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Advanced Hazmat Life Support (AHLS): Development and Demographics from 1999 through 2003

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Abstract

This is a prospective, descriptive, feasibility study to determine whether an interdisciplinary group of healthcare experts could design and successfully deliver an international, life support, continuing education program that teaches the medical management of hazmat patients. The interdisciplinary experts designed and delivered the two-day Advanced Hazmat Life Support (AHLS) Provider Course, the six hour AHLS Instructor Course, and the five hour AHLS for Toxic Terrorism Course. The AHLS Provider Course trained 3,036 healthcare professionals worldwide from 1999-2003. The AHLS Instructor Course trained 1,346 healthcare professionals worldwide from 1999-2003. The AHLS for Toxic Terrorism Course trained 138 healthcare professionals, starting in 2003. Healthcare professionals from 43 countries received AHLS training. The Advanced Hazmat Life Support Program is feasible and meets the continuing education needs of healthcare professionals around the world.

INTRODUCTION

Prior to 1999, there was no two-day, national or international standardized, life support course specifically addressing the medical management for victims of hazardous materials (hazmat) incidents. There had been statewide two-day educational programs that focused on the medical management for victims of hazmat incidents, such as Dr. Mike Vance's State of Arizona ToxMedic Program that he started in the 1980s. Nationwide, the Superfund Amendments and Reauthorization Act of 1986, known as SARA, required the US Federal Government's Occupational Safety and Health Administration (OSHA) to develop and implement standards to protect employees responding to hazardous materials emergencies; however, this Act did not focus on the medical management of hazmat victims [1]. This Act resulted in the Hazardous Waste Operations and Emergency Response standard, 29 CFR 1910.120, known as HAZWOPER [2]. This national standard defines the minimum acceptable skills, knowledge, and training necessary for emergency response personnel responding to hazmat incidents. These OSHA standards are mandated by law and violation of these OSHA standards can result in civil or even criminal liability [3]. In addition to these US Federal legal standards established by SARA and HAZWOPER, the National Fire Protection Association (NFPA) developed guidelines (NFPA 471, 472, and 473) that meet and exceed the standards of SARA and HAZWOPER [4,5,6,7].

Educational programs that were developed to meet NFPA 472 competency requirements for first responders at the awareness level, first responders at the operational level, and hazardous materials technicians. In addition, the National Fire Academy [NFA] developed a two week educational program designed to address the prehospital care for victims of hazmat incidents.[8]. This two week NFA educational program focuses on hazmat chemistry, is given only at the NFA in Emmitsburg, Maryland, and is called Advanced Life Support Response to Hazardous Materials Incidents [8].

As of 1998, the preceding courses were the only ones addressing response to hazmat incidents. These courses focused almost exclusively on prehospital operations by firefighters, hazardous materials technicians, Emergency Medical Technician (EMT) - Basics, EMT - Intermediates, and EMT - Paramedics. At that time, there was not an Advanced Life Support format course for a more interdisciplinary group of healthcare professionals that trained both prehospital healthcare professionals and hospital-based, poison center-based, clinic-based, public healthcare-based, and other healthcare professionals. To address this continuing education need for all healthcare professionals, the American Academy of Clinical Toxicology, the largest clinical toxicology society in the

world, and the Arizona Emergency Medicine Research Center of the University of Arizona College of Medicine, a leader in Emergency Medical Services education, partnered to provide a sixteen hour, two-day Advanced Hazmat Life Support Provider Course and a six hour Advanced Hazmat Life Support Instructor Course focused on the medical management of hazmat victims. When the Advanced Hazmat Life Support (AHLS) program started in 1998, the target continuing education audience was interdisciplinary and included EMT - Paramedics, nurses, pharmacists, physicians, and other healthcare professionals.

IMPORTANCE

Hazmat incidents involve not only prehospital hazmat responses that can include law enforcement departments, fire departments and Emergency Medical Services (EMS), but hazmat incidents can also involve patients that will be brought to hospitals or come to clinics for acute medical care, as well as involving responses from poison centers and public health professionals. The average case fatality rate for victims of hazmat incidents is 1% [9]. Clearly these hazmat incidents require an integrated, interdisciplinary response from multiple healthcare professionals in the pre-hospital, hospital, clinic, poison center, and public health settings. Prior to offering the first AHLS course in 1999, there was no two-day, international, hazmat course that focused on the medical management of patients for such a broad interdisciplinary continuing education audience.

GOALS OF THIS INVESTIGATION

This study is a feasibility study to determine whether an interdisciplinary group of healthcare experts could design and successfully deliver an international, two-day, life support, continuing education program focusing on the medical management of hazmat patients. In addition, this feasibility study also addresses whether a six hour, interdisciplinary, life support instructor course can train the trainers who bring this continuing education program back to their communities. We hypothesized that this interdisciplinary continuing education course would meet the needs of healthcare professionals. Our primary outcome measures were the number and type of healthcare professionals taking the courses and the number who passed the AHLS Provider and AHLS Instructor exams and became verified AHLS Providers and Instructors.

