



Original Article



Knowledge and Preparedness Regarding Chemical, Biological, Radiological and Nuclear (CBRN) Warfare among Doctors and Medical Students at Combined Military Hospital CMH Lahore Medical College, Lahore, Pakistan

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ABSTRACT

Chemical, biological, radiological and nuclear-related disasters have become increasingly common all around the world. **Objectives:** To assess the knowledge and preparedness regarding chemical, biological, radiological and nuclear Warfare among Doctors and Medical students at Combined Military Hospital Lahore Medical College. **Methods:** In this descriptive cross-sectional study, 311 respondents participated from November 2022 to May 2023. Non-probability convenience sampling technique was used. Data were analyzed on SPSS version 26.0. **Results:** The study revealed a significant knowledge gap regarding chemical, biological, radiological and nuclear warfare. Almost 290 participants had never encountered the term 'chemical, biological, radiological and nuclear' signifying a substantial lack of awareness. Furthermore, a slightly higher knowledge gap was observed among female participants, although this difference did not reach statistical significance (p -value=0.07). Additionally, students in their 3rd, 4th, and final years of medical college demonstrated a more comprehensive understanding of chemical, biological, radiological and nuclear compared to those in their initial years of study (p -value=0.008). **Conclusions:** It was concluded that there is a significant knowledge gap about chemical, biological, radiological and nuclear Warfare and its management among medical professionals. A very low percentage of professionals were properly trained in chemical, biological, radiological and nuclear emergency management. Respondents stressed the inclusion of chemical, biological, radiological and nuclear emergency management training in the curriculum. These findings suggest that proper provision of knowledge, and training related to these disasters is inevitable for timely management and future risk reduction from such events.

INTRODUCTION

Chemical, biological, radiological and nuclear (CBRN) weapons have the potential to cause significant mass destruction and pose a threat to public health and safety. Although CBRN events are rare but are consistently seen in the past. Technological advancement can potentiate their use. The effects of CBRN agents depend on a multitude of factors such as the type of agent, the dose and the concentration of the agent. There have been 565 individual CBRN incidents around the world from 1990-2020, causing a significant number of morbidities and mortalities [1]. Basic and prompt actions taken effectively by the first responders are of utmost importance in the CBRN chain of

survival. Competent healthcare providers are inevitable for the prompt response, and management of these incidents, in terms of reduction in CBRN-related morbidities & mortalities but also their protection [2]. Over time many events have put the risk of CBRN terrorism on the rise; the 1995 Tokyo subway sarin (nerve gas) attack was done in peacetime as a weapon of mass destruction [3]. Intentional distribution of Bacillus anthracis spores through the postal system in 2001 caused 22 cases of Anthrax, and five mortalities in America and changed the domain of public health [4]. Nuclear & radiological emergencies are among the highest priority risks.



Education about protective behaviour is essential to combat mortality associated with these incidents. Lack of preparedness is significantly associated with fatalism [5]. Unfortunately, there is a concerning lack of preparedness internationally. Healthcare providers need to enhance their knowledge so that they can respond adequately to CBRN emergencies. Their willingness to respond, knowledge & competence are the main prerequisites for prompt management and risk reduction [6]. After World War II many countries have embarked on nuclear arms and by the end of 2022, 1300 nuclear warheads were possessed by nine countries. Nuclear weapons destroy on a vast scale and jeopardize the environment for future generations. [7]. Since we have a history of conventional wars with our neighboring countries, Pakistan believes in no first use of nuclear weapons and declares that they would be used only if the conventional means failed [8]. With the growth of global terrorism and rapid advancements in the field of science, the threat of chemical, biological, radiological and nuclear attack remains imminent. Healthcare professionals must be prepared to deal with such casualties to minimize mortality. In the wake of the present global situation, the knowledge and preparedness of first responders matter a lot and need to be enhanced to deal with CBRN emergencies [9]. There is a lack of research regarding the knowledge and preparedness of healthcare professionals in Pakistan in case of a CBRN attack. So, the rationale of our study is to find out the knowledge gap among medical professionals, as they are the first-line responders for any CBRN emergency. These agents have become increasingly common all around the world. With terrorism on the rise, healthcare professionals must have the knowledge and training and be able to perform efficient emergency management.

