Chapter 25

RECRUIT MORTALITY

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INTRODUCTION TO THE EPIDEMIOLOGY OF RECRUIT MORTALITY

Deaths of seemingly healthy young adults are tragic—especially when these individuals die during basic military training (BMT) while serving their country, not only for the recruits' families and friends but also for the military communities. Highly visible to the general public, these premature deaths can create immediate policy implications.

Scoville and colleagues[1,2] identified 276 recruit deaths during US Air Force, Army, Marine Corps, and Navy BMT from 1977 through 2001. These deaths occurred among 6.3 million recruits over 25 years (representing 972,000 recruit–years of BMT experience).[1] For recruits aged 17 through 24 and 25 through 35, the mortality rates were 27 and 55 deaths, respectively, per 100,000 recruit–years.[1] In comparison, during the same period, US civilian mortality rates exceeded 81 and 101 deaths, respectively, per 100,000 resident population for ages 15 through 24 and 25 through 34.[3(p189)] Although the recruit mortality rates are less than half the equivalent US civilian mortality rates, preventable recruit deaths occasionally occur. However, the military is making great efforts to understand the epidemiology of recruit deaths so that future deaths during BMT might be prevented.

Publications of US military recruit deaths in peer-reviewed journals since 1977 have included isolated case reports,[4-13] cause-specific population-based studies,[14-16] service-specific population-based studies,[17, 18] and triservice population-based studies.[1,2] The case reports describe five recruit deaths related to physical training,[4,6,8,9,11] five to infectious diseases,[5,10,12,13] and one to unintentional injury.[7] Table 25-1 provides additional details on the 11 recruit deaths described in these case reports.

Two of the population-based studies analyzed Air Force recruit deaths.[16,18] Phillips and colleagues[16] published a 20-year review of sudden cardiac deaths during Air Force BMT at Lackland Air Force Base, Texas (the only Air Force BMT site). Retrospective review of autopsy records identified 21 cardiac deaths (19 sudden and 2 nonsudden) and 32 noncardiac deaths from 1965 through 1985. Strenuous physical exertion was associated with sudden cardiac death in 17 of the 19 cases. Two cardiovascular pathologists independently reviewed case histories, clinical records, circumstances of death, autopsy reports, and microscopic heart sections (19 of the cardiac deaths and 17 noncardiac deaths) and found that the most frequent underlying etiology was myocarditis (8 deaths). Hein and colleagues[19] later suggested that malignant hyperthermia may have contributed to six of the deaths identified by Phillips and colleagues.[16]

Drehner and colleagues[18] expanded this study population by conducting a descriptive analysis of Air Force recruit mortality from 1956 through 1996. All autopsy records were retrospectively reviewed and screened for subjects with the rank of airman basic at the time of death. A total of 85 deaths among recruits were identified, with 81% being nontraumatic, 17% traumatic (11 suicides and 3 unintentional injuries), and 2% unclassified. Of the nontraumatic deaths, 30 were attributed to cardiac causes (at least 23 of these were exercise-related), and 28 to infections (11 cardiac, 10 pulmonary, 6 central-nervous-system–related, and 1 systemic). The most common modality for committing suicide was jumping from heights (7), followed by hanging (2), exsanguination (1), and drug overdose (1). Two of the unintentional injuries were related to falling, and one involved a pedestrian hit by a vehicle.

The third population-based study categorized the causes and circumstances of a subset of Navy and Marine Corps recruit deaths at two training facilities from 1973 through 1985. Wagner and Clark[17] retrospectively identified 31 on-base recruit deaths at the Marine Corps Recruit Depot and Recruit Training Command, San Diego, California, from 1973 to 1981, by manually searching autopsy files. Deaths from 1981 through 1985 were identified prospectively by one of the authors,[17] who performed or supervised all autopsies of recruits who died in training during this period. There were 22 nontraumatic deaths (71%) and 9 traumatic deaths (4 of suicide, 4 of unintentional injury, and 1 by homicide). Of the 22 nontraumatic deaths, 8 were of infectious diseases (4 pulmonary, 3 central-nervous-system–related, and 1 other) and 6 of exercise-related cardiopathy. Methods of suicide included gunshots (3) and hanging (1). The four unintentional injury deaths occurred during an artillery mishap (1 of a missile wound), self-defense training (1 by blunt force trauma), and swim training (2 by drowning). One homicide occurred on the rifle range and was caused by multiple gunshot wounds.

A fourth population-based recruit mortality study found a 28-fold to 40-fold higher risk of exercise-related sudden death unexplained by prior disease in recruits with sickle cell trait (SCT). Kark and colleagues[15] identified 80 deaths among recruits undergoing Air Force, Army, Marine Corps, and Navy BMT from 1977 through 1981. They manually reviewed autopsy files, morgue logs, and patient administration logs of the 17 hospitals serving the 15 BMT sites that were operational during the study period. Most deaths (79%) were nontraumatic, and 42 of those (67%) were sudden deaths.

TABLE 25-1

PUBLISHED CASE REPORTS OF US MILITARY RECRUIT DEATHS, 1977–2001*

Author, Year	Age/Sex/Service	Fatal Activity	Date of Death	Cause of Death
Kollef, 1990[1]	18/M/Army†	PT (running)	Sep 1988	EHI (heat stroke and rhabdomyolysis)
Musser, 1994[2]	22/M/Air Force	Not exercise-related	Feb 1993	*Streptococcus pyogenes*
Murray, 1996[3]	19/M/Army†	PT (running)	Jun 1992	Sickle cell crisis
Malakooti, 1998[4]	19/M/Marine Corps	Not exercise-related	Nov 1997	*Neisseria meningitidis* serogroup B
Ross, 1999[5]	19/M/Marine Corps	Boxing match	Feb 1997	Blunt force trauma to head
Garigan, 1999[6]	18/M/Army	PT followed by marksmanship training	Jul 1997	Hyponatremia due to acute water intoxication
Phelps, 2000[7]	19/M/Army†	PT (running)	Sep 1996	Anomalous left coronary artery and EHI (heat stroke and rhabdomyolysis)
CDC, 2001[8]	21/M/Navy	Not exercise-related	Jun 2000	Adenovirus
	18/M/Navy	Not exercise-related	Sep 2000	Adenovirus-related (probable streptococcal toxic shock syndrome)
Gardner, 2002[9]	19/M/Air Force‡	PT (road march/hike)	Sep 1999	Heat stroke and hyponatremia
Baker, 2005[10]	18/M/Marine Corps	Not exercise-related	Dec 2001	*Streptococcus pneumoniae* serotype 38

*All cases listed in the table are included in the Recruit Mortality Registry. There is an additional published case report[11] of a "recruit death" that does not meet the Recruit Mortality Registry's definition of a recruit death because the subject was an Army Reservist with prior service and the fatal incident occurred during a 14-day period of active duty training.
†Data that were not provided in the publication were obtained through the Recruit Mortality Registry.
‡Also includes description of the case previously reported by Garigan.[6]
CDC: Centers for Disease Control and Prevention
EHI: exertional heat illness
PT: physical training
(1) Kollef M. Sudden death in Air Force recruits [letter]. *Mil Med.* 1990;155:A7. (2) Musser JM, Kapur V, Peters JE, et al. Real-time molecular epidemiologic analysis of an outbreak of *Streptococcus pyogenes* invasive disease in U.S. Air Force trainees. *Arch Pathol Lab Med.* 1994;118:128-133. (3) Murray MJ, Evans P. Sudden exertional death in a soldier with sickle cell trait. *Mil Med.* 1996;161:303-305. (4) Malakooti M. Meningococcemia in a recruit. *Naval Med Surveillance Rep.* 1998;1:9–10. (5) Ross RT, Ochsner MG Jr, Boyd CR. Acute intracranial boxing-related injuries in U.S. Marine Corps recruits: Report of two cases. *Mil Med.* 1999;164:68-70. (6) Garigan TP, Ristedt DE. Death from hyponatremia as a result of acute water intoxication in an Army basic trainee. *Mil Med.* 1999;164:234-238. (7) Phelps SE. Left coronary artery anomaly: An often unsuspected cause of sudden death in the military athlete. *Mil Med.* 2000;165:157–159. (8) Centers for Disease Control and Prevention. Two fatal cases of adenovirus-related illness in previously healthy young adults—Illinois, 2000. *MMWR Morb Mortal Wkly Rep.* 2001;50:553-555. (9) Gardner JW. Death by water intoxication. *Mil Med.* 2002;167:432-434. (10) Baker CI, Barrozo CP, Ryan MA, et al. Fatal meningitis in a previously healthy young adult caused by *Streptococcus pneumoniae* serotype 38: an emerging serotype? *BMC Infect Dis.* 2005;5(1):38. (11) Sateriale M, Hart P. Unexpected death in a black military recruit with sickle cell trait: Case report. *Mil Med.* 1985;150:602-605.

The remaining population-based studies analyzed deaths during Air Force, Army, Marine Corps, and Navy BMT from 1977 through 2001.[1,2,14] Recruit deaths were identified through the Recruit Mortality Registry (RMR) in the Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology (AFIP). The RMR provides standardized cause of death coding among the military services, as well as centralized medical mortality surveillance data for US Air Force, Army, Marine Corps, and Navy recruit deaths since 1977. The descriptive epidemiology of traumatic and nontraumatic recruit deaths from 1977 through 2001 will be described later in this chapter. Traumatic deaths, infectious disease deaths, and deaths among recruits identified with SCT from 2002 through 2005 are also included in the epidemiology sections of this chapter. Recruit deaths with the fatal incident occurring outside of the training installation (ie, during authorized or unauthorized leave status) are not included in this chapter.

ACTIVE DUTY MEDICAL MORTALITY SURVEILLANCE

The Report of Casualty (DD Form 1300) is the official record of death for all military personnel who die while serving on active duty.[20] The military service casualty offices provide monthly automated data files containing an individual record for each completed DD Form 1300 to the Department of Defense (DoD) Directorate for Information Operations and Reports for incorporation into the DoD's Worldwide Casualty System.[20] The DoD's source of statistical information, the Directorate provides periodic summaries of all active duty casualties by type (hostile and nonhostile) and manner of death, branch of military service, geographical location, and year of occurrence.[21] These casualty data also categorize the manner of nonhostile deaths by accident (ie, unintentional injury), illness, homicide, self-inflicted (ie, suicide), undetermined, or pending.

Although the Worldwide Casualty System provides accurate casualty information based on manner of death, it does not provide the kind of medical information necessary to focus a preventive intervention program. To overcome these limitations, the AFIP established the Mortality Surveillance Division in 2001. The Mortality Surveillance Division maintains the DoD Medical Mortality Registry (DoD MMR), which is the first comprehensive medical mortality surveillance system for Air Force, Army, Marine Corps, and Navy active duty deaths.[22] In addition, an alert component was established to monitor causes of death daily and to rapidly detect deaths due to unexplained or infectious causes.[23] The Mortality Surveillance Division receives daily notification of active duty deaths through electronic casualty reports from the military service casualty offices. Circumstantial and medical information are obtained from legal, criminal, and safety investigations from DoD investigative agencies; autopsy reports from both DoD and civilian medical examiners; and telephone inquiries. These data are abstracted and entered into the DoD MMR.

Recruit Mortality Surveillance

Initial entry training status is not a standardized data field that is routinely provided on casualty reports, but the Mortality Surveillance Division began actively tracking recruit deaths in 2001. Deaths are categorized as *onsite* recruit deaths if the fatal incident occurred at a BMT site prior to completion of initial BMT while in an enlisted status in the Air Force, Army, Marine Corps, or Navy. Deaths are excluded if they occur enroute to a BMT installation and are categorized as *offsite* if the fatal incident occurred during authorized or unauthorized leave status. Deaths during Army one-station unit training (initial entry training conducted at one installation, in one unit, with the same cadre, using one program of instruction[24]) are included only if the fatal incident occurred before the advanced individual training phase started (ie, during in-processing or the basic training phase). The Mortality Surveillance Division identifies recruit deaths after manually reviewing casualty reports for pay entry base date, age, grade, unit, and duty station to confirm recruit status. Before 2001, a centralized resource for identifying recruit deaths was not available, and the AFIP's RMR was implemented specifically to provide surveillance data for recruit deaths since 1977.[25]

The Recruit Mortality Registry

This section briefly discusses the methods used to create the RMR (additional details are available in a published article[1] and dissertation[25]). All deaths included in the RMR are also included in the DoD MMR. However, the RMR provides additional epidemiologic data specific to recruit deaths that are not available in the DoD MMR.

Recruit deaths since 1977 were retrospectively identified through the active duty loss file at the Defense Manpower Data Center; loss data from the Center for Naval Analyses; military service casualty office data; and shared data from John Kark, MD, and Katerina Neuhauser, MD, DrPH. Cause of death was determined after review of all available records and was categorized as traumatic (ie, suicide, unintentional injury, homicide) or nontraumatic. Nontraumatic deaths were categorized as cardiac; idiopathic sudden death; exertional heat illness (EHI); infectious disease; vascular (eg, intracerebral hemorrhage); pulmonary (eg, asthma); or other (eg, autoimmune disease). Cardiac deaths were categorized as atherosclerotic cardiovascular disease, coronary artery abnormality, myocarditis, cardiomyopathy, or other. Deaths were defined as cardiac in origin if a heart disease was pathologically confirmed. Therefore, sudden deaths due to arrhythmia were included in the idiopathic sudden death category. Idiopathic sudden death was defined as any sudden death (ie, when the patient died or was in unrelenting coma, life support, or both, within 1 hour of the onset of symptoms) unexplained by either preexisting disease or current illness. EHI was defined to include all of the exertion-related heat illness syndromes.[26] Additionally, deaths were classified as exercise-related based upon whether or not the fatal illness began during, or within 1 hour after, exercise.

