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Influence of External Factors on Medical Waste Management Practices among Public Hospitals in Libya

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Abstract: Previous studies have shown that certain organizational characteristics such as culture, government policy and operational location of an organization will influence the medical waste management practice. Underpinned by the organizational control theory, a survey was conducted to examine the statistical relationships between organizational external factors and the medical waste management practice among public hospitals in Libya. The correlation analysis illustrates that the environmental factors and government policy significantly influence medical waste segregation, collection and disposal.

Key words: Medical waste management practice, government policy, environmental factors, externa, hospitals, disposal

INTRODUCTION

Research works, of both the past and present have highlighted the factors that influence the management of healthcare waste (such as the provision of education and training to their staff and the compliance with proper waste management practices (Botelho, 2012) types of hospital and clinic, reimbursement payment by the National Health Insurance, total number of beds, bed occupancy, number of infectious disease beds and outpatients per day, Cheng *et al*. (2009) appropriate legislation and effective control (Alagoz and Kocasoy, 2008); infrastructure, government, technical support, awareness-raising programs, employee training, support and funding (Troshani *et al*., 2011). This study focuses on the external factors (such as environmental condition) that influence medical waste management practices in Libyan hospitals.

Libyan medical waste management concern: From the early 1980's, a number of environmental decrees and laws were passed to guide the activities of medical waste in Libya. Such major laws include the Law of Environment No. 7 the Law of Atmosphere and Air Protection and the Law of Transport of Hazardous Materials. These legal instruments covered municipal wastes and pollution control but they did not extend their mandates to cover the management of medical waste.

However, in recent years, the Environmental General Authority in Libya has worked together with the Ministry of Health in outlining the regulations and instructions for healthcare waste management. Nonetheless, these regulatory guidelines are still in their early stages due to insufficient information available on the generation (quantities and compositions) as well as the handling and dumping of hospital waste. A thorough assessment of the present condition concerning the medical waste management in Libya is necessary for the design of good regulatory policies.

Theoretical framework and hypothesis development: The organizational control is well discussed in the literature and it focuses on the approach used by top managers to get the attention and motivation of employees within an organization in order to achieve its objectives (Cardinal, 2001; Eisenhardt, 1985; Govindarajan and Gupta, 1985; Jaeger and Baliga, 1985; Kerra, 1985; Langfield-Smith, 1997; Snell, 1992).

The control that has been highlighted in the literatureis the structural control which is also known as the bureaucratic or behavior control (Lebas and Weigenstein, 1986), the input control (Merchant, 1985; Mintzberg, 1979, 1983), the output control (Jaworski, 1988; Merchant, 1985), the culture control (Wanous, 1980), the market control (Williamson, 1975) and the integrative control (Roth *et al*., 1994).

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Among the aforementioned types of control, the input control and behavior control are regarded as relevant in the field of medical waste management practices. For example, the mechanism of the input control implies the control of the initial introduction of a human resource into the hospital and "it could be deemed a form of resource allocation because it regulates the antecedent conditions of performance" (Cardinal, 2001). In any healthcare facility, the input control can include the specific skills needed, also the experiences and attitudes of the individual members (Mintzberg, 1979, 1983).

Independent variables; organizational external factors (environmental factors and government policy)

Government policy: Government policy refers to the creation or review of standards and guidelines for organisational processes and organisational member behaviors (Pallas *et al*., 2012). Normally, the government policy will have a significant impact on new ideas in different manners (Harman, 1980). The fundamental elements of the government policy contain identifying processes that can be standardised and developing the standard operating procedures. Creating standards and guidelines may also be the first step in the organisation's quality assurance processes for example in laboratory testing or surgical room procedures. Strategies in this area will be most effective when there is an agreement about the best practice for particular organizational tasks, based on scientific evidence or on ethical or legal grounds. This strategy area is therefore most closely associated with disciplinary mentalities from the natural sciences, law and ethics. Examples include the clinical care pathways and standardized procedures for tasks such as record-keeping, staff and patient safety and procurement (Pallas *et al*. (2012). Again, in the absence of standards and guidelines for organizational processes and organizational member behaviors this may result in different types of toxics. For instance when waste is deposited in pits or locations close to water sources, contamination may occur in the water bodies. Similarly, the burning of health-care waste in an open site or in an incinerator with no emission control (which is a common scenario with most incinerators in many developing countries) could lead to the release of different poisonous chemicals such as dioxins, furans and other toxic air pollutants (WHO., 2005).

