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Management of Mass Casualty Incidents Following Disasters: Individual Level Capacity of the Doctors in a Curative Healthcare Institution, Sri Lanka

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Abstract

The foremost concern of disaster management is to minimize human suffering, where the health sector has to play a critical role. Doctors play a major role by getting directly involved as the decision-makers and first responders in patient management. The study aimed to assess the individual level capacity of the doctors for the management of mass casualty incidents following disasters in the major curative healthcare provider in Sri Lanka. An institution-based descriptive cross-sectional survey was carried out among all doctors who were permanently attached to the institution, using a self-administered, pre-tested, validated questionnaire from March 2016 to January 2017. Response rate was 89.9% (n=346). Among them, 28.9 % (n=100), 27.5% (n=95), 38.2% (n=132), 25.7% (n=89), 6.9% (n=24) had good knowledge, attitudes, experience, formal training, and participated in simulations, respectively. Further, 46.8% (n=162) had the desired goal for the management of mass casualty incidents. Those at first respondent units were more likely to have good knowledge than those at other units ($p<0.05$). Those who had desired goals were significantly more likely to have good knowledge, good attitudes, and prior training in the management of mass casualty incidents ($p<0.001$). There is a clear need for improvement in the capacity by conducting awareness programs.

Key words: *Disaster, disaster management, Individual capacity, Mass Casualty Incidents*

1. Introduction

Disaster is defined as 'a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources' (UNISDR, 2009). Disaster management is a cyclical process. There are three major elements of disaster management, which are preparedness, response, and recovery. Preparedness includes mitigation and preparation. The measures to ensure the organized mobilization of resources for effective relief should be ensured during the phase of preparedness. Response phase is a set of activities implemented after the impact of a disaster. The measures to assess the needs to minimize the suffering, and to reduce the consequences of the disaster should be ensured during response phase(WHO/EHA, 2002). An institution should strengthen the capacity during preparedness phase to overcome the hardships during response phase and the recovery phase, following disasters. Mass Casualty Incident (MCI) is defined as 'any event resulting in a number of victims large enough to disrupt the normal course of emergency and healthcare services' (PAHO, 1995). Sri Lanka is a country vulnerable to various hazards leading to disasters. The vulnerable population has to suffer because of consequences of disasters and the foremost concern of any disaster is to minimize the human suffering where the health sector has to play a critical role. Therefore, it is of utmost importance that the health sector is prepared to respond effectively and efficiently in a disaster situation. As stated in the National Strategic Plan for Health Sector in Sri Lanka, the legal provision for disaster management is the Disaster Management Act No. 13 of May 2005, which was enacted to develop the country capacity for disaster management with the vision of ensuring least human suffering (DPRD, 2011; Sri Lanka Disaster Management Act, 2005). The capacity is defined, as 'the combination of all the strengths, attributes, and resources available within a community, society or organization that can be used to achieve agreed goals'. There are three levels of capacity including 'individual level, organizational level, and enabling environment level', which are not mutually exclusive(UNISDR, 2009) (Figure 1).

Figure 1. Levels of capacity

(Source: Davis & Lemma, 2009)

The individual level is the 'experience, training, skills, attitudes and knowledge that allow each person to perform'. They can be acquired formally through education and training or informally through experiences. Access to resources and experiences can develop the individual capacity. Institutional and environmental factors are influenced by the capacity development in everyone. Capacity assessment is defined as 'a process by which the capacity of a group is reviewed against desired goals, and the capacity gaps are identified for further action'(UNISDR, 2009). A capacity assessment is an important process in development of an institution to understand the expected status, resources needed for the changes, and the strategies that need to be adopted, and to achieve their desired goals. Davis and Lemma (2009) stated that to achieve

sustainable development, there is clear need to establish a systematic approach in planning capacity development programs. At first, existing needs and demand for capacity development must be assessed by carrying out surveys, before designing long-term capacity development strategies. Major challenges in the management of MCIs have been identified as lack of resources including human and material, lack of communication, and poor coordination (Murshed & Sultana, 2015). Hospitals are the major resource for the admission of casualties and treatment of patients affected by disasters. Evaluation and treatment of patients can be affected by disasters. Health personnel must be aware of the pattern of different types of injuries. If so, they will be able to plan for appropriate optimal and timely interventions during the golden hour following such MCIs (MHFW, 2010).Thus, every hospital must be fully prepared to deal with MCIs, and critical mortality is the more accurate measure of outcome of medical management of MCIs. Moreover, rapid, and accurate triage is essential to minimize mortality among survivors (Frykberg, 2004). Therefore, an assessment of the response capacity of individuals is an essential part in preparing for management of MCIs. Furthermore, hospitals have to treat a number of casualties beyond its conventional capacity during MCIs. It indicates a temporary mismatch between demand and supply of care for disaster victims. Assessing the knowledge and skills for disaster management is the first step to obtain baseline data about the capability to respond to disasters in respective institutions (Al-Ali & Ibaid, 2015). Therefore, this study was designed to conduct at the major healthcare institution in Kurunegala district and the only Teaching Hospital in North-Western Province (NWP) as it is one of the largest hospitals in Sri Lanka.

