

Hospital Waste Management KAP Study among Nurses in Hospitals Lahore, Pakistan

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ABSTRACT

Background: Health care waste (HCW) is considered as the second dangerous waste in the world that needs to be properly disposed by trained health care staff. Good knowledge, positive attitude and safe practices of medical staff are very imperative while managing this infectious waste.

Objective: This assessment has been conducted to determine the situation and KAP of infectious waste management in health care workers working at tertiary care settings health facilities of Lahore, Pakistan.

Methods: A structured questionnaire having three sections was used covering information about socio-demographics, knowledge and practices among nurses in tertiary care hospitals. 130 respondents were surveyed. Data analysis was done by using SPSS program.

Results: This study results showed that knowledge among nurses in tertiary care hospitals have 36% correct knowledge about HWM while 64% have improper or incomplete knowledge. The study also showed that satisfactory practice done by 29% nurses as set in criteria.

Conclusion: Education level, experience and their designation in hospitals were main contributory factors affecting their knowledge and practice. It is recommended that continuous training should be given for the proper improvement of their practices among HCWs.

Keywords: Health care waste (HCW), Hospital waste management (HWM)

INTRODUCTION

Hospital waste management has recently emerged as an issue of major concern not only to hospitals, primary health-care centers and nursing home authorities but also to the environment [1]. Hospital waste can be threatening to the environment and public health in particular. It requires proper handling and treatment prior to its final disposal. A large bulk of hospital waste is dumped untreated due to increase in number of hospitals and their inherited bio medical waste [2].

Globally, the management of hospital waste is a major health problem, causing serious bad health impacts. Reason behind this scenario is that despite the distribution of circulated manual and memorandums among health staff, they are continuing improper practices regarding waste dealing, resulting in improper segregation of waste at point of origin [3].

In developing countries like Pakistan, awareness regarding hospital waste management in terms of its segregation, collection, storage, transportation and disposal is lacking. In

Pakistan, every hospital must comply with the Waste Management Rules 2005 of the Government of Pakistan [4].

As nurses deal majority tasks of the wards and patients care, they are highly concerned with waste management practices. Their exposure to waste is greater than other health professionals.

HOSPITAL WASTE

Hospital waste can be defined as “any waste which is generated in the diagnosis, treatment or immunization of human beings or animals or in research in a hospital” [5].

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Hospital waste management is defined as “hospital waste management means the management of waste produced by hospitals using such techniques that will help to check the spread of diseases through infection” [5].

TYPES

One should know the types of hospital waste as its essential.

Infectious waste

Materials containing pathogens if exposed can cause disease [5].

Human anatomical waste: Waste from surgery and autopsies on patients with infectious diseases; sharps objects: disposable needles, syringes, saws, blades, broken glasses, nails or any other item that could cause a cut.

Pathological: Tissues, organs, body parts, human flesh, fetuses, blood and body fluids [5].

Non-infectious (Hazardous)

Pharmaceuticals: Drugs and chemicals that are returned from wards, spilled, outdated, contaminated or are no longer required.

Radioactive: Solids, liquids and gaseous waste contaminated with radioactive substances used in diagnosis and treatment of diseases like toxic goiter [5].

Non-infectious (non-hazardous)

Domestic waste: From the offices, kitchens, rooms, including bed linen, utensils, paper [5].

Table 1. Color coding.

Color coding	Type of containers	Waste category	Treatment option as per Table 1
Yellow	Plastic bag/disinfected	1, 2, 3, 6	Incineration/deep burial
Red	Plastic bag/disinfected container	3, 6, 7	Autoclaving/microwaving/chemical treatment
Blue/white/translucent	Plastic bag/puncture proof container	4, 7	Autoclaving/microwaving/chemical treatment and destruction shredding
Black	Plastic bag	5, 8, 9, 10	Disposal in second landfill

Source: Google

It is a potential health hazard to health workers, public, flora and fauna of the area. It has been established that, worldwide, about 5.2 million people (including 4 million children) die each year from waste related diseases [6]. The hazards of exposure to hospital waste can range from gastro-enteric, respiratory and skin infections to more deadly diseases such as HIV/AIDS and Hepatitis [3].

