

## **Nuclear Disaster Preparedness Level of Medical Responders in Pakistan**

Nadeem Ahmad Shah<sup>1</sup>, Naeem Shahzad<sup>1\*</sup>, Muhammad Sohail<sup>2</sup>

<sup>1</sup>Department of Disaster Management, National University of Sciences and Technology (NUST),  
Pakistan

<sup>2</sup>Pakistan Institute of Engineering and Applied Sciences, Pakistan

Naeem Shahzad\* (corresponding author), Tel no. +92-333-5144521, Fax no. +92-923-631343,  
naeemshahzad@mce.nust.edu.pk

Nadeem Ahmad Shah (first author), Tel no. +92-322-6868697, Fax no. +92-923-631343,  
[naddi1435132@gmail.com](mailto:naddi1435132@gmail.com) (MS student)

Word Count: 4654

No financial support was available for this study.

## **Abstract**

**Background:** Pakistan is a nuclear capable country in the region sharing borders with two other nuclear powers i.e., India in the East and China in the North East. This makes the area a “nuclear flash point”. It is therefore, imperative to have commensurating health care facilities to meet any eventualities. While Pakistan is trying to improve medical facilities for the people, but health care facilities are already overwhelmed by patients because of large population of the country. The study was conducted to evaluate the level of awareness/preparedness of medical responders against nuclear/radiological disasters in public hospitals in major cities of Pakistan.

**Methods:** A detailed questionnaire survey covering all the different aspects of the study was designed and discussed with the most concerned people including health care workers in the field of medicine, nuclear sciences and disaster management in Pakistan. It was adopted based on the early studies on the subject with necessary modification to fulfill the requirements at Pakistan’s level. Semi-structured interviews were also conducted with key personnel of different response agencies in Pakistan.

**Results:** Of 880 surveys, a total of 554 surveys were completed and collected from medical providers in different hospitals across the country. Medical responders included doctors, nurses and medical assistants from emergency and non-emergency departments. The medical responders were aware about the catastrophic consequences of nuclear disaster and were found willing to respond to these kinds of disasters voluntarily, but they were not satisfied with their level of preparedness/awareness about nuclear/radiological disasters.

**Conclusion:** Although medical responders had good educational background and knowledge in their specific fields and were found quite active and energetic in response against conventional injuries and natural disasters but in order to effectively respond to nuclear/radiological disasters a dire need was felt to enhance their level of knowledge/preparedness against unconventional disasters/injuries.

**Keywords:** preparedness, nuclear warfare, emergency medical services, disaster

## **Introduction**

Any disaster can be complicated to handle but a nuclear disaster requires even more complex management apparatus. We live in a world where nuclear weapon issues are on the front pages of our newspapers on a regular basis. Some people think that nuclear weapon destroy everything in the world with unimaginable damage to the life and infrastructure, while others think that they are not very much different from the conventional weapons. The reality is however, somewhere in between the two arguments. Nuclear weapons can cause immense damage and huge losses of life but the effects are still comprehensible on a human scale. It is also believed that the most destructive technology ever created by the human being is the invention of nuclear weapon. A conflict anywhere in the world, leading to use to nuclear weapons, would bring unavoidable and adverse destruction and human suffering. Magnitude of destruction represented by nuclear weapons is very difficult to imagine; a scale of violence that most people struggle to rationalize

- (1). In both Hiroshima and Nagasaki, 50 percent of the people within 1.2 kilometers (three-quarters of a mile) of the hypocenter died on the day of the explosion and 80-100 percent of those exposed at this distance eventually died from wounds or radiation inflicted by the bomb
- (2). After Chernobyl incident, approximately 5 million people in the region may have had excessive radiation exposure, primarily through internal contamination, as such Nuclear Reactor accidents can release a variety of radioisotopes into the environment
- (3). If a large scale nuclear war breaks out between the countries then the atmosphere would be contaminated with huge quantities of radioactive pollutants. These pollutants would be injected in the atmosphere through fires in urban and industrial centers, cultivated lands, forests and grasslands. The combined effect of lack of sunlight, frost and other adverse meteorological conditions would add

enormously to the already huge problems of the survivors. The presumed effect would be an extreme darkness in large areas and reduced crop growth and biospheric productivity (4).

Because of the tense relationship between the two nuclear armed neighboring countries i.e Pakistan and India, there are chances of nuclear escalation that can lead towards the catastrophic circumstances not only for the two countries but also for the South Asian region. Negative health effects will be gigantic and may exceed the normal handling capability of medical responders in the affected areas. In case of such troublesome incident, the demands on the medical system would be vast and overwhelming, all the more so because the nuclear disaster would have destroyed much of the capacity to respond. Furthermore, it is very important to assess the patients handling capability of hospitals and the knowledge of local medical providers about the negative health effects and the procedures to treat the patients effected with nuclear contaminations. Accumulated evidences about radiation health effects on atomic bomb survivors and other radiation exposed people have formed the basis for national and international regulations about radiation protection (5).