Teaching Hospital, Kurunegala (THK) is exposed to both external and internal disasters. It caters to more than 1.2 million patients annually. The average number of outpatients coming to the hospital for treatment is more than 1 million annually. It serves as a referral hospital for several hospitals in its referral chain, which includes the patients from the other districts (THK, 2016). Hospital statistics showed that in the recent past there had been an increase in the number of disasters attended by them. Most of these emergencies have been as a result of road traffic accidents (RTA). The capacity of a hospital should be developed during preparedness phase to overcome the temporary mismatch between demand and supply of care following MCIs. A capacity assessment is needed to perform by the health managers to identify the activities required to carry out on a priority basis (DPRD, 2011). Capacity assessment surveys among medical officers for the management of MCIs have not been conducted in this hospital. Therefore, this study was able to provide important information about the existing capacity among doctors for the management of MCI at a given time. The assessed capacity was reviewed against the desired goals and conclusion was made on the desirability. The results of the study will help policy planners to conduct capacity development activities in line with the standards and guidelines. In addition, the results of the study can be taken into consideration in designing the capacity development strategies. Therefore, it is of utmost importance to assess the capacity of doctors of a major healthcare provider of one of the major districts in Sri Lanka, to obtain baseline data prior to initiating capacity development programs. Therefore, this study aimed to assess the individual capacity of the doctors at the only teaching hospital in the Kurunegala district to manage MCIs following disasters.

2. Methodology

An institutional based descriptive cross-sectional survey was carried out at Teaching Hospital Kurunegala (THK), which is situated in Kurunegala district, Northwestern province (NWP), in Sri Lanka from March 2016 to January 2017. According to the Census and Statistics, 2012, Sri Lanka has an area of 65,000 square kilometers and it is divided into nine provinces for the administrative purposes. The NWP is one of the nine provinces, which is consisted of two districts namely, Kurunegala and Puttalam. Total population of the country was reported as 20,359,439. Twelve percent (n=2,380,861) of Sri Lankan population lived in NWP. The highest population (68%; n=1,618,465) of NWP lived in Kurunegala district with a population density of 350 (Department of Census & Statistics, 2012). The THK is the only teaching hospital in NWP and one of the largest hospitals in Sri Lanka. It was established in 1899 and the current administrating building was established in 1942. It is situated on the Colombo-Kurunegala main road. The bed strength is over 1400, which is set to increase as it is undergoing renovations, and the staff is 2327.The hospital spreads over 35 acres land and serves people through more than 100 units. In terms of emergency services, the hospital has an accident and emergency (A&E) department which is operational 24 hours a day and has a resident physician. In terms of disaster preparedness, the hospital has a disaster management multi-stakeholder committee, which is currently working on the disaster preparedness and response plan which was updated in September 2014. Mission of the hospital is 'to cure patients and prevent them from diseases in a congenial environment utilizing medicine and equipment of accepted standards through a professionally qualified team of ethically bound, by using the latest knowledge in medicine and research performed, institutionally' (THK, 2016).

The survey was conducted among all doctors having MBBS or equivalent, who are permanently attached with more than one-year working experience in the health sector. The doctors are the ones who play a major role by directly involve in managing Mass Casualty Incidents (MCIs) as the decision makers and first respondent of patient management (Sathishka, 2016). In calculating sample size for this study, level of knowledge was considered as 50% and desired level of precision as 5%.(Lwanga, & Lemeshow, 1991). With the 10% non-response rate, total sample size was427. According to the administrative branch of the institution, 434 doctors were working at the institution during the period of data collection. According to inclusion and exclusion criteria, 385 were eligible as the study participants. Therefore, all 385 eligible doctors were invited to participate in the study to achieve the required minimum sample size.

A self-administered pre-tested questionnaire was used to assess the knowledge, attitudes, experiences, and the desired goals for the management of MCIs. The questionnaire was designed by the principal investigator in consultation with the experts on the subject and based on guidebooks on mass casualty management (Chemenya, 2011; DGHS, 2010; Fernando, 2014; Green, 2000; Moabi, 2008; PAHO, 1995; WHO, 2007; West Virginia Emergency Medical Services, 2004).Judgmental validity was achieved by taking expert opinion from the field of disaster management and emergency medicine. The questionnaire consisted of six sections; demographic data including age, sex, present grade, level of education, working experience and the place of work at the present station;questions to assess knowledge with open-ended and MCQ type questions in eight broad areas namely, 'overview, triage and its purposes, emergency management, dead body management, documentation, coordination and resource management, communication,

media relationship and psycho-social assistance following MCIs. The total score was weighted according to the importance of the areas on knowledge. Ten attitudinal are as were rated with the 'Likert' scale. To evaluate the experiences, close-ended questions with broad three areas of disasters were included, and space was given to mention any other type of disasters and questions to find out the status of training received on disaster management. If they had any formal training on disaster management, duration and the benefit in brief were obtained. Moreover, questions to find out the participation on disaster management drills/simulations, type, place, and the date were obtained. An open-ended question which was ranked zero to five according to WHO goals of MCI management (WHO, 2007) was used to assess desired goals.

