Annual Congress 2011
Being at the Leading Edge – How to Give Quest for Excellence a New Meaning
January 31st - 3rd February 2011 Atlantis, The Palm Dubai, UAE

3rd e-Health Conference in the Middle East
Excellence in Healthcare: From Global Perspectives to Local Opportunities

Proceedings of Conference
Edited by
Syed Aziz Anwar

Hamdan Bin Mohammed e-University
P.o. Box 71400
Dubai
United Arab Emirates
# Table of Contents

**Foreword** ................................................. 4  
Dr. Narimane Hadj-Hamou  Assistant Chancellor for Academic Development, Hamdan Bin Mohammed e-University  
Congress Chair ........................................ 4

**Technical Papers** ........................................ 5  
Dubai’s Need for Innovative Municipal Solid Waste Treatment Technologies .......... 6  
Rashed M. Karkain ........................................ 6

Challenges in Implementing Information and Communication Technology (ICT) in Tertiary Care Hospital: Case Studies of Five Hospitals in Saudi Arabia ................. 45  
Ammah Bindakheel ........................................ 45  
Rosmini Omar ........................................ 45

Nutritional Status in Postmenopausal Women Admitted in Osteodensitometry Center and its Relationship with Bone Mass Density in Isfahan, Iran ......................... 53  
Zamzam Paknahad ........................................ 53  
Zahra Bonakdar ........................................ 53  
Zinat Sharif Hosein ........................................ 53  
Akbar Hasan Zadeh ........................................ 53

Are Public Hospitals in Saudi Arabia Ready to Implement Electronic Health Records? Hospital Managers’ Perspective ......................... 59  
Fares Alshammari ........................................ 59

Calcium Intake and Body Mass Index Status in Women Attending Health Centers and Health Care Providers in Tabtiz, Iran ........................................ 73  
Rafraf M. ........................................ 73  
Bazyun B. ........................................ 73

Relationship between Patients’ Understanding of Treatment Plan and Medication Compliance ........................................ 79  
Ahmed I. Albarrak ........................................ 79  
Jawaher Almulhem ........................................ 79  
Saad H. Alfraikh ........................................ 79  
Mohammed Alotaibi ........................................ 79

Participation of Patients with Chronic Illness in Nursing Care: An Iranian Perspective 91  
Mohsen Soleimani ........................................ 91  
Forough Rafii ........................................ 91  
Naiemeh Seyedfatemi ........................................ 91

An Examination of the Role Discrepancy and Turnover Intention Among ICU Nurses at a Jordanian Teaching Hospital ........................................ 102  
Muhammad W. Darawad ........................................ 102
Enhancing the Learner Experience: Accessing Learners’ Utilization of Communicative Tools in Online Health Courses ................................................................. 117
Samer Hamidi ........................................................................................................ 117

RFID Tracking and Record Management for e-Health in Developing Countries 130
Ali Zalzala ........................................................................................................... 130
Laura Zalzala ...................................................................................................... 130
Shekhar Mehta .................................................................................................... 130
Stanley Chia ........................................................................................................ 130
Ali Karimi .......................................................................................................... 130

A Case Study of e-Health Usage Trends amongst Arab Undergraduate Students in the UAE 143
Syed Kabir Nasir ................................................................................................. 143
Syeda Shahla Kabir ............................................................................................. 143

Pulmonary Hydatid Cyst in Duhok ................................................................. 157
Mohammed Salil Al-Ani .................................................................................... 157

List of Reviewers ................................................................................................ 168
Foreword

Dr. Narimane Hadj-Hamou
Assistant Chancellor for Academic Development, Hamdan Bin Mohammed e-University
Congress Chair

One of the strengths of health and environment as an area of research is its diversity. The terrain of health and environment is almost everything and everywhere. One can safely say that health and environment issues affect our life more than anything else. As our life is characterized by diversity and is expressed in so many ways by so many people all over the world, so is the area of health and environment. Looking at the scientific papers that have come from various parts of the world for this conference is a proof of this statement.

The papers compiled in this conference proceedings focus on a wide range of issues facing decision makers all over the world. The depth and breadth of issues tackled by the authors show that health and environment involve a complex interactive process between policies, history, governance and leadership. Although the complex interactive process involving healthcare and environment is inevitable in the contemporary world, the question of how to solve problems stemming from the impact of deteriorating environment on healthcare management is the point of departure for viable discussion for policy makers. Such a discussion concerns an inquiry into the core challenge in the existing literature.

I am pleased to see that the papers compiled here address some of the challenges facing scholars and policymakers. The debates and discussions at various multilateral fora such as WHO point to the pressing need for mankind to address the pressing issues related to health and environment. The scientific papers and case studies presented here have surely upgraded the level of importance of health and environment issues of our time. We received a large number of papers for this conference. The Conference Chair and the Technical Committee members have done a great job to review and accept the papers for presentation at the conference sessions. The papers span departments, methodological approaches, geographic domains of inquiry and even geographic locations.

While several points made in the papers have been argued in venues including the UN forums, the papers assembled here build upon that prior work using case studies, new empirical methodologies and new data sets to make progress in the analysis of the impact of the environment on healthcare issues. They offer more richness in the operationalisation of the issues and imaginative research design and analyses to capture the impact of the environment on healthcare strategy. I believe, the papers presented in this volume of proceedings contain interesting ideas and directions for future research.

I hope, you will benefit from the papers compiled here. I wish you a very fruitful and enjoyable conference.
Dubai’s Need for Innovative Municipal Solid Waste Treatment Technologies

Rashed M. Karkain
Waste Management Department, Dubai Municipality

Abstract
Over the course of the next 20 years, there are development plans for the Emirate of Dubai, which will substantially increase the permanent resident population. Such growth projections would also dramatically affect the underlying environmental and the waste management infrastructure. Principal amongst this is the management of municipal solid waste generated within a growing economy. At present reliance of waste management is on disposal of waste in landfills.

With an intention to dramatically reduce the amount of waste being landfilled, inline with the ideals of modern society, other methods of innovative and sustainable waste management facilities must be introduced to the Emirate’s waste management system.

This paper will proceed by first carrying out a situation analysis of municipal solid waste with respect to the waste quantity and waste characterization in the Emirate of Dubai and projection of such for next 20 years. These data will be collected on a format of survey or spread sheet documents from concerned stakeholders such as Dubai Municipality’s Waste Management Department as well as private Waste Management Companies. Then, innovative technologies in line with international best practices will be identified, analyze and compared among each other and will conclude by proposing the best innovative technology that is suitable as an immediate and sustainable solution to Emirate of Dubai’s Waste Management. A search of such innovative technology provider will be carried out at the Internet for related technical data.

Keywords: Waste Treatment Technology, Waste Characterization, Sustainable Waste Management

Introduction
Over the course of the next 20 years, there are development plans for Dubai, which will substantially increase the permanent resident population. Such growth projections would also dramatically affect the underlying environmental and the waste management infrastructure. Principal amongst this is the management of municipal solid (MSW) waste generated within a growing economy and the associated waste increase. At present reliance of waste management is on disposal of MSW in landfills. With an intention to dramatically reduce the amount of MSW being landfilled, commensurate with the ideals of modern society, other methods of innovative and sustainable waste management facilities must be introduced to the Emirate’s current waste management system. Currently Dubai generates about 10,000 tonnes per day (tpd) of MSW and with the 1,000 tpd operational capacity of a Dirty Material Recycling Facility (MRF) that has been commissioned by a private sector, this will have a small effect on reducing the amount of waste being landfilled because of a low recovery rate and represents a fraction of the facilities that will be needed as the decades pass.
In response to these concerns and in the context of such significant and diverse growth, this study is to review and evaluate the innovative municipal waste treatment needs for the Emirate of Dubai.

Population

Dubai has seen a dramatic population increase in its short history. Since 1975 there has been an increase in population from 183,187 people to 1,645,973 in 2008. This is shown graphically in Figure 1.

![Figure 1 - Dubai's population trends](image)

The change in population growth rate as reported on the Dubai Statistics Website are summarised below:

- 1975 – 1980: 8.2%
- 1980 – 1985: 5.9%
- 1985 – 1993: 6.2%
- 1993 – 1996: 6.0%
- 1995 – 2000: 4.5%
- 2000 – 2005: 7.3%

Waste Characteristics

This section looks at waste characteristics for Dubai, including the types of waste, historical increase and trends of the different types and the composition of materials in the waste. The five major types of solid wastes in Dubai are:

- Municipal (general) Solid Wastes (MSW)
- Construction and demolition (C&D)
- Industrial (non hazardous)
- Hazardous
- Horticultural

MSW covers household/domestic waste, some commercial waste (such as shops, malls, restaurants and hotels), government and public buildings waste, street sweepings and beach litter and waste from other areas such as the various transport networks and some of the waste from airports and ports.

Waste Emergence

Figure 2 shows the percentage breakdown of the MSW (general), C&D, horticultural and hazardous streams in the overall waste. It has not been possible to show the percentage of industrial non-hazardous waste as this information has not been made available at the time of writing this paper, however it is expected that some industrial non-hazardous waste would be incorporated in the MSW.
figures due to mixed collection. From this figure it can be seen that by far the largest waste stream in Dubai is construction and demolition waste.

**Figure 2 – Percentage of waste types in 2008**

**MSW (General Waste)**

In 2008 MSW arisings were recorded as being 11,253 tonnes per day, approximately 4.11 million tonnes per year. This has increased from 1.05 million tonnes in 2000, with the highest increase of nearly 32% between 2004 and 2005. This can be seen in Figure 3.

**Figure 3 – Municipal solid waste Arisings Trends 2000 – 2008 (tonnes per day)**

**City Comparisons**

This section compares Dubai’s waste arisings with other cities around the world. The figures below compare Dubai’s MSW and C&D waste with other major cities in the world. Of the cities shown in Figure 4, Dubai
is only the sixth highest producer of MSW overall.

![Diagram showing comparison of waste arisings in MTPA (millions of tonnes per annum) for major cities](image1)

**Figure 4 - Comparison of waste arisings in MTPA (millions of tonnes per annum) for major cities**

When MSW is analysed as a per capita figure (as shown in Figure 5) Dubai is the second highest producer after Abu Dhabi. One of the reasons for this may be the way waste is classified and managed in Dubai. MSW in Dubai includes commercial waste and most likely some non-hazardous industrial waste.

![Diagram showing comparison of waste arisings in tonnes per capita per annum in major cities (2008)](image2)

**Figure 5 - Comparison of waste arisings in tonnes per capita per annum in major cities (2008)**

**Waste Composition Analysis**

This section presents the composition of MSW to identify the main components of such waste stream. This is important as it can show what percentage of the waste can potentially be recycled, treated or safely disposed of.

Dubai Municipality has conducted a relatively detailed MSW analysis since 2003 for approximately 40 days during the spring and summer of each year at the Al Qusais disposal site. Tables 1 and 2 show the weight and percentage breakdown of the analysed waste.
Statistics from 2008 show organic waste as the largest component at 34% and plastic and paper as the second and third largest components at 18% and 15% respectively.

Table 1 - Major Waste Components of Municipal solid waste by Weight tonnes: 2003-2007

<table>
<thead>
<tr>
<th>Waste Component</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>400,727</td>
<td>468,311</td>
<td>487,172</td>
<td>526,816</td>
<td>501,401</td>
<td>125%</td>
</tr>
<tr>
<td>Plastic</td>
<td>301,688</td>
<td>346,299</td>
<td>342,913</td>
<td>555,906</td>
<td>590,100</td>
<td>196%</td>
</tr>
<tr>
<td>Glass</td>
<td>109,705</td>
<td>113,040</td>
<td>201,018</td>
<td>143,122</td>
<td>154,972</td>
<td>141%</td>
</tr>
<tr>
<td>Metal</td>
<td>92,944</td>
<td>95,098</td>
<td>170,274</td>
<td>105,596</td>
<td>102,088</td>
<td>110%</td>
</tr>
<tr>
<td>Green</td>
<td>19,808</td>
<td>48,446</td>
<td>153,719</td>
<td>113,159</td>
<td>302,916</td>
<td>1,530%</td>
</tr>
<tr>
<td>Organic</td>
<td>425,106</td>
<td>504,196</td>
<td>539,200</td>
<td>988,471</td>
<td>1,140,034</td>
<td>268%</td>
</tr>
<tr>
<td>Rubber</td>
<td>6,095</td>
<td>10,766</td>
<td>52,028</td>
<td>20,654</td>
<td>19,413</td>
<td>319%</td>
</tr>
<tr>
<td>Wood</td>
<td>42,663</td>
<td>64,595</td>
<td>120,611</td>
<td>103,851</td>
<td>91,377</td>
<td>214%</td>
</tr>
<tr>
<td>Textile</td>
<td>70,089</td>
<td>84,332</td>
<td>172,639</td>
<td>130,031</td>
<td>87,360</td>
<td>125%</td>
</tr>
<tr>
<td>Inert</td>
<td>19,808</td>
<td>21,532</td>
<td>75,677</td>
<td>134,977</td>
<td>237,312</td>
<td>1,198%</td>
</tr>
<tr>
<td>Household Hazardous Waste</td>
<td>6,095</td>
<td>5,383</td>
<td>9,460</td>
<td>2,036</td>
<td>10,041</td>
<td>165%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>18,284</td>
<td>23,326</td>
<td>40,204</td>
<td>84,070</td>
<td>109,786</td>
<td>600%</td>
</tr>
</tbody>
</table>

Table 2 – Composition by Major Waste Components of Municipal solid waste by Percentage Weight: 2003 – 2007

<table>
<thead>
<tr>
<th>Waste Components</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>26.3</td>
<td>26.1</td>
<td>20.6</td>
<td>18.11</td>
<td>14.98</td>
<td>-43%</td>
</tr>
<tr>
<td>Plastic</td>
<td>19.8</td>
<td>19.3</td>
<td>14.5</td>
<td>19.11</td>
<td>17.63</td>
<td>-11%</td>
</tr>
<tr>
<td>Glass</td>
<td>7.2</td>
<td>6.3</td>
<td>8.5</td>
<td>4.92</td>
<td>4.63</td>
<td>-36%</td>
</tr>
<tr>
<td>Metal</td>
<td>6.1</td>
<td>5.3</td>
<td>7.2</td>
<td>3.63</td>
<td>3.05</td>
<td>-50%</td>
</tr>
<tr>
<td>Green</td>
<td>1.3</td>
<td>2.7</td>
<td>6.5</td>
<td>3.89</td>
<td>9.05</td>
<td>696%</td>
</tr>
<tr>
<td>Organic</td>
<td>27.9</td>
<td>28.1</td>
<td>22.8</td>
<td>33.98</td>
<td>34.06</td>
<td>122%</td>
</tr>
<tr>
<td>Rubber</td>
<td>0.4</td>
<td>0.6</td>
<td>2.2</td>
<td>0.71</td>
<td>0.58</td>
<td>145%</td>
</tr>
<tr>
<td>Wood</td>
<td>2.8</td>
<td>3.6</td>
<td>5.1</td>
<td>3.57</td>
<td>2.73</td>
<td>-2%</td>
</tr>
<tr>
<td>Textile</td>
<td>4.6</td>
<td>4.7</td>
<td>7.3</td>
<td>4.47</td>
<td>2.61</td>
<td>-43%</td>
</tr>
<tr>
<td>Inert</td>
<td>1.3</td>
<td>1.2</td>
<td>3.2</td>
<td>4.64</td>
<td>7.09</td>
<td>545%</td>
</tr>
<tr>
<td>Household Hazardous Waste</td>
<td>0.4</td>
<td>0.3</td>
<td>0.4</td>
<td>0.07</td>
<td>0.30</td>
<td>-25%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1.2</td>
<td>1.3</td>
<td>1.7</td>
<td>2.89</td>
<td>3.28</td>
<td>273%</td>
</tr>
</tbody>
</table>

**Existing Waste Management System**

Waste management covers the supervised handling of waste materials from their source through recovery processes to treatment and disposal. A variety of different mechanisms are utilised across Dubai to manage waste depending on area and type and this section provides a brief summary of the main waste systems currently in use.

**Waste Management Facilities**

A number of waste management facilities are in operation across the Emirate of Dubai to manage the range of waste streams produced. Table 3, below, shows the name of the waste management sites, the waste being managed and the type of facility.
Table 3 – Dubai Municipality Waste Management Facilities

<table>
<thead>
<tr>
<th>Site</th>
<th>Facility Type</th>
<th>Waste Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al Qusais</td>
<td>Landfill</td>
<td>MSW, C&amp;D, Waste Tyres</td>
</tr>
<tr>
<td>Warsan</td>
<td>Landfill</td>
<td>MSW</td>
</tr>
<tr>
<td>Tadweer (adjacent to Warsan)</td>
<td>MRF</td>
<td>MSW</td>
</tr>
<tr>
<td>Lehbab</td>
<td>Landfill</td>
<td>MSW</td>
</tr>
<tr>
<td>Al Warqaa</td>
<td>Landfill</td>
<td>MSW</td>
</tr>
<tr>
<td>Bayadha</td>
<td>Landfill</td>
<td>C&amp;D</td>
</tr>
<tr>
<td>Al Lusaily</td>
<td>Treatment facility</td>
<td>C&amp;D</td>
</tr>
<tr>
<td>Jebel Ali</td>
<td>Treatment facility</td>
<td>Hazardous waste</td>
</tr>
<tr>
<td>Medical incinerator</td>
<td>Medical</td>
<td></td>
</tr>
<tr>
<td>Landfill</td>
<td>MSW and C&amp;D</td>
<td></td>
</tr>
</tbody>
</table>

A location map of the facilities is shown below in Figure 6.

Figure 6 – Location Map of Dubai Municipality Waste Management Facilities

Dubai Municipality is responsible for the operation and management of all the landfill disposal sites and the hazardous waste treatment facility as well as medical incinerator at the Jebel Ali site. There is currently no bulking of waste in Dubai and all the waste is direct delivered to the treatment/disposal facilities.

Waste Quantities Managed at the Waste Management Facilities

Details of the quantities of MSW handled by each facility are provided in Table 4 below. This table shows that the two dominant landfills for MSW in Dubai are Al Qusais and Jebel Ali receiving 53% and 40% of municipal solid waste respectively.
Table 4: Municipal solid waste Facilities for 2008

<table>
<thead>
<tr>
<th>Disposal site</th>
<th>Waste TPA</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al Qusais</td>
<td>2,171,834</td>
<td>53</td>
</tr>
<tr>
<td>Jebel Ali</td>
<td>1,654,752</td>
<td>40</td>
</tr>
<tr>
<td>Lebab</td>
<td>59,302</td>
<td>1</td>
</tr>
<tr>
<td>Hatta</td>
<td>8,581</td>
<td>1</td>
</tr>
<tr>
<td>Warsan</td>
<td>212,804</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>4,107,273</td>
<td>100</td>
</tr>
</tbody>
</table>

Historical data in Figure 7 show that since 2005, Al Qusais has been the dominant landfill accepting MSW at a relatively consistent level, though there is a slight decrease from 2007 to 2008. However, in 2008 Jebel Ali’s municipal solid waste input was double that of 2007 which accounts for the majority of the municipal solid waste growth in Dubai along with other smaller landfills, which also saw an increase in their input in 2008.

Figure 7 – Destination of Municipal solid waste to Landfill for 2005 – 2008

*Al Warqaa is now closed*

**Waste Management Facility Environmental Issues**

The main environmental concerns for the existing MSW waste management facilities that all the existing waste landfills are not engineered landfills and can only be considered as large dumpsites with soil cover operation. Many of these landfills are either
located within developed areas such as Al Qusais Landfill or partially developed or future development areas such as Warsan and Al Waraqaa Landfill. The potential environmental impacts for the existing waste management facilities including the treatment facilities; the waste recovery facilities and landfills are related to site selection issues and the poor design and operations practices. The existing general waste recovery facility employs a Dirty MRF, which is less efficient in diverting waste from landfills than the Clean MRF.

The environmental impacts from the existing waste management facilities are summarised in Table 5. There is a need for improving the existing practices with regard to waste management facility including site selection, facility planning, design, operation and maintenance, closure and decommissioning. There is also an urgent need for implementation of innovative treatment technologies to minimize the land filling of MSW.

### Table 5 - Summary of the Environmental Concerns

<table>
<thead>
<tr>
<th>Waste Management Facility</th>
<th>Facility Type</th>
<th>Environmental Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al Qusais</td>
<td>General Waste Landfill</td>
<td>X</td>
</tr>
<tr>
<td>Warsan</td>
<td>General Waste Landfill</td>
<td>X</td>
</tr>
<tr>
<td>Tadweer (adjacent to Warsan)</td>
<td>MRF</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Composting Plant (window)</td>
<td>X</td>
</tr>
<tr>
<td>Lehab</td>
<td>General Waste Landfill</td>
<td>X</td>
</tr>
<tr>
<td>Al Warqaa*</td>
<td>Landfill</td>
<td>X</td>
</tr>
<tr>
<td>Bayadha</td>
<td>C&amp;D Waste Landfill</td>
<td>X</td>
</tr>
<tr>
<td>Al Lusailly</td>
<td>C&amp;D Recycling Facility</td>
<td>X</td>
</tr>
<tr>
<td>Jebel Ali</td>
<td>Hazardous Waste Treatment Facility</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Hazardous Waste Landfill</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>General Waste Landfill</td>
<td>X</td>
</tr>
<tr>
<td>Hatta</td>
<td>Landfill</td>
<td>X</td>
</tr>
</tbody>
</table>

**Factors Leading to High Landfill Disposal**

This paper has highlighted the issue that the majority of waste produced in Dubai is disposed of in landfills. Problems with disposing waste to landfill include pollution of the environment and a lack of space for expansion of facilities. International best practice places landfill disposal as the least desirable option for waste management, hence moving forward any waste management strategy should look to reduce the amount of waste being sent to landfill. Issues that have
lead to high rates of landfill disposal are outlined as below:

- Low levies for waste disposal to landfill (AED10 per vehicle) and therefore no financial incentives to reduce waste at source or divert waste from landfill.
- Contaminated waste arriving at sorting facilities.
- Limited recycling facilities with no support to local recycling facilities that need to compete with international markets to buy waste.
- Limited and mixed infrastructure for source segregation.
- A culturally diverse population with limited awareness programmes for residents as to why waste management is important.

**Innovative MSW Treatment Technologies**

Most of Dubai’s MSW is collected in a mixed form and mostly deposited in landfills. However, there are a number of different routes, which the Municipality can adopt to derive value from waste. If waste is collected in multiple streams by segregating the waste at source then potentially even greater benefits can be yielded.

This section of the paper will focus on the mechanisms by which municipal solid waste can be treated and for convenience divided into the following categories:

- Recycling Centres
- Materials Recycling Facilities
- Organic Waste Composting
- Mechanical Biological Treatment
- Mechanical Heat Treatment
- Waste to Energy
- Advanced Thermal Treatment
- Landfill

**Recycling Centres**

Recycling centres are bring-site/places where the public are able to dispose of their unwanted goods and materials, which may not normally be included in the kerbside collection service. The majority of local authorities in European countries encourage the public to use these systems for recycling and not the deposition of general waste. This creates a mindset of recycling as opposed to disposal. There are two principal types of recycling centres: Recycling Banks and Household Waste Recycling Centres (HWRC).

**Recycling Banks**

Recycling banks are small scale and are often located in the car parks of community areas and supermarkets. They comprise individual bins of various shapes and sizes either singly or in groups. Each bin is reserved for one particular type of waste such as glass, paper and plastic bottles. A bank of bins placed side by side permits the public to deposit a range of recyclable materials at the same location. Examples of recycling banks in public areas are illustrated in Figure 8.

Figure 8, 9 and 10 are recycling banks that can be placed near community facilities, schools and shopping centres.
Figure 8 - Examples of Recycling Banks
Source: Suffolk County Council and Worth1000.com

Figure 9 - Recycling Bank
In cities where space is at a premium, there is an emerging trend for the recycling banks to be located underground as illustrated below in Figure 11. Although the capital outlay is more expensive, they also bring additional security benefits, which avoid vandalism and extend container life, and therefore reduce servicing and replacement costs. There is also increased hygiene, tidiness and cleanliness within the surrounding environment.
Table 6, Summary of Recycling Banks

<table>
<thead>
<tr>
<th>Waste Materials Handled</th>
<th>Segregation of general household waste. Recyclable household waste materials such as paper, card, glass, plastics, textiles, shoes, books.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative Sizes of Facilities</td>
<td>Typically one bank system for every 5,000 to 10,000 people</td>
</tr>
<tr>
<td>Footprint</td>
<td>Excluding access to collect the bins, the space required is less than 10m² for each bank, although this is dependent on the number of bins</td>
</tr>
<tr>
<td>Advantages</td>
<td>Many already in operation in developed nations across North America, Europe and Asia. Proven technology. Proven ‘bankability’. Achieves a good rate of segregation and diversion of recyclables from landfill. Reduces material contamination and therefore increases attainable revenue. Extremely small footprint required. Good public perception. Relatively low cost. Can be paid for by reprocessors</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Requires the public to actively engage in the system as they will have to take their recycled stuff to the collection point. Can become unsightly if badly managed and promoted</td>
</tr>
</tbody>
</table>

**Household Waste Recycling Centres (HWRC)**

A HWRC is a much larger facility than the recycling bank. However, they allow the public to dispose of a much wider range of waste materials. The common range of materials that can be taken to an HWRC is as follows:

- Glass
- Cardboard
- Plastic (various types of polymer – PVC, PET, HDPE)
- Paper
- Cans (aluminium and steel)
- Metal
- Wood
- Textiles
- Shoes
- Books
- White goods (e.g. fridges, freezers, washing machines)
- Electrical goods (e.g. computers, Hi-Fi, radios)
- Furniture
- Green waste (e.g. Grass cutting, Shrubs and flowers, twigs and branches)
- Soil
- Demolition materials (e.g. concrete, tarmac)
- Hazardous materials (e.g. used engine oil, cooking oil, batteries, asbestos)
- Residual waste (e.g., destined for landfill or WtE)

Traditionally these facilities were constructed in the open as shown in figure 12. This illustrates the main areas of an HWRC. However, more often local authorities are seeking to fully or partially enclose the facility so they are less visually intrusive. Examples of these are presented in Figure 13 and 14 with separate work areas of the
facilities. An important strand of the site operations is to ensure that the maximum amount of recycling takes place. Therefore, adequate staff and clear signage is fundamentally important.
Table 7 - Summary of Household Waste Recycling Centres

<table>
<thead>
<tr>
<th>Waste Materials Handled</th>
<th>Recyclable household waste materials such as paper, card, glass, plastics, aluminium cans/ foil, ferrous cans, scrap metals, textiles, electrical items (WEEE), paint, batteries and timber. Segregation of general household waste Household hazardous waste (Batteries, fluorescent tubes, paints, etc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative Sizes of Facilities</td>
<td>Typically 5,000 to 50,000 tpa</td>
</tr>
<tr>
<td>Footprint</td>
<td>0.8 to 2 ha</td>
</tr>
<tr>
<td>Advantages</td>
<td>Common practice across developed nations in EU, North America and Asia Proven technology Proven ‘bankability’ Achieves high rate of segregation and diversion of recyclables from landfill Reduces material contamination and therefore increases revenue attainable Relatively small footprint required Good public perception</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Most financially intensive, but still cost effective Redevelopment of sites can, however, be expensive</td>
</tr>
</tbody>
</table>

**Materials Recycling Facility**

Unlike recycling centres where the public deliberately drop off materials, a materials recycling facility (MRF) is a special sorting factory where mixed waste or commingled recyclables from collection vehicles are separated into individual materials, prior to dispatch to reprocessors who wash and prepare the materials for manufacturing into new recycled products. The Tadweer Dirty MRF in Dubai receives mixed municipal solid waste collected by Dubai Municipality or the various private contractors. Dubai currently has a single waste stream collection and potential improvement in recycling rates can be made by introducing
multiple stream waste collection. This would entail processing of commingled recyclables and bulking up prior to transport to downstream specialist re-processors.
Table 8 - Summary of Material Recycling Facilities

| Waste Materials Handled                                                                 | Mixed municipal solid waste (dirty MRF)  
|                                                                                       | Comingled recyclable materials such as paper, card, glass, plastics, textiles and aluminium/steel cans (clean MRF) |
| Indicative Sizes of Facilities                                                        | Typically 20,000 to 300,000 tonnes per annum |
| Footprint                                                                             | 1 to 3 ha                                   |

Advantages

- Proven, especially for Clean MRF
- Bankable
- High landfill diversion and high segregation from co-mingled recycling stream for clean MRF
- Higher revenue from commingled recyclable stream (clean MRF)
- Relatively small footprint

Disadvantages

- Technology can be expensive
- Not all waste materials are recyclable
- Difficult to achieve high public participation in kerbside recycling
- Material contamination reduce yield of recyclables significantly in particular materials from Dirty MRF
- Material contamination affects value of material – dirty MRFs attract a lower value for recycled stuff as compared with clean MRFs

**Organic Waste Composting Facilities (Aerobic)**

Composting is a natural process where microorganisms aerobically (in the presence of oxygen) convert waste organic materials into a mixture of stable substances and inorganic plant nutrients to form ‘compost’.

For composting to take place efficiently, five key factors need to be controlled, these are: temperature, moisture, oxygen, the porosity of the material, and the carbon to nitrogen ratio. By products of composting include the release of carbon dioxide, water and heat energy.
Composting systems are either open systems or in-vessel systems. As a waste recovery and management tool for Dubai Municipality, composting technology has the advantage of being relatively simple technique. It can manage a large throughput of material, but is also flexible and provides a return in the form of gate fees and sale of end product. Composting can essentially be split into two types of technology: Windrow composting & In-vessel composting. Organic waste composting facilities do not accept mixed waste streams.

Figure 18 - An Open Windrow Being Turned by Specialist Machinery

Figure 19 – Covered Windrow Composting

Figure 20 – VCU 18,000 TPA vertical composting units in Ireland with schematic
Table 9 - Summary of Organic Waste Composting Facilities

<table>
<thead>
<tr>
<th>Waste Materials Handled</th>
<th>Organic garden waste (Windrow/ASP) or organic garden and kitchen waste (In-Vessel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative Sizes of Facilities</td>
<td>Typically 5,000 to 50,000 tonnes per annum depending on technology</td>
</tr>
</tbody>
</table>
| Footprint                                    | 1 to 4 ha (Windrows/ASP)
                                                  | 0.5 to 2.5ha (IVC)                                                              |
| Advantages                                   | Proven
                                                  | Bankable
                                                  | Windrow has low CAPEX and OPEX as compared with IVC systems
                                                  | Windrows and ASP have bigger footprint when compared with In-vessel systems
                                                  | In-vessel systems have higher throughput per unit area and the ability to treat organic food waste. |
| Disadvantages                                | Odour emissions
                                                  | Need to establish a market for end products
                                                  | Compost produced from mixed waste can be of low grade and therefore its main use is for land remediation or as landfill cover. |

**Mechanical Biological Treatment**

Overall MBT technology represents an opportunity to recover recyclables from single stream waste collection as in Dubai and the by-products can be used for generating energy (RDF) or use in landfill restoration (soil improver) based on the configuration of the facility.
Figure 22 – EcoDeco 130,000 TPA MBT (Biodrying) Facility, Frog Island, UK

Figure 23 – Internals and Externals of Arrow Bio Facility (35,000 TPA)
### Table 10 - Summary of Mechanical Biological Treatment Facilities

<table>
<thead>
<tr>
<th>Waste Materials Handled</th>
<th>Mixed general waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative Sizes of Facilities</td>
<td>Typically 100,000 to 300,000 tonnes per annum</td>
</tr>
<tr>
<td>Footprint</td>
<td>1.5 to 5 ha</td>
</tr>
</tbody>
</table>

#### Advantages
- Many planned or already in operation
- Can be used for recovering most residual organic waste for composting
- Proven technology across Europe and in developing countries
- Modular design provides flexibility for future expansion
- Achieves relatively high rate of segregation and diversion of recyclables from landfill
- Reasonable public perception
- Can produce a marketable end product/soil conditioner

#### Disadvantages
- Uncertainties over markets for output (RDF/Floc)
- Recovered recycled stuff and organic fraction may be of poor quality
- Comparatively high capital and operating expenditure
- Wastewater from wet MBT process

### Mechanical Heat Treatment

Mechanical heat treatment (MHT) is a relatively new term. It is used to describe configurations of mechanical and thermal (including steam based) technologies. The most common system being promoted for the treatment of municipal solid waste is autoclaving. This technology is in common use for the treatment of hazardous clinical wastes and also for rendering processes for animal wastes. The alternatives seen in the waste sector for MHT can be classified into two main categories:
- Autoclaving – batch steam processing in a vessel under the action of pressure
- Continuous heat treatment in a long vessel, not under the action of pressure
Figure 24 - FLI Environmental Autoclave during construction

Figure 25 - Orchid Environmental 80,000 TPA Facility at Merseyside, UK
Table 11 - Summary of Mechanical Heat Treatment Facilities

<table>
<thead>
<tr>
<th>Waste Materials Handled</th>
<th>Mixed general waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative Sizes of Facilities</td>
<td>Typically 40,000 to 200,000 tonnes per annum</td>
</tr>
<tr>
<td>Footprint</td>
<td>1 to 3 ha</td>
</tr>
<tr>
<td>Advantages</td>
<td>Several planned or already in operation Can be used for recovering most residual organic waste for composting Modular design provides flexibility to be built in phases Achieves relatively high rate of segregation and diversion of recycled stuff from landfill Reasonable public perception Can produce a marketable end product/ soil conditioner</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Uncertainties over markets for output (RDF/ Floc) Recovered recycled stuff and organic fraction may be poor quality Comparatively high capital and operating expenditure</td>
</tr>
</tbody>
</table>

**Anaerobic Digestion**

Anaerobic digestion (AD) has long been recognised as a process for the generation of methane through the decomposition of organic matter. AD essentially is biological treatment of biodegradable organic waste in the absence of oxygen, utilising microbial activity to break down the waste in a controlled environment. Anaerobic digestion results in the generation of:

- Biogas, which is rich in methane and can be used to generate heat and/or electricity,
- Fiber, (or digestate) which is nutrient rich and can potentially be used as a soil conditioner, and
- Liquor, which can potentially be used as a liquid fertiliser.