A primary data abstraction form was completed for each recruit death. The abstraction form recorded

demographic, circumstantial, and medical information. A supplemental data abstraction form was completed for all infectious disease and traumatic deaths. The following records (when available) were obtained for each death to confirm recruit status and abstract epidemiological data:

- DD Form 1300s, death certificates, and autopsy reports;
- AFIP consultations and toxicology studies;
- legal and criminal investigative reports;
- accident reports from the Army Safety Center's Risk Management Information System;
- medical records; and
- personnel records.

These records were received from the following sources:

- the DoD MMR and Air Force Mortality Registry;
- the AFIP;
- casualty offices of each military service;
- the Directorate for Information Operations and Reports;
- the Judge Advocate General of the Navy;
- the Army Criminal Investigation Command;
- the Army Safety Center; and
- the National Personnel Records Center.

EPIDEMIOLOGY OF TRAUMATIC DEATHS

There were 78 traumatic recruit deaths from 1977 through 2001 (this includes one additional death due to suicide which was identified after the publication of the 2004 article by Scoville, Gardner, and Potter[2]). Therefore, slightly more than one fourth (28%) of all recruit deaths during BMT are classified as traumatic, compared with three fourths in both the overall active duty military population[22,27-31] and the US civilian population ages 15 through 24 years.[32] The lower proportion of traumatic deaths in recruits compared with that in the overall active duty military population and same-age US civilian population can probably be attributed to the close supervision of recruits, the emphasis on safety, and the inaccessibility of alcohol and motor vehicles during BMT. Motor vehicle crashes (privately owned and government-owned vehicle accidents combined) are the leading cause of death in the entire active duty military population, accounting for 30% to 40% of fatalities.[29]

No appreciable trend in traumatic recruit mortality rates was found over time, but the overall traumatic (Table 25-2) and suicide (Table 25-3) death rates peaked in the 5-year period from 1987 through 1991 at 12.3 and 8.7 deaths, respectively, per 100,000 recruit-years. The age-adjusted traumatic death rates were highest in the Army (3.9 times higher than those in the Navy, 3.5 times higher than those in the Air Force and 1.9 times higher than those in the Marine Corps), as shown in Table 25-4. The traumatic mortality rate for men was more than triple the rate for women in all military services (rate ratio [RR]=3.9; P=0.01). A total of three

TABLE 25-2

TRAUMATIC MORTALITY RATES OVER TIME FOR ALL US MILITARY RECRUITS, 1977–2001

Case No.†	Years	Traumatic Deaths	Overall Deaths	Population x 10^5	Traumatic Rate* (95% CI)	Overall Rate* (95% CI)
1–19	1977–1981	19	85	16.5	7.5 (4.8–11.7)	33.5 (27.1–41.4)
20–34	1982–1986	15	64	15.3	6.4 (3.9–10.5)	27.2 (21.3–34.7)
35–58	1987–1991	24	52	12.7	12.3 (8.3–18.3)	26.6 (20.3–34.9)
59–68	1992–1996	10	30	9.3	7.0 (3.8–12.9)	21.0 (14.7–29.9)
69–78	1997–2001	10	47	9.1	7.1 (3.9–13.1)	33.6 (25.2–44.6)
Totals	**1977–2001**	**78**	**278**	**62.9**	**8.1 (6.5–10.1)**	**28.7 (25.5–32.3)**

*Calculated by multiplying the numeric death rate by 6.5 (52 weeks divided by the average of 8 weeks of basic military training for all services combined) and expressed per 100,000 nonprior service active component recruit–years.
†Case numbers were assigned chronologically by 5-year categories; these categories are also cited in Tables 25-6, 25-7, 25-8, and 25-10.
CI: confidence interval
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

TABLE 25-3

RECRUIT SUICIDE RATES OVER TIME BY US MILITARY SERVICE, 1977–2001

Years	Air Force	Army	Marine Corps	Navy	All-Service	Rate* (95% CI)
1977–1981	1	5	1	3	10	3.9 (2.1–7.3)
1982–1986	2	7	0	1	10	4.2 (2.3–7.8)
1987–1991	1	11	4	1	17	8.7 (5.4–13.9)
1992–1996	0	3	1	1	5	3.5 (1.5–8.2)
1997–2001	1	2	2	1	6	4.3 (2.0–9.4)
Totals	**5**	**28**	**8**	**7**	**48**	**5.0 (3.7–6.6)**

*Calculated by multiplying the numeric death rate by 6.5 (52 weeks divided by the average of 8 weeks of basic military training for all services combined) and expressed per 100,000 nonprior service active component recruit–years.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

female traumatic recruit deaths (two suicides and one unintentional injury) were found, and all occurred during Army training. Most traumatic deaths were due to suicide (62%), followed by unintentional injuries (33%), and homicide (5%).

Suicide

Suicide accounted for all five of the traumatic deaths in the Air Force, and 56% to 78% among the other military services (Figure 25-1). Of the 48 suicides among all services, 38 (79%) occurred while the recruits were in routine training status. The other 10 suicides occurred while the recruits were inpatients in the hospital (4), awaiting administrative separation (3), or both (3). For ages 17 through 24 and 25 through 34, the suicide rates were 5 and 2, respectively, per 100,000 recruit–years from 1977 through 2001. This is less than half of the rate among US civilians (exceeding 10 deaths per 100,000 resident population in ages 15–34) during this period.[3(p221)] Table 25-5 shows the distribution of suicides for each service by sex, race, age, training duration, and method. The median duration from arrival at BMT for in-processing to the fatal incident was 41 days (range: 4 to 88 days). The suicide rate for males was at least triple compared to females in all military services (RR=3.6, P=0.06).

Gunshots were the most common method of suicide used by both Army (54%) and Marine Corps (50%) recruits; there were no gunshot suicides identified among Air Force and Navy recruits (see Table 25-5). Army and Marine Corps recruits are assigned a rifle during basic training (although it is stored in a secured unit arms room when not in use). In contrast, Air Force and Navy recruits have limited use of firearms. Table 25-6 provides case summaries of the 19 gunshot suicides. Military-issue M-16 rifles were used for all gunshot suicides and most (84%) occurred during marksmanship training, field training, or range detail. The remaining three gunshot suicides occurred outside the barracks after the recruit obtained his weapon from the unit arms room (cases 35 and 60) or during field training while posted as the equipment guard (case 40). From 2002 through 2005, there were two recruit gunshot suicides using military-issued M-16 rifles. One occurred during Army rifle qualification, and the other during Marine Corps marksmanship training.

Hanging was the most frequent method of suicide (57%) used by Navy recruits; there was only one suicide by hanging among Air Force recruits (see Table 25-5). Table 25-7 provides case summaries of the 15 suicides by hanging among recruits in all services; cases 25, 47, and 78 occurred while the recruits were awaiting administrative separation. In case 78, the recruit hanged himself with his pajama pants over the bathroom door in his hospital room. Items used in the remaining hangings included web belts, carrying case straps, elastic bandages, suspenders, bootlaces, electrical cords, neckerchiefs, ropes, and pillow cases. These items were attached to overhead pipes or beams, coat racks, closet clothes bar, bunks, stairwell handrails, and tree limbs. From 2002 through 2005, two Army recruits at different training installations hanged themselves. One was awaiting administrative separation when he hanged himself using an electrical cord attached to the hinge of a utility closest door; the other hanged himself in a utility closet from a pipe in the ceiling using a shelter half rope.

Most Air Force suicides (80%) were due to jumps or falls (see Table 25-5). Table 25-8 provides case summaries

TABLE 25-4

NUMBER OF TRAUMATIC RECRUIT DEATHS, RECRUIT ACCESSIONS, AND CATEGORY-SPECIFIC MORTALITY RATES BY US MILITARY SERVICE, 1977–2001

	Air Force			Army			Marine Corps			Navy			All-Service*		
Category	**n†**	**N‡**	**Rate§ (95% CI)**	**n†**	**N‡**	**Rate§ (95% CI)**	**n†**	**N‡**	**Rate§ (95% CI)**	**n†**	**N‡**	**Rate§ (95% CI)**	**n†**	**N‡**	**Rate§ (95% CI)**
Age in Years															
17–19	4	7.3	4.7 (1.8–12.2)	29	15.2	12.4 (8.6–17.8)	12	6.5	8.7 (5.0–15.3)	6	11.3	3.5 (1.6–7.5)	51	40.2	8.2 (6.3–10.8)
20-24	1	4.1	2.1 (0.4–12.0)	17	7.8	14.2 (8.8–22.7)	2	2.0	4.7 (1.3–17.2)	3	5.2	3.8 (1.3–11.0)	23	19.0	7.9 (5.2–11.8)
≥ 25	0	0.5	—	4	1.9	13.7 (5.3-35.2)	0	0.2	—	0	1.0	—	4	3.6	7.2 (2.8-18.6)
Sex															
Male	5	9.5	4.6 (1.9–10.7)	47	21.2	14.4 (10.8–19.2)	14	8.2	8.1 (4.8–13.5)	9	15.4	3.8 (2.0–7.2)	75	54.3	9.0 (7.2–11.3)
Female	0	2.3	—	3	3.7	5.3 (1.8–15.5)	0	0.5	—	0	2.1	—	3	8.5	2.3 (0.8–6.7)
Race¥															
Black	5	10.1	4.3 (1.8–10.0)	41	18.6	14.3 (10.6–19.4)	13	7.2	8.5 (5.0–14.6)	6	14.5	2.7 (1.2–5.9)	65	50.3	8.4 (6.6–10.7)
Non-Black	0	1.7	—	9	6.3	9.3 (4.9–17.6)	1	1.5	3.2 (0.6–17.9)	3	3.0	6.5 (2.2–19.1)	13	12.5	6.8 (4.0–11.6)
Manner of Death															
Suicide	5	11.8	3.7 (1.6–8.6)	28	24.9	7.3 (5.1–10.6)	8	8.7	4.3 (2.2–8.6)	7	17.5	2.6 (1.3–5.4)	48	62.9	5.0 (3.7–6.6)
Unintentional Injury	0	11.8	—	19	24.9	5.0 (3.2–7.7)	5	8.7	2.7 (1.2–6.4)	2	17.5	0.7 (0.2–2.7)	26	62.9	2.7 (1.8–3.9)
Homicide	0	11.8	—	3	24.9	0.8 (0.3–2.3)	1	8.7	0.5 (0.1–3.1)	0	17.5	—	4	62.9	0.4 (0.2–1.1)
Totals	**5**	**11.8**	**3.7 (1.6–8.6)**	**50**	**24.9**	**13.1 (9.9–17.2)**	**14**	**8.7**	**7.6 (4.5–12.8)**	**9**	**17.5**	**3.3 (1.8–6.4)**	**78**	**62.9**	**8.1 (6.5–10.1)**
Adjusted¶			3.7			13.0			7.0			3.3			8.1
Rate Ratio			1.1			3.9			2.1			1.0			—

*Discrepancies in the sums of recruit accessions across rows are due to rounding directly from the Defense Manpower Data Center's all-service data.
†Number of traumatic recruit deaths.
‡Expressed per 100,000 nonprior service active component recruit accessions.
§Calculated by multiplying the numeric death rate by average training period expressed in years (52 wk/6, 8, or 11 wk, respectively, for the Air Force; All-Service, Army and Navy; and Marine Corps). They are expressed per 100,000 nonprior service active component recruit–years.
¥Race/ethnicity was categorized as black and non-black because categorization of race and ethnicity in the population data from the Defense Manpower Data Center was not standardized over the 25-year study period.
¶Age-adjusted using the total recruit population as the standard.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

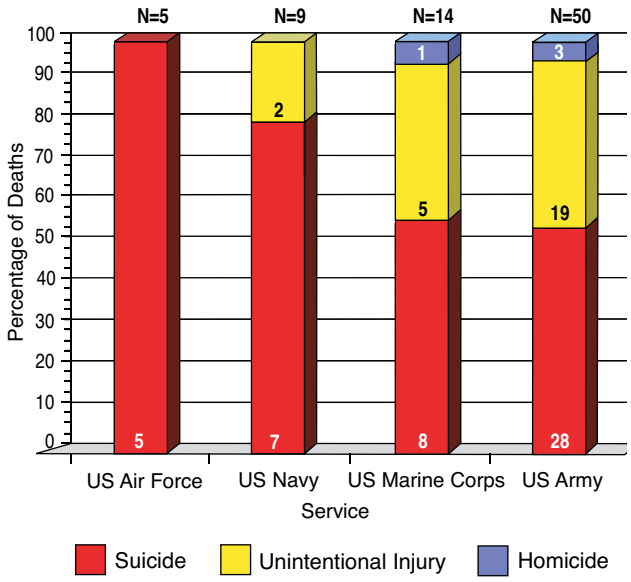

Fig. 25-1. Percentage of traumatic recruit deaths by cause for each US military service, 1977 to 2001. Note that most were due to suicide, followed by unintentional injuries and homicide.

of the 12 all-service suicides by jump or fall. The fatal incident most commonly occurred at the training installation's hospital (50%) or barracks (42%). Cases 9, 28, 48, and 49 occurred among inpatients; cases 8 and 50 among inpatients awaiting administrative separation. Case 72 involved a recruit awaiting administrative separation under unit watch[33] in the barracks.