3. Results

Eligible number for the study was 385 of which 346 participated giving a response rate of 89.9%.

3.1 Socio-Demographic characteristics

Mean age of the study group was 40.5 years (SD=7.3) with a range from 28 to 59 years. The highest proportion of the participants (46.8%; n=162) were between the ages of 31 to 40 years and the lowest proportion of the participants (7.2%; n=25) were between the ages of 21 to 30 years. The sample consisted of 162 (46.8%) males. The highest proportion of participants (62.1 %; n=215) belonging to professional grade two. In the study group, 22.5% (n=78) had postgraduate qualification after the basic medical degree and the highest proportion of participants (77.5%; n=268) had MBBS or equivalent basic medical degree only. Response rate for the work experience at the health sector among the study group was 99.1 % (n=343) and the highest proportion of participants (35.5%; n=123) had 11 to 20 years of working experience as medical officers at the health sector. Moreover, the highest proportion of participants (54.1%; n=187) had three to five years of working experience at the same institution. The highest proportion of participants (38.7%; n=134) worked at the first respondent units (OPD/A&E/ICU/Theater) category.

3.2 Knowledge

Mean knowledge score was 57.8 (SD=15.5) out of a possible 100 with a range from 10 to 86. Out of the study participants, 64.7% (n=224) had scored more than 50%, 25.1% (n=87) belonged to the 40% to 49% category, only one participant (0.3%) belonged to 10% to 19% category, and there were no individuals with less than 10% scored or more than 90%.The highest mean score of 60.6% (n=25, 7.3%; SD=13.5) for the knowledge was taken by the less than 30 years age category of doctors with a range from 25% to 82%. The lowest mean score of 54.9% (n=39; 11.3%; SD=17.9) was taken by the more than 50 years age category with a range from 10% to 86%. There was no statistically significant ($p = 0.39$) association with knowledge and the age categories. Of the study group 71.1% (n=246) had poor knowledge for the better management of MCIs following disasters. Knowledge categories were decided with the cut-off mark of 70% for each broad eight aspects of knowledge. Among the study group, less than 50% participants belonged to good knowledge category in the areas of overview of MCI (15.6%; n=54), emergency management (23.1%; n=80), triage and its purposes (39.9%; n=138), and media management (44.5%; n=154) during disasters. The highest percentage (69.9%; n=242) belonged to good knowledge category for documentation during management of MCIs (Table 1).

Table 1. Distribution of the study population by eight aspects of knowledge on management of MCIs

	Aspects of knowledge	Category	n (%)
1)	Overview mass casualty management	good	54 (15.6%)
		poor	292 (84.4%)
2)	Triage and its purposes during management of MCIs	good	138 (39.9%)
		poor	208 (60.1%)
3)	Emergency treatment during management of MCIs	good	80 (23.1%)
		poor	266 (76.9%)
4)	Dead-body management during management of MCIs	good	186 (53.8%)
		poor	160 (46.2%)
5)	Documentation during management of MCIs	good	242 (69.9%)
		poor	104 (30.1%)
6)	Resource management during management of MCIs	good	206 (59.5%)
		poor	140 (40.5%)
7)	Media management during management of MCIs	good	154 (44.5%)
		poor	192 (55.5%)
8)	Psycho-social support during management of MCIs	good	190 (54.9%)
		poor	156 (45.1%)

Out of the demographic characteristics of the study group, age categories, sex, professional grade, level of education and the working experiences at health sector were not significantly associated with good knowledge on management of MCIs. There was a statistically significant (p= 0.04) association between the knowledge and working place. Those who worked at first respondent units were more likely to have good knowledge than the workers who worked at other units with an Odds Ratio (OR) of 1.63 (95% CI: 1.02-2.61) (Table 2). Mean attitude score of the study group was 32.9 (SD=4.2) with a range from 20 to 40. The cut-off value for the demarcation of good and poor attitude categories was 35. A higher proportion of participants (72.5%; n=251) had poor attitudes (Table 2).