Environmental factors: The environmental conditions have some clear influence on the functions of an organization in which it is embedded (Crank, 1990). The environment consists of various types of factors that shape the transformation of the existing resources into performance results (Wang and Ellinger, 2011). Environmental factors as mentioned in the literature, include industry characteristics, government regulations and infrastructure support (Oliveira and Martins, 2010; Troshani *et al*., 2011). Pallas *et al*. (2012) stated that, drawing a systemic map for an organisation's environmental conditions can reveal potential pitfalls in strategies that otherwise seem well suited to the organisation's internal dynamics. Common methods include soliciting expert external advice to map environmental trends of which organisations may be unaware and convening discussions internally among organisation members or externally with other organisations in the field. The organisation's history may be thought of as part of the environmental factors for instance, a hospital established as a country's premier teaching hospital may face particular reputational, institutional and political constraints as it designs and implements performance improvement interventions. Identifying present and possible future trends in environmental conditions can help decision-makers avoid strategies that are likely to become obsolete. More importantly, Ruel *et al*. (2004) highlighted six environmental characteristics that influence human resource management implementation they are technological development, completion, HRM state of art, labor market, government regulations and societal developments. In the same way, Taherkhani *et al*. (2012) maintained that in order for any individual or organization to adopt feasible strategies, it is essential to grasp their current position and status (individual or organization) in correlation with the external environment. The four main environmental factors that can be used as a foundation for future planning and strategic management are political, economic, social and technological (Taherkhani *et al*. (2012). The application of the factor analysis can help a business to understand the variety of macro environmental factors that they need to take into account when determining the decrease or growth of a particular market. Reference will be made to these factors in the current study due to the fact that the investigation of the important factors can have an influence on the Medical Waste Management Practices (MWMP) in Libya. This analysis, however has been conducted to identify the factors that can facilitate the development and improvement of MWMP in Libyan hospitals.

In the context of medical waste management, following Oliveira and Martins (2010), Troshani *et al*. (2011), environmental factors that have an effect on waste management encouragement are the infrastructure, government, technical support, raising awareness, employee training, support and funding. Gupta *et al*.

(2009) stated that the undesirable impact of medical waste on human health and the environment is felt because it has not yet, received considerable attention from either the people affected or the concerned authorities. By establishing these factors, an organization may go global and it becomes necessary to keep a fair balance between the global and local elements of the organization.

Undoubtedly, in order to protect our environment, it is important to regulate such hazardous waste in an environmentally reasonable and sound manner (Misra and Pandey, 2005).

Dependent variable; medical waste management practice: Having good health waste management first depends on a dedicated team, good administration, careful planning well-established organization, the underpinning of legislation, adequate financing and full participation by trained staff (WHO., 2005). SC (2002) stated that the medical waste management is a process that helps to ensure proper hygiene in health institutions and the safety of health-care employees and other personnel involved. Johannessen *et al*. (2000) pointed out that the proper management of medical waste can minimize the risks within and outside health-care facilities. The first priority is to segregate wastes, preferably at the point of generation into reusable and non-reusable, hazardous and non-hazardous components. They identified other important steps such as the institution of sharps management system, waste reduction, avoidance of hazardous substances wherever possible, ensuring worker safety, providing secure methods of waste collection and transportation and installing safe treatment and disposal mechanisms. Johannessen *et al*. (2000) stated that the four major key steps to medical waste management are: segregation into various components, including reusable and safe storage in appropriate containers, transportation of waste to treatment and disposal sites, treatment and final disposal. Acharya and Singh (2000) had also identified the medical waste management processes to include handling, segregation, mutilation, disinfection, storage, transportation and final disposal. However, they think that there are very important steps to achieve safe and scientific management of medical waste in any establishment.