If the level of preparedness of health workers against nuclear disaster is not good then they can feel anxiety which can be reduced by maintaining coordination and cooperation with them (6).

After such a unique incident involving radiological or nuclear elements, people are expected to rush towards hospitals. All Emergency Departments (EDs) of hospitals must therefore have radiological emergency plan, tested through the vigorous and regular drills. Under these situations, medical responders must have clear understandings to treat the patients with conventional injuries first and then the radiological injuries (7; 8). The growing tension between Pakistan and India on the conflict of Jammu and Kashmir can lead to a limited war followed by

nuclear conflict between these two countries (9). US Secretary of Defence warned the world about the negative consequences of the nuclear exchange between the two countries, if it breaks out (10). Modeling of the India-Pakistan regional nuclear war suggests that the burning effects of nuclear disaster will create soot at extensive level and will have considerable negative effects on the climate (11).

It is therefore, very important for the countries to have a broad and balanced program of preventive and preparedness measures. It requires to improve intelligence and strengthen the emergency-services preparations and the public health system (12). The health consequences of the NBC (Nuclear, Biological, Chemical) agents possess a great priority than seen in the conventional injuries. The response against the NBC attack needs more collaboration between the responding agencies and the medical professionals. Against any nuclear terrorism event, the hospitals will be overwhelmed and the medical providers would be unable to handle the victims carrying nuclear contamination. It will result in increase in number of casualties and spread of contamination (13). Effective strategies including policy decisions, public education, efficient and elaborate medical preparedness and interventions are always required to deal with massive nuclear or radiological events (14). The training on handling of casualties affected by nuclear disaster is becoming an important part of education. The International Atomic Energy Agency (IAEA) has repeatedly requested the countries to prepare their emergency plans and conduct regular training sessions against nuclear emergencies (15).

The level of preparedness against nuclear disaster is not high in the world. After nuclear emergency, the main injuries inflicted on the people include thermal burns, trauma and radiation injuries. All these categories can result in the large number of casualties and may lead to great

loss of efficiency among the medical providers to handle the situation. The medical community is not fully knowledgeable and prepared to handle the casualties carrying nuclear contamination (16). Under present situations, it is very important to enhance the understanding at all levels about the preparedness against nuclear disaster. The main target of such studies should be the safety of medical first responders. These first responders will encounter the threat while facing all odds, so it is vital that these people are kept educated, motivated and fully aware about the situation. This study has therefore, tried to evaluate the present awareness/preparedness level of the medical first responder in Pakistan against nuclear/radiological disasters in public hospitals in major cities of Pakistan.

### **Materials and Methods**

Primary Data was collected through questionnaire surveys. A detailed questionnaire covering all the different aspects of the study was designed and discussed with professionals in the field of medicine, nuclear sciences and disaster management. The questionnaire survey was adopted based on the early studies on the subject with necessary modification to fulfill the requirements at Pakistan's level (16). The questionnaire was also pre-tested before it was disseminated for the data collection. It was distributed among medical responders in selected major public hospitals in Pakistan. The target groups for questionnaire survey were doctors, nurses and medical assistants. Besides questionnaire surveys, semi-structured interviews were also conducted with individuals of related field such as Rescue 1122 Emergency Service, National Disaster Management Authority (NDMA) and National Health Emergency Preparedness and Response Network (NHEPRN). These people have an impact on the decision-making process at different levels at

varying degrees. These individuals were interviewed subject to their relevancy and relativity to the study and their availability and access of the researcher.

Constructive interactions with concerned departmental heads and related experts were conducted by visiting them in offices / departments. An evaluation and interpretation of the data was carried out through direct and structured techniques to accomplish the purpose of this study.

## **Results**

The survey was conducted in major public hospitals in Pakistan, which included provincial capitals. These cities included Islamabad/Rawalpindi, Lahore, Peshawar, Quetta and Karachi. This initiative was focused upon identifying the concepts and principles of the medical responders for clinical management of casualties during nuclear and radiological disasters and the resulting public health emergencies. A total of 880 questionnaires were distributed among the medical responders resulting in 554 (62.9%) respondents completing the questionnaires correctly. Moreover, 76 surveys (8.6%) were found incomplete and not included in the survey results, while 28.4% did not respond.