Table 2. Association of demographic characteristics of the study population and their knowledge on management of MCIs

Variable	Knowledge		Test of significant
	Good (n)	Poor (n)	
Age category (years) (N=344)			
Less than 30	7 (28.0%)	18 (72.0%)	
31 to 40	42 (25.9%)	120 (74.1%)	χ^2 (d.f.= 3, N=344) = 3.91
41 to 50	42 (35.6%)	76 (64.4%)	p = .27
51 & over	9 (23.1%)	30 (76.9%)	
Sex (N=346)			
Male	55 (34.0%)	107 (66.0%)	χ 2 (d.f.= 1, N=346) = 3.78
Female	45 (24.5%)	139 (75.5%)	p = .052
Grade (N=342)			
Preliminary	15 (26.8%)	41(73.3%)	
Grade 2	66 (30.7%)	149 (69.3%)	χ 2 (d.f.= 2, N=342) = 0.89
Grade 1	18 (25.4%)	53 (74.6%)	p = .64
Level of education (N=346)			
MBBS only	59 (26.0%)	168 (74%)	χ 2 (d.f.= 1, N=346) = 2.72
MBBS+ Pg. qualification	41 (34.5%)	78 (65.5%)	p = .09
Working experience in health sector (years) (N=343)			
1 to 5	16 (29.6%)	38 (70.4%)	
6 to 10 y	33(28.0%)	85 (72.0%)	χ 2 (d.f.= 3, N=343) = 0.88
11 to 20	39 (31.7%)	84 (68.3%)	p = .83
20 or over	12 (25.0%)	36 (75.0%)	
Working experience at THK (N=341)			
Less than 1	15(31.3%)	33 (68.8%)	χ 2 (d.f.= 2, N=341) = 0.19
1 to 5	79 (28.4%)	199 (71.6%)	p = .91
6 to 10	4 (26.7%)	11 (73.3%)	
Working place at THK (N=346)			
**Fist respondent units	60 (33.7%)	118 (66.3%)	χ 2 (d.f.= 1, N=346) = 4.12; p = 0.04*
***Other units	40 (23.8%)	128 (76.2%)	OR (95% CI) =1.63 (1.02-2.61)

* The χ2 is significant at the 0.05 level.

** Fist respondent units: [OPD, A&E, ICU, Theater]& Major Specialty wards: [Medicine, Surgery, Gynecology & Obstetrics and Pediatrics, Management units and Health Education Unit].
*** Others units [Lab, Blood Bank, Radiology unit, Cardiology, Thalassemia ward, Urology, Nephrology, rheumatology, ENT, Eye, Dermatology, Psychiatry, Neurology, Oncology, Oncosurgery, Plastic surgery, Gastroenterology, GI Surgery, Orthopedics ward, Nutrition and Sports medicine]

3.3 Attitude

There were statistically significant associations between the attitude and age where 41 to 50 years group was more likely to have good attitude than the 31 to 40 years group ((p= 0.034), OR = 1.75 (95% CI = 1.04 - 2.94)) (and more than 51 years age group (p= 0.014), OR = 3.15 (1.22 – 8.13)). There was no significant association with less than 30 years age group with any other age category. There was a statistically highly significant (p<0.001) association between attitude and knowledge on MCI management where the participants who had good knowledge were more likely to have good attitudes towards better management of MCIs following disasters with an OR of 7.80 (4.60-13.24) (Table 3). Good attitudes were not significantly associated with other demographic variables.

Table 3. Association of age categories and the attitude categories of the study population

Age (years)	Attitude category		Test of significant
	Good (n)	Poor (n)	
Less than 30	5 (11.1%)	20 (14.1%)	χ 2 (d.f. = 1, N=187) =.26
31 to 40	40 (88.9%)	122 (85.9%)	p = .61
Less than 30	5 (10.4%)	20 (21.1%)	χ 2 (d.f. = 1, N=143) =2.50
41 to 50	43 (89.6%)	75 (78.9%)	p = .11
Less than 30	5 (45.5%)	20 (37.7%)	χ 2 (d.f. = 1, N =64) =.23
51 & over	6 (54.5%)	33 (62.3%)	p = .63
41 to 50	43 (51.8%)	75 (38.1%)	χ 2 (d.f. = 1, N=280) =4.52; p = .034*
31 to 40	40 (48.2%)	122 (61.9%)	OR (95% CI) = 1.75 (1.04 - 2.94)
31 to 40	40 (87.0%)	122 (78.7%)	χ 2 (d.f. = 1, N=201) =1.54
51 & over	6 (13.0%)	33 (21.3%)	p = .21
41 to 50	43 (87.8%)	75 (69.4%)	χ 2 (d.f. = 1, N=157) =6.05; p = .014*
51 & over	6 (12.2%)	33 (30.6%)	OR (95% CI) =3.15 (1.22 - 8.13)

* χ 2 is significant at the .05 level.

3.4 Experience in managing disasters and Status of formal training

The proportion of participants in the study population who had experience in managing any type of disaster was 38.2% (n=132). Among them, only 12.1% (n=42) had previous experience in managing natural disasters, and 12.4% (n=43) had experiences in managing medical disasters. The highest proportion (26.3%; n=91) of the study population had experience in managing human-made disasters. Out of the study participants, the lowest proportion (1.7%; n=6) had experience in managing strife and the highest proportion (16.8%; n=58) had experience in managing RTA. There was no statistically significant association with prior experience in managing disasters with none of the demographic characteristics assessed on the study population. Out of the 132 doctors having prior experience, only 34.8% (n=46) had good knowledge and 30.3% (n=40) had good attitudes. There was no statistically significant association between experience and knowledge or attitudes of the study population. The proportion of participants in the study population who had undergone any type of formal training on management of disasters was 25.7% (n=89) and 6.9% (n=24) had participated in disaster drill/simulation exercise. A significant (p =0.03) proportion of males had received disaster management training than females (OR = 1.72 (1.05 - 2.80)). There was no statistically significant association with the status of the training received on disaster management and the other assessed demographic variables (Table 4).