Two additional suicides (cases 34 and 73), not included in Tables 25-6 through 25-8, were due to drug overdoses. In case 34, an 18-year-old white male ingested a full bottle of prescription benzonatate (Tessalon, Forest Pharmaceuticals Inc, St Louis, Mo). Two days after he was prescribed this medication for persistent cough due

TABLE 25-5

RECRUIT SUICIDES BY SEX, RACE, AGE, TRAINING DURATION, AND METHOD BY US MILITARY SERVICE, 1977–2001

Category	Air Force (%*)	Army (%*)	Marine Corps (%*)	Navy (%*)	All-Service (%*)
Sex					
Male	5 (100)	26 (93)	8 (100)	7 (100)	46 (96)
Female	0	2 (7)	0	0	2 (4)
Race					
White	5 (100)	23 (82)	7 (88)	3 (43)	38 (79)
Black	0	4 (14)	1 (12)	2 (29)	7 (15)
Asian	0	1 (4)	0	2 (29)	3 (6)
Median age (years)	19	19	19	19	19
Range	17–22	18–35	18–24	17–21	17–35
Median training duration (days)†	45	37	54	21	41
Range	9–75	10–68	14–88	4–45	4–88
Method					
Gunshot	0	15 (54)	4 (50)	0	19 (40)
Hanging	1 (20)	7 (25)	3 (38)	4 (57)	15 (31)
Fall/jump	4 (80)	5 (18)	1 (12)	2 (29)	12 (25)
Overdose	0	1 (4)	0	1 (14)	2 (4)
Totals	**5**	**28**	**8**	**7**	**48**
Rate‡(95% CI)	3.7 (1.6–8.6)	7.3 (5.1–10.6)	4.3 (2.2–8.6)	2.6 (1.3–5.4)	5.0 (3.7–6.6)

*Percentages may not total 100 due to rounding.
†Training duration is total days from arrival to reception station at basic training site to the fatal incident.
‡Calculated by multiplying the numeric death rate by average training period expressed in years (52 wk/6, 8, or 11 wk, respectively, for the Air Force; All-Service, Army, and Navy; and Marine Corps). They are expressed per 100,000 nonprior service active component recruit–years.
CI: confidence interval
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

TABLE 25-6

CHRONOLOGICAL CASE SUMMARIES OF GUNSHOT SUICIDES AMONG US MILITARY RECRUITS, 1977–2001

Case	Demographics*	Service	Activity	Circumstances
1	22/M/White	Army	Marksmanship training	Placed muzzle of weapon under his chin and pulled the trigger
2	24/M/White	Army	Marksmanship training	Placed muzzle of weapon under his chin and pulled the trigger
3	19/M/White	Marine Corps	Work detail after marksmanship training	Found behind range shack with a gunshot wound to the abdomen
20	24/M/White	Army	Marksmanship training	Placed muzzle of weapon under his chin and pulled the trigger
21	18/M/White	Army	Work detail after marksmanship training	Found behind latrine with a gunshot wound to the head
22	20/F/White	Army	Prior to departure for marksmanship training	Found locked in a portable toilet with a gunshot wound to the head
35	18/M/White	Army	Work detail after morning meal	Found outside barracks with a gunshot wound to the head
36	19/M/White	Army	Marksmanship training	Found in the holding area with a gunshot wound to the head
37	19/M/White	Army	Range detail	Observed taking the blank adaptor off his weapon prior to being found with a gunshot wound to the head
38	18/M/White	Army	Marksmanship training	Placed muzzle of weapon to his forehead and pulled the trigger
39	20/M/White	Army	Marksmanship training	Found slumped over against the bunker wall with a gunshot wound to the head
40	18/M/White	Army	Equipment guard during bivouac training	Found with a gunshot wound to the head in a wooded area near the bivouac area
41	18/M/Black	Army	Marksmanship training	Engaged several targets, then placed muzzle of weapon under his chin, and pulled the trigger
42	18/M/White	Marine Corps	Reveille during field training	Found lying in a shelter half-tent with a gunshot wound to the head
43	19/M/Hispanic	Marine Corps	Marksmanship training	Placed muzzle of weapon to his forehead and pulled the trigger while preparing to fire his weapon
59	19/M/White	Army	Marksmanship training	Placed muzzle of the weapon in his mouth and pulled the trigger
60	23/M/Asian	Army	Retrieving gear from inside the barracks after receiving an Article 15	Found with a gunshot wound to the head at the wood line near the barracks
69	18/M/Black	Army	Marksmanship training	Found behind the latrines with a gunshot wound to the head
70	18/M/Black	Marine Corps	Marksmanship training	Grabbed the rifle of another recruit, put the muzzle in his mouth, and pulled the trigger

*Age (in years)/Sex/Race. "Hispanic" refers to persons of Hispanic origin (ethnicity) from any race; "White" refers to white, non-Hispanic; "Black" refers to black, non-Hispanic; and "Asian" refers to Asian or Pacific Islander.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

TABLE 25-7

CHRONOLOGICAL CASE SUMMARIES OF HANGING SUICIDES AMONG US MLITARY RECRUITS, 1977–2001

Case	Demographics*	Service	Activity and Location	Circumstances
4	19/M/White	Army	Unknown activity in the barracks	Found hanging by a web belt from the ceiling
5	35/M/White	Army	Lights out in the barracks	Found hanging by a thin white rope from the clothing bar in his closet
6	17/M/Black	Navy	Personal time in the barracks prior to taps	Found hanging by a web belt from his upper bunk
7	17/M/White	Navy	Marching party muster in the barracks	Found hanging by a neckerchief from the coat rack attached to the bulkhead in an empty barracks
23	18/M/White	Army	Lights out at the bivouac site	Found hanging by a tent rope from a tree limb
24	20/M/White	Army	Lights out in the barracks	Found hanging by a web belt from the stairwell
25	19/M/White	Navy	Stowing gear after checking in to Special Training Division	Found hanging by a web belt and pillow case from the coat rack attached to the bulkhead
44	19/M/White	Army	Lights out at pavilion near the barracks	Found hanging by an electrical cord from a steel cross beam
45	20/M/White	Army	Reinforcement training in the barracks	Found hanging by a protective mask carrying case canvas strap from the stairwell
46	22/M/White	Marine Corps	Gear guard in the barracks	Found hanging by two nylon belts buckled together from an overhead pipe in the shower (stepped off footlocker)
47	19/M/White	Marine Corps	Working party detail in the Recruit Casual Section	Found hanging by a boot lace and web belt from an overhead pipe in the shower.
61	19/M/Black	Army	Personal hygiene in the barracks prior to formation	Found hanging from his top bunk by the web strap of his dummy M-16
62	20/M/Asian	Navy	Lights out in the barracks	Found hanging by a neckerchief from an electrical conduit pipe in the ceiling
71	18/M/White	Marine Corps	Unknown activity in the clinic	Found hanging by suspenders and an elastic / athletic bandage from an overhead pipe in bathroom (stepped off toilet)
78	19/M/White	Air Force	Psychiatric ward inpatient on suicide watch	Found hanging by his pajama pants from the bathroom door of his hospital room

*Age (in years)/Sex/Race. "Hispanic" refers to persons of Hispanic origin (ethnicity) from any race; "White" refers to white, non-Hispanic; "Black" refers to black, non-Hispanic; and "Asian" refers to Asian or Pacific Islander.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

to pneumonia, he reportedly came out of the bathroom and told a fellow recruit he had just chewed all the pills in the bottle. In case 73, a 20-year-old African American male was found in his bed having seizures about 2 hours after ingesting approximately 24 tablets of antimycobacterial isoniazid,[34] which was prescribed as the result of a positive tuberculin skin test. Toxicological analysis revealed isoniazid at a level of 77 mg/L in his blood.

TABLE 25-8

CHRONOLOGICAL CASE SUMMARIES OF JUMP OR FALL SUICIDES AMONG US MILITARY RECRUITS, 1977–2001

Case	Demographics*	Service	Activity and Location	Circumstances
8	19/M/White	Air Force	Psychiatric ward inpatient for acute schizophrenic reaction	Signed out for a walk, left ward, then jumped through a 9th-floor window
9	26/M/White	Army	Psychiatric ward inpatient for Tranxene (Abbot Laboratories, North Chicago, Ill) detoxication	Left the ward and jumped off the roof
10	21/M/White	Navy	Lights out in barracks	Jumped off the roof
26	22/M/White	Air Force	Unknown activity in barracks	Observed standing on the 3rd-floor fire escape before he struck the ground (had been diagnosed several days earlier with passive aggressive personality disorder)
27	17/M/White	Air Force	Personal time in barracks (last seen polishing his boots in the dayroom)	Used a chair to climb out the 3rd-floor window and onto ledge before jumping
28	22/M/White	Army	In-processing to the psychiatric ward for a suicidal attempt	Left the ward, broke out an 8th-floor window, and then jumped
48	19/M/White	Air Force	Psychiatric ward inpatient for clinical depression	Left the ward and jumped from 9th-floor window
49	18/M/White	Army	Psychiatric ward inpatient for a brief reactive psychosis	Jumped off the 1st-floor balcony while working on a project
50	21/F/Black	Army	Psychiatric ward inpatient for a brief reactive psychosis, schizophreniform disorder	Left the ward dayroom after dinner and then jumped from the 9th-floor window
51	18/M/Asian	Navy	Attending lecture in classroom	Requested to use the bathroom, left the room, ran down hall, climbed up on the 2nd-floor railing, and jumped
63	24/M/White	Marine Corps	Sunday morning holiday routine in barracks	Observed leaning forward on the outside of the 3rd-floor guardrail before letting go
72	18/M/White	Army	Lights out in barracks (under full unit suicide watch)	Opened a 3rd-floor window and then jumped during the fireguard changeover

*Age (in years)/Sex/Race. "Hispanic" refers to persons of Hispanic origin (ethnicity) from any race; "White" refers to white, non-Hispanic; "Black" refers to black, non-Hispanic; and "Asian" refers to Asian or Pacific Islander.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

Unintentional Injury

The 26 unintentional injury deaths accounted for 22% to 38% of all traumatic deaths among the Army, Marine Corps, and Navy (see Figure 25-1). The wide distribution in the overall types of unintentional injury deaths included falls (5), explosions (5), gunshots (5), electrocutions (4), inadvertent drug overdoses (3), asphyxiations (2), and close combat injuries (2) (Table 25-9). Table 25-10 provides case summaries by type for the unintentional injury deaths. Most unintentional injuries (92%) occurred during routine training status. However, case 64 occurred while the recruit was awaiting administrative separation, and case 76

occurred while the recruit was assigned to an overnight evaluation unit that served as an "extended training timeout."

All three unintentional drug overdose deaths were associated with prescription medications. Cases 29 and 64 were likely related to overuse of prescription adrenergic bronchodilators.[35-37] The most recent (case 64) occurred in a recruit who used approximately 375 doses of Medihaler (3M Pharmaceuticals, St. Paul, Minn) over a 2-week period in 1994. As of April 2004, individuals with a history of reliably diagnosed asthma after the 13th birthday are disqualified from entry into the military; there were no changes to this standard in January 2005.[38] However, applicants who do not meet accession standards can be waived on a case by case basis. For Army recruits, if asthma manifests itself within the first 6 months of active duty, retention standards can be followed instead of the stricter accession standards. The retention standard defines degrees of asthma that need referral for the medical evaluation board, physical evaluation board, and permanent profiling (P-3 or P-4).[39] This allows the Army to keep recruits who require bronchodilators or inhaled corticosteroids (as needed) but can still complete the physical training requirements. The third unintentional drug overdose death from 1977 through 2001 was case 52. This recruit overdosed on over-the-counter salicylate and prescription-strength ibuprofen (Motrin, Upjohn Co, Kalamazoo, Mich) in a suicide gesture (ie, an attempt to gain command attention) that resulted in an unintentional injury death. During treatment at the hospital, she stated that she did not take the pills to commit suicide. As a result of this death, local recommendations included removing all over-the-counter medications that could be toxic when taken in overdose from the branch post exchanges located in the trainee areas. In 2004, there was an Army death from acute narcotic intoxication; toxicology was positive for methadone at 0.29 mg/L. The recruit had been prescribed multiple narcotics for a leg injury and had a history of snorting these medications and taking extra doses to achieve improved pain management (by self-report).

Three of the unintentional explosion deaths (cases 54–56) occurred in the same incident when a group formation was hit during bivouac training by a 105-mm howitzer shell. The recruit in case 66 died from gunshot wounds from an improperly mounted M-60 machine gun used to provide overhead fire during night infiltration training. Another Army recruit died in 2003 at a different training installation but under similar circumstances as in case 66.

