



Hearing Conservation Forward: Acoustic Trauma and Noise Induced Hearing Loss in Operation Iraqi Freedom

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DoD Industrial Hygiene Forum

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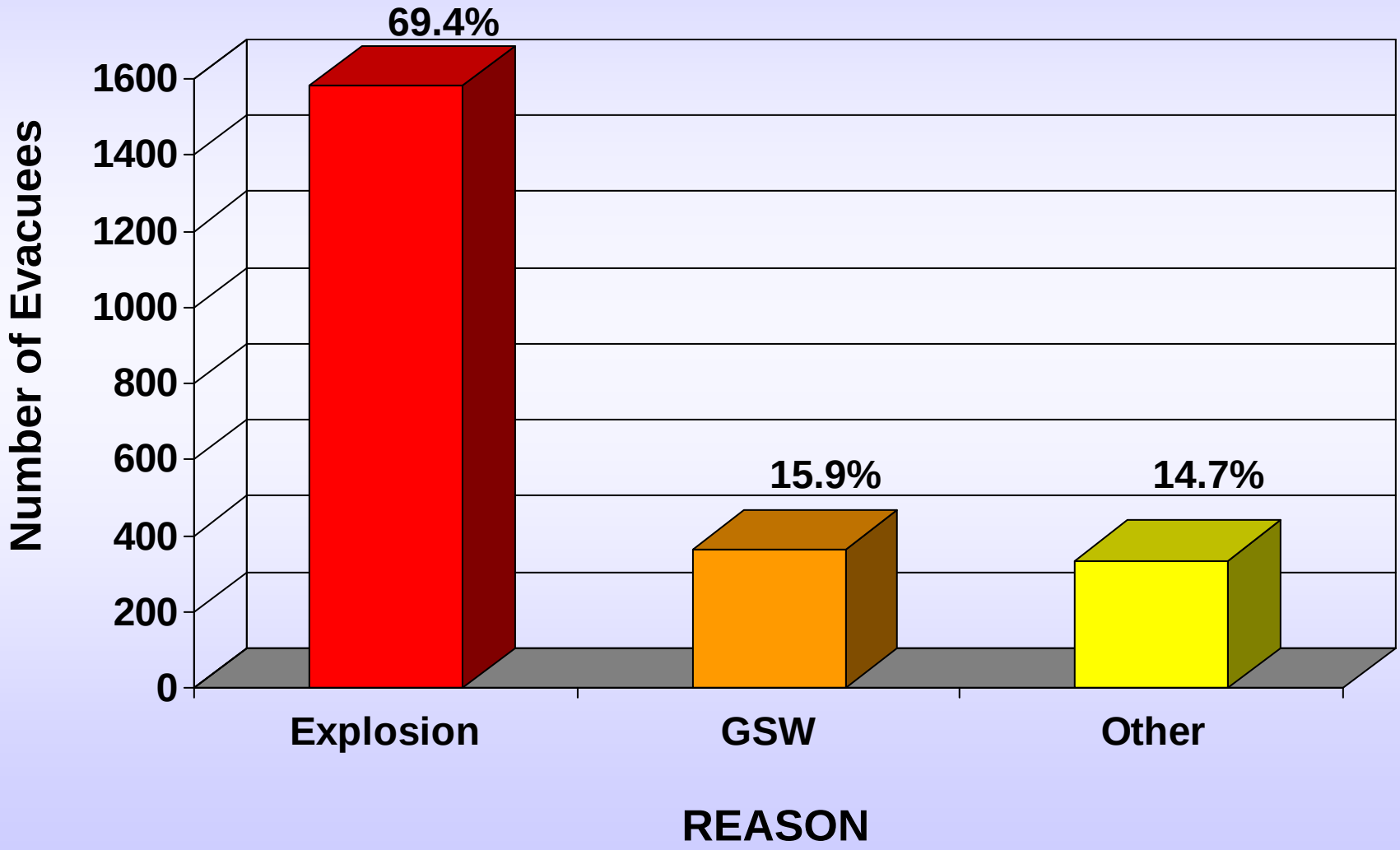
Agenda

- Military Operations and Blast Injury
- Effects of Blast to the Ear
- Audiology In Iraq
- Hearing Protection
- Summary

Military Operations and Blast Injury

WIA Evacuations
(2,278 thru 28 Feb 05)



UNCLASSIFIED

WIA EVAC - WOUNDED AREAS

2,278 WIA's - 4,111 Sites of Injury - 1.8 sites/WIA

(19 March 2003 – 28 Feb 2005)