MATERIALS AND METHODS

AHLS educational materials include textbooks, PowerPoint slides, videos, interactive case studies/table top exercises, student lectures, pre-tests, and post-tests (Table 1). These AHLS educational materials have been developed and written by the nine members of the AHLS Scientific Advisory Committee, as well as other content experts. The nine members of the AHLS Scientific Advisory Committee are an interdisciplinary group of healthcare professionals consisting of paramedics, pharmacists, and physicians. The physicians that serve on the AHLS Scientific Advisory Committee are also interdisciplinary and include physicians board certified in emergency medicine, occupational and preventive medicine, internal medicine, and medical toxicology.

Figure 1

Table 1: AHLS Educational Course Materials

Course Materials	AHLS Provider Course	AHLS Instructor Course	AHLS for Toxic Terrorism Course
Course Manual:			
Copyright (year)	2003	2000	2003
Edition	3rd	2nd	1st
Pages (n)	579	156	393
Chapters (n)	39	8	23
Authors (n)	16	5	14
PowerPoint Slides (n)	735	130	262
Videos (n)	2	0	0
Interactive Case Studies/ Table Top Exercises (n)	4	0	1
Pre-test (n)	1	0	0
Post-test (n)	1	1	0

The two-day AHLS Provider Course syllabus and educational content are outlined in Box 1.

Figure 2

Box 1: The AHLS Provider Course Syllabus

Day 1

- **Provider Exam - Pre-Test**
- **General Principles of AHLS**
  - Hazardous Materials Epidemiology
  - Important Properties of Hazardous Materials
  - Medical Management of Hazmat Victims
  - Personal Protective Equipment and Decontamination
  - Toxidromes & Toxicodynamics
  - Antidotes in General
  - Establishing and Organizing a Hazmat Response Team
- **Toxic Inhalations**
  - Irritant Gases
  - Asphyxiants
  - Antidotes in Detail:
    - Normobaric Oxygen
    - Hyperbaric Oxygen
    - Methylene Blue
    - Amyl Nitrite
    - Sodium Nitrite
    - Sodium Thiosulfate
- **Pesticide Poisoning**
  - Organophosphates & Carbamates
  - Antidotes in Detail:
    - Atropine
    - Pralidoxime
- **Interactive Case Studies/ Table Top Exercises**

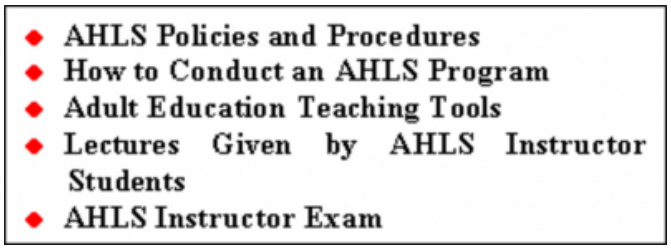
Day 2

- **Toxic Terrorism**
  - Introduction to CBRN Incidents
  - Chemical Terrorism: Nerve Agents
  - Bioterrorism: Anthrax, Smallpox & Botulism
  - Radiological & Nuclear Incidents
- **Corrosives, Hydrocarbons, and Halogenated Hydrocarbons**
- **Miscellaneous Toxicants**
  - Hydrazines
  - Hydrofluoric Acid & Fluorides
  - Antidotes in Detail:
    - Pyridoxine
    - Calcium Gluconate
    - Calcium Chloride
- **Interactive Case Studies/Table Top Exercises**
- **AHLS Provider Exam Post-Test**

The six hour AHLS Instructor Course syllabus and educational content are outlined in Box 2.

Figure 3

Box 2: AHLS Instructor Syllabus and Educational Content



The five hour AHLS for Toxic Terrorism Course syllabus and educational content are outlined in Box 3.

