DEVELOPMENT AND VALIDATION OF INSTRUMENT TO ASSESS THE ATTITUDE OF HEALTHCARE WORKER TOWARDS BIO-MEDICAL WASTE MANAGEMENT

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ABSTRACT

The purpose of the present study is to develop a reliable and valid instrument to evaluate the attitude of healthcare worker towards Bio-medical waste management. The questionnaire consists of 3 domains capturing the basic elements of bio-medical waste management. Principal Component Analysis is performed to identify the factors underlying the tool developed. The content validity is established with the help of a panel of experts which includes Surgeon, Radiation Oncologist, Rheumatologist and Statistician. The face validity is evaluated through a focus group of junior resident doctors, interns and staff nurses. The construct validity is established using Karl Pearson's product moment correlation coefficient and reliability was established using Cronbach's α-coefficient. The reliability and validity coefficients for the first component are obtained as 0.802 and 0.731, respectively.

KEYWORDS: Bio-medical Waste, Healthcare worker, Attitude, Questionnaire, Reliability, Validity.

Bio-Medical Waste (BMW) refers any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps, including the categories mentioned in Schedule I of the Bio-Medical Waste (Management) Rules, 2016. (BMW (Management) Rules, 2016).

The rule makes it mandatory for the health care establishment to segregate, disinfect and dispose their waste in eco-friendly manner. Clearly, statutory safeguards for biomedical waste management practice in Indian hospitals have still not achieved the desired standards. (Hegde et al., 2007).

Poor Bio-medical Waste Management (BMWM) practices can be attributed to lack of knowledge (law, methods of disposal, harm of improper disposal), lack of motivation (personal belief, perceived threat, lack of training & facilities) and lack of adequate funding to foster these activities. Improper BMWM starts with poor segregation at the point of generation and culminates with improper terminal disposal. Safe and sustainable management of bio-medical waste is not possible without a favorable attitude among health care workers as Attitude refers to the way in which the healthcare workers think, feel or behave regarding the biomedical waste management.

The most vital component of the bio-waste management plans that have been formulated is to bring about a transformation in the mindset and develop a system and culture through education, training and constant motivation of the health care worker. (Chandorkar and Nagoba, 2004).

Study conducted by McConville et al, 2002 used 5 point scale for the attitude measurement regarding the syringe disposal practice of individuals with diabetes. Similarly, a study conducted by Raina, 2012 also used 5 point Likert scale to assess the attitude of type 2 diabetes patients on safe disposal of sharps.

The project entitle "Bio-medical Waste Management & Treatment" (Government of India/ World Health Organization collaborative) was conducted for the period of 5 months from 1st September 1999 to January, 2000 in the C. S. M. Medical College, other similar hospitals and laboratories in the Lucknow. In this project, an attitudinal survey was also performed to evaluate the attitude of hospital / laboratory employees and patients and their attendants towards waste problem and its

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management. Data was collected with the help of questionnaire. (Agarwal et al., 2012).

In the present study the modified version of attitudinal survey questionnaire of Bio-medical Waste Management & Treatment project was used after including more questions based on the personal belief (Social factor), healthcare setting and demographic details. Aim of the present article is to establish the reliability and validity of a tool to assess the attitude of healthcare worker regarding Bio-medical waste management.

MATERIALS AND METHODS

A questionnaire was developed to assess the attitude of healthcare worker towards Bio-medical Waste Management. The questionnaire includes 58 questions arranged into three different sections. First section includes four questions related to health care setting, second section includes five questions related to socio-demographic profile and third section includes 39 questions related to the attitude towards psychosocial variables (waste management). The questionnaire was administered over 260 subjects including Doctors, nurses, lab technicians and sweepers of King George Medical University.

Statistical Analysis

Principal Component Analysis

A principal component analysis (PCA) was performed (i) to reduce the number of questionnaire items and (ii) to determine, if any, empirically derivable subscales. In PCA new variables are generated, called as principle component, which are linear function of the observed variables. The first principal component accounts for as much of the variability in the data and each succeeding component in turn account for maximum possible variability under the condition that it is uncorrelated with the preceding components.

