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U.S. Navy and Marine Corps Recruit Training Deaths in San Diego, California, 1973–1985; A Review of 31 Cases

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ABSTRACT: The deaths of military recruits associated with training activities nearly always fall under close scrutiny from relatives of the deceased recruit and the media. The literature contains isolated case reports of recruit deaths but no comprehensive reviews of all deaths at a single training facility. The purpose of this study is to describe the circumstances and causes of all recruit deaths occurring at the Naval Training Command and the Marine Corps Recruit Depot in San Diego, California, from 1973 through 1985. Thirty-one male recruits died in training during this period; eight died from medical conditions not detected by preenlistment questioning or examination. In five of these cases, the conditions were probably known to the recruit but were not listed on a medical history form. Seven recruits died in incidents related to training, and there were six cases of "sudden cardiac death," as well as eight deaths caused by infectious diseases.

KEYWORDS: pathology and biology, postmortem examinations, death, military populations, forensic pathology, sudden death, recruit deaths

The sudden and unexpected death of an apparently healthy young man is difficult for families to accept. It is not surprising that deaths occurring during military basic training in individuals screened for the presence of disease come under close public scrutiny. Movies, television, and the popular press have often depicted military boot camp as a rigorous, demanding, demeaning, and sometimes dangerous experience [*1–4*]. When a recruit dies while in training there may be implications or accusations that the military is hiding the true cause or circumstances of death. Such suspicions seem to originate largely from a well-publicized 1956 incident in which Staff Sergeant Matthew C. McKeon, a junior Marine Corps drill instructor at Parris Island, South Carolina, led a platoon of 74 recruits on an unauthorized "disciplinary march" through a swamp, resulting in the drowning deaths of six men [*3,5,6*]. Since that event, deaths associated with recruit training have been scrutinized by the families of the dead recruits, who frequently claim to have had difficulties in obtaining information [*1–4*]. While isolated incidents may be widely publicized, the death rates of U.S. Navy and Marine Corps recruits released to

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the *San Diego Union* newspaper in 1982 gave a rate of 9.86 per 100 000 (including off-base deaths). The same age group of males in the general population had a death rate of approximately 120 per 100 000 [*1*]. It is of extreme interest to note that while the Navy and Marine Corps released the death rates of recruits, they have refused to provide us with the number of recruits trained during the period of this study.

The purpose of this study is to categorize the causes and circumstances of death in all on-base deaths of recruits from 1973 through 1985 at two large military training facilities: the Marine Corps Recruit Depot (MCRD) and the Naval Training Command (NTC), in San Diego, California. These facilities trained only male recruits during the period covered by the study.

Methods

All deaths of active-duty military personnel occurring on military bases in San Diego, California, are investigated by the military authorities. Autopsies on such fatalities are all performed either at the U.S. Naval Hospital, San Diego, or, if they occur at Marine Corps Base Camp Pendleton, at the U.S. Naval Hospital, Camp Pendleton, California. The data for this study were collected during the period 1981 through 1985 when one of the authors (M.A.C.) was chief of the Autopsy Service at the U.S. Naval Hospital, San Diego. The cases were located by manually searching the autopsy files at the U.S. Naval Hospitals at San Diego and Camp Pendleton for all training deaths that occurred between 1973 and 1981 (records prior to 1973 were not available). The autopsy reports were then checked against lists of recruit fatalities that appeared in local newspapers as well as a list provided by the Public Affairs Office at the Marine Corps Recruit Depot. Data for 1981 through 1985 had been collected prospectively when one of the authors performed or supervised all autopsies on recruits who died while in training. Autopsy reports and information concerning the circumstances of death for all on-base recruit deaths occurring at MCRD and NTC in San Diego from 1973 through 1985 were reviewed, along with microscopic slides from all the cases. Investigative reports, hospital records, and autopsy photographs were also available for review.