Figure 4

Box 3: AHLS for Toxic Terrorism Syllabus

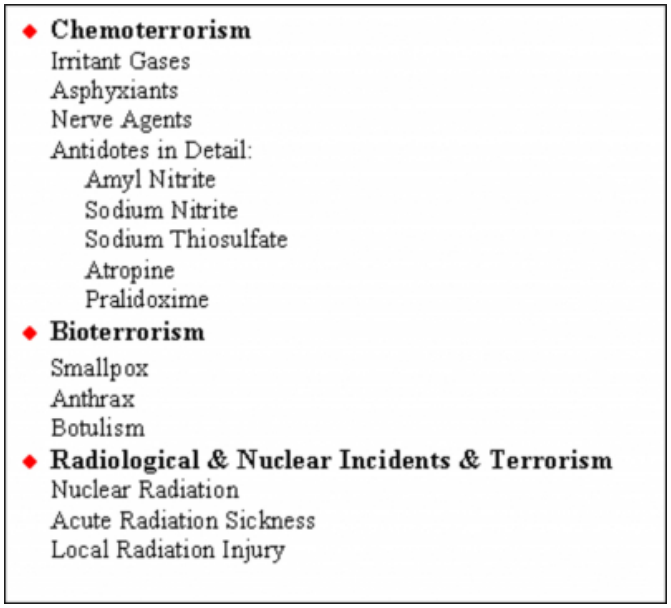


Figure 5

Table 2: AHLS Courses per Year for 1999-2003

AHLS Course	Year					Total
	1999	2000	2001	2002	2003	
AHLS Provider (n)	1	4	11	26	45	87
AHLS Instructor (n)	1	3	9	19	26	58
AHLS for Toxic Terrorism (n)	0	0	0	0	5	5

AHLS Regional Directors are nationally and internationally recognized specialists in clinical toxicology who oversee the quality of AHLS Programs in their regions and foster the growth of AHLS training in their regions. The United States has 11 Regional Directors. There are two AHLS Regional Directors in Australia; one AHLS Regional Director in Canada; one AHLS Regional Director in Europe, based in Italy; one AHLS Regional Director in the Peoples Republic of China, based in Hong Kong; and one AHLS Regional Director in Mexico.

RESULTS

The number of AHLS Provider and Instructor courses has grown steadily from 1999 through 2003 (Table 2). The half-day AHLS for Toxic Terrorism Course was first introduced in 2003 with five courses in that inaugural year (Table 2).

The number of healthcare professionals who attended an AHLS Provider and/or Instructor Course has increased steadily from 1999 through 2003 (Table 3). The AHLS for Toxic Terrorism Course was introduced in 2003 and 138 healthcare professionals received training that inaugural year (Table 3). Table 3 includes all healthcare professionals who attended and received training in any AHLS course in the years from 1999 through 2003. This includes healthcare professionals who attended AHLS Provider and/or Instructor Courses and either chose not to take the AHLS Provider Exam Post-Test or the AHLS Instructor Exam, did not pass the AHLS Provider Post-test Exam or the AHLS Instructor Exam, or because of their professional background were not eligible to receive AHLS verification as an AHLS Provider and/or Instructor. EMT-Basics and Industrial Hygienists are examples of professionals who are not eligible to receive AHLS verification as an AHLS Provider or Instructor.

Figure 6

Table 3: Healthcare Professionals Trained per Year for 1999-2003

Health Professionals Receiving AHLS Training	Year					Total
	1999	2000	2001	2002	2003	
AHLS Provider (n)	77	114	362	958	1525	3036
AHLS Instructor (n)	76	82	174	491	523	1346
AHLS for Toxic Terrorism (n)	0	0	0	0	138	138

The number of healthcare professionals passing the AHLS Provider and Instructor Exams and becoming verified as AHLS Providers and Instructors has increased steadily from 1999 through 2003 (Table 4). Comparing the total number of healthcare professionals receiving AHLS verification as AHLS Providers (2,882) with the total number receiving AHLS training in an AHLS Provider Course (3,036) indicates that 95% of those who have taken the AHLS Provider course successfully pass the AHLS Provider Exam Post-Test and receive verification as AHLS Providers (Tables 3 and 4). Comparing the total number of healthcare

professionals receiving AHLS verification as AHLS Instructors (1,332) with the total number receiving AHLS training in AHLS Instructor Courses (1,346) indicates that 99% of healthcare professionals who take an AHLS Instructor Course receive AHLS Instructor verification by successfully passing the AHLS Instructor Exam. Only those AHLS Instructor participants who have successfully passed the AHLS Provider Exam Post-test and the AHLS Instructor Exam verified as AHLS Instructors (Tables 3 and 4).

Figure 7

Table 4: Healthcare Professionals Passing AHLS Exams & Becoming Verified as AHLS Providers or Instructors per Year for 1999-2003

Health Professionals Receiving AHLS Verification	Year					Total
	1999	2000	2001	2002	2003	
AHLS Provider (n)	76	114	337	916	1439	2882
AHLS Instructor (n)	76	75	174	488	519	1332

Comparing the total number of healthcare professionals receiving AHLS training in an AHLS Instructor Course (1,346) with the total number receiving AHLS training in an AHLS Provider Course (3,036) indicates 44.2% of those receiving AHLS training in an AHLS Provider Course go on to take an AHLS Instructor Course (Table 3). Comparing the total number of healthcare professionals receiving AHLS verification as AHLS Instructors (1,332) to the total number of receiving AHLS verification as AHLS Providers (2,882) indicates that 46.2% of those total healthcare professionals receiving AHLS verification as AHLS Providers go on to receive verification as AHLS Instructors (Table 4).