Hospital waste was brought into focus in 1983 when WHO European office convened a working group at Bergen.

European Commission, in 1990, under the Environmental Protection Act, imposed strict controls and instituted statutory duties. Ignorance or defiance of these can result in severe fines and custodial sanction [7].

In 1995, legislation on incinerator plants to integrate pollution control was introduced. After 1996, the European Commission turned their attention to waste minimization by reuse, recycling, segregation and better management with minimum impact on the environment and ecosystem [7].

Legislation related to medical waste

Guidelines for medical waste management were set by WHO [8], UNEP [9] and a chapter on “waste management”

has been introduced in all manuals of hospitals’ accreditation and certification [10].

It has been reported that the health care waste generation rate ranges from 0.5 to 2.0 kg/bed per day globally [11]. Studies proved around 1.35 kg/bed healthcare waste has been generated by the tertiary care hospital of Pakistan. About 92,000 beds are available only at the tertiary care hospitals of public sector in Pakistan that produces 0.8 million tons of waste every day. Infectious waste management is a big challenge for hospital administration in limited resource settings and Pakistan is not an exception. Rapid population growth, patient load on hospitals and negligible investment in healthcare waste management measures have posed a serious public health hazard and threat [12].

OBJECTIVES

- To determine knowledge among nurses related to hospital waste management in tertiary care hospitals, Lahore.
- To check practices among nurses related to hospital waste management in tertiary care hospitals, Lahore.

- To determine risk factors associated with improper handling of hospital waste among nurses in tertiary care hospitals Lahore.

SIGNIFICANCE OF THE STUDY

In Pakistan, exposure to hazards by hospital waste disposal is still high. Main reason behind this fact is lack of supervision of followed practices among health professionals for waste disposal. In another rapid assessment carried out by the National Program for Prevention and Control of Hepatitis in 2006 involving 39 health facilities of various levels, it was found that 94% of the facilities had no arrangements for solid hospital waste management, 21% facilities could not give the estimated amount of waste generated by them. A major survey by Punjab health sector revealed that written protocols and procedures were not available in any of the visited facility [13]. A total 414 hospital staff were trained in 10 public and private sector hospitals, of which five hospitals were major tertiary care settings and five, were private hospitals [13].

This study therefor can help in identification of malpractices performed by nurses and knowledge regarding hospital waste disposal.

PROBLEM STATEMENT

Healthcare workers are exposed to blood-borne infections which usually expose them to diseases such as HIV, TB, hepatitis B and hepatitis C. Substantial morbidity and mortality among these workers inevitably lead to loss of skilled personnel and adversely impact healthcare services which are already strained in many low- and middle-income countries [14].

A very few researches have done on practices related to hospital waste management. Thus, current study is focused to fill the gap between identified malpractices and unidentified malpractices among nurses in tertiary hospitals regarding hospital waste management.

REVIEW OF LITERATURE

Good healthcare waste management in a hospital depends on a dedicated waste management team, good administration, careful planning, and sound organization, underpinning legislation, adequate financing and full participation by trained staff [15].

A study conducted at national level in Europe showed that proper waste segregation done at the point of European Commission, in 1990, under the Environmental Protection Act, imposed strict controls and instituted statutory duties. In 1995, legislation on incinerator plants to integrate pollution control was introduced. After 1996, the European Commission turned their attention to waste minimization by reuse, recycling, segregation and better management with minimum impact on the environment and ecosystem. They imposed strict laws to manage and control hospital wastes.

In the European countries, the majority of wastes incinerated, with stringent control of air pollution [7].

A major study in North America explored about waste legislation that US Environmental Protection Agency has regulations and guidelines, but actual regulation done at the state level [16]. Most healthcare wastes burnt in hospital incinerators, but those also disposed of in landfills and public sewers. Other treatment methods included steam or gas sterilization, irradiation and chemical disinfections. The privately-owned facilities compete to handle wastes. Some new technologies, such as bio-oxidation, gas-pyrolysis, plasma-treatment technology, microwave disinfecting, autoclaving, etc., practised now.