Currently, most of the biodegradable waste in Dubai such as food, garden waste, card and paper is sent to landfill, where it breaks down to release methane, a powerful greenhouse gas.

Organic waste collected from kerbside collections such as food waste or organic waste from post treatment using Dirty MRF has significant potential to tackle climate change by producing 100 per cent renewable energy from biodegradable waste in the form of biogas.

The main competitor of anaerobic digestion with respect to the biological treatment of waste is composting.
Table 12 - Summary of Anaerobic Digestion

| Waste Materials Handled                        | Mixed municipal solid waste (organic fraction) |
|                                              | Mixed commercial waste (organic fraction)     |
|                                              | Source segregated organic waste               |
| Indicative Sizes of Facilities               | Typically 50,000 to 200,000 tonnes per annum  |
| Footprint                                    | 1 to 1.5 ha                                   |
| Advantages                                   | Many already in operation                     |
|                                              | Proven technology                             |
|                                              | Proven bankability                            |
|                                              | Achieves high rate of diversion from landfill |
|                                              | Good public perception                        |
|                                              | Can produce marketable energy                 |
|                                              | Generates a marketable soil conditioner/compost|
| Disadvantages                                | Requires pre-treatment                        |
|                                              | Additional composting of fibers may be required|
|                                              | Not fully proven on a large scale commercial  |
|                                              | basis with general waste                      |
|                                              | Requires outlets for liquid digestate and solid |
|                                              | compost                                      |
|                                              | Production of wastewater                      |

**Waste to Energy (WtE)**

Worldwide municipalities are seeing the costs of waste collection and disposal escalate
partly because the once “costs effective” traditional disposal option “landfill” is becoming more and more expensive. One of the options is combustion, often referred to as Waste to Energy, where the heat energy is recovered and put to beneficial use as either heat or power.

The waste hierarchy sets out an order of preference for waste management policy – reduction, reuse, recovery and disposal. Where waste minimisation has reduced the waste stream to the extent practical, and recovered materials are reused or recycled, it is preferable to recover energy from the residual mixed waste stream that contains no further practical value for reuse, recycling or reprocessing as a resource.

Combustion of waste is not new but the process is now a lot more efficient and most applications controls are put in place to minimise the environmental impacts. The volume of waste needing disposal following large scale thermal treatment can be reduced by up to approximately 90%, therefore considerably reducing the need for landfill.

The resultant output of a thermal treatment plant is energy and ash, the ash, is far more stable than the mixed municipal solid waste input, mainly due to the oxidation of the organic component of the waste stream. The ash can equate to 10% of the input tonnage and will require disposal, usually to landfill, although there are options for further recycling.

Figure 28 – Schematic of Waste to Energy Process
In terms of electricity generation, for every 100,000 tonnes of waste, approximately 7 megawatts (MWh) of electricity can be exported to the grid, enough to meet the needs of about 11,000 typical UK homes.

Figure 29 – Veolia (Marchwood EfW) Facility, UK, 165,000 TPA

Figure 30 – AVR Rozenburg EfW, Netherlands, 1.1 MTPA
Table 13 - Summary of Waste to Energy Facilities

<table>
<thead>
<tr>
<th>Waste Materials Handled</th>
<th>Mixed general waste</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Refuse derived fuel (RDF)</td>
</tr>
<tr>
<td>Indicative Sizes of Facilities</td>
<td>Typically 50,000 to 800,000 tonnes per annum</td>
</tr>
<tr>
<td>Footprint</td>
<td>3 to 8 ha</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Can handle a range of waste types (general waste, industrial waste, hazardous waste and horticulture waste)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Waste feedstock requires little pre-treatment</td>
</tr>
<tr>
<td></td>
<td>Can produce a marketable energy</td>
</tr>
<tr>
<td></td>
<td>Well proven technology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disadvantages</th>
<th>Poor public perception</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seen as prohibiting increased recycling</td>
</tr>
<tr>
<td></td>
<td>Relatively high maintenance costs</td>
</tr>
</tbody>
</table>

**Advanced Thermal Treatment Technologies**

Pyrolysis and gasification, like normal combustion, involve a chemical reaction, which takes place at high temperature. This generally generates energy from organic or hydrocarbon containing materials. The application of these techniques to the treatment of mixed municipal solid waste stream is a relatively recent development, as they were previously confined to applications mainly in the oil and chemical industries.

**Pyrolysis**

Pyrolysis takes place either in the complete absence of oxygen. The production of charcoal from wood is an example of pyrolysis/gasification, where the wood is prevented from combusting in the usual way due to air starvation.

**Gasification**

Gasification is a thermal upgrading process, in which carbon is converted to a syngas leaving a solid residue. This takes place in the presence of air, or air enriched with oxygen.
Plasma Arc

Plasma Arc technologies are a heat-based destruction system and are thought to be suitable for municipal solid waste and hazardous waste. Plasma Arc processes is already operating in the metal refining industry. The technology avoids the large volumes of air required in traditional combustion; plasma-arc heating (the energy released by an electrical discharge in an inert atmosphere) is used to raise the temperature of the waste to anything between 3000 and 10,000°C. This converts organic material to a hydrogen-rich gas and non-combustibles to an inert, glassy residue. The gas produced (which is relatively uncontaminated) is suitable for generating electricity to support the process.
Figure 34 - AlterNRG 68,000 TPA Plasma Gasification facility under construction for hazardous waste at Pune, India

Table 14 - Summary of Advanced Thermal Treatment Facilities

<table>
<thead>
<tr>
<th>Waste Materials Handled</th>
<th>Mixed general waste</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Refuse derived fuel (RDF)</td>
</tr>
<tr>
<td>Indicative Sizes of Facilities</td>
<td>Typically 20,000 to 200,000 tonnes per annum</td>
</tr>
<tr>
<td>Footprint</td>
<td>3 to 5 ha</td>
</tr>
<tr>
<td>Advantages</td>
<td>Higher efficiency than conventional thermal treatment</td>
</tr>
<tr>
<td></td>
<td>Well suited to handling of difficult waste streams such as hazardous</td>
</tr>
<tr>
<td></td>
<td>Production of sterile clinker</td>
</tr>
<tr>
<td></td>
<td>Can produce marketable energy</td>
</tr>
<tr>
<td></td>
<td>Potentially a better public perception than conventional incineration</td>
</tr>
<tr>
<td></td>
<td>Complete residual waste solution</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Waste requires some form of pre-treatment</td>
</tr>
<tr>
<td></td>
<td>Technology can be expensive</td>
</tr>
<tr>
<td></td>
<td>Technologies not yet widespread</td>
</tr>
</tbody>
</table>

**Biofuels**

Biofuels from residual waste have recently attracted a lot of attention globally especially with the potential for replacement of fossil fuels such as gasoline and diesel with biodiesel, ethanol, hydrogen, etc. Other benefits include reduced landfill, available markets, revenue from fuel sales and benefits towards climate change and energy security.

Table 15 - Summary of Biofuels

<table>
<thead>
<tr>
<th>Waste Materials Handled</th>
<th>General Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C&amp;I Waste</td>
</tr>
<tr>
<td></td>
<td>Horticultural Waste</td>
</tr>
<tr>
<td>Indicative Sizes of Facilities</td>
<td>Typically 5,000 to 100,000 tonnes per annum</td>
</tr>
<tr>
<td>Footprint</td>
<td>1 to 10 ha</td>
</tr>
<tr>
<td>Advantages</td>
<td>Can produce a marketable product</td>
</tr>
<tr>
<td></td>
<td>Reduces waste to landfill</td>
</tr>
<tr>
<td></td>
<td>Benefits towards climate change and energy security</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Not well proven on commercial scale</td>
</tr>
<tr>
<td></td>
<td>Can be expensive</td>
</tr>
<tr>
<td></td>
<td>Waste requires some form of pre-treatment.</td>
</tr>
</tbody>
</table>
Disposal to Land – Landfill and Landraise

Irrespective of the technology used for waste treatment and recovery of recyclable materials from municipal solid waste streams, there is almost always residues material remaining, which needs to be disposed of safely. The only practicable means of dealing with the residue material is by disposing it in an engineered landfill. A landfill containing active waste is in fact an anaerobic digester but on a much larger scale.

A modern landfill will be engineered to high standards in order to ensure that adverse environmental impacts are avoided or minimised and will include:

- Lining systems (seal) on the bottom/base, sides and top (cover)
- Leachate collection, treatment and management systems;
- Landfill gas collection, treatment and management systems;
- Operation plan requiring careful control of operating procedures
- Long-term monitoring and aftercare systems, expected to continue a minimum of 30 years after closure.

Landfills are the most common and least sustainable method for waste disposal and remain so in many places around the world. Dubai is no different and has been dependent on landfills for disposal of nearly all the waste generated. However, modern landfill engineering has made significant advances in the past 20 years. While still considered as being the least favoured process, sufficient protection and management measures are available which if installed would substantially protect the surrounding environment.

A large number of adverse impacts can occur from badly managed landfill operations. These impacts can vary from pollution of the environment (such as contamination of groundwater and/or aquifers by leakage and residual soil contamination during landfill usage, as well as after landfill closure); off-gassing of methane generated by decaying organic wastes; harbouring of disease vectors such as rats and flies, particularly from improperly operated landfills and other nuisance problems (e.g., dust, odour, vermin, or noise pollution). Noise and dust are generated from vehicles accessing a landfill as well as from working face operations. Increasingly many local authorities have found it difficult to locate new landfills.

Changing waste management practices including increasing emphasis on waste reduction, recycling and treatment are likely to result in less waste being disposed. Despite this, there will always be a need for landfill to deal with materials that cannot be recycled or managed in another way.

Figure 35 – Operational Landfill Site
Table 16 - Summary of Disposal to land – Landfill

<table>
<thead>
<tr>
<th>Waste Materials Handled</th>
<th>General</th>
<th>C&amp;D</th>
<th>Industrial</th>
<th>Hazardous</th>
<th>Horticulture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative Sizes of Facilities</td>
<td>Typically 100,000 to 500,000 tonnes per annum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Footprint</td>
<td>3 to 100 ha</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Advantages
- Landfills can be engineered to handle all kinds of waste.
- Historically have been the most cost effective option and still the most cost effective method for disposal in many countries.

Disadvantages
- Increased noise, dust and traffic
- Pollution to land, air and water
- Slow decomposition of waste for more than 50 years
- Huge footprint
- Least sustainable option

Predicting Future Waste Flows

Population is the primary driver of waste production making future population forecasts essential for predicting future waste flows. The population forecasting as shown in Table 17 presented two growth rate scenarios:

- A ‘realistic’ growth scenario of 3.4% annually over the next 20 years; and
- A ‘high’ growth scenario of 4.2% annually over the next 20 years
Table 17 – Summary of Population Projections (in millions)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Central Case</th>
<th>High Case</th>
<th>Base Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1.646</td>
<td>1.646</td>
<td>1.646</td>
</tr>
<tr>
<td>2010</td>
<td>1.675</td>
<td>1.755</td>
<td>1.800</td>
</tr>
<tr>
<td>2015</td>
<td>2.032</td>
<td>2.142</td>
<td>2.320</td>
</tr>
<tr>
<td>2020</td>
<td>2.364</td>
<td>2.525</td>
<td>3.110</td>
</tr>
<tr>
<td>2025</td>
<td>2.889</td>
<td>3.222</td>
<td>4.360</td>
</tr>
<tr>
<td>2030</td>
<td>3.446</td>
<td>4.082</td>
<td>6.110</td>
</tr>
<tr>
<td>Absolute Growth</td>
<td>1.800</td>
<td>2.436</td>
<td>4.464</td>
</tr>
<tr>
<td>Annual Growth</td>
<td>3.40%</td>
<td>4.20%</td>
<td>6.10%</td>
</tr>
</tbody>
</table>

However, for the purpose of this paper, only the ‘realistic’ growth rate is used as this was considered to be more representative of proposed future growth. As general waste growth is intrinsically linked to population the population growth has been used to predict the future increase in general waste in Dubai.

**Data Sources**

The waste scenarios have been developed using a variety of data sources by Dubai Municipality and summarised including, but not limited to the following:

- Tonnage arisings
- Waste composition
- Waste growths
- Current recycling performance
- Current waste management practices
- Proposed future waste management practices
- Phasing of implementation of each technology

**Summary**

Municipal solid waste is one of the main by-products of the people of Dubai’s lifestyle. It is produced on a daily, weekly, monthly basis and is discarded by every homeowner and tenant alike. It represents the materials for which the populous in Dubai has no further use. It is placed in plastic bags, bins and dumpsters of various sizes according to the place of occupation and left for the Municipality or private contractor to collect. In 2008 4.1 million tonnes of municipal solid waste was produced in Dubai, this is more than a 3 fold increase from 2000 figures and ranks Dubai as one of the highest waste per capita cities in the world. A contributor to this high municipal solid waste per capita may be partly due to the collection and recording of waste in Dubai where domestic household waste, commercial waste produced from shops, businesses and hotels and non-hazardous industrial waste are grouped and collected together. The responsibility for storage and collection of municipal solid waste in Dubai changes according to location, with the Municipality responsible for ‘older’ areas of Dubai located around the creek and developers and businesses responsible for waste produced in the freehold areas and Free Zones.

Of the municipal solid waste produced in Dubai more than 97% is being disposed of in landfills with the majority going to Al Qusais Landfill located at the northern (‘older’) end of the emirate near the Sharjah border and increasingly more MSW being disposed of in the Jebel Ali Landfill at the south-west (‘newer’) end of the emirate. Composition analysis on waste being disposed of in the Al Qusais landfill conducted by Dubai Municipality in 2008 classified 34% as organic, 18% as plastic and 15% as paper.

Limited recycling of municipal solid waste exists in Dubai. The most significant recycling initiative instigated by Dubai Municipality is a mixed waste MRF. Th
waste. However, currently only 10% of the 1000 tonnes per day is being recycled. There are plans to expand capacity to 4,000 tonnes per day of municipal solid waste with a recycling rate of around 15-20% by the end of 2011. There are also plans to install a plastics granulating plant that can handle 50 tonnes per hour and to increase the capacity of the windrow composting facility from approximately 100 tonnes per day to 300 tonnes per day of organic material.

There are a number of small private sector recycling initiatives such as Union Paper Mill, Lucky Can Recycling and Eco-plastic who buy waste from businesses for recycling. Currently their operations are limited due to variable supplies of waste. They must compete with international markets when buying waste.

This report has developed some potential waste technology option scenarios, to manage the waste generated in Dubai. The scenarios are essentially a series of technology packages with various collection systems, recycling technologies (including recycling centres and Material Recovery Facilities) and recovery facilities (in the form of waste to energy plants). Scenario 1 and Scenario 2 illustrate the existing situation and planned future situation in Dubai and are included for comparison purposes only.

The six scenarios were for over a 20-year period with the various technologies being implemented incrementally over this period. For each scenario the amount of waste recycled, recovered and landfilled was predicted in order to understand what technologies and levels of investment would be required to meet specific recycling and diversion from landfill targets.

**Scenarios and Results**

**Scenario 1 – ‘Existing Infrastructure’**

Figure 37 below represents the anticipated performance in continuing waste management operations without the addition of any further infrastructure. The scenario shows the continued use of the existing dirty MRF (with a throughput of 4,000 tonnes per day and a 15% recycling rate) with the remainder of waste being landfilled.

This scenario will only achieve low recycling and landfill diversion rates of less than 10%. In addition, as waste increases over time the levels of recycling and diversion decrease.

![Figure 37 – Recycling and Landfill Diversion (million tonnes per annum) - Scenario 1](image-url)
If scenario 1 waste management practices continued to be adopted then Dubai would remain one of the lower performing cities across the World with regards to recycling and landfill diversion levels. Scenario 1 would require very little expenditure with the exception of operation of landfills and their future engineering and remediation.

**Scenario 2 – ‘Existing and Planned Infrastructure’**

Figure 38 below represents the anticipated performance in continuing with existing waste management operations but with the addition of the proposed waste to energy facility. Scenario 2 shows the continued use of the existing dirty MRF (with a throughput of 4,000 tonnes per day and a 15% recycling rate), the introduction of the proposed 6,500 tonnes per day WtE facility and the remainder of waste being landfilled. This scenario will only achieve low recycling (less than 10%) but will achieve medium levels of landfill diversion (i.e. between 10-20%) for the duration of time that the WtE is operational. As waste increases over time the levels of recycling and diversion decrease although the infrastructure continues to deliver medium levels of landfill diversion in the long term.

Scenario 2 would require additional expenditure when compared to Scenario 1, due to costs associated with the development, delivery and operation of the WtE facility.

**Scenario 3 – ‘Introduction of further Recycling Facilities and Source Segregation using Survival Sacks’**

Scenario 3 is expected to achieve medium recycling (between 10-20%) and also medium levels of landfill diversion (i.e. between 10-20%) for the duration of time that the WtE is operational as shown in Figure 39 below. As waste increases over time the levels of recycling and diversion decrease although the
infrastructure continues to deliver medium levels of landfill diversion in the long term.

Scenario 3 would require relatively high levels of additional expenditure when compared to Scenario 2, due to costs associated with the development, delivery and operation of the additional MRF and Recycling Centres. This scenario assumes that a kerbside collection of dry-recyclables would be implemented in conjunction with the development of the MRFs. The kerbside collection would enable source segregation of dry recyclable materials into biodegradable ‘survival’ sacks. This approach utilises the existing collection fleet and minimises impacts to collection rounds thus helping to reduce financial impacts.

**Scenario 4 – ‘Scenario 3 with additional WtE Capacity’**

As shown in Figure 40 scenario 4 is expected to achieve medium recycling (between 10-20%) but very high levels of landfill diversion (i.e. >75%) for the duration of time that the additional WtE facilities are operational. As per other scenarios, as waste increases over time the levels of recycling and diversion decrease although the infrastructure continues to deliver very high levels of landfill diversion in the long term coupled with medium recycling. The phased introduction of the WtE facilities leads to noticeable step changes in performance levels with regards to landfill diversion.
Scenario 4 is likely to require considerably higher levels of additional expenditure when compared to scenario 3, due to costs associated with the development, delivery and operation of the additional WtE facilities and Recycling Centres. In addition, a smaller capacity MRF will be developed. This scenario assumes that a kerbside collection of dry-recyclables would be implemented in conjunction with the development of the MRF. The kerbside collection would enable source segregation of dry recyclable materials into biodegradable ‘survival’ sacks. This approach utilises the existing collection fleet and minimises impacts to collection rounds thus helping to reduce financial impacts.

**Scenario 5 – ‘Scenario 4 with additional Recycling Capacity and a Two Bin Collection System’**

Despite the increasing recycling capacity and introducing a two-bin collection system this scenario only achieves a relatively small increase in recycling rates (<3%) from the previous scenario (4). This small increase in recycling rate places scenario 5 in the high recycling category (between 20-30%) and very high levels of landfill diversion (i.e. >75%) for the duration of time that the additional WtE facilities are operational. As per other scenarios, as waste increases over time the levels of recycling and diversion decrease although the infrastructure continues to deliver very high levels of landfill diversion in the long term coupled with high recycling. The phased introduction of the WtE facilities leads to noticeable step changes in performance levels with regards to landfill diversion.
Scenario 5 would require considerably higher levels of additional expenditure when compared to scenarios 1-4, due to costs associated with the development, delivery and operation of the additional WtE facilities (as per scenario 4), the larger MRF and Recycling Centres. This scenario assumes that a kerbside collection of dry-recyclables would be implemented in conjunction with the development of the MRF. The kerbside collection would enable source segregation of dry recyclable materials into a second bin/container. This approach would require an additional collection fleet, or the use of split bodied vehicles, to undertake the collections. These additional vehicles and crews would add significant costs to the collection system.

**Scenario 6 – ‘Scenario 5 with addition of an Anaerobic Digestion Facility and a Three Bin Collection System’**

Despite the addition of an anaerobic digestion facility and a three-bin collection system, again only small percentage (0.5%) gains are made to the recycling rate from the previous scenario. This means that scenario 5 achieves a high recycling rate (between 20-30%) but very high levels of landfill diversion (i.e. >75%) for the duration of time that the additional WtE facilities are operational. As per other scenarios, as waste increases over time the levels of recycling and diversion decrease although the infrastructure continues to deliver very high levels of landfill diversion in the long term coupled with high recycling. The phased introduction of the WtE facilities leads to noticeable step changes in performance levels with regards to landfill diversion.
Scenario 6 would require considerably higher levels of additional expenditure when compared to scenarios 1-5, due to costs associated with the development of the additional anaerobic digester and the introduction of a 3-stream waste collection system and the associated fleet and staffing requirements necessary to undertake the collections.
Conclusions

The recycling and landfill diversion performance in 2030 of the six scenarios are summarised in Table 18 below. Given recycling and landfill diversion performance and the increased performance associated with increased investment in future infrastructure a scenario that achieves ‘medium’ recycling and ‘medium’ to ‘very high’ landfill diversion without exceeding excessive cost would be preferred.

The provision of additional recycling facilities combined with waste to energy and the introduction of a source segregated waste collection system using ‘survival sacks’ to collect dry recyclable materials offers a solution to achieving the challenging (yet considered practical and achievable for implementation in Dubai) performance targets.

Table 18 – Summary of Scenario Performance (2030)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Recycling Rate</th>
<th>Landfill Diversion Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;10% (Low)</td>
<td>&lt;20% (Low)</td>
</tr>
<tr>
<td>2</td>
<td>&lt;10% (Low)</td>
<td>20-50% (Medium)</td>
</tr>
<tr>
<td>3</td>
<td>10-20% (Medium)</td>
<td>20-50% (Medium)</td>
</tr>
<tr>
<td>4</td>
<td>10-20% (Medium)</td>
<td>&gt;75% (Very High)</td>
</tr>
<tr>
<td>5</td>
<td>20-30% (High)</td>
<td>&gt;75% (Very High)</td>
</tr>
<tr>
<td>6</td>
<td>20-30% (High)</td>
<td>&gt;75% (Very High)</td>
</tr>
</tbody>
</table>

Limitations

All findings in this report, to keep to consistency, have been derived strictly on the basis of information, and statistics for the year 2008 in respects to the waste characteristics, waste classifications as well as the population of the Emirate of Dubai. Within the report, information obtained from third parties, and websites has been assumed correct and corresponding to the site in question; it has not been independently checked and verified.
References
Dubai Statistics Centre http://www.dsc.gov.ae/

Dubai Municipality Waste Management Department
http://www.suffolkrecycling.org.uk
http://rookery.s3.amazonaws.com/
http://www.ecoisland.co.uk/
http://www.wikimedia.org
http://lmorganicfertilizer.com/
http://www.amgen-cymru.com
http://www.waste-management-world.com
http://www.letsrecycle.com
http://www.industcards.com
http://www.bolsover.gov.uk
Challenges in Implementing Information and Communication Technology (ICT) in Tertiary Care Hospital: Case Studies of Five Hospitals in Saudi Arabia

Amnah Bindakheel
University Technology Malaysia

Rosmini Omar
University of Malaya

Abstract
This paper is based on case studies of five tertiary care hospitals in Saudi Arabia. We aim to discover problems, issues and challenges associated with implementation of information communication technology in these different hospitals. We employ qualitative technique of inquiry for data collection. This includes conducting interviews and discussion group among 50 respondents who are mainly staff of the hospital namely administrative, IT personnel. We conduct the study based on the outcome of an earlier research which indicates that the adoption of ICT at Saudi Arabia hospitals is affected by many factors such finance, culture, end-users' issues, as well as technological standards.

Keywords: Information Communication Technology (ICT), tertiary care hospitals, quality, IT personnel

Introduction
Information and communication technology (ICT) has been a key engine for the performance and growth of economies since the early 1970's, and it has perhaps become the main technological enabler of economic globalization. More recently, this particular technology is widely accepted as an effective tool to improve the quality of health services (Bulgiba, 2004).

Significant advancement in the field of ICT mainly generate from well-developed nations. Nonetheless, developing nations also contribute to tremendous growth of this technology. Many of these developing nations have began to take steps to improve their national information infrastructures and create an environment conducive to ICT growth as critical enabler to advance human development (Ammenwerth and Ehlers, 2002).

In contributing to such a knowledge area, we apply a case study approach to explore and understand the challenges of five tertiary care hospitals in adopting ICT in their strategic operations. These five tertiary hospitals are namely King Faisal Specialist Hospital (KFSH), National Guard Hospital (NGH), and King Fahed Medical City (KFMC). The Riyadh Armed Forces Hospital (RAFH) and King Khalid University Hospitals (KKUH).

The next table summarizes the characteristics of the five hospitals:
Table 1: Selected tertiary care hospitals for the Case Studies

<table>
<thead>
<tr>
<th>Hospitals name</th>
<th>Number of Beds</th>
<th>Type of Facility</th>
<th>Composition of People Served</th>
</tr>
</thead>
<tbody>
<tr>
<td>King Faisal Specialist Hospital(KFSH)</td>
<td>894</td>
<td>Specialized Hospital and research center</td>
<td>To the general Public</td>
</tr>
<tr>
<td>National Guard Hospital(NGH)</td>
<td>691</td>
<td>general and subspecialty</td>
<td>employee of NG &amp; families</td>
</tr>
<tr>
<td>King Fahed Medical City (KFMC)</td>
<td>1092</td>
<td>Specialized Hospital</td>
<td>To the general Public</td>
</tr>
<tr>
<td>The Riyadh Armed Forces Hospital (RAFH)</td>
<td>1200</td>
<td>general &amp; subspecialty</td>
<td>employee of ministry of defiance &amp; families</td>
</tr>
<tr>
<td>King Khalid university hospitals (KKUH)</td>
<td>800</td>
<td>general &amp; subspecialty</td>
<td>employee of the university &amp;families</td>
</tr>
</tbody>
</table>

**Literature Review**

Health care is one of the most, if not the most, complex sectors of the economy. Sizable capital investments and multiyear commitments to building systems will be needed widespread adoption of many information technology applications also will require behavioral adaptations on the part of large numbers of clinicians, organizations, and patients (Institute of Medicine, 2001). that may help to explain why provider adoption of health care ICT remains low(Gagnon, 2006; Simon et al., 2005; DesRoches et al., 2008; Bodenheimer and Grumbach, 2003).

In recent years, there has been an increasing amount of literature on the challenges to adoption of ICT in health care especially in the United States. A study (Fonkych, 2006) on accelerating adoption of clinical IT among the health care providers in US showed that the most relevant barrier for potential adopters remains the availability of capital and organizational resources that are necessary for adoption of a complex Health information technology system.

Recent study by (Nixon, 2009) explored the barriers involved in Electronic Medical Record adoption by selected primary care physicians in Arizona. The results of this study uncover evidence that the barriers to implement electronic medical record were negative opinions/experiences with EMR systems Limited EMR experience and implementation decision making power. In addition, high costs were the primary reason for negative attitudes toward EMR Security concerns. Limited customization abilities are additional barriers of this phenomenon. Despite such barriers, most will implement EMR systems. There were no unique barriers to EMR implementation specific to Arizona practicing primary care physician. There are healthcare policy related roadblocks to EMR implementation. These studies portray the challenges of adopting health information technology and EMR in US . How far are these barriers and challenges affect adoption ICT and EMR in Saudi Arabia? Could we expect similar facets of challenges despite variations in settings, culture and other perspectives? This issues merit investigation, and thus we aim to explore them in the case studies.

**Study Objectives and Data Collection Approach**
The primary objective of this paper is to investigate the challenges while implementing the Information Communication Technology in tertiary care hospitals in Saudi Arabia. In this qualitative inquiry, interviews proved to be a useful tool in exploring issues that could not be achieved by using the questionnaire methodology alone. Via series of in-depth interviews, we explore the respondents’ opinions on the challenges while implementation of ICT in these hospitals. It had also helped the researchers to understand the current situation and the kinds of systems adopted by these hospitals. All the data were directly gained from the specialists.

We gathered data by interviewing 50 respondents who were selected from some sections of each hospital. The respondents comprised of IT personnel, administrative staff at the five relevant hospitals. Each interviewee was briefed on the information concerning the goals of the study and the purpose of conducting the interviews. Each interview session lasted from fifty minutes to two hours, and with the permission of the interviewees, most sessions were audio-taped. The recorded interviews were then transcribed and analyzed in order to determine the challenges faced in adopting ICT.

The five interview questions were designed as open-ended questions and are related to various aspects of challenges that affect negatively the adoption of ICT at health care organizations. The questions mainly consist the following:

1. What is the company that designed the implemented system in this hospital?
2. Did the current system applied in one stage or several stages?
3. Is there any retardation in implementing this program? If yes, explain the reasons?
4. Is there any challenges face the implementation of this system inside the hospital?
5. If yes what are these challenges?

Analysis of the Interviews

We posed many issues and questions related to the ICT field. In order to examine the collected data, each theme was individually analyzed and a concluding theme emerged. These data are summarized at the end of this paper. According to Ritchie and Lewis [2003], a common procedure used in the analysis of qualitative data is the identification of key themes, concepts or categories. It was observed that the interviewees’ views are dependent upon their background and experiences in the ICT field.

The Participants

IT Personnel and Administrators are the participants who choose to answer the interview questions about the challenges face when implementing information communication technology at the hospitals. In order to answer the interview question, the researchers randomly choose participants from various departments or units. All the participants interviewed were Saudi by race. Their ages ranged between 23 and 60 years old. Their lengths of service at the department were between one and 30 years. The academic qualifications of 90% of these personnel are degrees in computer studies, while 10% others possess diplomas. 42 years. The administrative staff comprised 58% of the group, while 42% worked as clerks. Their experiences ranged from two to 19 years. 90% of the participants were Malays, while Indians formed another 10% of the total number. As for their levels of
qualification, 40% were degree holders; diploma holders (20%) and high school certificate (40%).

Results and Discussion

Level of ICT Adoption at Hospitals

Ninety eight percent of the interviewees indicated that most of the processes carried out at their hospital were automated. The workflow was very fast and much easier with using technology. The public hospitals under the study have partially used information communication technology. None of these hospitals have fully use ICT .because any types of application, no matter how sophisticated, could only achieved 60 to 70 percent implementation. In fact, this would also need some customization to suit the hospitals.