This study began after involuntary military service (the Draft) ended in the United States. For this reason, all individuals who attempted to enlist in the military during the study period were called volunteers and were not designated "recruits" until basic training began at a recruit training center. The processing was done by the current system, which is as follows: Prior to being sent to a recruit depot for training, each volunteer is processed at a local processing center where he is required to fill out Standard Form 93 (SF 93) "Report of Medical History," which is an 81-item checklist designed to identify a history of significant illnesses or injuries that might disqualify an applicant from military service [*7*]. He is then given a physical examination by a physician, who reviews the SF 93 and completes Standard Form 88 (SF 88), "Report of Medical Examination." If the volunteer is judged to be physically qualified for military service, he is then sent to a recruit training center at a time selected by him within six months of this physical examination. When the volunteer arrives at a training center, he is designated a "recruit" and a second physical examination is performed. The records of the first examination at the processing center are reviewed, along with the results of the physical examination performed at the recruit center. A complete blood count, urinalysis, venereal disease research laboratory (VDRL) analysis, hemoglobin electrophoresis, and a glucose-6-phosphate dehydrogenase deficiency screening test are also performed, along with a chest X-ray. Recruits are placed on "light duty" until the results of their physical examinations and laboratory studies are reviewed and they are judged "fit for full duty." It is not unusual for some recruits to be rejected for service at this point and sent home without beginning basic training. Medical care is available on an around-the-clock basis to recruits, and their complaints

are evaluated in a timely fashion by medical personnel. For the purposes of this study, a recruit is defined as any individual who is undergoing initial basic training in the U.S. Navy or Marine Corps while in an enlisted status.

Results

A total of 31 male recruits died during the study period: 8 had medical conditions that were undoubtedly present before basic training; 9 died from incidents related to training; 6 were categorized as "sudden cardiac death"; and 8 were infectious disease-related deaths (Table 1).

Medical conditions existing before enlistment, which were probably known to the recruit but denied by him on the SF 93, are listed in Table 2, Cases 1 through 5. In Cases 1 and 2, the recruits were found to have histories of multiple civilian hospital admissions for pneumonia prior to entering military service. The history and autopsy findings in Case 2 are suspicious for cystic fibrosis, but the medical records and autopsy report do not indicate that this diagnosis was ever considered. The recruit in Case 3 denied a history of asthma on the SF 93, even though it was later learned by an investigator that he had a long-documented history of asthma. In Case 4, it is not known whether the recruit had a previous diagnosis of asthma, but there were striking microscopic changes indicative of chronic asthma in the lungs. Case 5 involves a long-protracted bout with ulcerative colitis, in which the recruit had bloody diarrhea starting on the first day of boot camp.

There were three cases (Table 2, Cases 6 through 8) in which known preexisting conditions did not exclude a recruit from service but resulted in his death. In Case 6, there was a spontaneous rupture of a preexisting elastic defect in the subclavian artery, which would not have been identified by the recruit on the SF 93 or detected on a routine physical examination. This recruit demonstrated cafe-au-lait spots and cutaneous neurofibromas at autopsy, which had been noted on his enlistment physical, but neurofibromatosis does not appear on the list of conditions for exclusion from service under "Skin and Cellular Tissues" [7]. Cases 7 and 8 are sudden deaths associated with sickle cell trait. In Case 7, the preinduction hemoglobin electrophoresis did not show sickle cell trait, but a blood sample obtained at autopsy showed a hemoglobin AS phenotype. Subsequent investigation revealed that the labels on this blood sample and that of another recruit had been transposed prior to submission to the laboratory. In Case 8, the recruit had 42% hemoglobin S on the preinduction hemoglobin electrophoresis. In neither case would the presence of sickle cell trait alone have excluded the recruit from service.

Table 3 summarizes the training incidents that resulted in death. Four gunshot wound cases were reviewed (Cases 9 through 12). The circumstances listed in the autopsy reports are characteristic of suicide in Cases 9 and 10, but the autopsy pathologist, who had no forensic pathology training or supervision, declined to certify a manner of death in these cases. In Case 11, the recruit shot himself in front of witnesses after failing a marksmanship test, and in Case 12, one recruit was shot by another on the rifle range. Case 13 was

TABLE 1—*Summary of recruit deaths in San Diego, 1973 through 1985.*

Category	Number of Cases
Medical conditions existing before basic training	8
Training incidents (including suicides and homicide)	9
Sudden cardiac deaths	6
Infectious diseases	8
Total	31