One of the most innovative recycling solutions that Germany had promoted was the green dot system - a system that had been replicated in many forms across European Union countries and is a prime example of "producer responsibility" in practice [17]. Manufacturers and retailers had to pay for a green dot on the packaging of their products. The more packaging, the higher the fee creating an incentive for businesses to reduce packaging and facilitate recycling. This system had led to less paper, thinner glass and less metal been used therefore reducing the amount of waste produced. The green dot scheme reduced the amount of waste by 1 million tonnes every year.

Belgium is also a top performer in waste management; it possesses the best waste diversion rate in Europe: 75% of their waste is reused, recycled or composted; all helping to reduce overall waste generation [17]. The green event and assessment guide is another digital tool that is used in Belgium in the fight against waste generation. It allows event organisers to calculate the ecological impact of their events and is even able to prevent waste during them. Their website also has a list of places that lend reusable cutlery for events in a bid to promote best practice and promote eco-friendly businesses.

The United Kingdom hits the 39% mark with that percentage going into recycling. Lastly, closing out our top ten are Italy - recycling 36% of its trash - and France following closely behind with 35% [18].

With its on-going recycling revolution, less than one percent of Sweden's household waste ended up in a rubbish dump. The rest recycled in different ways. The opti bag Company had developed a machine that can separate colored waste bags from each other. People throw food in a green bag, paper in a red one and glass or metal in another. Once at the recycling plant, opti bag sorted the bags automatically. This way, waste sorting stations could be eliminated.

A study conducted in Sudan showed that, before the implementation of the educational intervention program, 58% of the intervention study group had fair knowledge, while 25% and 17% had poor and good knowledge, respectively, regarding HCW management [19]. This may be

due to a lacking curriculum with regard to HCW management in higher secondary school and undergraduate studies, lack of training and/or unavailability of HCW management hand-outs and tools in the three hospitals.

One of the biggest risks for African healthcare facilities is the disposal of sharps (needles, scalpel blades, blood vials, glassware, etc.) that are in contact with infectious germs [7]. The high cost of safety boxes for proper disposal of sharps limits the use of these boxes. Asian countries have started to produce these boxes locally, bringing down the cost, but African countries are still buying them from outside vendors. Nonetheless, all the countries surveyed by the UNDP did not allow sharp waste to be disposed of at the dump sites and some hospitals had separate sharp pits.

In 1995, the Regional Office for south-east Asia of the World Health Organization (WHO) made a survey of healthcare waste management in 9 countries in the region with substantial responses from Indonesia of waste-management guidelines [20]. The responses on the types and segregation of wastes seem to indicate only a limited safe management of wastes with plenty of opportunity for mix-ups and disposal into the municipal dustbins. In Indonesia and Thailand, where legislation is in place, did better on most accounts. In November 1996, WHO arranged a regional consultation at Chiang Mai, Thailand, for outlining an action plan and for enacting legislation on waste management.

In a study conducted in Bangladesh, for the answer of knowledge about general waste, only 4% gave all correct answers [20]. In the answer of knowledge about infectious waste, 63.2% gave one correct answer, of knowledge about pharmaceutical waste only 8% gave all correct answers and of knowledge about biomedical waste only 7.2% gave all correct answers. In the answer of knowledge about color coded bins collecting waste 53.6% cannot give any correct answer and only 46.4% gave all correct answers and of knowledge about the safe disposal of hospital waste, 16% could not give any correct answer. However, against all questions were 5 options. Conclusion is that knowledge about hospital waste and its management is very poor among senior staff nurses. As a recommendation to improve this situation continuous training should be made compulsory for healthcare personnel specially staff nurses working in Bangladesh.

