al. from Egypt [21], the country that reports the highest prevalence of hepatitis C in the world [27].

The present study shows very low prevalence of hepatitis B and C carrier state among the students of health colleges and institutes in Saudi Arabia. It is recommended that screening of anti-hepatitis B core antigen (HBcAg) be included in the screening profile of newly admitted students in order to detect occult cases of HBV that show negative HBsAg and anti-HBc, and to assess immunization status and the efficacy of the vaccination against hepatitis B.

References


21. El-Gilany AH, El-Fedawy S. Bloodborne infections among students from a rural background is similar to the findings of El-Gilany et al. from Egypt [21], the country that reports the highest prevalence of hepatitis C in the world [27].
Study of antibiotic prescribing among dental practitioners in Shiraz, Islamic Republic of Iran

G. Vessal,¹ A. Khabiri,² H. Mirkhani,² B.D. Cookson⁴ and M. Askarian²

ABSTRACT Inappropriate prescribing of antibiotics by health care professionals is a worldwide concern. This study evaluated the knowledge and practices of dental practitioners in the city of Shiraz, Islamic Republic of Iran regarding their therapeutic use of antibiotics for patients with dentoalveolar infections. Of 219 (48.6%) dentists responding to the questionnaire more than 40% would prescribe antibiotics for localized fluctuant swelling and for problems for which antibiotics are not required according to good practice guidelines (acute pulpitis, chronic apical infection, periodontal abscess, chronic gingivitis, chronic periodontitis, pericoronitis and dry socket). A majority correctly prescribed antibiotics for acute periapical infection (77.2%), cellulitis (75.3%) and acute ulcerated gingivitis (63.0%). Amoxicillin was the most frequently prescribed antibiotic for all clinical conditions but there was a wide variation in dosage, frequency and duration for all antibiotics used. Guidelines on rational antibiotic use are needed for dental practitioners in the Islamic Republic of Iran.

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Introduction

Dental practitioners regularly prescribe antibiotics for therapeutic or prophylactic purposes to manage oral and dental infections. However, inappropriate prescribing and excessive use of antibiotics have been identified as major factors in the emergence of antibiotic resistance, which is an ongoing challenge ever since the discovery of antimicrobial agents [1]. There are other issues too, such as possible adverse events and additional costs of prescribing. Consequently, surveillance of antimicrobial resistance, monitoring of antibiotic usage and attempts to improve prescribing attitudes have become crucial [2].

In 1997 more than 3.5 million prescriptions for antibiotics were dispensed by general dental practitioners in England at a net ingredient cost of £5.2 million. Antibiotic prescribing by dentists may therefore play a major role in the emergence of resistant bacterial strains, particularly when there is evidence of misuse [3].

Currently there are no specific guidelines in Islamic Republic of Iran for prophylactic or therapeutic prescribing of antibiotics in dentistry. In addition, there are no data describing the indications for which antibiotics are prescribed, whether these have any scientific basis, or whether the antibiotic agents, their dose, frequency and duration, are based on published guidelines or standards. We therefore conducted this study to evaluate the knowledge and attitude of dental practitioners in the city of Shiraz (the capital of Fars province) regarding their therapeutic use of antibiotics for patients with dentoalveolar infections.

Methods

Sample

We estimated the sample size of 197 using \( d = 0.3 \), standard deviation = 1.5, \( \alpha = 0.05 \) and \( \beta = 0.2 \). We mailed questionnaires to all dentists in the study area (\( n = 450 \)), which according to our previous studies would enable us to reach the calculated sample size.

Questionnaire

The questionnaire was a modification of that described by Palmer et al. [3] and aimed to investigate the knowledge of dental practitioners about therapeutic prescribing of antibiotics. To ensure its validity the questionnaire was piloted and discussed with 12 dental specialists from each department of the School of Dentistry in Shiraz. In order to evaluate the reliability of the questionnaire, an extended pilot study was performed on 50 dental practitioners. The Kuder–Richardson coefficient of reliability was high (\( r = 0.86 \)). Thus no changes were made to the questionnaire.

The questionnaires were mailed out to the selected dental practitioners in the city of Shiraz over a 3-week period in 2006, and collected 1 week later from their offices. It recorded the age, sex, practitioners’ final degree (general or specialist), when and where it was obtained, whether the practitioner was affiliated to the university and any participation in the last 2 years in continuing education programmes related to the rational use of antibiotics. Respondents answered anonymously and were requested to avoid use of any reference materials while answering the questionnaire.

The questionnaire also explored the number of patients treated per week and for which clinical signs the practitioner would prescribe antibiotics for patients presenting with a dental infection. The clinical signs chosen were: elevated temperature and evidence of systemic spread; localized fluctuant swelling; gross or diffuse swelling; restricted mouth opening; difficulty in swallowing; and closure of the eye due to swelling. We also explored whether patients’ expectations of an antibiotic prescription would be a reason for prescribing antibiotics.

Another part of the questionnaire investigated the use of antibiotics for common clinical conditions. If a positive response was given, the practitioners were asked to state the antibiotic they would prescribe, its dose, interval and duration, for patients who were not allergic to penicillin. The practitioner was also asked what antibiotic s/he would choose if the patient was allergic to penicillin. The clinical conditions were acute pulpitis, acute periapical infection, chronic apical infection, periodontal abscess, acute ulcerative gingivitis, chronic gingivitis, chronic periodontitis, pericoronitis, dry socket, and cellulitis.

In reviewing the literature, a systematic search for literature published in English available via MEDLINE for the years 1996 through December 2007 was conducted. The search terms included: “antibiotic treatment and dentistry”. Identified articles were used to select additional key terms for further searches. Other relevant articles were identified from the bibliographies of these papers. A search was also conducted of the US Centers for Disease Control and Prevention and World Health Organization published documents, which focused on antibiotic treatment and dentistry. We also searched several leading textbooks on this subject.

Data analysis

A knowledge score was constructed for each question asked regarding signs in which the practitioner would prescribe antibiotics. Each of these 6 questions were graded as 0 (if incorrect) versus 1 (if correct). For questions regarding use of antibiotics in common clinical conditions, knowledge of respondents was evaluated based on evidence-based guidelines and standards in selected published literature.

Means and standard deviations (SD) were obtained for continuous variables, and compared using Student t-test. Categorical variables were reported as percentages and compared using the chi-squared test. Non-parametric
correlation was used to determine the strength of the relationship between demographic and professional factors and the knowledge score. The level of statistical significance of all tests was a 2-tailed \( P \)-value < 0.05. All analyses were performed using SPSS, version 9.

**Results**

**Background characteristics**

Of the 450 dental practitioners to whom the questionnaires were sent, 219 (48.6%) completed the forms (64.4% male, 35.6% female). The majority of the practitioners graduated from Shiraz Dental School (66.2%). Only 5.9% of the practitioners had attended a continuing education programme on rational use of antibiotics within the previous 2 years. The demographic and professional characteristics of respondents are shown in Table 1.

**Prescribing habits**

Table 2 shows the clinical signs for which the practitioners would prescribe antibiotics. Over 80% would prescribe for patients with elevated body temperature, gross or diffuse facial swelling and closure of the eye due to swelling. A minority of practitioners (17.7%) would prescribe antibiotics as a result of a patient’s demand.

Regarding antibiotic prescriptions for clinical signs, the mean knowledge score was 3.9 (range 0–6). There was no statistical significant difference in the mean knowledge scores by sex, professional qualifications or having attended a continuing education course (Table 3).

**Prescribing for specific conditions**

The percentage of practitioners prescribing for specific conditions are shown in Table 4. The results showed that the majority of dentists would prescribe for acute periapical infection (77.2%), cellulitis (75.3%) and acute ulcerated gingivitis (63.0%). The practitioner’s preferred choice of antibiotics for specific conditions that actually need antibiotic treatment, assuming no allergy to penicillin, is shown in Table 5. Amoxicillin was the antibiotic most frequently prescribed.

The dose, frequency and duration of treatment with each antibiotic prescribed differed among the practitioners. Of the 126 practitioners who would prescribe amoxicillin for acute periapical infection, the great majority (70.6%) chose a 250 or 500 mg dose 3× daily for a period of 6–10 days. Few dentists (6.3%) chose the lower dose of 250 mg and only 2.4% preferred a shorter duration of 2–3 days. Some practitioners (10.3%) even chose a duration of 4 weeks. Of those 37 practitioners who prescribed penicillin V for acute periapical infection, more than 81.1% chose a 250 or 500 mg dose 4× daily for 6–10 days but only 8.1% chose the lower dose.

For acute ulcerative gingivitis, more than half of the 61 practitioners who prescribed amoxicillin (52.5%) chose a 500 mg dose 3× daily for a period of 6–10 days; only 3.3% chose a shorter duration of 2–3 days and 16.4% even chose a duration of 4 weeks. Of 38 practitioners who chose metronidazole to treat acute ulcerative gingivitis, 50.0% chose a 250

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>141</td>
</tr>
<tr>
<td>Female</td>
<td>78</td>
</tr>
<tr>
<td>Degree</td>
<td></td>
</tr>
<tr>
<td>General practitioner</td>
<td>186</td>
</tr>
<tr>
<td>Specialist</td>
<td>33</td>
</tr>
<tr>
<td>Academic position</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
</tr>
<tr>
<td>No</td>
<td>205</td>
</tr>
<tr>
<td>Age (years)</td>
<td>36.5 (7.8)</td>
</tr>
<tr>
<td>Duration of practice (years)</td>
<td>9.6 (7.0)</td>
</tr>
<tr>
<td>No. of patients/week</td>
<td>35.7 (27.5)</td>
</tr>
</tbody>
</table>

SD = standard deviation.

**Table 2** Prescribing of antibiotics by dental practitioners for selected clinical signs and patient expectations (\( n = 219 \))

<table>
<thead>
<tr>
<th>Clinical sign</th>
<th>Would prescribe No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross diffuse swelling*</td>
<td>193</td>
<td>88.3</td>
</tr>
<tr>
<td>Elevated temperature and evidence of systemic spread*</td>
<td>185</td>
<td>84.4</td>
</tr>
<tr>
<td>Closure of the eye because of swelling*</td>
<td>178</td>
<td>81.4</td>
</tr>
<tr>
<td>Difficulty in swallowing</td>
<td>103</td>
<td>46.9</td>
</tr>
<tr>
<td>Localized fluctuant swelling</td>
<td>101</td>
<td>46.0</td>
</tr>
<tr>
<td>Restricted mouth opening</td>
<td>94</td>
<td>42.7</td>
</tr>
<tr>
<td>Patient’s expectation for a prescription</td>
<td>39</td>
<td>17.7</td>
</tr>
</tbody>
</table>

*Clinical signs that that need antibiotic treatment.
mg dose 3× daily for 6–10 days, 34.2% incorrectly chose 4× daily interval for this drug and only about 7.9% would treat for 2–3 days. Practitioners who chose tetracycline for the treatment of this condition used a variety of different dosages, durations and intervals.

For the treatment of cellulitis, a majority of the 85 practitioners who prescribed amoxicillin (64.7%) chose a 500mg dose 3× daily for 6–10 days and 21.2% chose an even higher duration of treatment (4 weeks). Most of the 21 practitioners who chose penicillin V to treat this condition chose a 500 mg dose 4× daily for 7–10 days (57.1%), while 19.0% preferred 4 weeks of treatment. A considerable proportion of the practitioners surveyed preferred an injection of penicillin to treat this condition; however, there was considerable disagreement regarding the dosage and the number of injections.

For patients allergic to penicillin, erythromycin was the most common antibiotic prescribed by the respondents (70.0%), followed by clindamycin (15.7%) and cephalexin (7.6%). Of those practitioners who preferred erythromycin more than half chose a 400 mg dose 4× daily for 6–10 days. Others incorrectly prescribed a 3× daily dose, or a longer duration of treatment of up to 4 weeks.

**Discussion**

Within the last few decades antimicrobial resistance has become a worldwide problem and constitutes a major threat to public health. The unsystematic prescribing of antibiotics by health care professionals is a major factor to be considered. Evidence of the inappropriate use of antibiotics in dentistry has increased and this could lead to the problem of antimicrobial resistance [3–6]. This fact and the increase in the number of antibiotic prescriptions written by dentists each year [4] shows the importance of examining the role of dentists in prescribing antibiotics in everyday practice.

The present study showed evidence of poor prescribing of antibiotics by dentists in Shiraz. The indications for antibiotics in acute dentoalveolar infections have been defined as: signs of spreading infection, patient malaise, temperature elevation and lymphadenitis [3,4]. Generally the survey showed that dental practitioners are aware of these indications and mostly used antibiotics wisely for acute infections. However, more than 40% would prescribe antibiotics for localized fluctuant swelling. Therefore, a considerable proportion of practitioners prescribed antibiotics for all swellings where local treatment would have been sufficient. This was a similar finding to studies performed in Kuwait [6], and Yemen [5], where 55% and 68% of the practitioners respectively prescribed antibiotics for local swelling. With a mean score of 3.9 out of a maximum possible score of 6, we could say that our dental practitioners had an intermediate knowledge regarding clinical signs that require antibiotic treatment, a score

<p>| Table 3 Knowledge score by professional and demographic variables for clinical signs that need antibiotics |</p>
<table>
<thead>
<tr>
<th>Variable</th>
<th>No.</th>
<th>Mean (SD) score</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>139</td>
<td>3.9 (1.2)</td>
<td>0.76</td>
</tr>
<tr>
<td>Female</td>
<td>77</td>
<td>3.9 (1.2)</td>
<td></td>
</tr>
<tr>
<td>Degree</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>180</td>
<td>3.9 (1.2)</td>
<td>0.53</td>
</tr>
<tr>
<td>Specialist</td>
<td>32</td>
<td>3.8 (1.4)</td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td>14</td>
<td>3.9 (1.6)</td>
<td>0.98</td>
</tr>
<tr>
<td>Non-academic</td>
<td>203</td>
<td>3.9 (1.2)</td>
<td></td>
</tr>
<tr>
<td>Continuing education course</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>13</td>
<td>4.4 (1.1)</td>
<td>0.18</td>
</tr>
<tr>
<td>No</td>
<td>197</td>
<td>3.9 (1.2)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>219</td>
<td>3.9 (1.3)</td>
<td></td>
</tr>
</tbody>
</table>

*Attended continuing education programme on rational use of antibiotics within the previous 2 years.

*Range: 0–6.