Table 4. Association of the training received and demographic characteristics of the study population

Variable	Training		Test of significance
	Yes (n)	No (n)	
Age (years) (N=344)			
21 to 30	7 (28.0%)	18 (72.0%)	χ 2 (d.f.= 3, N=344) = 7.05
31 to 40	35 (21.6%)	127 (78.4%)	p = .07
41 to 50	39 (33.1%)	79 (66.9%)	
51 to 60	6 (15.4%)	33 (84.6%)	
Sex (N=346)			χ 2 (d.f.= 1, N=346) = 4.74
Male	50 (30.9%)	112 (69.1%)	p = .030*
Female	38 (20.7%)	146 (79.3%)	OR (95% CI) =1.72 (1.05 - 2.80)
Grade (N=342)			
Preliminary	12 (21.4%)	44 (78.6%)	χ 2 (d.f.= 2, N=342) = 1.86
Grade 2	60 (27.9%)	155 (72.1%)	p = .39
Grade 1	15 (21.1%)	56 (78.9%)	
Level of education (N=346)			
MBBS/equivalent only	55 (24.2%)	172 (73.8%)	χ 2 (d.f.= 1, N=346) = 0.51
MBBS + Postgraduate	33 (27.7%)	86 (72.3%)	p = .48
Experience in the health sector (N=343)			
1 to 5 years	10 (18.5%)	44 (81.5%)	χ 2 (d.f. = 3, N=343) = 5.87
6 to 10 years	30 (25.4%)	88 (74.6%)	p = .12
11 to 20 years	39 (31.7%)	84 (68.3%)	
More than 20	8 (16.7%)	40 (83.3%)	
Working experience at THK			
less than 1	10 (20.8%)	38 (79.2%)	χ^2 (d.f.=2, N=341) = .65
1 to 5	73 (26.3%)	205 (73.7%)	p = .72
6 to 10	4 (26.7%)	11 (73.3%)	
Working places (N=346)			
Fist respondent units	47 (26.4%)	131 (73.6%)	χ 2 (d.f. = 1, N=346) = 0.18
Other units	41 (24.4%)	127 (75.6%)	p = .67

* The χ 2 is significant at the 0.05 level

3.5 Association of the training with knowledge, attitude, and experiences on management of MCIs

There were statistically highly significant ($p<0.001$) associations between the training received on disaster management, knowledge, and attitudes where the participants who had good knowledge and good attitude were more likely to have had training on disaster management than those who had poor knowledge and poor attitudes with ORs of 7.32 (4.29 – 12.50) and 5.02 (2.97 – 8.46) respectively. Moreover, there was a statistically significant ($p<0.05$) association between the training received on disaster management and experience where the participants who had prior experience on disaster management were more likely to have had training than those who have not with an OR of 1.81 (1.11 – 2.96) (Table 5).

Table 5. Association of the training with knowledge, attitude, and experiences on management

		Training		
		Yes	No	Test of significance
		n (%)	n (%)	
Knowledge	Good	54 (61.4%)	46 (17.8%)	χ 2 (d.f. = 1, N=346) = 60.52; p < 0.001
	Poor	34 (38.6%)	212 (82.2%)	OR (95% CI) =7.32 (4.29 – 12.50)
Attitude	Good	47 (53.4%)	48 (18.6%)	χ 2 (d.f. = 1, N=346) = 39.91; p < 0.001
	Poor	41 (46.6%)	210 (81.4%)	OR (95% CI) =5.02 (2.97 – 8.46)
Experience	Yes	43 (48.9%)	89 (34.5%)	χ 2 (d.f. = 1, N=346) = 5.74; p = 0.017*
	No	45 (51.1%)	169 (65.5%)	OR (95% CI) =1.81 (1.11 – 2.96)

* The χ 2 is significant at the 0.05 level

3.6 Goals on management of MCIs following disasters

The highest proportion of participants (53.2%; n=184) did not have desired goals for mass casualty management. There was no statistically significant association with desired goals in managing disasters with none of the demographic characteristics assessed on the study population. However, there were statistically highly significant ($p<0.001$)

associations between the desired goals on disaster management and knowledge, attitudes and status of training received, where the participants who had good knowledge, good attitude and received formal training on disaster management were more likely to have desired goals on managing MCIs than those who had poor knowledge, poor attitudes and no formal training with ORs of 13.74 (7.35 - 25.70), 3.93 (2.36 - 6.54), and 7.02 (3.94 - 12.50) respectively. There was no statistically significant association with desired goals and the prior experience on managing MCIs following disasters (Table 6).

