

Results: There were 1,028 respondents to the survey. The respondents primarily were male, frontline personnel with >15 years of experience. Only 63% of respondents indicated they had received either theoretical or practical training to work in a contaminated environment. Of those that had received any training, 61% indicated they had received “hands on” or practical training. In regards to identifying a possibly contaminated scene, 82% indicated they had received some training. Only 42% had received training on symptoms of nerve agent exposure, 37% on symptoms of blister agent exposure, and 46% on symptoms of asphyxiants. In regard to treating victims of chemical agents, 32% had received training regarding nerve agents, and 30% regarding blister agents. Only 31% of all respondents had received training regarding the detection of radiation.

Conclusions: Chemical, biological, radiological, and nuclear events have unique hazards and require specific education and training. As assessed with this survey, Canadian prehospital providers do not uniformly receive the training to identify and work in contaminated environments.

Keywords: chemical, biological, radiological, and nuclear; preparedness; education; prehospital; preparedness; training
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Medical Care within the Hot Zone: An Innovative Concept in Vienna during the EURO08

Andreas Ziegler

EMS, City of Vienna, Parndorf, Austria

Introduction: The response to hazardous materials or chemical, biological, radiological, nuclear (CBRN) incidents typically consists of: (1) cordons regulating access into and egress from designated zones; and (2) use of appropriate personal protective equipment. In most systems emergency medical services (EMS) will stay outside of the “hot zone”. The patient will be rescued by the fire service and, after some gross decontamination, handed over. As mass gatherings are regarded as high-risk events, this system was used in Vienna during the Euro08 and augmented by: (1) casualty decontamination units (seven parallel lines for stretcher decontamination, located before triage); (2) a rapid intervention group for medical care in the hot zone (25 medical personnel), responsible for triage, life support (airway, breathing, bleeding), and antidote therapy; and (3) a joint CBRN incident command for close cooperation with detection units.

Methods: After a review of the available open-source literature, a risk analysis was performed and the tactical concept described above was developed with cooperation of all involved services. Special training was performed for all members of the aforementioned units.

Results: As the concept was not tested by an actual emergency, the following observations can be made: (1) readiness of the units could be successfully maintained during the EURO08; (2) the chosen equipment was experienced as appropriate; (3) several minor cases corroborated the risk analysis; and (4) manpower and training requirements were considerable.

Conclusions: While it is possible to perform medical care within the hot zone, concepts are rarely tested in reality and the necessary efforts raise the question of proportionality.

Keywords: chemical, biological, radiological, and nuclear; contaminated patients; decontamination; detection; hazardous material; mass gatherings; mass events
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Fifteen Years since the Tokyo Subway Attack and Development of Chemical, Biological, Radiological, Nuclear, or Explosive Terrorist Countermeasures in Japan

Tetsu Okumura

Saga University, Saga, Japan

Introduction: Although 15 years have passed since the Tokyo subway attack, it was the preparations for the Kyushu-Okinawa G8 summit (2000) five years thereafter that catalyzed the development of countermeasures and policy against chemical, biological, radioactive, nuclear, or explosive (CBRNE) threats in Japan.

Report: No substantial progress was made for five years after the subway attack. Preparedness for the Kyushu-Okinawa G8 Summit included promulgation of the Civil Protection Law (2004), which codified the responses to CBRNE terrorist attacks, and consequently, the effectiveness with which the countermeasures against CBRNE terrorism acts could be deployed at a national level. Countermeasures included the establishment of a CBRNE task force, syndromic surveillance programs, and the stockpiling of antidotes, antitoxins, and antibiotics. Decontamination facilities were introduced throughout Japan. **Conclusions:** Preparedness for the summit facilitated recognition of the need for medical countermeasures against CBRNE threats to protect healthcare providers in Japan. In the 15 years since the Tokyo Subway Attack, the measures implemented in the last five years have been most effective. However, future challenges include the promotion of civilian awareness, inter-agency collaboration, and increasing the mutual-aid capacity of local communities.

Keywords: chemical, biological, radiological, nuclear or explosive; Japan; preparedness; terrorism; Tokyo
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Responsibility and Methods for Detection of Chemicals and Radioactive Substances and Decontamination

Andreas Ziegler

Emergency Medical Services, City of Vienna, Parndorf, Austria

Introduction: The response to incidents with chemical and radioactive substances has been shaped primarily by firefighters' experiences with hazardous material (HAZMAT) accidents. Globally, HAZMAT tactics consist of the main elements of: (1) appropriate use of personal protective equipment; and (2) cordons regulating access into and egress from designated zones. Detection and casualty decontamination are far less uniformly organized.