A study conducted in Cairo, Egypt showed that doctors and nurses had better knowledge than paramedics and sanitary workers about infectious waste management. Mostly (48%) doctors were aware about the segregation of infectious waste at source as per the WHO guidelines, while this knowledge was found poor in sanitary workers and paramedics. Regarding collection of infectious waste from different areas of the hospital, (63%) doctors had better knowledge as compared to other groups and were found statistically significant [21]. Majority of the doctors (65%) and nursing

staff (60%) had good attitude regarding the waste throw in the proper waste bin at their working area as compared to sanitary workers and paramedics. When asked about the collection of waste bins, once it filled was found statistically significant in doctors and nurses. Practices of using the waste color coding (**Table 1**) and segregation of waste were poorly recorded except doctors and nurses; they were also not practicing as per the WHO standards. Regarding occupational hazards due to improper waste management and protocols of infectious disease control were better known to all the doctors and nurses. Paramedical staff and sanitary workers were found to be less knowledgeable and their practices regarding HCW management was found low as compared to doctors and nursing staff. A study conducted in India exposed that management of hospital waste required its segregation and removal from the health care establishments in such a way that it will not be a source of health hazards to those who are directly or indirectly related to the hospital environment [22]. The segregation of waste in almost all hospitals was not satisfactory. Proper and judicious handling of bio-medical waste continues to be a matter of serious concern for health authorities in India. Around 52% of the participants agreed that they have awareness regarding Bio-medical waste (management and handling) Rules, 1998 [22]. Among these 65.9% of nurses and 82.05% of doctors agreed that they have awareness regarding the same. No sanitary staff had any knowledge regarding the bio-medical waste [23]. These findings were similar to other studies in which technically qualified personnel like the doctors, nurses and laboratory staff have high knowledge regarding these rules but it was low among the sanitary staff. Knowledge about color coding of containers and waste segregation were high among Nurses (72.72%) than other participants. Only 34 out of 157 participants were able to match the color coding given in the questionnaire.

Many findings in developing countries on healthcare wastes management revealed that segregation, collection of waste using recommended color coding container and storage of waste in isolated area were not satisfactory. Personal protective equipment and accessories were not provided and not used by HCWs. Moreover, healthcare wastes originating from HCFs dumped either into their backyard in a simple pit or put in open garbage to bins on the roads. Few studies done on healthcare waste management in Ethiopia indicated that there was no waste segregation in most studied HCFs [24]. Healthcare wastes were stored, transported, treated and disposed inappropriately at all surveyed HCFs. In Ethiopia, nowadays, HCFs are becoming greater than ever to address the basic health needs of the society and to achieve the Millennium Development Goal (MDG). Previous studies focused on healthcare waste management at facility level without identifying the role of each actor on healthcare waste management practices such as HCWs, waste handlers and health managers. Credible evidence showed that

Healthcare waste management practices of HCWs across Ethiopian health institutions are inadequate.

A study conducted in teaching hospital of Lahore, Pakistan to analyse the knowledge regarding hospital waste management in MBBS final year students showed that only 8 (8%) final year MBBS students had excellent knowledge about infectious waste generated from a health care facility, while 92 (92%) of students had poor knowledge about it [25]. Almost half 41 (41%) of students had an excellent awareness of BM waste management practice. Of the 100 students who completed the study, 46 (46%) students agreed that hospital waste management course in community medicine was sufficient to practice/handle waste in hospitals, however 34 (34%) did not agree to it and 20 (20%) were on neither sides. 62 (62%) of the students have emphasized that college should organize separate classes or continue medical education program to upgrade knowledge about hospital waste management, safe management of health care waste and they agreed that they will attend voluntarily programs that enhance upgrade of knowledge about waste management. In the questions about knowledge and suggestions for labeling container before filling it with waste of any importance and should infectious waste be sterilized by autoclaving before disposal, 96 (96%) and 68 (68%) went in favor of it. Rest 4 (4%) and 32 (32%) said no or don't know, respectively. When the level of knowledge of needle-stick injuries was assessed, it was good to know that 95 (95%) knew that it is a health concern and they do discard used needle immediately. However, it was found out not encouraging that only 50 (50%) were in practice of not re-capping used needles, though 96 (96%) were aware of consequences about needle stick injury, of which even 4 (4%) MBBS students sustained a needle stick injury during the last 12 months. 53 (53%) only knew that it should be reported to a doctor, who is the right person in a hospital setup, but the knowledge about filling an incident report among the participant students was found out to be only 19 (19%). It has been amazing to know that 18 (18%) of final year students were not even vaccinated against Hepatitis B and only 68 (68%) were fully vaccinated for it. And 14 (14%) did not know if they were vaccinated or not.