The Progress of the Implementation

One hundred percent of the participants indicated that the implementation process was going very slow. Despite the use of advance systems and good financial support in the public hospitals, usage did not exceed the rate of mechanization of 70% in most hospitals. Nonetheless, they still addressed many of the challenges.

Challenges faced by the hospital staff while implementing ICT

Challenges face the adoption of ICT

All the interviewers indicated that there were challenges in adopting ICT in public hospitals in Saudi Arabia. These challenges emerged from the hospital itself (organizational), users, system, IT personnel, and challenges came from the venders.

Hospital

In terms of the overall organization, the challenges came from the hospital design. We observed that the public hospitals under this study were in the process of expansion. They have many units under the IT departments; yet, many of the personnel did not know each other. Thus, communication became difficult.

All the hospitals under the study are large hospitals and there were many buildings which were far away from the IT department. As we observed, this location factor affected the networks in the event of rain for example. This affects the communication speed. In addition, the hospital procedures in the public hospitals are long and complex.

User

Through the in-depth interviews, we found that the users of ICT have lukewarm attitude towards adoption of ICT in public hospitals in Saudi Arabia.

a. They were basically having Resistance to changes: Some of the employees resisted the changes and adoption of ICT. The resistance mostly came from senior staff in the hospital more than the junior staff.

b. Lack of knowledge

In some of the government hospitals, there are few employees who lack exposure with computers. Hence, training them to deal with new application of computers became a difficult process. The head of IT department at NGH and head of IT at KKUH explained the reason for the lack of knowledge among the staff: “When making time for training, they didn’t come. There is delay from in their adoption because they didn’t know how to use the system.”

c. Unclear requirements and direction

To establish new application pertaining to adoption of new technologies, requirements must be and direction to the users must be clear. However, in the public hospitals one of the challenges that face the implementation of ICT was
due to unclear directions and requirements given to users.

**The Systems**
Some of the problems that affect the adoption of ICT came from the systems itself. For instance, KKUH was using obsolete systems from 1993. They faced difficulties in changing and transferring all the data to the new Oracle data base. Also, the integration between the old and the new system was another challenge faced by the hospitals when they adopted ICT.

**IT Personnel**
a. Lack of knowledge. The IT professionals in public hospital in Saudi Arabia expressed their lack of knowledge in their expert areas. There was a lack of training in Saudi Arabia especially pertaining to advanced courses and thus led to incompetence among staff in the IT departments.

b. Shortage. The first challenge that faces public hospitals in Saudi Arabia is the shortage of IT professionals which is stated by all the participants. The reasons of this shortage were explained during the focus group discussion in the military hospital. In terms of this, we could see the issues of:

- Systems which cost millions of Riyal can fail because the management did not want to spend few hundred thousand to recruit more staffs for the implementation of this project. Also some of the projects can take one or two years only because of the shortage of the qualified staff.
- In the past there were large investments in hospitals but not in the IT department and the current administration tried to reduce employment at the hospital, including the IT Department.
- The staff in IT departments consisted of 60 persons, while they have to serve large hospitals with more than 1200 beds. Therefore, everyone should be charged more than one work at the same time and this causes an inability to work correctly or to follow all standard procedures of the project implementation. This also causes a lack of communication between elements of the project.
- The remuneration packages failed to attract as well as maintain qualified IT personnel’s.

c. IT Talent flights to the private sector. One reason for the shortage of staffs in IT departments in public hospitals is the movement of talented IT staffs to the private sector, particularly to banks and IT companies. These industries offered salaries which were doubled from the public hospitals from the researchers’ observations during the data collection, it was found that there was increasing number of staff movement between these hospitals involved in the study, especially to the National Guard Hospital and Faisal Specialist Hospital. The salaries at the two hospitals were higher than the other three.

**Vendors**
The providers were significant different in terms of quality. As demonstrated by the
advisor of the Ministry of Health: "Some of these companies sell products which they didn’t know but they actually were viewed as best companies around the world. The sales people were not knowledgeable as they did not provide relevant information about the use and benefits of some systems and it affected our adoption of ICT". This happened in the public hospitals in Saudi Arabia and issues comprised of:

a. Lack of Credibility
   Programmer from KFSH explained the lack of credibility from the company as:
   “Some companies tried to circumvent the terms of the contract when they see that the implementation could cost them a lot.”
   The head of IT department at KKUH added:
   “There is some manipulation by the companies, but we do not have a clear regulation that can protect hospitals. There are the legal procedures but it’s very long. We need them and we want this relationship to continue because they are the only one in the market.”

b. Lack of knowledge of the implementation team:
   The teams of the implementation from the vendors also post problems as stated by participants in the focus group discussion at AFH and NG hospitals:
   • “When we bought the system for the dental clinic, it serves 70 clinics. The team from the company didn’t know how to do the communication between it and the hospital information system”.
   • “Some companies didn’t provide the efficient team.. may be because they think the

Middle East is not a priority for them.”
   • “Some companies have difficulties in obtaining visa for professionals.”

c. Shortage of the Staff.
   The implementation team from the vendor company which usually came to support the client hospitals was inadequate in numbers, despite the size of these hospitals. As stated during the group discussion in the NGH and KFSH hospital:
   • “Companies tried to work with less cost therefore they do not have enough teams.”
   • “Any company, whether large or small provides number of services such as:
   • three or four systems, so it does not have a sufficient number of technicians to implement these projects.”
   • Some companies take work more than what they can deal with..for example, they come to service me for two days and then they go to another place two days... this cause disruption in my work.”
   • “They do that in order to continue their business because the cost of systems is very high.”

d. Do not support their products. KKUH and AFH hospitals used systems in which the original vendor companies did not support them anymore. Some of these systems were previously well-developed for the hospitals
Conclusions

The case studies provide valuable information, worthy of being considered by decision makers in the Saudi Arabia hospitals. The results of these case studies emphasize areas to deliberate upon when adopting ICT in tertiary care hospitals. There is a need to avoid the failure either from organizational and human perspectives. In particular, conclusions made from this qualitative inquiry invoke four major findings. First, the ICT systems at these hospitals are at a good stage of development. Secondly, in order to encourage more ICT adoption, the hospital staff should be motivated towards awareness of the benefits of ICT. This could enhance their propensity in adopting advanced technologies. Thirdly, in order to overcome the challenges, decision makers in these hospitals must balance between IT staff and the needs of the hospital. Fourthly, more training courses should be provided for the users, on top of crystal clear regulations and policies to overcome the challenges which arose from the vendors.
References


Ammenwerth, E., F. Ehlers (2002). "Supporting Patient Care by Using Innovative Information Technology: A Case Study from Clinical Psychiatry." Disease Management & Health Outcomes, 8:


Nutritional Status in Postmenopausal Women Admitted in Osteodensitometry Center and its Relationship with Bone Mass Density in Isfahan, Iran

Zamzam Paknahad
Zahra Bonakdar
Zinat Sharif Hosein
Akbar Hasan Zadeh
Isfahan University of Medical Sciences
Food Security Research Center

Abstract
Introduction: Osteoporosis is a multifactorial disease and one of the most important modifiable factors in the development and maintenance of bone mass is nutrition. The aim of this study was to determine the nutritional status among osteoporotic postmenopausal women and compare intake of several nutrients important in terms of bone health with the standard values (DRIs).

Method: Seventy-two postmenopausal osteoporotic women were studied. Bone mineral density of the lumbar spine and total hip were measured using dual-energy X-ray absorptiometry. Demographic and dietary informations were collected by interview and using validated 72 hrs dietary recall and food frequency questionnaires.

Results: Mean of age and duration of menopause was nearly 57 and 10.5 years respectively. The mean t-scores for bone mineral density (BMD) of LS, and total hip were 0.877 ± 0.179 and 0.997 ± 0.21 respectively. The mean of calcium, phosphorous, flouride, vitamin D, vitamin K, vitamin C were nearly 1024, 1223, 181, 2.05, 159.31, 255 mg respectively, and there were lower than RDA(except the latest). BMD of hip was significantly correlated with dietary calcium, phosphorous, and animal protein. BMD of Spine did not show any significant correlation with nutrients.

Conclusion: Most of the postmenopausal osteoporotic women in Isfahan have a considerable deficiency in terms of micronutrients such as calcium, vitamin D and phosphorous which can be deleterious for bone health.

Keywords: Diet, nutrition, postmenopausal, bone Mass density

Introduction
Osteoporosis is a complex, multi-factorial condition characterized by reduced bone mass and impaired micro-architectural structure, leading to an increased susceptibility to fractures(1). It gives rise to morbidity and markedly diminishes the quality of life of women after menopause, and of both women and men over 65 years of age. In the twentieth century the proportion of older persons started to rise and is expected to continue throughout this century. The number of individuals aged 60 and above is projected to grow to almost 2 billion by 2050, of who fifty-four percent live in Asia and the vast majority of who will be in the developing world(2). After the age of...
30, there is no further increase of bone mass and a gradual natural reduction occurs(3).
Bone mass in elderly depends on the peak bone mass achieved during growth and the rate of subsequent age-related bone loss. Development of maximal bone mass during growth and reduction of loss of bone later in life are the 2 main strategies of preventing osteoporosis (1). Consequently, any factor that influences the development of peak bone mass or the loss of bone in middle-age will affect later fracture risk.

Many factors are suggested to influence bone mass. These can be broadly grouped into unmodifiable such as gender, age, body (frame) size, genetics and ethnicity, and modifiable such as hormonal status (especially sex and calcitropic hormone status), lifestyle factors including physical activity levels, smoking and alcohol consumption patterns, and diet (including functional foods). The interaction of these genetic, hormonal, environmental and nutritional factors influences both the development of bone to peak bone mass at maturity and its subsequent loss(4).

Although most of the bone strength (including bone mass and quality) is genetically determined, many other factors also influence bone(1), Nutrition plays a major role in the development and maintenance of bone structures resistant to usual mechanical loadings and the prevention and treatment of osteoporosis(5,6).

Methods
Seventytwo postmenopausal women who were referred to Bone densitometry Center were selected. To minimize any known confounding effects on BMD, the subjects with the following conditions have been excluded from the study: on corticosteroid therapy at pharmacological levels for duration of more than 6 months; with rheumatoid arthritis or collagen disease; diabetes mellitus (except for easily controlled, non insulin dependent diabetes mellitus); evidence of other metabolic or inherited bone disease, such as hyper- or hypoparathyroidism, Paget’s disease, osteomalacia, osteogenesis imperfect and hyperthyroidism. Information about life style such as physical activity and smoking habits were obtained at the time of BMD assessment. Weight and height were measured in light clothing and without shoes using a scale to the nearest 0.05 kg and a stadiometer to the nearest 0.1 cm, respectively. Body mass index (BMI) was calculated as weight (kg) divided by height square (m2). The BMD measurements of the left proximal femur (the femoral neck, or FN), the lumbar spine (LS; L2–4) and total hip were performed using dual-energy X-ray absorptiometry. Instruments were calibrated daily and had measurement precisions of 0.008 g/cm2 for the spine and 0.013 g/cm2 for the femoral neck. A validated food frequency questionnaire12 was also used to determine general diet during the previous year. The information was obtained through face to-face interviews, with standard food models, and a variety of measuring tools to evaluate intake. Nutrients were analyzed by Nutritionist IV software, which was modified for Iranian foods. Total energy intake ( kcal), macronutrient (proteins, lipids and carbohydrates) and micronutrient (calcium, phosphate, magnesium, iron, zinc, copper, vitamin D,vitamin K, selenium, vitamin B6, folate, vitamin B12, vitamin A and vitamin C) intakes were estimated and compared with dietary reference intakes (DRIs).Statistical analysis was done using SPSS Software (version 16). To correlate variables with normal and non-normal distribution, Pearson’s and Spearman’s correlations respectively were used. The All tests were two-tailed, and p<0.05 was the significance range.

Results
As it is shown in table 1, subjects had mean age near 57 years and BMI near 27.66 kg/m² and history of menopause near 10.58 years.

| Table 1: Demographic and anthropometric characteristic of subjects (mean ± SEM) |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Age(y)          | BMI (kg/m²)     | Height(cm)      | Weight(kg)     | Gravida (n)     | Lactation duration(y) | Menopause history(year) | BMD (hip)     | BMD (lumbar spine) |
| 57.54 ± 7.28    | 27.66 ± 4.25    | 55.88 ± 5.45    | 66.99 ± 10.05  | 4.37 ± 2.63     | 5.479 ± 5          | 10.58 ± 7.11      | 0.877 ± 0.179  | 0.977 ± 0.21     |

Table 2: Bone Mass Density according to menopausal history (mean ± SEM)

<table>
<thead>
<tr>
<th>Menopausal Duration(y)</th>
<th>Lumbar spine BMD (g/cm²)</th>
<th>Hip BMD (g/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5 years</td>
<td>1.11 ± 0.28</td>
<td>0.96±0.21</td>
</tr>
<tr>
<td>5-10</td>
<td>0.928±0.198</td>
<td>0.911±0.184</td>
</tr>
<tr>
<td>11-15</td>
<td>0.9±0.11</td>
<td>0.803±0.139</td>
</tr>
<tr>
<td>15-20</td>
<td>0.972±0.139</td>
<td>0.838±0.137</td>
</tr>
<tr>
<td>&gt;20</td>
<td>0.898± 0.077</td>
<td>0.78±0.045</td>
</tr>
<tr>
<td>f=3.2, P=0.018</td>
<td>f=2.76, P=0.03</td>
<td></td>
</tr>
</tbody>
</table>

Dietary intake of energy and nutrients are shown at table 3. The computer-generated T-scores, comparing each individual's intake with that of same age women (DRI) showed that only dietary vitamin C and protein was higher than RDA, but the other were lower than recommended values.

Table 3: nutrient intake in menopausal elderly (mean ± SEM)

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V.</td>
<td>C</td>
<td>k</td>
<td>D</td>
<td>F</td>
<td>F</td>
<td>Ca</td>
<td>E</td>
</tr>
<tr>
<td>37.86± 2.269</td>
<td>215.5± 15.9</td>
<td>159.3± 12.86</td>
<td>2.057± 0.213</td>
<td>181± 10.69</td>
<td>1223.3± 47.96</td>
<td>1024.3± 50.087</td>
<td>1763± 57.35</td>
</tr>
<tr>
<td>71.11± 2.873</td>
<td>274.3± 9.66</td>
<td>48.16± 1.5796</td>
<td>33.25± 2.269</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There was a significant correlation between intake of animal protein and hip BMD. Among the micronutrients, calcium was positively correlated with BMD of total hip. There were no other significant relationships between other micronutrients and BMD at different skeletal regions. We categorized subjects to 3 groups ( normal, osteopenia and osteoporotic based on WHO criteria) ,more than 60 % of them suffered from osteopenia or osteoporosis. Analysis of variances of different demographic factors between 3 groups showed that duration of menopausing was significantly different among three groups ( f= 4.015, and p=0.02 based on spine
, and f = 6.517, p = 0.003 based on Hip BMD).
Conclusion

In this cross-sectional study of postmenopausal women, the consumption of different nutrients, which are important for bone health, was assessed. The results indicated that intake of some important nutrients such as calcium, vitamin D, and phosphorus, etc. was significantly less than the recommended levels.

On average, BMD in our population was lower than normal range (1.216 ;hip and 1.17; L2-L4), it is also reported by similar study in Iran(7). According to table 2, BMD decreased as menopausal duration increased. Mean of Dietary calcium was lower than RDA. It is suggested that some reasons such lack of knowledge, dislike or intolerance of milk and milk products, low socioeconomic status or restriction of dairy products due to fat content are related to insufficient intake of calcium resulted in low milk and dairy products consumption(6).

Correlation test also showed significant correlation between BMD and dietary calcium, this is in concordance with Hejazi et al findings(3). Vitamine D plays is necessary for calcium, phosphorus and bone homestasis(6,8), However in our study against Hejazi et al study it wasn't significantly correlated with BMD. At the other hand BMD was significantly correlated with Dietary phosphorus and animal protein, these are similar to ich et al findings (9).

In this study, BMD wasn't significantly correlated with dietary fat, although high fat intake may reduce the efficiency of calcium absorption absorption through calcium soaps formation which lead to lowering calcium absorption(8,9).

Vitamin C in not only necessary for collagen synthesis, but also for bone protection against oxidative stress. The subjects had dietary vitamin C intake above RDA, however it wasn't correlated with BMD.

Low protein intake is risk factor for osteoporosis. Dietary protein results in urinary calcium loss, negative calcium balance, and bone loss (10). On the other hand, there is convincing evidence indicating that low protein intake is associated with low BMD and greater fracture risk. Animal protein induce intestinal calcium absorption, at the other hand dietary protein increase IGF1 which affects on bone development. At the result dietary protein similar to calcium and vitamin D is also important in Bone development and osteoporosis development(6).

Dietary proteins positively influence the production and action of the bone anabolic agent, insulin-like growth factor-1 (IGF-1) in both animal and human studies. The "Dietary protein IGF-1 - Bone Health" axis plays a key role in the prevention of osteoporosis(5).

Preclinical studies in adult animals have documented that an is caloric low protein diet reduces IGF-1, induces negative bone balance with both decreased formation and increased resorption, thereby leading to a decline in bone strength (5).

Vitamin k has significant role in osteocalcin formation. In menopausal women vitamin K increases renal reabsorption of calcium and reduce risk of bone fracture (6), however in our results didn't show significant correlation between BMD and Vitamin K.

In this study, BMD was negatively significant correlated with duration of menopause. Long exposure to esterogen reduce risk of osteoporosis. Guthrie et al in similar study suggested menstruation duration more than 5 years as a risk factor(2).
References


Bonjour JP: Dietary Protein: An Essential Nutrient for Bone Health: J Am Coll Nutr, 2005;24(90006),526s-536s


Akbarian etal: Bone mass density in the normal population of Iran: APLAR Journal of Rheumatology, 2007: 8(3); 177-183

L. Kathleen Mahan, Sylvia Escott-Stump: Krause's food, nutrition & diet therapy: Edition: 12, 2008, Saunders publication, pp; 127-129


ConnieMW: The Role of Nutrition on optimizing peak bone mass: Asia Pac J Clin Nutr 2009;17 (s1): 135-137
Are Public Hospitals in Saudi Arabia Ready to Implement Electronic Health Records? Hospital Managers’ Perspective

Fares Alshammari
School of Primary Health, Monash University, Australia

Abstract
Despite the potential of using Electronic Health Record (EHR) in hospitals for enhancing the quality of patient care and safety, it has been shown that the implementation of EHRs is low. This paper examines the hospital manager’s perception on the introduction of EHRs in Saudi Arabia public hospitals. A cross-sectional design using survey and open-ended question has been used and this paper will only examine the quantitative results. A descriptive survey was developed from the literature and this was mailed to all public hospital managers in Saudi Arabia. With a 74% response rate, 41.1% percent of the hospital managers were not familiar with the concept of EHR and 73.6% of them have no experiences with it. In addition, 64.4% of the respondents believed that current IT infrastructures did not support the EHR implementation and also hospital staffs were not ready enough. Financial resources and unclear implementation process model were identified as the most important barrier to implement EHR in their hospitals. This paper has highlighted the significance of considering the hospital manager’s Perception when implementing EHR.

Keywords: Electronic health records (EHR), implementation, hospital managers, and perception

Introduction

Electronic health records (EHRs) has been identified as a strategy to improve healthcare delivery and quality. The EHR has the potential to transform healthcare by progressing healthcare quality, reducing healthcare costs, avoiding medical errors, improving administrative efficiencies, reducing paper work and increasing access to affordable healthcare (Brennan and Safran 2005).

Although there are a number of benefits recognized in the implementation of EHRs, it has been internationally reported that up to 50 percent of all IT implemented projects in healthcare fail (Littlejohns, Wyatt et al. 2003; Whetton 2005). The reasons for this failure are varied and it is obvious that implementation of the IT application in the healthcare setting is not only a technical issue (Kucukyazici, Keshavjee et al. 2008). The challenges facing hospital managers’ are numerous and can be a major problem in the implementation of IT. Amatayakul (1999) identified the main factor affecting successful implementation of EHRs as lack of top management support. Without appropriate hospital manager with sufficient skills and knowledge, the risk of EHR project failure increases. Gaining a greater understanding of hospital manager’s perspective is a vital step in implementation of EHR.

Saudi Arabia Healthcare System and Medical Technology
The Ministry of Health (MOH) is the main governmental agency entrusted with the
provision of preventive, curative and rehabilitative health care for the country’s population, including citizens and non-citizens (Mufti 2000). The healthcare in Saudi Arabia consists of three sectors which are MOH, government agency hospitals and private sectors. The MOH is the largest of the three sectors contributing 57 percent of the healthcare services in Saudi Arabia and most public hospitals fall under MOH governance (Ministry of Health 2006). Health services through the MOH in Saudi Arabia are organized at three levels Primary (equivalent of general practitioner GP), Secondary (general hospitals with specialist curative services), Tertiary (hospitals dealing with specific disease, research and education).

There are 220 public MOH hospitals that are managed by the above mentioned public health services in each city (Ministry of Health 2006). However, the MOH is the funding body for all these hospitals by health services authority in each city that has its own budget and recruits its own personnel. While the MOH manages the majority of the hospitals in the country, most of these hospitals have not implemented any e-health solution and are still using traditional paper-based records (Alotaibi 2005). Alotaib (2005) reported that there are only 20 out of 220 hospitals in MOH that use various health information systems (HIS), but without any network connection among hospitals (Altuwaijri 2008). Although forty hospitals belonging to MOH have established electronic connection to the Ministry of Health Wide Area Network (Wang, Middleton et al.), none of them have implemented any HIS (Alotaibi 2005).

The WHO regional office for the Eastern Mediterranean Al-Shorbaji (2006) argued that Saudi Arabia is three to four years behind the U.S. and two years behind Europe in introducing health information system (HIS) into healthcare services. However, there is no obvious change of paces for introducing e-health in Saudi Arabia hospitals. The MOH already adopted a plan to implement an EHR, but there was not a comprehensive strategy for entering the public sector (WHO 2006) and very little has changed in the adoption of this technology. In the middle of 2010 MOH has announced plan and prioritize the first five years of e-Health projects (MOH 2010). The MOH at various levels have recognised the challenges for EHR adoption. MOH e-health strategies emphasised that the implementation of e-health application will be depend on a leader who can drive the change management to be success (Alyemeni 2010).

Therefore, focussing on the hospital managers to ensure that they have a thorough understanding of EHRs implementation and readiness in each provision and how it affects their hospital work practice are essential.

Previous study on EHR implementation topic have only investigated barriers of using EHR in Saudi Arabia in six privately owned, government agency hospitals in capital city Riyadh in Saudi Arabia (Alanazi 2006). Because there are many differences facing hospital managers performance such as culture, environment, infrastructures, facilities and experiences, the survey results drawn only from the private government agency hospitals in the capital city is not applicable to that in the public hospitals in regional areas.

**Hospital Managers and EHR Implementation**

Understanding and recognizing the critical factors that influence the hospital manager’s success may facilitate the adoption and implementation of EHRs. Hospital managers need to be able to understand EHRs function and usability before implementation. Understanding working processes, standardization, the involvement of end users and using the new application of IT are major ingredients for the creation of an effective virtual team (Gootveld, Swaak et al. 2004). This can significantly affect hospital
manager’s likelihood of EHRs implementation. For example, researchers in US have identified strong leadership as the main strategy to overcome computerized physician order entry (CPOE) resistance in the US hospitals and this strategy was as important as the quality of the technology (Poon, Blumenthal et al. 2004). Nancy and Kathleen (1999) in their study on healthcare change claimed that administrators need to identify the positive, negative, and ambivalent responses to change so as to limit their negative impact and support resilience in employees. While management may thinks that EHR is the backbone of the hospitals, it is the responsibility of hospital managers to present a clear road map to introduce its application. Hospital managers need to be recognized as a leader in EHRs project to overcome the barriers (Poon, Blumenthal et al. 2004). Shore (2005) in his global information system research confirmed this argument that leadership has been identified as a critical success factor, especially in information system project which is one of the main challenges to manage the change process. Therefore, hospital manager’s need to shift the change process from healthcare worker resistance’s to using EHRs (historical position) to acceptance (current position) to dependence (cannot work without it) (Protti 2008). These processes require that hospital managers have high level of skills in both management and leadership.

Aim and Objectives

The main aim of this paper was to examine the hospital managers’ perceptions on the introduction of an integrated EHR in public hospitals in Saudi Arabia. Preliminary knowledge and information occur from this study will assist administration to better plan for EHR application which may lead to more implementation successful with less failure risk. The objectives of the study was to examine the current status of EHR implementation in public hospitals in Saudi Arabia and the characteristics of hospital managers and their expectation towards implementing EHRs in Saudi Arabia public hospitals.

Method

Study Design and Population

The quantitative data research project was obtained via a self-administered questionnaire survey instrument. All hospital managers in MOH hospitals were the target population group for this study. Hospital manager in Saudi Arabia is equivalent to a chief executive officer (CEO) in the western world. The number of the MOH hospitals was 220 with total bed occupancy of 31877 (Ministry of Health 2007).

Ethics Approval

Approval for the conduct of the research was obtained from MOH Medical Research Ethical Committee (MREC) in Saudi Arabia and Monash University Human Research Ethics Committee (MUHREC).

The Survey Instrument

A comprehensive review of the research literature was undertaken to define the relevant factors that influence EHRs implementation in order to produce useful guidelines for hospital managers to implement EHRs system. In addition, most of the questions in the study have been previously used in some research to identify critical factors. This can clearly facilitate and ensure validity and reliability of questions to contain internal validity.

Validity of the questionnaire survey has been done by the research group and later piloting was started with ten formal hospital managers and other appropriate participants in the first week of the survey build. The survey was amended prior to use to reflect the outcomes of a pilot trial. The Cronbach’s alpha was analyzed for the main sub-scales variable,
with a value greater than 0.7 indicative of a reliable scale (Field 2005). For hospital managers’ Perspective to implement EHR system, a 15-item sub-scale - 3 factors in five items each -, the Cronbach’s alpha was 0.85 that was exceeded the recommended values in Nunnally's (1978) guidelines. The survey instrument contained 28 questions addressing the following:

- Demographic, geographic and social variables such as hospital size, type of qualification and age (7 questions).
- EHRs experience and implementation (4 questions).
- Hospital managers’ Perspective of EHRs system (15 questions).
- Challenges to implement EHRs (1 question).

The survey instrument used (yes =1 or no=2) and a 5-point Likert scale for each of the statements, ranging from (strongly agrees=1 to strongly disagree=5). The respondents were required to check the boxes of their preferred responses to all of the closed ended questions; three questions allowed more than one response. The final question was an opens ended, providing an opportunity for the hospital managers to provide additional comments.

**Sample**

The sample frame was 220 hospital managers from the secondary and tertiary hospitals. At the time of the sampling (between September 2009 to November 2009), the MOH had 220 hospital managers. The number in the sample was 220, which encompasses the entire population to be included in the survey. Saudi Arabia has 13 administrative regions cities and each administrative region has its own public healthcare organization, which is funded by the Ministry of Health (Ministry of Health 2007) (See Figure 1).

![Figure 1: 220 hospitals in 13 Cities in Saudi Arabia](image)
Data Collection

The survey was conducted from September through November 2009. Each hospital manager has received an introductory letter from the director of the General Directorate for Health Research at the MOH encouraging them to participate in it, an information sheet about the study, a cover letter, a copy of the questionnaire in both English and Arabic and a self-addressed pre-paid envelope.

Data Analysis

The completed questionnaires were coded and entered into the Statistical Package for the Social Sciences 17 (SPSS). Descriptive statistics were also calculated and chi-squared analyses were used to test for significant differences between the characteristics of respondent. Also, t-test, and ANOVA analyses were conducted as appropriate based on eight different variables, namely: hospital location, hospital beds, EHR implementation, managers’ age, education, English language, qualifications, and experience.

Result

The response rate was relatively high (74% of the targeted population), with 163 hospital managers completing the questionnaire and handing it in. All of the participating managers were males, and the findings for each section of the questionnaire are summarized in the following subsections.

Demographic and Profile le of Respondent

Fifty eight percent of the hospitals were 100 beds and less and most of the hospitals were in urban and suburbs (81%). A majority of the hospital managers (37.4%) hold technical background and (32.5%) of the total respondents had less than bachelor degree. Approximately 43% of the participants were in age between 41 – 50 years and around (31%) of respondents had 6 - 10 years experiences as a hospital managers. Ninety four percent of the participants had good and advance English level. The demographics and profile of survey respondents is depicted in Table 1.
Table 1: Demographics and profile of survey respondents from the Hospital managers (n = 163)

<table>
<thead>
<tr>
<th>Hospital Beds</th>
<th>N</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-50</td>
<td>59</td>
<td>(36.2%)</td>
</tr>
<tr>
<td>51-100</td>
<td>35</td>
<td>(21.5%)</td>
</tr>
<tr>
<td>101-200</td>
<td>38</td>
<td>(23.3%)</td>
</tr>
<tr>
<td>201-300</td>
<td>23</td>
<td>(14.1%)</td>
</tr>
<tr>
<td>301-more</td>
<td>8</td>
<td>(4.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>31</td>
<td>(19.0%)</td>
</tr>
<tr>
<td>Urban</td>
<td>85</td>
<td>(52.2%)</td>
</tr>
<tr>
<td>Suburban</td>
<td>47</td>
<td>(28.8%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Qualification</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physician</td>
<td>52</td>
<td>(31.9%)</td>
</tr>
<tr>
<td>Business Administration / Public Health/ Health Management</td>
<td>50</td>
<td>(30.7%)</td>
</tr>
<tr>
<td>Technical*</td>
<td>61</td>
<td>(37.4%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education Level</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than Bachelor</td>
<td>53</td>
<td>(32.5%)</td>
</tr>
<tr>
<td>Bachelor</td>
<td>48</td>
<td>(29.5%)</td>
</tr>
<tr>
<td>Master</td>
<td>23</td>
<td>(14.1%)</td>
</tr>
<tr>
<td>PhD or Equivalent</td>
<td>39</td>
<td>(23.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30</td>
<td>6</td>
<td>(3.7%)</td>
</tr>
<tr>
<td>31-40</td>
<td>64</td>
<td>(39.3%)</td>
</tr>
<tr>
<td>41-50</td>
<td>69</td>
<td>(42.3%)</td>
</tr>
<tr>
<td>51-more</td>
<td>24</td>
<td>(14.7%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Experience as Hospital Manager</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 years</td>
<td>40</td>
<td>(24.5%)</td>
</tr>
<tr>
<td>6-10</td>
<td>51</td>
<td>(31.3%)</td>
</tr>
<tr>
<td>11-15</td>
<td>44</td>
<td>(27.0%)</td>
</tr>
<tr>
<td>More than 16 years</td>
<td>28</td>
<td>(17.2%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>English Language</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>2</td>
<td>(1.2%)</td>
</tr>
<tr>
<td>Medium</td>
<td>67</td>
<td>(41.1%)</td>
</tr>
<tr>
<td>Good</td>
<td>48</td>
<td>(29.5%)</td>
</tr>
<tr>
<td>Advanced</td>
<td>46</td>
<td>(28.2%)</td>
</tr>
</tbody>
</table>

Note: *Technical including nurses, pharmacists, x-ray technicians, and lab technicians with allied health qualifications

**Electronic Health Records (EHR)**

Almost all hospital managers (98%) had problems with paper based patient records. Of all respondents, 58.9% were familiar with the concept of EHR and only 26.4% had experiences with EHR. The current status of EHR implementation has been summarized in figure 2.
Perceived Benefits and Impact of Change

The majority of the participants 79.8% strongly agreed that using EHRs in hospital would enable to accomplish tasks more quickly. In addition, only 21.5% disagreed that there was a comprehensive vision in hospital for using EHRs, including operational change. Seventy three percent of the participants n=119 strongly agreed that using EHRs in hospital would provide better quality of health care system.

Ease of use and Leadership Skills

Only 20% of the hospital managers believed that interaction with an EHR would be not clear and understandable in hospital. However, around half of the respondents 46% agreed that there was not an appropriate plan to guide the change management process of implementing EHRs in hospital. Participants were relatively had confident (32.5% “strongly agreed” and 40.5% “agreed”) that they can effectively change in workflow and implement an EHR system in hospital.

