
# Handling Health Care Waste Management and gender differences in the Madinah Primary Healthcare Centers, Kingdom of Saudi Arabia

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## Abstract

Health care waste management (HCWM) is a major challenge in developing countries. Poor HCWM will exacerbate the risk of infection. HCW segregation is considered the most important step of health care waste management (HCWM). This article attempts to analyze and evaluate gender differences in their perception of HCW segregation at the Madinah primary health care centers (PHCC) in the Kingdom of Saudi Arabia (K.S.A.). Questionnaire surveys were conducted to gather primary data from 925 respondents (230 females and 225 males) at various PHCCs in Madinah. Data were then analyzed using the SPSS and PLS-smart 2.0. In general, female respondents had higher qualifications and income, and longer working experience than males. About 80% of the departments managed by females had the correct type of container compared to the males' 42%. The study also found that the waste segregation at the PHCCs was poor as it was not achieved at 34.1% of all the departments. Similarly, the results of the hypothesis tests showed that waste segregation in PHCC did not have a direct relationship with HCWM (0.0001; t = 0. 0015) just as there were no direct relationships between waste segregation of males and females with HCWM ( 0.0565; t=1.3669).

**Keywords**: gender differences, handling of HCW, Health Care Waste Management, health hazards, medical waste, waste segregation

## Introduction

Health Care Waste Management (HCWM) is a great challenge that faces by developing countries (Hossain, 2011). By definition, Health Care Waste (HCW) includes health hazards, ecological risks and the lack of public awareness (Abdulla, 2008; Tuduetso, 2008; Manzurul, Ahmed, Rahman, & Biswas, 2008; Mosler, Drescher, Zurbru¨gg, Rodrı´guez & Guzmán Miranda, 2006; Gupta & Boojh, 2006). It also contains a wide range of materials, such as blood, syringes, used needles, body parts, soiled dressings, pharmaceuticals, diagnostic samples chemicals, medical devices and radioactive materials (Komilis, 2012; Prüss, Giroult & Rushbrook, 1999). Unfortunately, HCWM has not been the priority in developing countries because health issues are forced to contend with other issues to share the limited resources. Moreover, the exclusive rules and regulations are employed for HCWM systems in these countries. Hence, HCWM in many developing nations is mostly deprived and bounded with technical difficulties (Prüess et al., 1999). Unsafe handling of HCWM will pollute the surrounding environment and therefore easily risks health staff to several diseases (Hossain, 2011). Therefore, HCWM should be givena great attention to ensure a better hospital hygiene and safety of health care staff and communities (Jafri, Siddiqui & Jafri, 2014).

According to World Health Organization, the key to minimization and effective management of HCW is identification and segregation of the waste (Prüss et al., 1999). Segregation is the first and most

important step in HCWM practices. One of the responsibilities of health staff is the proper management of health care waste which can be implemented by understanding how waste should be segregated and stored, etc. (Royal College of Nursing, 2014). Also, the awareness of health staff refers to the understanding about cross infections, types of hazardous waste and segregation (Kasoma, 2013). Moreover, segregation is the process of the separation of solid waste into two categories namely hazardous waste (15-25%) and normal waste (75-85%). Segregation is beneficial, as it reduces the amount of hazardous waste and costs less money because hazardous waste disposal costs 10-20 times more than the disposal of normal waste (Tudor, 2006; DOH, 2006; Taru & Kuvarega, 2005; Townend, 2005; Barratt, Chambers & Vergoulas, 2004; Rayner, 2003; Mohammadi-Baghaee, 2000).

According to Abo-Malk (2008), Kingdom of Saudi Arabia (K.S.A) lacks of researches in HCWM which led to improper implementation of the systems in this field and the lack of understanding regarding the impact of poor handling of health care waste (Kied, 2005). Moreover, a lot of health facilities do not organize training courses related to HCWM (Abo-Malk, 2008). In addition, the application of quality standards which refers to health care waste as one of the most important standards in Saudi Arabian establishments is very poor (Alharbi & Zien, 2012). The study by Manyeleand Lyasenga (2010) concluded that the problems in segregation were due to lack of awareness and poor handling of HCWM.