All four of the electrocution deaths (cases 32, 67, 68, and 75) were caused by lightning. In addition, an Army recruit was electrocuted in 2004 when he sat down and leaned back against the exterior of an old metal latrine (which had become electrified due to an electrical short), located adjacent to a new latrine on a training range.

TABLE 25-9

UNINTENTIONAL INJURY RECRUIT DEATHS BY TYPE AND US MILITARY SERVICE, 1977–2001

Type	Air Force	Army (%)	Marine Corps (%)	Navy (%)	Total (%)
Fall	0	4 (21)	0	1 (50)	5 (19%)
Explosion	0	5 (26)	0	0	5 (19%)
Gunshot	0	3 (16)	2 (40)	0	5 (19%)
Electrocution	0	3 (16)	1 (20)	0	4 (15%)
Overdose	0	3 (16)	0	0	3 (12%)
Asphyxiation	0	1 (5)	0	1 (50)	2 (8%)
Close combat	0	0	2 (40)	0	2 (8%)
Totals	**0**	**19**	**5**	**2**	**26**
Rate* (95% CI)	-	5.0 (3.2-7.7)	2.7 (1.2-6.4)	0.7 (0.2-2.7)	2.7 (1.8-3.9)

*Calculated by multiplying the numeric death rate by average training period expressed in years (8, or 11 wk, respectively, for the All-Service, Army, and Navy; and Marine Corps). They are expressed per 100,000 nonprior service active component recruit–years.
CI: confidence interval
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

TABLE 25-10

CHRONOLOGICAL CASE SUMMARIES OF UNINTENTIONAL INJURY DEATHS BY TYPE AMONG US MILITARY RECRUITS, 1977–2001

Case	Demographics*	Service	Activity and Location	Circumstances
			OVERDOSE	
29	21/M/Hispanic	Army	Lights out in the barracks	Observed having breathing problems, assisted to the Charge of Quarter's office for observation, then collapsed; had been prescribed a Medihaler ([isoproterenol hydrochloride] 3M Pharmaceuticals, St. Paul, Minn) 2 d earlier
52	20/F/White	Army	Lights out in the barracks	Ingested ~100–200 aspirin plus several Motrin (Upjohn Company, Kalamazoo, Mich) in an attempt to gain command attention (toxicology positive for salicylate)
64	23/M/Black	Army	Awaiting evening meal at the dining facility	Observed having breathing problems standing in line outside, brought inside the air conditioned facility, then collapsed; had been prescribed a Medihaler ([metaproterenol sulfate] 3M Pharmaceuticals, St. Paul, Minn) 3 wk earlier
			FALL	
11	19/M/White	Army	Releasing bird from an air shaft in the barracks	Stepped on improperly replaced grating, fell 25 feet, and struck head on concrete floor of air shaft
12	18/M/White	Army	Physical training at the obstacle course	Descending from the top of an obstacle, lost footing on the 4th rung from the top, fell 25 feet, and struck the incline ladder at the base
30	18/M/White	Army	Cleaning detail in the barracks	Slipped while wearing wool socks and struck head on adjacent shower stall wall
65	19/M/Hispanic	Navy	Lights out in the barracks	Fell from top bunk while sleeping and struck head on the cement floor
74	19/M/White	Army	Physical training at the obstacle course	Released rope while negotiating obstacle, struck the first cross beam with left leg, and then struck the second beam with midsection[1]
			EXPLOSION	
13	30/M/Hispanic	Army	Hand grenade training at the range	Failed to throw the live fragmentation grenade out of the throwing bay, taken to safety bay, then ran into danger area
53	21/M/Black	Army	Hand grenade training at the range	Detonated the live fragmentation grenade while still in the throwing position
54 55 56	21/M/White 18/M/White 25/M/White	Army	Bivouac training at the administrative area	Unit formation hit by a 105-mm howitzer shell that landed beyond range limits
			GUNSHOT	
14	18/M/Black	Army	Marksmanship training in the parking area	Struck by M-16 round that discharged during Drill and Ceremony class break
15	18/M/Hispanic	Marine Corps	Marksmanship training at the range	Bent forward to pick up his data book on the yellow ready line and hit the trigger of his M-16 with his thumb†

(**Table 25-10** *continues*)

Table 25-10 *continued*

16	18/M/Hispanic	Marine Corps	Marksmanship training at the range	Discharged round from .45 caliber pistol into right temple after firing one round down range[†]
31	18/M/White	Army	Marksmanship training at the rang	Struck by improperly cleared M-16 in the staging / ready area
66	21/M/Black	Army	Night infiltration training at the range	Struck by M-60 round from live overhead fire while navigating the obstacle course
			ELECTROCUTION	
32	18/M/White	Army	Bivouac training at the range	Struck by lightning while using an entrenching tool to cut camouflage for the shelter half-tent
67	19/M/White	Army	Field training exercise	Struck by traveling lightning ground current while in the prone position in shelter half tent
68	18/M/White	Marine Corps	Marksmanship training at the range	Struck by lightning as the platoon was moving toward the lightning dispersal area
75	18/M/White	Army	Hand grenade training at the range	Struck by lightning while in the crouching and kneeling position in the lightning dispersal area
			ASPHYXIATION	
33	17/M/White	Army	Lights out in the barracks	Fire guard discovered the recruit sitting up in bed choking (food particles were found in larynx and trachea at autopsy)
76	19/M/Black	Navy	Lights out near the Recruit Special Quarters	Manic episode/panic attack, ran out of building, physically assaulted others, resisted arrest, and then physically restrained in prone position (positional asphyxia)
			CLOSE COMBAT	
57	18/M/Hispanic	Marine Corps	Boxing in the physical training area	Collapsed after being assisted back into the ring after being injured by a blow
77	19/M/White	Marine Corps	Boxing in the combat training area	Injured by a blow, inhaled an ammonia capsule, began swinging wildly, restrained by the referee, and then lost consciousness

[*]Age (in years)/Sex/Race. "Hispanic" refers to persons of Hispanic origin (ethnicity) from any race; "White" refers to white, non-Hispanic; "Black" refers to black, non-Hispanic; and "Asian" refers to Asian or Pacific Islander.
[†]Not enough evidence to establish manner of death as suicide.
(1) Soldier Dies From Fall. Countermeasure: Army Ground Risk-Management Publication. 2000;21(7):8-9. Available at https://safety.army.mil/pages/media/pubs/cm/cmjul00.pdf. Accessed 28 January 2005.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces

There were two boxing-related unintentional injury deaths among Marine Corps recruits, both of whom were wearing proper protective gear. Case 57 occurred during a voluntary supervised recruit boxing match. Case 77 occurred during a supervised boxing program called Combat Hitting Skills.[7] Neither recruit had reported a head injury or concussion before the fatal incident, although both had such injuries: the recruit in case 57 had been hospitalized for a concussion before enlistment, and the recruit in case 77 had been hit on the head 2 days earlier during Combat Hitting Skills and subsequently experienced headaches, which he did not report to drill instructors. Additional information on some of the other unintentional injury deaths is provided in the prevention section of this chapter.

Homicide

There were four homicides among military recruits (three in the Army and one in the Marine Corps),

accounting for 6% to 7% of traumatic deaths among Army and Marine Corps recruits (Figure 25-1). Cases 17 and 18 resulted from punishment-induced heat stroke among fellow Army recruits shortly after they arrived at the company area from the reception station. Cases 19 and 58 were caused by craniocerebral trauma. In case 19, an Army recruit failed to report to formation after becoming intoxicated during an on-post pass. Two fellow recruits demonstrated intent to harm in the process of bringing the recruit downstairs to formation and "sobering him up" before lights-out. All three Army homicides occurred before 1980. The final homicide (case 58) occurred when a Marine Corps recruit struck a fellow recruit on the head with his fist following a verbal altercation in the dining facility. The victim was standing in a platoon formation and struck his head on the asphalt parade ground after being hit.

EPIDEMIOLOGY OF NONTRAUMATIC DEATHS

From 1977 through 2001, 200 nontraumatic deaths were identified (this includes one additional idiopathic sudden death in a recruit with sickle cell trait which was identified after the publication of the 2004 article by Scoville, Gardner, Magill, Potter, and Kark[1]). The mortality rates decreased over time, with the exception of the last 5-year period, from 1997 through 2001 (Table 25-11). During this period, the nontraumatic death rate was almost twice as high (RR=1.9, P=0.02) as the rate for the previous 5-year period (1992–1996), which can be attributed to an increase in both EHI and infectious disease rates.

The age-adjusted nontraumatic death rates were highest in the Army (70% higher than in the Air Force, 60% higher than in the Navy, and 30% higher than in the Marine Corps), as shown in Table 25-12. The rate of nontraumatic death generally increased with age (overall RR=2.5 for ≥ 25 vs < 25 years, P<0.001). The highest nontraumatic death rate was observed in the Army age group 25 years or older. There were no deaths among women Air Force recruits; men had 40% higher age- and race-adjusted mortality rates than women in both the Army and Navy; and there was no sex difference in the Marine Corps. The age- and sex-adjusted mortality rates were more than twice as high for blacks compared to non-blacks in all military services (average RR=2.6, P<0.001).

Most of the nontraumatic deaths (70%) were exercise-related (Table 25-13). The most frequent cause of exercise-related death was sudden cardiac death (43%), followed by idiopathic sudden death (24%) and EHI (21%).

Sudden Cardiac Death

Most of the cardiac deaths (87%) were exercise-related and at least half of these occurred within 4 weeks of arriving for BMT (Figure 25-2). The most common cardiac causes of sudden death were coronary artery

TABLE 25-11

NONTRAUMATIC MORTALITY RATES FOR ALL US MILITARY RECRUITS, 1977–2001

Years	Nontraumatic Deaths	Overall Deaths	Population x 10^5	Nontraumatic* Rate (95% CI)	Overall Rate* (95% CI)
1977–1981	66	85	16.5	26.0 (20.4–33.1)	33.5 (27.1–41.4)
1982–1986	49	64	15.3	20.8 (15.7–27.5)	27.2 (21.3–34.7)
1987–1991	28	52	12.7	14.3 (9.9–20.7)	26.6 (20.3–34.9)
1992–1996	20	30	9.3	14.0 (9.0–21.6)	21.0 (14.7–29.9)
1997–2001	37	47	9.1	26.4 (19.2–36.4)	33.6 (25.2–44.6)
Totals	**200**	**278**	**62.9**	**20.7 (18.0–23.7)**	**28.7 (25.5–32.3)**

*Calculated by multiplying the numeric death rate by 6.5 (52 weeks divided by the average of 8 weeks of basic military training for all services combined) and expressed per 100,000 nonprior service active component recruit–years.

CI: confidence interval

Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

TABLE 25-12

NUMBER OF NONTRAUMATIC RECRUIT DEATHS, RECRUIT ACCESSIONS, AND CATEGORY-SPECIFIC MORTALITY RATES BY US MILITARY SERVICE, 1977–2001

	Air Force			Army			Marine Corps			Navy			All-Service*		
Category	**n†**	**N‡**	**Rate§ (95% CI)**	**n†**	**N‡**	**Rate§ (95% CI)**	**n†**	**N‡**	**Rate§ (95% CI)**	**n†**	**N‡**	**Rate§ (95% CI)**	**n†**	**N‡**	**Rate§ (95% CI)**
Age in Years															
17–19	11	7.3	13.1 (7.3–23.4)	61	15.2	26.1 (20.3–33.5)	22	6.5	16.0 (10.6–24.2)	19	11.3	10.9 (7.0–17.1)	113	40.2	18.3 (15.2–22.0)
20-24	8	4.1	16.9 (8.6-33.4)	24	7.8	20.0 (13.4–29.8)	12	2.0	28.4 (16.2–49.6)	17	5.2	21.3 (13.3–34.0)	61	19.0	20.9 (16.2–26.8)
≥ 25	2	0.5	34.7 (9.5–126.4)	16	1.9	54.7 (33.7–88.9)	1	0.2	23.6 (4.2–133.9)	7	1.0	45.5 (22.0–93.9)	26	3.6	46.9 (32.0–68.8)
Sex															
Male	21	9.5	19.2 (12.5–29.3)	87	21.2	26.7 (21.6–32.9)	33	8.2	19.0 (13.5–26.7)	39	15.4	16.5 (12.0–22.5)	180	54.3	21.5 (18.6–24.9)
Female	0	2.3	-	14	3.7	24.6 (14.7–41.3)	2	0.5	18.9 (5.2–68.9)	4	2.1	12.4 (4.8–31.8)	20	8.5	15.3 (9.9–23.6)
Race¥															
Non-Black	15	10.1	12.9 (7.8–21.2)	55	18.6	19.2 (14.8–25.0)	22	7.2	14.4 (9.5–21.9)	24	14.5	10.8 (7.2–16.0)	116	50.3	15.0 (12.5–18.0)
Black	6	1.7	30.6 (14.0–66.7)	46	6.3	47.5 (35.6–63.3)	13	1.5	41.0 (23.9–70.1)	19	3.0	41.2 (26.4–64.3)	84	12.5	43.7 (35.3–54.1)
Cause of Death															
Exercise-Related	15	11.8	11.0 (6.7–18.2)	74	24.9	19.3 (15.4–24.2)	25	8.7	13.6 (9.2–20.1)	27	17.5	10.0 (6.9–14.6)	141	62.9	14.6 (12.4–17.2)
Infectious Disease	3	11.8	2.2 (0.7–6.5)	17	24.9	4.4 (2.8–7.1)	6	8.7	3.3 (1.5–7.1)	9	17.5	3.3 (1.8–6.4)	35	62.9	3.6 (2.6–5.0)
Totals	**21**	**11.8**	**15.4 (10.1–23.6)**	**101**	**24.9**	**26.4 (21.7–32.0)**	**35**	**8.7**	**19.0 (13.7–26.4)**	**43**	**17.5**	**16.0 (11.9–21.5)**	**200**	**62.9**	**20.7 (18.0–23.7)**
Adjusted¶			15.4			25.8			20.1			16.0			20.7
Rate Ratio			1.0			1.7			1.3			1.0			-