## **Demographics**

Demographic distribution in the study maintained almost equal representation of doctors, nurses and medical assistants who were 36, 35 and 29%. Almost half of the responders (48%) were young between 20-30 years of age, while, 45% of responders were between 30-40 years who were found to be more experienced and educated in their fields. The survey showed that almost half of the respondents were graduates, 6 % held diplomas in medical emergency management, 22% were undergraduates, while 21% had post graduate qualifications.

During the survey, one city from each province i.e Provincial capital city were selected to assess the response. It was found that 24% of respondents belonged to Karachi, 24% from Lahore, 20% from Peshawar, 12% from Quetta and 20% respondents from Islamabad/Rawalpindi. **(Figure 1).**

### **Knowledge about Nuclear / Radiological Contamination Risks**

In relation to the number of courses taken with specific radiological and/or nuclear content; 86% never took a single course on nuclear emergency management, 11% had taken one course, 2% had taken two to four courses, and 1% had taken five or more courses. **(Figure 2)**

The study established that 76% of medical responders had knowledge on the symptoms on people affected with Acute Radiation Syndrome. Almost half (50%) of medical responders were aware about different levels of PPE (Personal Protective Equipment) while majority of the medical respondents (87%) were aware about the requirement and importance of the decontamination of patients arriving in hospitals after a nuclear/radiological disaster.

During survey, medical responders were asked about the type of decontamination they would prefer if they have to do it on the affected people before starting medical treatment. The results revealed that 47% respondents preferred to remove clothing as an option of decontaminating a patient. However, 35% respondents favored the use of any decontamination solution on the patients before starting any treatment. The number of respondents who opted to rinse patients with water was 13%. However, 5% of medical respondents were of the view that there is no need of decontamination and to treat the patients as a normal case. **(Figure 3)**

### **Responders on Radiological/Nuclear Decontamination**

To know the level of awareness of medical responders on types of injuries to the victims after nuclear/radiological incident, they were given different options to choose based on the severity



of the injuries. The survey revealed that 49% respondents selected burn injuries as the most dominant and more severe among all other injuries after nuclear detonation; followed by radiation injuries (39%), psychological injuries (7%) and laceration (scratch) injuries (5%) in the descending order. **(Figure 4)**

After a nuclear incident, victims may be contaminated with radioisotopes that are harmful to other individuals caring for these types of patients. During the survey, medical respondents were asked to estimate their risk of exposure to nuclear contamination while handling such patients. The survey found that 46% of respondents thought that their own exposure while handling a contaminated patient, will be high, followed by moderate level of exposure (34%), low risk of exposure (6%) and no risk of contamination (7%). There was also a group of medical responders' i.e 7%, who was not clear about the level of exposure they might have in handling these kinds of victims. **(Figure 5)**

Based on their educational qualification, nature of duty and number of courses undertaken during their service, medical responders were asked about their level of confidence in handling patients carrying nuclear contamination. It was found that 43% of medical responders were confident, followed by "highly confident" (24%) and "not confident" (24%). However, 9% of respondents did not know the level of their confidence to handle contaminated patients. **(Figure 6)**

The respondents were also asked about their basic knowledge of medical responders as per their understandings on CBRN (Chemical, Biological, Radiological, and Nuclear) threats, which were categorized under four events, based on "the catastrophic nature" of these events. It was established that majority of respondents, (60%), thought Nuclear disaster as the most devastating

event, followed by radiological disaster (26%), biological disaster (10%) and chemical disaster (4%), in a progressively decreasing order.

Sequel to the previous question in the survey, medical responders were further asked to rank these four disasters (Chemical, Biological, Radiological, and Nuclear) based on “the level of difficulty” to handle these disasters. Correspondingly, the highest ranking was given to nuclear disaster (65%), followed by radiological disaster (16%), chemical disaster (11%) and biological disaster (8%), in a steadily decreasing order. **(Figure 7)**

The surveys revealed that 83% respondents were aware about the medical effects of nuclear/radiological disaster on human body and 60% of responders had studied medical effects of nuclear bomb attack on the people of Hiroshima and Nagasaki. However, only 22% of medical responders were trained to handle the patients affected with nuclear contamination.

### **Willingness to manage contaminated Patients**

Medical responders were asked about their willingness to treat patients in the time of need after nuclear incident, even if they are not trained in this field. In response to this question, 80% of medical responders showed their willingness to treat the patients under these disastrous situations. When asked about their willingness to be a part of an emergency response team to treat the casualties affected with Nuclear/Radiological contamination/effects in the affected area, 90% of responders showed their willingness to become a part of emergency response teams, voluntarily. In order to ascertain their willingness to work at their workplace after nuclear/radiological disaster, 79% of responders showed their willingness to continue working at workplace and were ready to treat the patients even after nuclear/radiological emergency in the area.

