HOSPITAL WASTE MANAGEMENT: A STUDY ON KNOWLEDGE, ATTITUDE AND PRACTICE AMONG HEALTH STAFF AND WASTE HANDLERS IN JIGME DORJI WANGCHUK NATIONAL REFERRAL HOSPITAL, THIMPHU, BHUTAN

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ABSTRACT: Inadequate hospital waste management, especially in the developing world, is a cause for concern. This cross-sectional study explored the level of knowledge, attitude and practice on hospital waste management among the health staff and waste handlers in the National Referral Hospital of Bhutan. Data were collected in June 2011 with self-administered questionnaires for health staff and face to face interview using the questionnaires for the waste handlers. A sample size of 274 was recruited for the study. Overall, 54.2% of doctors were found to have high level of knowledge compared to majority of nurses (75.3%) and paramedics (69.0%) who possessed moderate level of knowledge. With majority of health staff possessing neutral attitude, 75.0% doctors, 58.8% nurses and 58.0% paramedics performed good practice on hospital waste management. Among the waste handlers, nearly 51.4% had high knowledge, 53.1 % showed positive attitude and 62.2% performed good practice on hospital waste management. The result showed that higher age group of both health staff and waste handlers, and the senior health staff performed good practices in hospital waste management (Chi square, $p \leq 0.05$).Some of the specific recommendations from the study are: to emphasize proper segregation of waste, labeling of waste bags, strict supervision and monitoring, regular training program, review of present waste management guidelines, and to consider acquiring a hospital incinerator.

Keywords: Hospital waste management, knowledge, attitude, practice, Bhutan

INTRODUCTION

Hospital waste has been identified as a potential health and environmental hazard [1]. Bhutan, a small Himalayan Kingdom with Gross National Happiness (GNH) as a developmental policy [2], faces several challenges in managing its hospital waste adequately. Hospital waste includes all waste materials that are generated from health care establishments, research facilities and laboratories and also those from "minor" and "scattered" sources like home health services (dialysis, insulin injections, etc.) [3]. Assessing the generation of hospital wastes, including their quantities and characteristics, is crucial in order to develop appropriate regulations and instructions for hospital waste management [4]. Hospital wastes are classified into eight types including infectious, sharps, pharmaceutical, chemical, genotoxic, radioactive, pathological and pressurized wastes

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[3]. There are six key steps of safe hospital waste management: segregation, collection, transportation, storage, treatment and safe disposal [5]. Segregation is a crucial step in waste management.

The study was conducted to determine the level of knowledge, attitude and practice among the health staff and waste handlers of Jigme Dorji Wangchuk National Referral Hospital (JDWNRH) in hospital waste management. The study also explored the association between the level of knowledge, attitude and practice as well as between the socio demographic characteristics and practice on hospital waste management.

METHODOLOGY

The study recruited 274 participants at JDWNRH, including 236 health staff (41.2% of all health staff) and 38 waste handlers (40.8% of all waste handlers). Self-administered, questionnaires for the health staff and face to face interview for the waste handlers were the measurement tools used. For knowledge and practice the questions were

structured and close-ended where the maximum and minimum scores were "yes" and "no", respectively. Whereas for attitude, the questions were set in a Likert Scale with a maximum score of 5 (strongly agree) and 1 (strongly disagree) for positive statements and vice versa for negative statements. The descriptive characteristics were presented from frequency distribution, percentages and the measures of central tendency. Association between the socio-demographic characteristics and the level of practice were tested with Chi square test (*p-values* ≤ 0.05 were considered statistically significant). The analyses for knowledge, attitude and practice were done separately for the health staff and waste handlers as the questions were slightly different for the two categories depending upon their nature of job. Data were collected in June 2011.

RESULTS

Table 1 presents the socio-demographic characteristics of health staff and waste handlers. The health staff in the study were between the ages of 21 and 64 years with a mean ± SD of 32.42 ± 8.28, median of 31.00 years, and mode 24 years. The female to male ratio among the health staff was 1: 1.5. Majority of the health staff, 48.4%, were certificate holders, 28.5% had diploma and the rest, 23.1%, were among Bachelors/ Masters and higher education level. Doctors constituted 10.9% of health staff, nurses 43.9% and paramedics 45.2%. The number of years in the present occupation ranged from one year to 36 years. The mean was 9.76, mode was 2 years and SD was 8.17.

