

NAVAL HEALTH RESEARCH CENTER

OUTBREAK OF GROUP A STREPTOCOCCAL PNEUMONIA AMONG MARINE CORPS RECRUITS - CALIFORNIA, NOVEMBER 1 - DECEMBER 20, 2002

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MMWR Series on Public Health and Aging

The demographic shift toward an aging population poses major challenges for public health programs and practice in the 21st century. This issue of *MMWR* begins a special series on Public Health and Aging that will highlight important health topics associated with older populations and the implications for public health. Reports will examine data about older adult health; discuss the influence of aging on current public health program priorities, program delivery, relevance, and reach; and explore potential strategies for future directions in public health as the population ages.

Reports in *MMWR* (Weekly) will present science-based information on key public health and aging topics. An accompanying *MMWR Recommendations and Reports* series will discuss public health policy implications of the aging population.

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Public Health and Aging

~~Trends in Aging — United States and Worldwide~~

~~The median age of the world's population is increasing because of a decline in fertility and a 20 year increase in the average life span during the second half of the 20th century (1). These factors, combined with elevated fertility in many countries during the 2 decades after World War II (i.e., the "Baby Boom"), will result in increased numbers of persons aged ≥65 years during 2010–2030 (2). Worldwide, the average life span is expected to extend another 10 years by 2050 (1). The growing number of older adults increases demands on the public health system and on medical and social services. Chronic diseases, which affect older adults disproportionately, contribute to disability, diminish quality of life, and increased health and long term care costs. Increased life expectancy reflects, in part, the success of public health interventions (2), but public health programs must now respond to the challenges created by this achievement, including the~~

~~growing burden of chronic illnesses, injuries, and disabilities and increasing concerns about future caregiving and health care costs. This report presents data from the U.S. Bureau of the Census, the World Health Organization, and the United Nations on U.S. and global trends in aging, including demographic and epidemiologic transitions, increasing medical and social costs related to aging, and the implications for public health.~~

U.S. Trends

In the United States, the proportion of the population aged ≥65 years is projected to increase from 12.4% in 2000 to 19.6% in 2030 (3). The number of persons aged ≥65 years is

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health care providers, and aging experts; 2) to support health care providers and health care organizations in prevention efforts; 3) to integrate public health prevention expertise with the aging services network; 4) to identify and implement effective prevention efforts; and 5) to monitor changes in the health of older adults. These roles will require new efforts to address the special needs of older adults and to deliver programs in communities in which older adults work, reside, and congregate. Existing public health programs will be required to examine whether they meet the needs of an aging population.

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Outbreak of Group A Streptococcal Pneumonia Among Marine Corps Recruits — California, November 1–December 20, 2002

During November 1–December 20, 2002, a total of 163 Marine Corps personnel from the Marine Corps Recruit Depot (MCRD) in San Diego, California, including 160 new recruits, were admitted to the Naval Medical Center San Diego (NMCS) for possible pneumonia. For 128 (79%) patients, pneumonia was confirmed by chest radiograph; of these 128 cases, 31 (24%) were definitely or probably caused by group A streptococci (GAS). This is the first outbreak of serious GAS-associated illness at a San Diego military training facility since the 1987 outbreak of rheumatic fever (1) and the largest outbreak of GAS pneumonia in the United States since 1968 (2). This report summarizes the results of the investigation of this outbreak, which indicate that GAS infection can occur among military recruit populations despite routine chemoprophylaxis administered to incoming recruits. Instituting routine surveillance for noninvasive GAS disease in military training facilities might prevent future invasive GAS outbreaks.

All patients with radiographically confirmed pneumonia were tested by sputum, blood, and throat cultures; *Mycoplasma pneumoniae* IgM (ETI-MP enzyme-linked immunosorbent assay [ELISA], Diasorin, Inc.) and IgG (ELISA, Wampole); *Chlamydia pneumoniae* IgM and IgG (microimmunofluorescence, Focus Technologies); rhinoprobe direct fluorescent antibody for respiratory syncytial virus, adenovirus, influenzae, and parainfluenzae; urine *Legionella* antigen test; urine *Streptococcus pneumoniae* antigen test; and an antistreptolysin O (ASO) titer. Available GAS isolates underwent *emm*-typing through sequencing of the 5' *emm* variable region and antimicrobial susceptibility testing by broth microdilution and E-test.