Kaiser's criterion was used to retain the individual items. According to this criterion the components with Eigen-values ≥ 1.0 and including three or more items were considered significant and the individual items having component loadings of ≥ 0.10 on these components were retained for the final questionnaire having component.

Translational validity

Content Validity

It is the extent to which the measuring instrument provide adequate coverage of the topic under study and ensure the contents of the questionnaire were appropriate and relevant to the study purpose. Content validity indicates the content reflects a complete range of the attributes under study and was established with the help of a panel of experts of related fields. (DeVon et al., 2007)

Face Validity

Face validity indicates the questionnaire appears to be appropriate to the study purpose and content area. It is the easiest validation process to undertake but it is the weakest form of validity. It justified the appearance of the questionnaire in terms of feasibility, readability, consistency of style and formatting and the clarity of the language used. It is established with the help of a focus group. (DeVon et al., 2007) (Haladyna, 2012) (Trochim and Donnelly, 2001)

Construct Validity

Construct validity refers to the degree to which the items on an instrument relate to the relevant theoretical construct (DeVon et al., 2007) (Kane, 2001) Construct validity is a quantitative value rather than a qualitative distinction between 'valid' and 'invalid'. It refers to the degree to which the intended variable (construct) relates to the proxy variables (indicators). (Hunter and Schmidt, 2004) Product-moment correlations were computed between component scores and the waste to assess construct validity.

Reliability

Once the validity procedures were completed, the final version of the questionnaire was examined to assess its reliability. Reliability refers to the ability of a questionnaire to consistently measure an attribute and how well the items fit together, conceptually. To establish the reliability Cronbach's α was used. Cronbach's α was computed for the components obtained by using PCA.

RESULTS AND DISCUSSION

Socio-demographic Profile

To establish the reliability and validity of the tool survey was conducted over 261 subjects of King George Medical University. Among these subjects

maximum were female (53%), most of the subjects were educated upto graduation (47.9%) and most were working as nurse (27.6%) (Table 1).

Table 1: Socio-demographic Profile

Socio-demographic Profile	No. of Healthcare worker (%)
Gender	
Male	121 (46.4%)
Female	140 (53.6%)
Educational Qualification	
Illiterate	6 (2.3%)
Just Literate	8 (3.1%)
Middle School	23 (8.8%)
High School/ Intermediate	48 (18.4%)
Graduate	125 (47.9%)
Post Graduate	51 (19.5%)
Designation	
Doctor	101 (38.7%)
Nurse	72 (27.6%)
Paramedical Staff	88 (33.7%)

Transitional Validity

Content Validity

To assess content validity, environmental consultant for Healthcare Sector from the World Health Organization (Geneva, Switzerland) reviewed the questionnaire to ensure relevance and clarity of the items. An expert panel of healthcare professional includes radiation oncologist, surgeon, statistician, rheumatologist and one from community medicine and public health department was formed. All the healthcare professionals are actively working in the field of bio-medical waste management. On the suggestions of experts one question related to social factor and one question related to vaccination status is included. The expert panels confirmed that all of the areas pertinent to the waste management were sampled.

Face validity

A healthcare personnel focus group was conducted to establish the face validity of the questionnaire. The focus group for face validity includes of King George's Medical University. Feedback from the focus groups consisted of doctors, staff nurses and paramedical staff identifying ambiguous items and suggesting additional items. Items were reworded to eliminate ambiguous phrasing. For instance, the word "garbage" was replaced with "waste" and question "Are

you vaccinated against Hepatitis B" was shifted from section C to section B.