A study was conducted in tertiary care governmental hospitals of Rawalpindi to gather information about knowledge regarding medical waste management by interviewing healthcare workers (HCWs) who were selected randomly after the sample size calculation [11]. This study was part of an on-going quasi-experimental with control and intervention design. It was concluded that practices among HCWs were not found up to the standards in these tertiary care hospitals of Pakistan and were not following the proper guidelines and WHO rules.

A cross-sectional study was conducted in five teaching hospitals of Lahore through convenience sampling [26]. Hospitals of both government and private sector were

included. Needle cutter was used in 60% of hospitals which shows that 60% of hospitals have waste generation plan. Segregation of waste in different colored bags like yellow, red and black colored containers was practiced in 80% of hospitals. Transportation to final treatment site was done by hospital employees in 80% of hospitals. Infectious liquid waste from laboratories, different departments produced in all hospitals but 40% hospitals had liquid waste management plan. Record keeping of waste generated is very important as it provides information about categories and quantities of waste handled every day. Record of waste generated was kept in 60% of hospitals. Pharmacist was a member of waste management team in 80% of hospitals. There was not enough information on medical waste management technologies and its impact on public health and environment. Practice of proper medical waste disposal and management was also inadequate.

METHODOLOGY

Study design

The research was conducted used descriptive, cross sectional design by using simple random sampling technique because it seeks to describe the current status of an identified variable or phenomenon that is knowledge and practices of nurses regarding hospital waste management in tertiary care hospitals Lahore, Pakistan.

Sample selection

Application of this sampling method is done by randomly selecting 130 nurses from 3 tertiary care hospitals:

1. Mayo Hospital, Lahore
2. Lahore General Hospital, Lahore
3. Jinnah Hospital, Lahore of Lahore, Pakistan

Sample size is 130 calculated by using expected knowledge about HWM 17.5%, 5% absolute precision and 95% confidence level using following formula.

$$n = \frac{z_{1-\frac{\alpha}{2}}^2 p(1-p)}{d^2}$$

RESULTS

Knowledge and practice results

22% respondents marked two practices - wearing PPE and correct handling of blood contaminated fomites. 5% marked two practices - wearing PPE and correct handling of sharps, 7% marked two practices - wearing PPE and washing hands after injections (**Figure 1 and Table 2**). 7% marked three practices - wearing PPE, correct handling of general waste and washing hands after injections. 22% marked all practices mentioned in options (**Figure 2**).