*Discrepancies in the sums of recruit accessions across rows are due to rounding directly from the Defense Manpower Data Center's all-service data.
†Number of nontraumatic recruit deaths.
‡Expressed per 100,000 nonprior service active component recruit accessions.
§Calculated by multiplying the numeric death rate by average training period expressed in years (52 wk/6, 8, or 11 wk, respectively, for the Air Force; All-Service, Army, and Navy; and Marine Corps). They are expressed per 100,000 nonprior service active component recruit–years.
¥Race/ethnicity was categorized as black and non-black because categorization of race and ethnicity in the population data from the Defense Manpower Data Center was not standardized over the 25-year study period.
¶Age-adjusted using the total recruit population as the standard.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

TABLE 25-13

CAUSES OF NONTRAUMATIC DEATHS AMONG US MILITARY RECRUITS, 1977–2001

Cause of Death	Exercise-Related (%*)	Not Exercise-Related (%*)	Total (%*)
Sudden cardiac	60 (43)	9 (15)	69 (34)
Idiopathic sudden death	34 (24)	4 (7)	38 (19)
Infectious disease	1 (1)	34 (58)	35 (18)
Exertional heat illness	30 (21)	0	30 (15)
Vascular disease	9 (6)	3 (5)	12 (6)
Other	3 (2)	7 (12)	10 (5)
Asthma	3 (2)	1 (2)	4 (2)
Undetermined	1 (1)	1 (2)	2 (1)
Totals	**141**	**59**	**200**

*Percentages may not total 100 due to rounding.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

abnormalities (45%), myocarditis (20%), cardiomyopathy (12%), and atherosclerotic cardiovascular disease (10%), as shown in Table 25-14.

Coronary artery abnormalities included hypoplastic artery, tunnelling, aneurysm, dissection, and abnormalities of anomalous origin. Anomalous coronary arteries accounted for 21 (30%) of all sudden cardiac deaths. All were exercise-related and due to the left coronary artery arising from the right (anterior) sinus of Valsalva, with a course between the pulmonary artery and aorta. Of the 21 recruits who died of this cause, at least 11 (52%) experienced prodromal symptoms of chest pain, syncope, or both before the day of the fatal incident.[14] (Additional details regarding one of these deaths are available in a published case report.[9])

Sickle Cell Trait

The higher nontraumatic death rates for black recruits could be attributed to SCT. The increased risk (up to 28-fold) for exercise-related death among black recruits with SCT has been previously described.[15] SCT was identified in a total of 27 deaths, all of which occurred among black recruits during exercise (Table 25-15). Of the 27 deaths, 13 resulted from EHI and 13 were categorized as idiopathic sudden deaths; the final death was caused by congenital mitral-valve disease (and was heat-related). From 2002 through 2005, four exercise-related deaths (two in the Army, one in the Marine Corps, and one in the Navy) occurred among recruits identified with SCT.

From July 1981 through November 1996, DoD policy required the military services to screen military accessions for SCT.[40] However, a new sickle-cell policy

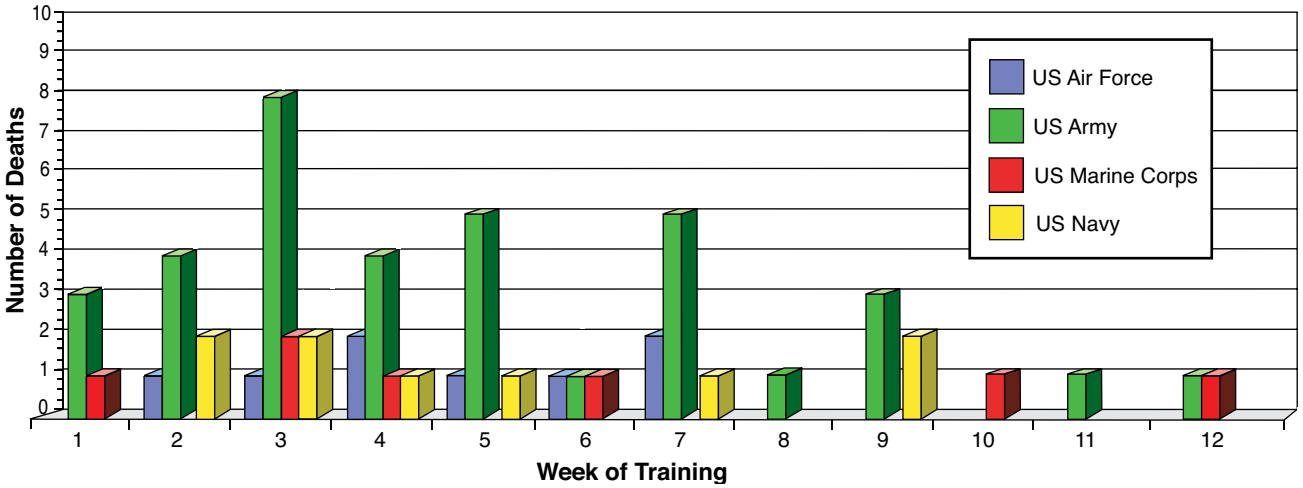

Fig. 25-2. There were 60 exercise-related cardiac deaths among US recruits between 1977 and 2001, shown by training duration. At least half (53%) occurred within 4 weeks of arrival at basic training. Training duration is the number of weeks from arrival at training installation for in-processing until the fatal incident; the average training period over the 25-year study period was 6 weeks for the Air Force, 8 weeks for both the Navy and Army, and 11 weeks for the Marine Corps. This does not include the additional time (days to weeks) spent in-processing at the training installation.

TABLE 25-14

CAUSES OF SUDDEN CARDIAC DEATHS AMONG US MILITARY RECRUITS, 1977–2001

Cause of Death	Exercise-Related (%*)	Total (%*)
Coronary artery abnormality	28 (47)	31 (45)
Myocarditis	12 (20)	14 (20)
Cardiomyopathy	5 (8)	8 (12)
Atherosclerotic cardiovascular disease	6 (10)	7 (10)
Conduction system abnormality	3 (5)	3 (4)
Cardiac valvular disease	3 (5)	3 (4)
Myocardial fibrosis	2 (3)	2 (3)
Ephedrine-induced arrhythmia	1 (2)	1 (1)
Totals	**60**	**69**

*Percentages may not total 100 due to rounding.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

was released on November 22, 1996, stating that most SCT-related sudden deaths could be prevented by adequate preventive measures against heat-related illness, and that screening for a risk factor which rarely, if ever, resulted in death under normal circumstances was not cost-effective.[41] Therefore, as of early 2006, the SCT screening policies differ among the military services. The Air Force, Navy, and Marine Corps screen their accessions, but the Army does not. The Air Force allows recruits identified with hemoglobin S the option of leaving military service; the Navy and Marine Corps mandate that such recruits leave military service if their hemoglobin S level is higher than 45%.[42]

Exertional Heat Illness

During the study period, there were 30 heat-related deaths due to heat stroke, rhabdomyolysis, or both, in which no other pathological cause of death was identified (see Table 25-13). Heat stroke was diagnosed based on elevated body temperature and encephalopathy manifesting as delirium, obtundation, or coma, without other obvious cause. Severe rhabdomyolysis was diagnosed from histological evidence of extensive muscle necrosis, acute biochemical abnormalities, or both. This category also included a case of acute water intoxication related to EHI.[8,11] Almost half of these deaths (13 of 30) occurred among recruits with SCT. Although EHI deaths occurred throughout the year, 21 (70%) of the fatal incidents were from May through September. At least three quarters of EHI deaths among Army and Marine Corps recruits occurred within the first 4 weeks of arrival to BMT (Figure 25-3). In contrast, the Air Force and Navy EHI deaths occurred later in training.

In addition to the 30 EHI deaths, heat stress contributed to at least 13 cardiac exercise-related deaths (22%), including coronary artery abnormality (7); myocarditis (2); cardiomyopathy (2); congenital mitral valve disease (1, in a recruit with SCT); and conduction system abnormality (1). EHI is possibly underreported in deaths labeled as cardiac. Heat stress also contributed to two deaths attributed to vascular causes (intrathoracic hemorrhage and aortic hypoplasia). Therefore, heat stress was a primary or contributory cause in at least 45 (32%) of the exercise-related deaths. An additional contribution of EHI remains possible because of the low frequency of screening for EHI among sudden deaths during the postmortem examination. EHI is explored more fully in Chapter 24, Exertional Heat Illnesses.

Infectious Diseases

One fourth of all nontraumatic deaths (49 of 200) were infection-related. This includes 14 myocarditis deaths (see Table 25-14) of presumed infectious etiology (viral myocarditis was confirmed for the two

TABLE 25-15

EXERCISE-RELATED DEATHS AMONG RECRUITS IDENTIFIED WITH SICKLE CELL TRAIT OVER TIME BY US MILITARY SERVICE, 1977–2001

Years	Air Force	Army	Marine Corps	Navy	All-Service
1977-1981	1	6*	2	4	13
1982-1986	0	0	0	3	3
1987-1991	0	0	0	1	1
1992-1996	3	2	0	1*	6
1997-2001	0	4	0	0	4
Totals	**4**	**12**	**2**	**9**	**27**

*Excludes one sickle cell disease death (for a total of two cases)
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

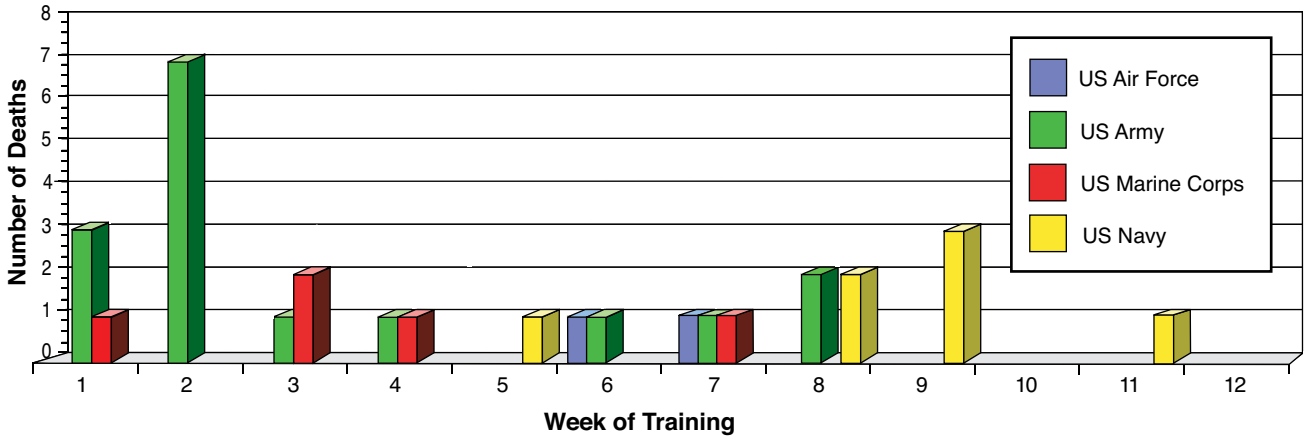

Fig. 25-3. There were 30 exertional heat illness deaths among US recruits between 1977 and 2001, shown by training duration. At least three-quarters of the deaths among Army (75%) and Marine Corps (80%) recruits occurred within the first 4 weeks of arrival at basic training. In contrast, the Air Force and Navy deaths occurred later in training. Training duration is the number of weeks from arrival at training installation for in-processing until the fatal incident; the average training period over the 25-year study period was 6 weeks for the Air Force, 8 weeks for both the Navy and Army, and 11 weeks for the Marine Corps. This does not include the additional time (days to weeks) spent in-processing at the training installation.

nonexercise-related deaths). Excluding the myocarditis deaths, only one of the 35 infectious disease deaths was exercise-related (see Table 25-13). This pneumonia death occurred in a recruit who was prescribed erythromycin for a respiratory infection, collapsed 2 days later during a physical training run, and died within 1 hour.