This study aims to assess the Knowledge and preparedness regarding CBRN Warfare among Doctors and Medical students at Combined Military Hospital (CMH) Lahore Medical College.

METHODS

This cross-sectional study was conducted at CMH Lahore Medical College using a non-probability convenience sampling technique. Data collection took place between November 2022 and May 2023. The inclusion criteria were participants who fully completed the questionnaire. Undergraduates, graduate trainees and doctors of CMH Lahore Medical College were eligible to participate. Participants who submitted incomplete questionnaires were excluded. Verbal consent was taken. Answering the questionnaire means that the respondents agreed to participate. Confidentiality and anonymity were ensured. Ethical approval was taken from the Institutional Review Board (648/ERC/CMH/LMC). The questionnaire was designed based on a thorough literature review. Cronbach's alpha value was 0.78. It included socio demographic

information (age, gender, academic level, and further qualifications), CBRN knowledge, and preparedness levels. The participants' level of knowledge and preparedness was assessed using a 10-point ordinal scale. Additionally, a 9-item quiz containing theoretical questions was included to evaluate the participants' understanding of CBRN Warfare. Sample size was calculated through WHO statistics calculator, based on 5% margin of error and 95% confidence level. Statistical analysis was carried out using SPSS version 26.0. Chi-square test of significance was used to see association between level of education and CBRN knowledge and ability to deal with emergencies. $p < 0.05$ was considered statistically significant (Figure 1).

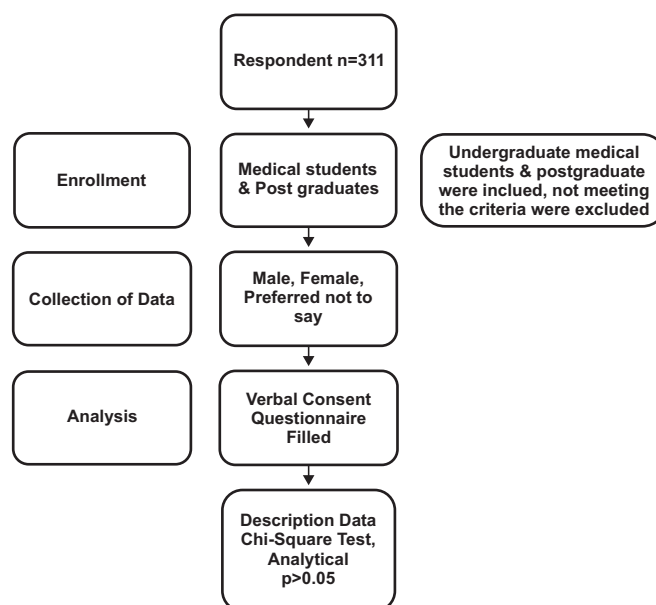


Figure 1: Graphical Presentation

RESULTS

In this study, we surveyed 311 medical students and doctors affiliated with CMH Lahore Medical College and Hospital to evaluate their knowledge of CBRN (Chemical, Biological, Radiological, and Nuclear) warfare. The mean age of the respondents was 19.96 years \pm 1.9 SD. The range of age was (17-28 years). Out of 311 respondents, 96 (30.9%) were in their first year, 42 (13.5%) were in their second year, 35 (11.3%) were in their third year, 89 (28.6%) were in their fourth year, 38 (12.2%) were in final year and 11 (3.5%) were postgraduate students. 300 were MBBS students, 3 were fellows of the College of Physicians and Surgeons (FCPS), 3 were MPhil, and 5 had postgraduate degrees in other specialities. Among the participants, 167 (53.7%) were male, 141 (45.3%) were female, & 3 (1%) preferred not to say, all of whom completed the questionnaire (Figure 2).