HEAD/NECK

1322

(32.2%)

UPPER EXTREMITY

1221

(29.7%)

TORSO

477

(11.6%)

PELVIS

159

(3.9%)

LOWER EXTREMITY

932

(22.7%)

CAUSES

Explosion	1581
GSW	362
Other	335

Effects of Blast to the Ear

Ambroise Paré (1510-1590):

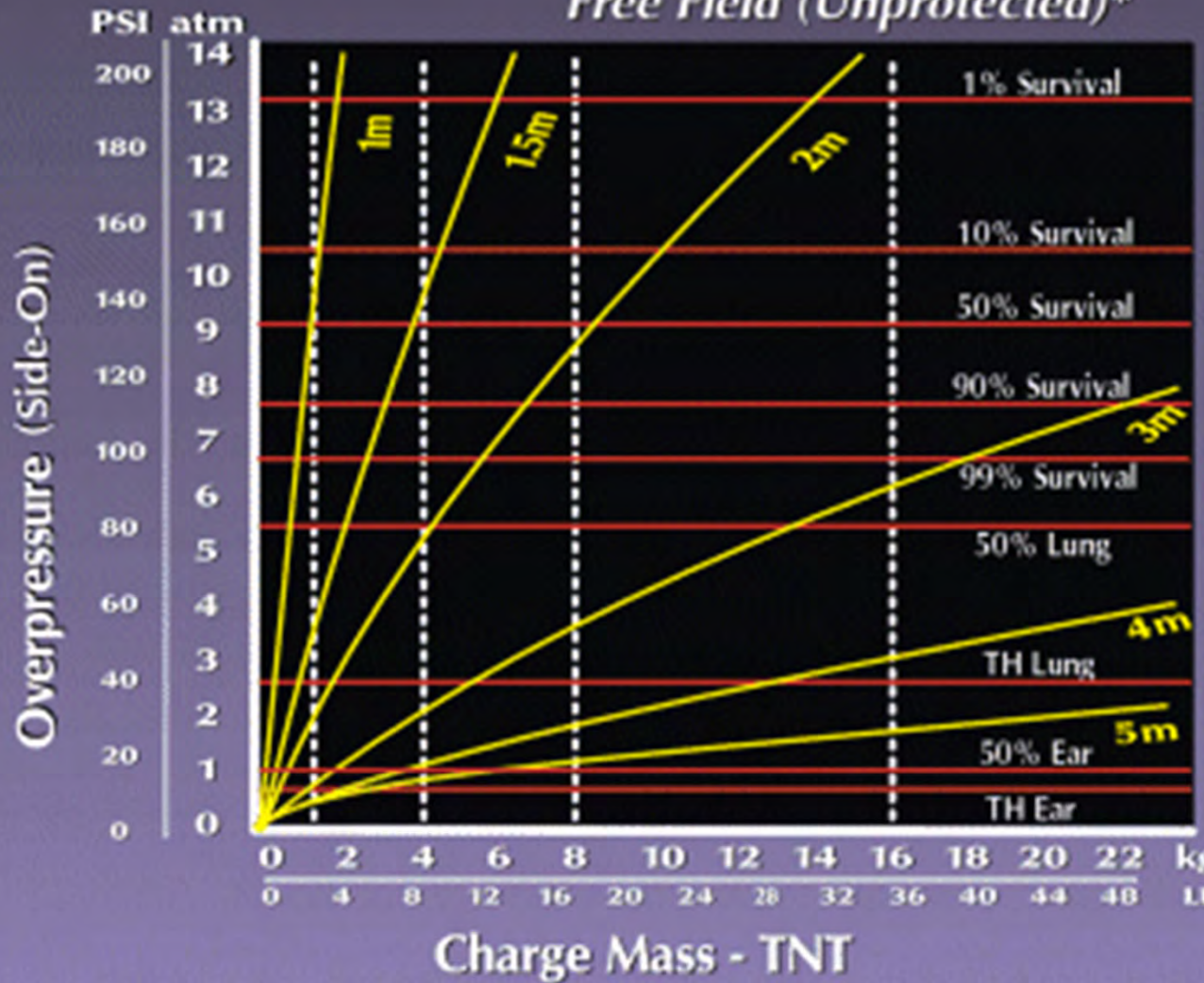
“ … a great thunderous noise, large bells or artillery, and thus one often sees gunners losing their hearing whilst drawing the machinery because of the great agitation of the air inside the ear which breaks the aforementioned membrane and moves to the bones known as ossicles out of their natural position: so that the air is implanted or absorbed within the sinuses of the mastoid cavity and the patient has a continuous noise and air within the ear.”