SD = standard deviation.

<p>| Table 4 Prescribing of antibiotics by dental practitioners for selected dental diagnoses (n = 219) |
| Diagnosis | Would prescribe |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute periapical infection</td>
<td>169</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>165</td>
</tr>
<tr>
<td>Pericoronitis</td>
<td>147</td>
</tr>
<tr>
<td>Acute ulcerative gingivitis</td>
<td>138</td>
</tr>
<tr>
<td>Periodontal abscess</td>
<td>134</td>
</tr>
<tr>
<td>Chronic apical infection</td>
<td>72</td>
</tr>
<tr>
<td>Acute pulpitis</td>
<td>55</td>
</tr>
<tr>
<td>Chronic periodontitis</td>
<td>45</td>
</tr>
<tr>
<td>Dry socket</td>
<td>45</td>
</tr>
<tr>
<td>Chronic gingivitis</td>
<td>30</td>
</tr>
</tbody>
</table>

*Diagnoses that need antibiotic treatment
similar to the Yemeni general dentists (mean score of 3.7) [5]. It is gratifying to note that only a minority of the respondents (17.7%) would prescribe antibiotics for an unscientific reason such as patients’ expectations, which is irrational and an abuse of antibiotic usage. This figure was found to be only 4% for dental practitioners in Kuwait [6], and 10% for the dentists in England [3], but was similar to dental practitioners practising in Yemen (15%) [5].

The proportion of practitioners who would routinely prescribe antibiotics for specific conditions varied a great deal among the presenting diseases. More than 70% of those surveyed would correctly prescribe antibiotics for cellulitis and acute apical infections, while only 63% would prescribe antibiotics for acute ulcerative gingivitis, which is recommended as part of the initial therapy [4]. The majority of uncomplicated infected swellings of dental origin can be successfully treated by removing the source of infection by drainage of abscesses, removal of infected pulp contents or tooth extraction. Antibiotics are not effective in the management of pain associated with irreversible pulpitis [4,7]. However, 25.0% of our dental practitioners surveyed believed in the use of antibiotics in patients presenting with acute pulpitis. This was similar to the study performed in Yemen and Kuwait in which 32% and 20% of dentists respectively would prescribe antibiotics for this condition [5,6]. However, a lower percentage (13%) of dental practitioners in England prescribed antibiotics for this condition [5,6]. However, a lower percentage (13%) of dental practitioners in England prescribed antibiotics for this acute pulpitis.

Chronic apical infections rarely need antibiotics unless there is evidence of gross local spread; extraction or root canal therapy are the definitive treatment options. In this survey about one-third of the practitioners would prescribe antibiotics for chronic apical infections, similar to the studies in Kuwait and England [3,6]. However, our practitioners’ knowledge in this regard was much higher than the Yemeni dental practitioners in whom 72% would prescribe for chronic apical infections. Chronic dentoalveolar infections rarely require antibiotics, unless there is evidence of gross local spread [4], and the majority of patients with the commonly encountered forms of chronic periodontitis usually respond well to conventional therapies [8]. Adjunctive antibiotics should be prescribed only for a very limited group of patients—e.g. those with specific clinical features or aggressive forms of periodontal disease—in order to prevent antibiotic resistance due to periodontal therapy [9]. Nevertheless about 14% and 20% respectively of our dental practitioners surveyed would prescribe antibiotics routinely for chronic gingivitis and chronic periodontitis. These results were similar to those obtained from dental practitioners in Kuwait [6]. Our dental practitioners were more knowledgeable in this regard compared with the dental practitioners in Yemen, where 54% and 66% respectively would routinely prescribe antibiotics for these infections [5]. A lower percentage (3% and 13% respectively) of dental practitioners in England would prescribe antibiotics in the above conditions [3].

Pericoronitis, periodontal abscesses and dry sockets are treated by local measures, and antibiotics are only indicated for large spreading infections or systemic involvement [4,10]. The use of systemic antibiotics in the treatment of periodontal disease is controversial. It is acceptable not to use antibiotics routinely for the treatment of adult periodontal disease. Mechanical debridement methods, including drainage of pus for acute periodontal abscesses, should be considered the first-line treatment for most periodontal diseases. Systemic antimicrobials should be considered as adjuncts to such methods, and never used alone in this chronic disease, as they can predispose to abscess formation. Adjunctive systemic antimicrobials may be considered in acute disease where debridement or drainage of pus is difficult, or there is local spread or systemic upset. There is also evidence that systemic antibiotics can be used in juvenile periodontitis [4,11]. Initial treatment of pericoronitis is usually aimed at debridement of the

### Table 5 Antibiotics preferred by dental practitioners for clinical conditions that need antibiotic therapy

<table>
<thead>
<tr>
<th>Clinical condition</th>
<th>Would prescribe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
</tr>
<tr>
<td><strong>Acute periapical infection</strong> (n = 169)*</td>
<td></td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>126</td>
</tr>
<tr>
<td>Penicillin V</td>
<td>37</td>
</tr>
<tr>
<td>Other†</td>
<td>6</td>
</tr>
<tr>
<td><strong>Acute ulcerative gingivitis</strong> (n = 138)</td>
<td></td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>61</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>38</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>18</td>
</tr>
<tr>
<td>Other*</td>
<td>21</td>
</tr>
<tr>
<td><strong>Cellulitis</strong> (n = 165)</td>
<td></td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>85</td>
</tr>
<tr>
<td>Penicillin</td>
<td>40</td>
</tr>
<tr>
<td>Penicillin V</td>
<td>21</td>
</tr>
<tr>
<td>Other†</td>
<td>19</td>
</tr>
</tbody>
</table>

*Number of dentists who would prescribe an antibiotic for this condition.
†Penicillin V, metronidazole, metronidazole, cephalexin, ampicillin, cephalexin, erythromycin, doxycycline, penicillin V.
*Penicillin V, metronidazole, metronidazole, cephalexin, ampicillin, cephalexin, erythromycin, doxycycline, penicillin V.
periodontal pocket by irrigation or by mechanical means, disinfection of the pocket with an irrigation solution such as hydrogen peroxide or chlorhexidine, and surgical management by extraction of the opposing maxillary third molar, and occasionally, of the offending mandibular third molar. Severe cases of pericoronitis with systemic symptoms may warrant antibiotic therapy [12]. Such exceptional situations were not covered in our questionnaire, and unfortunately more than 60% of our dental practitioners surveyed would prescribe antibiotics routinely for periodontal abscess and pericoronitis. In the study performed in England and Yemen more than 80% of the practitioners, would prescribe for these two conditions [3], while this percentage was more than 70% in Kuwait [6]. The percentage of our practitioners prescribing antibiotics for dry socket was 20%, much lower compared with the studies performed in Kuwait, Yemen and England (> 50%) [3,5,6].

Amoxicillin was the most frequently prescribed antibiotic for acute dentoalveolar infections requiring antibiotics, which is similar to other studies [3,6,13]. This was followed by penicillin V for acute periapical infections, metronidazole for acute ulcerative gingivitis and penicillin injection for cellulitis (Table 3). The data revealed that the dentists surveyed prescribed a wide spectrum of antibiotics. The use of penicillin V is based on old studies that have isolated mainly streptococci and staphylococci from dental abscesses, while more recent studies have shown that the main isolates from dental abscesses are complex mixtures of facultative and anaerobic bacteria, some of which are penicillin resistant [14,15]. Based on a review of the evidence and good practice for prescribing therapeutic antibiotics in dentistry [4], amoxicillin 250 mg 3x daily for a maximum of 5 days and metronidazole 200 mg 3x daily for 3 days have been recommended as first and second choice treatments respectively. For patients allergic to penicillin, erythromycin 250 mg 4x daily or 500 mg 2x daily up to 4 days have been recommended [4].

In agreement with previous studies [13,16,17], there was a considerable variation from the recommended frequencies, doses and duration of antibiotic therapy. There is increasing evidence that short courses of antibiotics together with local surgical measures are adequate for treating dentoalveolar infections [4,18,19]. Prolonged courses of antibiotics, which were recommended by most of the practitioners in our survey for periods up to 10 days, could be harmful, due to the fact that the dose and duration of therapy are key factors in developing antibiotic resistance. The fact that a considerable number of our practitioners surveyed chose a duration of treatment of up to 4 weeks is of great concern. Acute orofacial infections have a rapid onset and relatively short duration of 2 to 7 days, particularly if the offending cause is treated and/or eliminated [20]. If clinical experience and the nature of the infection demonstrate that its predicted course may be 3 days, then 3 days of antibiotic therapy is enough. When clinical evidence indicates that the infection is expected to resolve or is resolved, the antibiotic therapy should be terminated [4,19,20].

Unfortunately the optimal duration of antibiotic therapy for many dental infections has never been defined by randomized controlled trials. Current guidelines are based on expert opinion, which is considered to be the lowest level of evidence. There is an urgent need for randomized controlled trials with the objective of providing a scientific basis for best practice recommendations. Until such data exist, the antibiotics should be applied for a short duration. It is believed that large doses of amoxicillin (500 mg), which was prescribed by a majority of our practitioners, are not necessary in acute dentoalveolar infections, as the absorption of this antibiotic in standard 250 mg amounts is good enough to be therapeutically effective [3,4]. The dose of metronidazole prescribed by our dental practitioners was 250 mg (in contrast with the recommended dose of 200 mg [4]), due to the fact that in the Islamic Republic of Iran the tablets are formulated at this higher dosage level.

Our findings indicate that the scientific basis for prescribing antimicrobial agents was neglected by the majority of the respondents. Most of those surveyed used antibiotics routinely for conditions where local treatment would be sufficient. This is not surprising as similar findings were reported among other health professionals in Islamic Republic of Iran [21–23], and by dental practitioners in other countries [3,5,6]. It is clear that our dental practitioners need expert advice on when and what to prescribe, for how long and in what dosage. Qualitative research is required to see if we can find out directly from practitioners why this problem of inappropriate antibiotic prescribing is so intractable, as well as the practitioners’ attitude towards changing their prescribing behaviour.

Audit of clinical antibiotic prescribing in dentistry has been reported to improve general dental practitioners’ attitudes to prescribing antimicrobials, reducing the number of prescriptions following the introduction of guidelines [24,25]. It is important to inform the dental community about the accepted current antibiotic prescription guidelines and the related evidence-based clinical practice and this paper adds to the evidence needed for designing national guidelines for our dental practitioners. There is also a need to improve undergraduate education and to increase postgraduate courses and other educational activities on antibiotic prescribing, especially since there was no difference in prescribing between those practitioners who had completed a continuing education programme and those who had not. This study lends support to the hypothesis that antibiotics are being inappropriately
prescribed by the dental profession in Islamic Republic of Iran. The response rate to the questionnaire was poor and, as those who responded were likely to be more knowledgeable about the issue, the actual level of knowledge among dentists in this area may be even lower. Introducing guidelines and re-auditing after a few years would be an important step in implementing rational antibiotic use.

Acknowledgements

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References

Road safety in the Eastern Mediterranean Region – findings from the Global Road Safety Status Report

H. Soori, S.J. Hussain and J.A. Razzak

ABSTRACT A secondary data analysis using the Global Status Report on Road Safety (GSRRS) was carried out to assess the epidemiology of road traffic injuries (RTIs) and preventive strategies in the Eastern Mediterranean Region (EMR). EMR countries ranked equal first in the world for the highest number of fatalities due to RTIs (32.2 per 100 000 population). The region had about 4% of the world’s vehicles with 0.097 registered vehicles per person. The number of injured cases in EMR was 210.1 per 100 000 population. Only 15% of EMR countries had a funded, independent, multisectoral body for road safety. Only 25% had mandatory seat-belt laws for both front-seat and rear-seat passengers, 60% had mandatory helmet laws for both drivers and passengers of motorized two-wheelers and 10% had child restraint laws. Road safety in EMR countries needs more attention and consideration.

Sécurité routière dans la Région de la Méditerranée orientale – résultats du Rapport de situation sur la sécurité routière dans le monde

RÉSUMÉ Une analyse des données secondaires extraites du Rapport de situation sur la sécurité routière dans le monde a été menée pour évaluer l’épidémiologie des traumatismes dus aux accidents de la circulation et les stratégies de prévention dans la Région de la Méditerranée orientale. Les pays de la Région sont ceux dans lesquels on constate le nombre le plus élevé au monde de décès causés par des traumatismes dus aux accidents de la circulation (32,2 pour 100 000 habitants). La Région possède environ 4 % des véhicules dans le monde avec 0,097 véhicule immatriculé par personne. Le nombre de cas de traumatismes en Méditerranée orientale est de 210,1 pour 100 000 habitants. Seuls 15 % des pays de la Région disposent d’un organisme en charge de la sécurité routière qui soit multisectoriel, indépendant et financé. Ils ne sont que 25 % à avoir promulgué une loi rendant obligatoire le port de la ceinture de sécurité à l’avant comme à l’arrière des véhicules ; 60 % des pays ont une législation sur le port obligatoire du casque pour les conducteurs comme pour les passagers de deux-roues motorisés et 10 % se sont dotés d’une loi sur les dispositifs de retenue pour enfants. Davantage d’attention et de considérations doivent être accordées à la sécurité routière dans la Région de la Méditerranée orientale.
Road traffic injuries (RTIs) are a serious public health problem in different regions of the world. More than 1.27 million people are killed each year due to road traffic crashes, and as many as 50 million are injured [1,2]. RTIs are the leading cause of death in 15–29-year-olds and result in disability for many victims. A recent study by the World Health Organization (WHO) estimated the incidence rate of fatal RTIs to be 32.2 per 100 000 in the WHO Eastern Mediterranean Region (EMR), compared to 13.4 per 100 000 in European Region and 18.8 per 100 000 worldwide [3].

More than 90% of deaths from RTIs occur in low- and middle-income countries, which only have 48% of the world’s vehicles [1]. Around 94% of EMR residents live in low- and middle-income countries. According to the Global Status Report on Road Safety (GSRRS) about 62% of reported road traffic deaths occur in 10 countries of the world out of which 2 are in EMR. It is very important to take steps to address the global assessment of road safety, to have regular comparisons on a number of indicators between different years and countries, and present epidemiological data on RTIs for better policy-making as well as a more effective road traffic injury prevention plan [1].

The number of scientific reports on RTIs in EMR is limited compared to most of the developed countries and this paper aims to present the epidemiological pattern of RTIs in this region and compare the results for the EMR Member States and the global status of RTIs as a whole.