TABLE 2—*Medical conditions existing prior to enlistment.*

Case	Age	Race	Cause of Death	Autopsy Findings	Significant History Prior to Enlistment
1	19	W	acute confluent pseudomonas pneumonia	1. right pulmonary artery agenesis 2. pseudomonas pneumonia	multiple hospital admissions for pneumonia
2	18	W	pseudomonas pneumonia and bronchiolitis obliterans	1. bilateral pneumonia 2. bronchiolitis obliterans 3. myocarditis	7 previous hospitalizations for pneumonia
3	17	W	asphyxia due to asthma	1. asthma 2. tracheobronchitis	long history of asthma
4	20	B	asphyxia due to chronic bronchitis and asthma	1. severe bronchitis and bronchiolitis 2. pulmonary hypertension 3. asthma	none
5	18	W	complications of ulcerative colitis	1. status—post total colectomy and gastrectomy with pancreatectomy	none
6	22	W	acute right hemothorax due to rupture of focal elastic tissue defect in right subclavian artery	1. thinning of intimal layer of right subclavial artery 2. neurofibromatosis of the skin and right vagus nerve 3. cafe-au-lait spots	none
7	24	B	sickle cell crisis with DIC	1. multiple bowel infarcts	enlistment Hgb electrophoresis normal but postmortem sample positive for sickle trait (see text)
8	24	B	sickle cell crisis with DIC	1. liver infarction 2. acute renal tubular necrosis	hemoglobin electrophoresis showed Hgb AS

TABLE 3—*Fatal training incidents.*

Case	Age	Race	Incident
			GUNSHOT WOUNDS
9	18	W	shot self in the head with a .45 caliber weapon during training (suicide)
10	18	W	shot self in the head (suicide)
11	19	W	shot self in the abdomen with an M-16 rifle after not passing the marksmanship test (suicide)
12	19	W	multiple gunshot wounds of chest and abdomen (homicide) (shot by another recruit)
			MISSILE WOUNDS
13	18	W	missile wound of head—shot when another recruit improperly collapsed on M-72 antitank weapon
			BLUNT FORCE INJURIES
14	20	W	hit in face, neck, and abdomen while walking with a pugil stick; resultant subluxation of cricoid cartilage with asphyxia
			DROWNING
15	18	Mongolian	drowning while swimming in a pool; fibrosis of AV nodal artery at autopsy
16	18	B	drowned in a pool during a routine training exercise; not noticed sinking below the surface by lifeguards
			HANGINGS
17	17	W	sent to barracks for demerits; hanged self with a belt ligature (suicide)

clearly an accident due to improper collapsing of an M-72 antitank weapon. Case 14 was an accident in which the recruit was hit in the neck with a pugil stick during self-defense training, which resulted in neck injuries and an asphyxial death. Two deaths (Cases 15 and 16) involved drowning. In Case 15, a precipitating cardiac arrhythmia was suspected by the autopsy pathologist since the artery supplying the atrioventricular node showed extensive narrowing due to intimal hyperplasia. In Case 16, no underlying disease or anomalies were found at autopsy, and the toxicology results were negative. This recruit could not swim prior to enlistment and apparently sank beneath the surface of the pool without attracting the attention of a lifeguard. In addition to the three gunshot wound suicides, there was a fourth suicide, in which a recruit hanged himself (Case 17).

Table 4 lists the nine cases of sudden, unexpected death associated with physical exertion during routine training exercises. Two recruits with sickle cell trait, which were discussed earlier, collapsed while running and subsequently developed disseminated intravascular coagulation (DIC) prior to death. Case 13 was a clear case of exercise exacerbation of chronic asthma in a recruit who denied a history of asthma on the SF 88. There were six cardiac deaths with an anatomic cardiac defect found in two cases. In Case 18, there was a fibrous malformation of the atrioventricular node, and in Case 19, myocarditis was found in the atrioventricular node. Cases 20 through 23 were grossly and microscopically negative for cardiac pathology, but the histories and autopsies ex-

TABLE 4—*Sudden and unexpected deaths associated with training exercises—no pre-enlistment history of illness.*

Case	Age	Race	Incident	Autopsy Findings
			SICKLE CELL TRAIT	
7[a]	17	B	collapsed after 2½ mile (4-km) run	rhabdomyolysis with associated acute tubular necrosis and DIC
8[a]	24	B	collapsed following a run	DIC
			EXERTIONAL ASTHMA	
13	17	W	respiratory arrest while running	bronchial asthma and tracheobronchitis
			CARDIAC DEATHS	
18	18	B	experienced back pain after a march; then became breathless and pulseless after walking a short distance	fibrous malformation of the AV node
19	17	W	collapsed during a 2-mile (3.2-km) run	myocarditis of the A-V node
20	18	W	collapsed after a "long" cross-country hike, apparently on a very hot day	aspiration of vomitus
21	20	W	became tired while treading water, could not get out of pool unassisted, respiratory arrest followed	none
22	19	W	collapsed and vomited after a 3-mile (4.8-km) run	aspiration of vomitus
23	18	W	collapsed while running	none

[a]Also listed in Table 1.

cluded all conditions except a cardiac arrhythmia as the cause of death. Agonal aspiration of gastric contents was the only anatomic finding in Cases 20 and 22, while Cases 21 and 23 were devoid of abnormal anatomic findings.