Based on the mentioned problems above, this paper attempts to investigate the statistical differences between the averages of responses of female and male health staff in segregation of HCWM. The paper also examines the reality of segregation of health care waste at the Madinah primary health care centers.

## Study area and methodology

The current study adopted a quantitative research approach. The data were collected through survey questionnaire from 33 Madinah primary health care centers (PHCC) in the K.S.A, between July and November 2013. All employees in the PHCC in Madinah received an invitation. Out of 925 health staff, who were given the questionnaire, only 552 responded, which the response rate was around 59%. However, it wasabout455 of the returned questionnaires were completed. Therefore, the adjusted response rate was around 49%. The data was analyzed by using Microsoft Excel statistics packages and SPSS Software. Data were firstly analyzed by using descriptive analysis and exploratory factor analysis (EFA). Data in the SPSS format (matrix form) were then process and analyzed by using Smart-PLS 2.0 software following the guidelines of Hair et al. (2014). Firstly, factor loading of each of the all observed items (variables) was more than 0.7, with the exception of two items. Secondly, CR values for each construct was greater than 0.823. Finally, AVE test values for each construct exceeded 0.6. These three tests results conclude that the instrument used to collect the main data has good convergent validity (Hair, et al., 2010).The consistent reliability test, Cronbach's Alpha was equal to (0.897). Based on Nunnally (1978) it is a good reliability. The second test was the Composite Reliability (CR) 0.823 which is considered good reliability (Hair, Black, Babin & Anderson, 2010). According to George and Mallery (2003) all dimensions exhibited adequate construct reliability.

## Descriptive analysis for the respondents

Table 1 illustrates the general information of the research respondents, who were 225 males (49.5%) and 230 females (50.5%). In terms of the respondents' occupational category, 72.1% of them were technicians, who consisted of 52% males and 48% females. Also, 22.9% was physicians, which was in equal number of males and females. Moreover, 4.2% was managerial staff, of which 63% males and 37% was females. The remaining 0.9% was specialists of non physicians, who were only females. The lowest education level of the respondents was lower secondary education (1.8%) of which 75% was females and 25% was males. Moreover, it was observed that3.1% with PhD in which58% was females and 42% was males. Also, master's degree holders had 5.3%, which consisted of 59% females and 41% males. In

addition, secondary education certificate holders had 6.8% of which 45% was females and 55% was males. Furthermore, bachelor degree holders had a percentage of 19.6% in which 56%was females and 44% was males. Finally, the Diploma certificate was the second highest after the secondary education holders i.e.63.5% of which 56% was females and 44% was males.

**Table 1. General Information of the respondents**

| General Information | | Total | Percent | % Male | % Female |
|---|---|---|---|---|---|
| Gender | Male | 225 | 49.5 | 49.5 | - |
| | Female | 230 | 50.5 | - | 50.5 |
| | Total | 455 | 100 | 49.5 | 50.5 |
| Occupation category | Technician | 328 | 72.1 | 52 | 48 |
| | Physician | 104 | 22.9 | 50 | 50 |
| | Managerial | 19 | 4.2 | 63 | 37 |
| | Specialist non Physician | 4 | 0.9 | 0 | 100 |
| Qualification | Diploma after secondary education | 289 | 63.5 | 44 | 56 |
| | Bachelor | 89 | 19.6 | 54 | 46 |
| | Secondary education | 31 | 6.8 | 55 | 45 |
| | Masters degree | 24 | 5.3 | 41 | 59 |
| | PhD | 14 | 3.1 | 42 | 58 |
| | Lower than secondary education | 8 | 1.8 | 25 | 75 |
| Working experience | less than 2 years | 42 | 9.2 | 64 | 36 |
| | from 2 to 5 years | 112 | 24.6 | 55 | 45 |
| | from 6 to 9 years | 91 | 20.0 | 41 | 59 |
| | more than 9 years | 210 | 46.2 | 49 | 51 |
| Income | less than 4,999 | 17 | 3.7 | 53 | 47 |
| | from 5000 to 9,999 | 185 | 40.7 | 54 | 46 |
| | from 10000 to 14,999 | 179 | 39.3 | 51 | 49 |
| | more than 15000 | 74 | 16.3 | 41 | 59 |
| Age | less than 25 years | 26 | 5.7 | 65 | 35 |
| | from 26 to 45 years | 370 | 81.3 | 53 | 47 |
| | More than 45 years | 59 | 13.0 | 29 | 71 |
| Marital status | Married | 369 | 81.1 | 55 | 45 |
| | Single | 74 | 16.3 | 31 | 69 |
| | Divorce | 12 | 2.6 | 0 | 100 |