**Introduction**

**Methods**

This is a secondary data analysis study using data from the GSRRS [1] and other available data sources in the region and international databases. EMR includes 22 countries (out of 195 member and associate member states of WHO): Afghanistan, Bahrain, Djibouti, Egypt, Islamic Republic of Iran, Iraq, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates and Palestine (West Bank and Gaza). The region has about 555 million inhabitants, about 8.5% of the world population [4]. Only 6.2% of this population live in high-income countries (HIC) while the remaining live in low- and middle-income countries. In EMR, all Member States, except Djibouti and Somalia, and 1 non-member area participated in the study. These 2 countries represent 1.7% of the total population of the whole region. Details on methodology of the original study are available in GSRRS.

In summary, the work on the report began in August 2007 with the specific objectives of:

- assessing the status of road safety in all WHO Member States;
- indicating the gaps in road safety to help countries identify the key priorities for intervention;
- stimulating road safety activities at a national level.

For the original study, a self-administered questionnaire was completed by each country using a national trained coordinator, who facilitated a consensus meeting involving a multisectoral group of 8 road safety experts. Data collection began in March 2008 and was completed in September 2008.

Reported number of deaths was adjusted for 30-day definition of a road traffic death and the modelled number of deaths calculated using negative binomial regression [5] to identify outliers and determine the extent of missing data. In many countries the level of severity of an injury was recorded by different organizations; however the data on non-fatal injuries presented in this report was mainly gathered from the emergency departments of different countries.

Variables selected from GSRRS for this paper are: countries in EMR, number of deaths from RTIs, total population, number of registered vehicles, national legislations on speed limit, drink-driving law, motorcycle helmet law, seat-belt law, child restraint law, institutional framework and reported non-fatal RTIs.

Data was re-analysed using Excel 2007.

**Results**

Type of vehicle and trends of mortality rates were not available for all countries and so are not presented here.

**Population and vehicles**

Table 1 shows the total population and number of registered vehicles in 20 different countries of EMR. The total population of 20 countries recorded in this study (2007) was 45.5 million, estimated to be about 8.5% of world’s population. Three countries, Egypt, Islamic Republic of Iran and Pakistan, contribute to 57% of the total population of the region (Table 1).

The total number of registered vehicles in the region was 52.7 million with 65.4% in the Islamic Republic of Iran, Saudi Arabia, Pakistan and Egypt (Table1). The total number of vehicles in the region represents about 4% of the world total. About 62.0% of the vehicles are motor cars, 19.4% buses or minibuses, 8.7% motorized 2- or 3-wheelers and 7.1% trucks. The proportion of registered vehicles per person in EMR is 0.097, while the figure for the rest of the world is 0.2.

**Mortality**

In total, 175 668 deaths from RTIs were reported in the region for 2007, 32.2 per 100 000 population. High-
income and middle-income countries of EMR have the highest death rate from RTIs in the world. These death rates were more than 3 and 2 times greater than the lowest rates in other high-income and middle-income countries of the world respectively (Table 2).

The RTI fatality rate in EMR is 6.4% of total global deaths from RTIs [1]. The Islamic Republic of Iran has the highest number of deaths from RTIs and is responsible for 14.5% of total deaths from all causes in the region. However, the highest rates of fatal RTIs (per 100 000 population) are for Egypt (41.6%), Libyan Arab Jamahiriya (40.5%) and Afghanistan (39.0%) (Table 3). Fatal RTIs per 10 000 vehicles was 33.8. Table 3 gives more details of the actual and modelled number of deaths and modelled rates (per 100 000 population) in 20 countries of the region.

Table 1: Total population and registered vehicles in 20 countries of the World Health Organization Eastern Mediterranean Region in 2007

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>Total registered vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>2,714,275</td>
<td>4.98</td>
</tr>
<tr>
<td>Bahrain</td>
<td>752,648</td>
<td>0.14</td>
</tr>
<tr>
<td>Egypt</td>
<td>75,497,913</td>
<td>13.84</td>
</tr>
<tr>
<td>Iran (Islamic Republic of)</td>
<td>71,208,384</td>
<td>13.05</td>
</tr>
<tr>
<td>Iraq</td>
<td>28,993,374</td>
<td>5.31</td>
</tr>
<tr>
<td>Jordan</td>
<td>5,924,245</td>
<td>1.09</td>
</tr>
<tr>
<td>Kuwait</td>
<td>2,851,144</td>
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</tr>
<tr>
<td>Lebanon</td>
<td>4,099,115</td>
<td>0.75</td>
</tr>
<tr>
<td>Libyan Arab Jamahiriya</td>
<td>6,160,483</td>
<td>1.13</td>
</tr>
<tr>
<td>Morocco</td>
<td>31,224,137</td>
<td>5.72</td>
</tr>
<tr>
<td>Oman</td>
<td>2,595,133</td>
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</tr>
<tr>
<td>Pakistan</td>
<td>163,902,405</td>
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</tr>
<tr>
<td>Qatar</td>
<td>840,635</td>
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</tr>
<tr>
<td>Saudi Arabia</td>
<td>2,473,533</td>
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</tr>
<tr>
<td>Sudan</td>
<td>38,560,488</td>
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</tr>
<tr>
<td>Syrian Arab Republic</td>
<td>19,928,316</td>
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</tr>
<tr>
<td>Tunisia</td>
<td>10,327,285</td>
<td>1.89</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>4,380,439</td>
<td>0.80</td>
</tr>
<tr>
<td>West Bank and Gaza</td>
<td>4,018,000</td>
<td>0.74</td>
</tr>
<tr>
<td>Yemen</td>
<td>22,389,169</td>
<td>6.03</td>
</tr>
<tr>
<td>Total</td>
<td>545,533,321</td>
<td>100</td>
</tr>
</tbody>
</table>

<2007 data not available; latest available used from http://data.un.org/.

Table 2: Modelled road traffic injury fatality rates (per 100 000 population), by World Health Organization (WHO) Region and income group

<table>
<thead>
<tr>
<th>WHO Region</th>
<th>High-income</th>
<th>Middle-income</th>
<th>Low-income</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Mediterranean</td>
<td>28.5</td>
<td>35.8</td>
<td>27.5</td>
<td>32.2</td>
</tr>
<tr>
<td>African&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-</td>
<td>32.2</td>
<td>32.3</td>
<td>32.2</td>
</tr>
<tr>
<td>South-East Asian&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-</td>
<td>16.7</td>
<td>16.5</td>
<td>16.6</td>
</tr>
<tr>
<td>Americas&lt;sup&gt;c&lt;/sup&gt;</td>
<td>13.4</td>
<td>17.3</td>
<td>-</td>
<td>15.8</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>7.2</td>
<td>16.9</td>
<td>15.6</td>
<td>15.6</td>
</tr>
<tr>
<td>European</td>
<td>7.9</td>
<td>19.3</td>
<td>12.2</td>
<td>13.4</td>
</tr>
<tr>
<td>Global</td>
<td>10.3</td>
<td>19.5</td>
<td>21.5</td>
<td>18.8</td>
</tr>
</tbody>
</table>

<sup>a</sup>30-day definition  
<sup>b</sup>No high-income countries  
<sup>c</sup>No low-income countries  
Source: Global status report on road safety [1].
Morbidity

The number of people injured in the region in 2007 was 1,145,958 which is 210.1 per 100,000 population. This equates to 220.5 per 10,000 vehicles in the region. The Islamic Republic of Iran with more than 962.8 per 100,000 population has the highest rate of non-fatal RTIs in the region. The highest rates of non-fatal injuries from RTIs per 10,000 registered vehicles are in Qatar, Pakistan and Iraq with 17.4, 24.6, 33.3 respectively. Table 4 gives details of non-fatal RTI rates per 100,000 population and per 10,000 vehicles in participating countries of EMR.

Enforcement of laws and legislations

Table 5 shows the presence of certain important laws and legislations on road safety in different countries of EMR.

Few countries in EMR (15%) have a funded, independent, multisectoral body for road safety. In EMR, 90% of the countries had a seat-belt law but only 25% had mandatory seat-belt laws for both front-seat and rear-seat passengers. The majority of countries (85%) have some form of helmet law for 2-wheeler vehicles but only about 60% have mandatory helmet laws for both rider and passenger. Only 10% of EMR countries have child restraint laws.

National speed limits in urban areas for vehicles in 20 countries of the region ranged from 50 km/h in many countries to 120 km/h. Oman (120 km/h), Iraq, Qatar and Lebanon (100 km/h) have the highest speed limits in urban areas.

Blood alcohol concentration over 0 g/dL is illegal for the general population for most of the countries in the region while it is 0.10 g/dL in the United Arab Emirates. There was no difference in blood alcohol concentration levels for the general population, young/novice drivers and professional/commercial drivers in all countries. Except in Morocco, all other countries have national drink–driving laws and in some countries alcohol consumption is prohibited. The methods used for enforcing drink–driving laws are mostly through measurement of blood alcohol concentration and by random breath testing by police check-points in 8 countries (Afghanistan, Islamic Republic of Iran, Kuwait, Lebanon, Oman, Pakistan, Tunisia and United Arab Emirates).

### Table 3

<table>
<thead>
<tr>
<th>Country</th>
<th>Reported number of deaths</th>
<th>Modelled number of deaths</th>
<th>Estimated road traffic death rate per 100,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>1,779</td>
<td>10,593</td>
<td>39.0</td>
</tr>
<tr>
<td>Bahrain</td>
<td>91</td>
<td>91</td>
<td>12.1</td>
</tr>
<tr>
<td>Egypt</td>
<td>15,983</td>
<td>31,439</td>
<td>41.6</td>
</tr>
<tr>
<td>Iran (Islamic Republic of)</td>
<td>22,918</td>
<td>25,491</td>
<td>35.8</td>
</tr>
<tr>
<td>Iraq</td>
<td>1,932</td>
<td>11,059</td>
<td>38.1</td>
</tr>
<tr>
<td>Jordan</td>
<td>992</td>
<td>2,027</td>
<td>34.2</td>
</tr>
<tr>
<td>Kuwait</td>
<td>482</td>
<td>482</td>
<td>16.9</td>
</tr>
<tr>
<td>Lebanon</td>
<td>536</td>
<td>1,170</td>
<td>28.5</td>
</tr>
<tr>
<td>Libyan Arab Jamahiriya</td>
<td>2,138</td>
<td>2,497</td>
<td>40.5</td>
</tr>
<tr>
<td>Morocco</td>
<td>3,838</td>
<td>8,850</td>
<td>28.3</td>
</tr>
<tr>
<td>Oman</td>
<td>798</td>
<td>553</td>
<td>21.3</td>
</tr>
<tr>
<td>Pakistan</td>
<td>7,234</td>
<td>41,494</td>
<td>25.3</td>
</tr>
<tr>
<td>Qatar</td>
<td>199</td>
<td>199</td>
<td>23.7</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>6,358</td>
<td>7,166</td>
<td>29.0</td>
</tr>
<tr>
<td>Sudan</td>
<td>2,227</td>
<td>13,362</td>
<td>34.7</td>
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<tr>
<td>Syrian Arab Republic</td>
<td>3,663</td>
<td>6,552</td>
<td>32.9</td>
</tr>
<tr>
<td>Tunisia</td>
<td>1,497</td>
<td>3,568</td>
<td>34.5</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>1,056</td>
<td>1,626</td>
<td>37.1</td>
</tr>
<tr>
<td>West Bank and Gaza</td>
<td>188</td>
<td>896</td>
<td>22.3</td>
</tr>
<tr>
<td>Yemen</td>
<td>3,003</td>
<td>6,553</td>
<td>29.3</td>
</tr>
<tr>
<td>Total</td>
<td>76,912</td>
<td>175,668</td>
<td>32.2</td>
</tr>
</tbody>
</table>

*Adjusted for 30-day definition of a road traffic death.

In 2007 in EMR, there were 32.2 RTI deaths per 100,000 population. While this was the same as the African region, it was much higher than the 13.4 per 100,000 in the European region. Indeed, only 2 countries of EMR (Bahrain and Kuwait) had lower death rates from RTIs than the world estimate of 18.8 per 100,000. EMR ranked second after the African region for fatal RTIs per vehicle; 87.3 per 10,000 vehicles for the African region versus 33.8 for EMR. The figure is 3.2 per 10,000 vehicles for the European region and 9.3 per 10,000 vehicles for the world.

The number of people injured in the region in 2007 was 1,145,958 (210.1 per 100,000 population) which is lower than the 269.3 per 100,000 reported in the European region.

Few countries in EMR (15%) had a funded, independent, multisectoral body for road safety while this figure was about 74% in the European region. In addition, only 25% of EMR countries had mandatory seat-belt laws for both front-seat and rear-seat passengers compared to about 92% in the European region, and only 60% had mandatory helmet laws for both rider and passenger compared to 98% in the European region. In fact, only the Islamic Republic of Iran, Sudan and Tunisia meet the recognized helmet standards. Only 10% of EMR countries had laws in place on restraint of children in cars compared to 86% in European region.

This study shows that EMR has one of the worst road safety situations in the world. The fatality rate per 100,000 population ranked first equal (with the African region). While injuries per 100,000 population were lower, the validity and reliability of the data on non-fatal RTIs derived from secondary data set is open to question. In many countries, non-fatal injuries from RTIs are recorded by police at the site of the crash, whereas in some less severe injuries are either not recorded and/or a standardized scoring method for injury severity is not used. Thus, there may in fact be an under-reporting of non-fatal injuries. As a result, data on non-fatal injuries on RTIs are not comparable between different countries of the region and rest of the world.

Injuries apart, the high fatality rate compared with Europe raises the question of response to road traffic crashes, the facilities available to deal with RTIs, access to care and the quality of medical care received. In middle- and low-income countries, adequate capacity may be limited.

Our study shows that some driving safety laws are in place but they are not as far-reaching as those in the European region. In addition, laws need to be enforced but our study could not determine how well the current laws were being implemented.