According to Rao *et al*. (2004), the key to the minimization and effective management of medical waste is segregation and identification of the waste. They suggest that the most appropriate way to identify the categories of medical waste is to sort the waste into colour-coded plastic bags or containers. Medical waste should be segregated into containers/bags at the point of generation. The WHO suggests that hospitals should provide plastic bags and strong plastic containers for infectious waste such as empty containers of antiseptics used in the hospital (Pruess *et al*., 1999). General waste such as garbage and garden refuse should join the stream of domestic refuse. Sharps should be collected in puncture-proof containers. Bags and containers for infectious waste should be marked with the biohazard symbol. Highly infectious waste should be sterilized by autoclaving. Cytotoxic wastes are to be collected in leak-proof containers clearly labelled 'cytotoxic waste' (Acharya and Singh, 2000). Needles and syringes should be destroyed with the help of a needle destroyer and syringe cutters provided at the point of generation. Infusion sets, bottles and gloves should be cut with curved scissors. The disinfection of sharps, soiled linen, plastics and rubber goods is to be achieved at the point of generation by using sodium hypochlorite with a minimum contact of an hour. A fresh solution should be made in each shift. Also, it should be understood that on-site collection requires staff to close the waste bags when they are three-quarters full either by tying the neck or by sealing the bag. The storage area needs to be hard-standing and impermeable with good drainage. It should provide easy access to waste collection vehicles. According to scientific standards, infectious wastes in the tropical areas can be kept in a temporary storage area for 24 h during the hot season and up to 48 h in cooler seasons (Pruess *et al*., 1999). Medical waste should be transported within the hospital by means of wheeled trolleys, containers or carts that are not used for any other purposes. The trolleys have to be cleaned daily and designated to particular wards at the hospital. Off-site transportation vehicles should be marked with the name and address of the carrier. The biohazard symbol should be painted on and a suitable system for securing the load during transport should be ensured. Such vehicles should be easily cleanable with rounded corners. Johannessen *et al*. (2000) recommended that the transportation of medical waste on public roads should be carried out by trained staff in a dedicated vehicle with closed containers. All disposable plastics should be subjected to shredding before being disposed to a vendor. The final treatment of medical waste can be done through technologies like incineration, autoclave, hydroclave or microwave (Rao *et al*., 2004). It is important at this point to discuss the various methods of treating and disposing of medical waste (Fig. 1).

Theoretical framework; organizational external factors and medical waste management practice in libyan public hospitals

The relationship between organizational external factors and medical waste management practice of libyan public hospitals: In this study, the medical waste management practice refers to any dangerous substances or objects of waste that pose hazard to both the environment and

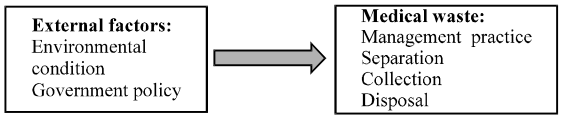

Fig. 1: Conceptual framework

human beings and which result from various medical activities which are intended or mandatory to be disposed of, according to the provisions of the local regulations and policy for medical waste.