Only 9.2% of respondents had an experience of less than 2 years, which included 36% females and 64% males. However, the majority of them had an experience of more than 9 years where by the respondents with working experience of more than 9 years were 46.2%, in which 51% was females and 49% was males. Those who had experienced between 2 and 5 years were 24.6%, which was comprised of 45% females and 55% males. The remaining 20.0% was respondents whose working experience was between 6 and 9 years, which composed of 59% females and 41% males.

In terms of income groups, about 40.7% of the respondents earned income between 5000 and 9,999 Saudi Riyals (SR), in which 46% was females and 54% was males. Moreover, 39.3% earned income between 10,000 and 14,999 SR, who consisted of 49% females and 51% males. The respondents who earned more than 15,000 SR were only 16.3%, which comprised of 59% females and 41% males. In

addition, there were 3.7% of respondents whose earning was less than 4,999 SR, in which 47% was females and 53% was males. Around 5.7% was young employees below 25 old years, who were 35% females and 65% males. While 81.3% was between the age of 26-45, who included 47% females and 53% males. The remaining13% was older employees of more than 45 years old, with a combination of 71% females and 29% males. In terms of marital status, almost 81.1% of the respondents were married, who consisted of 45% females and 55% males. There were 2.6% of respondents were divorced females. Moreover, around 16.3% were single, who were 69% females and 31% males.

**Table 2. Type of container available in departments**

| departments | normal wastecontainer | Infectious waste container | Sharp waste container | No any type of container | normal waste and infectious waste container | normal waste and sharp waste container | Infectious waste and sharp waste container | normal waste, infectious waste and sharp waste | Total | right answer | Percent of correct answer | correct answer of females | correct answer of males |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Director of the Center | 9 | 6 | 0 | 1 | 0 | 0 | 0 | 2 | 18 | 9 | 50.0 | 9 | 0 |
| Biomarkers | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 6 | 2 | 33.3 | 1 | 1 |
| Clinic elderly | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 2 | 50.0 | 1 | 1 |
| Health Awareness | 6 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 10 | 6 | 60.0 | 5 | 1 |
| Maternity care | 2 | 0 | 0 | 0 | 2 | 1 | 1 | 6 | 12 | 2 | 16.7 | 1 | 1 |
| Medical records | 22 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 25 | 22 | 88.0 | 20 | 2 |
| Pharmacy | 10 | 0 | 1 | 0 | 0 | 6 | 0 | 0 | 17 | 10 | 58.8 | 9 | 1 |
| Preventive section | 24 | 2 | 0 | 8 | 0 | 1 | 0 | 6 | 41 | 24 | 58.5 | 23 | 1 |
| Radiology | 8 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 11 | 8 | 72.7 | 0 | 8 |
| sterilization | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0.0 | 0 | 0 |
| Child Health | 3 | 1 | 0 | 0 | 15 | 3 | 0 | 2 | 24 | 15 | 62.5 | 15 | 0 |
| Clinic pregnant | 3 | 0 | 0 | 1 | 10 | 2 | 1 | 15 | 32 | 10 | 31.3 | 10 | 0 |
| General Clinic | 7 | 4 | 0 | 0 | 43 | 5 | 0 | 19 | 78 | 43 | 55.1 | 18 | 25 |
| Chronic diseases | 0 | 3 | 2 | 0 | 2 | 4 | 0 | 28 | 39 | 28 | 71.8 | 18 | 10 |
| Dental Clinic | 0 | 0 | 1 | 0 | 1 | 2 | 1 | 26 | 31 | 26 | 83.9 | 17 | 9 |
| Dressing | 2 | 3 | 0 | 0 | 0 | 4 | 2 | 31 | 42 | 31 | 73.8 | 10 | 21 |
| Emergency | 5 | 1 | 0 | 0 | 1 | 1 | 1 | 4 | 13 | 4 | 30.8 | 1 | 3 |
| Laboratory | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 12 | 16 | 12 | 75.0 | 2 | 10 |
| vaccinations | 1 | 0 | 0 | 0 | 2 | 6 | 1 | 25 | 35 | 25 | 71.4 | 24 | 1 |
| Total | 106 | 24 | 4 | 15 | 80 | 38 | 7 | 181 | 455 | 279 | 61.3 | 184 | 95 |
| | | | | | | | | | | | % | 65.9 | 34.1 |
| | | | | | | | | | | | Percentage for the correct answers of 225 male respondents | | 42 |
| | | | | | | | | | | | Percentage for the correct answers of 230 female respondents | 80 | |