This is the first report on road safety in EMR that shows an overall picture

Table 4 Non-fatal road traffic injuries in participating countries of the World Health Organization Eastern Mediterranean Region

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of reported cases</th>
<th>Rate per 100,000 population</th>
<th>Rate per 10,000 vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>16,980</td>
<td>62.6</td>
<td>232.1</td>
</tr>
<tr>
<td>Bahrain</td>
<td>3,415</td>
<td>453.7</td>
<td>89.2</td>
</tr>
<tr>
<td>Egypt</td>
<td>154,000</td>
<td>204.0</td>
<td>358.1</td>
</tr>
<tr>
<td>Iran (Islamic Republic)</td>
<td>685,611</td>
<td>962.8</td>
<td>403.3</td>
</tr>
<tr>
<td>Iraq</td>
<td>7,467</td>
<td>25.8</td>
<td>33.3</td>
</tr>
<tr>
<td>Jordan</td>
<td>17,969</td>
<td>303.3</td>
<td>213.4</td>
</tr>
<tr>
<td>Kuwait</td>
<td>8,584</td>
<td>301.1</td>
<td>62.9</td>
</tr>
<tr>
<td>Lebanon</td>
<td>6,266</td>
<td>152.9</td>
<td>44.8</td>
</tr>
<tr>
<td>Libyan Arab Jamahiriya</td>
<td>9,524</td>
<td>154.6</td>
<td>52.1</td>
</tr>
<tr>
<td>Morocco</td>
<td>89,264</td>
<td>285.9</td>
<td>390.8</td>
</tr>
<tr>
<td>Oman</td>
<td>8,531</td>
<td>328.7</td>
<td>135.5</td>
</tr>
<tr>
<td>Pakistan</td>
<td>12,990</td>
<td>7.9</td>
<td>24.6</td>
</tr>
<tr>
<td>Qatar</td>
<td>1,053</td>
<td>125.3</td>
<td>17.4</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>36,025</td>
<td>145.6</td>
<td>48.7</td>
</tr>
<tr>
<td>Sudan</td>
<td>21,329</td>
<td>55.3</td>
<td>177.7</td>
</tr>
<tr>
<td>Syrian Arab Republic</td>
<td>16,145</td>
<td>81.0</td>
<td>116.2</td>
</tr>
<tr>
<td>Tunisia</td>
<td>14,559</td>
<td>141.0</td>
<td>116.9</td>
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<tr>
<td>United Arab Emirates</td>
<td>11,155</td>
<td>254.7</td>
<td>63.6</td>
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<tr>
<td>West Bank and Gaza</td>
<td>5,838</td>
<td>145.3</td>
<td>742.7</td>
</tr>
<tr>
<td>Yemen</td>
<td>19,253</td>
<td>86.0</td>
<td>247.6</td>
</tr>
<tr>
<td>Total</td>
<td>1,145,958</td>
<td>210.1</td>
<td>220.5</td>
</tr>
</tbody>
</table>
of RTIs in 20 member countries of the region. Published studies from different EMR countries are limited. A comprehensive review in Safetylit [7] showed that there were only 138 papers on RTIs from member countries of EMR published in international scientific journals from 1966 to September 2008. More than 71% of these papers were from Saudi Arabia (31), Islamic Republic of Iran (23), Pakistan (26) and United Arab Emirates (18); there were no published studies on RTIs for 4 member countries.

Findings from this report show some similarities and some differences from the literature published from studies in the region. Most studies in different countries of the region show RTIs as a major cause of death in those countries [8–17]. For example, a higher frequency of RTIs in the Islamic Republic of Iran, Pakistan and Saudi Arabia has been reported [6,10,16]. However, the scope of the problem of high rates of RTIs per 100 000 population in Egypt, Libyan Arab Jamahiriya and Afghanistan has not been well documented.

Although 12 of the countries in the region reported that they had a lead agency on road safety, only 3 countries that had a funded national strategy with measurable targets and so the data available were limited to basic road safety management.

Interventions, particularly the enforcement of laws and legislation and obligatory rules for use of seat-belts by drivers and car occupants, wearing of helmet by motorcyclists and educational programmes, can be effective in RTI prevention and in lowering the RTI rates [18,19]. Such interventions should be strictly implemented in different parts of the region. In addition, more reliable evidence is needed to determine the scope of different types of injuries and to evaluate the interventions already implemented. While some countries in the region have taken steps towards addressing road safety, additional efforts are needed. Some studies show that despite increasing numbers of cars, there is a lack of significant environmental modifications for road and vehicle safety promotion [1].

In conclusion, RTIs are a serious problem in EMR with one of the highest fatality rates in the world. Researchers in the region are encouraged to study the scope of the problem, risk factors, interventions and evaluation of road traffic injuries in their own countries as well as the region. Stronger leadership from the lead agency and adequate resources and support for infrastructure are required and that the health sector should take a more active role in RTI prevention. In addition, policy-makers need to endorse proven interventions and their implementation.

<table>
<thead>
<tr>
<th>Table 5 Some measures on laws and legislations in different countries of the World Health Organization Eastern Mediterranean Region</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
</tr>
<tr>
<td>Afghanistan</td>
</tr>
<tr>
<td>Bahrain</td>
</tr>
<tr>
<td>Egypt</td>
</tr>
<tr>
<td>Iraq</td>
</tr>
<tr>
<td>Iran (Islamic Republic)</td>
</tr>
<tr>
<td>Jordan</td>
</tr>
<tr>
<td>Kuwait</td>
</tr>
<tr>
<td>Lebanon</td>
</tr>
<tr>
<td>Libyan Arab Jamahiriya</td>
</tr>
<tr>
<td>Morocco</td>
</tr>
<tr>
<td>Oman</td>
</tr>
<tr>
<td>Pakistan</td>
</tr>
<tr>
<td>Qatar</td>
</tr>
<tr>
<td>Saudi Arabia</td>
</tr>
<tr>
<td>Sudan</td>
</tr>
<tr>
<td>Syria</td>
</tr>
<tr>
<td>Tunisia</td>
</tr>
<tr>
<td>United Arab Emirates</td>
</tr>
<tr>
<td>West Bank and Gaza</td>
</tr>
<tr>
<td>Yemen</td>
</tr>
</tbody>
</table>

*Alcohol is prohibited [1].
References

ABSTRACT We evaluated the prevalence of diabetes comorbidity in Greek psychiatric patients, differences between type 1 and type 2 diabetics and the outcome of psychiatric disorder. Of 800 psychiatric patients meeting our inclusion criteria, 82 (10.2%) had diabetes mellitus; 28% type 1 and 72% type 2. The mean age at onset of mental illness was earlier for type 1 diabetics (mean 26.95, SD 9.09 years) than type 2 (mean 33.22, SD 10.71 years) ($P < 0.015$). The duration of untreated mental illness was also shorter for type 1 (mean 2.86, SD 3.06 years compared with mean 4.13, SD 6.24 years for type 2 diabetics). Schizophrenia was the commonest psychiatric diagnosis in both types of diabetes. There was no significant difference in outcome of psychiatric disorder between the 2 types of diabetics. Existence of diabetes mellitus (regardless of type), duration of untreated mental illness and lack of patient therapeutic education were negative predictors of (unfavourable) outcome. These findings provide evidence of a high prevalence of diabetes in psychiatric patients and that having diabetes has an adverse effect on outcome of psychiatric illness.

Comorbidité psychiatrique et diabète de type 1 et de type 2

RÉSUMÉ Nous avons évalué la prévalence de la comorbidité du diabète chez des patients grecs atteints de troubles psychiatriques, les différences entre les diabétiques de type 1 et de type 2 et l’évolution des troubles psychiatriques. Sur 800 patients atteints de troubles psychiatriques remplissant nos critères d’inclusion, 82 (10,2 %) souffraient de diabète. Parmi eux, 28 % présentaient un diabète de type 1, et 72 % un diabète de type 2. L’âge moyen d’apparition du trouble mental chez les diabétiques de type 1 était inférieur (moyenne 26,95 ; E.T. 9,09 ans) à l’âge moyen d’apparition chez les diabétiques de type 2 (moyenne 33,22 ; E.T. 10,71 ans) ($P < 0.015$) ; la période sans traitement du trouble mental était également plus courte chez les diabétiques de type 1 (moyenne 2,86 ; E.T. 3,06 ans) que chez les diabétiques de type 2 (moyenne 4,13 ; E.T. 6,24). La schizophrénie était le diagnostic le plus fréquent dans les deux types de diabète. Aucune différence significative dans l’évolution du trouble psychiatrique n’a été observée entre les deux types. La présence d’un diabète (quel que soit le type), la période pendant laquelle le trouble mental n’était pas traité et l’absence d’éducation thérapeutique du patient étaient des facteurs prédictifs négatifs d’évolution défavorable. Ces résultats prouvent la prévalence élevée du diabète chez les patients souffrant de troubles psychiatriques et l’effet néfaste du diabète sur leur évolution.
Introduction

The incidence of diabetes mellitus in psychiatric patients has been found to be 2 to 8 times higher than in the general population [1–3].

A 10% frequency of diabetes mellitus in patients with bipolar disorder (manic and mixed subtypes) has been reported [2]. A study in the United States based on medical records found a prevalence of 26% for diabetes inpatients with bipolar 1 disorder [4]. A Canadian study found a prevalence of 11.7% of diabetes mellitus in a community-based sample of individuals diagnosed with bipolar disorder [5]. Such figures are significantly greater than the 4% frequency expected in the general population [6].

Other studies suggest that diabetes doubles the risk of depression [7]. The adverse influence of depression on the course of diabetes has been discussed extensively [8]. A randomized control trial found improvements in depression concomitant with improved diabetic control [9]. This link to metabolic control gives depression a unique importance in diabetes.

The association between diabetes and schizophrenia has been a long-standing consideration for those working in the fields of medicine and psychiatry. “Diabetes is a disease which often shows itself in families in which insanity prevails” [10]. This observation reported in 1867, uncomfortably expressed by today’s standards, is supported by a more recent study that found that 15.8% of a patients diagnosed with schizophrenia also had a diagnosis of diabetes mellitus [3]. Other literature suggests that type 2 diabetes is 2 to 4 times more prevalent in people with schizophrenia compared to the general population [11,12].

As evidenced by a recent journal supplement devoted entirely to schizophrenia and diabetes [13], research investigating the comorbidity of diabetes and mental illness is pertinent. However, differences between type 1 and type 2 diabetics with psychiatric disorders have rarely been considered by previous research.

We therefore sought to (i) evaluate the prevalence of the comorbid diabetes in a sample of Greek psychiatric patients and (ii) determine if differences in demographic characteristics, clinical profile and outcome of psychiatric disorder in the sample were associated with type of diabetes.

Methods

Sample

Data were collected from all consecutive voluntarily and involuntarily admissions (3124 patients) to the Kastallinohellinkon Psychiatric Clinic in Athens in Greece during the study period 2001–2006. Inclusion criteria were: age ≥ 18 years (to enable psychiatric diagnosis based on DSM-IV [14]); no treatment drop-out before completion of the inpatient treatment phase; and an absence of mental retardation, alcoholism or neurological illness.

Only the 800 (25.6%) patients who fitted the selection criteria were evaluated for the presence of the comorbid condition of diabetes mellitus. A diagnosis of diabetes mellitus was based on clinical signs, as observed by a diabetologist, and a fasting venous plasma glucose (FPG) level >140 g/dL was used to have a clear diagnosis is diabetes.

The final sample consisted of 82 (10.2%) psychiatric patients who were found to have diabetes mellitus. This sample was further categorized on the basis of diabetes type (1 or 2), in order to facilitate the identification of any differences between the two types of diabetes and the demographic characteristics and clinical parameters of the patients.

All patients were known to the first author who was part of the team of clinicians that had supervised their treatment process.

Measures

Psychiatric diagnoses were based on DSM-IV [14] and resulted from clinical interview at admission of the patient to the psychiatric unit. Clinical interviews were designed to gather data about relevant clinical history, including treatment compliance and therapeutic education, current symptoms and sociodemographic characteristics.

Consistent with previous studies [15], duration of untreated mental illness (duration of untreated psychosis) was defined as the time from the onset of psychiatric illness (defined as the time period in which the patient first experienced the signs and symptoms of the diagnosed disorder) to the time when the patient received treatment.

Outcome of psychiatric disorder was measured in terms of the presence of relapse to a new episode, re-hospitalization over a 2-year follow-up period, and degree of symptom remission. Follow-up assessments were conducted by the same clinical team that treated the patients in the hospital. A 2-year follow-up period was chosen as the majority of new episodes occur within 2 years of remission [16]. Poor outcome was defined as the presence of relapse to a new episode or re-hospitalization over the 2-year follow-up period. A favourable outcome was defined as no relapse within the 2-year follow-up period.

Data obtained from the above measures were supplemented by information obtained from clinical records, referring and treating psychiatrists and interviews conducted with family members of the patients.

Ethical issues

All patients were informed about the nature of the research within the hospital and willingly gave their consent to participate. In fewer than 10 patients we used educational interventions, which according to the literature have
been shown to improve understanding of study information in patients with psychotic and mood disorders [17,18]. Information sheets and preliminary interviews made it clear that the choice to consent or otherwise would have no bearing on the treatment offered.

The project ensured the anonymity of the subjects by replacing patient names with unique identifying numbers before the statistical procedures began.

**Statistical methods**

A secure computerized database was established and maintained throughout the study. Patient names were replaced with unique identifying numbers.

Statistical analyses were performed using the SPSS, version 10.0 for Windows. Data are presented as mean and standard deviation (SD) for continuous variables and frequencies for categorical variables. Differences between type 1 and type 2 diabetics were analysed by the Pearson chi-squared test for discrete variables (sex, education, marital status, employment status) and t-tests for continuous variables (age, age at onset of psychiatric symptoms, number of admissions, duration of untreated mental illness). Multiple regression analysis was used to determine the predictors of outcome of mental illness.

**Results**

**Demographics and prevalence**

Of the 800 psychiatric patients, 82 (10.2%) had diabetes as a comorbid condition. Type 2 diabetes was the most prevalent type in 59 (72%) patients while the remaining 23 (28%) was classified as type 1 diabetes.

As reflected in Table 1, type 1 diabetics were typically younger in age (mean 35.21, SD 10.72) than type 2 diabetics (mean 46.08, SD 9.01 years), a statistically significant difference (t = 4.64, df=80, P < 0.001). The mean age at onset of mental illness was earlier (mean 26.95, SD 9.09 years) than for type 2 diabetics (mean 32.22, SD 10.71 years) (t = 2.48, df=80, P < 0.015). The duration of untreated mental illness was shorter for type 1 diabetics (mean 2.86, SD 3.06 years) compared to type 2 diabetics (mean 4.13, SD 6.24 years). The duration of untreated mental illness was positively correlated with the age of diabetics at study entry (r = 0.21, P < 0.05), but not with their age at onset of psychiatric symptoms.