Acute Ear Trauma

- Acoustic Trauma
  - Single event or intense exposure for short period
  - Levels typically < 185 dB PPL
  - Duration < 1.5 ms
  - Typically affects one ear
  - Middle ear damage is unusual
- Blast Trauma
  - Single event, duration > 1.5 ms
  - Levels exceed 185 dB PPL
  - Usually bilateral
  - Frequent middle ear trauma

Theoretical Overpressure VS Charge Mass as a Function of Distance From Charge

*Free Field (Unprotected)**



Injury levels derived from data published by the Lovelace Foundation (DASA 2113, by I.G. Bowen, E.R. Fletcher, D.R. Richmond, DA-49-146-XZ-372, October 1968)

** Injury Levels Assume Positive Phase Duration of 1.5 msec.*

Mechanisms of Blast Injury

Category	Characteristics	Injury / Body Part Affected
Primary	Impact of overpressure wave	Gas-filled organs, GI tract, TBI, solid organs
Secondary	Shrapnel, debris	Whole body – Blunt trauma, penetrating, laceration, amputation
Tertiary	Projection of individual	Whole body – Fracture blunt trauma, amputation
Quarternary	Other injuries, illnesses	Whole body – Oxygen depletion, burns

ARMY OIF WIA BY SPECIALTY
19 Mar 03 – 31 Oct 04

Category	Occurrences	Percentage
General Surgery	853	46%
Orthopedic	585	31%
Neurosurgery	83	4%
Ophthalmology	75	4%
Ear-Nose-Throat	60	3%
Burns	58	3%
Misc.	51	3%
Neurology	25	1%
Internal Medicine	23	1%
Oral Surgery	19	1%
Thoracic	16	1%
Audiology	13	1%
Total	**1861**	**100%**

Current Scope Of Problem

- Hazardous noise exposure greatest in > 30 yrs
- Prev Med resources limited, compliance is poor
- Prevalence of NIHL increasing
  - Army claims increasing after 14 years of decline
  - 2004 had highest percentage of increase in >17 yrs