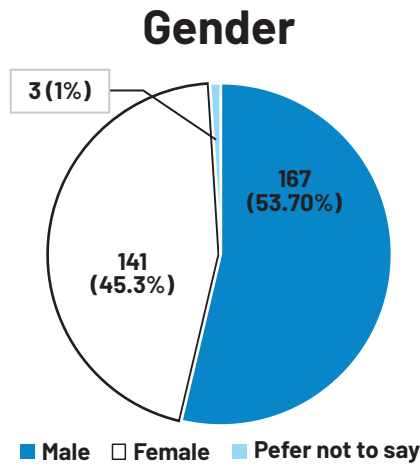


Figure 2: Gender Distribution

Surprisingly only 22(7.1%) heard the term CBRN, and 289(93%) out of the 311 respondents had not previously heard before entering into the medical profession, indicating a significant knowledge gap in this area (Figure 3).

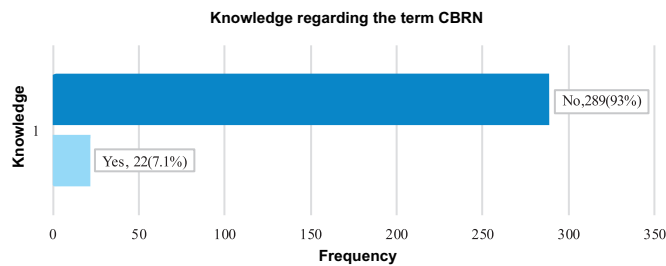


Figure 3: Level of Knowledge Regarding CBRN Warfare

There was a slightly greater knowledge deficit among females than male, the difference did not reach statistical significance (p-value: 0.07) (Figure 4).

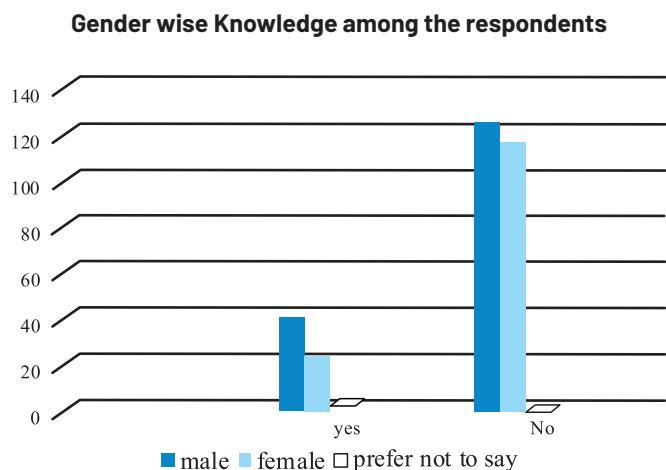


Figure 4: Knowledge About CBRN among Male and Female Students

Students in their 3rd, 4th, and final years exhibited a more substantial understanding of CBRN when compared to those in their initial years of study, and postgraduates had better knowledge regarding CBRN, p=0.008 (Figure 5).