Table 6. Association of the goals with the knowledge, attitude, experiences, and the status of the formal training received

Variable		Desired goal		Test of significance
		Present (n)	Absent (n)	
Knowledge	Good	86 (53.1%)	14 (7.6%)	χ^2 (d.f. = 1, N=346) = 86.7; p < .001*
	Poor	76 (46.9%)	170 (92.4%)	OR (95% CI) =13.74 (7.35 - 25.70)
Attitude	Good	67 (41.4%)	28 (15.2%)	χ^2(d.f. = 1, N=346) = 29.6; p < .001*
	Poor	95 (58.6%)	156 (84.8%)	OR (95% CI) =3.93 (2.36 - 6.54)
Experiences	Yes	68 (42.0%)	64 (34.8%)	χ^2 (d.f. = 1, N=346) = 1.89
	No	94 (58.0%)	120 (65.2%)	p = .17
Training received	Yes	70 (43.2%)	18 (9.8%)	χ^2 (d.f. = 1, N=346) = 50.8; p < .001*
	No	92 (56.8%)	166 (90.2%)	OR (95% CI) = 7.02 (3.94 - 12.50)

* The χ 2 is significant at the 0.05 level

4. Discussion

Hospital is the key place to provide medical and psychological services out of all public health emergency response agencies. Medical staff members are the key characters involved during response to Mass Casualty Incidents (MCIs). The management of MCIs mainly depends on key determinants of emergency response capacity such as the knowledge, skills, attitudes and behavior of the medical staff and their capabilities. Knowledge and attitude on disaster management reflects the theoretical knowledge and beliefs, and behavior reflects practices and experience of the responders. Key determinants directly affect the capability of their response capacity. Exploring the response capacity and the capabilities of the responders has great significance in managing emergencies (Zhiheng et.al, 2012). Moreover, the individual level includes the knowledge, experience, training, attitudes and skills that allow each person to perform (UNISDR, 2009). Therefore, the individual level capacity was ascertained by assessing knowledge, attitudes, experiences, and training of doctors at a major healthcare institution on management of MCIs following disasters and the assessed capacity was reviewed against the desired goals.

The doctors are basically the first line managers because they take leadership role in different aspects in managing MCIs following disasters (Sathishka, 2016). They are the ones involved in coordination, triage, emergency treatment, documentation, communication, information management and dissemination of relevant information, and counselling of relatives of the victims and managing the deceased. Present study was a cross sectional descriptive study. The internal validity of the study was achieved by conducting among all doctors. There can be limitations in generalization of results to the doctors at other hospitals. A limitation of cross-sectional study is the inability to elicit a temporal relationship between goals and determinants of capacity hence inferences cannot be drawn about causality of association. The validity of the study is enhanced by selecting a study population on which complete and accurate information could be obtained (Hennekens, & Buring 1987). Data

were collected using a self-reported questionnaire, which might be subjective and could reflect personal bias.There is no proof of actual competencies in disaster management. The unwillingness of doctors to take part in this study resulted in a response rate of 89.9% (n=346). Lack of interest in participating in a disaster related study and time constraints were the most probable factors that affected for non-responders.For the analysis purpose, major specialty wards, acute treatment units, and management units were amalgamated as 'fist respondent units' during disasters and all other units as 'other units'. Because, according to the disaster preparedness and response plan of the institution, initial staff mobilization should be done from the major specialty units, ICU/Anesthesia and management unit doctors should help to coordinate the incident by managing information, communicating with stakeholders, and counselling the relatives as well as the victims.

4.1 Knowledge

A mass casualty incident is defined by Hsu and others, as 'disasters involving a significant human toll' (Hsu et. al., 2004). Moreover, any event resulting in a number of victims large enough to disrupt the normal course of emergency and health care services is another definition for MCIs (PAHO, 1995). Among the study population, only 15.6% had good knowledge on defining a mass casualty incident, which represents a very low percentage. In 2005, Jan and others have revealed that proper pre-event planning and mechanism for resource coordination are the main elements for the successful response during disasters. Collaboration and sharing of knowledge, information and expertise help the institution to build effective preparedness programs. Tagging of the triaged victims should be done to avoid confusion during MCIs (Jan et. al., 2005). Even though, the study group had good knowledge on resource coordination, they had poor knowledge on triage and emergency treatment. Frykberg (2004) pointed out that rapid and accurate triage is essential to minimize mortality among victims.In addition, Ozoilo and others (2013), have pointed out that effective triage by a trained physician is necessary to categorize the victims to achieve the desired goals of MCI management. In the present study, only 39.9% (n=138) belonged to the good knowledge category for the triage and its purposes. That shows the poor response capacity. Ozoilo and others (2013) have identified the challenges of management of MCIs as poor record keeping (including non-registration, non-documentation, and incomplete documentation) poor communication with public leading to tension, neglect of patients, suboptimal care, lack of subsequent care after resuscitation of the victims as well as the exhaustion of staff. Communication has been identified as a key component of disaster management and media management as well as coordination as other key components. During a disaster, existing ways of communication can be highly inadequate (Ozoilo et. al., 2013). When looking at the results of the present study, 69.9% (n=242) belonged to good knowledge category for accurate documentation during disasters. That helps for the better management of MCIs. In a study on capacity assessment for dead-body management following disasters in DGH Trincomalee, out of the study population of healthcare workers including doctors, 75.2% had more than average knowledge on dead-body management following disasters. In that study, doctors had a statistically significant ($p<0.01$) higher mean knowledge than minor employees but not with nurses' knowledge. There had been a statistically significant correlation ($p<.05$) between knowledge and training received. That study concluded that overall individual level capacity for "dead body management" among health care workers at District General Hospital (DGH), Trincomalee needs to be improved by