Audiology Support in Iraq

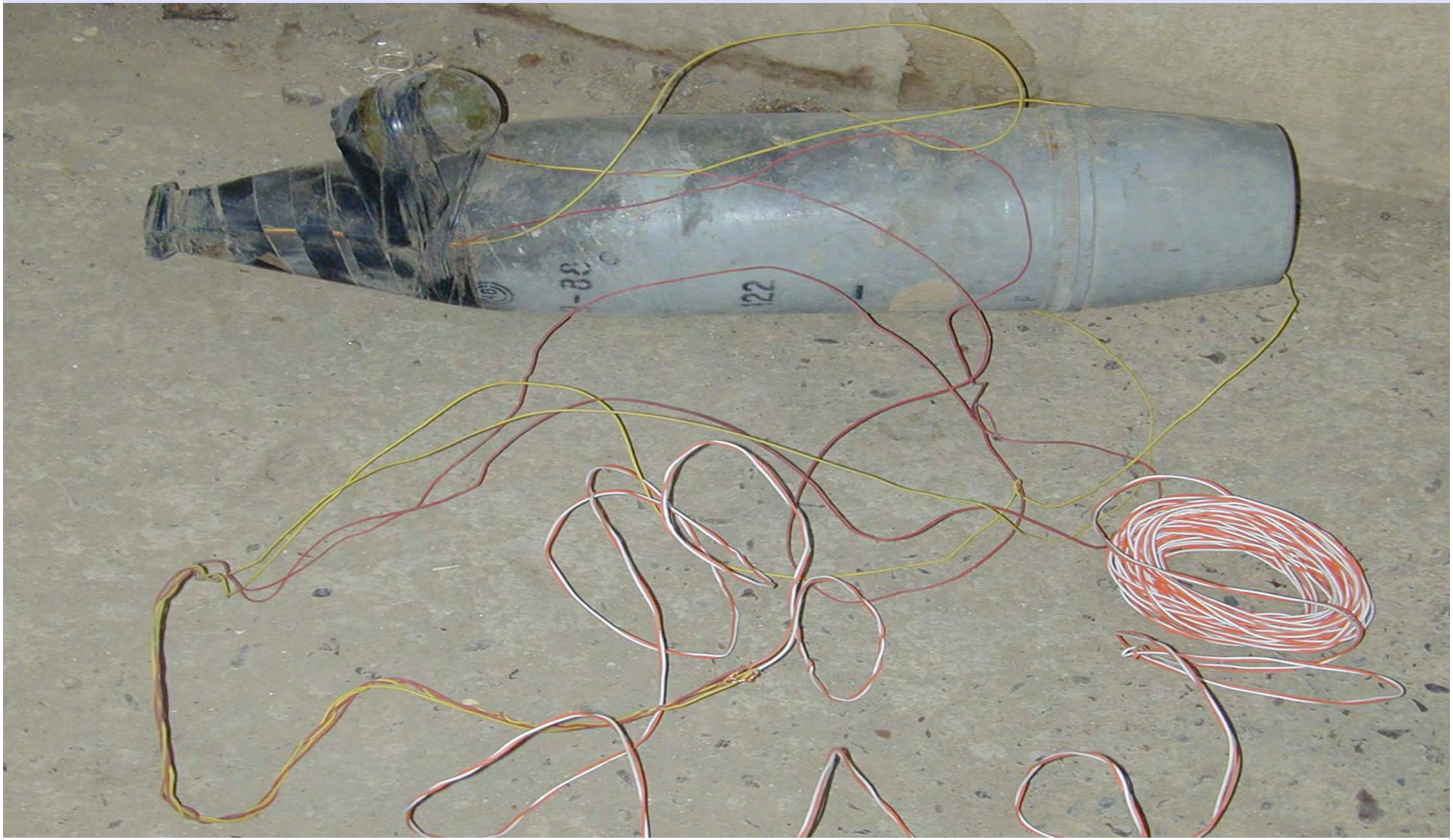

Occupation Garrisons
The Green Zone
Baghdad Airport


IBN SINA HOSPITAL

Mission

- Diagnostic Audiology
  - Blast Trauma
  - Chronic Ear Disease
- HCON
  - Hearing Protection
  - Sound Surveys