Socio-Technical Intention

Approximately half of the participants 48.5% agreed that there was a general willingness among staff in the hospital to implement the EHR system. Hospital managers showed high level of skills needed to deal with the resistance from hospital staff to use EHR (35% “strongly agreed” and 44.8% “agreed”). Sixty percent of the respondents strongly agreed to be involved with senior management for planning EHR implementation and software selection.

Security and Privacy

In regard with the security of EHR, majority of the respondents 60% strongly agreed that EHR technologies were more secured than traditional paper-based health records. Moreover, 71% of the hospital managers strongly agreed that a written policy on privacy, security and confidentiality of EHR was essential. More than half of the participants 56.4% strongly agreed that their hospital needs EHRs to improve security of health information.

Reliability and Infrastructures

None of the hospital managers believed that EHRs were not more reliable than traditional paper-based health records. The respondents strongly agreed 67.5% that EHR were more reliable. An interesting finding was that 64.4
31.3% “strongly disagreed” and 33.1% “disagreed”) of the participants disagreed that the current IT infrastructures in hospital support the use of an EHR. The surprising was 58.9% (14.7% “strongly disagreed” and 44.2% “disagreed”) of the hospital managers believed that hospital staff was not ready enough to use an EHR system.

**Challenges Facing the Implementation of EHR**

To capture the hospital managers’ perceptions about the challenging obstacles which are hindering the adequate implementation of EHR systems at the participating hospitals, the questionnaire provided a list of issues from which the participants had to select. Table 2 summarized all challenges facing the respondents.

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Yes N (%)</th>
<th>No N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of computer literacy or training program</td>
<td>114 (69.9%)</td>
<td>49 (30.1%)</td>
</tr>
<tr>
<td>Privacy, illegal record tampering and confidentiality issues.</td>
<td>100 (61.4%)</td>
<td>63 (38.7%)</td>
</tr>
<tr>
<td>Lack of EHR awareness.</td>
<td>111 (68.1%)</td>
<td>52 (31.9%)</td>
</tr>
<tr>
<td>Unclear capacity to select, install and implementation process model of EHR.</td>
<td>127 (77.9%)</td>
<td>36 (22.1%)</td>
</tr>
<tr>
<td>System maintenance</td>
<td>114 (69.9%)</td>
<td>49 (30.1%)</td>
</tr>
<tr>
<td>Lack of adequate funding or resources</td>
<td>141 (86.5%)</td>
<td>22 (13.5%)</td>
</tr>
<tr>
<td>Instability of vendors and software providers</td>
<td>123 (75.5%)</td>
<td>40 (24.5%)</td>
</tr>
<tr>
<td>Resistance or techno-phobia for a new technology</td>
<td>67 (41.1%)</td>
<td>96 (58.9%)</td>
</tr>
<tr>
<td>Critical need for English language fluency</td>
<td>108 (66.3%)</td>
<td>55 (33.7%)</td>
</tr>
</tbody>
</table>

**Discussion**

This study investigated the hospital managers’ perception on and knowledge of introducing an integrated EHR and if they will be able to implement EHR and manage the change process in Saudi Arabia public hospitals. Since only 23.3% of the hospitals had partially implemented EHR, it was not surprising that 73.6% had no experiences with EHR. Interesting finding showed that 41.1% were not familiar with the concept of EHR. These hospital managers were working in hospitals with less than 100 beds and their age was between 41-50 years with a technical background. Hospital size seems to be a vital factor that should to be taken into consideration when determining the implementation of EHR. Poon et al (2004) emphasized that lack of knowledge of EHR system was one of the main barriers. This study suggests that it is important for hospital managers to understand which needs and barriers are present in their hospitals in order to determine appropriate interventions that address the successful implementation of EHR.

Almost all hospital managers 98% had problems with paper based patient records which increased the need for EHR implementation. A majority of the participants believed the EHR system would enable to accomplish tasks more quickly (79.8%) and better quality of health care system (73%). According to the published literature, perceived usefulness including relative benefits over existing systems with individual values and experiences will effectively facilitates adoption of technologies (Dixon 1999; Telford, Maddock et al. 2006; Amatayakul 2008).

In this study, 20% of the respondents agreed that interaction with EHR would be not clear and understandable in hospital. However, only 6.1% of the participants they do not have
the confidents to effectively change in workflow. Since most respondents did not have experiences with EHR and almost half of them agreed that there was not an appropriate plan to guide the change management, it is clear that hospital managers had over confidence. This is a favourable result to indicate the lack of managerial knowledge and leadership skills on fundamental principles of change management and health informatics. This is because leadership has been mentioned as a key factor to successful transition that understands the transition process and sensitive to people’s needs as well as they can move throw different levels (Bridges and Mitchell 2000). Those finding concurs with many studies that understanding and recognizing organization change process by managers are necessary to ensure that organization on the right track (Berner and Jacobs 2002; Lawson and Price 2003; Lorenzi and Riley 2004; Day and Norris 2008).

In general, the findings showed that the hospital managers had a positive attitude (48.5%) and that hospital staff was motivated and willing to implement the EHR. Kotter (1995) confirmed this status that motivation staff for change can foster the implementation. Another interesting finding was that only (3.7 %) of the participants did not have skills needed to deal with the resistance from hospital staff to use EHR. From this perspective, hospital managers showed a critical competence issue that needed to overcome the EHR implementation failure. Managing resistance in hospital environment is essential step before implementing and change occurred (Turner 2007).

The results of this study highlight the fact that none of the hospital managers believed that EHR technologies were not as secure as the traditional paper-based health records. Also, a majority of the participants strongly agreed with a written policy on privacy, security and confidentiality of EHR and this was essential. This statement was supported by Cornwall (2002, p16) “a coherent legal framework to appropriately protect the privacy and confidentiality of personal health records is therefore an essential first step for successful EHRs”. Also, Anderson (2007) stressed that national government action was needed to build up and legalize a comprehensive set of national privacy laws on data protection. Many countries have already addressed these concerns such as US, Canada and Australia. However, in Saudi Arabia there is no privacy and confidentiality legislation of EHRs and MOH is still working under strategies plan to implement ISO 27001 for data privacy and security (MOH 2010). Moreover, none of the respondents believed that their hospital did not need EHRs to improve security of health information.

One of the issues that emerged from these findings was that more than half of the participants agreed that the current IT infrastructures in hospital did not support the use of an EHR. Hospitals must have solid infrastructures to be able to implement EHRs system and hospital managers were needed to recognize the appropriate infrastructures. Richards(2005) identified the infrastructures as hardware, software and management systems, the data network (wires, hubs, routers, switches), workstations (laptop, PCs, hand-held device), services (application, database, print/file) and telecommunication equipment and services. Some researchers argued that some hospitals lack these basic infrastructures needed to support EHR implementation and that this concern obstructs the widespread implementation of EHRs (Larum, Ellingsen et al. 2001; Vishwanath and Scamurra 2007). Therefore, providing appropriate infrastructures in Saudi Arabia hospitals were essential to successful implementation of EHR.

On the other hand, 58.9 % participants believed that that hospital staff was not ready
enough to use an EHR system. This may reflect to the shortage of training and courses in information technology. Generally, health informatics systems are complex and require advanced knowledge and technical skills to successfully interface with the system (Dixon 1999). For example, inadequate training, lack of computer skills and lack of typing skills have been identified as a significant barrier to use CPOE (Metzger and Fortin 2003). While hospital staffs were not technical experts and the systems were naturally complicated, hospital managers recognized a need for appropriate technical training and were unwilling to use EHRs without it. The literature review found that two-thirds of physicians indicated a lack of training and technical support as an obstacle to the implementation of EHRs (Loomis, Ries et al. 2002).

Hospital managers in this study identified lack of adequate funding or resources (86.5%), unclear capacity to select, install and implementation process model of EHR (77.9%), instability of vendors and software providers (75.5%), Lack of computer literacy or training program (96.9%) and system maintenance (96.9%) as a major factors obstacle the implementation of EHRs. Those challenges have been recognized internationally and also in Saudi Arabia as the main barriers to implement EHR (Poon, Blumenthal et al. 2004; Shortliffe 2005; Doebbeling, Chou et al. 2006; Altuwaijri 2008). From hospital manager perspective, some challenges were within and others beyond the control of implementers. For example, overcoming the lack of adequate financial source challenge, particularly the purchase costs associated with EHRs, may need incentives from the MOH or Saudi government.

**Limitations of the Study**

This study examined hospital managers perceptive from MOH government hospital only, which limits the generaliability of the finding to private and other agency hospital in Saudi Arabia such as defence force and National Guard. One can question whether the sample is representative of all hospital managers. While most medical hospital managers were represented, the sample was limited to hospital manager affiliated with a single hospital.
Conclusion

Although this study showed the positive side of using EHRs in Saudi Arabia hospitals, it has been shown that the implementation of EHRs is low. In this study, 163 hospital managers (74% of the targeted population) were examined on their perceptions of introducing an integrated EHR and if they will be able to implement EHR and manage the change process in hospitals.

The finding of this study can be used as an overview of the hospital managers’ perspective and their about implementing EHR in their hospitals. The study indicates that MOH should be more aware of the hospital managers’ background in leadership and change management before implementing EHRs. To be successes in implementation of EHR application, experienced and skilled hospital managers in health informatics are essential. Also, providing a road map of organization change process and managing resistance will increase the rate of EHR implementation. MOH in Saudi Arabia should understand that overcoming financial, technical and training challenges is not enough to ensure the recognition of the benefits of EHR.

This study provides a set of baseline data and some indicators to conducting future studies with large samples from different sectors in Saudi Arabia. Also, the finding may help MOH or policymakers to understand the perception and perspective about EHR implementation among hospital managers that significantly affect its successful implementation.
References


of global information technology management 8(3): 1-5.


Calcium Intake and Body Mass Index Status in Women Attending Health Centers and Health Care Providers in Tabriz, Iran

Rafraf M.
Bazyun B.
Nutritional Research Center, Tabriz, University of Medical Sciences, Tabriz, Iran

Abstract

Background and Objective: The objectives of this study were to determine and compare calcium intake and body mass index (BMI) and their relationship in women who were attending health centers and health care providers in Tabriz.

Materials and Methods: This cross-sectional study was conducted on 399 childbearing age (non pregnant-non lactating) women who were attending health centers and 200 healthcare providers. By interviewing to each subject questionnaires about general characteristics, 24-hour recall, and dairy food consumption were completed, and weight and height of them were measured.

Results: Two groups of women had calcium intake deficiency. Daily frequency of milk and cheese consumption’s in healthcare providers were significantly higher (p<0.001 and P<0.01 respectively) than that of women attending health centers.

Mean BMI in women who attended health centers was significantly higher than that of healthcare providers (P<0.001). There were no significant statistics relationships between BMI with calcium intake by adjusting age in both groups.

Conclusion: Majority of women had overweight and calcium intake deficiency as a health problem. Establishment of educational interventions for healthcare providers to inform and motivate them to active consultation with women attending health centers is suggested as a primary approach to prevent calcium deficiency and promote healthy life styles.

Keywords: mass index, calcium, women

Introduction

Calcium is the most frequent mineral in the body, and 99% of its quantities are in bones and dentals (1,2 ). Adequate calcium intake is necessary for maintains of bone health’s (3). Although disease such as osteoporosis and osteomalacia have complex etiology, however development of these diseases may reduce by optimal nutrition during lifetime. The adequate calcium intake is important especially in girls and women’s, because bones with high density can protect them from osteoporosis in years after menopause (1,2).

Based on reports osteoporosis is the important public health problem in worldwide in both sexes especially in women (3).Liew and et al reported that Asian women have calcium intake lower than recommended allowances (4). Other studies also showed low calcium intake in women (5,6). Some studies reported the relationship between increasing calcium intake and dairy food consumption with reduced body mass index (BMI) in women (7-9).However other studies did not report such relationships (10-12).

Taking into consideration that information about women’s calcium intake and BMI
status of our community are spacy, so we initiated a study to evaluate calcium intake and BMI status of women who were attending health centers and women of healthcare providers in Tabriz, the capital of Azerbaijan province in the northwest of Iran.

Methods
This cross-sectional descriptive study was conducted on healthy 399 childbearing age women (15-49 years old) who were attending health centers by random sampling method (group 1) and 200 healthcare providers (group 2) in Tabriz. Written consent was obtained from each subject prior to study. The ethical committee of Tabriz University of Medical Sciences approved the study protocol. Information about general characteristics obtained by interviewing with subjects. Twenty-four hour recall method was used for evaluating dietary calcium intake. Food habits were evaluated by food frequency questionnaire. Weight and height of subjects were measured and BMI was calculated as the weight in kilograms divided by height in meters squared. BMI lower than 18.5, 18.5-24.99, 25-29.99 and ≥30 classified as underweight, normal, overweight, and obese, respectively (13).

Statistical analysis was performed with SPSS for Windows; version 11.5. The results were considered statistically significant if p<0.05. FP2 food software also used for analyzing of food intakes data gathered by 24-hour recall method. Mean and frequency of variables were determined. Independent t-test, Mann-Whitney U test, X² test, and partial correlation coefficient test were used for analyzing of data.

Results
Table 1 shows mean of studied variables. Mean of BMI was significantly higher in women who attending health center than that of women of healthcare providers. Mean daily frequency use of milk and cheese were significantly higher in women of healthcare providers that those of women who attending health center. No significant differences were found between mean of daily dietary calcium intake and mean daily frequency use of yogurt between two groups.

<table>
<thead>
<tr>
<th>variables</th>
<th>Group 1 (N=399)</th>
<th>Group 2 (N=200)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>33.13±7.51</td>
<td>37.85±7.91</td>
<td>-</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>27.40±4.95</td>
<td>26.07±2.92</td>
<td>0.12</td>
</tr>
<tr>
<td>Dietary calcium intake</td>
<td>689.08±393.15</td>
<td>755.93±450.46</td>
<td>0.12</td>
</tr>
<tr>
<td>Milk (frequency/day)</td>
<td>0.58±0.72</td>
<td>0.82±0.82</td>
<td>0.001*</td>
</tr>
<tr>
<td>Yogurt (frequency/day)</td>
<td>1.25±0.94</td>
<td>1.38±1.02</td>
<td>0.12</td>
</tr>
<tr>
<td>Cheese (frequency/day)</td>
<td>0.84±0.32</td>
<td>0.94±0.49</td>
<td>0.01**</td>
</tr>
</tbody>
</table>

* Independent t-test
** Mann-Whitney U test

Distributions of subjects based on BMI status are shown in table 2. Percent of obese subjects was higher in women who attending health centers than that of women of healthcare providers (X²= 21.14, P<0.001).
Table 2: Distribution of subjects based on BMI classification

<table>
<thead>
<tr>
<th>BMI classification</th>
<th>Group 1 (N=399)</th>
<th>Group 2 (N=200)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Under weight</td>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td>Normal</td>
<td>124</td>
<td>31.2</td>
</tr>
<tr>
<td>Overweight</td>
<td>161</td>
<td>40.2</td>
</tr>
<tr>
<td>Obese</td>
<td>105</td>
<td>26.4</td>
</tr>
<tr>
<td>Total</td>
<td>399</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Group 1: women who attending health centers
Group 2: women of healthcare providers

No significant relationship (partial correlation coefficient test) was found between BMI and daily calcium intake by adjusting age in both groups (data are not shown).
Discussion

The results of this study (table 1) indicated calcium intake deficiency in studied women. Means of calcium intake in both groups were lower than 1000 mg (RDA-1000mg), as 65.2% and 57.2% of subjects, respectively who attended health centers and healthcare providers had calcium intake lower than 75% RDA(1). Studies on women of other countries such as US and EL Salvador also reported calcium intake deficiency in childbearing age women(5,14-16). One study indicated that Asian women have had lower calcium intake than Caucasian women(4). The results of present study and studies mentioned above shows that although women are under risk of osteoporosis, but their calcium intake are not adequate.

Data in table 1 shows that mean frequency of milk and cheese intake which are important resources of calcium, were lower than 1 times per day, however mean frequency consumption of those foods in healthcare providers were significantly higher than women who attending health centers. Thus, women of healthcare providers had better food habits regard to consumption of milk and cheese compared to women who attending health centers, that maybe resulted of high nutritional knowledge of them. Yogurt consumption was more frequent than milk and cheese in both groups. So, it seems that yogurt is the main source of calcium intake in studied subjects.

Based on results (table 2), overweight as an important health problem was seen in both groups of women. However, in women who were attended health centers, obesity was more prevalent than that of healthcare providers. So, women of healthcare providers were more succeed in control of weight because of theirs higher knowledge than the women who attending health centers. The health risk of obesity is very serious (17,18). It is estimated that 0.45 kg increasing in weight in 30-40 and 50-62 years old results in 1% and 2% increases in risk of death, respectively(17). Therefore, establishment of weight control programs for all of our community women should be considered as one of the most important health priorities in prevention of chronic disease.

There were no significant statistics relationships between BMI with calcium intake by adjusting age in both groups. Some other studies showed similar results(10-12).

High Calcium intake may reduce overweight and obesity. Suggested mechanisms are, reduced paratormone secretion, and 1,25 (OH) vitamin D, which inhibit lipogenesis. Increasing fecal excretion of lipids (1). In our study, calcium intake in both groups was lower than recommended allowances. So, being not significant relationship between these two variables may be due to calcium intake deficiency in our studied subjects.

As a Conclusion, majority of women had overweight and calcium intake deficiency as a health problem. Establishment of educational interventions for healthcare providers to inform and motivate them to active consultation with women attending health centers is suggested as a primary approach to prevent calcium deficiency and promote healthy life styles.
References


Hernandez-Rauda R, and Martinez-Garcia S.Osteoporosis-related life habits and knowledge about osteoporosis among women.


Relationship between Patients’ Understanding of Treatment Plan and Medication Compliance

Ahmed I. Albarrak  
Jawaher Almulhem  
Saad H. Alfraikh  
Mohammed Alotaibi  
College of Medicine, King Saud University, Saudi Arabia

Abstract

Introduction: Patients’ non compliance with medication plans has been recognized as a major problem in disease management and healthcare delivery. It is considered as a main reason for low therapeutic response. Moreover, Lack of compliance is associated with poor clinical outcomes, increased hospitalizations, lower quality of life, and higher overall healthcare costs. The rehospitalization rates increased over time for patients not complying with appointments. The patients understanding of treatment plan and patient education in general are very important factors in compliance, it was reported that if patients don’t understand treatment plan they will not fully comply with it.

Objective: to examine the relationship between patients understanding of treatment plan and their compliance to it.

Methodology: a self-design questionnaire was distributed to 80 patients in primary care clinics in King Khalid University Hospital. The questionnaire was design based on literature review and it consisted of three parts: personal information, treatment plan, and patient compliance to treatment.

Results: a total of 80 patients surveyed, only 71 completed questionnaires were collected, yielding a response rate of 88.7%. The result showed a significant correlation between acknowledgement and total compliance ($r=.25$, $p$-value=0.05). More than half of respondents (66.2%) mentioned they were committed to treatment plan from their view point. Furthermore, the result revealed a significant correlation ($r=.63$, $p$-value=0.01) between compliance of patient from their view point and total compliance calculated by the study instrument. Regarding sources of information, third of respondents (32.9%) rely on physicians as a source of information which related to the complications of the chronic disease(s), side effects of the medication(s),benefits of the medication(s). This finding indicates the importance of physicians as a principal source of information for patients. Less than half of respondents (46.5%) depend on trusted source of information (physicians, the hospital, and health education center) on the other hand, 53.5% depend on the non trusted sources (friends, internet and other sources). Most of the respondents (80.3%) agreed that they become more compliant if treatment plan is explained to them.

Conclusion: The current study results stress on the importance of an effective communication between the patients and physicians, not only to enhance medication compliance, but to improve overall healthcare outcome. Physicians are very important source of information for patients, and this
study findings stress on the importance of utilization of physician educational role. It is clear that patient education and in general and treatment understanding specifically have a significant positive impact on patient compliance.

Introduction

Patient compliance with medication is recognized to have a critical influence on outcomes of medical interventions. Patients’ non compliance has been increasingly acknowledged as a major problem in healthcare environment and considered to be a main reason for low therapeutic response.1-3 Furthermore, lack of compliance is associated with poor clinical outcomes, increased hospitalizations and physician visits, lower quality of life, higher overall healthcare costs and a source of ongoing frustration to physicians.3-8

Non-compliance is defined as any deviation by a patient from the physician’s treatment plan. None or low compliance is an ever present and complex problem that has an effect on the failure of treatment plans and its consequence, namely: deterioration of the patient’s health, the need for further consultation and hospitalization, and direct and indirect increase in the cost of case management especially for patients with a chronic illness. The non-compliance of the patient to the physician’s treatment plan can be a result of many factors; non understanding of the treatment plan is an important factor.7, 9, 10 Patients' non-compliance to their treatment plan could create serious health problems which cause important economic repercussions. Lack of compliance to medical advice is also a source of ongoing frustration to doctors. Compliance to treatment is a key link between process and outcome in medical care.11, 12 Relevant studies were retrieved and analyzed through comprehensive searches of different database systems to enable a thorough assessment of the major issues in compliance to prescribed medical interventions13. Given the importance of medication noncompliance, the WHO has published an evidence-based action for clinicians, scientists, policy-makers and health managers to improve worldwide rates of adherence.6

Although, there are enormous amount of quantitative researches undertaken of variable methodological quality to assess patient’s compliance, however, no gold standard for the measurement of compliance was defined. Often absent in the research on compliance is the patient acknowledgement of treatment plan, although the concordance model points at the importance of the patient's agreement and harmony in the doctor-patient relationship.3,14,15 The backbone of the concordance model is the patient as a decision maker and a cornerstone is professional empathy. Recently, several qualitative researchers have identified important issues such as the quality of the doctor-patient relationship and patient health beliefs in this context. Because non-compliance remains a major health problem, more high quality studies are needed to assess these aspects.14, 16, 17 The aim of the current study is to examine the relationship between patients understanding of treatment plan and their compliance.

Methods

Subjects

This is a descriptive cross sectional study to examine the relationship between patients understanding of treatment plan and their compliance. In total (80) patients were surveyed in primary care clinics in King Khalid University Hospital (KKUH). Patients were excluded if they were not oriented to person, place, and time, were unaware of the circumstances surrounding their visit/admission to the hospital, and/or did not speak or understand Arabic or English.
**Data Collection Procedure**

Due to the complexity in measuring compliance to medications, and the absences of a gold standard method of measurement. A self design questionnaire designed based on literature review was employed first to assess patients’ compliance to medications and then to examine the relationship between patients understanding of treatment plan and their compliance to it. The questionnaire consists of three parts. The first part included questions about patients personal information: gender, age, education level, occupation, socioeconomic level and daily habits. The second part was regarding treatment plan and patient understanding and acknowledgement. It contained questions about patient’s knowledge and acknowledgement of name of the physician, suffering any chronic disease, complications of the chronic disease, using medication(s) for the chronic disease, medications, benefits of the medication(s), side effect(s) of medication(s), and sources of information about the side effects and benefits of the medication(s).

The third part was about patient compliance to the treatment plan and included questions about the patient compliance to the treatment plan from patient point of view, what patient will do if he/she missed a dose at certain time while he/she is outside home, anyone who remind the patient for the time of the medications, skipping some doses will affect the healing process, if the patients feel some improvement before the end of the medications course will he/she stop continuing the course. In addition the questioner included asking the candidate, will he/she become more committed to the treatment if the physician explained the treatment plan, number of ignorance to the drug dose time during the last week, when he/she take the drug and if the dose time is during sleeping time what will you do.

**Statistical Analysis**

Data have been analyzed using Predictive Analytics Software (PASW). Questions related to understanding of treatment plan dimension were calculated into total acknowledgment and the questions related to compliance dimension were calculated into total compliance not including patient direct question of compliance from their view point. Pearson correlation was used to measure correlation between different variables. P value at 0.05 and less was considered as statistically significant.

**Results**

A total of 80 patients surveyed, only 71 completed questionnaire was collected, yielding a response rate of 88.75%. Most of the patients were female (female 46, male 25) and relatively young, with mean age 35.63 years (SD ± 12.57). Educational level in the questionnaire was categorized into 5 categorizes: illiterate, elementary, secondary, high school and college education level. Only one third (33.8%) of the respondents had college education level. For More details regarding educational level among study respondents see Figure 1, and patients’ characteristics are summarized in Table 1.
Table (1) Demonstrating the patient characteristics of the participated sample

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
</tr>
<tr>
<td>10-20</td>
<td>7 (9.9)</td>
</tr>
<tr>
<td>21-30</td>
<td>20 (28.2)</td>
</tr>
<tr>
<td>31-40</td>
<td>22 (31.0)</td>
</tr>
<tr>
<td>41-50</td>
<td>12 (16.9)</td>
</tr>
<tr>
<td>51≤</td>
<td>10 (14.1)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>25 (35.2)</td>
</tr>
<tr>
<td>Female</td>
<td>46 (64.8)</td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>13 (18.3)</td>
</tr>
<tr>
<td>Elementary</td>
<td>7 (9.9)</td>
</tr>
<tr>
<td>Secondary</td>
<td>12 (16.9)</td>
</tr>
<tr>
<td>High school</td>
<td>15 (21.1)</td>
</tr>
<tr>
<td>College</td>
<td>24 (33.8)</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>4 (5.6)</td>
</tr>
<tr>
<td>Housewife</td>
<td>28 (39.4)</td>
</tr>
<tr>
<td>Student</td>
<td>11 (15.5)</td>
</tr>
<tr>
<td>Employee</td>
<td>23 (32.4)</td>
</tr>
<tr>
<td>Retired</td>
<td>5 (7.0)</td>
</tr>
<tr>
<td>Social Status</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>21 (29.6)</td>
</tr>
<tr>
<td>Married</td>
<td>42 (59.2)</td>
</tr>
<tr>
<td>Divorced</td>
<td>5 (7.0)</td>
</tr>
<tr>
<td>Widow</td>
<td>3 (4.2)</td>
</tr>
</tbody>
</table>

Figure (1) a bar chart displaying the percentage of educational level among study respondents

During analysis, questions related to understanding treatment plan dimension were calculated into total acknowledgment and the questions related to compliance dimension were calculated into total compliance (calculated compliance). The result showed a significant correlation between acknowledgement and calculated compliance (r = 0.25, p-value = 0.05). When respondents were asked about how they see their compliance to the treatment from their view point, 66.2% of respondents mentioned they were committed and 31.3%
mentioned they were poorly committed. (See Figure 2 for more details).

Furthermore, the result showed a strong significant correlation ($r=0.63$, $p$-value=$0.01$) between compliance of patient from their view point and the calculated compliance. This indicates sort of validity for the calculated compliance and give an evidence that it can be relied on patient’s view point of compliance to the treatment as a measure of compliance. In addition, as showing in Figure 3, most of the respondents agreed (80.3%) that they become more compliance if the physician explains to them the treatment plan.

![Pie chart displaying the patients respond to (How do you see your compliance to the treatment from your point of view)](image)

*Figure (2) a pie chart displaying the patients respond to (How do you see your compliance to the treatment from your point of view)*

![Pie chart shows the patients respond to (Will you be more compliance if the physician explain to you the treatment plan)](image)

*Figure (3) A pie chart shows the patients respond to (Will you be more compliance if the physician explain to you the treatment plan)*

Patients were asked about their sources of information regarding complications of a chronic disease(s), side effects of the medication(s), and benefits of medication(s). The result revealed that 32.9% of respondents depend on physicians as a source of information, 10.3% of respondents take information from the hospital, and only 3.3% obtain their information from health education.
center. See Figure 4 for more details about sources of information. Sources of information were grouped during analysis into trusted sources and non-trusted sources. The trusted sources included: physicians, hospital, and health education center, and the non-trusted sources included: friends, internet and other sources. More than half of respondents (53.5%) depend on the non-trusted sources and only 46.5% depend on the trust source of information.

*Figure (4) a bar chart shows patients sources of information regarding complications of the chronic disease(s), side effects of the medication(s) and benefits of medication(s)*
Conclusion

The present study aimed to assess patient compliance and its relationship to patient understanding of treatment plan and prescribed medication. Although several studies have investigated and reported the relationship between knowledge and education with level of compliance. However, few or no study has investigated the relationship between patient compliance with patient understanding of treatment plan and prescribed medication. Claesson S. et al. reported that since the patient who decides how to use the therapy, his or her involvement in the process of explaining and understanding it is the key to improved compliance.

Indeed, there are numerous social, psychological, and physical factors that account for variations in patients' compliance with physician advice and there are many studies that addressed these factors. The range of factors that may account for variations in patients' compliance is enormous and includes personal characteristics, the nature of the regimen prescribed for each patient, paramedical and other influential persons, and the doctor-patient relationship. A study aimed to identify important factors that can influence patient compliance with prescribed medication found that age, gender, duration of disease, the attitude of staff and information/education about disease were factors of importance for self-report compliance. Another study evaluated factors affecting medication adherence in geriatric diabetic patients treated at private clinics and tertiary hospitals showed that drug storage and self-efficacy were factors affecting adherence to medication in tertiary hospital patients, and the significant variables in private clinic cases were financial level, severity for diabetes complications, and self-efficacy. Tsiantou V. et al. indicated that previous experience with hypertension, fear of complications, systemic disease management, acceptance of hypertension as a chronic disease, incorporation of the role of the patient and more personal relationship with the doctor facilitated adherence to the treatment.

The results of current study indicated that, there is significant correlation between acknowledgement and patient understanding of treatment plan with calculated compliance to medication plan ($r=.25$, $p$-value=0.05). Furthermore, most of the respondents (80.3%) reported that they become more compliance if physician explains to them the treatment plan. In a study of non-compliance and knowledge of prescribed medication in elderly patients with heart failure, Cline et al. found that non-compliance in elderly heart failure patients is shortcomings in patients' knowledge regarding prescribed medications. According to a study assessed the effect of patient education on antiobstructive medication dispensed from pharmacies, found educated asthmatics showed improved steroid inhaler compliance compared with the uneducated patients. Additionally, a study by Bhushan B, and Gaude G demonstrated that after employing the various strategies of patient's education, the compliance increased in one third of the subjects (34.3%) among the earlier defaulted patients. Based on the earlier mentioned study about asthmatic patients, the staff listened and took patients views about their asthma into account, and having received information and education about asthma tended to increase the odds of taking medication as prescribed.

As can be inferred from the present study, most of respondents (66.2%) reported they were committed to treatment plan from their viewpoint. In addition, the results revealed a significant correlation between compliance of patient from their viewpoint and total compliance (calculated compliance) ($r=.63$, $p$-value=0.01). Regardless the difference between subjects in both studies, self reported
compliance in present study was near to study aimed to determine physician- and patient-rated treatment compliance with osteoporosis treatments which found 65.5% of women considered themselves to be fully compliant. In addition it was adjacent to percentage reported by respondents in study of asthmatic patients' (57.8%).

The validity of self-reported adherence is a topic of current debate. Murri et al. 30 found that patient report may be a valid method for detecting non-adherence, but may be an insensitive measure of adherence. Conversely, a study carried out to construct validity comparisons of three methods for measuring patient compliance stated that the patient-report method yielded validities of about (0.4) compared to the nurse rating method of measuring patient compliance (0.7) and the physiological assessments (0.5).31 According to a study evaluated self-report and microelectronic monitoring, the adherence rates for all dosing errors between self-report and the Medication Event Monitoring System was significantly different and it considered patient self-report alone is not a reliable measure of adherence.32 Another study compared patient self report with pill-count as a measure of drug compliance; patient self report was poorly predictive of non-compliance and only 65% of patients were correctly classified using self-report.33

As previously indicated, most of the respondents (80.3%) reported that they become more compliance if the physician explains to them the treatment plan. Moreover, third of respondents of current study reported that they depend on physicians as source of medical information in the complications of the chronic disease(s), side effects of the medication(s) and benefits of the medication(s). This finding indicates the importance of communications, physician-patient relationship, and patient education in general to enhance compliance. This has been noted by Hulka et al. 34 in a study of the impact of medication regimen and doctor-patient communication in affecting patient medication-taking behavior. They found that for patients with congestive heart failure, good communication of instructions and information from physician to patient was associated with low levels of all types of medication errors. A literature review study of how do you improve compliance presented the issue in the context of its incidence of and barriers to compliance and provided general principles to improve compliance in pediatrics stated that a one-on-one relationship between physician and patient is needed for communication and improved compliance. In addition, improve communication between physician and patient and/or family one of general principles to improve medication compliance.35 Thrall et al. 36 considered the patient–physician relationship is perhaps the most important factor in enhancing medication compliance and improved physician–patient communication is essential.