conducting capacity development programs (Rajapaksha, Vallipuranadan & Fernando, 2015). In the present study, only 53.8% (n=186) of doctors had good knowledge on dead-body management. That is most probably due to lack of experience of real time mass scale dead body management for doctors at THK than at DGH Trincomalee, where there was a mass fatality incident following Tsunami in 2004.During disaster, victims and survivors want leadership with immediate availability, psychosocial support, and high level of competency from the responders. The capacity and the capabilities differ from person to person. Therefore, knowledge assessment should be done as a first step to decide better-suited personnel. The American Association of Physicians' specialist includes planning and preparation, coordination, triage, assessment and treatment, communication, psycho-social support, public health issues, decontamination and PPE and ethical and legal considerations for the Board Certification Examination in Disaster Medicine (Guerdan, 2009). Therefore, the study tool was designed to assess broad essential areas of MCIs management.

4.2 Attitude

Attitudes were assessed in planning, preparedness and response phases in disaster management cycle. Attitudinal tool consisted of risk of disaster occurrence in the area, disaster plans to manage situations, regular update on plans, training and simulation on disaster management, prior preparation for disasters, responsibility of MCI management, identification of potential hazards likely to cause disaster during planning stage of the disaster management, regular conduct of drills to gain experiences for management of MCIs, training on emergency casualty management for all health care workers, coordination of post disaster activities and participation in disaster preparedness and response activities in the hospital.Present study indicates, if doctors have good knowledge and prior training, they are more likely to have good attitude. However, as health personnel, we are expected to improve our good attitudes with age, experiences and practices as well.

4.3 Experiences and training

As stated by Samuel Otim (2006), managing past knowledge from previous experiences of the decision making to future activity management can expedite the process of disaster management. According to an analysis of medical workers in Beijing, only 25.7% of respondents had participated in management of emergency, which indicated the poor response capacity of medical workers in China (Zhiheng et. al., 2012).The present study also shows similar results where there was 38.2% (n=132) of participants having prior experiences in managing disaster situations. That is because, 49.7% medical officers among the study population have experience of less than 10 years in the health sector and there were no mass scale disasters like Tsunami during the last 10 years in Sri Lanka, except post war casualties in 2009 and landslide at Meeriyabedda in 2014.Tsunami in 2004 was a catastrophic disaster with high fatality and casualties. Estimated deaths in Sri Lanka were more than 30,000 following tsunami and most of the deaths were reported in Eastern and Southern provinces of Sri Lanka. Although Sri Lanka had experienced different forms of disasters, the administrative and health sectors were simply not able to respond rapidly to the workload demands created by the tsunami because of inadequate capacity (Sumathipala, Sribandana & Perera, 2006).

For nearly 30 years up to 2009, Sri Lanka faced a major conflict between the Tamil Terrorists and the Sri Lanka Government mainly in North and Eastern provinces. Out of all participants, 26.3% (n=91) had experiences in managing human-made disasters including war casualties, casualties following strife and road

traffic accidents during their lifetime and 11.0% (n=38) of the study population had experience in managing disaster situation following terrorist attacks. Experience in the management of mass casualties leads to improved capacity to handle disaster situations. According to present study results, there was no significance association between experience and the knowledge (p = 0.06) or attitudes (p= 0.35), but in ideal situations, experiences improve the knowledge. Even though there was no statistically significant association, 38.2% of the study population with past experience can be the strength of the hospital. Hence, it is a favorable factor for capacity development. Frykberg (2004) has pointed out that because of the rarity of actual MCIs, experience from a real time event is the only reliable way to prepare for and implement the many unique elements during disaster response. Moreover, only $1/4^{th}$ (25.7%; n=89) had received any type of formal training on mass casualty management during their lifetime. A study in Guangdong Province, China, has revealed that about one-third of the respondents had never participated in training on emergency management and suggested most appropriate training methods as practical sessions. In addition, 78.4% medical staff of the study sample believed that there was a necessity to implement training for all medical staff. Thus, training plays an important role for the development of emergency response capacity (Zhiheng et. al., 2012).