Table 2 shows the types of containers available in various departments. It showed that in the departments of director of the center, biomarkers, clinic elderly, health awareness, maternity care, medical records, pharmacy, preventive section, radiology and sterilization, normally there were no infectious waste and sharp waste, because of that there should be only normal waste containers inside these departments in accordance with the HCWM guide in primary health care centers. Moreover, general clinic, child health and clinic pregnant departments there are no sharp waste because of that there should be infectious waste and normal waste container inside these departments. However, chronic diseases, dental clinic, dressing, emergency, laboratory and vaccinations departments or rooms contain all types of waste, for that there should be all waste containers inside these departments or rooms (normal waste, infectious waste and sharp waste containers).

Table 2 also illustrates the responses of the respondents to the question posed "what type of container is available in your room? In the table all the correct possibilities answers of the type of container inside the room (eight possibilities) was shaded in black box, according to the HCWM guide in primary health care centers. It was only 65.9% of the answers was the correct answers by females and 34.1% by males. Therefore, it showed that about 80.0% of the departments managed by females had the correct type of container in their room. On other hand, only 42% of males had the correct type of container in their room.

## Analysis and results

Firstly, factor loading of each segregation items was more than .7 (Hair et al., 2010) with the exception of three items which were deleted, while the recommended value is above 0.5. Secondly, CR values for each construct were greater than 0.8231. Finally, AVE test values for each construct exceeded 0.6. These three tests results concluded that the instrument used to collect the main data has good convergent validity (Hair, et al., 2010). In addition, KMO test result was 0.809 with the significant level of Bartlett's tests of sphericity equal to .000 and the results that all items, except 3 items that were omitted due to the low factor loading (<0.5) are in fact significant, having factor loading ranged from 0.507 – 0.739, with Kaiser-Meyer-Olkin (KMO) coefficient of 0.858, indicated that the factor analysis with four major factors was adequate. The results of EFA ran on the four items of HCWM showed that the remaining items demonstrated the four items converged to single dimension, with factor loadings (communalities) greater than 0.5, and initial eigen value of 2.961. In addition, by grouping 4 items into single factor, it can explain 74.02% of variance. Finally, the KMO value of 0.767 further supports the claim of study such that the factor analysis with single factor for HCWM was adequate.

*Relationship between segregation and HCWM*

This study proposed that there is a significant relationship between waste segregation and HCWM in the Madinah PHCC. Smart-PLS 2.0 was employed in this study to ascertain the underlying hypothesis. The relationship was examined by using Smart-PLS 2.0, the t-statistic for each coefficient was then obtained using the bootstrapping method as presented in Table 3. It showed that all male and female respondents of waste segregation "allSegreg -> HCWM", only female respondents "femaleSegreg -> HCWM" and only male respondents "maleSegreg -> HCWM" values were less than 1.96 indicating that there is no significant relationship between segregation and HCWM across the gender. This means that male and female respondents are not different in segregating health care waste at the Madinah primary health care waste management centres.