The largest group of healthcare professionals participating in AHLS training are EMT-Paramedics (44.1%) [Table 5]. The next largest group of healthcare professionals participating in AHLS training are physicians (28.4%), followed by nurses (20.2%), pharmacists (1.8%), and physician assistants (1.8%) [Table 5]. Table 5 also includes a list of other healthcare professionals participating in AHLS training (Table 5). Healthcare professionals classified as Toxicologists in Table 5 include healthcare professionals who have received basic science degrees in toxicology and then have received additional practice-preceptorship, clinical training to eventually allow them to practice as clinical toxicologists in countries outside the United States.

Figure 8

Table 5: Healthcare Professions of AHLS Course Participants, Cumulative Totals, for 1999-2003

Profession	AHLS Provider & Instructor Verified	AHLS Provider Verified Only	AHLS Trained, but not verified	Total by Profession	
				(n)	(%)
EMT-B	0	0	38	38	1.2
EMT-I	3	13	28	44	1.4
EMT-P	583	729	28	1340	44.1
Industrial Hygienist	0	0	23	23	0.8
Nurse	193	393	27	613	20.2
Pharmacist	31	23	0	54	1.8
Physician	495	360	8	863	28.4
Physician Assistant	26	26	1	53	1.8
Respiratory Therapist	0	2	0	2	0.1
Toxicologist	5	0	1	6	0.2
Total	1336	1546	154	3036	100.0

Table 6 indicates that AHLS Courses have an international reach with participants from 43 countries around the world. The country with the largest number of healthcare professionals participating in AHLS training is the United States (87.7%) [Table 6]. The Peoples Republic of China has the next largest number of healthcare professionals participating in AHLS training (3.3%), followed by Canada (3.2%), Australia (1.8%), and Italy (1.0%) [Table 6]. These are the top five countries for healthcare professionals receiving AHLS training. The remaining 38 countries listed in Table 6 each supplied less than 1% of all healthcare professionals receiving AHLS training worldwide (Table 6). The number of healthcare professionals who have participated in AHLS training correlates with the number of AHLS Regional Directors per country.

Figure 9

Table 6: Country of Origin of AHLS Participants for 1999-2003

Country	AHLS Provider & Instructor Verified	AHLS Provider Verified Only	AHLS Trained, but not verified	Total	
				(n)	(%)
Argentina	2	0	0	2	0.1
Australia	29	28	0	56	1.8
Belgium	0	1	0	1	0.0
Canada	35	59	3	96	3.2
Chile	1	0	0	1	0.0
Columbia	1	0	0	1	0.0
France	2	0	0	2	0.1
Germany	3	0	0	3	0.1
Greece	5	6	0	11	0.4
Guatemala	1	0	0	1	0.0
India	0	1	0	1	0.0
Ireland	0	0	1	1	0.0
Italy	12	17	0	29	1.0
Japan	6	1	0	7	0.2
Malaysia	1	0	0	1	0.0
Malta	0	1	0	1	0.0
Mexico	9	4	0	13	0.4
Netherlands	1	0	0	1	0.0
New Zealand	1	2	0	3	0.1
Oman	0	1	0	1	0.0
Papua New Guinea	1	0	0	1	0.0
People's Republic of China	51	50	0	101	3.3
Peru	1	0	0	1	0.0
Philippines	1	0	0	1	0.0
Portugal	0	1	0	1	0.0
Puerto Rico	2	0	0	2	0.1
Saudi Arabia	3	1	0	4	0.2
Scotland	1	0	0	1	0.0
Serbia	0	1	0	1	0.0
Singapore	4	0	0	4	0.2
Slovenia	0	1	0	1	0.0
Spain	3	0	0	3	0.1
Sweden	0	1	0	1	0.0
Switzerland	1	0	0	1	0.0
Taiwan	5	0	0	5	0.2
Thailand	1	0	0	1	0.0
The Netherlands	1	0	0	1	0.0
Trinidad & Tobago	1	0	0	1	0.0
Turkey	0	1	0	1	0.0
United Kingdom	5	1	0	6	0.2
United States	1128	1397	138	2663	87.7
Venezuela	2	0	0	2	0.1
West Indies	1	0	0	1	0.0
Total	**1336**	**1546**	**154**	**3036**	**100**

DISCUSSION

This prospective feasibility study indicates that the AHLS Provider and Instructor Courses meet the educational needs of an interdisciplinary group of healthcare professionals. This is evidenced by the steady growth in the number of AHLS Provider and Instructor Courses, as well as a steady growth in the number of healthcare professionals who received AHLS Provider and Instructor training during the years 1999 through 2003.

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