In 28 of the 34 nonexercise-related deaths, an etiological diagnosis was available for 10 streptococcal infections (Table 25-16); for 10 *Neisseria meningitidis* infections (Table 25-17**)**; for 5 *Staphylococcus aureus* infections (pneumonia [3], toxic shock syndrome [1], and sepsis [1]; all occurring from 1977 through 1997); and for 3 adenoviral infections (pneumonia [2] and encephalitis [1]; one in 1981 [type 21] and two in 2000[10]). The remaining six deaths were classified as infectious based on clinical evidence; they included pneumonia (3), meningitis (1), ruptured appendix (1), and sepsis (1). Most (69%) of the infectious disease deaths occurred after 4 weeks of training (Figure 25-4).

Most (80%) of the fatal streptococcal infections were caused by *Streptococcus pyogenes*. Cause of death included acute epiglottitis, pneumonia, necrotizing fasciitis,[43] toxic shock syndrome,[44] and meningitis.[5] In addition, there were two fatal *S pneumoniae* infections (cases 3 and 9). Case 9 was a pneumococcal meningitis death in December 2001 due to serotype 38, a serotype not covered by current vaccine formulations.[13]

At least two deaths due to *Neisseria meningitidis* serogroup B (cases 15 and 19) were identified. The recruit in case 15 had a history of a mild upper respiratory infection for about 2 days prior to arriving in the emergency room with a temperature of 106°F, in shock, and covered with petechiae and purpura. Despite intensive medical management, he died approximately 2.5 hours after admission. Case 19 occurred during the final test for Marine Corps recruits, a 54-hour exercise called the "Crucible," which tests physical and mental strength and emphasizes teamwork.[12] Although case 12 occurred during a period when the monovalent (serogroup C) vaccine was routinely used, the recruit had arrived at the BMT site only 9 days prior to admission to the hospital (and was found comatose in bed with a temperature of 106°F on the day of admission).

From 2002 through 2005, there were seven infectious disease deaths identified among recruits, excluding a myocarditis death in a Marine recruit who had been diagnosed and treated for pneumonia during BMT 1 month before his death. In 2002 a Marine recruit died of purpura fulminans caused by *N meningitidis* serogroup C during a group A streptococcal infection outbreak in 2002 at the Marine Corps Recruit Depot in San Diego, California.[45,46] In 2003 there were three adenovirus-related recruit deaths (two in the Army and one in the Marine Corps) caused by adenovirus types 4, 7, or both. The Marine recruit collapsed during the combat conditioning course, and pathologic findings showed pneumonia caused by adenovirus (primary cause) and *N meningitidis* (secondary cause, unknown serogroup). In addition, polymerase chain reaction

TABLE 25-16

CHRONOLOGICAL FATAL STREPTOCOCCAL INFECTIONS AMONG US MILITARY RECRUITS, 1977–2001

Case	Clinical Diagnosis	Demographics*	Year†	Service	Etiology	Laboratory Confirmation
1	Acute epiglottitis	19/M/B	A	Army	GABHS	Blood culture
2	Pneumonia	19/M/H	A	Marine Corps	GABHS	Sputum and wound (vesicle) cultures
3	Pneumonia	20/F/W	A	Army	*S pneumoniae*	Sputum culture; Gram-positive diplococci in lung tissue
4	Pneumonia	21/M/H	A	Marine Corps	GABHS	Blood and postmortem lung tissue cultures
5	Pneumonia	23/M/W	C	Army	GABHS	Blood culture
6	Necrotizing fasciitis	20/M/W	C	Air Force	GABHS	Not available[1]
7	Toxic shock syndrome	19/M/B	C	Army	GABHS	Blood culture[2]
8	Meningitis	22/M/W	D	Air Force	GABHS	Blood and cerebrospinal fluid cultures[3]
9	Meningitis	18/M/W	E	Marine Corps	*S. pneumoniae* serotype 28	Blood and cerebrospinal fluid cultures[4]
10	Toxic shock syndrome	18/M/W	E	Marine Corps	GABHS	Blood culture

*Age (in years) / Sex / Race; W: White; B: Black; H: Hispanic; M: Male; F: Female
†Year of death categorized by 5-year groups; A: 1977-1981, B: 1982-1986, C: 1987-1991, D: 1992-1996, E: 1997-2001
GABHS: group A beta-hemolytic streptococcus
S pneumoniae: Streptococcus pneumoniae
(1) Peters JE, Gackstetter GD. *Streptococcus pyogenes* transmission among Air Force recruits: Efficacy of surveillance and prophylaxis protocols. *Mil Med*. 1998;163:667-671. (2) Gunzenhauser JD, Longfield JN, Brundage JF, Kaplan EL, Miller RN, Brandt CA. Epidemic streptococcal disease among Army trainees, July 1989 through June 1991. *J Infect Dis*. 1995;172:124-131. (3) Musser JM, Kapur V, Peters JE, et al. Real-time molecular epidemiologic analysis of an outbreak of *Streptococcus pyogenes* invasive disease in US Air Force trainees. *Arch Pathol Lab Med*. 1994;118:128-133. (4) Baker CI, Barrozo CP, Ryan MA, Pearse LA, Russell KL. Fatal meningitis in a previously healthy young adult caused by Streptococcus pneumoniae serotype 38: An emerging serotype? *BMC Infect Dis*. 2005;5:38.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

testing of lung tissue at the Naval Health Research Center in San Diego, California,[47] was positive for both of these agents. Also in 2003, there was a Navy death due to influenza A virus (during the 2002–2003 influenza season) and an Army death caused by toxic shock syndrome resulting from *S pyogenes*. In 2005 there was a pneumonia death in a Navy recruit caused by hantavirus. However, the recruit had been exposed to the virus before arriving at the BMT site. See also the chapters in Section 4, Communicable Illnesses.

Other Causes

All 38 cases of idiopathic sudden death (including undiagnosed cardiac arrhythmias) occurred within 1 hour of symptoms and had no contributory medical history or autopsy findings that could explain cause of death (see Table 25-13). Of the 34 exercise-related idiopathic sudden deaths, 13 recruits were identified with SCT. The four nonexercise-related idiopathic sudden deaths show no evidence of SCT and remain unexplained, despite the availability of medical and autopsy information.

Vascular disease deaths (see Table 25-13) included intracerebral hemorrhage (6), pulmonary embolism (2), intrathoracic hemorrhage (2), primary pulmonary hypertension (1), and aortic hypoplasia (1). All of these deaths were exercise-related with the exception of the three pulmonary vascular disease deaths.

Other causes of exercise-related death included asthma (3), sickle cell disease with sickle cell crisis (2),

TABLE 25-17

CHRONOLOGICAL *NEISSERIA MENINGITIDIS* DEATHS AMONG US MILITARY RECRUITS, 1977–2001

Case	Demographics*	Year†	Service	Laboratory Confirmation
11	19/M/W	A	Army	Blood culture (seroroup Y)
12	18/M/W	A	Navy	Blood culture (serogroup C)
13	18/M/W	A	Navy	Blood and CSF cultures (serogroup W135)
14	20/M/B	A	Army	Blood, CSF, and joint fluid cultures (serogroup Y)
15	20/M/W	A	Navy	Blood culture (serogroup B)
16	17/M/W	A	Navy	CSF culture (serogroup Y)
17	17/M/B	A	Army	Brain and CSF cultures (serogroup Y)
18	19/M/B	D	Army	Intracellular Gram-negative diplococci in unfixed brain tissue
19	19/M/B	E	Marine Corps	Blood and CSF cultures (serogroup B)[1]
20	17/F/W	E	Navy	Diagnosis based on clinically consistent course

*Age (in years) / Sex / Race; W: White; B: Black; M: Male; F: Female
†Year of death categorized by 5-year groups; A: 1977-1981, B: 1982-1986, C: 1987-1991, D: 1992-1996, E: 1997-2001. The quadrivalent meningococcal vaccine was introduced in 1982.
CSF: cerebrospinal fluid
(1) Malakooti M. Meningococcemia in a recruit. *Naval Med Surveillance Rep.* 1998;1:9-10.
Data source: Recruit Mortality Registry, Mortality Surveillance Division, Office of the Armed Forces Medical Examiner, Armed Forces Institute of Pathology.

Schmidt's syndrome (an autoimmune disease [1]), and undetermined (1). Other causes of nonexercise-related deaths included autoimmune diseases (4), Budd-Chiari syndrome (1),[48] idiopathic encephalopathy (1), adenocarcinoma (unknown site [1]), asthma (1) and undetermined (1). The RMR categorized deaths as undetermined if there was insufficient circumstantial and medical information to definitively determine the cause of death. All four deaths of acute asthma occurred before 1987; one of the recruits who died of asthma (exercise-related) also had disseminated sarcoidosis.

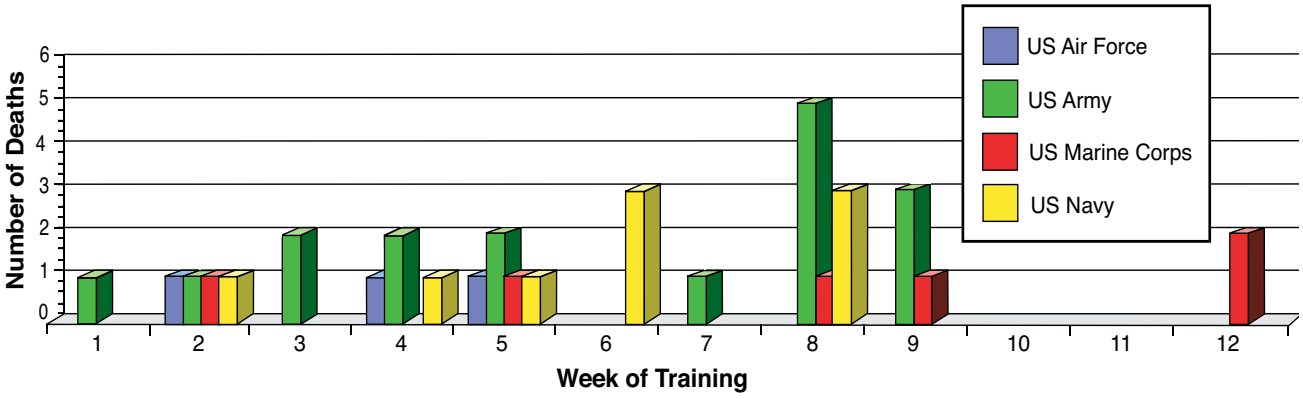

Fig. 25-4. There were 35 US recruit deaths caused by infectious disease between 1977 and 2001, shown by training duration. Most (69%) of the infectious disease deaths occurred 4 weeks after arriving for basic training. Training duration is the number of weeks from arrival to training installation for in-processing until the fatal incident; the average training period over the 25-year study period was 6 weeks for the Air Force, 8 weeks for both the Navy and Army, and 11 weeks for the Marine Corps. This does not include the additional time (days to weeks) spent in-processing at the training installation.

PREVENTION

Each death during BMT may represent only the "tip of the iceberg" of a vast number of infections, injuries, suicidal thoughts, and other morbidity that might be affecting these otherwise healthy young adults.[49] Every recruit death should be considered a sentinel event, prompting reevaluation of prevention efforts at the local training installation and all BMT sites.

Traumatic Deaths

Suicide

The lower rates of suicide among military recruits compared to the same-age civilian population can probably be attributed to the following factors: (*a*) mental health screening before the start of military service; (*b*) the controlled, closely monitored setting of BMT; and (*c*) ready access to free medical care during BMT. However, preservice screening is limited to self-reported histories of depression and suicide attempts on questionnaires, and recruits can withhold or falsify information on their mental health history. The second factor, the BMT environment, guarantees that recruits are closely supervised, engaged in scheduled daily routines, and prohibited access to motor vehicles, alcohol, or drugs while onsite. However, the third factor, ready access to free medical care, does not guarantee that all recruits needing evaluation or treatment will receive it. Some recruits may not seek medical care out of fear that missed training might result in delayed graduation from BMT.

The handling of recruits with suicidal ideation is not standardized across the military services (or across the five BMT sites within the Army). For example, Army recruits may be admitted to the psychiatric ward of the local military hospital or placed on "unit watch."[33] Used with recruits identified by commanders as having a minimal suicide risk or being "conditionally suicidal" (ie, "I will kill myself if you don't let me out of the Army"), unit watch is intended to prevent the recruits from harming themselves, or others, while being maintained in the unit.[33(p57)] However, unit watch may also be used under other circumstances (eg, a mental health ward is not available at the local military hospital). The decision to place a recruit under unit watch should be made in consultation with mental health personnel. The basic procedures of unit watch include removing potential items of harm (eg, shoelaces, belt, and firearms) and placing the recruit's mattress in a common area of the barracks where he or she can be monitored. The recruit should be escorted at all times and not left alone or unsupervised. Despite these policies, three recruit suicides occurred among Army recruits from 2000 through 2002 during, or immediately following release from unit watch, demonstrating the difficulty of administering unit watch as well as assessing the level of suicidality among recruits. The recruit in case 69 had been cleared from unit watch several hours before the fatal incident, and in case 72, the recruit was on unit watch while awaiting administrative separation. In 2002 another Army recruit committed suicide while on unit watch pending administrative separation.

Significant challenges for the military include accurately diagnosing suicidal ideation and determining the appropriate disposition for recruits with suicidal ideation. Unfortunately, this is complicated by recruits making false mental health complaints because they desire a discharge from the military. See Chapter 17, Management of Recruit Suicide, for further discussion.