**Table 3. Significant relationship between segregation and HWMP**

| Path | Coefficients | Sample Mean | ST. DEV. | Standard Error | T Statistics | Hypothesis testing |
|---|---|---|---|---|---|---|
| allSegreg -> HCWM | 0.041 | 0.041 | 0.045 | 0.045 | 0.904 | Not supported |
| maleSegreg -> HCWM For male respondents | 0.0001 | 0.0016 | 0.047 | 0.0471 | 0.0015 | Not supported |
| femaleSegreg -> HCWM For female respondents | 0.0565 | 0.0564 | 0.041 | 0.0413 | 1.3669 | Not supported |

Significant if T > 1.96 at 0.05 significance level

## Discussion

In the occupational category, the percentage of female and male technicians and physicians were almost the same percentage i.e. about 50%. However, huge difference between male and female in the managerial division in which male was 26% higher than female. All the specialists of non-physician respondents were females. Moreover, there are more females with higher qualifications such as PhD with a difference of 16%, master degree with a difference of 18%, and in diploma after secondary education by 12%. In terms of working experience, it showed that more female were working of more than six years whereby more males working less than five years. However, for respondents with income of more than SR15000, there were more females with a percentage of 18%, the reason might be that there were more female respondents with higher qualifications. 81.3% of respondents were between the age of 26 and 45 years, and the percentage of females and males were almost similar. However, there were more females with an age more than 45 years with a difference of 42%. Also the percentage of male respondents, who were less than 25 years was higher by a difference of 30%. 81.1% of respondents were married with more males than females by a percentage of 10%. Also the percentage of single female was 38% higher than single male. In general, female respondents have higher qualifications, working experience and higher income than male respondents. Also, the females represented by the highest age group of more than 45 years old.

The current study evaluated and analyzed the gender differences at the Madinah PHCC in the issue of segregation of health waste. The study proposed that there is a significant relationship between waste segregation and HCWM in primary health care centers. Further analyse by using Smart-PLS 2.0 was employed to ascertain the underlying hypothesis. Three relationships were established among the research constructs, and by examining these results, a detailed elaboration concerning each of the current research hypotheses is presented:

$H_1$: There is a significant positive relationship between the waste segregation and HCWM.
$H_2$: There is a significant positive relationship between the waste segregation of female and HCWM.
$H_3$: There is a significant positive relationship between the waste segregation of male and HCWM.

Table 3 showed the results of the hypothesis test. The obtained path coefficient of the waste segregation implementation 0.041 (t=0.904), showing that waste segregation in PHCC does not have a direct relationship with the HCWM. Following, results likewise did not show a direct relationship with path coefficient of 0.0001 (t = 0.0015) between waste segregation of male and HCWM. Lastly, the study showed the relationship of waste segregation of female pertaining to waste management and how it will affect the HCWM in PHCC. It showed that the path coefficient of 0.0565 and t value of 1.3669. However, it did not have a direct relationship between waste segregation of female and HCWM. Hence, the three formulated hypotheses were not supported. Therefore, there was no statistically significant relationship between male and female respondents in the segregation process at the HCWM.

The study was also asking respondents about the type of container which is available in their departments. The answer was shown in Table 3. The correct answer by females was 80% and the correct answer by males was 42%. This means that females were better than males in choosing the right type of container in their departments. Moreover, the departments managed by females were better than the departments managed by male in choosing the right type of containers. Likewise, from Table 2 only 65.9% of the answers were the correct answers meaning that the first and most important step in HCWM was not achieved. This step is shared between the management, the department and the inspector, and this step is the base for the following steps. Therefore, from the table it is shown that about 34.1% of the departments, the process of putting the containers is incorrect which means segregation was not carry out in the right way.

Based on the above findings, the current study showed a weak waste segregation process carried out by PHCC staff. Also, it showed that waste segregation was not achieved in 34.1% of departments. In support of these results, Alharbi and Zien (2012) found that the application of quality standards in Saudi establishments is very weak. This situation could be due to the lack of awareness of HCWM especially among staff. In addition, study by Al-Jabre and Al-Quorain, (2002) found that lack of policy and procedure in the handling of human waste at the King Fahd Hospital. Alzahrani, (2013) also found lack of awareness, ignorance of policy and procedure in the handling of HCW among health care staff at the King Fahd Hospital in Saudi Arabia.

