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TOTAL QUALITY MANAGEMENT APPROACH IN SOLID WASTE OF HEALTHCARE SYSTEM IN PAKISTAN

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KEYWORDS	ABSTRACT
Total Quality Management, Health Care, Waste in Hospital, Medical Waste	TQM plays an important role in hospitals. TQM is a well-known concept; it is a management philosophy of continuously improving the quality of products and processes. Total quality management is based on 3-principles continuous quality improvement, customer services, team work. Hospitals are by nature complex organizations and complexities are multifaceted in-service hospitals with a sense of lack of services. Quality has emerged as a major issue in the healthcare sector and total quality management has been recognized as the major long-term strategic plan to further improve the quality of health care. The primary data was analyzed for ANOVA, the research results showed the significant relationship. The implementation of TQM in service providers will require the quality management awareness, training and framework progress and customer awareness. The results provide significant information results in reaching conclusion and offering recommendations to management and concerned stakeholders.
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INTRODUCTION

TQM began in Japan in early 1980's and spread to Western countries and Australia. During the 1990s, TQM topics became more important, and many companies wanted to use TQM and use it to grow and improve their businesses. At same time, the implementation and operation of TQM in organization gives Comprehensive Quality Management is defined as "the management philosophy of people and work processes that focus on the customer satisfaction and improve the organizational performance". The use of TQM as an integrated management philosophy aimed at further refining product performance, as well as services to achieve the higher quality and beyond customer expectations is encouraged by many quality professionals. it the opportunity to transform the dynamic business environment and the flexible performance of staff in problem solving and optimal use of opportunities that influence the overall performance of the organization. In this connection, this success can

only be achieved through concerted effort of all strengths and stakeholders, striving for senior management and leadership support, staff involvement, staff empowerment, education and training, customer focus, continuous improvement as well as the process management especially in a hospital setting (Alolayyan, 2012; Sadikoglu & Zehir, 2010; Smith & Offodile, 2008).

The implementation of TQM in health care reduces costs, provides awareness and improves efficiency. Health care waste is defined as solid or solid rot that is released from the health care facility or facility during the identification or treatment of a person. The medical waste consists of the non-infectious decay (75% to 95%), pens, infectious substances, chemicals, pharmaceuticals, radioactive waste, pressure vessels, gas cylinders (10% to 25%). The non-hazardous waste from the healthcare facilities is treated and treated in the same way as household waste (Sadikoglu & Zehir, 2010). However, if this decay is related with hazardous waste, it should be disposed of in accordance with hazardous waste regulations. Although both people and government attach great importance to medical waste, it is called with different names such as "hospital decay, "medical decay", "regulated medical decay" and "infectious decay". It is not known that there is no universally accepted standard definition of these terms, so definitions provided by most government authorities (that may be the federal, local, and state authority) and the other organization concerned with this problem are used. Infectious waste is medical decay. Infectious decay is part of the medical decay that can spread disease (Rad, 2005).

LITERATURE REVIEW

A study conducted by (Ullah, Ahmed, Malik, & Khan, 2011) that describe 7-S Total Quality Management (TQM) technology is used to evaluate an existing HCF waste management system attached to Shalimar Hospital in Lahore to determine post-training outcomes. The study design was chosen as interventional quasi-experimental study. Study was conducted from November 2009 to November 2010 at Shalimar Hospital in Lahore, Punjab, Pakistan. Thus, using McKinsey 7-S-TQM technology, 220 hospitals in Lahore, Gujranwala and Sheikh Kupula will be screened for hospital waste separation, collection, transport and disposal (SCTD). All educational institutions offer training. After a year of work, we compared four priorities prior and later training. Factors studied include quarantine, collection, transport, and discard systems in 220 health care facilities. Each element is more showed by elements of structure, system, strategy, people, skills, stakeholder values/shared values. The quality error of the variation in ratios is used to estimate significance using the 95% confidence level. After a three-month training program, all of these areas have improved significantly, ranging from 20% to 77%.