Methods: Review and analysis of open-source (medical- and first responder-oriented) English and German lan-

guage literature; informal questionnaire survey of first responders in several European countries.

Results: The initial on-scene measures during a HAZMAT response—cordoning off the scene and rescue out of the contaminated area—are done uniformly by fire service responders. In most cases, emergency decontamination of casualties at the scene (disrobing and flushing), is performed by firefighters, however, reliability appears variable. The probability of a coordinated patient handover from fire personnel to emergency medical services (EMS) staff is rated “low” by most sources.

In many countries, specialized casualty decontamination units have been commissioned and are operated by a variety of services: fire, EMS, military and civil protection.

Hospital decontamination facilities are in most countries still the exception and depend mostly on local commitment.

Substantial detection usually invalues only simple measurements performed by the first responders; specialized support is planned to be given mainly by military, civil protection and specialized laboratories.

Conclusions: Initial on-scene response to chemical/radiological incidents is fundamentally similar in most countries. However, distinctive differences beyond the first steps restrict the transferability of organizational solutions.

Keywords: chemical, biological, radioactive, nuclear; chemical substance; contaminated patient; decontamination; detection; HAZMAT; radioactive substance

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Effect of Physical Exertion in Level-C Chemical and Biological Protective Equipment on Physiological Function

Christopher Stein; Andrew Makkink; Craig Vincent-Lambert

Department of Emergency Medical Care, University of Johannesburg, Johannesburg, South Africa

Introduction: The objective of this study was to assess the effect of 20 minutes of heavy treadmill exertion in military-style, Level-C chemical and biological personal protective equipment (PPE), including a filtering face piece respirator, on physiological variables including venous pH, venous PCO₂, SpO₂ and tympanic temperature.

Methods: Baseline physiological variables were measured in 19 healthy subjects who undertook heavy physical exertion on a treadmill at a constant room temperature of 20°C: (1) once while wearing a short-sleeved t-shirt, shorts, and running shoes; and (2) once while wearing chemical and biological PPE. Repeat measurements of physiological variables were made after 10 and 20 minutes of exertion in both groups.

Results: Twenty minutes of physical exertion was undertaken by healthy subjects wearing chemical and biological PPE resulted in moderate hypoxemia, significantly decreased pH ($p = 0.003$), elevated PCO₂ ($p = 0.018$) and elevated tympanic membrane temperature ($p < 0.001$), compared to baseline values. Despite these significant differences, none of the mean venous blood gas values deviated from the normal range during physical exertion.

Conclusions: The degree and duration of physical exertion undertaken in chemical and biological PPE induced some significant changes in physiological variables compared to control but, with the exception of SpO₂, did not result in changes considered to represent abnormal physiology. However, it is likely that core body temperature was underestimated by tympanic measurement. Blood gas data indicating that CO₂ was retained during exertion in this type of PPE were unanticipated and require further investigation.

Keywords: chemical and biological warfare; emergency medical services; physical exertion; protective clothing

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Comfort Level of Emergency Medical Services Providers in Responding to Weapons of Mass Destruction Events: Impact of Training and Equipment

David S. Markenson; Michael Reilly

New York Medical College, Valhalla, New York USA

Introduction: Emergency medical services (EMS) providers are ill-prepared in the areas of training and equipment for weapons of mass destruction (WMD) events and other public health emergencies.

Methods: A nationally representative sample of the basic and paramedic emergency medical service providers in the United States was surveyed to assess whether they had received training in WMD and/or public health emergencies, as part of their initial provider training and as continuing medical education (CME) within the past 24 months. Providers also were surveyed as to whether their primary EMS agency had the necessary specialty equipment to respond to these specific events.

Results: More than half of EMS providers had some training in WMD response. Hands-on training was associated with EMS provider comfort in responding to chemical, biological and radiological events and public health emergencies (OR = 3.2; 95% CI = 3.1–3.3). Only a small portion (18.1%) of providers surveyed indicated that their agencies had the necessary equipment to respond to a WMD event. The comfort level and having equipment to respond to these incidents was not as highly associated as the comfort level and having had training to respond to these incidents.

Conclusions: Lack of training and education as well as the lack of necessary equipment to respond to WMD events is associated with decreased comfort among emergency medical services providers in responding to chemical, biological, and radiological incidents. Better training and access to appropriate equipment may increase provider comfort in responding to these types of incidents.

Keywords: bioterrorism; emergency medical services; equipment; training; weapons of mass destruction

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The New Austrian Plan for Medical Diagnostics and Therapy after Radiation Accidents

Andreas Ziegler

EMS, City of Vienna, Parndorf, Austria

Recently, the plan for Medical Diagnostics and Therapy after Radiation Accidents was developed in Austria as part