All case definitions required radiographic confirmation of pneumonia in a marine recruit hospitalized with acute respiratory illness (ARI) during the outbreak period. A confirmed case of GAS pneumonia required a blood or pleural fluid culture that was positive for GAS. A probable case of GAS pneumonia required a positive throat or sputum culture for GAS or an ASO titer of >250 Todd units in the absence of another identified etiologic agent. A confirmed case of *M. pneumoniae* pneumonia required IgG seroconversion, and a probable case required a positive IgM. A confirmed case of *C. pneumoniae* required a fourfold rise in IgG or an IgM titer of ≥ 16 , and a possible case required an IgG titer of ≥ 12 .

A total of 128 male recruits aged 18–33 years (median: 20 years) had radiographically confirmed pneumonia; 110 (86%) were white non-Hispanics, 14 (11%) were white Hispanics, and four (3%) were members of other racial/ethnic groups. All recruits were previously healthy and were seronegative for human immunodeficiency virus. Of the 128 recruits with confirmed pneumonia, 66 (52%) had multilobar involvement, and 29 (23%) had a pleural effusion, including five (4%) with an empyema. GAS was identified in 31 (24%) pneumonia episodes (six confirmed and 25 probable GAS cases), resulting in a GAS pneumonia attack rate of 0.7% among the approximately 4,500 recruits present at the training facility during November 1–December 20. An etiologic agent could be established for 47 (48%) of 97 remaining pneumonia episodes and for 78 (61%) of the pneumonia episodes overall (Table). Multiple etiologies were identified for several pneumonia cases; one patient had confirmed GAS and confirmed *C. pneumoniae* infections, and three patients had confirmed GAS and possible *C. pneumoniae*. Sputum or throat cultures were positive for GAS or the patient had an ASO of >250 Todd units in two (29%) of the seven confirmed and five (28%) of the 18 possible *C. pneumoniae* cases, one (33%) of the three confirmed and nine (56%) of the 16 probable *M. pneumoniae* cases, and one (20%) of the five adenovirus cases.

Symptoms reported by the 31 recruits with GAS pneumonia included cough (29 [94%]), fever (20 [65%]), sore throat (19 [61%]), pleuritic chest pain (15 [48%]), dyspnea (14 [45%]), chills (nine [29%]), and exanthem (two [7%]). The mean ASO titer for GAS pneumonia cases was 997 Todd units (range: <25–>4,800) compared with 249 for non-GAS cases ($p = 0.03$). Those with GAS were more likely to have an empyema (16% versus 0%; $p = 0.005$) and had a longer mean hospital stay (5.4 versus 2.4 days; $p = 0.03$) than those with non-GAS pneumonia. Two patients with GAS had streptococcal toxic shock syndrome (TSS) and required intensive

care management. All recruits with pneumonia were treated successfully with ceftriaxone and either levofloxacin or azithromycin; clindamycin also was administered to those with TSS. One marine recruit died of purpura fulminans caused by *Neisseria meningitidis* serogroup C during the outbreak period. All GAS isolates were identified as *emm* type 3. In addition, all GAS isolates were susceptible to all 15 antibiotics tested, including penicillin, erythromycin, and azithromycin.

Before the outbreak, recruits had received intramuscular benzathine penicillin on the day of arrival at MCRD and 28 days later (or oral erythromycin twice daily) as prophylaxis against streptococcal disease. Of the 31 recruits with GAS pneumonia, 27 (87%) were hospitalized with suspected pneumonia ≥ 21 days after the last dose of penicillin was administered. The epidemic was halted by re-administration of antibiotic prophylaxis to all 4,500 recruits at the facility on December 15 by using benzathine penicillin 1.2 million units intramuscularly; azithromycin 1 g was administered orally for those recruits who reported a penicillin allergy (Figure). Medical personnel from NMCS, MCRD, and the Naval Health Research Center were involved in halting the outbreak.