Principal Component Analysis

Principal component analysis was performed over 39 items related to psychosocial variables. The 7 components, having Eigen-value $\geq$ 1.0, were extracted (table 2) which was also suggested by Scree plot (Fig. 1). Using Kaiser's criteria a 6-component solution suggested containing three or more items which adequately represent the data in a meaningful way (table 3). The 6-component solution was accepted because it didn't eliminate items in this preliminary analysis and ensured that several different dimensions of questionnaire were still captured. These 6 components explain 71% of the variation in waste management, and each includes 3 or more items (table: 3).
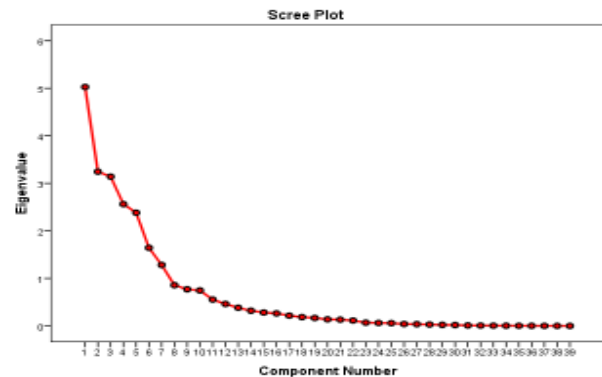

Figure 1: Scree Plot

Reliability and Validity Coefficients

The reliability is obtained using Cronbach's α coefficient. Validity is obtained using correlation between waste and factor scores. The results are represented in the Table 4.

The reliability coefficients are obtain as 0.802 or less and validity coefficients are 0.759 or less thus it can be said that questionnaire is valid as well as reliable.

The validity coefficient shows that the highest validity (0.759) was obtained for factor 1 which contains nine questions while the minimum validity (0.671) was obtained for factor 6 containing four questions. The Validity coefficient for factor 2, containing ten items was obtained 0.713, for factor 3, containing eight items was obtained 0.690, for factor 4, containing four items was obtained 0.721 and for factor 5, containing three items was obtained 0.623 which shows all that the questionnaire

is suitable for the assessment of attitude of healthcare worker regarding bio-medical waste management.

Combining with the content validity of the expert group, the face validity of the healthcare personnel focus group addressed the instrument can be considered as valid as well as reliable.

Table: 2 Component Extraction

Component	Variance Explained			Component	Variance Explained		
	Total	% of Variance	Cumulative %		Total	% of Variance	Cumulative %
1	5.027	19.911	19.911	21	0.132	0.523	98.080
2	3.246	12.854	32.765	22	0.114	0.452	98.533
3	3.141	12.441	45.206	23	0.069	0.273	98.806
4	2.563	10.151	55.357	24	0.062	0.247	99.053
5	2.383	9.437	64.794	25	0.058	0.231	99.284
6	1.644	6.510	71.304	26	0.041	0.161	99.445
7	1.283	5.081	76.385	27	0.037	0.145	99.590
8	0.857	3.395	79.780	28	0.030	0.119	99.709
9	0.771	3.053	82.832	29	0.022	0.089	99.798
10	0.746	2.956	85.788	30	0.018	0.073	99.871
11	0.554	2.196	87.984	31	0.010	0.039	99.910
12	0.463	1.833	89.817	32	0.007	0.028	99.939
13	0.382	1.513	91.330	33	0.005	0.022	99.960
14	0.320	1.267	92.597	34	0.004	0.015	99.975
15	0.283	1.119	93.716	35	0.003	0.012	99.987
16	0.263	1.043	94.759	36	0.002	0.008	99.995
17	0.216	0.855	95.614	37	0.001	0.003	99.998
18	0.186	0.735	96.349	38	0.000	0.001	100.000
19	0.167	0.663	97.012	39	0.000	0.000	100.000
20	0.138	0.546	97.557				