Among the waste handlers, age range was 21 – 41 years with the mean age of 33.30, median of 32.00 ± 6.83. Male to female ratio was 1:1. 56.8% were found to have primary or secondary level of education, 13.5% had middle or higher secondary education and there were 29.7% of waste handlers who were illiterate. There were more of ward boys/girls (62.2%) than cleaners (37.8%). The range of number of years in the present occupation was 1 to 19 years with a mean ± SD of 8.84 ±5 .21 and mode of 2 years.

Table 2 shows the level of knowledge, attitude and practice for both health staff and waste handlers according to scores obtained. Among the health staff the maximum score observed for knowledge was 15 and the minimum was 2 and only 13.6%were found to have high level of knowledge, followed by 69.2% who had moderate level of knowledge and 17.2%withlow level of knowledge. In contrast, among the waste handlers, whose the maximum score observed for knowledge was 10

Table 1 Socio-demographic characteristics of health staff and waste handlers

Socio-demographic characteristics	Number (Percentage)
Health staff (n = 221)	
Age	
20 – 30	110 (49.8)
31 – 40	76 (34.4)
41 – 50	26 (11.8)
>50	9 (4.1)
Range = 21 – 64, Mean = 32.42, Median = 31, SD = 8.28	
Gender	
Male	132 (59.7)
Female	89 (40.3)
Education level	
Certificate	107 (48.4)
Diploma	63 (28.5)
Bachelors/MBBS/Specialist	51 (23.1)
Present occupation	
Doctors	24 (10.9)
Nurses	97 (43.9)
Paramedics	100 (45.2)
Service years	
0 – 10 years	133 (60.2)
11 – 20 years	60 (27.1)
21 – 30 years	26 (11.8)
> 30 years	2 (0.9)
Range =1 –36 years, Mean = 9.76, SD = 8.17	
Waste Handlers (n = 37)	
Age	
20 – 30	14 (37.8)
31 – 40	17 (45.9)
41 – 50	6 (16.2)
Mean = 33.30, Median = 32, SD = 8.28, Range = 21–41	
Gender	
Male	18 (48.6)
Female	19 (51.4)
Education level	
No education	11 (29.7)
Pry and Lower Secondary	21 (56.8)
Middle and higher Secondary	5 (13.5)
Present occupation	
Ward boys/girls	23 (62.2)
Cleaners	14 (37.8)
Service years	
0 – 10 years	23 (62.2)
11 – 20 years	14 (37.8)
Range = 1-19 years, mean = 8.84, mode = 2 and SD = 5.21	

and the minimum was 5;51.4%, 43.2% and 5.4% had high, moderate and low level of knowledge, respectively. For attitude, the maximum score observed among the health staff was 30 and the minimum was 14 where 16.3% were found to possess positive attitude, majority (67.9%) had neutral attitude and 15.8% had negative attitude. Among the waste handlers, 12 was the maximum score observed for attitude and 8 was minimum with 35.1%, 40.5% and 24.3% having positive,

Table 2 Level of knowledge, attitude and practice among health staff and waste handlers

Level of KAP	Minimum and maximum Score	Frequency (%)
Level of knowledge		
Health staff (n =221)		
High level of knowledge	12 – 15	30 (13.6)
Moderate level of knowledge	8 – 11	153 (69.2)
Low level of knowledge	2 – 7	38 (17.2)
Waste handlers (n = 37)		
High level of knowledge	9 – 10	19 (51.4)
Moderate level of knowledge	7 – 8	16 (43.2)
Low level of knowledge	5 – 6	2 (5.4)
Level of attitude		
Health staff (n = 221)		
Positive attitude	26 – 30	36 (16.3)
Neutral attitude	21 – 25	150 (67.9)
Negative attitude	14 – 20	35 (15.8)
Waste handlers (n = 37)		
Positive attitude	11 – 12	13 (35.1)
Neutral attitude	10	15 (40.5)
Negative attitude	8 – 9	9 (24.3)
Level of Practice		
Health Staff (n = 221)		
Good Practice	13 – 17	133 (60.2)
Poor Practice	6 – 12	88 (39.8)
Waste handlers (n = 37)		
Good Practice	10 – 13	23 (62.2)
Poor Practice	7 – 9	14 (37.8)