In line with the past organizational waste management research, the current research proposes that organizational external factors will influence the medical waste management practice. We therefore, develop the following hypotheses:

- H_{A1}: there is a significant relationship between environmental condition and segregation in public Libyan hospitals
- H_{A1}: there is a significant relationship between environmental condition and collection in Libyan public hospitals
- H_{A1}: there is a significant relationship between environmental condition and disposal of medical waste in Libyan public hospitals
- H_{A1}: there is a significant relationship between government policy and segregation in Libyan public hospitals
- H_{A1}: there is a significant relationship between government policy and collection in Libyan public hospitals
- H_{A1}: there is a significant relationship between government policy and disposal in Libyan public hospitals

MATERIALS AND METHODS

Sampling and data collection: The sampling technique used in this research is the proportionate stratified random sampling as employed by Sekaran (2006) in which the research population is divided into a mutually exclusive group. The sample frame consists of names and addresses of hospitals obtained from (www.health.gov.ly) published in 2010. The questionnaire was distributed among the five Southern states in Libya from 20 January and the survey had taken 5 mon. to be completed. The population for the current research included respondents from the different levels of medical waste organization (Top management, head departments, administration and doctors). The researcher uses a 5 point scale to measure all variables in the order of 1 = "strongly disagree,"2 = "disagree, "3 = "neutral, "4 = "agree, "5 = "strongly agree. The Cronbach's coefficient alpha was utilized to determine the reliability of the various items used in the research. All the Cronbach's coefficient alpha values gathered in this research were above 0.65 as the minimum acceptance value (Nunnally, 1978).

Measurement of variables: The government policy was measured by an eight-item instrument adapted from (WHO., 1999). Environmental condition was measured by eleven items adapted from Warszawski Badir Chung, CIDB, Junid, Esa and Nurudin, Kamar, AbdShukor Hamzah, Peng and Lessing.

RESULTS AND DISCUSSION

Background of the respondents: About 171 useable questionnaires were returned and used for the analysis. Table 1 describes the background of the participants. 70.7% of the participants were from the District General Hospital while 7.0% from a teaching hospital and 5.7% were from a specialist hospital. They held various positions in the hospital. The majority of them was heads of department (41.1%) and doctors (12.5%). The 55.2% of the respondents were male while 44.8 % were female. Most of the participants had finished their tertiary education and had >8 years of experience. It could also be found that most of the hospitals were old hospitals, established for >20 years. According to the number of employees, the majority of the participants were from hospitals with >300 employees. Details on the respondents' background are presented in Table 1.

Factor analysis for the external factors: The measurement scales for organisational external factors consisted of 19 items. The varimax rotated principal components factor analysis was conducted. Prior to performing the Principal Components Analysis (PCA) the suitability of the data for the factor analysis was assessed. The correlation matrix indicated that the item coefficients were 0.3 and above. There were two statistical measures used to assess the factorability of the data conducted through Kaiser-Meyer-Olkin (KMO) to determine the "measure of the sampling adequacy" value. The value reported was 0.835, exceeding the recommended value of 0.6. Barlett's test of sphericity was significant at $p<0.001$. Since, the KMO value was reported as 0.835 it is interpreted as being in the range of "fair". Therefore, the sample size here is adequate for the factor analysis. The total variance explained was reported as 48.42%. Only factors with a loading value of 0.40 and above were considered. The anti-image correlation matrix

Table 1: Background of the respondents

Variables	Frequency	Percentage
Type of the hospital		
Teaching hospital	11	7.0
Specialist hospital	9	5.7
District general hospital	111	70.7
Others	26	16.6
Position		
Head of hospital	3	1.8
Hospital manager	8	4.8
Head of hospital department	69	41.1
Inflection control officer	11	6.5
Hospital engineer	6	3.6
Chief pharmacist	13	7.7
Radiation officer	7	4.2
Senior nursing officer	11	6.5
Financial controller	6	3.6
Waste management officer	3	1.8
Doctor	21	12.5
Others	10	6.0
Gender		
Male	74	55.2
Female	60	44.8
Education		
High school	5	3.6
High diploma	49	35.8
University	83	60.6
Experience (years)		
1-3	17	11.4
4-7	32	21.5
>8	100	67.1
Years of established		
<10	24	14.0
10-20	15	8.8
21-30	88	51.5
31-40	43	25.1
>40	1	0.6
Number of employees		
<100	9	5.3
100-200	13	7.6
201-300	18	10.5
301-400	45	26.3
401-500	54	31.6
>500	32	18.7