Reported by: *NF Crum, MD, BR Hale, MD, DA Bradshaw, MD, JD Malone, MD, HM Chun, MD, WM Gill, MD, D Norton, MD, CT Lewis, MD, AA Truett, MD, C Beadle, MD, JL Town, MSN, MR Wallace, MD, Naval Medical Center; DJ Morris, MD, EK Yasumoto, MD, Marine Corps Recruit Depot; KL Russell, MD, Naval Health Research Center, San Diego, California. E Kaplan, MD, Univ of Minnesota Medical School, Minneapolis. C Van Beneden, MD, Div of Bacterial and Mycotic Diseases, National Center for Infectious Diseases; R Gorwitz, MD, EIS Officer, CDC.*

Editorial Note: Outbreaks of ARI, including pneumonia, among military trainees are well documented (3,4). Factors that might contribute to increased ARI susceptibility in this population include the rapid gathering of persons from across the country into crowded living and working quarters, which

TABLE. Number* and percentage of episodes of radiographically confirmed pneumonia among Marine Corps recruits, by etiology — San Diego, California, November 1–December 20, 2002

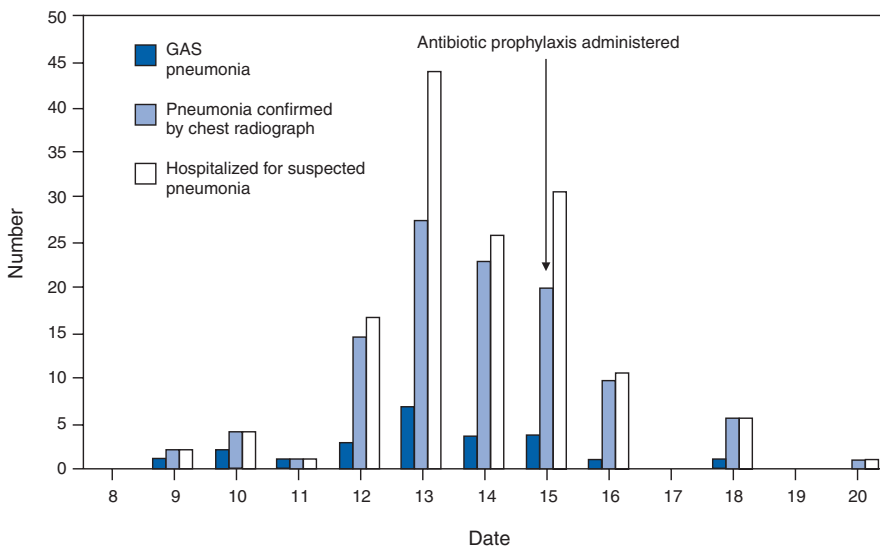
| Pathogen | Confirmed cases | | Probable or possible cases [†] | | Total [§] | |
|--------------------------------------|-----------------|---------------|---|---------------|--------------------|---------------|
| | No. | (%) | No. | (%) | No. | (%) |
| Group A streptococcus (GAS) | 6 | (4.7) | 25 | (19.5) | 31 | (24.2) |
| <i>Mycoplasma pneumoniae</i> | 3 | (2.3) | 16 | (12.5) | 19 | (14.8) |
| <i>Chlamydia pneumoniae</i> | 7 | (5.5) | 18 | (14.1) | 25 | (19.5) |
| Adenovirus | 5 | (3.9) | 0 | — | 5 | (3.9) |
| <i>Streptococcus pneumoniae</i> | 2 | (1.6) | 0 | — | 2 | (1.6) |
| Unknown etiology | | | | | 50 | (39.1) |
| Total with a defined etiology | 22 | (17.2) | 56 | (43.8) | 78 | (60.9) |

*n = 128.

[†]The alternate case definition was “possible” for *C. pneumoniae* only. For *M. pneumoniae* and GAS, the alternate case definition was “probable.”

[§]Categories are not mutually exclusive; one patient had confirmed GAS and confirmed *C. pneumoniae* infection, and three patients had confirmed GAS and possible *C. pneumoniae* infection.

FIGURE. Number of persons with Group A streptococcus (GAS) pneumonia*, with pneumonia confirmed by chest radiograph†, and with suspected pneumonia§, by date of hospitalization — San Diego, California, December 8–20, 2002¶



* n = 24.

† n = 110.

§ n = 143.

¶ During November 1–December 7, 2002, an additional 20 Marine Corps recruits were hospitalized for suspected pneumonia. For 18 patients, pneumonia was confirmed by chest radiograph; seven cases were caused by GAS.

exposes nonimmune persons to several pathogens, and the physical and psychological stressors of training. Disease prevention efforts include immunoprophylaxis (e.g., pneumococcal, meningococcal, and influenza vaccinations) and chemoprophylaxis (e.g., penicillin prophylaxis for streptococcal infections) administered to incoming recruits (3) and ongoing surveillance for ARI (4).