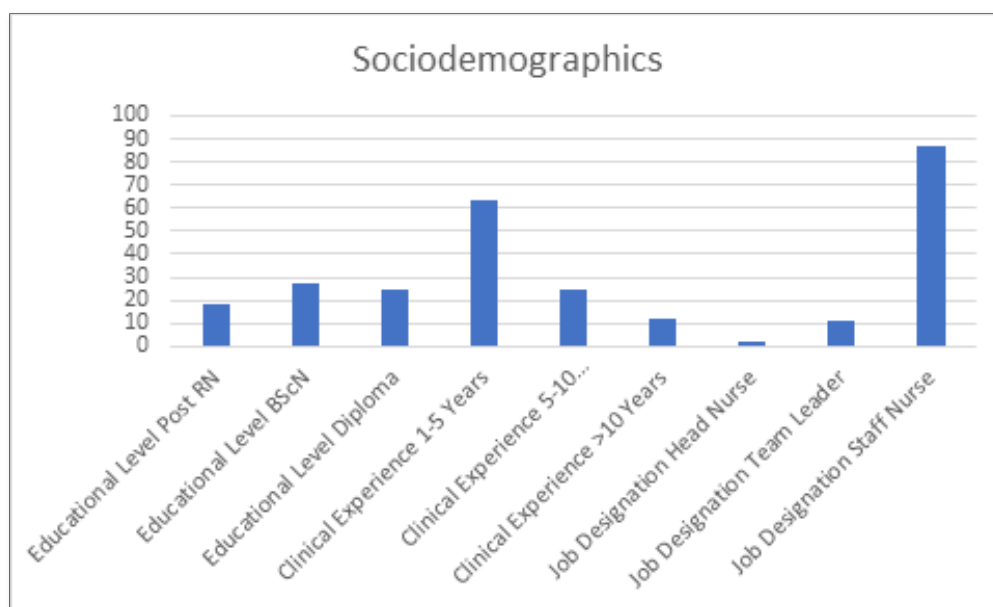


Figure 1. Demographic data.

Table 2. KAP factor results.

Characteristics	Frequency	Percentage%
Wearing PPE and correct handling of blood contaminated fomites	28	22
Wearing PPE and correct handling of sharps	5	5
Wearing PPE and correct handling of general waste	10	7
Wearing PPE and washing hands after injections	49	37
Wearing PPE, correct handling of general waste and washing hands after injections	10	7
All of above mentioned	28	22

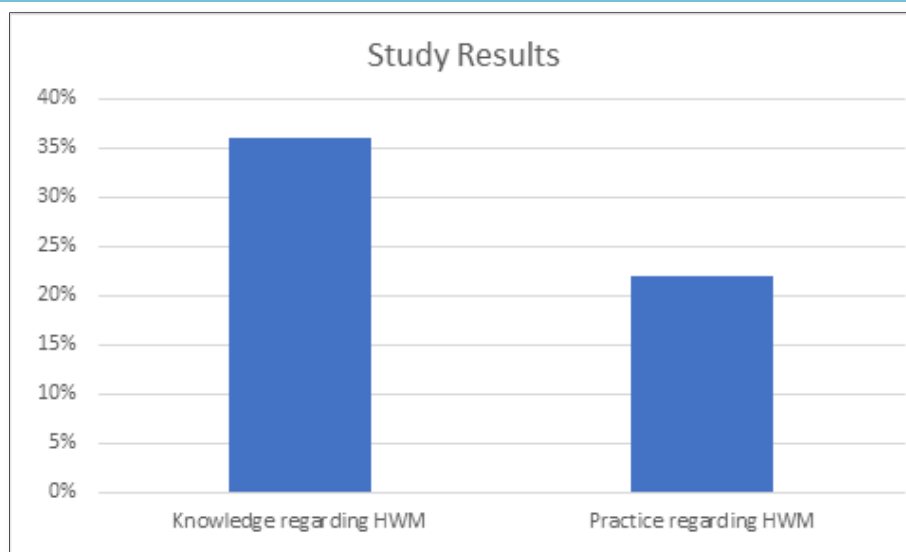


Figure 2. KAP study results.

COMPARISON OF ALL FACTORS WITH KNOWLEDGE AND PRACTICES REGARDING HOSPITAL WASTE

After determining basic factors, next step is to determine if there is some association or not. This study applied chi-square test to check correlation of socio-demographic and economic factors with mainly focused factors knowledge and practice among nurses regarding HW.

DISCUSSION

Factors that showed their effects on knowledge and practice among nurses are education level, clinical experience, designation in hospitals and written protocols for HW and HWM in hospitals. Majority of nurses – 64% are unaware of the risks to health and environment due to HW. That is probably because of lack of awareness among them (**Table 3**).

Table 3. KAP Study correlation results.