Table 2: Factor analysis of organisational external factors

	Loading	
Factor/Item	1	2
Factor 1: environmental factors		
Caring for employment issues	0.865	-
Experience and skills	0.768	-
Training	0.800	-
Worker's development	0.576	-
Professional skills for MWMP	0.714	-
Method of handling MW	0.773	-
Awareness about MWMP	0.826	-
Safety and health	0.777	-
Surveillance system on international level	0.743	-
Factor 2: government policy		
MWM plan	-	0.670
Administrative department in the ministry of health	-	0.679
Legislation applicable to MW	-	0.749
Eigenvalues	4.200	1.610
Percentage	34.990	13.430
KMO	0.835	-
Barlett's test of sphericity	646.670	-
Sig.	0.000	-

suggested that 7 items were to be deleted. The items were d10a, d11a, d6b, d8b, d7b, d1b and d4b. Factor loading accepted all two factors based on the original items. Table 2 below shows the factor loading value for this scale. It ranged from 0.576- 0.865.

Medical waste management practice: The measurement scales for the medical waste management consisted of 14 items. The varimax rotated principal components factor analysis was conducted. Prior to performing the Principal Components Analysis (PCA) the suitability of the data for the factor analysis was assessed. The correlation matrix indicated that the item coefficients were 0.3 and above. There was a total of two statistical measures to assess the factorability of the data conducted through Kaiser-Meyer-Olkin (KMO) to determine the "measure of the sampling adequacy" value. The value reported was 0.788, exceeding the recommended value of 0.6. Barlett's test of sphericity was also found significant at $p<0.001$. Since, the KMO value was reported as 0.788, it is interpreted as being in the range of "fair". Therefore, the sample size here is adequate for the factor analysis. The total variance explained was reported as 55.01%. Only factors with a loading value of 0.40.5 and above were considered. Two items were deleted prior to the anti-image analysis. Factor loading accepted all two factors based on the original items. Table 3 shows the factor loading value for this scale. It ranged from 0.523- 0.793.

Correlation between organisational external factors and medical waste management practice: Table 4 shows the summary of the correlation analysis to examine the relationship between medical waste management practices and external factors. It was found that there was a significant relationship between both variables ($r =0.739$, $p<0.01$). Environmental factors were found to have a significant relationship with separation ($r = 0.190$, $p<0.05$), collection ($r = 0.372$, $p<0.01$) and disposal ($r = 0.500$, $p<0.01$). The government Policy also demonstrated a significant relationship between separation ($r = 0.296$, $p<0.01$), collection ($r = 0.176$, $p<0.05$) and disposal ($r = 0.209$, $p<0.01$). This finding supported all H_{A1}.

Regression analysis: Table 5 illustrates the effect of the external factors on waste management practices. Overall, external factors explained 64.2% of WMP ($R^2 = 0.642$, $F = 57.27$, $p<0.01$). Both dimensions had also significantly predicted WMP in public hospitals in Libya as follows: environmental factors ($B = 0.577$, $t = 9.576$, $p<0.01$) and government policy ($B = 0.205$, $t = 3.399$, $p<0.01$).

Table 3: Factor analysis of the medical waste management practice

	Loading		
Factor/Item	1	2	3
Factor 1		-	-
Policy	0.523	-	-
Strategy	0.530	-	-
Tools and equipment	0.711	-	-
Standard operation procedure	0.635	-	-
Factor 2			
Standard operation procedure to new staff	-	0.757	-
Waste segregation	-	0.793	-
Total patient beds in department	-	0.725	-
Knowledge and skills	-	0.604	-
Factor 3			
WHO recommendation	-	-	0.704
Waste implementation system by the WHO	-	-	0.672
Procedures for collection and handling	-	-	0.528
Biohazard containers recommended by the WHO	-	-	0.701
Eigenvalues	1.837	1.696	1.069
Percentage	31.976	14.130	8.906
KMO	0.788	-	-
Barlett's test of sphericity	533.202	-	-
Sig.	0.000	-	-