## **Familiarity with Disaster Management System in Pakistan**

In order to know the level of awareness, medical responders were asked about their familiarity with the disaster response teams in the country. It was found that 56% of medical responders were aware about response teams in the country/province. It was further found that 49% of medical responders were aware about the role and task of NDMA.

There are different emergency response agencies/authorities working in the country. During the survey, when medical responders were asked as to which agency they thought will respond first to give medical assistance in case of nuclear disaster/emergency, the highest ranking was given to Military (39%), followed by 1122 Emergency Services (23%), National Disaster Management Authority/Provincial Disaster Management Authority (22%), and Edhi/Chhipa (16%).

In continuation of the previous question, medical responders were further asked “Which disaster response team will act as first responder, following a nuclear disaster in Pakistan? The survey revealed that 48% of the respondents thought that Military will be the first responder after nuclear/radiological disaster, followed by 1122 emergency services (29%), NDMA (19%) and International organizations (4%) in a progressively decreasing order. The survey also found that only 12% of medical responders served as a part of disaster/emergency response teams in Pakistan.

## **Semi-structured Interviews**

In addition to the questionnaire survey among medical responders in hospitals, semi-structured interviews were also conducted with responsible persons in different departments to know the capability level of these departments/agencies to effectively respond to nuclear/radiological

events in the country. These departments/agencies included NDMA, Rescue 1122 emergency service and NHEPRN.

## **NDMA**

NDMA is the main response agency in Pakistan, responsible to respond after any kind of disaster in the country. At federal level it acts as the implementing, coordinating and monitoring body for disaster management. At provincial level, Provincial Disaster Management Authority (PDMA) works as the main disaster response authority that also helps and assists District Disaster Management Authority (DDMA) at district level. During one of the interview it was revealed that NDMA is striving very hard to implement, coordinate and monitor activities to manage disasters in the country. However, the level of preparedness against nuclear/radiological disaster in the country is not high. The main emphasis of this authority is towards the management of natural disasters in the country. Nuclear/radiological disasters are not common, so the preparedness against such kind of disasters is limited to only few dedicated organizations / agencies in the country.

## **Rescue 1122 Emergency Service**

The emergency service is providing help to the community in emergencies like medical, fire, bomb blast, building collapse, road traffic accident, drowning, flood relief operations, land sliding etc. In semi-structured interview it was found that rescuers are not aware how to respond after nuclear/radiological emergencies. Under present level of awareness/training, the rescuers will become victims to the radiation/nuclear contamination in the area, if they choose to respond

first. The study reveals that the rescuers do not have the basic knowledge of nuclear/radiological disaster.

## **NHEPRN**

The study revealed that NHEPRN works to establish a network among different agencies responding after health emergencies. It was found that NHEPRN does not have any contingency plan to counter the negative health effects of nuclear/radiological disaster in the country. Although, NHEPRN also conducts training on Emergency Life Support Skills (ELSS) and Basic Life Support (BLS), however, it does not have effective communication channels to respond to any health emergency resulting from nuclear/radiological disaster.

## **Discussions**

Nuclear disasters are not common in the world and less emphasis is given towards enhancing the level of preparedness/awareness and training. Emergency services and the disaster response teams are more inclined towards preparedness against conventional forms of disasters (earthquake, floods, cyclones, fire incident, road accidents etc) which are more common in their areas. The results of present study can be summarized in Table below:-

The Study revealed that medical responders were interested to learn more about this kind of disaster as they think it can happen in their region. Most of the respondents in the questionnaire survey were very young (Age group 20-30 years) and responded efficiently with great enthusiasm and interest. Almost half of the respondents had graduate degrees in medical and

other related fields and were quite aware about the importance of geographical location of Pakistan and the chances of nuclear escalation in the region. A good number of respondents had post graduate degrees and generated good discussion on the importance of enhancing the level of preparedness among medical responders and the response agencies against nuclear/radiological disasters in the country.

The respondents were from both the emergency and non-emergency departments in the hospitals. The study revealed that 85% of the respondents did not attend a single course related to nuclear/radiological safety or treatment of contaminated patients. Courses in this field are not common and very few people were moderately qualified to handle patients after such a disaster. This kind of response regarding training/knowledge of medical responders may lead to dangerous consequences after any nuclear disaster as under such circumstances the medical responders may themselves become victims compromising the already overstretched health care systems. It was found that less emphasis is given on training of medical personnel to treat casualties from nuclear and radiological events. Although a large number of respondents were aware of the signs and symptoms of victims after nuclear incident but were not confident in treating such patients. Most of those people who got basic training were also uncertain about their abilities to respond effectively at the time of need. This appears to be a lack of practical training and refresher courses. With the passage of time, the limited theoretical knowledge on handling patients after nuclear incidents will result in further loss of knowledge. Around 50% of the medical responders were aware about different levels of PPE. Majority of the medical responders knew the importance of decontamination of patients and its significance after nuclear disaster to avoid spread of contamination; however knowledge on procedures of using PPE under such circumstances was not sufficient. This is because of less emphasis on the use of these kinds

of protective equipments and may result in self contamination of medical personnel, if not properly utilized.