It was found that strategies, structures and systems for waste management after training increased by 60%, 65% and 75%, respectively. Study concludes that 7-S technology play a significant activity in evaluation of hospital decay management systems. The development

of medical personnel has also played weighty activity in medical educational institutions. In 2005 (Zeeshan et al., 2018) conducted a study on the Pakistani HWM (Hospital Waste Management) regulations were adopted. Developed over 10 years, HWM 2005 compliance is incompatible and World Health Organization (WHO) has recommended a questionnaire for the systematic assessment of compliance with teaching hospitals in the Peshawar area. This study assessed adherence to 2005 HWM Guidelines for HWM personnel, policies and practices in Peshawar tertiary hospitals. According to WHO guidelines, from January to March 2015, all teaching hospitals in Peshawar area were surveyed using pre-tested structured questionnaires. In addition, UHM infrastructure and process data were collected from one randomly selected medical, surgical, pediatric, obstetric and obstetric unit at each hospital. In addition to descriptive statistics, Fisher's direct tests and Wilcox on the scale tests were used to compare public and private hospitals.

Most of the tested hospitals do not have official HWM system (70%), manuals (80%), job descriptions (80%) or records (90%). Most hospitals do not train HWM management (56%) and do not offer official HWM courses for new recruitment (40%). There are no hospitals that separate and insert color code into the trash. Compared with the HWM National Regulations of 2005, there are certain gaps in transportation, storage and proper disposal of public and private hospitals, and there are no statistically significant differences. There are large gaps in HWM2005 tracking among tested hospitals. As a result of the devolution of power to environmental services recently, the Khyber Pakhtunkhwa government has established (and strengthened) HWM regulations to promote effective HWM practices in all public health facilities. A research conducted by (Ishtiaq, Khan, & Haq, 2018) that said health care facilities need to manage waste to solve environmental problems at a low cost. Most importantly, hazardous and non-hazardous waste needs to be segregated, as are many developing countries.

Two types of medical waste are discarded together, which is dangerous practice. Hospital waste should be managed properly to reduce the risk to patients and medical staff. In this review, (Shafiq, 2011) investigates how a textile company in Pakistan, one of the countries tested, uses Total Quality Management (TQM). We test whether the ISO9001 certification can improve performance and use TQM. It also identified the relationship between TQM performance and the organizational performance, as well as the challenges facing selected companies in implementing quality improvement programs. A self-help questionnaire was compiled and sensory data were collected from the fabric company sample at 020 (210). About 150 questions were sent to the company. Respondents were heads of the various departments in the sample company. Proper disposal of medical waste is an important problem in resource-poor countries in the South Asia. Existing scientific research on this subject usually includes epidemiological and behavioral studies. Likewise, the assessment

of the environmental impact of health care waste is primarily done from the perspective of the end user or person.

In this study, we applied new method for analyzing medical waste from an environmental point of view. Here we use a case study of public hospitals in major cities in Pakistan to analyze the energy contained in waste by category. Use energy analysis to assess the true economic potential of recycling this waste. This process compares the economic potential of existing waste management methods with a useful 100% waste recycling program. Life Cycle Assessment / Test (LCA) are used to assess various effects of existing and alternative hospital solid waste (HSW) management methods. Two options are used to illustrate the existing alternatives (Option A and Option B), including incineration or direct disposal of high-speed rail waste without sorting collected material. Due to the lack of information available prior to the impact analysis, data including waste measurements and collection characteristics were collected directly from district special police department and private hospitals. At the same time, hospital staff was interviewed. In terms of waste generation, public hospitals generate more waste (74%) than private hospitals (24%).

Inadequate regulatory evidence and a lack of clear collection, disposal and management commitments continue to be major obstacles to the implementation of best practices. A study was done by (Kumar, Somrongthong, & Shaikh, 2015) in developing countries, the disposal of infectious waste has always been viewed as a public health problem, and as a result, the general public is exposed to severe environmental pollution. It also identified the relationship between TQM performance and organizational performance, as well as the challenges facing selected companies in implementing quality improvement programs. Health care workers are the ones responsible for the disposal of infection at any hospital. Perform Knowledge, Attitude and Practice Assessment (KAP) and statistical analysis before and after the procedure. Overall, remission rate after intervention was 92%. The baseline survey identified total of the 275 health care workers, including doctors, nurses, medical personnel and healthcare professionals. After three months of intervention, 255 people took part in study. In terms of KAP control, there were no significant differences between the two control groups, other than gender and gender differences.

However, post-intervention studies showed statistical differences between the intervention group and the control group in terms of knowledge, attitude, and performance (<0.05). In addition, there were no statistically significant differences in the control group (> 0.05) after 3 months. Studies have shown that IHWM training can be used as an effective way to improve the knowledge, attitudes and behaviors of health care workers when dealing with infectious waste. Such training should be performed regularly in all hospitals to minimize the damage caused by the waste disposal. It also identified the relationship between TQM performance and organizational performance, as well as the challenges facing selected

companies in implementing quality improvement programs. The study was directed by (Chiarini & Vagnoni, 2017) with the aim of expanding the discussion on overall quality management (TQM implementation) in the health care industry and assessing how leadership affects quality management (TQM implementation).