Table: 3 Component Loadings

Components and variables	Factors					
	1	2	3	4	5	6
Factor 1						
SFPC17: Do you perceive that the segregation at the point of generation is not an extra burden on your existing work load?	**0.796**	0.393	0.219	0.013	0.515	0.194
FCC39: While you see pus soaked cotton near patient's bed if the bed side dustbin is not available, then also do you dispose off the waste in its proper place?	**0.721**	0.089	0.417	0.149	0.403	0.009
SFPC16: Would you like to attend training programme on hospital waste management?	**0.695**	0.019	0.108	0.002	0.073	0.122
SFRC12: When you see someone throwing waste here and there, do you tell/ explain people not to do so?	**0.456**	0.034	0.275	0.158	0.066	0.196
HBC3: Do you yourself take time out to dispose off the waste everyday?	**0.452**	0.218	0.133	0.443	0.155	0.122
AFC20: Do you feel irritated while seeing waste here and there?	**0.431**	0.036	0.434	0.229	0.092	0.201
FCC37: We have modern infrastructure and machinery for waste-disposal.	**0.424**	0.121	0.167	0.054	0.033	0.024
FCC36: Even if I have to walk some distance for throwing waste into dustbin, I do.	**0.384**	0.111	0.013	0.015	0.033	0.059
HBC1: Do you throw the garbage in dustbin only?	**0.375**	0.006	0.006	0.028	0.024	0.017
Factor 2						
INC30: Will you like to spend some of your income for the disposal of waste?	0.267	**0.832**	0.066	0.333	0.073	0.366
AFC21: Do you feel angry when someone throws waste here and there?	0.391	**0.646**	0.128	0.215	0.286	0.057
SFRC15: Do you feel that by segregating the different types of	0.051	**0.907**	0.371	0.765	0.550	0.187

waste, we can again use them by recycling them?						
SFRC11: Do you clean your workplace or disposing the waste on your own?	0.378	**0.565**	0.224	0.065	0.234	0.351
MOC26: Do you feel that this widespread waste can make you sick?	0.064	**0.193**	0.028	0.064	0.062	0.027
AFC23: Do you feel irritated by seeing people spiting on wall?	0.215	**0.323**	0.029	0.006	0.033	0.269
HBC5: Do you properly dispose off the groundnut shell or peels while walking on the road?	0.372	**0.528**	0.500	0.379	0.364	0.348
INC33: Should we use such kind of things that do not produce much garbage?	0.061	**0.210**	0.191	0.149	0.099	0.021
SFPC18: Do you feel that you have sufficient knowledge of Biomedical waste management?	0.205	**0.206**	0.050	0.022	0.133	0.158
INC34: Should we cooperate with the government in its cleanliness activities?	0.089	**0.127**	0.017	0.042	0.021	0.003
Factor 3						
HBC4: Do you throw divide the waste into two different Parts so that the recyclable products could be used?	0.534	0.068	**0.981**	0.451	0.157	0.537
MOC29: Does the hospital waste affects our life cycle?	0.249	0.197	**0.518**	0.144	0.081	0.351
HBC2: Do you like to properly dispose off the waste produced even while pre occupied to other important works?	0.029	0.104	**0.337**	0.033	0.094	0.026
SFPC19: Waste management is team work, no single class of people is responsible for safe management.	0.090	0.178	**0.598**	0.478	0.230	0.168
SFNC7: Does the proper disposal of hospital waste improve the image of Hospital?	0.046	0.117	**0.178**	0.034	0.019	0.079
MOC27: Do you feel that the reasons behind infectious diseases are improper disposal of waste?	0.033	0.196	**0.219**	0.042	0.117	0.018
SFNC6: Is proper disposal of hospital waste responsibility of us all?	0.061	0.008	**0.130**	0.118	0.050	0.113
SFNC8: Should the habit of proper disposal of waste be inculcated right from the childhood	0.026	0.039	**0.147**	0.028	0.023	0.012
Factor 4						
MOC28: Does the foul smell from Hospital waste makes you bother?	0.327	0.204	0.363	**0.701**	0.305	0.284
AFC22: Do you like to pass your time at a clean and tidy place?	0.041	0.007	0.112	**0.157**	0.050	0.036
INC31: Do you think that with the proper availabilities of dustbins and other facilities for disposal of waste, we will be able to dispose waste properly?	0.025	0.089	0.093	**0.177**	0.075	0.149
SFRC14: Is the expenditure incurred on proper disposal of waste necessary?	0.010	0.017	0.284	**0.301**	0.024	0.111
Factor 5						
SFNC9: Do you feel that the improper disposal of the Hospital waste should be a cognizable offence?	0.176	0.007	0.101	0.314	**0.916**	0.344
SFNC10: Do you think that the inappropriate disposal of hospital waste is a social evil?	0.015	0.046	0.034	0.074	**0.212**	0.036
FCC38: If Hospital administration does not make proper arrangements for waste disposal, do you do it on your own.	0.274	0.135	0.008	0.308	**0.423**	0.287
Factor 6						
MOC25: Are you concerned with the problem of improper waste disposal?	0.050	0.030	0.019	0.095	0.015	**0.246**
FCC35: Do you feel that the Biomedical waste disposal facility in your Hospital is satisfactory?	0.023	0.073	0.106	0.020	0.049	**0.285**
INC32: Should we create awareness against the problem caused by improper waste disposal?	0.004	0.075	0.079	0.103	0.004	**0.164**
SFRC13: Do you motivate others to dispose off the waste properly every where?	0.022	0.103	0.127	0.018	0.152	**0.158**