Table 2 gives the demographic characteristics of the patients with psychiatric illness and comorbid diabetes according to type of diabetes. There were no statistically significant differences between psychiatric patients with type 1 and 2 diabetes in terms of sex, education or marital status but there was a significant difference for employment with more patients with type 1 diabetes being unemployed (P < 0.03).

Table 3 shows that schizophrenia was the most prevalent psychiatric diagnosis in both types of diabetes (53.2% of psychiatric patients with type 1 diabetics had schizophrenia and 43.4% with type 2 had schizophrenia).

**Outcome of psychiatric illness**

As regards timing of diagnosis, 49.3% of the patients (81% type 1 and 37% type 2) had been diagnosed with diabetes mellitus before their first psychiatric hospitalization. In 29.6% of type 1 patients the onset of diabetes was almost at the same time as the onset of mental illness, with diabetes preceding mental illness by less than 6 months. In 31.5% of type 2 patients, mental illness preceded diabetes onset by more than 4 years. This was a statistically significant difference between type 1 and type 2 diabetes (χ² = 36.46, df = 7, P < 0.001).

**Discussion**

Prevalence of diabetes comorbidity

The present study confirmed the higher prevalence of diabetes in psychiatric patients (10.2%) than found in the general population, adding weight to the proposition that this may be a universal phenomenon [3]. Epidemiological studies [19] have typically established higher prevalence rates (15%–30%) of diabetes in psychiatric patients than...
our investigation. This may be due to the fact that our sample consisted of inpatients only and therefore excluded those patients with milder psychiatric symptoms. In addition, the method of participant recruitment (e.g. formal diagnostic criteria, audit of medical records) may have eliminated a proportion of false positives that may have been included in studies conducted in more naturalistic, outpatient settings. Putting aside the magnitude of the prevalence, it is clear that our study, along with numerous others [1–3], highlights the disproportionate prevalence of diabetes in individuals with psychiatric diagnoses.

**Psychiatric diagnosis and diabetes comorbidity**

Schizophrenia was the most common psychiatric diagnosis with diabetes (both type 1 and type 2). This finding contrasts with reports that identified depression [19]. This difference may be accounted for by the fact that our sample was obtained from an inpatient psychiatric setting and therefore more likely to have more severe psychiatric conditions.

**Differences between type 1 and type 2 diabetes**

In our study, type 1 diabetes patients were more likely to be diagnosed with diabetes prior to their psychiatric hospitalization (81%) and type 2 diabetes patients more likely to be diagnosed with diabetes after hospitalization (68%). It has been suggested that, in the case of type 2 diabetes, one should consider the possibility of neuroleptic-induced

### Table 1 Age and psychiatric characteristics of patients with psychiatric illness and comorbid diabetes mellitus

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Type 1 (n = 23)</th>
<th>Type 2 (n = 59)</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Age (years)</td>
<td>35.21</td>
<td>10.72</td>
<td>46.08</td>
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<tr>
<td>Age at onset of psychiatric symptoms (years)</td>
<td>26.95</td>
<td>9.09</td>
<td>33.22</td>
</tr>
<tr>
<td>Number of admissions</td>
<td>2.34</td>
<td>1.66</td>
<td>2.42</td>
</tr>
<tr>
<td>Duration of untreated mental illness (years)</td>
<td>2.86</td>
<td>3.06</td>
<td>4.13</td>
</tr>
</tbody>
</table>

SD = standard deviation.

### Table 2 Demographic characteristics of patients with psychiatric illness and comorbid diabetes mellitus

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Type 1 (n = 23)</th>
<th>Type 2 (n = 59)</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
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<td></td>
<td></td>
</tr>
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<td>37</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>47.8</td>
<td>22</td>
</tr>
<tr>
<td><strong>Education</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>10</td>
</tr>
<tr>
<td>Junior high school</td>
<td>4</td>
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<td>19</td>
</tr>
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<td>Senior high school</td>
<td>9</td>
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<td>16</td>
</tr>
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<td>College</td>
<td>2</td>
<td>8.7</td>
<td>1</td>
</tr>
<tr>
<td>University</td>
<td>5</td>
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<tr>
<td><strong>Marital status</strong></td>
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<tr>
<td>Single</td>
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<td>56.5</td>
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<tr>
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<td>6</td>
<td>26.1</td>
<td>27</td>
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<td>Divorced</td>
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<td>7</td>
</tr>
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<td>Widowed</td>
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<td>4</td>
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<td><strong>Employment status</strong></td>
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<td>Housewife</td>
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<td>21.7</td>
<td>12</td>
</tr>
<tr>
<td>Early retirement due to psychiatric illness</td>
<td>-</td>
<td>-</td>
<td>10</td>
</tr>
</tbody>
</table>
diabetes” where psychotropic medication may further increase the risk of the development of diabetes, either directly or as a result of iatrogenic weight gain [2]. This issue has been the focus of much recent research [12,20–22]. Literature supports an association between the use of antipsychotic medication and impaired glucose metabolism, however methodological weaknesses abound and prospective randomized trials are required [23].

Given that type 1 diabetes was once called ‘juvenile diabetes’, it was not surprising that type 1 diabetics in the present study were significantly younger than type 2 diabetics. This factor may explain many of the significant findings in contrasting type 1 and type 2 diabetics. Type 1 diabetics characteristically have an onset earlier in their life span than type 2, have a greater tendency for the need for insulin at an earlier age and have a shorter life expectancy. As a consequence of the vicissitudes of their illness, it is perhaps understandable that type 1 diabetics may experience obstacles in pursuing relationships, marriage, education and employment. This finding adds weight to the assertion made by other researchers that type 1 young diabetic patients should be seen more as a high-risk group for psychiatric disorders than the patients of most other chronic medical conditions [1].

Predictors of outcome of psychiatric illness

There was no significant difference in the course of psychiatric illness over a 2-year follow-up period between those with type 1 or type 2 diabetes, as indicated by the non-significant difference in the number of psychiatric hospitalizations. The existence of diabetes mellitus (regardless of type), the duration of untreated mental illness and the lack of patient therapeutic education were negative predictors of outcome in the present study. Given that comorbidity of disorders adds to treatment complexity and is frequently associated with chronicity [24], it is not surprising that diabetes negatively affects the course of psychiatric disorder.

Diabetes affects all aspects of everyday life and diabetics bear much of the responsibility for treatment decisions that will affect their immediate and long-term health but less than half of our patients had been exposed to therapeutic patient education and psychoeducational interventions. Therapeutic patient education aims to inform patients adequately about their chronic disorders in order to manage and take responsibility for their condition. Psychotherapeutic patient education can help patients to deal with the insecurity they suffer from and give the appropriate answers to their questions. Such education has brought about a significant decrease in the number of hospital admissions of patients with diabetic coma [25]. In the present study, a lack of therapeutic patient education was related to poor outcome of mental illness.

<table>
<thead>
<tr>
<th>Psychiatric diagnosis</th>
<th>Type 1 diabetes</th>
<th>Type 2 diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
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<td>Schizophrenia</td>
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<tr>
<td>Schizoaffective</td>
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</tr>
<tr>
<td>Major depression</td>
<td>4</td>
<td>17.4</td>
</tr>
<tr>
<td>Bipolar II – depression</td>
<td>1</td>
<td>4.3</td>
</tr>
<tr>
<td>Bipolar II – mania phase</td>
<td>5</td>
<td>21.7</td>
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</tbody>
</table>

Table 4: Regression analysis for variables predicting outcome of mental illness

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unstandardized coefficient</th>
<th>Standardized coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
</tr>
<tr>
<td>Sex</td>
<td>4.80</td>
<td>2.88</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>0.24</td>
<td>0.83</td>
</tr>
<tr>
<td>Age at onset of psychiatric symptoms</td>
<td>-6.59</td>
<td>0.17</td>
</tr>
<tr>
<td>Duration of untreated mental illness</td>
<td>-1.99</td>
<td>0.39</td>
</tr>
<tr>
<td>Marital status</td>
<td>-0.46</td>
<td>1.31</td>
</tr>
<tr>
<td>Psychoeducation</td>
<td>43.5</td>
<td>2.87</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>-0.10</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*P < 0.05; **P < 0.01.

*Outcome (dependent) variable = number of months after treatment that the patient relapsed.
SE = standard error.
A large proportion of our patients (41.4%) in our study were non-compliant with psychiatric treatment. Interestingly, 25.4% adhered to diabetic treatment (regular visits to the diabetologist and controlled blood glucose levels) but were non-compliant with their psychiatric treatment after discharge from the psychiatric unit. The fact that patients compliant with diabetes treatment were not always compliant with psychiatric treatment may be because of be denial of a psychiatric disorder in order to avoid stigmatization. Research evidence suggests that stigma has a significant effect on the lives of people with mental illness [26]. There is no stigma associated with high blood pressure or diabetes, but there is stigma associated with being mentally ill [26].

The significance of the duration of untreated mental illness, the third negative predictor of outcome, concurs with the vast majority of studies that have correlated early treatment with better outcome [27]. In our study, the duration of untreated mental illness was shorter for type 1 diabetics n compared with type 2 patients. Again, stigma may prevent people from seeking immediate professional intervention and consequently increase the duration of untreated psychosis, which has a negative impact on the course of the chronic disease [28].

**Limitations**

The present study was limited by the fact that the sample comprised of psychiatric inpatients only. Thus our findings relate to patients suffering more severe forms of psychiatric illness as the participants comprised those admitted, involuntarily in many cases, to a psychiatric hospital. A more representative sample of psychiatric patients would also include outpatients.

Certain crucial variables, such as the onset of psychiatric illness, could not be measured by standardized instruments. Such variables were assessed by the clinical team and were based on patient and family member reports and records of treating facilities.

**Clinical implications**

The proportion of diabetes as the comorbid condition in our psychiatric population was almost 3 times higher than that expected in the general population [1–3,19]. Although there is significant variation in the comorbid prevalence of diabetes in psychiatric patients, this prevalence is consistently higher than would be expected in the general population.

Psychiatric patients with comorbid type 1 diabetes had a differential profile than those with comorbid type 2 diabetes. Type 1 diabetics tended to be younger at age of onset of the psychiatric disorder, single, have a diagnosis of either schizophrenia or bipolar II (manic phase). Type 1 diabetes typically preceded mental illness by less than 6 months. Type 2 diabetics tended to be older at age of onset of the psychiatric disorder, were married and had a diagnosis of schizophrenia or depression.

There was no significant difference in the outcome of the psychiatric disorder in patients with type 1 or type 2 diabetes as the comorbid condition. The existence of diabetes mellitus (regardless of type) and the duration of untreated mental illness were negative predictors of (unfavourable) outcome psychiatric disorders while provision of patient therapeutic education was positive predictor of (favourable) outcome.

**References**

Mental health and development: targeting people with mental health conditions as a vulnerable group

People with mental health conditions have been excluded from the development agenda despite being a marginalized and vulnerable group in countries all over the world. This report, Mental health and development: targeting people with mental health conditions as a vulnerable group, highlights the urgent need to redress this situation. It presents compelling evidence that people with mental health conditions meet major criteria for vulnerability and yet fall through the cracks of development aid and government attention. It makes the case for reaching out to this vulnerable group through the design and implementation of appropriate policies and programmes and through the inclusion of mental health interventions into broader poverty reduction and development strategies. It also describes a number of key interventions that can provide a starting point for these efforts. The report is a call to action to all development stakeholders – multilateral agencies, bilateral agencies, global partnerships, private foundations, academic and research institutions, governments and civil society – to focus their attention on mental health. By investing in people with mental health conditions, development outcomes can be improved.

Further information about this and other WHO publications is available at: http://www.who.int/publications/en/
Health care system in Saudi Arabia: an overview

M. Almalki,1,2 G. Fitzgerald2 and M. Clark2

ABSTRACT The government of Saudi Arabia has given high priority to the development of health care services at all levels: primary, secondary and tertiary. As a consequence, the health of the Saudi population has greatly improved in recent decades. However, a number of issues pose challenges to the health care system, such as a shortage of Saudi health professionals, the health ministry’s multiple roles, limited financial resources, changing patterns of disease, high demand resulting from free services, an absence of a national crisis management policy, poor accessibility to some health care facilities, lack of a national health information system, and the underutilization of the potential of electronic health strategies. This paper reviews the historical development and current structure of the health care system in Saudi Arabia with particular emphasis on the public health sector and the opportunities and challenges confronting the Saudi health care system.

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Introduction

Health care services in Saudi Arabia have been given a high priority by the government. During the past few decades, health and health services have improved greatly in terms of quantity and quality. Gallagher has stated that: "Although many nations have seen sizable growth in their health care systems, probably no other nation (other than Saudi Arabia) of large geographic expanse and population has, in comparable time, achieved so much on a broad national scale, with a relatively high level of care made available to virtually all segments of the population." [1]

According to the World Health Organization (WHO) [2], the Saudi health care system is ranked 26th among 190 of the world’s health systems. It comes before many other international health care systems such as Canada (ranked 30), Australia (32), New Zealand (41), and other systems in the region such as the United Arab Emirates (27), Qatar (44) and Kuwait (45). Despite these achievements, the Saudi health care system faces many challenges which require new strategies and policies by the Saudi Ministry of Health (MOH) as well as effective cooperation with other sectors.

This review outlines the historical development and current structure of the Saudi health care system. A particular emphasis has been given to the public health sector that is operated by the MOH, including the key opportunities and challenges it faces. In addition, this review highlights demographic changes and the economic context of Saudi Arabia in relation to the Saudi health care system.

Demographic and economic patterns of Saudi Arabia

The last official census in 2010 placed the population of Saudi Arabia at 27.1 million, compared with 22.6 million in 2004 [3]. The annual population growth rate for 2004 to 2010 was 3.2% per annum [3], and the total fertility rate was 3.04 [4]. Saudi citizens comprise around 68.9% of the total population; 50.2% are males and 49.8% females [3]; 67.1% of the population are under the age of 30 years and about 37.2% are under 15 years; the population over the age of 60 years is estimated at 5.2% [5]. According to United Nation projections, it is estimated that the population of Saudi Arabia will reach 39.8 million by 2025 and 54.7 million by 2050 [6]. This is a natural outcome of the high birth rate (23.7 per 1000 population), increased life expectancy (72.5 years for men, 74.7 years for women) [4] and declining mortality rate among infants and children [1]. The under 5 years of age mortality rate fell 250 per 1000 live births in 1960 [7] to 20.0 per 1000 in 2009 [4]. Apart from advancements in health care and social services, these improved statistics can mostly be attributed to the compulsory childhood vaccination programme implemented by the government since 1980 [7]. This unprecedented growth will increase the demand for essential services and facilities including health care, while at the same time creating economic opportunities.