RESEARCH METHODOLOGY

During the exploration, current works in regards to medical care management of waste were checked on and investigated by an exhaustive overview on medical care sources of waste generation and the sorts. During the field research, broad documentation of the current circumstance was imagined. The studies additionally included site perceptions and meetings to check the dependability of the given data. This study was conducted in the Nishtar hospital, Multan. Employs of hospitals were 1800 people or provide the preventive public as well as primary assistance for 10days from 10th -20th June 2021. This hospital also creates other activities that are to provide help to the population. Different sectors of hospitals are identified as a critical origin for developing infectious as well as sharp waste incorporating two different laboratories such as clinical or dermatological analyses, along with consulting rooms like dermatology, woman's health, or dental assistance along with acupuncture. Similarly, various departments for nurse assistance like immunization as well as medication or wound dressing. It is known as a tertiary care hospital that is severing a huge population of South Punjab. For collecting waste along with its sorting and for the purpose of loading gloves, lab coats and facemasks were used for to collect in plastic bin whose empty weight was 2.0kg and has a weight capacity of 120kg. This study was divided into two sections measurement of waste and evaluation of waste management process of a health care center.

Measurement Sites

Five different wards the Surgical, Maternity, X-rays, OPD, and Laboratory were selected to collect generated waste of the hospital. These wards were selected to evaluate types as well as sources of waste that were generated in this health care center. Data of particular measurements were collected in three replicates in these specific wards so that accurate data with minimum bias can be obtained.

Wards of Hospitals

In different wards of that health care center, about 670 patients can be admitted, while during the period of measurement about 470 patients were admitted in that health care center. The total number of permanent workers was 1800. During study, it was estimated that the average inpatient was 160 while average of 340 out-patients was got admission per day. The nishtar health care center was consisting of 24 departments (Anesthesiology, Dental section, ICU, Cardiology) and 15 operation theaters while 30 wards. During study total bed was 1800 in the hospital.

On-site Waste Segregation or Measurements

Process of evolution segregation and measurement of on-site waste is followed according to the modified method of (Azmal et al., 2012). To segregate along with measurements that were followed by arrangement with the assistance of occupational or public health care officer who assigned the nurses who were in charge of the wards that were selected for measurement. They informed the nurses to not collect all generated waste until unless it was measured. During the research period, all waste of particular wards was collected before 8:00 am and transferred to a storage room for further waste management process. But in some conditions in a few wards waste was not gathered separately in relation to their types as it was mixed together all the waste it required sorting. Similarly, sometimes a particular type of waste was predominant while other was less dominant so that types of waste materials were assumed as negligible.

The procedure of Waste Measurement

The weight of the empty bin was determined with the help of a weighing balance. Bin was filled waste with continues shaking so that void spaces cannot exist. Similarly, it was weighted again when filled with waste known as W*T*. Concurrently, generated waste was also determined by evaluating an average number of patients((*p*) in a hospital during research time. By using the above procedure generated waste that is characterized as general, sharp and medical were measured during the period of ten days. The following formula was used to calculate waste generated per day:

WG=£ (WT - Wb)/p= (kg per patients per day)

Visual Inspection as Field Investigations

Visual as well as filed investigation were carried out by following procedure of (Ngwuluka et al., 2009). Improving the aesthetic quality of research features and building a foundation for finding out how to research facts, as well as statistics, compliance with visual inspections and field investigations were tested in five hospital wards. Similarly, solid waste generated undermined various management processes such as open disposal, physical rehabilitation, and landfill, in addition to these visual inspections of management and field investigations conducted simultaneously. The evaluation of waste management process was carried out on daily basis. Following above procedure provided information about waste management process under working conditions at the hospitals. These assessments were also carried out to provide an assist in the designing of procedure of management of waste in health care system.

Statistical Analysis

Data were analyzed by variance method analysis (ANOVA) using a completely randomized composition. Methods were compared with significant difference (LSD) at P-value below 0.05.