Unintentional Injury

Unintentional injuries accounted for one third of all traumatic recruit deaths from 1977 through 2001. Most unintentional injury deaths (73%) occurred among Army recruits. The Army Safety Center's Risk Management Information System is an important resource for unintentional injury prevention information, providing accident reports for all Army unintentional deaths. For Army unintentional injury deaths from 1977 through 2001 in which the recruit or recruit's supervisor made a mistake, recommended corrective actions are summarized below. Review and implementation, as needed, of these recommendations may prevent future deaths.

Falls. Case 74 was the result of a recruit failing to successfully mount an improperly constructed obstacle.[50] After completing the investigation, the Army Safety Center released a safety alert that recommended commanders review maintenance and inspection procedures for all obstacles on confidence obstacle courses.

Falls during obstacle course training may be prevented through adequate demonstration of obstacles before recruits start the course, with special attention paid to overly nervous and apprehensive recruits. Potential hazards can be identified by confirming the correct construction and maintenance of obstacles. Commanders should ensure that required safety nets, platforms, properly sized ropes, and other features identified in Field Manual 21-20, *Physical Fitness Training*,[51] are present before allowing recruits to train on obstacles. In addition, confidence obstacle courses

must be built in accordance with US Army Corps of Engineers Drawing Number 28-13-95.[52] Other falls can be reduced by ensuring that facility engineers make gratings safe and informing recruits to enter shower areas wearing shower shoes to prevent slipping on the smooth tile surface.

Fragmentation Grenade Explosions. For reasons unknown, the recruit in case 13 ran back into the danger zone after being taken into the safety bay. He responded to directions from the tower to get down, but he then rolled over and sat up, facing the grenade at the time it detonated. Investigation revealed that the recruit may have panicked because of a reported unpleasant experience with explosives before enlisting.

Case 53 involved two fatalities because a recruit failed to maintain constant pressure against a grenade's safety lever. The drill sergeant, while holding the recruit's arm to demonstrate the correct stance, failed to notice that the grenade's safety pin was pulled. The grenade detonated in the recruit's hand and killed both men.

To help prevent such events, maintain a training schedule that requires completion of the throwing aspect of grenade training before using live ordnance, and remind recruits of emergency procedures before each live grenade is thrown.

Gunshots. Case 31 occurred after a recruit left the firing line during training with a loaded weapon, pulled the trigger while playing with the weapon, and discharged a round that struck a fellow recruit in the back.

To prevent such accidents, implement stringent ammunition control procedures, use a chamber block device during all M-16 rifle firing, and make sure weapons are placed in racks immediately after recruits leave the firing line.

Electrocution from Lightning. The recruit in case 67 was in the prone position when the current from a bolt of lightning traveled into his tent.

When lightning strikes an object, the electricity does not necessarily go straight down, but often travels along the surface of the ground for a considerable distance (which is known as "side flash"). Therefore, the surface area of the body relative to the ground should be kept to a minimum. Enforce the proper defensive position for lightning strikes, which is presenting only a single point of contact with the ground. The best way to accomplish this is with the feet and knees together while crouched on the balls of the feet, hands on the knees, and head down, as in the aircraft crash position. Do not allow the hands (or other body parts) to touch the ground and keep the feet as close together as possible.

Nontraumatic Deaths

Sudden Cardiac Death

The finding that only a small number of recruit deaths were attributed to potentially preexisting conditions for which screening is currently performed demonstrates that the current military preenlistment health screening is generally effective. When performed optimally, the recruit induction history and physical examination has the potential to identify many cardiovascular abnormalities. A significant challenge of preenlistment screening, however, is applicants' failure to disclose an accurate medical history, either deliberately, to prevent disqualification from service, or mistakenly. In addition, the preenlistment screening may miss life-threatening ventricular arrhythmias, even in applicants who participated in high school sports (unpredictable sudden cardiac deaths also occur among apparently healthy professional athletes, such as Darryl Kile, the 33-year-old pitcher for the St. Louis Cardinals baseball team, who died in 2002 from previously undiagnosed coronary artery disease). This problem underscores the importance of having cardiac monitoring and defibrillation equipment on site during physical training activities. The maintenance of automated external defibrillators, in accordance with federal guidelines, was implemented at Fort Jackson, South Carolina, in 2002.[53]

Cardiac abnormalities are the leading identifiable cause of sudden death among recruits.[14] Because of the inability of current preenlistment screening to detect coronary artery anomalies, the significant contribution of these conditions to sudden recruit deaths from 1977 through 2001 is a matter of concern. Noninvasive procedures such as the electrocardiogram and echocardiogram may reveal significant cardiac pathology (eg, cardiomyopathies) before induction into the military, but more expensive cardiac catherization is required to diagnosis coronary artery anomalies. These tests are impractical and not cost-effective for preenlistment screening, particularly considering the infrequency of sudden cardiac death for recruits (7.1 / 100,000 recruit–years). The Air Force has conservatively estimated that it would spend $4 million on screening electrocardiograms to prevent one cardiac-related death.[18]

The postmortem finding that at least half of recruits with coronary anomalies experienced prodromal symptoms of exertional syncope, chest pain, or both, before the day of the fatal incident suggest that disclosure of a history of exertional syncope or chest pain requires exclusion of this anomaly.[54] However, a recruit may fail to recognize these symptoms or

may be motivated not to disclose them to avoid lost training days for medical evaluations. Therefore, it is extremely important that personnel responsible for the supervision of recruits are alert to signs and symptoms of cardiac conditions during recruit training. Chest discomfort, syncope or presyncope, or excessive dyspnea should be reported to medical personnel for an appropriate evaluation.[55] Screening for anomalous coronary arteries with an imaging technique (echocardiography, computed tomography, or magnetic resonance imaging) should be strongly considered in any recruit presenting with possible cardiovascular disease symptoms.[14]

Heat Stress

Heat stress was a factor in at least one third of exercise-related recruit deaths (45 of 141) from 1977 through 2001 (possibly underreported because of the infrequent postmortem screening for EHI). This finding demonstrates the importance of focusing on immediate risks of heat stress exposure during exercise.

Preventive measures for EHI include maintaining adequate hydration,[11] wet bulb globe temperature monitoring, work/rest cycles based on the wet bulb globe temperature and level of exercise, and using shade and appropriate clothing to assist in heat loss.[26] In addition, immediate medical attention to casualties onsite, with rapid cooling and rehydration, is very effective in preventing serious complications from EHI.[26,56] It is important to note that infections and certain medications (eg, cold medicines and supplements containing ephedra alkaloids) *increase* susceptibility to heat illness.[57]

The numbers of deaths among recruits with SCT should also decrease with proper implementation of EHI prevention. Recruits with SCT are not more susceptible to getting EHI, but *are* more susceptible to dying from a severe case of EHI.[58]

Infectious Diseases

Infectious agents remain a significant concern during BMT because recruits from diverse geographic locations enter crowded, high-stress conditions, which provide an ideal setting for transmission of infections. The low proportion of infectious disease deaths can be attributed to the effectiveness of routine immunizations against meningococcal disease, measles, mumps, rubella, tetanus, diphtheria, poliomyelitis, influenza, and adenovirus. However, adenoviral infection has become an emerging threat since the winter of 1994–1995. This was the first winter since 1971 that recruits trained without the availability of adenoviral (types 4 and 7) vaccine.[59,60] As a result, an outbreak of adenovirus type 4-associated acute respiratory disease occurred in April and May 1995 at Fort Jackson, South Carolina.[61,62] Immunizations against the adenoviruses were resumed in late March 1995.[62] This was the first documented adenovirus-associated outbreak of acute respiratory disease among Army recruits in 10 years, following a self-limited ARD outbreak at Fort Dix, New Jersey, in the spring of 1985 caused by adenovirus type 21.[59] Following this lapse in vaccine coverage, Wyeth-Ayerst (Marietta, Penn), the only manufacturer of adenovirus vaccine, delivered final vaccine lots to the DoD in 1996 and dismantled their production facility.[63] Adenoviral vaccine supplies for types 4 and 7 were completely depleted after early 1999.[63] Subsequently, several additional outbreaks of adenovirus illness have been documented at BMT installations since 1996,[63-67] rates of adenoviral illness among recruits have increased since the loss of the vaccines,[68] and at least five recruits (two in 2000[10] and three in 2003) have died of adenovirus-related illness. Because adenovirus is not identified with simple or commonly used laboratory testing, it is possible that undetected adenoviral illness contributed to other recruit deaths after the vaccine was lost.[49] The current unavailability of this effective, well-tolerated oral vaccine may continue to result in higher rates of adenoviral-associated illness, preventable outbreaks, and deaths until adenovirus immunization programs are reinstated.

An important cause of bacterial acute respiratory illness among military recruits is *S pyogenes* or group A streptococcus, which manifests as outbreaks of pharyngitis, acute rheumatic fever, and pneumonia. This risk of streptococcal infection has been greatly reduced by administering benzathine penicillin G to recruits during in-processing (primary penicillin chemoprophylaxis) or during outbreaks (secondary penicillin chemoprophylaxis). Training sites administer prophylaxis somewhat differently depending on local instruction, local surveillance, available supply, and often local professional opinion (also see Chapter 13, Respiratory Infections in Military Recruits). Two Air Force recruit deaths and one Army recruit death attributable to *S pyogenes* invasive disease (cases 6, 7, and 8) occurred from 1977 through 2001 despite the use of threshold-driven prophylactic penicillin treatment protocols.[5,43,44] Some military training centers have policies for use of penicillin prophylaxis when the incidence of group A streptococcal infections exceeds a specific threshold. However, in cases 6 through 8, the threshold surveillance system did not reach the critical levels that would have led to mass

penicillin prophylaxis. These fatal cases highlight the need for ongoing group A streptococcal surveillance, adequate antibiotic supply, and appropriate use of antibiotic prophylaxis among this high-risk population.

Meningococcal disease remains a significant threat to recruits despite the availability of a quadrivalent vaccine (which provides protection against serogroups A, C, Y, and W135) since fall 1982. Earlier, vaccines with different serogroup-specific components were used. By the fall of 1971, all new recruits were immunized with the polysaccharide vaccine against serogroup C strains.[69,70] In 1978 a bivalent meningococcal vaccine (serogroups A and C) was incorporated into routine immunization schedules.[70] Although the vaccine is administered early in the course of training, isolated cases of meningococcal disease still appear among recruits, particularly due to *N meningitidis* serogroup B. No vaccine effective against serogroup B is currently licensed in the United States, and at least two deaths due to *N meningitidis* serogroup B (cases 15 and 19) from 1977 through 2001 were identified through the RMR.

The Naval Health Research Center, through the DoD Global Emerging Infection Surveillance and Response System, provides active surveillance for respiratory pathogens such as *S pneumoniae*, *S pyogenes*, influenza, adenovirus, and other emerging threats to military training populations.[47] As of early 2006, febrile respiratory illnesses surveillance (laboratory-supported and population-based) was ongoing at eight training sites (Fort Benning, Georgia; Fort Jackson, South Carolina; Fort Leonard Wood, Missouri; the Naval Training Center at Great Lakes, Illinois; the Marine Corps Recruit Depots at San Diego, California, and Parris Island, South Carolina; Lackland Air Force Base, Texas; and the Cape May Coast Guard Training Center, New Jersey). Collaborators at each site monitor their training populations for febrile respiratory illness. Weekly counts are sent to investigators at the Naval Health Research Center, who calculate febrile respiratory illnesses rates for each site and publish them on the Internet and in a weekly report. In addition, the Army Medical Surveillance Activity, part of the US Army Center for Health Promotion and Preventive Medicine, conducts acute respiratory disease surveillance at all Army BMT posts and disseminates weekly reports of the incidence of acute respiratory disease at each location.[71] These examples of rapid dissemination of surveillance data constitute an early warning system for detection of potential epidemics among recruits.

NOTIFICATION OF NEXT OF KIN

The sudden, unexpected death of a young, seemingly healthy recruit can be devastating to the recruit's family, the military unit, and the military medical system charged with protecting the recruit. Such events are often deemed newsworthy by the public. The medical treatment facility staff has an important role in helping the family and recruit's unit cope with the death, in addition to promoting accurate news reporting and contributing to the medical literature. However, the media coverage of a recruit death may be stressful for military personnel or family who are approached by media representatives seeking interviews. The DoD has established regulations and programs to assist grieving family members through the next-of-kin notification process and public affairs assistance (see the Attachment, Aftermath of a Recruit Death).

SUMMARY

Although mortality rates during BMT are much lower than same-age US civilian mortality rates, many recruit deaths should still be considered preventable. Every recruit death is investigated, but the findings are generally maintained at the local level. Similarly, although autopsy rates are high for recruit deaths, the reports often remain archived at the local civilian or military hospital that performed the autopsy. Before the establishment of the RMR, there was no central repository of these records or centralized analysis covering US Air Force, Army, Marine Corps, and Navy recruit deaths. The RMR creates new opportunities for prevention-oriented research to further reduce recruit death rates during BMT. Every preventable death is a human tragedy that demands investigation of the causes and circumstances, with resultant implementation of controls to prevent similar occurrences from happening again.