The study further found that the medical responders had good basic understanding about the different types of possible injuries resulting from a nuclear detonation. During the study, it was revealed that majority of the medical responders (46%) thought that their chances of getting contamination from affected people are high.

The study also found that 43% of the respondents were confident to handle nuclear contaminated patients effectively but could not explain the reason behind their confidence to handle these kinds of events. Most of the people, who were confident to handle nuclear disaster, were not well trained. Their high level of patriotism and commitment to their profession brought confidence in them. One might surmise that over confidence to handle patients contaminated with nuclear contamination can result in self contamination as well. The knowledge and level of awareness of medical responders was also assessed on the disastrous nature of four unconventional disasters i.e CBRN (Chemical, Biological, Radiological, and Nuclear). Most of the respondents (60%) thought that nuclear event will be most disastrous in term of physical damage and of human lives fatalities. When asked about the level of training to handle the nuclear/radiological affected patients, 22% of the responders were found trained to some level. A large number of respondents volunteered themselves to treat patients if required after any nuclear contingency. They also volunteered their services to become part of any emergency team after nuclear/radiological incident in the area. Most of the medical responders showed their willingness to continue working at their workplace after nuclear incident, to treat nuclear contaminated people even at the risk of their own lives. History shows that people of Pakistan are highly resilient against all

the different types of disaster and manage to handle disasters/emergencies effectively. This is their high level of patriotism and commitment. The present study also finds that medical providers were found willing to volunteer their services at the time of need.

It was also found that majority of the respondents were aware about different disaster response teams/agencies in Pakistan. The study revealed that 39% of medical responders were of the view that the first medical response after nuclear disaster would be given by Pakistan Military and almost half (48%) of the respondents thought that Pakistan Military would be the first responder after such eventuality in the country. These results indicate the importance of role of the military in all the different kinds of disasters in Pakistan. Pakistan military has volunteered their services to different types of disasters in the country over the last many decades. Kashmir earthquake in 2005 is one of the recent example in this regard (17). One of the reasons of successful conduct of rescue after Kashmir earthquake in 2005 is the efficient role of Pakistan Military and great level of coordination between civil and military establishments during humanitarian assistance in the area (18). The study found that majority of the medical respondents in the survey had never been a part of any disaster/emergency response team. As the study focuses only on the awareness/preparedness level of the medical first responders, the capabilities of Pakistan Military in this context have not been discussed here.

## **Conclusion**

The complex nature of today's disasters, particularly the Weapons of Mass Destruction (WMDs) have increased need for multidisciplinary medical response. Nuclear/Radiological disasters have medical and public health consequences at enormous level. Medical responders in Pakistan are not appropriately trained against such events and are, therefore, not confident to handle disasters



of high magnitude, despite high level of motivation and dedication. Pakistan military, being the most disciplined organization in the country, responds first against all kinds of disasters. But the major responsibility should be borne by the different response agencies present in the country which seems to be more inclined towards handling recurring disasters in the country. The level of knowledge and handling capability of all these response agencies against nuclear disaster may be enhanced to effectively respond, when required. For this purpose, as a start, the medical first responders may be encouraged and incentivized to complete World Health Organization (WHO) online courses. Moreover, assistance may be sought from WHO for policy advice and technical support for national health authorities on preparedness, response, recovery and long-term follow-up for populations.

### **Funding**

No funding source was provided for this research work

### **Declaration of interests**

We declare no conflict of interests

### **Approval from ethics committee**

Ethical approval for this study was not required in accordance with local legislation and national guidelines

### **Authors Contributions**

Nadeem Ahmed Shah is the main author of this study. He was involved in data gathering and preparing the draft of the paper.