RESULTS AND DISCUSSION

Waste Solid Management Practices in Health Care Center

Pakistan previous policies on dealing with any solid waste management, including hospital waste, focused on the so-called "end of pipeline" treatment. In year 2000, the government introduced a new policy paper on waste management related to waste management. This is a policy that removes the emphasis on pollution prevention, waste minimization, impact management, remediation, and overall quality management. It is the most comprehensive policy in the management of solid waste, including hospital waste. The policy seeks to cover the management of entire waste management process, from generation to disposal in an integrated manner (Lee et al., 2016). In the solid waste of hospital, the Department of Health has developed various guidelines and recommendations about waste management practices that range from litter to final disposal. Guidelines aim to assist in implementation of the policy within the White Paper. Most of management practices used is in line with government-recommended approaches. The big problem is that in hospitals, government waste management guidelines are not fully followed. During production, the combination of different types of solid waste makes it difficult for other processes in the flow chart to be used more accurately. Implementation of integrated pollution and waste management policy for provincial hospitals is still needed; therefore, there have been various gaps that need to be addressed.

Classifications, Definitions, and Types of Waste in Nishtar Hospital:

Waste has been tested as standard, medical, and sharps. General waste is defined as the hospital waste that does not immediately cause harm to humans or environment. Typical garbage samples include packaging materials such as cardboard, office paper, leftover food, cans, etc. Disease waste is waste that affects tissues, the organs, placenta and other organs. Infectious wastes are defined as contaminated organisms that in large quantities can cause serious illness. Samples of this waste include custom plates, water bags, surgical and theatrical waste, contaminated plastic items, etc. Sharps are defined as anything that can cause a cut or piercing that has led to a wound. Medical devices such as needles, syringes, scales, knives, and broken glass form part of the sharp debris. Medical waste is simply placed in contagious, infectious and chemical waste. Hospital waste is defined as any waste disposed of in health care facilities such as general hospitals, medical centers, medical laboratories or the veterinary hospitals. This, in turn, includes non-hazardous and unsafe waste. Medical-generated waste has been found to contain all hazardous waste (Khatibet al., 2010)

Table 1 Classification of Various Types of Solid Waste of Hospital

Types of waste		Composition
General		Plastics bags, office paper, leftover food, Packaging materials, cans, or containers, etc.
Medical	Toxic waste	Surgical waste, clinical specimens, drainage bags, culture

		plates, blood, blood products, autopsy waste, blood products or body fluids
Medical	Pathological waste	Fetuses, human tissues, placentas, organs, amputated body parts or other body parts
Medical	Solid chemicals or pharmaceutical waste	Expired drugs or spilled and chemicals
Sharps		Broken glass, needles, scalpels, syringes, blades etc.

Types of hospital-generated waste are common in any country. What is different perhaps the prices generated due to differences in standard procedures performed in the medical field? Many types of waste were found in many wards at the hospital outside the kitchen where there was just general waste.

Table 2 Analysis of Variance for General Waste in Five Wards

Source	DF	SS	MS	F	P
Ward	4	3283.06	820.765	2886	0.0000
Error	10	2.84	0.284		
Total	14	3285.91			

** Highly significant

Table3 Mean Values for General Waste in Five Wards

Wards	Mean value
Maternity	43.223±0.84a
Surgical	28.237±0.79b
OPD	9.8867±0.43c
X-rays	7.0533±0.13d
Laboratory	4.9633±0.01e

That means having different characters is very different at the 0.05 probability level.

Generation Rate for Sharp Waste

Sharp waste such as needles, scalpels, syringes, blades, etc. generation rate was high in a laboratory (2.7 kg/day) while in x-rays ward generation rate was very low. While 2.5kg/day in surgical, 1.02kg/day in OPD, and 2.4kg/day sharp waste was generated. This type of waste usually is involved to cause disease and its transmission. That's why safe handling along with disposal practices is essentially required to control infections.

Table 4 Mean Values for Sharp Waste in Five Wards

Wards	Mean value
Maternity	2.4267±0.12b
Surgical	2.5733±0.24ab
OPD	1.0233±0.04c
X-rays	0.5067±0.03d
Laboratory	2.7667±0.188a

That means having different characters is very different at the 0.05 probability level

Generation Rate for Medical Waste

Level of medical waste production Surgery (clinical manifestations, fluid bags, cultural plates, blood, blood products, autopsy, blood or body fluids, fetuses, human tissues, placenta, organs, amputated organs, or other body parts) are produced in the maternity ward (13.08kg / day) and low levels were observed in laboratory (6.13 kg / day). Alongside, the X-rays department generates a zero ratio of medical waste. The medical waste consists of non-infectious decay (75%-95%), pens, infectious substances, chemicals, pharmaceutical, radioactive waste, pressure vessels, gas cylinders (10% to 25%). The distinction between non-hazardous decay and hazardous decay is vital economic parameter for the healthcare settings because of the large difference in costs linked with hazardous waste disposal of (Rau et al., 2000; Rushbrook & Zghondi, 2005). In this connection, although both people and government attach great importance to the medical waste, it is called with different names such as "hospital decay, "medical decay", "regulated medical decay" and "infectious decay" (Rad, 2005).