IEDs in Iraq



IEDs in Iraq

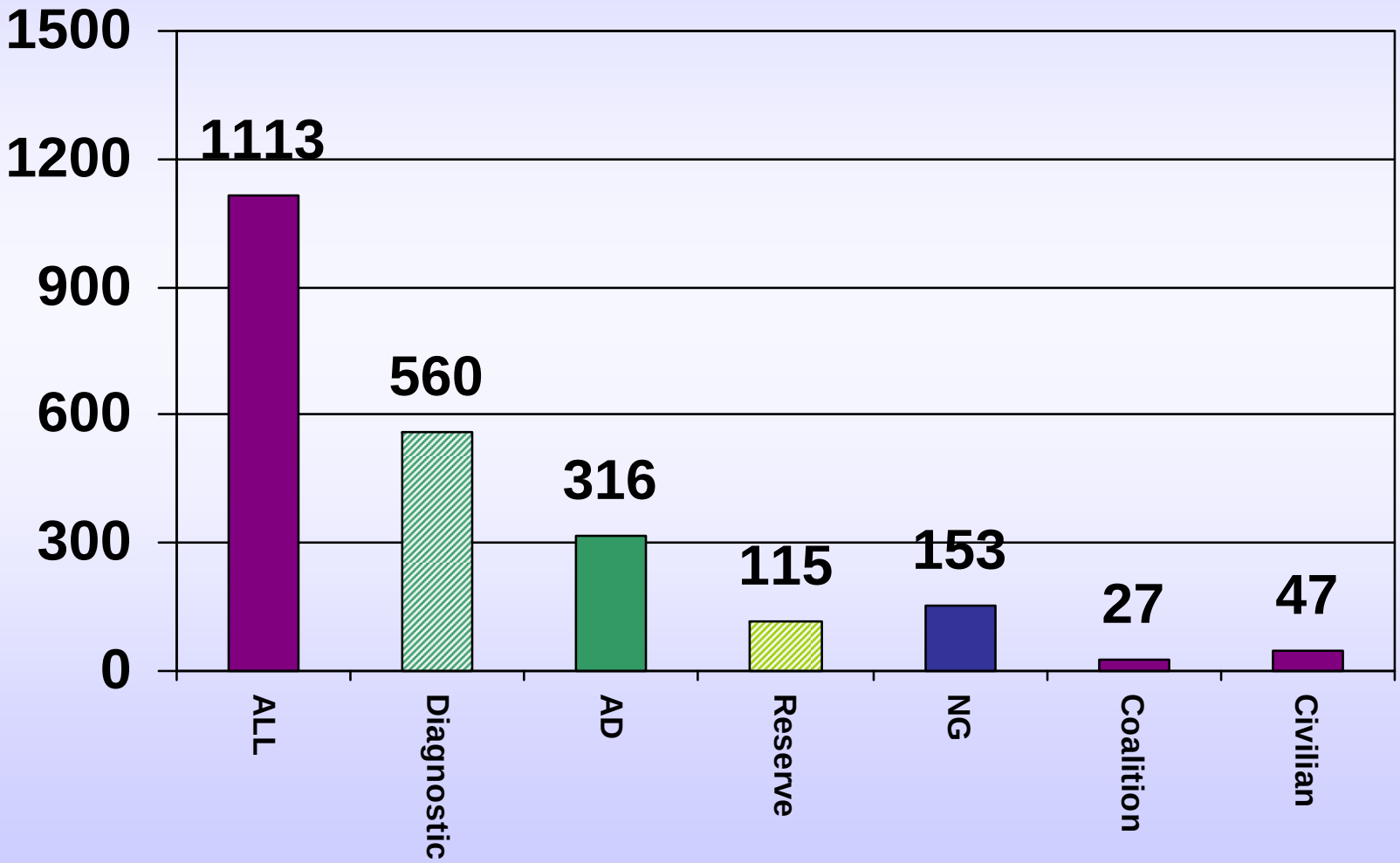
IEDs in Iraq

Green Zone Market

After Blast

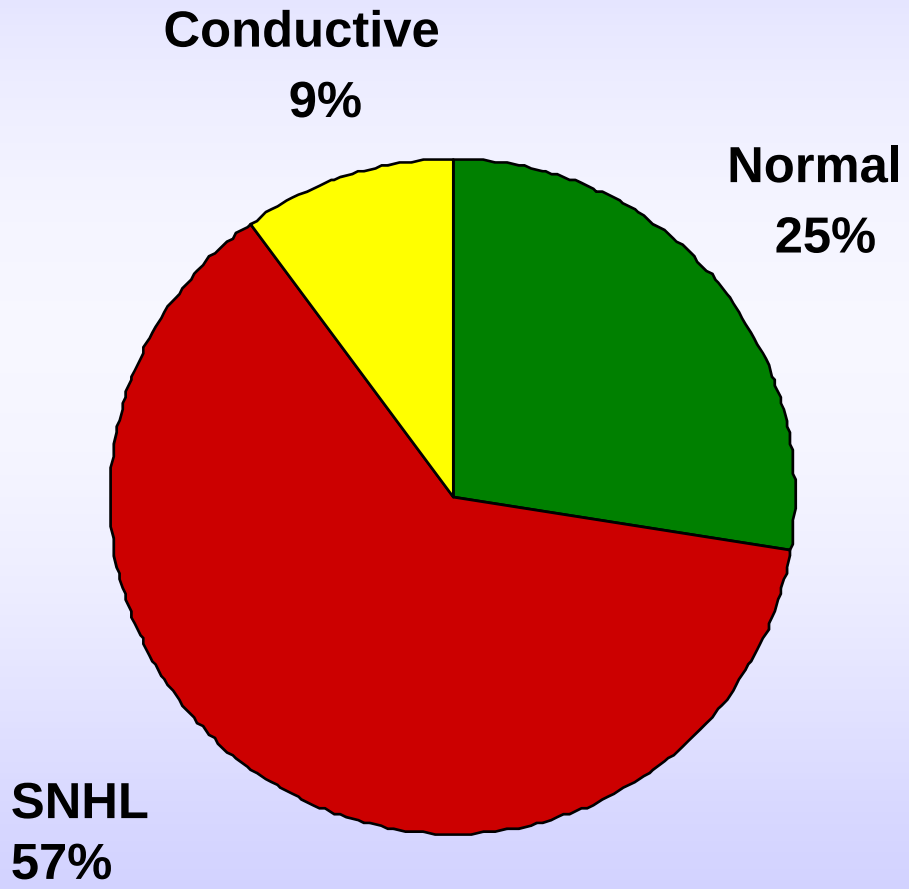
Audiology Visits at 31st CSH

Jan – Sep 2004



Audiology Visits at 31st CSH

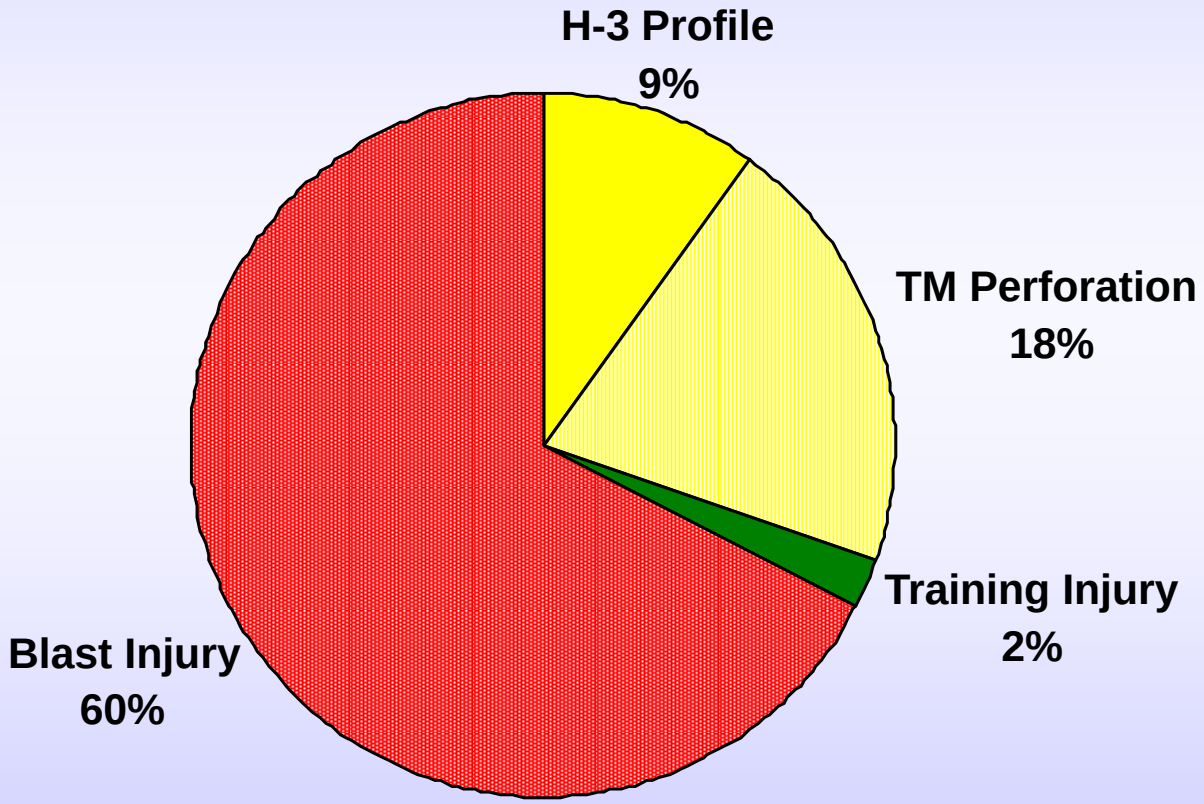
Diagnostic Cases



*Mixed HL included in SNHL

Audiology Visits at 31st CSH

SNHL Findings (Jun – Sep 04)



Hearing Protection

The Problem and Solution

"Earplugs or muffs appear to be counter-indicated, with regard to speech communication in the situation where they are probably needed most – namely, in the presence of intermittent, impulsive noise, such as gunfire. Here, the wearer of earplugs or muffs cannot hear weak speech during silent intervals between impulses. The ideal solution would be a nonlinear device that would let weak sounds through at full strength but would attenuate intense sounds."

pp. 68-69

K.D. Kryter, The Effects of Noise on Man (1970) Academic Press

COMBAT ARMS EARPLUG

- Insert **YELLOW** plugs for weapons fire to protect hearing and to hear between firings.
- Insert **GREEN** plugs for noise in and around aircraft, noisy vehicles and watercraft, etc.

- Check proper fit by gently tugging on plugs for tension.
- For very large ear canals, fold opposing plug back.
- Keep plugs clean with soap and water and filter holes free of ear wax and other debris. Return plugs dry to case.
- Although still protective, weapons fire is louder with yellow plugs in.


CEPS

Summary

- Blast trauma
- Noise and hearing loss
- Noise and communication
- Noise, hearing loss and communication
- Usable hearing protection

Questions