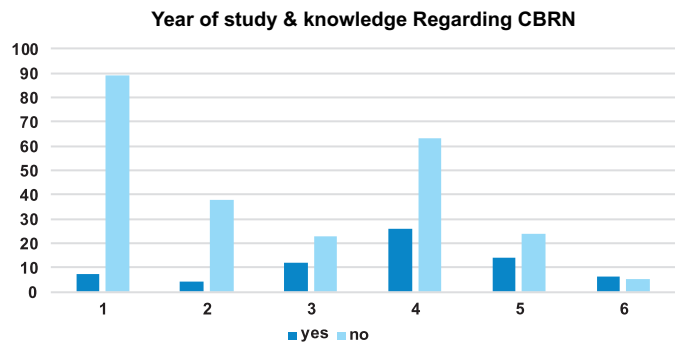


Figure 5: Comparison of Knowledge among Different Professional Levels

Sixty-eight (21.9%) respondents exhibited awareness regarding CBRN warfare; after joining the medical profession, while 243(78.1%) were still unaware of it. Out of 68 respondents who were aware of the term, 21(6.8%) knew, & proper training in emergency management. Out of 300 medical students, 112 (37.3%) wanted to become physicians, 51 (17%) wanted to excel in emergency medicine, and 148 (49.3%) showed interest in other specialities. Sixteen (5.1%) lived within a 20 km radius of a nuclear or chemical installation, and 291 (93.6%) did not. Twenty-five (8.0%) were involved in disaster management beyond their military and medical careers, 286(91.9%) were not. Regarding inclusion of CBRN training in the curriculum, which should prepare the graduates to deal with such incidents; 162(52.1%) strongly agreed, 36(43.7%) felt it should, and 13(4.2%) considered it unnecessary. Only 30 (9.6%) respondents knew how to respond to patients affected by chemical chain collisions. 289 (90.3%) did not. Regarding iodine tablets preventing internal radiation; 96 (30.9%) answered correctly. Out of which 52 (31.1%) were male and 44 (31.2%) were female. The first step in chemical decontamination is to wash with water and soap, which was correctly answered by 155 (50%) respondents. Limiting the exposure and increasing the distance, limits the damage by radiation was correctly answered by 152 (49%) respondents. The first step in nuclear irradiation decontamination is to remove clothes and shoes as soon as possible, which was answered by 95 (30%) respondents only. Regarding all the questions on the visual scale, the higher the year of study the better was knowledge & capability to deal with the patient. There was a positive correlation between years of study and their knowledge and capability to deal with emergencies related to chemical, and biological nuclear incidents (Table 1).

Table 1: Correlation between Knowledge, Capacity to Deal with Emergencies and Year of Study

Control Year of Study	Nuclear	Chemical	Biological	Contagious Disease Incidence	Capability to Deal with the Nuclear Incident Patients	Capability to Deal with the Chemical Incident Patients	Capability to Deal with the Biological Incidents Patients
Nuclear	0.001	-	-	-	-	-	-
Chemical	-	0.001	-	-	-	-	-
Biological	-	-	0.001	-	-	-	-
Contagious Disease Incidence	-	-	-	0.001	-	-	-
Capability to Deal with the Nuclear	-	-	-	-	0.001	-	-
Capability to Deal with the Chemical Incident	-	-	-	-	-	0.001	-
Capability to Deal with the Chemical Incident	-	-	-	-	-	-	0.001

DISCUSSION

Our study aimed to evaluate CBRN warfare knowledge and preparedness among 311 medical students and doctors at CMH Lahore. In our study, the mean age of the respondents was 19.96 years \pm 1.9 SD. Male respondents were 53.69 %, and females 45.33%. Forty-three percent of the respondents in another study belonging to the same age bracket exhibited a low level of knowledge [9]. Out of 311 respondents, 93% of participants had not previously encountered the term "CBRN", and only 7 % of the respondents heard the term. Similar results were seen in another study, in which 24.1 % of the respondents had ever heard the term CBRN [10]. A gender-wise slightly higher knowledge gap was seen among females, although this difference did not reach statistical significance ($p=0.07$). The professional level that the respondents wanted to achieve was 36% physicians, 16.4% emergency physicians, and 47.6% interested in other specialities. We found that only 21 (6.8%) respondents had formal training regarding disaster management, and felt capable of dealing with CBRN emergencies. A study revealed that there were insufficient healthcare providers and their awareness levels were very low regarding CBRN emergency management and were not skilled enough to deal with the situation, even in the presence of emergency plans [11-13]. When asked whether CBRN training should be included in the curriculum, 52.1% of respondents agreed, 43.7% said it should be, and 4.2% said that it's useless. A study depicted poor knowledge and preparedness regarding CBRN incidents. They stressed the inclusion of necessary training for medical and nursing staff to deal with such events, 50 % of the respondents considered themselves not prepared for CBRN warfare management. Similarly, seven out of ten hospitals had emergency plans, but only two were conducting drills and were lacking planning and adequate training for the medical staff to deal with emergencies [14, 15]. In the current study, the initial years of undergraduate medical students exhibited less knowledge as compared to clinical years, which indicates