## Conclusion

The paper attempts to evaluate and analyze the gender differences in segregation of the HCW at the Madinah PHCC in the K.S.A. The study showed the specialists non physician respondents were all females. Moreover, there were more females with higher qualifications such as PhD with a difference of 16%, master degree with a difference of 18%. In terms of respondents with experience of between 6 and 9 years, there were more females with a difference of 18%. The percentage of females and males were almost similar for more than 9 years experience. However, there were more females with an age more than 45 years with a difference of 42%. There was no statistical significant relationship between the segregation process and HCWM. The departments managed by females were better than the departments managed by male in choosing the right type of containers, in other words, the correct answer of females were 80% and the correct answer of males were 42%. But, only 65.9% the answers of males and females are the correct answers, meaning that the most important step in HCWM, which is waste segregation, was not achieved in 34.1% of departments.

## References

Abdulla F, Qdais HA, Rabi A (2008) Site investigation on medical waste management practices in northern Jordan. *Waste Management* **28**, 450–458.

Abo-Malk A (2008) Safe disposal reality in Saudi Arabian from health care waste: A field study on Riyadh City (Master Thesis). King Saudi University. College of Business Administration. Manangement department.

Alharbi M, Yusoff RZ (2012) Leadership styles, and their relationship with quality management practices in public hospitals in Saudi Arabia. *Management* **1**(10), 59-67.

Aljabre S, Al-Quorain A (2002) Hospital generated waste: An assessment of the awareness of hospital staff. *Journal of Family & Community Medicine* **9** (1), 47-50.

Al-Khatib I, Sato C (2009) Solid health care waste management status at health care centers in the West Bank – Palestinian Territory. *Waste Management* **29**, 2398–2403.

Alzahrani D (2013) Environmental Legislation and the Management of Medical Waste. Global Cities Research Institute, RMIT University, Melbourne, Australia.

Athavale AV, Dhumale GB (2010) A Study of Hospital Waste Management at a Rural Hospital in Maharastra. *Journal of ISHWM* **9** (1), 21-31.

Barratt J, Chambers N, Cherrett N, Jenkin N, Lewis K, Vergoulas G (2004) Material health: A mass balance and ecological footprint analysis of the NHS in England and Wales. Best Foot Forward Ltd., Oxford, UK.

Birpınar ME, Bilgili MS, Erdoğan T (2009) Medical waste management in Turkey: A case study of Istanbul. *Waste Management* **29** (1), 445–448.

Blenkharn JI, Odd C (2008) Sharps injuries in healthcare waste handlers. *Annals of Occupational Hygiene* **52**(4), 281-286.

Bouwer A, Abor P (2008) Medical waste management practices in a Southern African hospital. *International Journal of Health Care Quality Assurance* **21**(4), 356-364.

Central department of Statistics and Information (2013) Statistical yearbook forty ninth issue for 1434H-1435H, 2013. [Cited 13 April 2014]. Available from: http://www.cdsi.gov.sa/index.php?option=com_content&view=article&id=88.

Department of Health (DOH) (2006) Safe Management of Healthcare Waste: A Public Consultation. HMSO, London.

George D, Mallery P (2003) SPSS for Windows step by step: A simple guide and reference.11.0 update (4th ed.). Allyn & Bacon, Boston, MA.

Gupta S, Boojh R (2006) Report: Biomedical waste management practices at Balrampur Hospital, Lucknow, India. *Waste Management & Research* **24**(6), 584-591.

Hair JF, Hult GTM, Ringle C, Sarstedt M (2014) *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage Publications, Thousand Oaks.

Hair JF, Black WC, Babin BJ, Anderson RE (2010) *Multivariate data analysis*. 7th ed. Prentice Hall, Englewood Cliffs, New Jersey.

Hair JF, Ringle C, Sarstedt M (2011) PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice* **19** (2), 139–151.

Hair JF, Sarstedt M, Ringle C, Mena JA (2012) An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science* **40**(3), 414-433.

Hossain M, Santhanam A, Nik Norulaini N, Omar A (2011) Clinical solid waste management practices and its impact on human health and environment-A review. *Waste Management* **4**, 754-66.

Jafri A, Siddiqui M (2014) Current status of Bio-Medical Waste Management in hospitals of Luck Now City. *Asian Resonance* **3** (1), 221.