Name of variable	Association with variable	Chi-square value	Correlation	Description
Education level	Knowledge regarding HW	0.000	0.683	High level of education causes more knowledge
Experience	Knowledge regarding HW	0.000	0.883	High level of experience causes more knowledge
Designation in hospital	Knowledge regarding HW	0.000	0.387	High level designation causes more knowledge
Written protocols	Knowledge regarding HW	0.000	0.856	Written protocols of hospitals cause more knowledge
Education level	Practices regarding HW	0.000	0.433	High level of education cause more correct practice
Experience	Practices regarding HW	0.000	0.548	High level of experience causes more correct practice
Designation in hospital	Practices regarding HW	0.028	0.164	High level of designation causes more correct practice
Written protocols	Practices regarding HW	0.000	0.559	Written protocols of hospitals cause more correct practice
Knowledge regarding HW	Practices regarding HW	0.000	0.628	Higher knowledge cause more correct practices

Only 36% nurses correctly know waste categories while 37% don't know about categories and remaining have poor knowledge about categories. Even 64% nurses do not know that correct method of waste handling base on waste categories. Again, this situation probably associates with lack of awareness or education. This finding matches with the study of Shafee et al. [22] in which 8 (1.6%) study subjects knew about categories of BMW of which 5 (62.5%) were technicians. Total 353 (70.6%) study subjects were having idea about segregation of BMW. Only 72 (14.4%) subjects had knowledge about various methods of disposal of BMW (**Figure 3**).

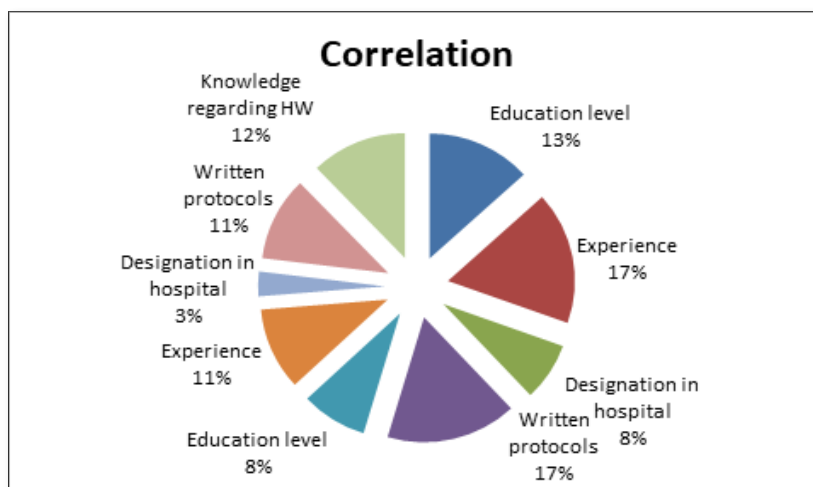


Figure 3. KAP factors results.

Results show that only 22% nurses have knowledge about marked international label on waste bins and containers. On the other hand, 56% nurses even don't know about HW containers or bag holder been put in all locations where particular categories of waste may be generated. This shows marked level of lack of awareness among them.

Results shows that only 36% nurses have knowledge about if the hospital has a set of transport schedule for infectious waste within the organization, if the hospital must have standard storage room for keeping HW.

This study finding shows that 7% nurses do three practices - wearing PPE, correct handling of general waste and washing hands after injections. And 22% do all practices mentioned in options. Overall satisfactory practices are performed by just 29% nurses who are quite low. This finding matches with the result of study by Kumar [11] in which it was noted that the practices regarding infectious waste management of HCWs were found very poor. Many of the health care workers were deficient in practicing the proper waste color coding and the use of personal protective equipment (PPE).

CONCLUSION

A continuous and a comprehensive training of health personnel in various units could improve the infectious waste management practices in the hospitals. However, a waste management plan, appropriate equipment, dedicated staff, and robust monitoring and supervision are some of the pre-requisites. This study concluded that knowledge among nurses in tertiary care hospitals have 36% correct knowledge about HWM while 64% have improper or incomplete knowledge. The study also concluded that satisfactory practice done by 29% nurses as set in criteria.

Education level, experience and their designation in hospitals were main contributory factors affecting their knowledge and practice. Nonetheless, hospital

administrations will be the foremost driver to bring about the change. More such studies could guide the interventions for improvement in the management of hazardous waste in the hospitals.