The present study categorized sources of medical information into trusted sources and non-trust sources. The trusted sources included: physicians, the hospital, and health education center and the non-trusted sources included: friends, internet and other sources. Only 46.5% of respondents reported that they depend on the trusted sources of information. In a study by Impicciatore P., et al. 37 reported that only a few web sites provided complete and accurate information for managing fever in children. The study aimed to assess the reliability of healthcare information on the World Wide Web and how it may help lay people cope with common health problems. Standardized review to assess medical information provided in a medically oriented Internet discussion group suggested that medical information available on the Internet discussion groups may come from
nonprofessionals and may be unconventional, based on limited evidence, and/or inappropriate.38

A limitation of the present study could be that, the result cannot be generalized because a compliance or non-compliance was patient self-reported which possibly the results easily distorted by the patient. Although results revealed a significant correlation (r=.63, p-value=0.01) between compliance of patient from their view point and total compliance calculated by the study instrument which indicates kind of validity for the calculated compliance and give an evidence that it can be relied on patient’s view point of compliance to the treatment as a measure of compliance. However the instrument to measure compliance in the current study was self-designed questionnaire based on literature review and the validity of instrument was not fully assessed. In addition, there is no yet a gold standard method to measure patient compliance and methods to assess adherence are multiple, even in the single field.1 With these different methods, each method has advantages, limitations, and disadvantages.20 Anhtr limitation of the present study is sample size, it is suggested to conduct a study with wider sample to include difference disease conditions which can lead to compare compliance across several disease, age, social, and other sub groups, to be more able to identify the factors which affect on compliance and adherence to treatment plan and develop strategies to improve medication compliance.

The current study results stress on the importance of an effective patient-physicians communications, not only to enhance medication compliance, but to improve overall healthcare outcome. Physicians are considered to be a very important source of information for patients, and this study findings stress on the importance of utilization of physician educational role. It is clear that patient education in general and treatment plan acknowledgement and understanding have a significant positive impact on patient compliance. Non-compliance remains a major health problem, more high quality studies are needed to assess its related aspects.
References


Thrall G, Lip GY, Lane D. Compliance with pharmacological therapy in hypertension: can we do better, and how?. J Hum Hypertens. 2004 Sep; 18(9):595-7.


Participation of Patients with Chronic Illness in Nursing Care: An Iranian Perspective

Mohsen Soleimani
Semnan University of Medical Sciences, Semnan, Iran

Forough Rafii
Naiemeh Seyedfatemi
Center for Nursing Care Research, Tehran, Iran
University of Medical Sciences, Tehran, Iran

Abstract
The increasing number of chronically ill people has served as an impetus for the promotion of patient participation in nursing care. However, little is known about patient participation in Iran. The aim of this study was to identify the factors that are relevant to patient participation and the nature of that participation, as experienced by chronically ill patients and registered nurses in Iran. Grounded theory was used as the method.

Twenty-two participants were recruited by using purposeful and theoretical sampling. The data were generated by semi-structured interviews and participant observations. Constant comparison was used for the data analysis. This study indicated that participation is an interactive process between nurses, patients, and family members in the care giving context. Participation occurred when the caring agents worked together. The core category of “convergence of the caring agents” emerged. The subcategories emerged as the levels of participation and included “adhering”, “involving”, “sharing”, and “true participation”. The factors related to the caring agents and care giving context could be considered as predictors of the level of participation when caring for these patients.

Keywords: chronic illness, grounded theory, Iran, nursing care, patient participation

Introduction
Chronic illnesses account for about 47% of the total burden of illness in the Eastern Mediterranean Region (Khatib, 2004) and 80% of all deaths in low and middle income countries such as Iran (WHO, 2005). As disease patterns have shifted towards a high prevalence of chronic illness, new approaches to providing care to chronically ill patients are needed (Bruce et al., 2007). The general aim of such approaches is to increase participation of patients in their own care (Jerant et al., 2005). Patient participation is a concept so central to health care that becomes a legally stated right of patients (Eldh et al., 2006). The Ministry of Health and Medical Education in Iran has highlighted the patient's position in health care and has emphasized the patient's right to receive individually adjusted information (Joolaei et al., 2008). Participation is known to reduce stress (Lauri & Sainio, 1998), and fostering greater adherence to complex self-care regimens. Consequently, it helps to reduce disability and improves quality of life (Jerant et al, 2005).

Background
Participation is described as to join others in doing something. However, it has also other meanings including, involvement, sharing, taking part, partnership, cooperation, assistance and association (Eldh et al., 2004). Some structures have been proposed to understanding of patient participation. Cahill (1996) has suggested a hierarchical structure. However, Hickey & kipping (1998) view participation as a continuum. The degree to which patient participation can be put into practice is consequence of qualifications of staff as well as patient, and the nature of patient's disease (Sahlsten et al., 2005).

To clarify the usual hospital care in Iran, nursing shortages and heavy workload are known as the common characteristics of health care system in Iran. Moreover, care is delivered using functional method or task-oriented nursing, where task completion and maintaining the ward routine takes precedence over the needs of individual patients. There are no facilities of long-term residential care in the country. Culturally, attachment among Iranian family members is very strong, and family members are often involved in their patient's problems. They involve in everyday care of their patients and each ill patient has a family member on the bedside to help with his/her daily care.

Although some studies have explored patient participation in different contexts, there is still no congruence regarding elements and processes of patient participation (Sahlsten et al., 2008; Larsson et al., 2007). The aim of this study was to clarify the factors involved in patient participation and the nature of participation of patients in their own nursing care as experienced by patients with chronic illness, and registered nurses in Iran.

Methods

This study aimed to clarify chronically ill patients' and registered nurses' understanding of patient participation. Grounded theory was used as method with the purpose of explaining a phenomenon from within the social situation and to identify the inherent processes operating therein (Baker et al., 1992). Constant comparative analysis was the starting point for both data collection and analysis (Strauss & Corbin, 1998).

Setting

The study was carried out in three teaching hospitals affiliated to Iran University of Medical Sciences (IUMS) in west of Tehran, Iran, where patients with chronic illnesses are hospitalized. A significant proportion of patients admitted to these hospitals are in a low socio-economic level and some of them have no insurance coverage.

Participants

Twenty two participants were recruited by purposeful and theoretical sampling (Strauss & Corbin, 1998). The sample consisted of nine patients with chronic illness, eight nurses and five patients' relatives (Table 1). The informants were recruited from the medical wards. Other criterion for patient informants was hospitalization for three days or more. Patients with different self-care needs and different chronic illnesses including cardiac disorder, diabetes, systemic lupus, multiple sclerosis and respiratory tuberculosis were selected in line with theoretical sampling. Nursing participants were in different levels and positions and different working shifts and were directly involved in patient care. They had at list 1 year of experience in medical wards and were recruited from the same wards where the patients had been enrolled. As the study progressed, theoretical sampling was used to guide further data collection (Strauss & Corbin, 1998). Since nurses and patients pointed to some issues concerning the patients' families, the researcher interviewed five patients' relatives in the process of theoretical sampling.

Ethical Considerations
The study was approved for human subjects' protection by the institutional review board of IUMS. Permission was also granted from the managers of related hospitals and their nursing administrators. Further permission and written consent were obtained from all participants. Permission was also sought from nurses, patients and family members to observe their nursing care activities.

**Data Collection**

Data were collected using semi-structured interviews and participant observation. The duration of interviews ranged between 30 and 90 min, depending on participants' tolerance and their interest in explaining their own experiences. All interviews were tape-recorded and transcribed. The initial questions were broadly focused to encourage informants to speak freely and to recount their personal experiences regarding participation. The later interview questions were specific allowing the researcher to explore issue raised by informants in earlier interviews, for example "Please tell me about a situation when you experienced an active role in your own care during hospitalization". The nurses were asked: "Please explain the situations in which your patients were actively involved in their nursing care".

After the termination of interviews, ten sessions of participant observations were performed in all medical wards and all shifts. As the researcher engaged in some nursing activities, he could directly observe the patient care without extensive change in nurses' behaviors. Data collection was terminated when data redundancy occurred and the categories were saturated (Strauss & Corbin, 1998).

**Data Analysis**

Data collection, analysis and interpretation were carried out simultaneously, in keeping with grounded theory methodology (Strauss & Corbin, 1998). After each interview and observation, transcripts were manually transcribed onto a personal computer and initial impressions of emerging themes were identified. Field notes regarding each session of observations were also analyzed. The transcripts were re-read and codes assigned to recurrent themes. This process, known as "open coding", allowed the data to be examined word by word and line by line, such that codes were freely generated, often reflecting the words of the respondents themselves. The codes similar in meaning were grouped in the same categories. In axial coding, categories were related to their subcategories, and categories were linked at the level of properties and dimensions. The course of integrating and refining the theory occurred by selective coding (Strauss & Corbin, 1998). In this stage, the core category was identified. Credibility was enhanced through validation of emerging codes and categories in subsequent interviews and debriefing with the supervisors. Using prolonged engagement, member checking, peer checking, and maximum variation of sampling attested to confirmability of the findings (Strauss & Corbin, 1998).

**Results**

Through analysis and interpretation of data the core category of 'Convergence of caring agents' emerged. This category was generated from four inter-related sub-categories, as levels of patient participation, including (i) 'Adhering', (ii) 'Involving', (iii) 'Sharing', and (iv) 'True participation'. Nurses, patients and family members were the agents commonly involved in participation levels. Participation occurred when the caring agents used their capabilities to work with each other in the care-giving context.

The factors related to the caring agents and the nature of their interaction determined the level of patient participation. Participation initiated by the nurse, patient or the family
members, and its level was depended on their unique capabilities and their appraisal of each other. It could change over time depending on the factors related to caring agents, status of illness and the nature of relationship between caring agents. However, inclination and trust were the preconditions to each level of participation and increased gradually in higher levels of participation.

**Adhering**

There were situations in which the nursing staff were more active than the other caring agents. In these situations, the least interaction occurred between nurses and other agents. Patients and their families tried to be congruent with nurses by following their professional advice. The nursing staff strove to give them some information. However, they did not ask them to do anything except following professional advice congruent with their instructions and without any dispute.

**Patient and Illness Status**

Patients with limited experience of health care; patients who were unaware of their diagnosis and those with symptomatic conditions were not willing to engage in nursing care and trusted in nursing staff. They believed that nurses do the best for them. A patient stated: "...I don't know. They better know what to do. The best thing is just listening to them ...."

**Nursing Staff**

Limited interactions were observed between patients and less experienced nurses. These nurses mostly emphasized routine tasks and related negative beliefs about patients' abilities and capacities. A young nurse stated: "Most patients do not have enough knowledge. They are better off listening to us. They are incapable of doing things."

**Family Members**

Some family members encouraged their patient to following professional advice without any question. They did not have the required information about health care needs of the patient. A nurse stated: "Sometimes, I just ask the patient's relative to remind the patient to following the health related advice."

**Care-giving Context**

Context of care giving provided situations in which the patient participation was directed to adherence. According to our observations, when the nursing workload was too heavy, nursing duties required to be prioritized. In such a situation, the nurses expected their advice to be followed and the patients' care be performed rapidly.

A nurse stated: "We don't have enough time even for routine tasks; so we have to perform our duties rapidly and expect our patients just obey."

**Involving**

Whenever the patients and their families sought more information, involving occurred. They attempted to obtain the needed information by establishing relationship with the nurses to learn how to reduce the disease symptoms.

**Patient and Illness Status**

Some patients with limited experience of health care were willing to know more about their illness. They utilized their abilities to seek information and learn about their illness from available resources (physicians, nurses and peers). They also tried to get reliable and comprehensive information from experienced staff. A patient stated: "I try to know more about my illness. I ask my questions from different nurses and doctors."

**Nursing Staff**

Relatively experienced nurses provided more opportunities for enthusiastic patients to ask their questions and were open to patients' concerns. They were often caring and friendly. One of the patients stated: "Some nurses act as a mother and pay a lot of
attention, but others keep themselves so aloof from me that I prefer not to ask anything."

**Family Members**

Family members, who were concerned about the condition of their patient, tried to talk to experienced staff to know more about their patients. They preferred the patient do not be aware of threatening matters because they were concerned about further worsening of his/her condition. They could facilitate nurse-patient relationship and provide personal care to the patient. A family member stated: "...My patient is incapable of doing things; I am here to notify nurses about his status ...."

**Care-giving Context**

When the nurses' workload was not heavy, they provided opportunities for patients and their families to ask their questions and to participate in nursing care. Although sitting to talk to patients was not reasonable from the managers' perspective, the experienced nurses tried to find a way to do this. One of the nurses stated: "... Talking to patients does not count as patient care. Anyway, we try to create extra time to do this."

**Sharing**

Patients and their families explained the situations in which they contributed to practical nursing care. Nurses shared some practical aspects of patient care with the patients themselves or their families.

**Patient and Illness Status**

Patients whose conditions were stable and those with prior experience of illness and hospitalization were more interested to have control on their care and be involved in their own nursing care. One of the patients stated: "I myself wish to check my blood glucose with glucometer... I know how to do it."

**Nursing Staff**

Experienced nurses and those with positive beliefs regarding the patients' capacities were more disposed toward giving responsibilities to patients. Sharing responsibilities required nurses to know patients and trust in their skill. One of the nurses stated: "I give some responsibilities such as taking temperature, and ... to those patients who I know and I trust in their abilities, as I have supervised them."

The patients stated that giving verbal support by the staff such as saying ‘well done’ was often enough for them to continue to contribution to their own nursing care. The nurses needed to have a close and friendly relationship with the patients and their families to be able to support them.

**Family Members**

When nurses could not fully trust in patients' capacities or the patients feared to participate in their own nursing care, the responsibility was assigned to family members. To take care of their patients and to cooperate with nurses, families needed to be well-informed about patient's problems and use their prior health care experiences. One of the family members stated: "...I myself take my patient’s temperature and feed him with the tube."

**Care-giving Context**

Nurses were legally responsible for patients; therefore, they could not share some of their tasks with them. Some nurses shared the procedures that did not pose a threat on to patient safety. A nurse stated: "I usually assign the nursing procedures that are not risky to patients' lives because I am legally responsible to them."

**True Participation**

True participation required the highest level of convergence of caring agents. At this level, the participation agents did their best and used their capabilities to work with each other. Each agent was somehow active in patient care.

**Patient and Illness Status**

(95)
Patients, who had lived with their illness for a long time, were well-informed and were physically, mentally and emotionally capable, cooperated with the nurses eagerly. Patients who were hopeful about their recovery tried to make use of all their capacities to work together with nursing staff. One of the nurses stated: "Some patients have learned what to do with the problem. They know how to manage their illness, sometimes better than us."

**Nursing Staff**

Experienced nurses, those with positive attitudes toward patients and knowledgeable about patient's capabilities assigned the self-care responsibility to patients. They were friendly and respected the patient’s knowledge about his/her illness and allowed the patients to express their views and feelings and make decisions about their nursing care.

A patient stated: "To avoid the complications of a drug, I asked the nurse to give my drug at night. The nurse asked me if I had done that before. Then, she asked me if I was able to inject myself as well."

**Family Members**

Some family members supported their patients physically and emotionally by cooperating with nurses in patient care. They helped their patients and provided facilities for self-care activities. In one observation session the patient's mother had brought some fresh juice from home. She said: "The nurse has told me that he needs fresh juice."

The family members facilitated the nurse-patient relationship by conveying the patient's requests to nurses.

**Care-giving Context**

Although the care-giving context was relatively constant, there were situations in which nurses could provide opportunities for patient participation. When the facilities and equipments were inadequate for participation of the patients in their own nursing care, nurses borrowed them from the other wards or asked the patients’ families for assistance.

The factors relevant to patient participation and the nature of participation as experienced by chronically ill patients and registered nurses in Iran.

**Discussion**

The findings of this study demonstrated the structure and nature of participation among Iranian patients with chronic illness. Patient participation changed over time depending on the factors related to caring agents, status of illness and the nature of relationship between caring agents. It was the outcome of an interpersonal process and emerged as four inter-related levels from adhering to true participation. The unique feature of these levels was that they depended to the degree to which patients, nurses and family members had utilized their capabilities in nursing care.

Many structures have been proposed to understanding of the patient participation. Cahill (1996) placed participation in a hierarchy from involvement to collaboration and participation to partnership. Thompson (2007) identified five distinct levels of patient involvement in consultation from information to control decisions about health care. Eldh et al. (2010) indicated that patients described participation as acting in relation to health professionals. In another study, Eldh et al. (2006) showed that the patients experienced participation as the feeling of being in tune with staff.

We found that the initiation of participation depends on knowing and appraising of caring agents of each other. The patients appraised nurses' behavior and skills and nurses assessed patients' and family members' inclination and capabilities. Knowing patients enables staff to interact in a way that supports patients to participate in their own care (Tutton 2005). Also, patients are more likely to participate with a nurse they know and trust.
to be responsive (McQueen, 2000). Sahlesten et al (2005) suggested that nurses need to know the patient, to imply trust and establish relationships.

In our study, nurses' positive attitudes toward patients' capabilities and their friendly relationships promoted patient participation. Nursing literature has consistently proposed that nurse-patient relationship is of great importance in promoting patient participation in nursing care (Epstein et al., 2004; Millard et al., 2006). Establishment of relationship is the vehicle for the exchange of information and supporting self-care management. (Millard et al., 2006; Von Korff et al., 1997).

Iranian patients with symptomatic and serious conditions were concerned about making a mistake, so they preferred to fully listen to the nurses' advice and adhere to their recommendations. Millard et al. (2006) believe that these patients are not passive non-participants; rather they are actively electing to adopt a passive role.

Some studies have shown that patients with symptomatic illnesses are less likely to involve in their care than those who are not very ill (Arora, 2000). Davis et al. (2007) proposed that participation of chronically ill patients in their cares may be changed over time and through the course of illness, depending on the symptoms of the disease. In our study, patients unaware of their diagnosis accepted what had been determined by nurses. Many chronically ill patients in Iran are not aware of their diagnosis and the prognosis of the disease. Moreover, family members frequently ask nurses to hide the patient diagnosis from their relatives. This may be due to the families' concerns about the feelings of hopelessness in their patients. Farahani et al. (2008) stated that although the patients' families use this approach to support their patients, but diagnosis concealment may result in ignorance of follow up treatment.

Our findings showed that patients' abilities and their physical, mental and emotional status were important factors which affected the level of participation. Larsson et al. (2007) suggest that the patient readiness to actively participate depends not only on actual knowledge but also on physical and mental capability and emotional connection. Lammers & Happell (2003) proposed that patients should be given the opportunity to participate in accordance with individual interest, need and ability.

In our study, less experienced nurses were concerned about maintaining the ward routine, so they limited their relationship with patients to task completion. Lack of professional experience for a nurse often perceives as insecurity and the need to be in control of all that is happening (Sahlesten et al., 2005).

Patients involved in their nursing care, initiated participation by obtaining information based on their individual health care needs. They were looking for correct information. Other studies regarded participation as the right to receive individually adjusted information, seek explanations and express the preferences (Eldh et al., 2006; Asghari et al., 2009). In our study most of patients preferred to ask their questions from experienced staff, because they were friendly and confident and allowed patients to ask their questions. Some studies have suggested that patients value those staff that are friendly and care for them with respect (Tutton, 2005; Farahani et al., 2008). Moreover, Eldh et al. (2010) believed that communication based on respect is a key characteristic of patient participation.

In our study family members supported their patients and provided required services for them. Asghari et al. (2008) concluded that Iranian patients wish their companions to have an apparent role in receiving information concerning their condition; because family members are commonly seen as a source of support for patients.
The organization and its policies were almost constant and there were extensive shortcomings. These deficiencies hindered the true participation of patients in their own nursing care. However, nurses and family members tried to create opportunities for patients to participate even though in lower levels; yet the degree to which a patient experienced participation was dependent upon the nurse-patient relationship and it required time. Other studies also suggest that developing interaction for successful relationship between a nurse and a patient requires sufficient time (Sahlsten et al., 2005). The more time spent, the more valued a patient felt. This increases the feeling of control and emotional comfort (Larsson et al., 2007). In our study heavy workload, nursing shortage and functional method of nursing limited the interaction of caring agents. Sahlsten et al. (2005) points that lack of nurse-patient relationship depends on the way work is organized or absence of holistic nursing care philosophy. Inadequate facilities and equipments created barriers to the active involvement of patients in nursing care. Sahlsten et al. (2005) stated that inadequately designed environments denote a greater risk for passivity and even prolonged hospital stay. So nurses need to use their own and family members' skills in finding workable solutions for patient participation regardless of shortcomings in the physical environment.
Conclusion

Participation in health care context of Iran is a dynamic process which occurs when patients, nurses and family members work together toward their common goal. The findings of this study suggest that the factors related to caring agents and care giving context could be considered as predictors of the level of participation. Considering the factors involved in true participation, nurses would increase their capacities and involvement and try to inform patients and families congruent with the related requirements. It is needed to encourage less experienced nurses to behave friendly and to be receptive to their patients to promote the level of participation. Patients and families also need to increase their health care information about the related chronic illness. However, as a qualitative and context-specific study, the findings should be used with caution. Exploring the concept in more contexts and specific chronic illnesses is suggested.
References


An Examination of the Role Discrepancy and Turnover Intention Among ICU Nurses at a Jordanian Teaching Hospital

Muhammad W. Darawad
School of Nursing, University of Jordan, Jordan

Abstract
Nursing shortage is affecting all components of patient care process. Literature identified nurses’ dissatisfaction with work environment and turnover as causes of the shortage, and ambiguity of nurses’ role as a cause for their dissatisfaction. ICU is considered amongst the most stressful settings for nurses. Considering nurses’ role in ICU is believed to promote a compatible environment that is appealing for nurses to stay.

Purposes: (a) to describe role discrepancy and turnover intention among Jordanian ICU nurses; and (b) to examine the relationship of nurses’ role discrepancy with their turnover intention.

Methods: Using a descriptive correlational design, a convenience sample of 114 ICU RNs, at a teaching hospital in Jordan, was used. Concepts were measured using Nursing role conception scale and Withdrawal Cognition Scale.

Results: Nurses’ reported perceiving a role discrepancy (ideal 4.26 vs. actual 3.14, p < .05). Average turnover intention was 3.59/6. However, nurses’ perception of role discrepancy was not found to have a statistically significant relationship with their level of turnover intention.

Conclusions: More attention needs to be directed toward nurses’ perception of their role. However, the low reliability and validity results of the used scales caused the results to be cautiously taken, and limited the generalizability of the findings. Further examination of those instruments is recommended.

Introduction
Nurses are considered the “nucleus of the health care system” (Abualrub, 2007 p. 117), and they constitute the largest percentage among health care professionals (Buerhaus, Auerbach, & Staiger, 2007). So, shortage of the nurses constitutes the most important component of health care workforce shortage, or "imbalance" as was entitled by the World Health Organization (WHO) (2002), which occurs "when the quantity of a given skill supplied by the workforce and the quantity demanded by employers diverge at the existing market conditions" (p. 1).

The problem of nursing shortage is reported worldwide. It was reported in the United Kingdom (UK) (Buchan, 2002), Australia (Nursing Education Review, 2002), Canada (Canadian Nurses Associations, 2002), Jordan (Mrayyan, 2006), and the United States of America (USA) (American Nurses Association, 2002). However, the future is not expected to be of any better as demand for the RNs is expected to exceed the supply (Buerhaus et al., 2007; Scott, 2001). To solve this problem, we need to address the reasons behind this issue. The United States General accounting Office (US-GAO) (2001a) summarized the factors that lead to nursing shortage to: (a) Aging of nursing workforces resulting from reduced entry of younger
nurses to the profession; and (b) the nurses' job dissatisfaction.

The aging of the nursing workforce is documented in the literature. Buerhaus, Staiger, & Auerbach (2000) reported that the average age of the US RNs increased from 37 to 42 years between 1983 and 1998. On the other hand, the American association of Colleges of Nursing (AACN) (2000) reported that the rate of nursing students enrollment in to the bachelor degree declined by 6.6% in 1997, 5.5% in 1998, and 4.6% in 1999.

The second cause identified by the US-GAO was the nurses' job dissatisfaction, which was found to contribute to both problems of recruiting and retaining nurses. Aiken et al. (2001) stated that nurses’ job dissatisfaction and their levels of burn out are considered of special importance within the context of nursing shortage. Also, they reported that more than 40% of the US nurses reported being dissatisfied with their jobs. Not only that, but also their results revealed that the low satisfaction and the low morale among hospital nurses were reported in countries other than the USA as Canada, England, Germany and Scotland.

As a result of nurses' job dissatisfaction, turnover rates among RNs have increased to significant levels, which are considered a challenge facing the health care organizations and are growing annually. Among those rates is what was reported by the Nursing Executives Center (2000) that the turnover rate among US hospital nurses raised from 12% in 1996 to 15% in 1999. Another survey by the Hospital and Healthcare Compensation Service (HHCS) (2000) revealed that the turnover rate for the overall US hospital nurses has doubled in just 2 years (from 11.7% in 1998 to 26.2% in 2000). Peterson (2001) stated that in order to understand the nurses' job dissatisfaction, we need to look to nursing work environment, which not only has a negative impact on retention of the RNs, but also on the ability of the profession to recruit new nurses. However, nursing work environment is known by the high workload, critical decisions, more stress, less satisfaction, low social status, and deterioration of the support system. All in all, the nursing work environment is best described as "more continuous and less rewarding" (Coffman, Spetz, Seago, Rosenoff, & O'Neil, 2001 p. 3).

The unhealthy work environment is known to cause a reality shock among the new nurses when they start their practice. Reality shock emerges due to the differences between what nurses are expecting and the reality of their clinical practice (Kramer, 1974; Nelson & Hillan, 1995). Unfortunately, not only new nurses feel this difference, but also experienced nurses are suffering from the reality shock or the gap between theory and practice (Landers, 2000; Takase, Maude, & Manias, 2006a).

The lack of specification of nursing role is considered among the conditions that makes nursing work environment difficult for nurses. For example, RNs are often asked to do things that are not in their job description. Dworkin (2002) reported that whenever there is a shortage of nursing assistants, nurses are asked to fulfill their roles including emptying garbage and changing beds. This dual role requirement is known in literature with "role discrepancy", which was one of the major risk factors identified by Takase et al. (2006a) to contribute to nurses' intention to leave their jobs. Role discrepancy is considered as a state of incompatibility between nurses and their environment in terms of their expected and actual roles (Takase, 2005), which is expected to have behavioral consequences.

Behaviorally, turnover is considered as the ultimate and the most dangerous consequences of role discrepancy. Because nurses can not change the situation within their work environment, they might choose to leave it. The results are those sky-rocketing rates of turnover that are documented in many
countries worldwide, such as 18-26% in USA (Joint Commission of Accreditation of Health Organization, 2002), and 20% in UK (Buchan & O'May, 1998).

Definitely, patients are the most affected group by the behavioral consequences of nurses’ role discrepancy. It is known that the high turnover rates of nurses will increase the patients-to-nurse ratio, which is not safe for patients. For instance, Aiken, Clarke, Sloane, Sochalski, and Silber (2002) reported that "each additional patient per nurse was associated with a 7% increase in the likelihood of dying within 30 days of admission, and a 7% increase in the odds of failure-to-rescue" (p. 1987). Distraction away from their patients and failure to provide the holistic nursing care are examples of how patients can be affected by the dissatisfied nurses (Mrayyan, 2006).

Health care institutions are also affected by the increased nursing turnover rates. Replacement of the leaving nurses is very costly considering that nurses are the largest sector in these institutions. Strachota, Normandin, O'Brien, Clary, & Krukow (2003) estimated that replacement of one medical-surgical nurse will cost a hospital approximately $42,000, while replacement of one specialty nurse will cost a hospital approximately $62,000. Also, the Advisory Board Company (2000; cited in O'Brien-Pallas et al., 2006) estimated that if a 500-bed hospital reduced nursing turnover only from 13% to 10%, the annual saving can amount to $800,000.

While majority of the hospitals are focusing on recruitment process, the need is for healthy work environments through both recruitment and retention processes. To help reducing problems of nursing workforce shortage, O'Brien-Pallas et al. (2006) stressed on considering nursing turnover as "a health human resource issue within the context of health environments where nursing shortages are growing" (p. 169). Also, we need to closely monitor nursing work environment through investigating how healthy they are, and strongly support nurses' participation in the health care workforces.

**ICU Environment**

Started in mid-1960s, ICU was found to gather patients who are critically ill in a defined place where they can be attended by knowledgeable, skilled, and compassionate personnel with a close access to life supporting equipments (Balbierz, 1977). Then, the number of ICUs increased over time. Between 1985 and 2000, ICU beds increased in the USA by 26.2% with an occupancy rate 65%, and a cost of $55.5 billion (Halpern, Postores & Greenstein, 2004). Because ICU contains both life-sustaining activities along with noise and fast-paced actions, it is considered a contradictory environment (Balbierz, 1977). It contains patients who are instable and disoriented, which requires care providers who are capable to do continuous evaluation and interventions. This working environment can negatively affect everybody works there, which in turn can affect safety and quality of care those patients receive.

The concern about ICU nurses first appeared in studies reported in late 1960s. even though some literature found that the ICU stress level is comparable to that found in general floors (Boumans & Landerweerd, 1994; Mrayyan, 2006), ICU was perceived to be an extremely stressful work environment for RNs and other health care workers (Cartledge, 2001; Chan & Huak, 2004; Ruggiero, 2003). Moreover, Cartledge (2001) stressed on the need for having the awareness of the potential for the nurses to become excessively stressed in the ICU environment.

Different types of ICU stressors have been found in literature to affect ICU nurses. These stressors are classified under three main categories; Interpersonal relationship,
management of the unit, and direct patient care activities (Chiriboga & Baily 1989). Balbierz, (1977) considered any perceived threat to nurse's self image, goals, or roles as a stressor that can affect nurses. For instance, the high rates of mortality, the nature of death in the ICU, and the fast changing pace of work were described by Lally & Pearce (1996) as the leading causes to what has been described as an environment of hidden tension and anxiety. Also, Ruggiero (2003) found the ICU to be a very busy place, whatever the shift is, and the level of fatigue encounters ICU nurses is the same among day and night nurses due to the similarity of shift duties of nurses within the ICU.

In general, research studies on the effects of stressful events have focused on the primary victims of those events. But nurses working in hospitals, especially in the ICUs, are exposed to stressful events in their daily work of taking care of those victims, and their needs were largely ignored (Vachon, 1987). The fact that the ICU nurses are at more risk makes it a necessity on nursing researchers to focus on the ICU, without ignoring that nurses in the other floors might have comparable levels of stress at certain times and places.

**Jordanian Nursing Workforce**

According to the Jordanian Nurses and Midwives Council, in 2007, the number of Jordanian nurses was 16,012, which constitutes the largest number among Jordanian health care professionals. This first rank is at risk as many nurses are migrating outside toward the Gulf countries, USA, UK, Australia, and Canada, searching for better work conditions and salaries. Approximately, the average salary for the newly graduated nurses ranges between $400 and $600. Jordanian nurses are sharing the nurses, globally, the same stressful work environment previously discussed, if not worse because Jordan is a developing countries that is known for its limited resources. Abualrub (2007) summarized the causes of the high nursing turnover rates and the nursing shortage in Jordan as the following: (a) slow salary increases, (b) fewer women are selecting nursing as a profession, (c) a decreased number of nursing faculties, and (d) the unattractive nursing work environments.

Concerning the fact that the ICU is more stressful for nurses than other nursing floors, it was proven to be true among Jordanian nurses. Ahmad, Saleem, Shankary, and Safady (1994) compared the level of stress and depression among nurses from the ICU, hemodialysis unit, and regular floor. They found that ICU nurses were suffering from more stress and depression than nurses from other units. Also, Mrayyan, (2006) noted that Jordanian ICU nurses had a slightly lower level of satisfaction than nurses from regular floors.