that the level of education in the higher level of medical study provided knowledge regarding CBRN. This is consistent with the results of a study, which states that case-based CBRN training in medical undergraduates enhances healthcare provider's knowledge and capacity to deal with such emergencies [16]. Out of 300 medical students, 112 (37.3%) wanted to become physicians, 51 (17%) wanted to excel in emergency medicine (EM), and 148 (49.3%) showed interest in other specialities. In another study in Saudi Arabia, only 7% of the students preferred emergency medicine as their first choice and 33.2% considered it in their top three possible career options [17]. Regarding inclusion of CBRN training in the curriculum, which should prepare the graduates to deal with such incidents; 162 (52.1%) strongly agreed, 36 (43.7%) felt it should, and 13 (4.2%) considered it unnecessary. Similarly, Timely response and preparedness combined with specialized training enable the healthcare responders to deal with CBRN emergencies. 94% of the respondents agreed to the inclusion of emergency aid, and disaster management in their curriculum [18, 19]. Regarding all the questions on the visual scale, the higher the year of study the better was knowledge and capability to deal with emergencies related to chemical, and biological nuclear incidents. These findings are similar to another study on medical students, in which the level of knowledge was found to be a significant predictor for emergency readiness [20]. The present study underscores the urgent need for improved education and training on CBRN warfare among medical students and doctors. The substantial knowledge gap identified in this research emphasizes the importance of further investigation to identify contributing factors and develop effective strategies for addressing this issue.

CONCLUSIONS

It was concluded that the current study highlights a notable knowledge gap concerning CBRN warfare among medical students, especially those in their early years. To address this, comprehensive education and training on CBRN hazards and management are essential to prepare future first responders effectively.

Authors Contribution

Conceptualization: FA, TR

Methodology: FA, FS, TR, GS, BA

Formal analysis: FA, FS, GS

Writing review and editing: FA, FS, GS

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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REFERENCES

- [1] Tin D, Cheng L, Shin H, Hata R, Granholm F, Braitberg G et al. A Descriptive Analysis of the Use of Chemical, Biological, Radiological, and Nuclear Weapons by Violent Non-State Actors and the Modern-Day Environment of Threat. *Prehospital and Disaster Medicine*. 2023 Jun; 38(3): 395-400. doi: 10.1017/S1049023X23000481.
- [2] Calamai F, Derkenne C, Jost D, Travers S, Klein I, Bertho K et al. The Chemical, Biological, Radiological and Nuclear (CBRN) Chain of Survival: A New Pragmatic and Didactic Tool Used by Paris Fire Brigade. *Critical Care*. 2019 Dec; 23: 1-3. doi: 10.1186/s13054-019-2364-2.
- [3] Tokuda Y, Kikuchi M, Takahashi O, Stein GH. Prehospital Management of Sarin Nerve Gas Terrorism in Urban Settings: 10 Years of Progress After the Tokyo Subway Sarin Attack. *Resuscitation*. 2006 Feb; 68(2): 193-202. doi: 10.1016/j.resuscitation.2005.05.023.
- [4] Hughes JM and Gerberding JL. Anthrax Bioterrorism: Lessons Learned and Future Directions. *Emerging Infectious Diseases*. 2002 Oct; 8(10): 1013. doi: 10.3201/eid0810.020466.
- [5] Gauntlett L, Amlôt R, Rubin GJ. How to Inform the Public About Protective Actions in A Nuclear or Radiological Incident: A Systematic Review? *The Lancet Psychiatry*. 2019 Jan; 6(1): 72-80. doi: 10.1016/S2215-0366(18)30173-1.
- [6] Gyllencreutz L, Carlsson CP, Karlsson S, Hedberg P. Preparedness for Chemical, Radiologic and Nuclear Incidents among a Sample of Emergency Physicians' and General Practitioners'—A Qualitative Study. *International Journal of Emergency Services*. 2023 Apr; 12(2): 161-70. doi: 10.1108/IJES-07-2022-0032.
- [7] Xu S and Dodt A. Nuclear Bomb and Public Health. *Journal of Public Health Policy*. 2023; 44(3): 348. doi: 10.1057/s41271-023-00420-x.
- [8] Babacan A. Knowledge Levels and Awareness of Healthcare Professionals On Protection from Chemical, Biological, Radiation, Nuclear Hazards, and Emergency Aid Practices. *Pamukkale Medical Journal*. 2023 Oct; 16(4): 618-26.
- [9] Nofal A, AlFayyad I, AlJerian N, Alowais J, AlMarshady M, Khan A et al. Knowledge and Preparedness of Healthcare Providers Towards Bioterrorism. *BioMed Central Health Services Research*. 2021 May; 21(1): 426. doi: 10.1186/s12913-021-06442-z.
- [10] Suryawanshi DM, Surekha A, Divya R, Gunasekaran K, Malini I. Awareness and Preparedness of First Responders Regarding Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) Disaster Management of a Tertiary Medical Institute in South India: A Mixed Methods Study. *Journal of Family Medicine and Primary Care*. 2022 Oct; 11(10): 6115-20. doi: 10.4103/jfmpc.jfmpc_202_22.
- [11] Abdelkarim S, AlMarei SO, Elyas A, Amri RA, Khawaji EA, Khormi GJ et al. Knowledge and Attitude Toward Biological Warfare among Health-Related Students: A Cross-Sectional Questionnaire-Based Survey. *Journal of Family Medicine and Primary Care*. 2023 Feb; 12(2): 276-81. doi: 10.4103/jfmpc.jfmpc_1123_22.
- [12] Yigitbas C. Do Health-Care Students Know About Chemical Biological Radioactive Nuclear Weapons? *Disaster Medicine and Public Health Preparedness*. 2023 Jan; 17: e54. doi: 10.1017/dmp.2021.307.
- [13] Alyami A, Dulong CL, Younis MZ, Mansoor S. Disaster Preparedness in the Kingdom of Saudi Arabia: Exploring and Evaluating the Policy, Legislative Organisational Arrangements Particularly During the Hajj Period. *European Journal of Environment and Public Health*. 2020 Jul; 5(1): em0053. doi: 10.29333/ejeph/8424.
- [14] Azeem AR, Sharif MW, Akhtar A, Sohail CS, Dar AA, Khan M et al. Perception of Preparedness of Health Care Professionals in Case of a Nuclear, Chemical, Biological Attack/Emergency in a Tertiary Care Hospital. *Cureus*. 2019 May; 11(5). doi: 10.7759/cureus.4657.
- [15] Alahmari AA and Khan AA. Chemical, Biological, Radiological, and Nuclear Preparedness of Public Hospitals in Riyadh. *Disaster Medicine and Public Health Preparedness*. 2023 Jan; 17: e401. doi: 10.1017/dmp.2023.66.