Kamalakanta M, Akhilesh B (2012) Challenges to Waste Management Practices in Indian Health Care Sector. *International Conference on Environment Science and Engieering IPCBEE* **3** (2).

Kasoma J (2013) Reducing non- segregated health care waste in ward 5A & 5AA of mulago national referral hospital Kampala, Uganda.

Kied (2005) Assessing the environmental impacts of the project for treatment of health care waste on the city of Saudi: Introduction to the study of Meteorology and Environment, Jeddah, Saudi Arabia.

Komilis D, Fouki A, Papadopoulos D (2012) Hazardous medical waste generation rates of different categories of health-care facilities. *Waste Management* **32**, 1434–1441.

Manga VE, Forton OT, Mofor LA, Woodard R (2011) Health care waste management in Cameroon: A case study from the Southwestern Region. *Resources, Conservation and Recycling* **57**, 108-116.

Manyele S, Lyasenga T (2010) Factors affecting medical waste management in low level health facilities in Tanzania. *African Journal of Environmental Science and Technology* **4** (5), 304-318.

Manzurul HM, Ahmed SA, Rahman AK, Biswas TK (2008) Pattern of medical waste management: Existing scenario in Dhaka City, Bangladesh. *Journal of BMC Public Health* **8**, 36.

Ministry of Health (2006) Health care management in the Kingdom of Saudi Arabia. Ministry of Health, Riyadh, Saudi Arabia. [Cited 16 September 2008]. Available from: envision/cws/index.htm.

Mohammadi-Baghaee D (2000) *Principles of Medical Waste Management.* 1st ed. Shaharab Co., Tehran. (in Persian).

Mohan DR, Prasad MV, Kumar KS (2012) Impact of training on bio medical waste management–A study and analysis. *EXCEL International Journal of Multidisciplinary Management Studies* **2**(6), 69-80.

Mohee R (2005) Medical wastes characterization in healthcare institutions in Mauritius. *Waste Management* **25**, 575–581.

Mosler HJ, Drescher S, Zurbru¨gg C, Rodrı´guez T, Guzmán Miranda O (2006) Formulating waste management strategies based on waste management practices of households in Santiago de Cuba. *Habitat International* **30**, 849–862.

Muduli K, Barve A (2012) Challenges to Waste Management Practices in Indian Health Care Sector. *International Proceedings of Chemical, Biological & Environmental Engineering* **32**.

Nunnally JC (1978) *Psychometric Theory*. pp. 86-113, 190-255. McGraw-Hill, New York.

Prem AA, Prashanthini V, Visvanathan C (2010) Healthcare waste management in Asia. *Waste* Management **30** (1), 154–161.

Prüss A, Giroult E, Rushbrook P (1999) Safe Management of Wastes from Health Care Activities. *World Health Organizations*, Geneva.

Rama D, Veera M, Kanagaluru K (2012) Impact of training on bio medical waste management – A study and analysis. *International Journal of Multidisciplinary Management Studies* **2** (6).

Ramokate T, Basu D (2009) Health care waste management at an academic hospital: Knowledge and practices of doctors and nurses. *SAMJ: South African Medical Journal* **99** (6), 444-445.

Rayner W (2003) The management of healthcare waste in the community. *Techno Centre*. Coventry University Technology Park, UK.

Royal College of Nursing (2014) The management of waste from health, social and personal care Royal College of Nursing guidance. London.

Sharma V, Bansal R, Sharma A, Ramachandran C (1994) Waste disposal and infection transmission in health care institutions. *Health Policy and Planning* **9**(1), 86-90.

Taru P, Kuvarega A (2005) Solid medical waste management.The case of Parirenyatwa Hospital, Zimbabwe. *Revista Biomédica* **16**, 153-158.

Townend WK, Cheeseman CR (2005) Guidelines for the evaluation and assessment of the sustainable use of resources and of wastes management at healthcare facilities. *Waste Management & Research* **23**, 398–408.

Tudor TL (2006) An Examination of the Influencing Factors and Policies for Sustainable Waste Management: A Case Study of the Cornwall NHS. (PhD Dissertation) Department of Geography, Archaeology and Earth Resources. University of Exeter, Exeter, UK.