RECOMMENDATIONS

The United Nations Conference on the Environment and Development (UNCED) in 1992 led to the adoption of Agenda 21, which recommends a set of measures for waste management [27]. The recommendations may be summarized as follows:

- Prevent and minimize waste production
- Reuse or recycle the waste to the extent possible.
- Treat waste by safe and environmentally sound methods.
- Dispose of the final residues by landfill in confined and carefully designed sites.

Other recommendations are as follows: Provision for future expansion of the hospital or of waste storage facilities should be made. The head of hospital appoints personnel to the posts with responsibility for waste management. Notices of these appointments should be widely circulated and updates should be issued when changes occur.

The Infection Control Officer should organize and supervise training programmes for all staff, in collaboration with the WMO and other members of the WMT. Initial training sessions should be attended by key staff members, including medical staff, who should be urged to be vigilant in monitoring the performance of waste disposal duties by non-medical staff [28]. The Infection Control Officer should choose the speakers for training sessions and determine the content and type of training given to each category of personnel.

- The WMT should review the WMP annually and initiate changes necessary to upgrade the system. Interim revisions may also be made as and when necessary. The Head of Hospital should prepare an annual report to the national government agency responsible for the disposal of health-care wastes, providing data on waste generation and disposal, personnel and equipment requirements and costs [29].

HEALTH AND SAFETY PRACTICES FOR HEALTH CARE PERSONNEL AND WASTE WORKERS

Health-care waste management policies or plans should include provision for the continuous monitoring of workers' health and safety to ensure that correct handling, treatment, storage and disposal procedures are being followed.

WORKERS' PROTECTION

A comprehensive risk assessment of all activities should involve in health-care waste management, carried out during preparation of the waste management plan, will allow the identification of necessary protection measures [30]. These measures should be designed to prevent exposure to hazardous materials or other risks, or at least to keep exposure within safe limits. That protection may involve followings

- Protective clothing - helmets, with or without visors - depending on the operation
- Face masks - depending on operation
- Eye protectors (safety goggles) - depending on operation
- Overalls (coveralls) - obligatory
- Industrial aprons - obligatory
- Leg protectors and/or industrial boots - obligatory
- Disposable gloves (medical staff) or heavy-duty gloves
- Personal hygiene
- Immunization
- Management practices - waste segregation, appropriate packaging, appropriate waste storage and appropriate waste transportation
- Special precautions for clearing up spillages of potentially hazardous substances - eye protectors and masks should be worn, in addition to gloves and overalls. Respirators (gas masks) are also needed if an activity is particularly dangerous.
- Response to injury and exposure
- A programme of response should be established that prescribes the actions to be taken in the event of injury or exposure to a hazardous substance. All staff who

handle health-care waste should be trained to deal with injuries and exposures [31-33]. The programme should include the following elements:

- Immediate first-aid measures, such as cleansing of wounds and skin, and irrigation (splashing) of eyes with clean water;
- An immediate report of the incident to a designated responsible person;
- Retention, if possible, of the item involved in the incident; details of its source for identification of possible infection;
- Additional medical attention in an accident and emergency or occupational health department, as soon as possible;
- Medical surveillance;
- Blood or other tests if indicated;
- Recording of the incident;
- Investigation of the incident, and identification and implementation of remedial action to prevent similar incidents in the future.

TRAINING AND AWARENESS PROGRAMMES FOR HEALTH CARE PROFESSIONALS

- The greatest care should be taken if needles have to be removed from syringes.
- In no case should any attempt be made to correct segregation mistakes by removing items from a bag or container or by placing one bag into another of a different color.
- Hazardous and general waste should not be mixed. If the two are accidentally mixed, the entire mixture should be treated as hazardous health-care waste [34].

Nursing and clinical staff should ensure that adequate numbers of bag holders and containers are provided for the collection and subsequent on-site storage, of health-care waste in the wards, clinics, operating theatres and other areas where waste is generated. These receptacles should be located as close to the common sources of waste as possible [35].

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