A leading cause of bacterial ARI among military recruits is *S. pyogenes* or GAS, which manifests as outbreaks of GAS pharyngitis, acute rheumatic fever, and pneumonia (3). This outbreak involved the circulation of a single GAS serotype and probably evolved from the introduction of this strain into a population of recruits lacking type-specific immunity. Streptococcal *emm* type 3 (corresponding to M type 3) is one of the most common serotypes associated with invasive GAS disease in the United States (5,6) and has been associated frequently, along with M types 1, 5, and 18, with outbreaks among U.S. military recruits (3). Population-based surveillance for all invasive GAS infections in nine disparate locations in the United States indicated that pneumonia accounted for 11%–14% of reported cases and was the third most common syndrome after invasive cutaneous or soft tissue infections and bacteremia without a known source (5,6). Among the civilian population, outbreaks of GAS pneumonia are rare.

A higher baseline rate of invasive and noninvasive GAS disease and a potential to delay seeking medical treatment for minor illness (including pharyngitis) among military recruit populations might account for this difference.

Several pathogens were identified as the potential source of pneumonia among the 78 (61%) pneumonia episodes for which a causative agent could be identified, and several pneumonia patients had dual diagnoses. Whether this represents a true concurrent increase in multiple respiratory pathogens or is an artifact of the diagnostic testing methods used is uncertain.

The findings in this report are subject to at least three limitations. First, a definitive diagnosis of GAS pneumonia is difficult. Blood cultures frequently are negative in GAS pneumonia (2); therefore, a confirmed diagnosis might not be possible unless pleural fluid is obtained. Second, because positive throat or sputum cultures can represent simple GAS pharyngitis or asymptomatic carriage of the organism, the specificity of these cultures for diagnosis of GAS pneumonia is low. Rising ASO titers might distinguish between GAS carriage and infection but are not specific for invasive GAS disease (7). Finally, diagnosing *M. pneumoniae* and *C. pneumoniae* infections by serology alone can be problematic, especially in the context of known GAS infections. Several serologic assays for *M. pneumoniae* are available commercially but vary in sensitivity and specificity (8). Although the microimmunofluorescence assay is considered the method of choice for serologic diagnosis of *C. pneumoniae* infection, interpretation of the results can be subjective. False positives can occur for *M. pneumoniae* and possibly for *C. pneumoniae* serologic assays in the presence of a nonspecific antibody response to GAS infection.

Primary and secondary penicillin chemoprophylaxis for GAS infections is effective in military recruit populations and has been used intermittently since 1951 (3,4). Primary (i.e., tandem) prophylaxis is administered to all recruits shortly after their arrival at a training facility to prevent the introduction of GAS into this population, and secondary (i.e., mass) prophylaxis is provided concurrently to all recruits in a given facility to interrupt established disease transmission. Oral erythromycin or azithromycin prophylaxis is used to prevent infection among recruits who are allergic to penicillin. The reason that primary prophylaxis failed in this circumstance is

unclear. Possible explanations include failure to achieve adequate serum levels of penicillin (9), waning protection as serum levels declined before the second scheduled dose of penicillin was administered on training day 28, and lack of compliance with oral erythromycin among penicillin-allergic recruits. Eradicating GAS carriage is difficult even with appropriate doses of penicillin and in the absence of penicillin resistance (10).

Early diagnosis and management of GAS infections might prevent the development of suppurative complications. Routine surveillance for noninvasive GAS disease was initiated recently at MCRD to identify breakthrough GAS infections and prevent outbreaks of GAS disease. Institution of routine surveillance for noninvasive GAS disease also might be useful for other military training facilities.

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Increase in Coccidioidomycosis — Arizona, 1998-2001