- [16] Sardarian A, Givens M, Schwartz JF, Cole R, Rudinsky SL. Introduction to Treating Patients Exposed to Chemical, Biological, Radiological, and Nuclear (CBRN) Threats: A Military Medical Case-Based Curriculum. *MedEdPORTAL*. 2024 Sep; 20: 11433. doi: 10.15766/mep_2374-8265.11433.
- [17] Mohammadi SB, Amirheidari B, Dehesh T, Moghadam MN, Yazdi-Feyzabadi V, Hassani E et al. Identification and Analysis of Parameters and Global Experiences of Hospital Preparedness Against Chemical, Biological, Radiological and Nuclear Disasters: A Scoping Review. *Journal of Clinical Research in Paramedical Sciences*. 2022; 11(1). doi: 10.5812/jcrps-123626.
- [18] Farhat H, Alinier G, Chaabna K, El Aifa K, Abougalala W, Laughton J et al. Preparedness and Emergency Response Strategies for Chemical, Biological, Radiological and Nuclear Emergencies in Disaster Management: A Qualitative Systematic Review. *Journal of Contingencies and Crisis Management*. 2024 Sep; 32(3): e12592. doi: 10.1111/1468-5973.12592.
- [19] Günaydin G and Günaydin M. Assessment of Disaster and CBRN Knowledge and Attitudes of First and Emergency Aid Program Senior Students. *Journal of International Health Sciences & Management*. 2023 Jan; 9(17). doi: 10.48121/jihsam.1222312.
- [20] Hassan Gillani A, Mohamed Ibrahim MI, Akbar J, Fang Y. Evaluation of Disaster Medicine Preparedness Among Healthcare Profession Students: A Cross-Sectional Study in Pakistan. *International Journal of Environmental Research and Public Health*. 2020 Mar; 17(6): 2027. doi: 10.3390/ijerph17062027.