Saudi Arabia is one of the richest and fastest growing countries in the Middle East. It is the world’s largest producer and exporter of oil, which constitutes the major portion of the country’s revenues [8,9]. In recent decades, however, Saudi Arabia has diversified its economy, and today produces and exports a variety of industrial goods all over the world. The sound economy and well-established industry base affects the Saudi community by increasing their income, leading to a per capita income of US$ 24,726 in 2008 [10] compared with US$ 22,935 in 2007, US$ 14,724 in 2006, US$ 13,639 in 2005 [11,12] and US$ 8,140 in 2000 [13]. Based on 2010 information, Saudi Arabia is ranked at a high level in the Human Development Index (0.75), which gives the country a rank of 55 out of 194 countries [10]. The improvement in the national income is expected to impact positively on its various services including the health care services.

Brief overview of health services development

Health services in Saudi Arabia have increased and improved significantly during recent decades [14]. The first public health department was established in Mecca in 1925 based on a royal decree from King Abdulaziz [15]. This department was responsible for sponsoring and monitoring free health care for the population and pilgrims through establishing a number of hospitals and dispensaries. While it was an important first step in providing curative health services, the national income was not sufficient to achieve major advances in health care, the majority of people continued to depend on traditional medicine and the incidence of epidemic diseases remained high among the population and pilgrims [15]. The next crucial advance was the establishment of the MOH in 1950 under another royal decree [15]. Twenty years later, the 5-year development plans were introduced by the government to improve all sectors of the nation, including the Saudi health care system [16]. Since then, substantial improvements in health care have been achieved in Saudi Arabia.

Current structure of health services

Currently the MOH is the major government provider and financier of health care services in Saudi Arabia, with a total of 244 hospitals (33,277 beds) and 2037 primary health care (PHC)
centres [4]. These services comprise 60% of the total health services in Saudi Arabia [4]. The other government bodies include referral hospitals (e.g. King Faisal Specialist Hospital and Research Centre), security forces medical services, army forces medical services, National Guard health affairs, Ministry of Higher Education hospitals (teaching hospitals), ARAMCO hospitals, Royal Commission for Jubail and Yanbu health services, school health units of the Ministry of Education and the Red Crescent Society. With the exception of referral hospitals, Red Crescent Society and the teaching hospitals, each of these agencies provides services to a defined population, usually employees and their dependants. Additionally, all of them provide health services to all residents during crises and emergencies [16].

Jointly, the government bodies operate 39 hospitals with a capacity of 10 822 beds [4]. The private sector also contributes to the delivery of health care services, especially in cities and large towns, with a total of 125 hospitals (11 833 beds) and 2218 dispensaries and clinics (Figure 1) [4].

The advancement in health services, combined with other factors such as improved and more accessible public education, increased health awareness among the community and better life conditions, have contributed to the significant improvements in health indicators mentioned earlier. It has been noted, however, that despite the multiplicity of health service providers there is no co-ordination or clear communication channels among them, resulting in a waste of resources and duplication of effort [17]. For example, there are considerable opportunities to take advantage of equipment, laboratories, training aids and well-trained personnel from different countries. However, as a result of poor coordination, the benefit of these opportunities is limited within each sector. In order to overcome this and to provide the population with up-to-date, equitable, affordable, organized and comprehensive health care, a royal decree in 2002 led to the establishment of the Council of Health Services, headed by theMinister of Health and including representatives of other government and private health sectors [18]. Although the aim of the Council was to develop a policy for coordination and integration among all health care services authorities in Saudi Arabia [19], significant progress has yet to be achieved in this area [20].

Figure 1 Current structure of the health care sectors in Saudi Arabia (MOH – Ministry of Health). Source of data: [4]
Public health care system (Ministry of Health)

In accordance with the Saudi constitution, the government provides all citizens and expatriates working within the public sector with full and free access to all public health care services [7,21]. Government expenditure on the MOH increased from 2.8% in 1970 [18] to 6% in 2005 and 6.2% in 2009 (Table 1) [4]. According to WHO the total expenditure on public health during 2009 was 5% of gross domestic product [22]. The MOH is responsible for managing, planning and formulating health policies and supervising health programmes, as well as monitoring health services in the private sector [23]. It is also responsible for advising other government agencies and the private sector on ways to achieve the government’s health objectives [16].

The MOH supervises 20 regional directorates-general of health affairs in various parts of the country [18]. Each regional health directorate has a number of hospitals and health sectors and every health sector supervises a number of PHC centres. The role of these 20 directorates includes implementing the policies, plans and programmes of the MOH; managing and supporting MOH health services; supervising and organizing private sector services; coordinating with other government agencies; and coordinating with other relevant bodies [23]. Figure 2 illustrates the organizational structure and the relationship of departments within the Saudi health care system from the community to MOH level. "Health friends" is a select committee consisting of useful and influential community members, including representatives from PHC centres, who are knowledgeable about common social norms and the potential of the community. The essential role of this committee is to liaise between PHC centres and the communities they serve [24,25].

Levels of health care services

The MOH provides health services at 3 levels: primary, secondary and tertiary [4]. PHC centres supply primary care services, both preventive and curative, referring cases that require more advanced care to public hospitals (the secondary level of care), while cases that need more complex levels of care are transferred to central or specialized hospitals (the tertiary level of health care).

Transition to PHC services

Until the 1980s, in line with the expectations of population, health services in Saudi Arabia were largely curative, emphasizing the provision of treatment for existing health problems [18,23]. The curative care model, however, can be costly to health providers, when many diseases can be prevented or minimized through developing a preventive strategy. A variety of preventive measures were run by the MOH through former health offices and to some extent through maternal and child health care centres. A number of disease control activities were performed by vertical programmes, e.g. malaria, tuberculosis and leishmaniasis control [18,23].

In accordance with the Alma-Ata declaration at the WHO General Assembly in 1978 [26], the Saudi MOH decided to activate and develop the preventive health services by adopting the PHC approach as one of its key health strategies. Consequently, in 1980, a ministerial decree was issued to establish PHC centres. The first step was to establish suitable premises throughout the country. Existing facilities located in adjacent areas were integrated into single units. These included former health offices, maternal and child health centres and dispensaries. The health posts in small and rural districts were upgraded to PHC centres [18,23]. The health centres aimed to focus on the 8 elements of the PHC approach: educating the population concerning prevailing health problems and the methods of preventing and controlling them; provision of adequate supply of safe water and basic sanitation; promotion of food supply and proper nutrition; provision of comprehensive maternal and child health care; immunization of children against major communicable diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and provision of essential drugs [24,25].

Focusing on a PHC strategy and applying a logical referral system has helped to reduce the number of visits to outpatient clinics [23]. About 82% of client visits to MOH facilities during 2009 were to PHC centres comprising more than $4 million PHC clients [4]. The creation of individual and family health records inside each PHC centre has reduced duplication of consultations. The use of the essential drugs list and documentation of prescriptions in patient health files has not only reduced the costs of medications, but also improved prescribing practices.

<table>
<thead>
<tr>
<th>Year</th>
<th>Government budget (SR)</th>
<th>MOH budget (SR)</th>
<th>%a</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>280 000 000</td>
<td>16 870 750</td>
<td>6.0</td>
</tr>
<tr>
<td>2006</td>
<td>335 000 000</td>
<td>19 683 700</td>
<td>5.9</td>
</tr>
<tr>
<td>2007</td>
<td>380 000 000</td>
<td>22 080 200</td>
<td>6.0</td>
</tr>
<tr>
<td>2008</td>
<td>450 000 000</td>
<td>25 220 200</td>
<td>5.6</td>
</tr>
<tr>
<td>2009</td>
<td>475 000 000</td>
<td>29 518 700</td>
<td>6.2</td>
</tr>
</tbody>
</table>

Source: [4].

aUS$ 1 = 3.75 SR; bAs a % of the total government budget.

SR = Saudi riyals

Table 1 Budget appropriations for the Ministry of Health (MOH) in Saudi Arabia in relation to the government budget, 2005–09
In recent years, the MOH has continued to develop the number of PHC centres (Figure 3) and has initiated further projects aimed at developing health care in general and PHCs in particular. For example, the project of the Custodian of the Two Holy Mosques aims to establish 2000 advanced PHC centres, and to develop the existing ones in terms of buildings, workforce and services.

Health services in the pilgrimage (hajj) season

Saudi Arabia has a unique position in the Islamic world, as it embraces the 2 holiest cities of Islam, Mecca and Medina. About 2 million pilgrims from all over the world perform the hajj annually. During the 2009 season, there were 2.3 million pilgrims, 69.8% of whom came from foreign countries [4]. Hosting such an event annually is a major challenge that requires a planned and organized effort across numerous agencies and departments to ensure adequate essential services, such as housing, transport, safety and health care [21].

Health care services in the hajj season provide preventive and curative care for all pilgrims, irrespective of their nationality. Preventive care includes health education programmes, vaccination and chemoprophylaxis for all pilgrims via quarantine services at airports and land ports. The provision of emergency and curative services takes place through a network of health care facilities. For example, in 2009, there were 21 hospitals, of which 7 were seasonal, with a total of 3408 beds and 176 beds for emergency admissions. There were also 157 PHC centres, of which 119 were seasonal. On average, each PHC centre treated 4734 pilgrims. The total workforce recruited to work in these facilities during 2009 was 17 886; an increase of 5% on the previous year. Of these, 69% were physicians, nurses and allied health personnel [4]. On average, each physician treated about 612 pilgrims, while each nurse treated about 372.
Every year, the Saudi health care agencies, particularly the MOH, seek to improve the health care services to pilgrims [21]. Nevertheless, the fact that all the services are provided free of charge for all pilgrims is creating considerable pressure on the health care budget and it may be necessary to seek ways to provide better services at a lower cost. One suggestion is to introduce a seasonal health insurance for all international pilgrims.

Challenges for health care reform

While many steps have been undertaken by the MOH to reform the Saudi health care system, a number of challenges remain. These relate to the health workforce, financing and expenditure, changing patterns of diseases, accessibility to health care services, introducing the cooperative health insurance scheme, privatization of public hospitals, utilization of electronic health (e-health) strategies and the development of a national system for health information.

Health workforce

The Saudi health care system is challenged by the shortage of local health care professionals, such as physicians, nurses and pharmacists. The majority of health personnel are expatriates and this leads to a high rate of turnover and instability in the workforce [27]. According to the MOH the total health workforce in Saudi Arabia, including all other sectors, is about 248 000; more than half of them (125 000) work in the MOH [4]. Saudis constitute 38% of this total workforce. Of these, 23.1% are physicians, while 32.3% are nurses (Figure 4). In the MOH, Saudis constitute about 54% of the health workforce, (physicians 22.6% and nurses 50.3%). The rates of physicians and nurses in Saudi Arabia are 16 and 36 respectively per 10 000 population, lower than in other countries such as Bahrain (30 and 58 per 10 000), Kuwait (18 and 37 per 10 000), Japan (12 and 95 per 10 000), Canada (19 and 100 per 10 000), France (37 and 81 per 10 000) and the United States of America (27 and 98 per 10 000) [28].

The ability to formulate and apply practical strategies to retain and attract more Saudis into the medical and health professions, particularly nursing, is a clear priority for effective reform of the Saudi health care system. Many efforts have been taken by the government to teach and train Saudis for health professional jobs. Since 1958, a number of medical, nursing and health schools have been opened around the nation to meet this goal [7]. Apart from private colleges and institutes, there are a total of 73 colleges for medicine, health and nursing as well as 4 health institutes in Saudi Arabia [4]. Efforts to establish such colleges are in accordance with training programmes that aim to substitute the largely expatriate workforce with qualified Saudi Arabian nationals in all sectors, including health [18,29]. The budget allocation for training and scholarships has increased and many MOH employees are offered a chance to pursue their studies abroad [18]. This strategy could improve the skills of current employees, raise the quality of health care and, it is hoped, decrease the rate of turnover among health professionals. However, these efforts may not be enough to solve the challenges. The proportion of Saudi Arabian health professionals in the MOH workforce is expected to decrease in the future as the expansion in health care facilities around the country has the effect of spreading a scare resource even more thinly [17,30].
More realistic plans and long-term strategies need to be consolidated by the MOH in cooperation with government and private sectors. A good example of such cooperation is the King Abdullah international scholarship programme which was established by the Ministry of Higher Education. In its stage 4, priority has been given to medical specialists including medicine, nursing, pharmacy and other health majors [31]. However, more medical colleges and training programmes need to be established around the country. New laws and regulations to develop and reorganize medical human resources by the MOH are urgently required.

**Reorganization and restructuring of the MOH**

The public health sector is overwhelmingly financed, operated, controlled, supervised and managed by the MOH [32]. This model of management may not be able to meet the population’s health care needs into the future unless serious and well-planned steps are taken to separate these multiple roles. Possible solutions include giving more authority to the regional directorates, applying the cooperative health insurance scheme and encouraging the privatization of public hospitals.

**Decentralization of health services and autonomy of hospitals**

To meet increasing pressure on the MOH, more autonomy has been given to the regional directorates in terms of planning, recruitment of professional staff, formulating agreements with health services providers (operating companies) and some limited financial discretion. It has been suggested that the functioning of the regional directorates is adversely affected by the lack of individual budgets and spending authority [16]. Expenditure for the majority of their activities must be authorized by the MOH, thus affecting the autonomy of regional directorates and hampering effective decision-making.

In terms of hospital autonomy, the MOH has tried a number of strategies for improving the management of public hospitals during past decades, including direct operation by the MOH, cooperation with other governments such as the Netherlands, Germany and Thailand, partial operation by health care companies, comprehensive operation by health care companies and the autonomous hospital system [33]. Considering the advantages and disadvantages of these approaches, the MOH has standardized an autonomous hospital system for 31 public hospitals in various regions [34]. The autonomous hospital system for public hospitals is expected to raise the efficiency of their performance in both medical and managerial functions, achieve financial and administrative flexibility through adopting a direct budget strategy, apply quality insurance programmes and simplify the contractual process with qualified health professionals [33]. In 2009, the MOH issued new regulations for self-operating public hospitals to ensure a high level of management practices and to improve the quality of services provided [35]. Giving more autonomy to hospitals will help the transition to full privatization of public hospitals in Saudi Arabia. It gives public hospitals more experience in the management of their budgets, health care quality and workforce.