neutral and negative attitude, respectively. For practice, 60.2% of the health staff performed good practicebut39.8% performed poor practice with a maximum observed score of 17 and a minimum of 6. Among the waste handlers, with a maximum observed score of 13 and minimum 7, 62.2 % of the waste handlers performed good practice and 37.8% poor practice.

All the socio-demographic characteristics of the health staff including age, gender, education level, present occupation and number of years in present occupation were significantly associated with the level of knowledge on hospital waste management with *p-value* <0.05, as presented in Table 3. However, there was no significant association with any of the socio-demographic characteristics for the waste handlers. For the association between socio-demographic characteristics and attitude, only the age of the health staff showed that older age group had positive attitude, *p-value* = 0.049. Table 4 shows the association between the socio-demographic characteristics and the level of practice. Among the health staff, age and number of years in present occupation were significantly associated with the level of practice on hospital waste management. Similarly among the waste handlers, only the age was significantly associated with the level of practice on hospital waste management.

With Spearman correlation, it was found that there small but significant positive correlation between the level of knowledge and attitude in the health staff (r_s=0.172, p=0.010), and a larger positive and significant correlation in the waste handlers (r_s=0.552, p<0.001). Knowledge and practice were positively and significantly correlated in the health staff (r_s=0.206, p<0.001), but not in the waste handlers (p=0.904). Attitude and practice were also positively and significantly correlated in the health staff (r_s=0.189, p=0.005), but not in the waste handlers (p=0.125).

DISCUSSION

For definition of hospital waste, only 50% of the health staff and 60% of waste handlers gave correct answers.65.6% of health staff said that they have the guideline and only 6.8% have never read it. The guideline clearly states that only 10 – 25% of hospital waste is hazardous and the rest are like any other general waste. Since the present guideline on hospital waste management do not emphasize on the management and disposal options for non-infectious hazardous waste, only 16.3% of health staff were aware that non-infectious hazardous waste should not be thrown in the general waste bin. 63.8% of health staff and almost 95% of waste handlers did not know how to manage mercury spills, which was one of the important questions,

Table 3 Statistically significantassociation between socio-demographic characteristics and the level of knowledge

Socio-demographic characteristics	Count	Knowledge n (%)			χ^2	*p-value*
		Low	Moderate	High		
Health staff (n = 221)						
Age						
20-30 yrs.	110	29 (26.4)	68 (61.8)	13 (11.8)	20.8	0.002
31- 40 yrs.	76	8 (10.5)	59 (77.6)	9 (11.8)		
41- 50 yrs.	26	1 (3.8)	21 (80.8)	4 (15.4)		
>50 yrs.	9	0 (0)	5 (55.6)	4 (44.4)		
Gender						
Female	89	13 (14.6)	57 (64.0)	19 (21.3)	7.8	0.020
Male	132	25 (18.9)	96 (72.7)	11 (8.3)		
Education Level						
Certificate	107	22 (20.6)	80 (74.8)	5 (4.7)	24.9	<0.001
Diploma	63	11(17.5)	44 (69.8)	8(12.7)		
Bachelors, Masters & Above	51	5 (9.8)	29 (56.9)	17 (33.3)		
Present Occupation						
Doctors	24	0 (0)	11 (45.8)	13 (54.2)	41.4	<0.001
Nurses	97	15 (15.5)	73 (75.3)	9 (9.3)		
Paramedics	100	23(23.0)	69 (69.0)	8 (8.0)		
No. of yrs. in the present occupation						
0 – 10 yrs.	133	18 (13.5)	97 (72.9)	18 (13.5)	15.1	0.020
11 – 20 yrs.	60	12 (20.0)	37 (61.7)	11 (18.3)		
21 – 30 yrs.	26	6 (23.1)	19 (73.1)	1 (3.8)		
>30 yrs.	2	2 (100.0)	0 (0)	0 (0)		