Table 5 lists the deaths related to infectious diseases. Cases 24 and 25 had culture-proven meningococcal meningitis. Aseptic meningitis was diagnosed in Case 26, and a viral etiology was suspected, but antemortem and postmortem cultures were negative. In Case 27, postmortem cultures grew *Haemophilus influenzae*, Group A. Cases 28, 29, and 30 were felt to be viral infections that were later complicated by bacterial superinfection. A viral cause of acute hepatic failure was suspected in Case 31, and this case was certified as "liver failure of unknown etiology."

Discussion

The 1956 Ribbon Creek incident, at Parris Island, South Carolina, which resulted in the drowning deaths of six Marine Corps recruits polarized public sentiment against military training practices [5]. The author of *Ribbon Creek*, who was the commanding officer of Parris Island at the time of the deaths, summarized public opinion at the time as follows [5]:

TABLE 5—*Infectious disease-related deaths.*

Case	Age	Race	Cause of Death	Autopsy Findings	Circumstances
24	20	W	fulminant meningococcemia with DIC	hemorrhages in kidneys, epicardium, lungs, GI tract, skin, and adrenals	sore throat for 2 days, acute purple rash, died within hours of the rash appearing
25	17	W	brainstem herniation complicating menigococcal meningitis	acute meningitis with acute cerebral edema septic emboli of skin and heart	sudden onset of headache, vomiting, and rash, died 12 h later
26	19	W	pneumonia complicating viral meningitis	aseptic meningitis bronchopneumonia	6-day history of fever and chills prior to hospital admission
27	23	W	bilateral interstitial pneumonitis with bronchopneumonia	*hemophilus influenzae*, Type A, cultured from muscle and lung	6-day history of coughing, abdominal pain, and vomiting presented with shock and severe dehydration
28	17	W	acute necrotizing bronchopneumonia	*staphylococcus aureus* cultured from lung hemorrhagic pneumonia with abscess	1-week history of fever, chills, coughs, and abdominal pain
29	21	Not Given	acute pneumonitis	interstitial tracheal and bronchial inflammation lung cultures: beta *streptococcus* and *staphylococcus aureus*	fever, chills, vomiting, dehydration, and abdominal cramps
30	19	W	bronchopneumonia with multiple abscesses	*staphylococcus aureus* bronchopneumonia with multiple abscesses	4-day history of coughing, dyspnea, fever, and chills
31	18	B	liver failure of unknown etiology	coagulopathy with hemothorax and hemoperitoneum acute yellow atrophy of liver	1-week history of chills, fever, nausea, sore throat, and swollen knees

> Nearly to the hour, forty days after the Ribbon Creek incident, five civilians died in a head-on automobile collision eight miles north of Ann Arbor, Michigan. One of these was my eldest son. This second tragedy was also caused by human frailty, but it was scarcely noticed in Washington. There was no public action. Emotionally involved were close relatives, intimate friends, some school officials.

When this study was begun in 1981, we expected to find many controversial cases in which physically impaired recruits had been pushed too far, with fatal results. To the contrary, we found that, in 5 of the 31 recruit deaths, a recruit had purposefully denied a history of a condition that would have resulted in his exclusion from service. This may at first seem paradoxical, but both the United States involvement in the war in Vietnam and compulsory military service ended in 1973. Prior to this time, many young American men went so far as to leave the country to avoid military service, and most would certainly have given any significant medical history on the SF 93 in an attempt to avoid induction into involuntary military service. With the advent of an all-volunteer military in the latter half of 1973, the young men and women who presented themselves for examination to enter the military were truly volunteers. Many came from disadvantaged backgrounds and looked upon service in the military as a potential career with considerable upward socioeconomic mobility. For these reasons, some volunteers, who would have feigned illness to avoid involuntary service a few years previously, now attempted to hide serious natural diseases that would disqualify them from service. The screening and examination processes are obviously quite accurate since only a very few individuals managed to enter recruit training with a significant preexisting illness.