Up to our knowledge, no study was found to explore the role discrepancy and its consequences among Jordanian RNs. So, this study is devoted to be the first with this regard. This study builds on the recommendations of (a) Takase et al. (2006a) who suggested their study to be replicated in different countries, and their instruments to be applied among different samples to test for their validity and reliability; and (b) Abualrub (2007) who recommended nursing researchers in Jordan to conduct research studies concerning nursing work conditions as one of the strategies to deal with the nursing shortage in Jordan. Also, there is a limited literature regarding the role discrepancy and its consequences among the RNs especially in the developing countries. The purposes of this study were (a) to describe role discrepancy and turnover intention among the ICU RNs in Jordan; and (b) to examine the relationship of role discrepancy with nurses' turnover intention.

**Methodology**
Design
The descriptive correlational, cross-sectional design was used in this study to explore role discrepancy and turnover intention among Jordanian nurses, and to examine the relationship of role discrepancy with nurses' reported level of turnover intention. This research design fits with the requirements of this study in exploring the study concepts as Takase et al. (2006a) reported that nurses did experience the role discrepancy, but the behavioral consequences of role discrepancy are still lacking of the empirical support. For such a purpose, Burns & Grove (2001) recommended the descriptive design as a helpful approach for investigating research areas with insufficient empirical support, which are believed to be stable over a period of time.

Setting
The sample of this study was selected from RNs working at ICUs of a major teaching hospital in Amman, the capital of Jordan. After determining their eligibility, all eligible RNs within those ICUs were invited to voluntarily participate in this study.

Sampling
A non-probability convenience sampling technique was used, which is "the most commonly used sampling method in nursing" (Polit & Hungler, 1999 p. 282). For calculating the sample size, the power analysis technique (Cohen, 1992) was used by applying the multiple regression test, and using eight independent variables Level of significance $\alpha = .05$ and power $(1- \beta) = .80$ have been adopted for this study as they are considered standards for the purpose of running the power analysis to estimate the sample size in nursing studies (Polit & Hungler, 1999). Also, a medium effect size, equals .15 using multiple regression test (Cohen, 1992), was used. By investigating the sample size table in Cohen (1992 p. 159), the required sample size was 107 participants. Participants' inclusion criteria included the following: (a) being a RN with a bachelor degree in nursing; (b) working at ICU for at least three months; (c) working at the bedside nursing care; and (d) able to comprehend reading in English.

Instruments Demographics
The demographic data sheet was developed by the researcher, and contained the information required to describe the characteristics of the study sample. Subjects were asked to report gender, age, marital status, level of education, years of nursing professional experience, years of ICU experience, unit specialty, number of night shifts per month, and the shift at which the questionnaire was filled out. Also, on a scale of 0-10, how satisfied they were with salary, work, and work environment.

Role Discrepancy
To measure nurses’ role discrepancy, the Nursing Role Conception Scale (NRCS), which measures nurses' conceptions of their ideal and actual roles concerning the use of nursing skills and task delegation, was used. The NRCS is a modified version by Takase (2005) who developed it using a combination of the Jefferson Survey of Attitudes toward Physicians-Nurses Collaboration (Hojat et al., 1999) and the Staff Nurse Role Conception Inventory (Taunton & Otteman, 1986). The NRCS consists of two identical 10-items subscales, ideal and actual, among which each has two factors, the use of nursing skills (8 items) and task delegation (two items). Each item is rated with a 6-points Likert scale ranging from “1” (strongly disagree) to “6” (strongly agree). The total is 10 items for the ideal subscale, with the high scores indicating that nurses are having a strong desire to engage in those roles, and 10 items for the actual subscale, with the high scores indicating that nurses believed those roles are
really applied in the actual work environment. Thus, it is possible to compare between nurses' desired roles and their perception of the actual roles assigned. The result is a scale that has two identical 10-items subscales (ideal and actual) with a possible range of 10-60 for each subscale. Finally, the scale contains three reverse-coded items.

Concerning the reliability of the NRCS, Takase (2005) reported that the reliability score for the actual role subscale was .73; whereas the subscale that measures nurses' ideal role had a moderate reliability score of .62. This low reliability was considered as a weakness in this scale (Takase, Maude, & Manias, 2006b). However, the researcher believed that the scale still could be used for this study for many reasons. First, the low reliability was in one part of the scale while the other part had a good reliability score. Second, this scale was the most recent and only one study has applied it, and applying it in this study, using a different population, was believed to give different results especially if we knew that there was a limitation in the population of the original study.

**Turnover Intention**

The nurses' turnover intention was defined as the “attitudinal (thinking of quitting), decisional (intention to leave), and behavioral (searching for new job) processes proceeding voluntary turnover” (Takase, 2005 p. 14-15).

To measure nurses' turnover intention, the modified version of the Withdrawal Cognition scale (WCS) (Takase, 2005) was used. The original scale was developed by Mowday, Koberg, & McArthur (1984) to measure the three factors of the turnover (thinking of quitting, searching for new jobs and intention to quit).

The modified WCS uses a 6-point Likert scale ranging from “1” (strongly disagree) to “6” (strongly agree). The scale has five items, with range of 6 to 30. The higher scores indicate strong turnover intention. Also, it is important to mention that the scale has three reverse-coded items. The WCS was found to have a good reliability of .79, and its construct validity was established with a result of one factor solution that explained a total variance 39.78% (Takase, 2005).

**Results**

**Sample Description**

**Demographic Characteristics**

The total number of those who met the inclusion criteria and were invited to participate was 123 nurses, among which the number of those who accepted participation was 114 participants, which resulted in a response rate of 93%. Only 36.8% of the participants were males (n = 42). The average age of the participants was 27.1 years (SD = 4.6), which ranged between 22 and 46 years. Sixty four participants (56.1%) were singles, which was relatively high according to the Jordanian community, and might be justified by the difficult financial situations. Also, only six participants (5%) reported having the master degree, which was justified by the old policy of the hospital, which did not allow nurses to continue their higher education.

**Professional Characteristics**

The average period of the nursing experience was 4.7 years (SD = 4.2), and the average period of experience at the current ICU was 3.9 years (SD = 3.5). Eight ICU units were included in this study, with the largest representation from both the Surgical-ICU and the Neonatal-ICU with 23 nurses each, and the lowest representation from both the Burn unit and the Neuro-ICU with seven nurses each, which reflects the size of those ICUs within the hospital.

The average night shifts per month reported by the nurses was 7.8 nights (SD = 2.9), with a range of 0 to 22. However, it was reported by the nurses that they were required, by the hospital policy, to make 7-9 nights per month except in certain cases. Finally, the majority
(40.4%) were interviewed during the night shift, which may be due to the busy time during the day and the evening shifts.

**Nurses’ Level of Satisfaction**

Trying to have some comparative variables, the researcher asked the participants to rate their satisfaction with salary, work, and work environment. Using a scale of 0-10, the researcher used single item scale to measure the above mentioned single item scale to measure the above mentioned variables, separately. Nurses’ reported moderate levels of satisfaction with salary, work, and work environment, with average satisfaction rates of 5.6, 5.4, and 4.2, respectively (Table 1).

Concerning the correlation between the main study variables, table 2 provides the means and the standard deviations of the main study variables as well as the correlation between those variables. There was no significant relationship between the study variables (Table 2).

**Answers of the Study Questions**

**Q1. Do Jordanian ICU RNs perceive discrepancy between their ideal and actual nursing roles?**

To test if nurses perceived role discrepancy or not, a paired t-test was conducted to compare their perception of their ideal and actual roles. Nurses rated their ideal role significantly higher than their actual engagement in those roles (ideal/ actual = 4.27/ 3.14, t (113) = 13.53, p < 0.01). On the other hand, the items of “Decision making on working conditions policy” (5.41/ 2.68) and “Decision making on patients’ hospital discharge” (4.74/ 2.85) had the highest levels of role discrepancy. In addition, while eight items had a positive discrepancy level (ideal - actual), the items of “delegation of patient hygiene” (3.08/ 3.64) and “delegation of patients’ daily activities” (3.14/ 3.40) had negative discrepancy levels.

**Q2. How much of the variance in the Jordanian ICU RNs’ turnover intention is explained by role discrepancy?**

It was assumed that the relationship between nurses' ideal role, actual role, and turnover intention is curvilinear, and that the person-job fit (less discrepancy level) contributes to low turnover intention among RNs. To test for those two assumptions, the polynomial regression analysis was used. To run this analysis test, the linear terms of the ideal and actual roles (C & A, respectively) were entered in the first step of the hierarchical regression. In the second step, the curvilinear terms (i.e. C2, A2, and CA) were added. Neither step showed any significant variance.
with the nurses’ turnover intention (R² = .014, F = 0.80, p = .45) and (R² = .03, F = 0.66, p = 0.66), respectively. To conclude, neither assumption could be supported statistically (Table 3).

Table 3: Results of the polynomial regression analysis (role discrepancy with turnover intention)

<table>
<thead>
<tr>
<th>Relationship</th>
<th>C</th>
<th>A</th>
<th>R²</th>
<th>C</th>
<th>A</th>
<th>C²</th>
<th>CA</th>
<th>A²</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnover intention</td>
<td>-.01</td>
<td>-.12</td>
<td>.02</td>
<td>-.06</td>
<td>.04</td>
<td>.09</td>
<td>-.09</td>
<td>.03</td>
<td>.03</td>
</tr>
</tbody>
</table>

C: Ideal role conception, A: Actual role

Discussion

Q1. Do Jordanian ICU RNs Perceive Discrepancy between their Ideal and Actual Nursing Roles?

Statistically significant difference between nurses’ ideal role and actual role was found, which means nurses had the perception of role discrepancy. Even though Jordanian nurses’ levels of ideal and actual role conception were lower (4.26 and 3.14) than that reported by the Australian nurses (5.02 and 4.01) (Takase et al., 2006a), the amount of discrepancy was higher (1.12 vs. 1.01, respectively). This may reflect a difference in the way of thinking between the nurses in both countries in terms of what represents ideal and actual nursing roles. Also, the significant perception of role discrepancy is consistent with Black (2002) who found the US nurses to rate their ideal role higher than their actual role.

Concerning the individual items, among the top three items of the highest discrepancy levels, only one item “decision making concerning work conditions” was common with the items reported by Takase et al. (2006a). The other items were “decision making concerning patient discharge” and “developing patient care plan”. However, having the largest discrepancy levels in the items where decision making was included calls for more attention to the nurses’ desire toward being involved in the process of decision making, and points out to how much they feel frustrated in this regard.

The other significant result that is different from Takase et al. (2006b) was the presence of two items with a negative discrepancy level, which meant that the actual roles were rated higher than ideal roles. Those items were “delegating patient hygiene measures” and “delegating patient daily activities to assistant nurses”. This extraordinary result may be due to high workload at the selected hospital as perceived by nurses, or due to the nature of the critical cases within ICUs, where many of the nursing interventions cannot be delegated and have to be conducted by RNs, or request their presence.

Consistent with the literature, this role discrepancy was considered a source of stress for the nurses. However, contrary to the study assumptions, this role discrepancy did not significantly correlate with nurses’ level turnover intention. This particular result is totally opposite to the results of Takase et al. (2006a) who found significant relationship between nurses’ perception of role discrepancy and turnover intention. Again, these results need to be taken with caution due to the low validity and reliability of the study instruments.

Q2. How much of the Variance in the Jordanian ICU RNs’ Turnover Intention is explained by Role Discrepancy?
Results of this study did not reveal a statistically significant relationship between nurses’ role discrepancy and turnover intention. Also, results could not support the hypothesized curvilinear relationship between them. This means that role discrepancy could not be used to explain the variance in the Jordanian nurses’ turnover intention. Nonetheless, it was remarkable that Jordanian nurses were found to have more intention for turnover than the Australian nurses (Takase, 2005), giving that both studies used the same scale, which possibly reflects more stress in their work environment. The intention to leave nursing was also reported by English, Scottish, and US nurses (Aiken et al., 2001), but with a lesser degree than the Jordanian nurses.

To compare with a Jordanian study, Mrayyan (2006) reported that the Jordanian nurses’ turnover rate was 18%, but this study found that 57.9% of the RNs scored turnover intention equal or greater than average (3.59 out of 6). So, unless serious interventions concerning recruitment and retention of RNs are stemmed, we can imagine the magnitude of the future problems Jordanian hospitals would confront if that turnover intention percentage became true turnover rate.

Another outstanding result was the high nurses’ professional turnover intention, which was found to be significantly higher than their organizational turnover intention. This points out to the fact that it is not only the work environment that drives nurses toward thinking to quit, but also nursing as a profession seems to be not capable to meet nurses’ ambitions and expectations, which makes them think to leave nursing to another profession.

Finally, the lack of relationship between Jordanian nurses’ perception of role discrepancy and their turnover intention is contrary to Takase et al. (2006a), who reported not only a relationship that is significant, but also a relationship that can be better explained by a curvilinear relationship, which could not be supported in this study. Due to the low validity and reliability of the study instruments, these results need to be cautiously taken.

**Limitations**

The most important limitation was the low reliability and validity results of the NRCS and the modified WCS, which caused the results to be taken with caution, and limited the generalizability of study results. This limitation might be rationalized by other limitations especially the relatively small sample size, and the discrepancy between of the language of the questionnaire and the native language of participants (English vs. Arabic, respectively). Even though the sample size was calculated at the beginning of this study, it seemed to be insufficient to test the validity and reliability of the newly-developed instruments. Also, nurses seemed to be more toward accepting the Arabic version of the instruments despite the fact that they have been taught nursing using the English language.

Due to the time constrain, the convenience sampling technique was adopted, which is known to limit the generalizability of the study results, and to hinder the ability to conclude a causal relationship between the study variables. Moreover, the sample was restricted to only one hospital and one category of hospital units (i.e. ICU). So, results of this study are applied merely to the participating nurses within those participating units. In addition, no conclusions can be made regarding the differences between those ICU units and the other hospital units in terms of role discrepancy and turnover intention. Concerning the condition of nurses during the data collection procedure, nurses were found to be very busy during their shifts. Data collector reported the need to visit the same unit many times to find nurses who are able to get 20 minutes to answer questions of the
study instruments. So, the lack of certain techniques to contact nurses outside their work shift was considered a limitation for this study, because subjects who are rush to answer the questionnaire are more likely to do so but with more carelessness.

**Implications**

**Nursing Knowledge**

It is true that this study is not the first to address nurses’ perception of role discrepancy. Though, it is the first to address nurses’ perception of role discrepancy, and to address the relationship of role discrepancy with turnover intention among the Jordanian nurses. The gained knowledge of this study is relevant to nursing because the study asked nurses themselves to state their role conception from two different views, ideally and actually. Also, this study asked nurses to report their turnover intention, unlike most of the nursing turnover studies that only reported the official turnover rates. Doing so should give nursing administrators an insight about nurses’ future decisions, and respite them sometime to take steps before nurses’ turnover intention develops to be actions toward leaving nursing.

This study came to fill out a significant gap in the nursing literature regarding the nurses’ perception of role discrepancy and its behavioral consequences, particularly in countries other than the western countries. The results of testing the validity and reliability of the study instruments are another contribution of this study to the body of nursing knowledge. The NRCS and the modified WCS could not be supported in terms of validity and reliability by this study, which necessitates further examinations of those two instruments.

**Education**

Many nursing literature have related the problem of nurses’ role discrepancy to the type of nursing education at nursing schools, where students are promised with advanced nursing professional roles and goals. This seems to be true for all the nursing schools all over the world. Nursing students should be informed, during their school time, with the truth regarding their roles, which may include carrying out physicians’ orders and caring for patients from A to Z. Also, the taught definitions of nursing at nursing schools should be more flexible to include all roles nurses might be required to carry out in the nursing work environment.

This is not a pessimistic invitation to lower the class of the nursing profession, or to restrict roles of nurses to the above mentioned roles. Rather, this is an invitation (a) to be realistic during teaching nursing students, (b) to define nursing to them as close as possible to what it is in the actuality, and (c) to include both the good and the bad regarding the current situation of nursing. By doing so, we can ask them for their input for change when they enter the actual field. Failure to do so, will keep the problem of nursing shortage within the same empty cycle of nurses graduating from nursing schools, get shocked with the reality, and then start thinking about leaving their profession.

**Practice Nursing Administrators and Policy Makers**

Even though role discrepancy was not found to be significantly related to nurses’ turnover intention, the results of the individual study concepts deserve to stop at, and the presence of the relationships between those two concepts should not be ignored especially with the low validity and reliability of the study instruments. Instead, the study results should be alarming to the nursing administrators and the health care policy makers who are required to set the policies that are capable to accomplish nurses’ desires of more contribution in the decision making, particularly when it comes to their work environment and conditions. Setting an
obvious job description seemed to be the most important step for the nursing administrators to start with as many nurses reported the lack of such description. Finally, health policy makers, particularly in Jordan, need to know that without immediate actions, more nurses will be leaving the profession, and the previous turnover rates will be dangerously replaced.
Conclusion
Further research studies are needed to more fully explore the concepts of nurses’ role discrepancy and turnover intention. However, more clarifying definitions of those two variables are needed in nursing as the current definitions seemed to be unable to include all the related components of those two concepts within the nursing work environment.

The researcher highly supports Takase et al (2006a) in recommending more research studies in the field of nurse’s perception of role discrepancy and its relationship to different psychological and behavioral consequences. Furthermore, it is recommended to replicate this study among nurses in Jordan and other developing countries but with a larger sample to give the NRCS and the modified WCS another chance for their validity and reliability to be retested. Also, it is recommended to translate the NRCS and the modified WCS to the Arabic language for the purpose of comparing both the Arabic and English versions.

Among the other research recommendations is to compare the perception of role discrepancy and turnover intention among nurses from different hospital units. Also, it is recommended to compare those variables among nurses from different health care sectors (e.g., public, private, and teaching). Finally, research studies to compare role discrepancy among nurses from different countries are also recommended.
References


Enhancing the Learner Experience: Accessing Learners’ Utilization of Communicative Tools in Online Health Courses

Samer Hamidi
e-School of Health and Environmental Studies, HBMeU, Dubai, UAE

Abstract

Purpose: The overall aim of this study is to draw-up recommendations on how the virtual learning environment (VLE) could be integrated and embedded more effectively in the studies of postgraduate health related courses at Hamdan Bin Mohammed e-University. The objective of this study is to measure the interactivity of learners within the VLE and to emphasize the importance of utilizing and maximizing Moodle features in the classroom as a necessity of the success of the e-learning process.

Methodology: A cross-sectional study was conducted on a sample of online graduate courses offered in the academic year 2009-2010 over two semesters at the e-School of Health and Environmental Studies (e-SHES). The sample included all ten courses offered in fall 2009 and spring 2010 semesters in the e-School of Health and Environmental Studies. Secondary data was collected from "Reports" section of Moodle. Data collected included information about activity types, user profiles, courses information, and dates. Ten online activity types were identified and grouped into three categories: course academic activities, online supportive academic activities, and the utilization of digitized material. The evaluation criteria for Moodle utilization included frequency of learner visits and use of resources.

Findings: Key findings of this study were that Moodle usability issues need to be addressed. The level of utilizing Moodle resources and communicative tools is very low and there is a great need to increase the utilization of features in the Moodle by encouraging faculty and learners to use activities such as Sharable Content Object Reference Model (SCORMs), forums, wikis, chat, and blogs. Furthermore, as existing Moodle features need to support interactive learning by displaying a score to indicate the level of interactivity with the SCORMS or other activities. It is also highly recommended to include length of time per visit, total number of posts per classroom, number of learners with low or very low posting numbers, and the average length of student posts in the reports generated by Moodle. Additionally, staff and faculty training regarding Moodle features, e-learning facilitation and search skills need to be addressed.

Keywords: e-learning, Moodle, digitization, virtual learning environment, discussion forums, wikis, blogs

Introduction

Technology is not a choice but a given in new learning environments. The role of learners and faculty members is changing rapidly due to the introduction of electronic Learning opportunities generally referred to as (e-learning). E-learning is defined as the use of digital technologies and media to deliver, support and enhance teaching, learning, assessment and evaluation (E-Learning Series, 2003). Other terms interchanged with e-Learning include online learning, web-
based learning and computer-based learning. Anderson (2005) depicts the differences in terms according to media uses where online learning refers to learning that occurs purely via the Internet, while E-learning is broader than online learning, since it includes off-line electronic media such as CD-ROMs, and distance learning is broader than both online and e-learning, because also uses non-electronic media such as printed material. What they all have in common is the use of information and communication technologies in delivering learning.

Many researchers have argued that the increased use of Internet technology will change the delivery of information and education services, and will allow effective online delivery of mixed media content. It also will allow for more interactivity and faster and easier access to knowledge. Most universities today use a combination of online learning and face-to-face learning activities or blended learning (White, 2005). A virtual learning environment (VLE) is a system designed to support learning in an educational setting. VLE, learning management systems (LMS) and course management systems (CMS) are used in different contexts to refer to the same family of applications. LMS applications like Moodle, Blackboard, and WebCT, serve as platforms for collaboration between teachers and learners.

**e-learning at Hamdan Bin Mohammed e-University**

Hamdan Bin Mohammed e-University (HBMeU), which is the first online university in the Gulf, follows a blended approach in its delivery of learning, which combines the benefits of face-to-face learning, online collaboration and self-paced learning. The online collaboration usually takes place in both a synchronous and asynchronous mode; the synchronous mode involves the presence and interaction of learners and their faculty in real time using virtual classrooms or chat rooms while the asynchronous interaction does not require a real time presence, it involves instead the use of tools such as e-mails and discussion forums. The self-paced learning component of the blend is the part through which learners take responsibility for their learning and relies on the use of various support material such as online course material, study books, recorded master classes, and text books (HBMeU Faculty Handbook, 2010).

HBMeU adopted the Modular Object-Oriented Dynamic Learning Environment (Moodle), which is an open-source e-learning software platform where learners can be assessed by means of different activities such as forums, wikis, blogs, and group work. Moodle is a very well known platform, and as of January 2010 Moodle had a user-base of 46,624 registered sites with about 32 million users in about 3 million courses in 209 countries and in more than 75 languages (Moodle Statistics, 2010). Moodle offers many of the tools needed to achieve learning outcomes for learners, where the interactive chat and forums and content creation like wikis and blogs can contribute significantly to successful learning and community building as it forces learners not only to learn but also to teach their colleagues.

HBMeU is one of the pioneers and largest user of Moodle in the UAE. The statistics of the Effectiveness Office at HBMeU shows that the average learner satisfaction from course media and VLE improved to 77% in 2009-2010 compared to 75% in 2009-2008. The statistics also shows that the average learner satisfaction from e-services was 80% in 2009-2010 compared to 76% in 2009-2008, where about 83% felt that they are part of a wider virtual learning community, while only 18% of learners felt isolated throughout their learning journey (Effectiveness Office, 2010).
Table 1 summarizes the features of the VLE and the learner's satisfaction rate of each of these features in 2009-2010 (Effectiveness Office, 2010).

Table 1: Features of the VLE and the Learner's Satisfaction Rate (2009-2010)

<table>
<thead>
<tr>
<th>No.</th>
<th>Question</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The course digitized material was providing a sense of continuity</td>
<td>77%</td>
</tr>
<tr>
<td>2</td>
<td>The quality of the media was good (graphics, animations, streaming sound and video)</td>
<td>76%</td>
</tr>
<tr>
<td>3</td>
<td>The Courses overall were attractive in design and layout</td>
<td>77%</td>
</tr>
<tr>
<td>4</td>
<td>The VLE has a user friendly interface and a site map to guide my navigation</td>
<td>77%</td>
</tr>
<tr>
<td>5</td>
<td>The VLE is available and accessible at all times during the semester</td>
<td>78%</td>
</tr>
<tr>
<td>6</td>
<td>The instructor and technical staff were available during online lectures</td>
<td>78%</td>
</tr>
<tr>
<td>7</td>
<td>All technical issues with VLE are noted and resolved by the technical staff on time</td>
<td>76%</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>77%</td>
</tr>
</tbody>
</table>

Source (Effectiveness Office, 2010)

However, despite this high rate of satisfaction, the learners presented major concerns in spring 2010 regarding the VLE. The learners reported technical problems that led to delay in starting classes, insufficient responses from the IT helpdesk as with respect to their availability during class time, a lack of group activities or interaction within the virtual classes, and the lack of digitized materials for some courses.

Objectives of the Study

The concerns raised by learners especially with respect to online interactivity are a major challenge to meet with respect to their learning outcomes. Using the Moodle to its maximum capacity by both faculty and learners is a great challenge and successfully overcoming it will aid the e-learning process and more interactive and media is needed to enhance the learning process. Little academic research was done to evaluate the online interactivity of learners on Moodle at HBMeU since its adoption in 2008. The objective of this study is to measure the online interactivity of learners with the VLE and to emphasize the importance of maximizing using Moodle features in the classroom as a necessity of success of online learning.

Methodology

Research Design

A cross-sectional study was conducted on a sample of graduate online courses offered in the academic year 2009-2010 over two semesters at the e-School of Health and Environmental Studies (e-SHES).

Sampling

All the 10 courses offered in the fall of 2009 and the spring of 2010 in the e-School of Health and Environmental Studies were included in the study. Four courses were offered in fall 2009, and 6 courses were offered in spring 2010 as shown by Table 2.
Table 2: List of Courses Offered in the e-SHES, 2009-2010

<table>
<thead>
<tr>
<th>NO</th>
<th>Course Name</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Epidemiology, Biostatistics, and Global Health</td>
<td>Fall 2009</td>
</tr>
<tr>
<td>2</td>
<td>Health Care Systems</td>
<td>Fall 2009</td>
</tr>
<tr>
<td>3</td>
<td>Operations Management in Health Care</td>
<td>Fall 2009</td>
</tr>
<tr>
<td>4</td>
<td>Patient Care and Safety</td>
<td>Fall 2009</td>
</tr>
<tr>
<td>5</td>
<td>Introduction to Quality and International Accreditation in Health Care</td>
<td>Spring 2010</td>
</tr>
<tr>
<td>6</td>
<td>Epidemiology, Biostatistics, and Global Health</td>
<td>Spring 2010</td>
</tr>
<tr>
<td>7</td>
<td>Economic and Financial Management in Health Sciences</td>
<td>Spring 2010</td>
</tr>
<tr>
<td>8</td>
<td>Health Care Management</td>
<td>Spring 2010</td>
</tr>
<tr>
<td>9</td>
<td>Health Information Systems</td>
<td>Spring 2010</td>
</tr>
<tr>
<td>10</td>
<td>Patient Care and Safety</td>
<td>Spring 2010</td>
</tr>
</tbody>
</table>

**Data collection and Analysis**

Data was collected from analysis of the Moodle statistics listed for each course offered in the fall of 2009 and the spring of 2010. The Moodle has the feature "Reports" in the administration section which enables researcher to select activity type, course, and date. Data was analyzed using the Statistical Package for the Social Sciences (SPSS) program.

**Measures**

The evaluation criteria for Moodle utilization included frequency of learner visits and use of resources. Ten online activity types were identified and grouped into three categories: course academic activities, online supportive academic activities, and using digitized material. Four online course academic activities were identified: assignment upload, assignment view, course view and resource view. Five online supportive academic activities were identified: discussion forum, wiki activity, blog activity, chat activity, and user profile view activity. Using digitized material was identified with one activity: SCROM activity.

**Discussion of the Results**

All online activities for each of the courses were counted and divided by the number of learners in each course to get the average activity per learner. The highest average activity per learner was 790 for "Health Care Systems" course, and the lowest average was 199 for "Epidemiology, Biostatistics, and Global Health" course offered in fall 2009. The average number of online activities per learner for fall 2009 was about 448 compared to 326 for spring 2010. The average number of all online activities per learner for all courses was about 366 activities per learner. The average activity per learner is about 3.2 activities per day per learner. This average is considered low and should be improved up to 7 activities per day per learner to reflect the blended approach used by HBMeU where asynchronous classes accounts about 55% of the course delivery time. Table 3 summarizes the average number of online activities for each course offered in the e-SHES during the academic year 2009-2010.
Table 3: The Average Number of Online Activities for Each Course

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Semester</th>
<th>Average activity per learner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidemiology, Biostatistics, and Global Health</td>
<td>Fall 2009</td>
<td>199</td>
</tr>
<tr>
<td>Health Care Systems</td>
<td>Fall 2009</td>
<td>790</td>
</tr>
<tr>
<td>Operations Management in Health Care</td>
<td>Fall 2009</td>
<td>366</td>
</tr>
<tr>
<td>Patient Care and Safety</td>
<td>Fall 2009</td>
<td>436</td>
</tr>
<tr>
<td>Average Fall 2009</td>
<td></td>
<td>448</td>
</tr>
<tr>
<td>Introduction to Quality and International Accreditation in Health</td>
<td>Spring 2010</td>
<td>340</td>
</tr>
<tr>
<td>Epidemiology, Biostatistics, and Global Health</td>
<td>Spring 2010</td>
<td>296</td>
</tr>
<tr>
<td>Economic and Financial Management in Health Sciences</td>
<td>Spring 2010</td>
<td>256</td>
</tr>
<tr>
<td>Health Care Management</td>
<td>Spring 2010</td>
<td>339</td>
</tr>
<tr>
<td>Health Information Systems</td>
<td>Spring 2010</td>
<td>319</td>
</tr>
<tr>
<td>Patient Care and Safety</td>
<td>Spring 2010</td>
<td>408</td>
</tr>
<tr>
<td>Average Spring 2010</td>
<td></td>
<td>326</td>
</tr>
<tr>
<td>Average number of activities per learner</td>
<td></td>
<td>366</td>
</tr>
<tr>
<td>Average number of activities per day per learner</td>
<td></td>
<td>3.26</td>
</tr>
</tbody>
</table>

The most frequent online activity was the course review with an average of 177 per learner, while the least frequent was for using wikis with no usage at all. The online academic activities constitute about 80% of the all activities while the supportive online activities constitute only 6%. The usage of digitized materials constitutes about 14% of the activities. The low percentage of utilizing the supportive online activities is alarming, and reflects a shortage of participation on both sides; faculty and learner. The average online activity per learner for each type of the online activities and each course offered in the e-SHES in fall 2009 are summarized in Table 4.

Table 4: Average Online Activity per Learner for Each Type and Course, Fall 2009

<table>
<thead>
<tr>
<th>Course offered in Fall 2009</th>
<th>Academic activities</th>
<th>Supportive academic activities</th>
<th>Digitized material usage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assignment upload</td>
<td>Assignment view</td>
<td>Course view</td>
</tr>
<tr>
<td>Epidemiology, Biostatistics, and Global Health</td>
<td>4 48 93 34 8 0.0 0.5 3.6 9</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Health Care Systems</td>
<td>4 107 304 143 42 0.0 0.6 15.4 38</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td>Operations Management in Health Care</td>
<td>0 0 177 38 22 0.0 0.9 3.3 22</td>
<td>103</td>
<td></td>
</tr>
<tr>
<td>Patient Care and Safety</td>
<td>12 109 189 105 13 0.0 0.5 1.0 6</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>4 57 177 70 20 0 1 6 19</td>
<td>59</td>
<td></td>
</tr>
</tbody>
</table>

The average online activity per learner for each type of the online activities and each course offered in the e-SHES in spring 2010 are summarized in Table 5. The largest
activity was the course review with an average of 114 per learner, while the lowest was for using wikis with an average of 0 per learner. The online academic activity per learner constitutes about 75% of the activities while the supportive online activities constitute only 21%. The usage of digitized materials constitutes 4% of the activities. The extra online academic activities improve in spring but still constitutes about one fifth of the activities.