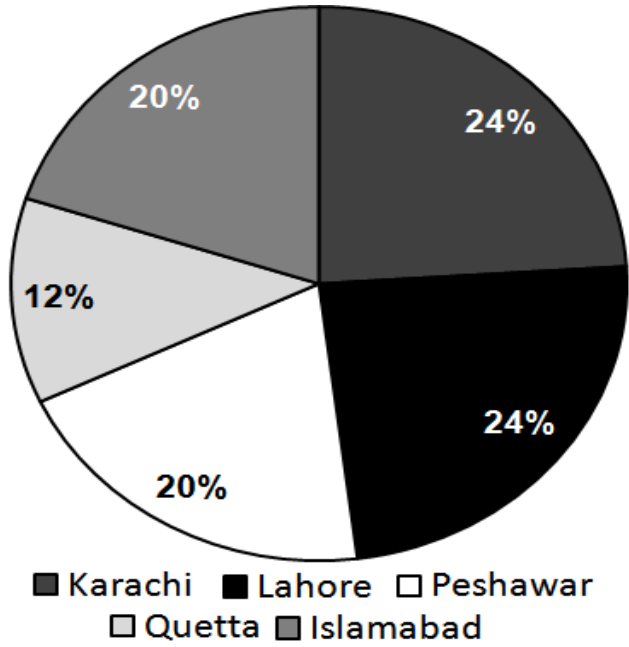
Naeem Shahzad was involved in overall guiding and conducting this study and improving the draft.

Muhammad Sohail was involved in vetting the final draft of this paper

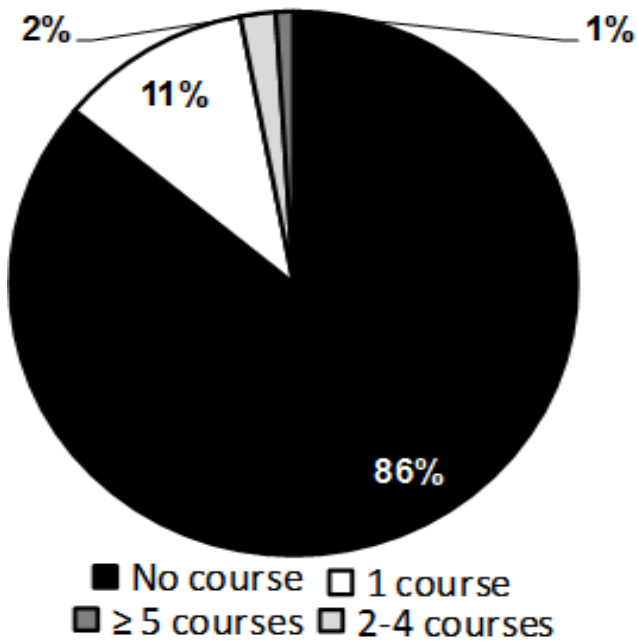
## References:

1. Ritchie N. 2014. The Story So Far: The Humanitarian Initiative on the Impacts of Nuclear Weapons. *White Rose Research Online, UK*
2. Selden KI, Selden M. 2015. *The Atomic Bomb: Voices from Hiroshima and Nagasaki: Voices from Hiroshima and Nagasaki*. Routledge
3. Christodouleas JP, Forrest RD, Ainsley CG, Tochner Z, Hahn SM, Glatstein E. 2011. Short-term and long-term health risks of nuclear-power-plant accidents. *New England Journal of Medicine* 364:2334-41
4. Crutzen PJ, Galbally IE, Brühl C. 1984. Atmospheric effects from post-nuclear fires. *Climatic Change* 6:323-64
5. Hasegawa A, Tanigawa K, Ohtsuru A, Yabe H, Maeda M, et al. 2015. Health effects of radiation and other health problems in the aftermath of nuclear accidents, with an emphasis on Fukushima. *The Lancet* 386:479-88
6. Hick JL, Weinstock DM, Coleman CN, Hanfling D, Cantrill S, et al. 2011. Health care system planning for and response to a nuclear detonation. *Disaster medicine and public health preparedness* 5:S73-S88
7. Bushberg JT, Kroger LA, Hartman MB, Leidholdt Jr EM, Miller KL, et al. 2007. Nuclear/radiological terrorism: emergency department management of radiation casualties. *The Journal of emergency medicine* 32:71-85
8. Van Dyke ME, McCormick LC, Bolus NE, Pevear J, Kazzi ZN. 2013. Radiological emergency preparedness: a survey of nuclear medicine technologists in the United States. *Journal of Nuclear Medicine Technology* 41:223-30
9. Raghavan V. 2001. Limited War and Nuclear Escalation in South Asia. *The Nonproliferation Review* 8:82-98
10. Winner AC, Yoshihara T. 2002. India and Pakistan at the Edge. *Survival* 44:69-86
11. Borrie J, Caughley T. 2014. *An illusion of safety: Challenges of nuclear weapon detonations for United Nations humanitarian coordination and response*. UNIDIR
12. Falkenrath RA. 1998. Confronting Nuclear, Biological and. *Survival* 40:43-65
13. Kenar L, Karayılanoğlu T. 2004. A Turkish medical rescue team against nuclear, biological, and chemical weapons. *Military medicine* 169:94-6
14. Gale RP, Baranov A. 2011. If the unlikely becomes likely: Medical response to nuclear accidents. *Bulletin of the Atomic Scientists* 67:10-8
15. Davari F, Zahed A. 2015. A management plan for hospitals and medical centers facing radiation incidents. *Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences* 20:871
16. Dallas CE, Klein KR, Lehman T, Kodama T, Harris CA, Swienton RE. 2017. Readiness for radiological and nuclear events among emergency medical personnel. *Frontiers in public health* 5:202
17. Madiwale A, Virk K. 2011. Civil–military relations in natural disasters: a case study of the 2010 Pakistan floods. *International Review of the Red Cross* 93:1085-105
18. Thompson WC. 2010. Success in Kashmir: a positive trend in civil–military integration during humanitarian assistance operations. *Disasters* 34:1-15