Slightly more than one fourth of all recruit deaths are traumatic. Most traumatic deaths are due to suicide, followed by unintentional injuries and homicides. The military has effectively prevented many unintentional injury deaths during BMT (the leading cause of death among US civilians aged 15 to 34 years), resulting in a large proportion of traumatic recruit deaths being attributed to suicide. However, recruit suicide rates from 1977 through 2001 were less than half the rate among same-age US civilians.

Almost three quarters of recruit deaths are nontraumatic, and most are exercise-related. The most

frequent causes of exercise-related death are sudden cardiac death (primarily due to coronary artery abnormalities), idiopathic sudden death, and EHI. The premortem identification of cardiac abnormalities will continue to be a challenge. A history and physical will likely identify an obvious cardiac problem in some recruits, *if* they report symptoms. The low incidence of sudden cardiac death among military recruits suggests that routine noninvasive testing is not warranted until better, more accurate, and lower-cost testing methods for high risk cardiac conditions are available. However, screening for anomalous coronary arteries with an imaging technique (echocardiography, computed tomography, or magnetic resonance imaging) should be strongly considered in any recruit reporting exertional chest pain or exertional syncope (with no obvious cause by history and physical). The presence of defibrillators (and personnel trained in their use) during all exercise-related training activities may further reduce exercise-related death. To prevent deaths due to EHI, training installations must continue to protect their recruits through EHI policy, procedures, and implementation.

Most nonexercise-related deaths were infection-related. Continuous surveillance of infectious diseases may yield additional recommendations for treatment and prevention, ranging from prophylactic antibiotic treatment of streptococcal infections to reestablishment of an adenovirus vaccination program.

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ATTACHMENT: AFTERMATH OF A RECRUIT DEATH

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Initial Actions and Next-of-Kin Notification

Army Regulation AR 600-8-1, "Army Casualty Operations/Assistance/Insurance," regulates the Army's immediate actions following the death of an Army recruit.[1] Similar regulations and protocols exist for all services in the US military. When a soldier has died and been identified, and after the details of his or her death have been verified, the unit notifies Department of the Army officials, who in turn assign the case to a Casualty Area Command. The Casualty Area Command is based near and usually headquartered by the command group of the nearest military post or base. The Casualty Area Command assigns a casualty notification officer to make the initial notification to the primary next of kin (NOK) on record. The casualty notification officer follows a specific script of notification and provides contact information from the Casualty Area Command, as well as initial information available from the Public Affairs Office. Then, a different officer is assigned as the casualty assistance officer. The casualty assistance officer is a senior enlisted noncommissioned officer or higher, and is often a member of the deceased soldier's unit. The casualty assistance officer helps coordinate family meetings with medical staff, unit officials, and others who assist in the bereavement and regulatory processes. The casualty assistance officer's primary job is to "determine the immediate needs or problems of the NOK and render prompt, courteous, and sympathetic assistance."[1]

The medical treatment facility (MTF) involvement initially includes preparation of the remains for autopsy, as well as bereavement support to the family and the recruit's unit. Autopsies are required for all recruit deaths. The remains are returned to the family within an average of 3 to 5 days. Medical staff members with expertise in the medical conditions possibly associated with the recruit's cause of death should be made available to discuss preliminary autopsy results with the family.

In most cases, a recruit death is the respective unit's first experience with the death of a comrade-in-arms. At Fort Jackson, South Carolina, same-day sessions with bereavement teams led by the Moncrief Army Community Hospital, in conjunction with unit chaplains and experienced members of the noncommissioned officer cadre, were beneficial in helping fellow recruits cope with a death. Besides typical grief responses, the most common issue needing attention was the fellow recruits' fear that they could die or suffer from a similar medical problem. Sick-call staff should plan for a possible increase in patient care visits by anxious recruits following a recruit death. This awareness should enable a sympathetic approach by the medical providers in the aftermath of the recruit death.

A local or service-wide safety board, or other similar investigative committee, is often convened within hours or days of the death. The MTF provides a physician representative to that committee.

Media Involvement

Well-publicized reports of recruit abuse arose from the "Ribbon Creek incident" in 1956, when a Marine Corps drill instructor led his recruit platoon on a night march through Ribbon Creek, resulting in the drowning deaths of six men.[2-4] Unintentional injury deaths from training activities like one that occurred December 2003 during a live-fire exercise at Fort Jackson[5] also make the news and contribute to the general public's concern about the safety of recruits during basic military training (BMT).

The Department of Defense (DoD) has a policy of timely and accurate disclosure of information. The intent of the policy is to ensure that leaders disseminate appropriate information to the news media and the public to prevent misperceptions and to deal with incidents proactively. Directive 5122.5 states:

> It is the policy of the DoD to make available timely and accurate information so that the public, Congress and the news media may assess and understand the facts about national security and defense strategy…. Information will be withheld only when disclosure would adversely affect national security or threaten the safety or privacy of the men

and women of the Armed Forces.[6]

When a recruit dies, protecting the individual's privacy and providing family assistance are of utmost importance. DoD guidelines restrict release of certain information.[7] No names or identifiable photographs may be released before NOK notification. Once NOK notification is complete, the following information may be furnished to the media without NOK consent:

- date of admission to a medical facility,
- date of death,
- biographical data not directly related to medical treatment such as unit, awards, service or job specialty, and so forth, and
- general type of wound or injury suffered.

Additionally, spokespersons may not comment on circumstances surrounding the recruit death while criminal, legal, or safety investigations are underway.

A public affairs officer is assigned to each family following NOK notification. The primary goal of the public affairs officer is to assist the family in its dealings with the media. DoD policy states:

> The public affairs posture is passive; the Public Affairs Officer assists the family, as they desire. They respond to queries and release information on the soldier only as desired by the family while working closely with the casualty assistance officer…. The Public Affairs Officer's bottom line responsibility is to facilitate the desires of the NOK regarding media engagement, whether that is to shield them from media scrutiny … to assist them in preparing a statement for the media or to facilitate media ops for them.[8]

Since the beginning of Operation Enduring Freedom and Operation Iraqi Freedom, the public affairs officer has provided each family of a military fatality a briefing packet on dealing with the media. Attachment Exhibit 1 includes the talking points from the briefing sheets, and Attachment Exhibit 2 shows tips for dealing with news media inquiries.[9] Some of the information is specific to casualties associated with the Global War on Terrorism,

ATTACHMENT EXHIBIT 1

MEDIA BRIEFING FOR NEXT OF KIN OF ARMY FATALITIES

There is intense national and international media interest in every aspect of our operations in Iraq and, because of what has happened to our loved one, the media will almost certainly contact you for comment.

If you do not want to talk to the media, we will arrange for assistance in that regard and we'll do our best to shield you from media scrutiny.

If you want to issue a statement for the media, we will help prepare and provide your statement to the media.

If you do choose to talk to the media, we will provide assistance if you wish. However, we ask that you strongly consider several important points:

- The media will report our comments widely and will rebroadcast any on-camera interviews in many outlets around the world.
- Even if you give an interview to only a local TV station or newspaper, your comments may well be shown or reproduced on other US and international media outlets, Iraqi television networks, and Middle Eastern television networks and newspapers.

Whether or not you talk to the media is completely your choice. We are prepared to assist you in any way possible.

Reproduced from: Department of the Army. *Public Affairs Assistance to NOK of Army Casualties*. Washington, DC: DA; 2003. Public Affairs Directive, 28 Jun 2003. RUEADWD0404.

ATTACHMENT EXHIBIT 2

FAMILY MEMBERS AND THE MEDIA: TIPS FOR SURVIVING NEWS MEDIA INQUIRIES

As a family member of a deceased or unaccounted for service member or civilian, you may find yourself approached by media representatives for interviews. Here are some tips for coping with the media.

- KNOW your rights. It's up to you whether or not to speak to reporters. If you do choose to speak, you may stop at any time.
- KNOW the role and purpose of the American press. They perform an important job in our democracy by keeping the public informed. It is not harassment if they call you at home or stop you out in public asking for an interview. It becomes harassment *only* when they persist after you have said "no."
- KNOW the reporter's identity. Write down the reporter's name, telephone number, and news organization before answering *any* questions. Do this even if you are not going to comment; this will discourage the reporter from persisting after you have said "no."
- KNOW your limits. It's best not to talk about anything of which you do not have first-hand knowledge. A response of "I don't know" is perfectly fine in response to questions for which you have no answer. Do not speculate or engage in rumor or gossip.
- KNOW who will hear what you say. Even family members might have sensitive information that should not be released. With today's technology, unauthorized sources can access what you say the moment you say it. On a positive note, your enthusiastic response about your spouse's mission can help to build morale and show American resolve.
- If you reside in government housing, you may not invite media to your home without prior clearance from the Public Affairs Office. Media must be escorted when on post. Whether you live on or off post, please have your casualty assistance officer contact the Public Affairs Office when you are approached by the media.
- Last but not least, be careful about information you share. Keep in touch with your Chain of Concern for accurate information. For your own safety and security, as well as other family members, it is best not to announce to the general public that you are alone by giving out personal information such as your home address or telephone number.

Reproduced from: Department of the Army. *Public Affairs Assistance to NOK of Army Casualties*. Washington, DC: DA; 2003. Public Affairs Directive, 28 Jun 2003. RUEADWD0404.

but most applies to recruit deaths as well. Much of the information presented in Attachment Exhibit 2 is also beneficial to MTF personnel who deal with the media. The DoD public affairs directives[9] also include a list of questions and possible answers for news conferences.

Medical Treatment Facility Communications With the Media

By providing medical experts to the media, MTF commanders can help shape the publicity generated by the death of a recruit. The expertise the Army can provide includes interviews with medical and recruit training professionals, press conferences, prepared newspaper articles, and medical journal articles. Several accounts of recruit deaths have been published in medical journals (see the case reports in Chapter 25, Recruit Mortality). The examples below demonstrate how the publicity from a recruit death may lead to unintended and unfounded consequences (eg, fear among fellow recruits). However, effective risk communication by medical experts to media representatives, fellow recruits, and the general population contributes to more positive media coverage.

The statistics provided in Chapter 25, Recruit Mortality, as well as other scientific articles,[10] demonstrate that the frequency of recruit deaths from cardiac causes is equal to or lower than those in the same-age civilian population. However, the *Air Force Times*[11] and *Army Times*[12] published articles in July and August 2002, respectively, that questioned the military's effort in identifying those recruits at risk for sudden death. The *Air Force Times* article[11] detailed the deaths of three Air Force trainees (one of whom was a recruit in BMT) and emphasized that military doctors frequently miss the diagnosis of heart disease in recruits. The article suggested increased cardiovascular screening and imaging techniques. Physicians who were interviewed tried (with moderate success)

to discuss the cost-effectiveness of such screening. The similar follow-up *Army Times* article[12] was written after an Army recruit died of sudden cardiac death a week later at Fort Benning, Georgia.

Both authors of these newspaper articles attempted to identify the number of recruit deaths by contacting each service individually, but they were unable to obtain data on Army recruit deaths. Even if these authors had obtained recruit death data from all services for a comparable period of time, a relatively superficial cause of death diagnosis and count data alone have very limited utility from an epidemiological standpoint. By providing only raw numbers of deaths, the reader is unable to accurately put these deaths into context of individual risk without knowing denominator (population) data.

In September 1999, an Air Force recruit died from exertional heat illness and acute water intoxication (hyponatremia).[13] This death was discussed in an *Army Times* article headlined "TOO MUCH WATER CAN KILL YOU: The facts you need to save your life."[14] The article, written after another hyponatremia-related death, of a female Army trainee (who had already graduated from BMT) at Fort Jackson in January 2000, included a fairly balanced discussion of hyponatremia and the need to maintain appropriate levels of hydration and salts during exercise and training. Many medical professionals, both military and civilian, contributed to the article. Unfortunately, the provocative headline had unintended consequences. The incidence of heat exhaustion temporarily increased at Fort Jackson the following spring and early summer because soldiers and the cadre were hesitant to drink appropriate amounts of water for fear of developing fatal hyponatremia. The article did not emphasize the fact that heat exhaustion and heat stroke are much more likely to occur during the South Carolina summer than hyponatremia. Educational intervention from the MTF personnel reversed the trend of increasing heat exhaustion.

An excellent example of effective risk communication and cooperation with the media through press conferences and interviews occurred at the Marine Corps Recruit Depot, San Diego, California, between November 1 and December 20, 2002. During this time, three recruit deaths occurred at this training site[15–17] following an outbreak of group A streptococcal pneumonia.[18] A joint press conference held by the director of medical services at Balboa Navy Regional Medical Center in San Diego and the commander of the Recruit Depot helped to dispel community fears of a widespread epidemic by disseminating information on group A streptococcal infections, and the actions taken to combat its spread. Similarly, a meningococcal meningitis outbreak (which resulted in no recruit deaths) in 2002 at Fort Leonard Wood, Missouri,[19,20] demonstrated the importance of both effective risk communication and cooperation with the media. The deputy commander for clinical services and the medical staff at Leonard Wood Army Community Hospital used radio, television, newspaper, and Internet coverage to inform the public about the meningococcal meningitis outbreak and the preventive vaccination program put in place for the entire community. Their effort successfully limited the outbreak to the military training community; no civilian illness occurred.

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