**Health insurance in Saudi Arabia**

Funding health care services is a central challenge faced by the MOH [32]. Since the total expenditure on public health services comes from the government and the services are free-of-charge, this lead to considerable cost pressure on the government; particularly in view of the rapid growth in the population, the high price of new technology and the growing awareness about health and disease among the community [14]. To meet the growing population demands for health care and to ensure the quality of services provided, the Council for Cooperative Health Insurance was established by the government in 1999 [19]. The main role of this Council is to introduce, regulate and supervise a health insurance strategy for the Saudi health care market.

The implementation of a cooperative health insurance scheme was planned over 3 stages. In the first stage, the cooperative health insurance was applied for non-Saudis and Saudis in the private sector, in which their employers have to pay for health cover costs. In the second stage, the cooperative health insurance is to be applied for Saudis and non-Saudis working in the government sector. The government will pay the cooperative health insurance costs for this category of employee. In the final stage, the cooperative health insurance will be applied to other groups, such as pilgrims [36]. Only the first stage has been implemented to date, with the cooperative health insurance being implemented gradually in a 3-phase programme to employees of the private sector and their dependants [14,37]. The first phase covered companies with 500 or more employees, while the second phase applied to employers with more than 100 workers. The third phase included employees of all companies in Saudi Arabia as well as domestic workers [14,37]. The government is now working systematically to apply the remaining 2 stages—for employees in the government sector and for pilgrims—before they privatize the state-owned health care facilities [14]. No information is available yet regarding the cooperative health insurance scheme for the population of Saudi Arabia other than employees and expatriates.

While the market for cooperative health insurance in Saudi Arabia started with only 1 company in 2004, it currently involves about 25 companies. The introduction of the scheme is intended to decrease the financial burden on Saudi Arabia due to the costs associated with providing health services free-of-charge. It will also give people...
more opportunity to choose the health services they require [14]. The real challenge for policy-makers in Saudi Arabia is to introduce a comprehensive, fair, and affordable service for the whole population. Clearly lessons can be learned from the experiences of other countries, including the advantages and disadvantages of different schemes.

Privatization of public hospitals

Privatization of public hospitals has been seen by policy-makers and researchers as the best way to reform the Saudi health care system [38,39]. Steps to implement a privatization strategy have been initiated and related regulation has been passed by the government. As a result, a number of public hospitals are likely to be sold or rented to private firms over the next few years [14]. Privatization of hospitals is expected to bring a number of advantages to the government and to the nation. It is hoped that privatization will assist in speeding up decision-making, reducing the government’s annual expenditure on health care, producing new financial sources for the MOH and improving health care services [38).

On the other hand, privatization may affect the current integrated system between hospitals and PHC facilities [14]. As hospitals become privatized, they will focus on attracting patients, even those who may not require hospital-level care. Moreover, people with health cover may prefer to access big hospitals directly instead of via PHC centres or community hospitals. Additionally, private hospitals will have incentives to shift non-refundable costs back to the public PHC [14]. Such practices will place financial burdens on the government.

A further drawback of privatization is that the traditional state/public hospitals will not be able to absorb enough of the health care market compared with private companies, unless they upgrade at all levels (e.g. management, infrastructure and workforce) before starting to privatize [14]. In the move to privatize, private companies are likely to focus their activities within cities and larger communities, leaving people in rural areas at a disadvantage. The government should set regulations that protect the rights of rural communities and provide them with fair and equitable health care services.

Finally, if the government does not apply adequate control over the health care market, expenditure on health care may increase dramatically as a result of higher pricing and profit-seeking behaviour [14].

Accessibility to health services

Optimizing the accessibility of health care services requires equity in the distribution of health care facilities throughout the nation and equity of access to health professionals, including transport to services and providers. Accessibility is also affected by the level of cooperation between related sectors [23,39]. The current MOH statistics indicate that there is a maldistribution of health care services and health professionals across geographical areas [4]. People experience long waiting lists for many health care services and facilities [14]. Additionally, there is a dearth of services for disadvantaged groups such as the elderly, adolescents and people with special needs such as disability, particularly in rural areas [39]. Finally, many people do not have the ability to access health care facilities, particularly those living in border and remote areas.

In order to improve accessibility to health care services in all parts of the country, a holistic strategy for the redistribution of health care services, involving PHC centres, general hospitals, central and specialist hospitals as well as the health professionals, should be adopted by the MOH. The MOH should also liaise with other sectors such transport, water and power companies and social security services in order to develop services in deprived areas and to care for people with the greatest needs.

Patterns of diseases

The change in disease patterns from communicable to noncommunicable diseases in Saudi Arabia is another challenge that needs more attention from the MOH [21]. There has been an alarming increase in the prevalence of chronic diseases, such as diabetes, hypertension, and heart diseases, cancer, genetic blood disorders and childhood obesity [28,40,41]. Treatment of chronic diseases is costly and may even be ineffective [40]. For example, the annual cost for treatment of diabetes mellitus in Saudi Arabia was estimated to be 7 billion Saudi riyal (SR) (US$ 1.87 billion) [42]. Early prevention is the most effective way to reduce the prevalence of chronic diseases and the costs and difficulties associated with treatment in the later stages of disease. Any projected reforms in the health care system must involve plans to address this change in emphasis.

Promotion and prevention programmes for crises

Development and implementation of practical plans and procedures to meet national crises in Saudi Arabia, such as wars, earthquakes and fires and explosions at petroleum factories, are a further important need. Road traffic accidents, for example, killed more than 39,000 and injured about 290,000 people between 1995 and 2004 [43]. According to WHO, road traffic accidents are now the highest cause of death, injury and disability in adult males aged 16 to 36 years in Saudi Arabia [32]. Caring for people affected by road accidents consumes a significant proportion of the MOH budget; for example, the cost of treating injured people during 2002 was estimated to be SR 652.5 million (US$ 174 million) [43]. These funds could be used to develop the health system and improve services. Plans to manage issues of this kind need to be comprehensive and well-coordinated among the related sectors in order to be achievable.
e-health and national health information systems

There is increasing concern about the underutilization of electronic health systems in Saudi Arabia. Implementation of e-health and electronic information systems has already started in a number of hospitals and organizations such as the King Faisal specialist hospital and research centre, national guard health affairs, medical services of the army forces and university hospitals [44]. While uptake of e-health systems is moving slowly in MOH institutions, there are a number of information systems operating in the regional directorates and in central hospitals. Unfortunately, these information systems are not connected to each other or to other private or specialized health organizations [44].

To develop e-health services in the public sector, a budget of SR 4 billion (US$ 1.1 billion) was allocated by the MOH to run a 4-year development programme (2008–11) [45]. Additionally, a series of conferences on e-health have been held by the Saudi Association for Health Information to emphasize the importance of e-health in enhancing the quality of health care delivery and to explore the necessary strategies, policies, applications and infrastructure [46].

More coordination among different health care providers is needed in order to enhance the use of e-health strategies and to launch a comprehensive national system for health information. A high level of coordination must be achieved with other related sectors to provide the required infrastructure such as internet and phone services.

New strategy for health care services

To meet the challenges of the Saudi health care system and to improve the quality of health care services, the MOH has set a national strategy for health care services. This strategy was approved by the Council of Ministers in April 2009. It focuses on diversifying funding sources; developing information systems; developing the human workforce; activating the supervision and monitoring role of the MOH over health services; encouraging the private sector to take its position in providing health services; improving the quality of preventive, curative and rehabilitative care; and distributing health care services equally to all regions.

The national strategy for health care services is to be implemented by the MOH in cooperation with other health care providers and it will be supervised by the Council of Health Services. A 20-year timeframe for achieving the objectives of this strategy has been identified [39].

Conclusion

As a result of the continued attention to and support from the government, Saudi health services have advanced greatly over recent years in all levels of health services: primary, secondary and tertiary. As a consequence, the health of the Saudi population has improved markedly. The MOH has introduced many reforms to its services, with substantial emphasis on PHC.

Despite these achievements, health services, and in particular public sector health services, are still facing many challenges. These include: human resource development; separation of the MOH’s multiple roles (financing, provision, control and supervision of health care delivery); diversifying financial sources; implementing the cooperative health insurance, privatization of public hospitals, effective management of chronic diseases; development of practical policies for national crises; establishment of an efficient national health information system and the introduction of e-health. In order to address these challenges and continue to improve the status of the Saudi health care system, the MOH and other related sectors should coordinate their efforts to implement and ensure the success of the new health care strategy.

Acknowledgements

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ABSTRACT Opinions of university students about euthanasia were studied in 4 cities in Pakistan using convenience sampling. A total of 836 students (316 males and 520 females) completed a questionnaire in which euthanasia was defined as deliberate administration of an overdose of a drug by a doctor to relieve pain and suffering of a dying patient at his/her explicit request to end his/her life. Only 25.6% of students agreed that euthanasia should be legalized in Pakistan. The most common reason cited for legalization of euthanasia was to relieve patient’s suffering but only when a committee of physicians agreed to recommend it. Students who opposed legalization (74.4%) cited impediments to future medical research as the most common reason, followed by the risk of misuse by physicians or family members. Only 8.9% of students cited religious beliefs as a reason against legalization. There is a need in Pakistan for more debate about euthanasia.

Croyances concernant l’euthanasie chez les étudiants des universités pakistaniennes

RÉSUMÉ Les opinions des étudiants en université concernant l’euthanasie ont été examinées dans quatre villes du Pakistan à l’aide d’un échantillonnage de commodité. Au total, 836 étudiants (316 hommes et 520 femmes) ont rempli un questionnaire dans lequel l’euthanasie était définie comme l’administration délibérée d’une surdose de médicaments par un médecin pour soulager la douleur et la souffrance d’un patient mourant, à la demande explicite de ce dernier, afin de mettre fin à sa vie. Seuls 25,6 % des étudiants consentaient à la légalisation de l’euthanasie. La raison la plus fréquemment citée en faveur de la légalisation de l’euthanasie était le soulagement de la souffrance des patients, à condition qu’un comité de médecins soit d’accord pour proposer cette décision. Les étudiants opposés à la légalisation (74,4 %) invoquaient principalement l’entrave aux futures recherches médicales que représenterait cette pratique, puis le risque d’utilisation abusive par les médecins et les membres de la famille du patient. Seuls 8,9 % des étudiants citaient les croyances religieuses comme motif d’opposition à la légalisation. Il est nécessaire d’approfondir le débat sur l’euthanasie au Pakistan.

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Introduction

Physician-assisted suicide usually entails the use of drugs with the explicit purpose of causing death so as to ease suffering in a terminally sick patient. The United States National Cancer Institute defines euthanasia as “an easy or painless death, or the intentional ending of the life of a person suffering from an incurable or painful disease at his or her request” [1]. Although euthanasia has been legalized in some European countries [2,3] the practice is fraught with ethical, moral, social and economic controversy. Studies in other several countries have been done to evaluate the attitudes of health care personnel, as well as the general public, towards euthanasia [4–6]. Little is know about public attitudes in the Eastern Mediterranean region, however, and this is the first study in Pakistan to determine the opinions of university students about the legalization of euthanasia.

Methods

A cross-sectional survey from March to November 2007 was conducted among university students in the cities of Islamabad, Rawalpindi, Sahiwal and Multan. A convenience sampling method was used in which 5 graduate students approached students of both sexes on the campus of various universities in the 4 cities, and after obtaining verbal consent, distributed the questionnaires and collected the completed ones. Only those students enrolled in masters or higher degree programmes and aged ≤ 30 years were asked to complete the questionnaire.

The questionnaire was designed in a focus group with 6 students and revised after testing with 17 students. It defined euthanasia as deliberate administration of an overdose of a medication by a doctor at the request of a terminally ill patient suffering from unbearable pain to end his/her life. In total there were 8 questions, a mix of open and close-ended questions. There were 2 questions about euthanasia: “In your opinion, is euthanasia ethically justified?” (yes/no) and “Should euthanasia be legalized?” (yes/no). For the second question respondents chose from a list of reasons why it should be legalized/not legalized or could suggest “other” reasons in an open-ended format; respondents were allowed to give multiple answers.

Minitab version 15 was used to analyse the data.

Results

A total of 836 students participated in this study: 316 (37.8%) males and 520 (62.2%) females. The mean age was 22.9 (SD 2.3) years for males and 21.9 (SD 1.8) years for females. Students were from the various departments of the arts and sciences faculties of the selected universities; no medical students were involved. Most students (84.6%) were enrolled in a Masters programme, while the rest were enrolled in MPhil or doctoral programmes.

A small proportion of students (17.2%) described themselves as very religious, 75.1% as moderately religious, while the rest described themselves as somewhat religious.

One-third of students (35.4%) had heard the term euthanasia before (33.2% of male and 31.0% of female students) and nearly half (47.5%) had reportedly seen a terminally ill patient in the past year (56.0% of males students compared with 42.3% of female students).

Overall 214 students (25.6%) agreed that euthanasia should be legalized in Pakistan (27.9% of male and 24.2% of female students). Table 1 depicts the students’ responses to reasons for and against legalization of euthanasia, by sex. The most common reason accepted for allowing euthanasia was to end a patient’s pain/suffering (10.2% of students), but only after a committee of physicians agreed to it (12.2%). Similar proportions of male and female students agreed on the reasons for legalization of euthanasia.

Three-quarters of students (74.4%) did not think that euthanasia should be legalized (72.2% of male and 75.8% of female students). The main reasons against legalization were that it could be misused by family members or physicians or that future medical research to find better care of dying patients would be jeopardized. A minority of students (8.9%) thought it was not acceptable for religious reasons (5.7% of male and 10.8% of female students).

A total of 88 students (10.5%) gave no reasons for or against legalization.

Discussion

Euthanasia raises complex ethical and moral issues. Arguments against euthanasia include the fear of this practice becoming a cost containment measure, that it devalues human life, that it goes against the core values of medicine/physicians, and that condoning voluntary euthanasia is a “slippery slope” towards allowing involuntary assisted killing [7–12]. Some of the arguments favouring the practice found in other studies included the need to relieve severe and incurable pain in the context of terminal illness or extremely poor quality of life, allowing patients to exercise freedom of choice and freeing up medical resources to help others [4–7,13,14].