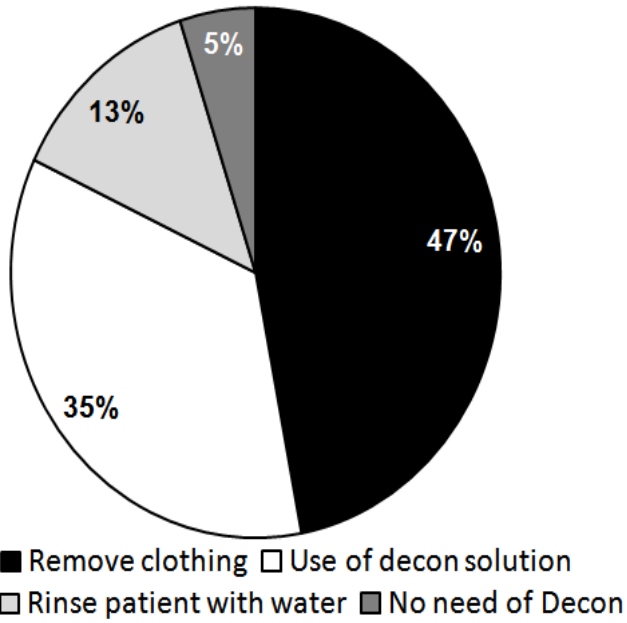
**FIGURES**



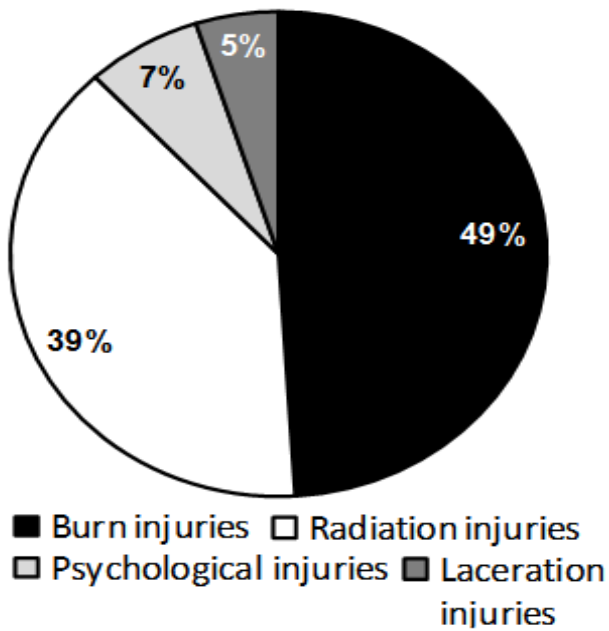
**FIGURE 1:** Participation of Responders from different cities



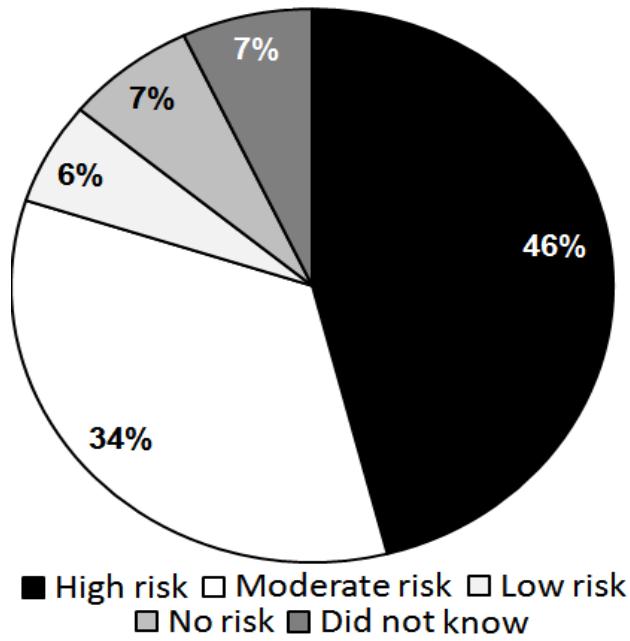
**FIGURE 2:** Number of courses taken by medical responders on Nuclear/Radiological management of patients