Routine screening practices failed to demonstrate the presence of disease in asymptomatic recruits with asthma, chronic bronchitis, ulcerative colitis, agenesis of the pulmonary artery, fibrous malformation of the atrioventricular node, and bronchiolitis obliterans. These individuals were either unaware of their illnesses or denied a medical history on the SF 93, which contains a certification of authenticity that is signed by the recruit. The careful review of a chest X-ray along with chest auscultation might have detected asymptomatic bronchiolitis obliterans and chronic bronchitis. A simple stool guaiac test would probably have uncovered the case of ulcerative colitis, since this recruit was hospitalized with bloody diarrhea on his first day of training. A chest X-ray, a complete blood count (CBC), and a physical examination are integral parts of the induction process, but a patient with a recurrent chronic problem who was currently asymptomatic might well pass the examination if the examining physician were unaware of the patient's history.

No significant coronary artery disease was found in the subjects of this study, and the value of the history in revealing occult cardiovascular disease in the young, healthy, and asymptomatic patient is of questionable value. With competitive athletes, electrocardiograms, especially with exercise, are potentially more sensitive in detecting occult coronary artery disease [*10*]. An electrocardiogram might have revealed a conduction defect in two of these cases, but electrocardiograms are not routinely administered to recruits. Resting electrocardiograms are less sensitive than radionuclide scans or exercise electrocardiograms in finding occult coronary disease [*10*]. None of the patients in the current study died of atherosclerotic coronary artery disease. In the young age group studied here, as well as in several other large series [*8,9,12–14,16,18*], sudden death due to coronary disease was less common than in the over-30 age group. In fact, screening for hyperlipidemia and obtaining a family history may better select those young adults at risk for coronary disease [*15*]. Such recruits, when identified, could be studied further if necessary. The large study of sudden deaths in World War II soldiers by Moritz et al. showed that 22% of the 115 selected cases involving coronary artery disease were in the under-30 age group [*11*]. This is in contrast to a recent study of U.S. Air Force recruits in which the incidence of coronary artery disease in the setting of sudden cardiac death was only 1 in 19 [*14*].

Our one case of fibrous malformation of the atrioventricular node might have been detected by a prescreening electrocardiogram. The finding of fibrosis of the conduction system seems to be a function of how diligently one searches for search anomalies [*17*]. In four of the "unexplained" cardiac deaths studied here, in which the conduction system was examined microscopically in multiple sections, no anomalies were found. One could speculate that these patients had the "prolonged Q-T syndrome" and that their condition might have been diagnosable by electrocardiography, since the prolonged Q-T syndrome has been described in patients with anatomically normal conduction systems [*21,22*]. Other potential problems such as heart block, preexcitation syndromes, and arrhythmias might also have been uncovered by electrocardiography [*14*]. Generally, asymptomatic conduction abnormalities are thought to be much less common in sudden death than myocarditis, idiopathic hypertrophic subaortic stenosis, and coronary artery disease [*18*]. The association of myocarditis of the atrioventricular node and sudden death has been previously described [*19,20*]. In general, many authors recommend avoiding strenuous exercise both during and after a viral illness to avoid possible arrhythmias and subsequent sudden death from asymptomatic myocarditis [*8,12*].

Both of the recruits in this study who died from sickle cell crises had symptoms and clinical presentations similar to those previously reported [*29–31*]. They were both running and then collapsed and presented in shock with the clinical picture of disseminated intravascular coagulation associated with rhabdomyolysis and acute tubular necrosis. The largest study to date in a military population by Kark et al. [*29*] demonstrated a substantially increased risk of sudden death in military recruits with sickle cell trait. The mechanism for sickling in these individuals is thought to involve acidosis, complicated by dehydration and lack of conditioning [*29–31*]. This leads to precipitation of hemoglobin S and subsequent disseminated intravascular coagulation, followed by rhabdomyolysis and renal failure [*29,30*]. In 1982, the U.S. Army published new regulations designed to reduce casualties due to exertion and sickle cell trait. Although such individuals are currently identified, their activities are not restricted. The preventative measures include monitoring their hydration and wet bulb thermometer temperature and adjusting exertional activities according to these conditions [*29*].

In summary, we found that few deaths occur in U.S. Navy and Marine Corps recruits and that those deaths are probably not preventable. Much controversy is avoided when the investigation is integrated with a well-documented autopsy performed by a competent forensic pathologist. We recommend thorough photographic documentation of autopsy findings, as well as toxicologic studies, cultures, and hemoglobin electrophoresis to answer any questions that may arise from family inquiries.

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