Table: 4 Represents the reliability & the validity coefficients

Factor	Reliability (Cronbach's α)	Validity
Factor 1	0.802	0.759
Factor 2	0.763	0.713
Factor 3	0.645	0.690
Factor 4	0.667	0.721
Factor 5	0.602	0.623
Factor 6	0.554	0.671

Table 5: Published studies based on questionnaires used to assess different aspects of Bio-medical waste management

References	Survey description	Questionnaire description
Al-Hadlaq et al., 2013	Bio-medical waste handling and management	Two different set of questionnaire were prepared. The main questionnaire was developed for medical stuff (doctors, nurses, laboratory technicians) and the second one to the hospital administration. The questionnaire aimed at gathering information about the generation, segregation, collection, internal and external storage, transportation, treatment and disposal of medical waste in government and private hospitals in Riyadh city.
Radha R, 2012	Knowledge, attitude and practices of the health care workers regarding the management of BMW	The questionnaire consisted of 10 questions to assess the knowledge having yes/no/not sure responses, 4 questions on attitude having agree/disagree/no comment as responses and 6 questions on practices having yes/ no responses.
Momin R, 2010	Knowledge, attitude and practice of bio-medical waste management amongst staff	The questionnaire consists of two sections. Section I includes 6 questions related to socio-demographic data and Section II includes 21 questions related to waste management policy, waste management practices, employee education and attitude assessment.
ASA Khalaf, 2009	Waste management practices	The questionnaire aimed at gathering information about the generation, segregation, collection, internal and external storage, transportation, treatment and disposal of medical waste, and also focusing on general cleaning in Jenin hospitals.

The Attitudinal Questionnaire

The attitudinal questionnaire consisted of 3 sections.

Section A: included Healthcare setting details (3 items) i.e. name of hospital, type of hospital (government/private) and number of beds,

Section B: included demographic data (7 items) i.e. age, sex, designation, educational qualification, waste generated at workplace and vaccination status.

Section C: included psychosocial variables (39 items) i.e. habit, motivation, facilitating conditions, social factors and perceived consequences.

Items used to measure each of psychosocial variables were quantified on a 5 point Likert scale in which the subject would specify levels of agreement (never, sometimes, occasionally, mostly and always). Those with scores 5 had a high intention for proper waste disposal and those with score 1 had low intention. The questionnaire was made in the local Hindi language and later on translated in English.

Several studies were found where data is collected with the help of questionnaire so we can say that the questionnaire is the building blocks of the research work but the validation process of questionnaire is not elucidated profoundly. It is important to develop a valid and reliable tool before starting study. Table 5 shows

various studies based on questionnaires used to assess different aspects of Bio-medical waste management

CONCLUSION

The attitudinal questionnaire is a valid and reliable research tool which can be used to assess the attitude of healthcare worker regarding bio-medical waste management.

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