Present study showed a statistically significant (p = .030) association of training received on disaster management with male sex. According to a study on perception of knowledge, skills and preparedness in Jordan among 207 health care workers including 56 physicians, males had better knowledge and better skills than females (Al-Ali & Ibaid, 2015). Evidence-based medical literature is lacking about the best methods to train healthcare providers in disaster response, and they found no conclusive evidence supporting a training and the good knowledge on disaster management (Williams, Nocera & Casteel, 2008). A pilot study by Guerdan on disaster preparedness and disaster management revealed that only 25% of the respondents had training and there was a significant difference in attitudes involving required training. In addition, 100% of physicians in the Florida sample felt that training on disaster management should be a requirement for the licensure of doctors(Guerdan, 2009).Furthermore, disaster drills and training programs are an important way to improve the level of preparedness of health care providers for management of emergencies (Al-Ali & Ibaid, in 2015). If there are frequent drills, impending problems can be picked up early and addressed in time. Another article revealed that, disaster drills are an effective way to evaluate the preparedness of the hospital for real time disasters and it provides opportunity to improve the past experiences (Jan et. al., 2005). According to the systematic review out of 21 studies on 'effectiveness of hospital staff MCI training methods', even though there is limited evidence, number of studies suggested that disaster drills could be effective in training hospital staff on disaster management. Existing evidence from that comprehensive review suggested that hospital disaster drills effectively allow health care workers to become familiar with disaster procedures, identify problems in areas of incident command, communication, triage, patient flow, materials and resource management, and crowd control etc. In addition, those provide the opportunity to apply lessons learned during the response during real time disasters (Hsu et. al., 2004).Importantly, access to resources and experiences that can develop individual capacity is largely shaped by the organizational and environmental factors, which in turn are influenced by the degree of capacity development in everyone (UNISDR, 2009).Lack of training of healthcare workers

can be directly associated with the reduction of the capacity to handle disaster situations. Therefore, training on mass casualty management will carry positive impact on capacity development.

4.4 Goals

The desired goals of managing disasters were described by the WHO, in 2007, as to minimize human suffering, by reducing morbidities, mortalities, disabilities, minimize the public health consequences by reducing damage to health care delivery services resulting from MCIs and maximum utilization of available resources at the health care institution. Marks were allocated in the current study according to the WHO standard goals. Even though there was no statistically significant association with desired goals and the prior experience, no one manages such incidents without a goal. If anyone is exposed to repeated experience, goals are more likely to become targeted. Frykberg (2004) has pointed out that the philosophy of the approach for managing MCIs has changed. The goal was 'to do greatest good for individual', which has changed to 'do the greatest good for the greatest number'.

4.5 Limitations and Implications

The present study is limited to one teaching hospital in Sri Lanka, and could partially reflect the situation in the country since medical officers are transferrable anywhere in the country. But, some of the results need to be further tested by research in different category of hospitals. Glow and others (2013) have concluded from a research on managing MCIs, that training is essential to have a well-coordinated response following disasters to overcome the challenges of the MCIs. That study revealed that the types of training and functional exercising they developed and implemented may be very effective in improving outcomes. A capacity assessment is needed to identify the priority activities required to overcome the temporary mismatch between demand and supply of care following a MCI, in view of developing the hospital preparedness capacity to respond effectively (DPRD, 2011). As stated by Al-Ali & Ibaid, in 2015, the WHO and the International Council of Nurses have recognized a worldwide urgent need of capacity building among healthcare providers in disaster management in order to achieve desired goals of management of mass casualty incidents. The present study provides important information about the existing capacity among doctors in a major healthcare providing institution at a given time. Results of the present study will help policy planners to initiate capacity building programs in line with the standards, guidelines and strategies.

5. Conclusion and Recommendations

The knowledge was inadequate for better management of MCIs following disasters and attitude among doctors regarding mass casualty management was unfavorable for better management. Experience also is inadequate and doctors with formal training on management of disasters was also insufficient. Lack of training of healthcare workers can be directly associated with the reduction of capacity to handle disaster situations. There were statistically highly significant ($p < 0.001$) associations between the desired goals, and good knowledge, good attitudes, and prior training. More than 50% of the study population did not have desired goals negatively affecting the management of MCIs. The results of this study showed a clear need for improvement of the overall individual level capacity in the aspects of knowledge, attitudes, experiences and training by conducting capacity development programs. Moreover, monitoring and evaluation should be done to assess the available disaster management related activities, disaster plan should be updated at least 4 yearly and simulation drills should be performed at regular intervals to improve the level of experience and awareness

of the components of the disaster plan and to achieve targeted goals.

Author contributions

Conceptualization and methodology: RMNUR, AB, CA, NV; Implementation: RMNUR, AB, SM; Original draft preparation: RMNUR; Review, and supervision: AB, CA, MSDW, SM, TT, YA

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Institutional Review Board Statement

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