<table>
<thead>
<tr>
<th>Courses offered in Spring 2010</th>
<th>Academic activities</th>
<th>Supportive academic activities</th>
<th>Digitized material usage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assignment upload</td>
<td>Assignment view</td>
<td>Course view</td>
</tr>
<tr>
<td>Introduction to Quality and International Accreditation</td>
<td>6</td>
<td>124</td>
<td>134</td>
</tr>
<tr>
<td>Epidemiology, Biostatistics, and Global Health</td>
<td>3</td>
<td>44</td>
<td>77</td>
</tr>
<tr>
<td>Economic and Financial Management for Health</td>
<td>6</td>
<td>64</td>
<td>111</td>
</tr>
<tr>
<td>Health Care Management</td>
<td>6</td>
<td>88</td>
<td>149</td>
</tr>
<tr>
<td>Health Information Systems</td>
<td>7</td>
<td>65</td>
<td>111</td>
</tr>
<tr>
<td>Patient Care and Safety</td>
<td>5</td>
<td>49</td>
<td>70</td>
</tr>
<tr>
<td>Average</td>
<td>5.5</td>
<td>79</td>
<td>114</td>
</tr>
</tbody>
</table>

|              | 75% | 21% | 4% |

To see if there is a difference between the two semesters in terms of interactivity of learners measured by the number of online activities, a Paired Two Sample t-Test for Means was done. The results showed that there is no significant difference between two semesters (P = 0.432). Since there is no significant difference between the two semesters, we will discuss the results for both semesters combined.

Four online course academic activities were identified: assignment upload, assignment review, course review and resource review. For both semesters, the online academic activities constitute about 75% of all activities with an average number of 273 activities per learner. "Health Care Systems" was the highest while "Epidemiology, Biostatistics, and Global Health" offered in Fall 2009 was the lowest. The main online academic activities for each course are summarized in Figure 1.
Learners construct their ideas and understandings of concepts through interactions with teachers, other students and with learning materials (Palinscar, 1998). Current theories of learning focus on the role and activities of the student rather than those of the teacher (E-Learning Series, 2003). Five online supportive academic activities were identified: discussion forum, wiki activity, blog activity, chat activity, and user profile view activity. The average per learner was 61 activities (16% of all activities). Although using these activities is very limited, there good three good examples of using discussion forums in Patient Care and Safety with an average of 203 per learner, Health Information Systems with an average of 86, and Epidemiology with an average of 81 per learner. The main online supportive academic activities for each course are summarized in Figure 2.

Digitized material use was identified with one activity: the SCROM activity. Five courses out of 10 courses were identified to have digitized materials. The average per learner was 32 activities (2 activities per week and 9% of all activities) for the course that have digitized materials in the academic year 2009-2010. The average percentage of using this activity out of all activities was about 13% for all courses. While the other 87% spent on academic and extra academic supportive activities. There is a great discrepancy from 28% Operations Management to 5% for Introduction to Quality. Health care systems and operations management were good examples of utilizing such activities as shown in Figure 3.
When analysis the each of the online activities for all courses, the course review activity was the highest of all activities (38% of all activities) while the Wiki and Blog activities were the least practiced activities with (0%).

The percentage of each online activity out of total number of activities for each one of the courses is shown in Table 6.

The percentage of each online activity out of total number of activities for all courses is shown in Figure 4. Course and assignment view have the largest contribution with 38% and 19%, respectively, of all activities. Wikis, chat and blogs are very minimally used and have not been used at all for most of the courses.
One of the most valuable things a learner can learn is how to engage with classmates, how to communicate using a variety of media, and how to clearly and effectively get their ideas across. This was especially important for learners at HBMeU, many of whom spoke and wrote English as a second language. Chat activity is one of those activities. Figure 5 below shows the Percentage of Chat View Activity for each course out of all online activities. The average percentage of chat out of all other online activities was 1%, which is considered for a blended approach like the one at HBMeU.

True interactivity in Moodle is where the learner manipulates the environment and not only views what is posted to him. Martin Dougiamas, the Moodle founder wrote that the reason forums are the main Moodle tool (Dougiamas, 1998). Discussion forum is an asynchronous means of communication between learners and faculties. It can be added as an activity following each lesson or it can be for general use. Learners can start discussions on their own or a teacher can initiate a discussion or present a topic (Danijela, et al., 2010). The discussion forum along with many other Moodle resources were all of great outcome in creating a sense of ownership and better rapport with peers and faculties (Fayad, 2010). The percentage of discussion forum activity for each course
of all online activities is shown in Figure 10. The courses were above the average percentage of 12%.

![Discussion Forum Activity](image)

*Figure 6: The Percentage of Discussion Forum Activity out of Total Number of Activities*

There is a big conceptual overlap between a blog and a forum. Blogs are a form of supportive online activity used for self-expression and communicating with other learners, so it is a sort of online diary. Blogs are usually organized as a chronological series of postings created by the author of the blog, and they are written by one person or groups of people. Three blog types were identified: tutor blog run by the teacher for the learners, learner blog run by a learner or a group of learners by themselves or class blog run by the whole class. (Aaron Campbell, 2003). A blog should be viewed as a creative activity in which learners can express their opinion, thoughts, reflection, state views, or write about anything they feel like. Blog entries provide good basis for formative assessment, because the faculty can read students' entries just to see whether a student is making progress and if not be able to identify ways forward (Danijela, et al., 2010).

The percentage of blog activity out of total number of activities is summarized in Figure 7. It was available only for one course with a percentage of 0.3% of all activities, which is considered very low.

A wiki activity is a collection of collaboratively authored online documents where everyone in class can create together. Moodle has its own simple Wiki, which can be used for collaborative writing, such as planning projects together or group writing exercises without need to be in the same place simultaneously. User profile activity is the activity in which the learner views his personal data, list of courses, and access time. Wiki activity was used in one course only. There is a general lacking of utilizing these activities both from faculties and learners. The percentage of these supportive academic activities out of total number of activities is summarized in Figure 7.
Table 7 summarizes the main indicators and the target to improve the interactivity. The target is based on the HBMeU blended approach and the researcher observation.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Overall for one year</th>
<th>Target</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>The average number of all online activities per learner for all courses</td>
<td>366 (47%)</td>
<td>784 (100%)</td>
<td>418 (53%)</td>
</tr>
<tr>
<td>The average number of all online activities per day per learner for all courses (semester includes 112 days = 16 weeks * 7 days)</td>
<td>3.26</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Percentage of supportive academic activities out of all online activities</td>
<td>16%</td>
<td>40%</td>
<td></td>
</tr>
</tbody>
</table>
Conclusion

Moodle should be used as a mean to encourage and foster activities that involve the learners in actively engaging with the materials, the professor and each other rather than just as a means to present material. There is a great need to utilize these features in Moodle by encouraging faculty and learners to use activities such as forums, wikis, chat and blogs, which are lacking in the current method of course delivery and are not used by the learners sufficiently. Learners must post on three forums per week to discuss the things they are learning that week. Unfortunately reply to the forum discussion via emails, where these replies would actually show up as posts on the forum, does not yet exist in Moodle, so it is important to add this feature to the Moodle.

To encourage such kind of online activities, forum posting must be graded and linked to the email system. The faculty must initiate these activities and give more emphasis to learner performance. Interactivity of the course requires both the faculty and the learner to be more proactive and accountable. The faculty needs to add collaboration forums as specific exercises, and support creative wiki practices; they do not always have to be depending on in-depth class discussions.

The level of usage of SCROM is low with an average of 2 activities per week. Although, most of the SCORM activities are straightforward learning lessons and having quizzes to add basic interactivity, the material is a resource-rich and should be utilized to the maximum. As least 7 activities per week is required to reach the satisfactory. For these SCORM activities, there is no score which appears to the user, they are recorded as not attempted, incomplete or complete. However, it is recommended instead to display a score to indicate the interactivity of utilization of the SCROMS. To reach the satisfactory level of SCROM activity, it must be scored and graded.

Technical training of both learners and faculty is needed. The online learning certificate is a necessity for all faculty and administrative people involved in the e-learning process to set up a series of benchmarks for faculty to achieve.

The evaluation criteria for Moodle utilization included frequency of learner visits and use of resources. However, it is highly recommended to include length of time per visit, total number of posts per classroom, number of learners with low or very low posting numbers, and average length of student posts. These indicators should be added to Moodle for future assessments.
References


Effectiveness office, Hamdan Bin Mohammed e-University, End of Year Report, 2010.


Hamdan Bin Mohammed e-University Faculty handbook, 2010
RFID Tracking and Record Management for e-Health in Developing Countries

Ali Zalzala  
Laura Zalzala  
Hikma Group Ltd., UAE

Shekhar Mehta  
Healthcare and Hospital Management Consultant, UAE

Stanley Chia  
Vodafone Group R&D, USA

Ali Karimi  
Trans Technology Group, USA

Abstract

Community based health care is becoming increasingly important for the wellbeing of inhabitants among many emerging economies. This paper describes an RFID-backed community health care solution implementation plan. Patients are provided with passive RFID tags for identification purposes and linked to an electronic health record system by means of either a mobile RFID read/write device given to community health care workers or similar devices located at the central medical facility. The solution framework proposes some potential service enhancements and addresses some of the critical issues related to such a project such as scalability and standardization, risk exposures, competitive solutions, cost optimization and environmental impact. Applicable technologies, standards, protocols as well as business projections and modeling are also discussed.

Keywords: RFID, e-health, EHR, community based health care, mobile health

Introduction

Health has always been a central concern for individuals, groups, communities or the global society and the importance of health cuts across individual of all ages and across all societies. In the 20th century we witnessed an extraordinary progress on health, but progress in health is fragile (The Global Agenda 2009)

If developed countries deal nowadays with equity in health and healthcare, most developing, less developed or low-income countries face other types of difficulties regarding health services. In these countries, far too many people have to deal with inadequate nighttime lighting or inadequate communication due to lack of reliable electricity, while many healthcare providers are forced to treat patients without having access to databases of past medical history.

The overall merits of an RFID-backed community healthcare solution is to enable easy and reliable identification of individual patients, maintain more accurate and
consistent medical records and, most important of all, facilitate better healthcare out-reach and enhance the quality of life for the individuals in communities remote from the central medical facility. In addition, it can also help to relieve the loading pressure on the central medical facility when it is overcrowded and can increase revenue opportunities by broadening the addressable base of patients to more remote locations. It may also help to improve the efficiency of the central medical facility to focus resource on the more specialized medical cases.

This project implements a real-time electronic individual identification and tracking system for rural healthcare. The system is planned upon international standards, defining public health in villages, allowing for trauma and emergency as well as disease response, control and studies, clinical healthcare, disease surveillance and prevention.

In this paper, we propose a Radio Frequency Identification (RFID) based community e-health system where a patient is given a "passive" RFID card or an equivalent device (such as a stylized bracelet in accordance to the local custom) and the community healthcare workers are each given a mobile RFID read/write device that can also access the central electronic medical record system. The technology principle is relatively simple but the process to make it works well in a real life situation is expected to be complex. To this end we examined the proposition, technology, basic system configuration, service process, data communication and the model to make the implementation self-sustainable rather than relying on recurring charitable support.

**RFID Tracking and Record Management System**

To understand the dynamics of the ecosystem, it is instructive to examine the associated value chain. In this case, the key stakeholders in the value chain are 1) the administrator and physicians at the central medical facility, 2) the pool of affiliated community healthcare workers, 3) the patients and the inhabitants in the immediate communities, 4) the equipment and e-health recorder solution providers and 5) the wide area communication provider.

These stakeholders will have to be able to extract value from the system in order for the scheme to be self-sustainable. The essential hierarchical relationship of the main constituents in the system consists of the central medical facility at the top of the pyramid which manages a number of community healthcare workers who in turn look after a large base of inhabitants in the rural community, see Fig 1. The equipment and resource providers are only facilitators.

![Figure 1. The hierarchical relationship in a community healthcare system](image_url)

More specifically, the patients are the end customers in remote, rural locations. The profiles of these people are generally underprivileged families or individuals in the community and many may live in some degree of poverty. The solution will provide better healthcare at an equivalent or lower cost to them to access medical help than before the solution is introduced and, hence, effectively creating a better standard of living. For the community healthcare workers, they will primarily be benefited from new income streams and job opportunities.

**Technology**
Radio Frequency Identification is an established wireless technology. The use of "near field communications" or RFID for public health in developing countries has been proposed and the technology is not completely new (Davidzon et al 2009). The solution framework described here built on the established concept but leverage the collaboration between community healthcare workers and the central medical facility to design a sustainable solution that can potentially improve the quality of life for people at remote, rural locations.

In the solution design, the mobile RFID read/write device utilized by the community healthcare workers can be a proprietary piece of equipment but it can also be a specially adapted, data communication-enabled mobile phone that can communicate with the remote centralized database of a medical facility in addition to servicing RFID tags locally. More specifically, wide-area data communication enables remote transfer and retrieval of medical record information of the patients in the field. At the same time the proximity near field communication capability read and writes the individual RFID-enabled "medical card" locally.

These RFID cards are preferably “passive” meaning that the energy for transmission and reception by the RFID tag is harvested from the read/write device through electrical induction as the tag has no inherent power source. High frequency RFID tags using 13.56 MHz are frequently used for very short range, high cost sensitive applications, such as in the situation of rural healthcare in developing countries. Several incompatible standards exist for these cards that include the ISO/IEC 14443 type A and B, ISO 15693 and FeliCa standards.

RFID, electronic medical record system and mobile RFID read/write device all are relatively mature technologies with products available in the market and are known to be used in medical facilities, such as hospitals, for patient tracking and enhancing hospital work flow (Chowdhury, & Khosla 2007). The use of such device for servicing outpatients in the remote locations is still relatively rare in practice (Gouthaman 2007) for cost reasons, even though the use of RFID for asset tracking is widespread in the pharmaceutical industries, laboratory automation as well as for inventory management (Jai Ganhesh, & Srikrishna 2008). The solution proposed here utilizes these mature components of a RFID system to enable the development of a self-sustainable community e-health solution through bringing in operating/business models that enable revenue sharing between the healthcare workers and the central medical facility.

**Basic System Configuration**

The proposed RFID solution needs to work in concert with an electronic medical record system as a whole. With this concept, the basic system configuration can be abstracted as shown in Fig 2. In the figure, the RFID system is used to register and monitor the transactions between the community healthcare worker and the patient in the field as well as enabling the healthcare worker to upload and download selected / incremental medical record information from the database located at the central medical facility.
Specifically, all patients are provided with individual RFID tags or their equivalent. This card can record a selection of the patient’s personal information such as the patient’s name, a thumbnail photo, and potentially some form of biometric verification media, such as thumbprint. Thus adequate non-volatile electronic memory needs to be embedded in the card. It may also record essential medical information, such as blood group and allergies, for the purpose of supporting emergency medical attention. That said the system is not intended for supporting mission-critical medical cases due to the fact that the underlying wide-area communication infrastructure may not be sufficiently robust at remote rural locations from time-to-time.

On the other hand, the community healthcare workers are each provided with a mobile RFID read/write device equipped with a graphic display so that information on the RFID tag and information retrieved from the central medical facility could both be displayed in an appropriate presentation format. This RFID read/write device will also have a small alphanumeric keyboard or a soft keypad based on touch-screen technology. In addition, sufficient onboard memory is also needed within the RFID read/write device in order to hold essential information. The mobile RFID read/write device is preferably be password or biometrically protected so that if the device is stolen or lost, it cannot be used by third parties to perform unauthorized reading of patient's medical card or retrieval of information from the central electronic medical record database. Furthermore the RFID read/write device will also be equipped for wide-area wireless data (and preferably voice) communications. As a mobile device, Global Positioning System based location information can also be included in the device to provide a position and time stamps for each transaction.

**Implementation Plan**

The RFID-TRM is an integrated RFID Tracking system and a Records Management system. It tracks individuals equipped with a RFID chip while keeping and updating their records under various circumstances. RFID is a technology that uses radio communications to exchange data between a terminal and an electronic tag. RFID involves an interrogator, also known as a reader and
tags, also known as labels. Passive RFID tags, where the tags have no power source and require external radio energy to initiate signal transmission, are used in the project. The system combines tracking hardware with record keeping software, integrating hardware components with software packages through the design and implementation of software-based interfaces. The system is built upon international standards, taking quality and securing issues into account where applicable. The RFID-TRM is depicted in Figure 3. The system targets patients associated with a healthcare facility (hereafter referred to as facility).

**Figure 3. RFID-TRM Implementation Plan**

- Patients must register a priori with the facility on-premises where they are issued with an identification TRMcard embedding an RFID tag and holding basic information in on-board memory (name, age, gender, contact details, brief notes) as well as printed serial/name/photo on the card. The RFID tag is initialized, and a biometric fingerprint is captured and included on the record.
- Thereafter, a patient will use the TRMcard every time a health service is required. The TRMcard can be scanned within the facility or in outreach locations.
- A patient’s data record is held on a secure server and can be accessed and/or updated by authorized staff through facility computer(s), facility mobile RFID units, and outreach mobile RFID units. In all cases, identity is verified at three levels: name/photo on the card, scan of the RFID tag, and a biometric scan of fingerprint.
- Secure wireless communications facilitate data transfer between the various parts of the system. In-house
Wi-Fi is used within the facility (shown as blue lines), while wireless (GPRS and 3G) is used everywhere (shown as green lines) through a service provider. Authorized staff will be able to access data in their offices, on the move within the facility, while on outreach, or even in their private time.

- Stationary as well as mobile devices are in use by the authorized staff, including laptop/desktop computers, and identity capable mobile devices. Besides providing feedback on experiences, the use of this collection of devices allows providing service under diverse circumstances within or outside the facility. The secure patient record will be accessible/updatable on all devices.

- The system brings together hardware and software technologies from several vendors, accommodating for diversity in the market place and allowing integration to the needs of an end-user. Hardware components are provided by Motorola, HP, Apple and others. Operating systems used vary between Windows 7 Professional, Windows Mobile, and iOS. Software includes two record management packages. 7i Clinic is a proprietary purpose-built package specifically for hospital management, while Microsoft Dynamics is a general purpose ERP that is applicable to healthcare management.

- The heterogeneous system is integrated by three interface programs, and will be developed by the project. The Data Collector is the main database receiving and storing data from various devices. The 7i Clinic data interface and the Dynamics data interface organize data in a format suitable for use with the relevant software. Generic mobile apps will be developed for iOS and Windows Mobile devices to interface to both software packages.

- Project management will have access to all system parts including data, and communications, provide reports to the team and supervise software development by external workers.

**Field test**

The field test comprises two parts: a pilot study, which is taking place in the UAE and the main implementation of the system, which will be located in India, the state of Gujarat.

**Pilot Study for RFID-Backed Community e-Health Solution in UAE**

A pilot study, is being planned to test the RFID-Tracking and Record Management System in the UAE. The process of providing basic medical service and tackling emergencies in this setting most closely resembles the process of provision of primary healthcare services in the remote areas. For the purpose of study, a university-attached Primary Healthcare Centre has been identified. This centre caters to the basic medical and emergency needs of the faculty, students and the staff associated with the university. The centre is headed by the Health Centre Director (Registered Nurse) who is supported by two staff nurses. Health services are available 24 hours a day. After working hours and during weekends, emergency health services are provided by staff nurses who reside on campus and are on call. Services include treatment for minor health emergencies and conditions, dispensing medication for minor health problems, providing individuals with medical referrals, and offering information on health related issues.

There are two treatment rooms equipped for emergencies in the Male and Female residential halls. The university Health Center.
maintains a close relationship with a tertiary-care hospital and regularly refers students to this facility for advanced consultation, investigations, diagnostics and treatment. Only the students, who live in the residential halls (about 536), would be taken into consideration for the purpose of the study to make it more precise and accurate. Registration for all the hostel students will be done at the healthcare centre. Demographic & medical history data will be collected from the ‘Student Health History Form’, which every student fills up at the time of joining the university. This information will be stored in the system database and each of these students will be given a RFID tag embedded-TRM card. The RFID tag will be initialized, and a biometric fingerprint will be captured and also included on the record. Thereafter, the student will use the TRM card every time a health service is required.

Both the staff nurses, the centre head and the concerned staff at the hospital will be given adequate training regarding the usage of hand-held device and retrieving of the information from the IT system or mobile phones. The students’ data record will be held on a secure server and can be accessed and/or updated only by authorized staff (health centre head and staff nurses in this case). A confidentiality agreement will be signed by the concerned people involved in handling of the data. Identity of the patients will be verified at three levels: name/photo on the card, scan of the RFID tag, and a biometric scan of fingerprint.

To attend to any emergency call outside the working hours, the staff nurses will carry these hand-held devices to the site/treatment rooms. They will be able to retrieve the information about the student’s medical history onsite immediately by scanning the TRM card. If they want to treat the patient there, they can do it there and just update the relevant information in the patient’s records in those devices. If they want to further consult the centre head/specialist doctors at the hospital for their advice, they can do that from the place of emergency and treatment can be immediately started/advised from there for any life-threatening situations. When a student carrying a TRM card will come to the health centre, his/her TRM card will be scanned and his/her stored demographic and medical information will be retrieved from the system automatically. If the centre head wants to consult the specialist physician in the hospital, she will do that by sending in the request on his system or mobile device and get immediate feedback, avoiding wastage of time to see the physician and cutting down costs drastically. Also, request for advanced laboratory investigations (sample is sent later) will be ordered from the hand held/devices/clinic to the hospital and the results will be made available to the mobile phones/hand held devices/system as soon as the investigations are completed. Also, follow up of the patients, who have consulted the hospital physician will be done from the hospital site remotely.

Study will be initially carried out for a period of 3 months and the data will be collected, measured and analyzed at the end.

**The Implementation**

The project implementation is taking place in the State of Gujarat, India. The targeted rural sites are within Ahmedabad as well as villages in various Gujarat districts. An overall description of these districts is offered via an example of the Kadi taluka (administrative division) of the Mahesana agricultural district situated in the north part of the Gujarat. Mahesana occupies an area of 4371 km2 with a population of 1.8M. Estimated 3.6% is urban area occupied by 22.4% of the population. Unemployment stretches to 54.9% of the population, although literacy rate is 75.2%. The target rural sites are villages in the Kadi taluka (administrative division) of the Mahesana agricultural district.
situated in the north part of the Gujarat state of India. Mahesana occupies an area of 4371 km² with a population of 1.8M. Estimated 3.6% is urban area occupied by 22.4% of the population. Unemployment stretches to 54.9% of the population, although literacy rate is 75.2%. In Mahesana, there are 593 inhabited villages, with 62 only having a population of 5000 or more. Kadi has 119 villages, out of which 61 have a population between 500 and 2000, and 12 below 500. Around 39.5% of villages have primary health sub-centers, with only 20.2% having a well for water supply, although 100% have electricity supply and bus services.

With the assistance of local volunteers within the solution team, the field test identified several sites covering various districts in Gujarat. Two sites are described in the following.

The slum community in Ahmedabad is considered the largest in India, and the third largest in Asia, housing around 140,000 individuals including around 8,000 children. The slum community center is operated by the Manav Sadhna located in the Gandhi Ashram, and looks after around 8,000 children from the community.

Palanpur Villages in Banaskantha District. The solution team studied two representative rural villages surrounding the town of Palanpur, namely Malana and Utanpura. The former has a population of around 5000 and the latter around 450 (66 children, 35 families).

**eHealth Concerns**

**Healthcare System in India**

The issue of health in India comes under the purview of the Ministry of Health and Family Welfare (Ministry of Health and Family Welfare, 2010), and its three departments: the Department of Health, Department of Family Welfare, and the Department of Ayurveda, Yoga, Naturopathy, Unani, Siddha and Homeopathy. In fact, there are several central government bodies responsible for the health of the nation. There is a National Health Policy for the country, identifying a Central Health Service, with local State Policies etc. relevant to each state within the country.

The main websites of interest to this project are the Health and Family Welfare Department (which can be reached from the Gujarat State Government portal), while the Citizen Health pages of the India Government offer a national view. The official outreach site to citizens is Healthy India.

The above primarily regulates the Public healthcare system in India. Each district in the country has a District (Civil) Hospital, under which Community Health Centers (CHCs) are associated with each administrative area (or taluka). There are a number of Primary Health Centers (PHCs) under a CHC, and subsequently sub-centers under each PHC. Primary Health Centers (Primary Healthcare System in India, 2010) are the cornerstone of rural healthcare. PHCs and their sub-centers are supposed to meet the health care needs of rural population. Each PHC covers a population of 100,000 and is spread over about 100 villages. A Medical Officer, Block Extension Educator, one female Health Assistant, a compounder, a driver and laboratory technician look after the PHC. It is equipped with a jeep and necessary facilities to carry out small surgeries.

With a well-defined structure and scenario currently reported for rural healthcare system, it is reported that PHCs have difficulties performing their assigned tasks. The issue with rural healthcare is not only healthcare services but also education and awareness amongst the population of issues such as sanitation, vaccination, etc.

Private healthcare sector in India includes trust-run hospitals, and commercial hospitals. The sector remains largely self regulating, although accreditation is possible via the National Accreditation Board for Hospitals & Healthcare Providers (NABH) (National

eHealth and Individual Record Systems
There is more than one eHealth initiative in India over the years, e.g. Health Management Information System (HMIS) (Health Management Information System, 2010), Drug Logistics Information & Management System (DLIMS) (Drug Logistics Information & Management System, 2010), Routine Immunization Monitoring System (RIMS) (Drug Logistics Information & Management System, 2010), District Health Information System (DHIS), and Integrated Disease Surveillance Project (IDSP).
The Multipurpose National Identity Card (MNIC) project is an initiative of the Indian government to create a national ID for every Indian citizen with the objective of increasing national security, managing citizen identity and facilitating e-governance. The Unique Identification Authority of India (UIDAI) was established in February 2009, attached to the planning commission. The purpose of the UIDAI is to issue a unique identification number to all the Indian residents that are robust enough to eliminate duplicity and forgery in an easy and effective way. The Mother and Child Tracking System (e-Mamta) (eMamta, 2010), is a national system operated in Gujarat by the Health and Family Welfare Department. It has been running in hardcopy format for around 18 months (as of July 2010), and in electronic format since around May 2010.
An Electronic Health Record (EHR) is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports. The EHR automates and streamlines the clinician’s workflow. The EHR has the ability to generate a complete record of a clinical patient encounter – as well as supporting other care-related activities directly or indirectly via interface – including evidence-based decision support, quality management, and outcomes reporting.
In the above context, the e-Mamta system is indeed wanting with the inclusion of medical records. However, the availability of this system will be helpful in setting up the planned tracking and medical records system.

Implementation Feasibility
Scalability is an important factor that could determine the success of a community healthcare solution with the complexity of utilizing RFID and electronic medical records. Specifically, there is a fixed cost of the solution associated with the basic infrastructure supporting the electronic medical record system within the central medical facility. Beyond that the cost of the system is largely scalable horizontally in the dimension of the number of patients and community healthcare workers for one central medical facility and can be replicated from one facility to another within one state or a country. The efficiency of the community healthcare system will be dependent on the geographical distribution of the inhabitants around the neighborhood of the community healthcare workers.
Any mass-market solution would look to standardization to gain economies of scale. In addition there could be issues with the compatibility across electronic health records and RFID formats between medical facilities. Ideally all equipment and records should follow some standardized format. As the rural population in emerging markets tends to be relatively static due to closely knit family units, this may be a less urgent issue to resolve in the first instance even though it is
important. The advantage of common formats for electronic healthcare records and RFID across different multiple medical facilities is that this can allow adequate tracking of patients moving from one location to another, such as migrant workers, with the aim of providing the right healthcare treatment even people move to another area of another healthcare facility. Another advantage of standardization would be to enable multiple sourcing of equipment supply and will better support the scaling of the system through exploiting the economies of scale and the availability of competitive supply chains.

**Business Implications**

At the heart of business projections is achieving self-sustainability for any model of implementation. It is important that the implementation of this system allows us further insight into the cost optimization of the entire business process (including technology components and deployment cycle), making the system more suitable particularly for developing countries.

The combined costs of RFID-related hardware, record management software, security compliance, even the $5 per identification tag, are on the high side for the poorer communities. While a pilot test may be feasible due to initial seed money from sponsors, expansion of the system into more outreach posts at state or country scale may be prohibited by cost.

Target developing countries, and even niches within a country, should be identified for implementation efforts following the successful completion of this system testing. The target market must have reached a sufficient level of primary care maturity and have a need for a unified EHR and a tracking system. Implementation may well focus on private hospitals/clinics in least developed countries or public hospitals in emerging rather than developing countries.

There may also be hidden costs in large-scale technology deployment. Tagging will need to incorporate medical instruments and pharmaceuticals within more complete healthcare services, and there will be the need to have active RFID as well as passive. Managing large data sets generated by the system when deployed widely may stretch database capabilities, and while integration with MS Dynamics would solve this, it would also raise the costs for the end-user.

Social and legal issues change according to regulatory maturity in a country, imposing and varying associated costs. For example, the allocation of electromagnetic spectrum bandwidth for RFID systems is determined on a country-by-country basis, and there are potential implications for continuous exposure to electro-magnetic waves.

This project has already studied innovative models for implementing services in the poorer communities, based on economic and business assumptions. The real challenge remains how to implement, not how to invent.
Figure 4. RFID system with payment integration
Conclusions
Delivery of quality healthcare depends in part on providers and facilities knowing beyond doubt just who the patient is. Failure to do so encumbers the provision of healthcare at the very least; at the worst, it can prove fatal (in the USA alone, it is estimated that preventable medical errors cause nearly 50,000 deaths each year). While patient identification errors have sparked safety initiatives worldwide, these typically focus on large healthcare institutions and are not suitable for the delivery of care in the developing world. Fundamental to this challenge, therefore, is accurate patient identification at the first point in the system - the primary care facility.

An RFID-based community e-health system is proposed that works in concert with an electronic medical record system to support the development of out-reach healthcare for rural communities. By adopting a revenue sharing model, it is anticipated the system to be self-sustainable and be able to improve healthcare and quality-of-life among people living in remote areas. The system carries risks that need to be mitigated as well as opportunities for enhancing the service that could be implemented as appropriate. The solution team now proceeds with the implementation based on the solution framework defined herewith.
References


A Case Study of e-Health Usage Trends amongst Arab Undergraduate Students in the UAE

Syed Kabir Nasir
Computer College, UAE

Syeda Shahla Kabir
Biomnis Arabia, UAE

Abstract
The Arab world is witnessing an increase in the number of services brought online especially in the Gulf Cooperation Council countries. According to World Wide statistics, the United Arab Emirates had an estimated 4.9 million population in 2010, out of which 3.7 million are Internet users. That is 75.9 % population penetration, the highest in the Middle East based on population. It would be really interesting to find out the Internet usage trends of all these Internet users especially regarding health. People with health concerns no longer have to become typical patients and consult a health professional. The Internet offers different e-Health options where users can access resources and information that can satisfy their requirements. In this paper we look at the use of Internet for health related purposes by students in Dubai. We describe the findings about online health information and other related e-Health areas that Arab undergraduate students are using on the Internet. The usage trends are presented in quantitative manner for the readers. We found that the most popular health topics of interests that students lookup on the Internet are Diseases, Exercise & Fitness, Normal Health & Well Being and Treatments. Most commonly the students use regular search engines to lookup health information and they also use handheld devices like mobile phones and PDAs for the lookup. The students are although satisfied with the information that they find online but they take precautions when following medical advice on the Internet and especially while taking medicines mentioned on the Internet. However, they usually do not read policies of use on the health websites that they visit.

Keywords: e-Health, Health Informatics, Health Information Retrieval, United Arab Emirates

Introduction
According to the International Telecommunications Union –ITU (2001), the Internet was introduced in UAE in 1995. Recent statistical figures from the World Internet Usage Statistics News and World Population Statistics (2010) show that the UAE had an estimated 4.9 million population in 2010, out of which 3.7 million are Internet users. That is 75.9 % population penetration, the highest in the Middle East based on population. A report by the Arab Advisors Group (2007) says that consumers in UAE spent over US$ 1.15 billion online in 2007. The government of Dubai is already encouraging use of electronic health care as Director General of the Dubai Health Authority – DHA (Ameinfo.com, 2008) said: "... modern healthcare technology, advanced information systems... will ultimately lead to
upgraded systems and improved healthcare delivery."

A leading national English newspaper (Gulf News, 2010) reports that UAE has plans to promote e-Health as Ministry of Health will implement e-libraries in the 2011 at its 14 hospitals and other health care centres. E-Health can be defined as “patients and the public using the Internet or other electronic media to disseminate or provide access to health and lifestyle information or services.” (Sullivan, 2006). People can access health information from home or from work and if they don’t have Internet then they can use Internet cafes. Even coffee shops like Starbucks and Caribou provide free Internet to their customers in the United Arab Emirates.