Table 5 Analysis of Variance for Medical Waste in Five Wards

Source	DF	SS	MS	F	P
Ward	4	323.472	80.8681	1266	0.0000
Error	10	0.639	0.0639		
Total	14	324.111			

** Highly significant

Table 6 Mean Values for Medical Waste in Five Wards

Wards	Mean value
Maternity	13.087±0.05a
Surgical	11.827±0.37b
OPD	8.0100±0.16c
X-rays	0.0000±000e
Laboratory	6.1333±0.41d

That means having different characters is very different at the 0.05 probability level

Table 7 Analysis of Variance for Waste Management Practices of Hospital

Source	DF	SS	MS	F	P
Practice	3	49802.8	16600.9	13068	0.0000
Error	8	10.2	1.3		
Total	11	49813.0			

** Highly significant

Table 8 Mean Value for Waste Management Practices of Hospital

Practice	Mean Value
Landfilling	215.18±1.16a
Reuse/recycle	72.211±0.38b
Incineration	66.103±1.25c
Open dumping	61.660±1.14d

That means having different characters is very different at the 0.05 probability level

CONCLUSION

In Pakistan, many hospitals are used to carry out mismanagement of solid waste that is not properly handled and similarly not environmentally friendly. In Nishtar hospital usually medical and generals waste was mixed during the research period. Hence practices like land filling or the incarceration process that is recommended by the national government system of waste management were needed to carry out to handle the waste of hospital. In the process of incineration, coal along with gallons of diesel was used in incinerators that are a source of toxic air pollution. These types of air pollutants can harm human health as well as consequences of the environments; the recent study was divided into two parts. Collection and segregation of waste material of five different wards (Surgical, Maternity, X-rays, OPD, and Laboratory) and evaluating the current practices of the hospital for waste management. The waste material was divided into three categories general, sharp, and medical.

The current study revealed rate of waste generation (Plastics bags, office paper, leftover food, Packaging materials, cans, or containers) was high in maternity ward (43.22 kg/day) while in the laboratory generation rate of general waste was very low (4.96 kg/day) as compared to other wards. Level of the medical waste the production Surgery (clinical manifestations, fluid bags, cultural plates, blood, blood products, autopsy, blood or body fluids, fetuses, human tissues, placenta, organs, the amputated organs, or other body parts) are produced in the maternity ward (13.08kg / day) and low levels were observed in the laboratory (6.13 kg / day). Sharp include such as needles, scalpels, syringes, blades etc. The production rate was high in the laboratory (2.7 kg / day) while the x-ray production rate was very low. In hospital containers of different colors, codes were used for the collection of waste.

Usually, general waste was mixed up with infectious and pathological waste. They were using only one-color code for the waste container. They collect waste from all wards at 8:00 am and 3 Pm and transferred it into a temporary storage room before a subject the solid waste to further process. Sometimes waste leaked out from the containers that were containing infectious as well as pathological waste. For management of waste in Nishtar hospital, different practices were carried out such as the incineration, autoclaving, landfill, recycling, and open dumping. In the process of incineration, they were used fuel and coal

for burning those results in waste conversion into ash that was subjected to the process of open dumping. While for the process of autoclaving infectious waste were subjected. On the other hand, sharp, general, and infectious waste was subjected to the process of land filling.

Recommendations

- ✓ Environmental health education approaches are required for a hospital for the management of waste and compliance of standard strict monitoring is required. To avoid mixing of the different waste material containers must contain proper color codes.
- ✓ To prevent disease probability and its cause of the spread storage room must be cleaned and sanitized. To avoid leakage, the waste material bags and containers should be completely inspected. In some cases, to prevent unauthorized access to the storage room, it must be properly protected
- ✓ The incineration process also caused pollution that's why it should be minimized and carried out in the far-away area of cities to prevent health hazards of people. Tins and wastepaper type general waste must be subjected to recycling process at hospitals
- ✓ The burning process of waste material cause health issues as well as environmental pollution that's why it should be stopped as soon as possible to prevent pollution General waste must be subjected to the practice of separate landfill than other hazardous waste material in a healthcare center. Properly secured process of land filling so that animals have minimum access to waste

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