Coccidioidomycosis is a systemic infection caused by inhalation of airborne spores from *Coccidioides immitis*, a fungus found in soil in the southwestern United States and in parts of Mexico and Central and South America (1). Infection occurs usually following activities or natural events that disrupt the soil, resulting in aerosolization of the fungal arthrospores (2). Clinical manifestations occur in 40% of infected persons and range from an influenza-like illness (ILI) to severe pneumonia and, rarely, extrapulmonary disseminated disease (3). Persons at higher risk for disseminated disease include blacks, Filipinos, pregnant women in their third trimester, and immunocompromised persons (4). During 2001, the Arizona Department of Health Services (ADHS) reported a coccidioidomycosis incidence of 43 cases per 100,000 population, representing an increase of 186% since 1995 (3). To characterize this increase, CDC analyzed data from the National Electronic Telecommunications System for Surveillance (NETSS) and the Arizona Hospital Discharge Database (AHDD), and environmental and climatic data, and conducted a cohort study of a random sample of patients with coccidioidomycosis. This report summarizes the findings of this investigation, which indicate that the recent Arizona coccidioidomycosis epidemic is attributed to seasonal peaks in incidence that probably are related to climate. Health-care providers in Arizona should be aware that peak periods of coccidioidomycosis incidence occur during the winter and should consider testing patients with ILI.

Surveillance and Hospitalizations

Coccidioidomycosis became a nationally reportable disease at the southwest regional level through NETSS in 1995, at which time a case definition was adopted that required laboratory confirmation*. During 1997, laboratory reporting of coccidioidomycosis became mandatory in Arizona, after which a marked increase was noted in the number of reported cases. However, incidence continued to increase in subsequent years. NETSS data for 1998-2001 were analyzed to calculate incidence by using U.S. Census 2000 data for denominators.

*The laboratory criteria for diagnosis are cultural, histopathologic, or molecular evidence of the presence of *Coccidioides* spp; a positive serologic test for coccidioidal antibodies in serum or cerebrospinal fluid by 1) detection of coccidioidal IgM by immunodiffusion, enzyme immunoassay (EIA) latex agglutination, or tube precipitin or 2) detection of rising titer of coccidioidal IgM by immunodiffusion, EIA, or complement fixation; or a coccidioidal skin test conversion from negative to positive after the onset of clinical signs and symptoms.

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13. SUPPLEMENTARY NOTES

14. ABSTRACT (maximum 200 words)
Between November 1, 2002 and December 20, 2002, 163 Marines, including 160 recruits, were admitted to the Naval Medical Center San Diego for possible pneumonia; 128 cases were confirmed by chest radiograph. All pneumonia cases had the following investigations: sputum, blood, and throat cultures; *Mycoplasma pneumoniae* IgM and IgG (ELISA, Wampole) Princeton, NJ; *Chlamydia pneumoniae* IgM and IgG (MIF, Focus Technologies, Herndon, VA; rhinoprobe DFA for respiratory syncytial virus, adenovirus, influenzae and parainfluenzae; urine *Legionella* antigen test; urine *Streptococcus pneumoniae* antigen test; and an antistreptolysin O (ASO) titer. A definite case of Group A streptococcus (GAS) pneumonia was defined as a blood or pleural fluid culture positive for GAS. A probable case of GAS pneumonia was defined as a positive throat or sputum culture for GAS or an ASO titer of 250 Todd units or greater in the absence of another identified etiologic agent. A definite case of *M. pneumoniae* was defined as IgG seroconversion and a probable case as a positive IgM. A confirmed case of *C. pneumoniae* was defined as a four-fold rise in IgG or an IgM titer of 16 or greater and a possible case as an IgG titer ≥ 512 . All cases were male with an age ranging from 18 to 33 years (median 20 years of age). One hundred thirty-two cases (81%) were white/non-Hispanic, 26 (16%) were white/Hispanic, three (2%) were Asian/Pacific Islander, and two (1%) were other. All cases were previously healthy and HIV-seronegative. Of the 128 cases of pneumonia, 66 (52%) had multilobar involvement, and 29 (23%) had a pleural effusion, including five (4%) with an empyema. Thirty-one (22%) of the pneumonia cases were caused by Group A streptococcus with six cases of definite GAS and 25 cases of probable GAS. Forty-seven pneumonia cases were caused by other organisms including six definite and 15 possible cases of *C. pneumoniae*, three definite and 16 probable cases of *M. pneumoniae*, five cases of adenovirus, and two cases of *S. pneumoniae*. Seventy-eight of 128 (61%) of pneumonia cases had a definite or probable diagnosis. Some cases may have had concomitant infections; sputum or throat cultures were positive for GAS and/or the patient had an ASO >250 Todd units in eight of the *C. pneumoniae* cases, seven of the *C. pneumoniae* cases, and seven of the *M. pneumoniae* cases, and one of the adenovirus cases.

15. SUBJECT TERMS
Streptococcal Pneumonia, Marine Corps Recruit Depot

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