Table 4 Statistically significant association between socio-demographic characteristics and the level of practice

Socio-demographic characteristics	Count	Practice n (%)		χ^2	*p-value*
		Poor	Good		
Health staff (n = 221)					
Age					
20 - 30 yrs	110	65 (59.1)	45 (40.9)	36.4	<0.001
31 – 40 yrs	76	19 (25.0)	57 (75.0)		
41 – 50 yrs	26	4 (15.4)	22 (84.6)		
>50 yrs	9	0 (0)	9 (100)		
No. of Yrs. in present occupation					
0 - 10 yrs	133	47 (35.3)	86 (64.7)	9.3	0.025
11 – 20 yrs	60	23 (38.3)	37 (61.7)		
21 – 30 yrs	26	16 (61.5)	10 (38.5)		
>30 yrs	2	2 (100)	0 (0)		
Waste handlers (n = 37)					
Age					
20 – 30 yrs	14	8 (57.1)	6 (42.9)	5.9	0.052
31 – 40 yrs	17	6 (35.3)	11 (64.7)		
41 – 50 yrs	6	0 (0)	6 (100)		

because many instruments like BP apparatus and thermometers with mercury are still widely used in the hospital. Even the guideline do not specify on how to manage it. Mercury must be securely recovered and not disposed in the red bags and not to autoclave [3]. Unlike the study in Bangladesh [6], the majority of the respondents in the present study, including waste handlers, have moderate to high level of knowledge on hospital waste and its management.

The attitude for labeling the waste bags was positive in majority of both health staff (88.2%) and waste handlers (89.2%), although, 66.5% of health staff and 91.9% of waste handlers did not label them prior to collection. Waste bags should not be removed without labeling [3]. Within the hospital, waste must be transported via separate ramps and lifts. Hospital waste must be stored within the hospital premises in a room, protected from rain, sun and the scavengers and with washing facility [3].

For the treatment of hospital waste, >60% of participants considered incineration to be the best option for JDWNRH. The National Environmental

Commission (NEC) of Bhutan does not approve incinerator due to their concern about pollution and other environmental impacts. However, this position is quite debatable. Recently, one of the newspapers, *Business Bhutan*, highlighted that untreated medical wastes found at the municipal landfill was a major health hazard for those people who work at the landfill and the scavengers who are exposed to health risks [7]. And incinerator has the benefit of reducing the volume of waste up to 90%, and is applicable to all types of hospital waste including sharps and pathological waste [8]. The modern hospital incinerator with a complex technology meets current stringent environmental pollution regulations. However, they are very expensive [8]. A feasibility study, conducted by the Ministry of Public Health found out that hospital incinerators can be installed and operated by the private companies rather than by the government as it is quite expensive for the government to afford [9].

The waste management guideline mentions that, once autoclaved, the sharp waste can be disposed of like any other general waste, which means that sharps can be disposed in the landfill. However, WHO reminds that sharps should undergo incineration or buried securely and not go to the landfill [3]. Hazardous liquid waste is mostly flushed down the toilets without treatment as per the responses from heath staff and waste handlers. WHO also mentions that infectious liquids, cytotoxic drugs and liquids with radioactive properties must never be discharged into the sewerage system [3].

Segregation of waste, which is the "essence of waste management" [10], is a crucial step in waste management which will separate waste into reusable and recyclable components, whereby, it will reduce the volume of the actual waste to be disposed off resulting in reduced expenditure for its management. It is even more important in the developing countries as the wastes are mostly disposed of in the landfill [4].

RECOMMENDATIONS
Short term recommendations from the study are: emphasis on proper segregation of waste, labeling the waste bags, initiate waste bins for non-infectious waste and strict supervision and monitoring. Long term recommendations include: regular training program, review of present guidelines, and considering a hospital incinerator.

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