Table 4: Relationship between waste management practices and organisational external factors

Variables	WNP	Separation	Collection	Disposal	External tactors	Environmental factors	Government policy
MWMP	1						
Separation	0.485	1					
Collection	0.643	0.272	1				
Disposal	0.699	0.319	0.180	1			
External factors	0.633	0.367	0.384	0.503	1		
Environmental factors	0.610	0.190	0.372	0.500	0.883	1	
Government policy	0.296	0.451	0.176	0.209	0.604	0.159	1

CONCLUSION

This study examines the influence of the organizational external factors on medical waste management practices within the Libyan public hospitals. A booklet containing a structured questionnaire was physically distributed to 210 selected hospitals in the five states followed by phone calls and reminders with the anticipation to obtain a good feedback. A total of 171 respondents were returned. The data were then analysed using a number of different analyses such as correlation, regression analysis and descriptive analysis aided by the Statistical Package for Social Science program for Windows (Version 20.0). Based on the outcome of the factor analyses of medical waste management practice, the current research has identified segregation, collection and disposing of medical waste as highly correlated. The linear regression and Pearson correlation analysis were carried out to figure out the relationship between organizational external factors and MWMP and how well organizational external factors could predict the practice of medical waste management in Libyan public hospitals. The relationship between organizational external factors (as measured by the government policy and environmental condition) was examined using the Pearson correlation coefficient (r) and coefficient (R^2). To ensure the reliability of the scale, the Cronbach coefficient of organizational external factors (government policy and environmental condition) was performed with the values of 0.796 and 0.782, respectively. This offers an indication that the variables are reliable. The relationship that strengthens between the organizational external factors has been identified in literature. For example (Tudor *et al*., 2005) indicated that some of the most common barriers that affect MWM fall into the social category (such as the perception of all contaminated MW from healthcare facilities, staff habits, public perception) and economic categories (such as the lack of viable markets for recyclable. To conclude, the two dimensions (environmental condition and government policy) were found to have a strong relationship with medical waste separation, collection and disposal, respectively. The current research summarizes and concludes that organizational external factors have a significant influence on the MWMP in Libya. This might be due to the strength of the relationship in which the correlation coefficient between the two variables was (r = 0.633). To conclude it is important to consider the influence of the system components on each other to arrive at an optimal plan for the hazardous waste management system (Misra and Pandey, 2010). From the practical perspective,

the findings of this research suggest that the propensity to adopt medical waste management practices (segregation, collection and disposal) in Libyan public hospitals is high. Also, organizational external factors (such as environmental condition and government policy are having a significant influence on MWMP. This implies that the medical waste management in Libyan public hospitals could be enhanced when all of the parties interested (such as hospital managers waste management officers and medical staff) consider all the above mentioned factors seriously. In the same vein by identifying the organizational external factors in the context of Libyan public hospitals, it will serve as a premise for a key execution marker and will serve as a premise for a key performance indicator and benchmarking and yet these organizational external factors such as environmental condition and government policy stand out as being among those factors that need to be improved in rectifying the current regulations and practicing medical waste management among the Libyan public hospitals. Furthermore this research is important to the stakeholders of the Ministry of Health and Ministry of Environment in Libya. This research in addition is rendered capable to contribute to future research on medical waste management.

LIMITATION

This research accounts for the use of a single respondent in gathering data at the organization level and the use of the survey method as the two main limitations arising from this research.

RECOMMENDATIONS

As for such reasons, future research should consider gathering data from multiple respondents. Also, more attention should be given to the influence of the moderating variables (such as organizational size and location) on the relationships between organizational factors and their safe management of healthcare waste.

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