Although 47.5% of students in our survey had seen a terminally ill patient in the past year, only 25.6% overall believed that euthanasia was should be legalized in Pakistan. Only 35.4% students were familiar with the term euthanasia prior to this survey, nevertheless every student in this survey expressed an opinion about the legalization of euthanasia and only 10.5% of students did not provide any specific reason either for or against legalization.
In our study, the most commonly accepted reason for allowing euthanasia was to end a patient’s suffering, but only when a committee of physicians agreed to recommend this course of action. Students who opposed legalization of euthanasia most commonly believed that it would be an impediment to future medical research in finding a better care of dying patients. Misuse of euthanasia by physicians or by family members were the next most commonly stated reasons for opposing legalization. Euthanasia has strong religious implications, but although 75.1% of students described themselves as either moderately or somewhat religious, only 8.9% specifically cited religion as a factor against legalization.

There is a need in Pakistan for the professional medical societies to encourage a wider debate about euthanasia, taking account of religious beliefs and the ethical questions surrounding the suffering of dying patients [7,15]. The need for population-based surveys to determine opinions about euthanasia would be pivotal to inform the debate in Pakistan.

Table 1: Opinions about legalization of euthanasia among male and female university students in Pakistan

<table>
<thead>
<tr>
<th>Variable</th>
<th>Males (n = 316)</th>
<th>Females (n = 520)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Euthanasia should be legalized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No reason specified</td>
<td>88</td>
<td>27.8</td>
</tr>
<tr>
<td>To end patient’s pain/suffering</td>
<td>2</td>
<td>0.6</td>
</tr>
<tr>
<td>To respect patient’s wishes</td>
<td>30</td>
<td>9.5</td>
</tr>
<tr>
<td>To help patient die with dignity</td>
<td>18</td>
<td>5.7</td>
</tr>
<tr>
<td>Only if patient has severe and unrelieved pain</td>
<td>14</td>
<td>4.4</td>
</tr>
<tr>
<td>Only after psychiatric consultation</td>
<td>16</td>
<td>5.1</td>
</tr>
<tr>
<td>Only after obtaining a second opinion from another physician</td>
<td>17</td>
<td>5.4</td>
</tr>
<tr>
<td>Only after committee of physician agrees to it</td>
<td>11</td>
<td>3.5</td>
</tr>
<tr>
<td>Only with consent of family members</td>
<td>26</td>
<td>8.2</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>0.6</td>
</tr>
<tr>
<td>Euthanasia should not be legalized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No reason specified</td>
<td>228</td>
<td>72.2</td>
</tr>
<tr>
<td>Could be misused for incapable patients by family members</td>
<td>27</td>
<td>8.5</td>
</tr>
<tr>
<td>Could be misused by physicians</td>
<td>77</td>
<td>24.4</td>
</tr>
<tr>
<td>Could jeopardize future medical research on care of dying patients</td>
<td>76</td>
<td>24.1</td>
</tr>
<tr>
<td>Other</td>
<td>117</td>
<td>37.0</td>
</tr>
<tr>
<td>Religious belief</td>
<td>18</td>
<td>5.7</td>
</tr>
<tr>
<td>Belief that is suicide/murder</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Respondents could give multiple reasons.

References

Bioethics

The critical role of ethical practices in health care and research is not only well recognized to ensure equity in health care and research, but also is important to protect individuals and communities from unnecessary risks and harm.

Many countries in the Region have long been developing a core ethical framework for health care and research ethics. The overall direction of this development has been within the context of religious, social and cultural practices in the Region, while at the same time embracing the ethical values and principles of other nations that are not in conflict with the local value systems. Several countries in the Region have already developed capacities in health ethics, with properly instituted review and regulation processes in place. Egypt, Islamic Republic of Iran, Lebanon, Oman, Pakistan and Yemen have created national ethical review committees (ERCs), while Morocco, Saudi Arabia and Sudan, have institutional ERCs, which also double as national ERCs. Egypt and Islamic Republic of Iran have prepared their own national guidelines for ethics in health and Morocco, Saudi Arabia and Sudan are in the process of developing their own national guidelines. Formal long term (degree oriented) training programmes on ethics in health research ethics do not exist at present but informal short-term training is imparted at universities / organizations in Egypt, Islamic Republic of Iran, Lebanon, Pakistan, and Saudi Arabia.

Source: http://www.emro.who.int/rpc/Bioethics.htm
Case report

Churg–Strauss syndrome with broad spectrum clinical presentations: a report of 3 cases

B. Mokri, S.F. Tafti and F. Talischi

Introduction

Churg–Strauss syndrome (CSS) is a rare systemic vasculitis characterized by hypereosinophilia, necrotizing vasculitis with granulomas of extravascular eosinophils and asthma history [1]. CSS has also been shown to be a pathological syndrome of angiitis and allergic granulomatosis [2]. Three principal classifications are described:

- Lanham’s criteria which depend upon clinical aspects [1].
- Chapel Hill Consensus Conference [3].
- The American College of Rheumatology that has suggested 6 criteria from which 4 are required for a diagnosis of CSS with 99.7% specificity and 85% sensitivity. The 6 criteria include: asthma, eosinophilia > 10%, paranasal sinusitis, vasculitis based on histology, and mononeuritis multiplex [4].

Vasculitis lesions of CSS on histological examination are not typically seen in biopsies and are not specific for CSS; at the same time their absence is not cause to reject a diagnosis of CSS [5].

It is important to differentiate CSS from other systemic vasculitis because of the association between start of treatment and CSS prognosis [6,7].

In the present study, we report 3 CSS cases with diverse clinical presentations to investigate if a clinical approach and history of the patient could be diagnostic for CSS without invasive procedures such as histological confirmation by biopsy. We also sought to assess whether the absence of leukocytosis and eosinophilia could allow a diagnosis of CSS to be rejected.

Case reports

Case 1

A 19-year-old woman was admitted to our hospital, Masih Daneshvari Hospital, in November 2008 with pseudo common cold symptoms, myalgia, nasal congestion and urticarial rashes. She was discharged on steroid therapy prescribed following skin biopsy reports of urticarial vasculitis. Two weeks later, she returned to the centre with dyspnoea, wheezing and severe rhinorrhoea. On general examination, severe nasal polyps and bilateral wheezing on breathing were detected.

Laboratory findings revealed eosinophilia (blood eosinophil count of 33%), WBC 11 500/mm$^3$ and ESR 32 mm/h. Other laboratory findings were normal. Biopsy of the nasal mucosa showed eosinophilic infiltration. Computer tomography (CT) of the sinuses showed opacities in all sinuses. Nasal polypectomy was carried out and revealed vasculitis with perivascular granuloma. Chest spiral CT before hospitalization in this centre revealed patchy infiltrates.

The patient was diagnosed with CSS and prescribed prednisolone therapy (50 mg/day). She became symptom-free after 10 days. Up to May 2010, the patient had not been rehospitalized and now uses prednisolone (5 mg/day 3 days a week and 2.5 mg/day 4 days a week) and azathioprine (5 mg/day).

Case 2

A 55-year-old man with a 3-year history of dyspnoea, wheezing and recurrent sinusitis was hospitalized in June 2002 with haemoptysis. The patient had received inhaled bronchodilator drugs and steroids before hospital admission. He had had a nasal polypectomy 7 years before. On clinical examination, bilateral expiratory wheezing was noted in chest auscultation. Chest X-ray showed bilateral diffused alveolar patches.

In laboratory tests, blood eosinophilia (eosinophil count of 30%), WBC 22 000/mm$^3$ and ESR 45 mm/h were found. Laboratory indices for autoimmune diseases were absent. In addition, a sputum culture test was negative on 3 occasions. On the third hospital day, skin rashes appeared on the front of his legs. Skin biopsy was done and showed perivascular infiltration of neutrophils and eosinophils with fibrinoid necrosis. He was diagnosed with CSS and treated with methyl prednisolone pulse therapy (1 g) followed by oral steroids (50 mg/day) for 3 weeks. The patient died 4 years after discharge from hospital due to CSS recurrence.

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Case 3

A 45-year-old woman was hospitalized in our medical centre in January 2002 because of maculopapular rashes on her lower extremities, fever, dyspnoea and decreased muscle power in the right leg that started a month before admission. She had a 1-year history of bronchial asthma diagnosed by dyspnoea, cough and increased sputum production. She was taking corticosteroid, methotrexate and zafirlukast, which had not resulted in improvement. Physical examination revealed respiratory distress, skin rashes, inspiratory generalized wheezing in breathing and a neurological finding of mononeuritis multiplex that was confirmed by electromyography and nerve conduction studies. Laboratory findings showed WBC count of 20 100/mm³ and with eosinophil count of 10%. The other findings and collagen vascular tests were normal. Bilateral infiltration in the lower fields of the lungs was seen on chest X-ray. Water’s view X-ray of the skull demonstrated pansinusitis. Skin biopsy indicated perivascular infiltration of lymphocytes and eosinophils and also endothelial cell proliferation with a microgranuloma. Bronchoalveolar lavage revealed eosinophilia in bronchial secretion. She was diagnosed as CSS and the signs remitted after 2 weeks of treatment with corticosteroid. The patient has been free of symptoms with no recurrence of CSS to May 2010.

Discussion

CSS is a rare systemic small-vessel necrotizing vasculitis and multorgan disorder characterized by asthma, extravascular necrotizing granulomas, lung infiltrates and hypereosinophilia. Asthma and hypereosinophilia are the main features of CSS in most cases. Allergic rhinitis, maxillary sinusitis, and sinus polyposis are seen in 70% of patients. Antineutrophil cytoplasm antibodies (ANCA) are found in a third to a half of cases. General symptoms associated with pulmonary infiltrates, peripheral neuropathy, usually mononeuritis multiplex, and skin, gastrointestinal tract and cardiac involvement are frequent.

The pathophysiology of CSS suggests that ANCA are probably responsible for CSS vasculitic manifestations, while eosinophil infiltration and related cytotoxicity could be involved in cardiomyopathy.

The factors associated with poor prognosis of CSS are renal failure, severe gastrointestinal tract involvement, cardiomyopathy and central nervous systems involvement [8,9].

The first line therapy for CSS should include a high dose of a corticosteroid. Immunosuppressive cytotoxic therapy is indicated if corticosteroid therapy is insufficient to control the disease or when the patient has factors associated with poor prognosis. Intravenous immunoglobulin therapy can be used as a second line in cases resistant to the standard treatment, such as cases of neuropathy or cardiomyopathy. Follow-up treatment of CSS, the outcome is good with a 5-year survival of 90%, but asthma often remains [10].

CSS is distinguished by the presence of asthma history, blood eosinophilia and necrotizing vasculitis [1,11,12]. In the absence of any biopsy or bronchoalveolar lavage fluid, other disorders causing pulmonary eosinophilic infiltrates should be considered and the reasons for eosinophilic lung disease should sought. Based on the classification by Crofton et al, which was extended by Davis and Allen, Löffler syndrome, chronic and acute eosinophilic pneumonia, idiopathic hypereosinophilic syndrome, asthma, certain parasitic infections, drug reactions, bronchocentric granulomatosis and allergic bronchopulmonary aspergillosis (ABPA) are CSS differential diagnosis.

The most common differential diagnosis of CSS is ABPA which appears with central bronchiectasis and IgE increase. Absence of multisystem disease differentiates ABPA from CSS [13–15].

Chronic eosinophilic pneumonia, another differential diagnosis of CSS, presents with cough, fever, weight loss and dyspnoea. Most patients have asthma. Elevation of eosinophil count in peripheral blood and bronchoalveolar lavage fluid is seen in 90% of patients. The absence of multisystem involvement and radiographic findings showing peripheral infiltrates differentiates chronic eosinophilic pneumonia from CSS [16,17].

Another principal differential diagnosis of CSS is idiopathic hypereosinophilic syndrome. Similar to CSS, idiopathic hypereosinophilic syndrome causes multiorgan involvement, but is can be distinguished by a peripheral blood eosinophil count > 1500/mm³ for more than 6 months [18]. Therefore, clinical pictures, laboratory findings and course of illness can differentiate idiopathic hypereosinophilic syndrome and CSS [7].

Normal cardiac size, absence of pleural effusion and nonetnse of irreversibe pulmonary complications such as honeycomb fibrosis, traction bronchiectasis and architectural distortion in high-resolution CT can lead to CSS diagnosis. Also, arthropathies, ophtalmopathies and hepatobiliary involvement are very rare in CSS versus other vasculitis disorders [7,19]. Some studies have reported that CSS can appear following the use of leukotriene-modifying drugs, corticosteroid withdrawal and history of polypectomy and vaccination desensitization, but these criteria cannot be considered diagnostic [20–22].

Recent reports of CSS suggest an increase in CSS incidence in the Islamic Republic of Iran; however the exact incidence of CSS is not known [23–25].

All 3 of our patients had a history of severe asthma and were found to have eosinophilia. In the first patient, nasal polyp, urticarial skin lesions and eosinophilic infiltrations in polyps as
well as vasculitis with granuloma in the nasal mucosa were found and led to a diagnosis of CSS. In the second patient, haemoptysis, skin rashes on the legs, pulmonary infiltration, perivascular fibro-necrosis, neutrophil and eosinophil infiltration led to CSS diagnosis. In the last patient, skin rashes, fever, right foot weakness with electromyography and nerve conduction velocity findings were diagnostic manifestations for CSS.

As can be seen with our cases, CSS can present with a broad range of clinical features. We carried out clinical and laboratory investigations for our patients which were appropriate and helpful for diagnosis of CSS; however excluding other causes of eosinophilia and establishing vasculitis in the patients was necessary to distinguish from other disorders and diagnose CSS.

Therefore, we believe CSS can be diagnosed by an accurate history, clinical examination and laboratory tests with no need for invasive procedures such as lung biopsy.

Our conclusion is based on only 3 cases and the diagnosis was not confirmed by biopsy/bronchoalveolar lavage fluid. However, it suggests that CSS could be diagnosed without invasive tests, which would be beneficial for patients and reduce costs for hospitals. There is a need therefore for further research with a large sample and comparing with the gold standard to establish whether CSS can be reliably diagnosed without the need for lung biopsy.

References

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Hospitals around the Region

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