There are several new developments and government initiatives in UAE, which will lead to further growth in Internet usage. Around the world the Internet as a medium is increasingly being employed for health information and healthcare delivery. However one needs to be cautious, both the medical personnel and the consumer need to understand the possibilities of this technology, and also be aware of potential risks to their health. Handheld devices like mobile phones and PDAs are also being used by consumers for health information search in UAE (Ameinfo.com, 2010). There are good expectations from the planned developments in healthcare since His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE, Ruler of Dubai, has given significant importance to the health sector in the Dubai Strategic Plan 2015 as stated by the Government of Dubai (2007).

**Literature Review**

Fox & Raine (2002) wrote that even people who are not Internet users say that information about important topics can be found on the Internet and 81% Internet users say that they can find reliable health information online. The World Health Organization (2005) defines e-Health as "e-Health is a new term used to describe the combined use of electronic communication and information technology in the health sector". E-Health has become a general term as Oh et al. (2005) found 51 unique definitions for e-Health in their study. Health information retrieval (HIR) is the term used to describe the use of Internet for seeking health related information. Fox, et al. (2000) and Williams, et al. (2002) stated that Internet HIR is quite common and that consumers use it in many ways. However, some studies say that consumer HIR is a challenging process (Zeng, 2004; Toms, 2007 and Hong, 2002). Internet users and non users having just basic knowledge of using a web browser can search the Internet for health information. They can use a search engine like Google or they can use a web portal like Yahoo, or any other website. Studies in this area have focused more on the search process. For example, a recent study was done by Efthimiadis (2009) on how undergraduate and postgraduate students search for health information on the Internet but the focus was to find how students actually do the search. Another study by Eysenbach (2002) also describes the search patterns when looking for health information. Zeng et al. (2006) developed the Health Information Query Assistant (HIQuA) system to aid users. They developed the system which can suggest query terms related to the user’s initial query since it is the difficulty in search they said, where the users need assistance.

Statistics in Canada (CIUS 2005) show that 56% Canadians search for information about specific diseases, 50% for lifestyle and 46% for information about specific symptoms. Similar study was done by Fox (2006) in USA and they did surveys on HIR in 2002, 2004 and 2006. This study stated that 64%
Americans search for information on specific diseases or medical problems, 51% for medical treatment and 49% for diet & nutrition. It would be very useful to conduct a similar study here in the UAE, but we believe that there are other questions that need answers as well. Currently there are 95 hospitals in the UAE out of which 14 offer online health services. The currently available online health services provided by hospitals in the UAE are: Make and Inquiry; Book an Appointment; Find a Doctor; and Ask a Doctor (Nasir, 2011). There may be other online health services available on the Internet but these will not be provided by hospitals in UAE but instead by other parties.

**Objectives**

We wanted to find out what are the e-Health usage trends amongst Arab students. For that we divided the study into 4 areas so that we can find out what are the students doing on the Internet regarding health information and online health services. The 4 areas that we wanted to examine were:

1. What are the health topics that students lookup?
2. When do they lookup information?
3. Do they trust the information that they find on the Internet?
4. And what are the tools and online health services that they use?

**Methodology**

For the study we designed a questionnaire for the students. This questionnaire had questions with the Likert Scale answers for frequency of use. Some of the questions that we thought needed to be answered were;

- What health topics do the students lookup on the Internet?
- When and why do the students lookup health information?
- Do students actually go to the doctor for treatment or second opinion and do they lookup information after coming back to the doctor as well?
- Do the students trust and rely on information they find on the Internet?
- Where do they lookup information? What portals or search engines do they use?
- Do they use online health services?
- Do they use handheld devices to lookup information as well?
- Do they read the usage policies on the websites that they visit?

The questions were divided into 4 areas namely Topics of interest; Reasons for lookup; Trust and Reliability; Tools and Services used. The exact questions are presented in tables in this paper. The questionnaire was distributed to undergraduate students enrolled in Business Administration and Computer Studies Programs. The responding students were predominantly Arab students. We asked the assistance of the Student Services department for the survey. A total of 310 students returned the survey out of which 186 were male and 124 were female as shown in Figure 1. We then entered the information in the computer and used Microsoft Excel 2003 to tabulate the findings.

![Figure 1– The Gender Distribution of Respondents (Total = 310)](image)

Out of the total 310 responding students, 280 were Arab students, 19 were from Iran and 11 were of other nationalities. The representation
of countries with 2 or more than 2 students is shown in Figure 2.

Figure 2 – Nationalities of responding students of countries with ≥ 2 respondents

Findings

Topics of Interest

We had asked the students about the health topics for which people usually lookup information on the Internet. We used the terms search / browse to make the questions easier for the students to understand. We used similar topics as used by other surveys done in 2002, 2004 and 2006 by Fox (2006). We found that the topics of interest in order of decreasing popularity were as follows, with Diseases being the most popular and the Alternative Medicine being the least popular topic of interest.

1. Diseases 70.32%
2. Exercise & Fitness 62.18%
3. Normal Health & Well Being 55.65%
4. Treatments 49.84%
5. Health Hazards 42.02%
6. Medicines 33.71%
7. Alternative Medicine 16.37%

As can be seen that the students lookup information for Disease the most. This is similar to the results of Fox (2006) in which Diseases was the most popular topic for HIR. It is interesting to note that the students also commonly lookup information on Exercise and Fitness, it is the second most popular topic of interest. Normal health and wellbeing is the third commonly sought topic of interest for students.

The complete results for this category are tabulated in Table 1 and shown in Figure 3.
Table 1– Responses to Topics of Interest

<table>
<thead>
<tr>
<th>Question</th>
<th>Always (Wt 4)</th>
<th>Very Often (Wt 3)</th>
<th>Sometimes (Wt 2)</th>
<th>Rarely (Wt 1)</th>
<th>Never (Wt 0)</th>
<th>No Ans</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you search/browse for information about Disease(s) on the Internet?</td>
<td>65</td>
<td>142</td>
<td>87</td>
<td>12</td>
<td>4</td>
<td>0</td>
<td>70.32%</td>
</tr>
<tr>
<td>Do you search/browse for information on Exercise and Fitness on the Internet?</td>
<td>56</td>
<td>120</td>
<td>56</td>
<td>75</td>
<td>3</td>
<td>0</td>
<td>62.18%</td>
</tr>
<tr>
<td>Do you search/browse for information about normal well being and health on the Internet?</td>
<td>21</td>
<td>123</td>
<td>108</td>
<td>21</td>
<td>33</td>
<td>4</td>
<td>55.65%</td>
</tr>
<tr>
<td>Do you search/browse for information on treatments or medical procedures on the Internet?</td>
<td>35</td>
<td>85</td>
<td>78</td>
<td>67</td>
<td>41</td>
<td>4</td>
<td>49.84%</td>
</tr>
<tr>
<td>Do you search/browse for information on other health hazards (like smoking, pollution, stress etc) on the Internet?</td>
<td>10</td>
<td>42</td>
<td>125</td>
<td>105</td>
<td>25</td>
<td>3</td>
<td>42.02%</td>
</tr>
<tr>
<td>Do you search/browse for information about Medicines or Drugs on the Internet?</td>
<td>12</td>
<td>25</td>
<td>86</td>
<td>123</td>
<td>59</td>
<td>5</td>
<td>33.71%</td>
</tr>
<tr>
<td>Do you search/browse for information on alternative medicine and treatments (like Homeopathy, Acupuncture, Ayurveda etc) on the Internet?</td>
<td>3</td>
<td>6</td>
<td>14</td>
<td>145</td>
<td>140</td>
<td>2</td>
<td>16.37%</td>
</tr>
</tbody>
</table>

Figure 3 – Graphical Representation of Responses to Topics of Interest

Reasons for Lookup

The other trend that we wanted to find out and was when do students lookup health information on the Internet? Do they lookup information only when they are sick? Or when someone that they know is sick? Or do they even lookup information when they are feeling fine? We found that it is when they are feeling sick that they actually lookup information most of the time, followed by
when someone they know is sick. Compared to these two reasons, they don’t commonly lookup health information when they are feeling fine. This is shown in table 2 and figure 4. It is thus reasonable to expect that people in general lookup health information on the Internet when they or someone they know is feeling sick.

Table 2 – Responses for reasons for lookup

<table>
<thead>
<tr>
<th>Question</th>
<th>Always (Wt 4)</th>
<th>Very Often (Wt 3)</th>
<th>Sometimes (Wt 2)</th>
<th>Rarely (Wt 1)</th>
<th>Never (Wt 0)</th>
<th>No Ans</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you search/browse for health information on the Internet on ordinary days when you are feeling fine?</td>
<td>11</td>
<td>85</td>
<td>126</td>
<td>31</td>
<td>45</td>
<td>2</td>
<td>46.94%</td>
</tr>
<tr>
<td>Do you search/browse for health information on the Internet when you are feeling sick?</td>
<td>165</td>
<td>131</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>86.94%</td>
</tr>
<tr>
<td>Do you search/browse for health information on the Internet when someone you know is feeling sick?</td>
<td>52</td>
<td>123</td>
<td>115</td>
<td>13</td>
<td>5</td>
<td>2</td>
<td>66.13%</td>
</tr>
</tbody>
</table>

Figure 4 – Graphical representation of reasons for lookup

**Trust and Reliability**

The other important aspect was the trust the students put in the information that they find online. We found that although 42.90% of students are satisfied with the information that they find online, only 26.85 % trust the information they find. 26.45% students follow the medical advice they find on the Internet. But only 23.87% actually take the drugs or other medication mentioned on the Internet. That shows that the students take some precautions with medications, which is a good sign.

71.61% students go to the doctor for treatment or second opinion and 41.45% lookup information after coming back from the doctor as well. This shows that the
students even double check the information the doctor gives them. The tabulation is shown in table 3 and the graph in figure 5.

It is an interesting finding that students of today take precautions and they don’t blindly trust the information they find online since it concerns their health and wellbeing. With the information that the students find on the Internet, they are more careful while taking medications mentioned on the Internet.

Table 3 – Responses for Trust and Second Opinion

<table>
<thead>
<tr>
<th>Question</th>
<th>Always (Wt 4)</th>
<th>Very Often (Wt 3)</th>
<th>Sometimes (Wt 2)</th>
<th>Rarely (Wt 1)</th>
<th>Never (Wt 0)</th>
<th>No Ans</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you satisfied with the health information that you find on the Internet?</td>
<td>5</td>
<td>36</td>
<td>168</td>
<td>68</td>
<td>21</td>
<td>12</td>
<td>42.90%</td>
</tr>
<tr>
<td>Do you trust the health information that you find on the Internet?</td>
<td>3</td>
<td>15</td>
<td>62</td>
<td>152</td>
<td>78</td>
<td>0</td>
<td>26.85%</td>
</tr>
<tr>
<td>Do you follow the medical advice (excluding drugs) that you find mentioned on the Internet?</td>
<td>2</td>
<td>15</td>
<td>75</td>
<td>125</td>
<td>90</td>
<td>3</td>
<td>26.45%</td>
</tr>
<tr>
<td>Do you take the medicines or drugs that you find mentioned on the Internet for treatment?</td>
<td>1</td>
<td>10</td>
<td>69</td>
<td>124</td>
<td>102</td>
<td>4</td>
<td>23.87%</td>
</tr>
<tr>
<td>Do you actually go to the doctor for treatment or second opinion after you have seen the health information on the Internet?</td>
<td>75</td>
<td>135</td>
<td>85</td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>71.61%</td>
</tr>
<tr>
<td>Do you search for health information after coming back from the doctor?</td>
<td>9</td>
<td>61</td>
<td>93</td>
<td>109</td>
<td>34</td>
<td>4</td>
<td>41.45%</td>
</tr>
</tbody>
</table>

Figure 5 – Graphical Representation of Trust
Tools and Services Used

We wanted to find out that how do the students actually lookup information on the Internet? Do they search for health information using search engines? And what are the search engines that they use? And what is the popularity of these search engines? We found that 77.74% students use search engines. The most commonly used search engine was Google followed by Yahoo as mentioned below in Table 4 and the graphical representation is shown in figure 6.

Some students were also using Arabic search engines as well.

Table 4 – Popularity of Search Engines

<table>
<thead>
<tr>
<th>Search Engine</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google</td>
<td>59.68%</td>
</tr>
<tr>
<td>Yahoo</td>
<td>21.29%</td>
</tr>
<tr>
<td>Alta Vista</td>
<td>6.45%</td>
</tr>
<tr>
<td>Ask.com</td>
<td>4.52%</td>
</tr>
<tr>
<td>Ayna.com</td>
<td>3.23%</td>
</tr>
<tr>
<td>Others</td>
<td>2.90%</td>
</tr>
<tr>
<td>No Response</td>
<td>1.94%</td>
</tr>
</tbody>
</table>

Figure 6 – Popularity of search engines used to retrieve health information

The other thing was that we wanted to find was whether the students are actually using health portals and what are the health portals that they use? We found that there was no single hugely popular health portal and the commonly used portals were MSN Health and Yahoo Health. 27.42% students did not give any response and 9.68% were using Sehha.com an Arab health portal. The graphical representation is shown in figure 7.
The other question was about use of PDAs or other handheld devices. We wanted to find if the students actually use these devices to lookup health information or use online health services. We found that 48.79% students use these devices to lookup information. Therefore, we believe that there is room for development for the health service providers to concentrate further at handheld devices and provide more content oriented for display and use on such devices.

It was interesting to find that only 8.47% students are actually using online health services. The only online services that the students mentioned were Use of Health Forums, Book an Appointment and Find a Doctor.

The other important finding that was a cause of concern is that only 13.47% students actually read the policies about use of online health information.

The tabulation of all these questions is presented in Table 5 and graphical representation is shown in figure 8.

Table 5 – Responses for tools used for lookup

<table>
<thead>
<tr>
<th>Question</th>
<th>Always (Wt 4)</th>
<th>Very Often (Wt 3)</th>
<th>Sometimes (Wt 2)</th>
<th>Rarely (Wt 1)</th>
<th>Never (Wt 0)</th>
<th>No Ans</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you use ordinary search engines (like Google) to search for health information on the Internet?</td>
<td>127</td>
<td>99</td>
<td>78</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>77.74%</td>
</tr>
<tr>
<td>Do you use medical portals (like WebMD) to search for health information on the Internet?</td>
<td>2</td>
<td>78</td>
<td>115</td>
<td>78</td>
<td>35</td>
<td>2</td>
<td>44.35%</td>
</tr>
<tr>
<td>Do you use any online health services?</td>
<td>1</td>
<td>5</td>
<td>16</td>
<td>54</td>
<td>227</td>
<td>7</td>
<td>8.47%</td>
</tr>
<tr>
<td>Do you use handheld devices (like mobile phone, PDAs) to search for health information as well?</td>
<td>2</td>
<td>65</td>
<td>165</td>
<td>72</td>
<td>5</td>
<td>1</td>
<td>48.79%</td>
</tr>
<tr>
<td>Do you read the usage policies on the health websites that you visit?</td>
<td>1</td>
<td>2</td>
<td>16</td>
<td>125</td>
<td>164</td>
<td>2</td>
<td>13.47%</td>
</tr>
</tbody>
</table>
Summary of Findings

In table 6 we have combined all the responses in one summarized table.

![Graphical Representation for tools and services](image)

Figure 8 – Graphical Representation for tools and services
<table>
<thead>
<tr>
<th>Area</th>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Topics of Interest</strong></td>
<td>Lookup Diseases on the Internet</td>
<td>70.32%</td>
</tr>
<tr>
<td></td>
<td>Lookup Exercise and Fitness on the Internet</td>
<td>62.18%</td>
</tr>
<tr>
<td></td>
<td>Lookup Normal well-being and health on the Internet</td>
<td>55.65%</td>
</tr>
<tr>
<td></td>
<td>Lookup Treatments or Medical procedures on the Internet</td>
<td>49.84%</td>
</tr>
<tr>
<td></td>
<td>Lookup Health Hazards (like smoking, pollution, stress etc) on the Internet</td>
<td>42.02%</td>
</tr>
<tr>
<td></td>
<td>Lookup Medicines or Drugs on the Internet</td>
<td>33.71%</td>
</tr>
<tr>
<td></td>
<td>Lookup Alternative medicine &amp; Treatments (like Homeopathy, Acupuncture, Ayurveda etc) on the Internet</td>
<td>16.37%</td>
</tr>
<tr>
<td><strong>Reasons for Lookup</strong></td>
<td>Lookup health information on the Internet on ordinary days when feeling fine</td>
<td>46.94%</td>
</tr>
<tr>
<td></td>
<td>Lookup health information on the Internet when feeling sick</td>
<td>86.94%</td>
</tr>
<tr>
<td></td>
<td>Lookup health information on the Internet when someone you know is feeling sick</td>
<td>66.13%</td>
</tr>
<tr>
<td><strong>Reliability and Trust</strong></td>
<td>Satisfied with the health information found on the Internet</td>
<td>42.90%</td>
</tr>
<tr>
<td></td>
<td>Trust the health information found on the Internet</td>
<td>26.85%</td>
</tr>
<tr>
<td></td>
<td>Follow the medical advice (excluding drugs) found mentioned on the Internet</td>
<td>26.45%</td>
</tr>
<tr>
<td></td>
<td>Take the medicines or drugs found mentioned on the Internet for treatment</td>
<td>23.87%</td>
</tr>
<tr>
<td></td>
<td>Go to the doctor for treatment or second opinion after lookup of health information on the Internet</td>
<td>71.61%</td>
</tr>
<tr>
<td></td>
<td>Lookup health information after coming back from the doctor</td>
<td>41.45%</td>
</tr>
<tr>
<td><strong>Tools and Services Used</strong></td>
<td>Use ordinary search engines (like Google) to lookup health information on the Internet</td>
<td>77.74%</td>
</tr>
<tr>
<td></td>
<td>Use medical portals (like WebMD) to lookup health information on the Internet?</td>
<td>44.35%</td>
</tr>
<tr>
<td></td>
<td>Use online health services</td>
<td>8.47%</td>
</tr>
<tr>
<td></td>
<td>Use handheld devices (like mobile phone, PDAs) to lookup</td>
<td>48.79%</td>
</tr>
<tr>
<td></td>
<td>Read the usage policies on the health websites that you visit?</td>
<td>13.47%</td>
</tr>
</tbody>
</table>
Conclusion
We can see from this study that students are actively using the Internet to lookup health information. They commonly use search engines to search for health information and the most commonly searched topics are

1. Diseases 70.32%
2. Exercise & Fitness 62.18%
3. Normal Health & Well Being 55.65%
4. Treatments 49.84%

The students are although satisfied with the information that they find online but they take precaution when taking medicines mentioned on the Internet. The students also often use handheld devices like mobile phones and PDAs to lookup health information, thus there exists a potential for growth in this sector. The students rarely use online health services and this appears to be an untapped area in this country. They also usually do not read the policies about use of online health information and this may have some consequences for using the health information. However, since the students take precautions while taking medicines mentioned online or while following online medical advice we can assume they know the consequences of fully relying on the information available online.

It would be very useful to conduct similar study at other colleges or universities and outside as well to cover a larger population base. A follow up study can be done in the future after 2 years, since this will show any changes in trends as done in USA by Fox in 2002, 2004 and 2006 (2006)
References

Ameinfo.com, 2007, UAE Internet users spend over USD 1.15 billion in B2C e-commerce over the past 12 months [Online], Available at: http://www.ameinfo.com/131415.html [Accessed 10-8-2010]


Canada Statistics, 2005, “The Canadian Internet Use Survey (CIUS), CANSIM - Canadian Socio-economic Information Management System,


Fox S. and Rainie L., 2002 Vital decisions: How Internet users decide what information to trust when they or their loved ones are sick, Pew Internet & American Life Project, May 2002


Hong, Y. et al., 2002, A query analysis of consumer health information retrieval, American Medical Informatics Association Annual Symposium Proceedings 2002, pp 1064


Nasir S. K and Kabir S. S., (in press), The extent of the online presence of health authorities, hospitals and available online health services in the United Arab Emirates, Proceeding of the first Middle East Conference on Biomedical Engineering (MECBME’11), Sharjah, UAE, (Accepted for Publication December 2010)


P. Williams, D. Nicholas, P. Huntington, F. McLean, 2002, Surfing for health: user
evaluation of a health information website. Part two: fieldwork, Health Information Library Journal, pp 214 -225

Sullivan F., 2006, ABC of Health Informatics, Wiley-Blackwell


Pulmonary Hydatid Cyst in Duhok

Mohammed Salil Al-Ani
Duhok University, Duhok

Abstract

Hydatid cyst disease is endemic in certain parts of Iraq. Duhok province is one of them.

Cases of pulmonary hydatid cyst in Duhok that has been dealt with surgically between 2007 and 2010 are studied; the study included the age of the patient, the site of the cyst, the complaint of the patient and whether the cyst was complicated or not.

Presentation varied from being asymptomatic discovered accidentally to severe complications following rupture of the cyst.

The type of surgery used in these cases is discussed as well as the surgical complications.

No chemotherapy was used pre-operatively, though a course was given in some of them post-operatively.

Lastly, the recommendation to eradicate or at least to reduce its incidence is discussed.

Introduction

Hydatid cyst disease is the larval cystic stage of a small tape warm (Echinococcus granulosus). The adult tape warm lives in the gut of dogs and other carnivores as (a definitive host). The ova of these warm contaminates the grass and vegetables in fields. Man is accidentally infected when he eats improperly washed vegetables and uncooked green leaves contaminated by the eggs of the tape warm as (intermediate host).

The ova will hatch in the sheep and human intestines and pass through the portal system to the liver where it is the first filter (the commonest site for hydatid cyst disease). If the parasite was able to pass this filter it will reach the systemic circulation where it is trapped in the second capillary system (the lung is the second common site).

In our province (Duhok), like many other areas in Iraq, where sheep raising is common, the incidence of hydatid cystic disease is common and endemic.

This paper reveals the cases of pulmonary hydatid cysts and analyzes the system followed for investigation, diagnosis and management.

Hydatid cyst of the lung grows faster than that of the liver as the surrounding lung tissue is softer and spongy in comparison to that of liver.

This fast growth of the cyst without much resistance might explain why there are, usually, no daughter cysts in pulmonary hydatid cyst.

Investigation and Diagnosis

1. Routine investigations like complete blood picture, blood sugar, urea and creatinine are done in all cases.
2. Only occasionally we do ELISA test, and complement fixation tests as they are not diagnostic.
3. CXR (2 views) is the item relied on diagnosing the cases. Uncomplicated pulmonary hydatid cyst will appear as a rounded or an oval opacity surrounded by the normal blackish appearance of the lungs. (Fig 1&2)
Complicated hydatid cyst shows a different appearance according to the type of complication and its state. Intrabronchial ruptured cyst might show fluid level (Fig 3), water lelly appearance (Fig 4&5) or appear as lung abscess. (Fig 6)

4. Ultra sound of abdomen to detect or exclude the presence of cysts in the abdominal cavity (e.g. liver), especially in cases of right pulmonary hydatid cyst as both can be dealt with during the same surgery.

5. CT scan done but not as a routine investigation, it is used to show more details (Fig 7,8,9,10&11)of the cyst or cysts in the mediastinum.

Symptoms of the patient vary according to the size and site of the cysts and whether there are any complications where cough and pain are the most common symptoms, haemoptosis might be the presenting symptom.

Treatment

There are two principle methods of treatment:
1. Chemical and its associated procedures (aspiration and lavage)
2. Surgical

Chemical Method

Early attempts to treat hydatid cyst with Mebendazole (Vermox) was used in the Medical City in Baghdad in 1970s without much benefit (personal communications).

Albendazole was recently used in treating hydatid cyst disease. It is helpful and effective in treating hepatic hydatid cysts. (5)

In the case of pulmonary hydatid cyst the condition is completely different. Preoperative use of Albendazole may cause rupture of the cyst.

a. Cyst ruptured in all cases after treatment, the cyst ruptured in days 7, 8, 10, 11, and 13 after the introduction of Albendazole. (6)

b. Pleural involvement by the disease after using Albendazole and hypertonic saline irrigation noticed in ten out of nineteen patients. (8)

The possible assumption of the cause of rupturing the cyst:
• Interference with cyst wall.
• Interference with the intracystic pressure. (6)

Post operative use of Albendazole is recommended especially if there is an obvious fluid leakage during surgery to minimize or eliminate the chances of recurrence or dissemination.

If the content of the cyst are infected whether infected intrapulmonary cyst or pleural rupture (empyema) there is no need to give Albendazole as the scolices are already killed by the infection.

Materials and Methods

Since the establishment of the cardiothoracic unit in Duhok early 2007, till the end of November 2010, eighty five patients with pulmonary hydatid cysts are dealt with.

In Our Series

Thirty four cases were in the right lung, Forty eight cases had the cyst in the left lung, and three patients had cysts in both lungs.

Nine of our patients had multiple cysts, six of them multiple in one lung, and three had cysts in both lungs.

Four patients had hydatid cysts in the liver as well as the pulmonary cysts and are dealt with them at the same time. One of them through a separate interconstal incision and the others through the diaphragm.

One had cysts in the spleen besides the left pulmonary cyst, dealt with through the diaphragm.
Sex
Forty seven patients were females, and thirty eight were males.

Age Distribution
The youngest patient was four years old boy with a large cyst in the right lung (Fig 12).

The oldest patient was 70 years old man presented as a suspected mass in the chest, diagnosed as a cyst during thoracotomy. Most of the patients were below the age of 20 years (49 out of 85), the mean age for all the patients was (24.06)

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of cases (total = 85 cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10 years</td>
<td>16</td>
</tr>
<tr>
<td>11-20 years</td>
<td>33</td>
</tr>
<tr>
<td>21-30</td>
<td>14</td>
</tr>
<tr>
<td>31-40</td>
<td>10</td>
</tr>
<tr>
<td>41-50</td>
<td>5</td>
</tr>
<tr>
<td>&gt; 51</td>
<td>7</td>
</tr>
</tbody>
</table>

Diagnosis made mainly by chest x ray and CT scan, besides history and being from known endemic villages and towns.
Serological tests done only on limited number on patients where it was done before admission to the surgical unit as they are only suggestive and not diagnostic. (2) (3) (4)
No treatment with Albendazole given pre-operatively because of its possible complications, but used post operatively especially if there is any suspicion of spillage of hydatid fluid during surgery.
After opening the chest cavity, the area of cyst is isolated by surrounding it by packs soaked with scolicidal solution (Povidone or Hibitane).
The cyst punctured by a wide bore needle which is already connected to negative pressure suction to evacuate as much as possible of the fluid to reduce the pressure inside it, then the cyst opened between two clamps, the suction is completed, the endocyst removed by sponge forceps.
Surgical treatment of pulmonary hydatid cysts included the removal of the cyst, closure of the bronchial holes and then conserve as much as possible of the lung and obliterating the space.
Lobectomy was needed in fourteen cases where the lobe looked unhealthy, unlikely to inflate properly after removing the cyst.
The most common complication was persistent air leak. Most of them stopped spontaneously on conservative measures, only two of them needed re-thoracotomy where lobectomy performed.

No mortality in the series.

Discussion
Diagnosis of hydatid cyst is suspected by noticing a single or multiple rounded homogenous lesions in the chest (8) (fig 1) specially if the lesion is detected in young age patient. These are uncomplicated cysts.
CT may be helpful in establishing diagnosis of complicated cysts. (4)
Sensitivity of diagnostic serological methods varies significantly in different centers. (2) (3) (4)
Cysts might rupture and become complicated cysts. Rupture might be intrabronchial and the cyst will appear as a cavity with fluid level or even water lelly and might convert to lung abscess.
Cyst might rupture to the pleural cavity and ends as hydro-pneumothorax. There is no report of major anaphylactic shock after rupture. (6) Treatment of pulmonary hydatid cyst falls in two categories or even combination of both:

**Chemical Method**

Chemotherapy alone is not reliable (6) through some reported that no viable protoscolices was found after six weeks treatment with Albendazole. (5) Chemotherapy in chest hydatid cysts has its limitations. Treatment of pulmonary hydatid cysts will increase the rate of rupture and this means converting the single non complicated cyst into a complicated one with higher rate of mortality and complications. Gerilol reported that all his six cases of pulmonary hydatid cysts ruptured within two weeks of starting the Albendazole therapy. (6) We did not use Albendazole treatment preoperatively but we used it post operatively especially if there was fluid spillage during surgery to prevent or reduce the risk of recurrence. Management by PAIR method where aspiration, injection and wash out has very limited use as it leads to rupture to the pleura and implantation of scolices in the pleural cavity. (8)

**Surgical Treatment**

Till now surgery is the only successful treatment method of pulmonary hydatid cyst. The technique used is as follows: after opening the chest cavity, the area of the cyst is isolated by surrounding it by packs soaked with scolicidal agents (Povidone or Hiritane). The most evident area of the cyst which usually appears as “white patch” is punctured by a wide bore needle connected to suction, when the intracystic pressure has been lowered the cyst opened from the upper-most part of the cyst, the whole contents are removed. Air leak is secured and we deal with the lung tissue in a very conservative way. The main principle followed is that no cure for hydatid cyst of the lung till all the contents of the cavity are removed and the air leak is secured.

Small cysts less than 2-3 cm in diameter may regress completely after rupture especially when they are in the upper zone where gravity will help in postural drainage.
Figure (1)

Figure (2)
Figure (3)

Figure (4)
Figure (9)

Figure (10)
References

Medical parasitology


Ali Reza Mirshewerani, et al.
Surgical treatment of pulmonary hydatid cysts in 72 children.
National research institute for T.B., and lung diseases. Iran (2009)

Gökhan Hacubrahinogla M.D
Surgical treatment of complicated cysts of the lung.
Turkish respiratory journal (2003)

D.L. Morsen: Albendazole treatment of pulmonary Hydatid cysts
Thorax-June 1985

Gerital: Reading on Hydatid cyst and Albendazole cure zone-kjpm-vol 6 no 1 2010

A. Pandy: pulmonary hydatidoses unusual cause of haemoptesis.
Indian Journal of medical microbiology 2007
MJAFI. Vol 61 No 1 2005
List of Reviewers

The Deanship of Scientific Research wishes to acknowledge and thank Conference and Technical Committee Chair Professor Rachid Hadj-Hamou and members of the Technical Committee listed below who have contributed their time to review submissions for this conference.

<table>
<thead>
<tr>
<th>Technical Reviewer</th>
<th>Position</th>
<th>Institution</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Rachid Hadj Hamou (Conference Chair)</td>
<td>Senior Advisor</td>
<td>Hamdan Bin Mohammed e-University</td>
<td>UAE</td>
</tr>
<tr>
<td>Dr. Martin Denz</td>
<td>President</td>
<td>European Health Telematics Association</td>
<td>Switzerland</td>
</tr>
<tr>
<td>Prof. Moustafa M Hassan</td>
<td>Dean of e-School of Health &amp; Environmental Studies</td>
<td>Hamdan Bin Mohammed e-University</td>
<td>UAE</td>
</tr>
<tr>
<td>Dr. Samer Hamidi</td>
<td>Graduate Program Director of e-School of Health &amp; Environmental Studies</td>
<td>Hamdan Bin Mohammed e-University</td>
<td>UAE</td>
</tr>
<tr>
<td>Dr. Heather Harvey</td>
<td>Assistant Professor, e-School of Health &amp; Environmental Studies</td>
<td>Hamdan Bin Mohammed e-University</td>
<td>UAE</td>
</tr>
<tr>
<td>Prof. Bob Bergman</td>
<td>Professor</td>
<td>Chalmers University</td>
<td>Sweden</td>
</tr>
<tr>
<td>Prof. Dr. Syed M. Aljunid</td>
<td>Professor of Health Economics &amp; Senior Research Fellow</td>
<td>UNU-IIGH</td>
<td>Malaysia</td>
</tr>
<tr>
<td>Dr. Habib El Habr</td>
<td>Director and Regional Representative</td>
<td>United Nations Environment Programme Regional Office for West Asia (UNEP/ROWA)</td>
<td>WHO</td>
</tr>
<tr>
<td>Dr. Eng. Bassel Al Yousfi</td>
<td>Director</td>
<td>WHO, Centre for Environmental Health Activities</td>
<td>UN</td>
</tr>
<tr>
<td>Dr. Robert Morris</td>
<td>Consultant</td>
<td>WHO</td>
<td>USA</td>
</tr>
</tbody>
</table>