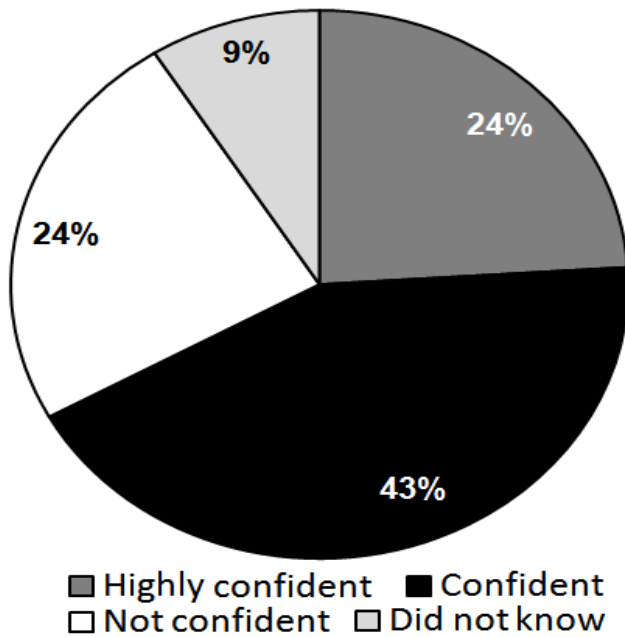
**FIGURE 3:** Level of Knowledge of Medical Responders on Radiological/Nuclear Decontamination



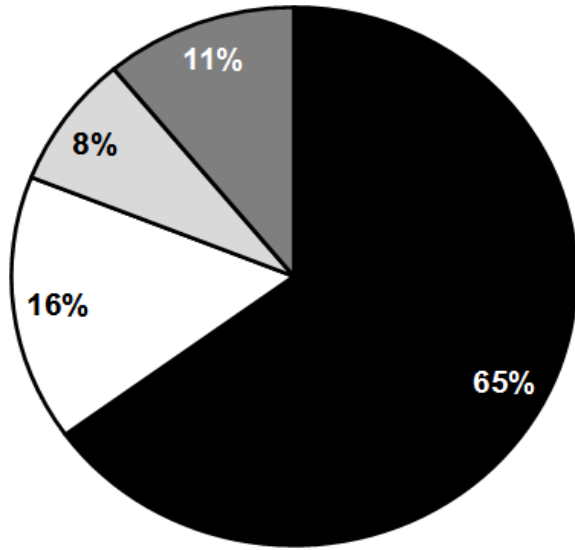
**FIGURE 4:** Level of Knowledge of Medical Responders on types of Injuries after Nuclear/Radiological incidents



**FIGURE 5:** Level of Knowledge of Medical Responders on Risks of self contamination while handling the contaminated patients



**FIGURE 6:** Level of confidence among medical responders in handling the Nuclear/Radiological contaminated patients



■ Nuclear disaster □ Radiological disaster  
□ Biological disaster ■ Chemical disaster

**FIGURE 7:** Ranking of Disasters with respect to difficulty in handling by medical responders

**TABLE**

**Table 1:** Summary of findings

<b>Field of Responders</b>	<b>Medical</b>
<b>Level of Education of responders</b>	Fairly Good
<b>Courses attended on Nuclear/Radiological</b>	Only few
<b>Practical Knowledge</b>	Not Good
<b>Level of knowledge on Decontamination</b>	Reasonably Good
<b>Level of Knowledge on type of Injuries</b>	Fairly Good
<b>Level of Knowledge on self contamination</b>	Satisfactory
<b>Experience level</b>	Nil
<b>Confidence level</b>	Good
<b>Level of Preparedness</b>	Not Good
<b>Risk Assessment</b>	Nuclear Disaster as most disastrous in nature
<b>Knowledge about Response agencies in Pakistan</b>	Good
<b>Main First Responder Agency in Pakistan</b>	Pakistan Military
<b>Semi-Structured Interviews</b>	
<b>NDMA</b>	More Emphasis on handling natural disaster
<b>Rescue 1122</b>	Emphasis on Conventional Emergency Services
<b>NHEPRN</b>	Not ready to handle health impact of nuclear disaster