



Estimated Burden of Acute Otitis Externa—United States, 2003-2007

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ACUTE OTITIS EXTERNA (AOE) (SWIMMER'S EAR) is inflammation of the external auditory canal most often caused by bacterial infection. AOE is characterized by pain, tenderness, redness, and swelling of the external ear canal, and occasionally, purulent exudate. AOE is associated with water exposure (e.g., recreational water activities, bathing, and excessive sweating) and warm, humid environments.¹⁻⁵ Because the overall burden and epidemiology of AOE in the United States have not been well described, data from national ambulatory-care and emergency department (ED) databases were analyzed to characterize the incidence, demographics, and seasonality of AOE and associated health-care costs. The analysis showed that in 2007, an estimated 2.4 million U.S. health-care visits (8.1 visits per 1,000 population) resulted in a diagnosis of AOE. Estimated annual rates of ambulatory-care visits for AOE during 2003-2007 were highest among children aged 5-9 years (18.6) and 10-14 years (15.8); however, 53% of visits occurred among adults aged ≥ 20 years (5.3). Incidence peaked during summer months, and the regional rate was highest in the South (9.1). Direct health-care costs for nonhospitalized AOE visits total as much as \$0.5 billion annually, and ambulatory-care clinicians spend nearly 600,000 hours annually treating AOE. Suggested AOE prevention measures include reducing exposure of the ears to water (e.g., using ear plugs or swim caps and using alcohol-based ear-drying solutions).³⁻⁵

To reduce the national incidence of AOE, additional preventive measures should be investigated, and effective prevention messages should be developed and disseminated.

To help direct future prevention efforts for AOE, the current epidemiology of AOE in the United States and its impact on the U.S. health-care system must be understood and quantified. Ambulatory-care estimates were calculated by using 2003-2007 National Ambulatory Medical Care Survey (NAMCS) data,* and ED estimates by using 2007 Nationwide Emergency Department Sample (NEDS) data.† Total national visits were estimated by summing the NAMCS and NEDS estimates, and a range derived by summing the respective 95% confidence limits.‡

The 2006-2007 Marketscan database§ was used to estimate costs for nonhospitalized visits (ambulatory-care visits and ED visits that did not result in hospital admission). Only visits resulting in a diagnosis of AOE without concurrent otitis media were included in the analyses.|| Statistical software was used to apply sampling weights and account for complex sample design. Statistical significance was determined by the Rao-Scott modified chi-square test ($\alpha=0.05$).

AOE was diagnosed in an estimated 2,067,335 ambulatory-care clinic visits and 377,440 ED visits during 2007, for a total of 2,444,775 (range: 1,953,159-2,936,392) visits for AOE, representing 8.1 visits per 1,000 population (range: 6.5-9.7).¶ Thus, an estimated one in 123 persons was affected by AOE in the United States during 2007. AOE accounted for an estimated one in 324 ED visits and one in 481 ambulatory-care visits.

During 2003-2007, annual estimates of ambulatory care visits for AOE varied from 1,728,824 to 2,685,861, with no significant difference by year ($p=0.19$). Children aged 5-9 and 10-14

years had the highest annual visit rates for AOE; however, 52.8% of visits occurred among adults aged ≥ 20 years. Women accounted for 54% of AOE visits, which was not significantly more than for men ($p=0.30$). A similar demographic distribution was observed among ED visits, with the exception that a larger proportion of AOE visits to the ED occurred among persons aged 20-39 years.

Ambulatory-care diagnoses of AOE displayed a pronounced seasonality; visits peaked in the summer (44% occurred during June—August) and reached their lowest point in the winter. Although ED rates were similar by U.S. region, the annual rate of ambulatory-care visits for AOE was highest in the South (9.1 per 1,000 population) and lowest in the West (4.3). Urban and rural rates did not differ. An annual mean of 77,077 (3.6%) ambulatory-care visits for AOE resulted in referral to another physician, but no ambulatory-care AOE patients in the sample were admitted to a hospital. An estimated 2.7% of ED visits for AOE during 2007 led to hospital admission. An estimated 597,761 hours were spent annually by health-care providers on ambulatory-care visits for AOE (median: 15 minutes per visit; mean: 17 minutes). With a mean cost of \$200 per nonhospitalized AOE visit, estimated annual direct health-care payments totaled \$489 million.

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CDC Editorial Note: This is the first study to describe the epidemiology of AOE alone (excluding concurrent otitis media) in the general U.S. population and to estimate AOE-associated health-care costs. Exclusion of con-

What is already known on this topic?

Acute otitis externa (AOE) (swimmer's ear) is more likely to occur among swimmers, particularly in warm, humid environments. Greater time spent in the water and greater frequency of head submersion increases the risk for AOE.

What is added by this report?

This is the first report to describe overall U.S. epidemiology and associated costs of AOE. An estimated 2.4 million U.S. health-care visits result in a diagnosis of AOE annually (8.1 visits per 1,000 population), costing approximately \$0.5 billion in direct health-care costs and nearly 600,000 hours of clinicians' time.

What are the implications for public health practice?

Although AOE is generally a mild illness, it is a frequently diagnosed condition responsible for a substantial health-care burden. Disseminating effective prevention messages to clinicians and the public could reduce the national impact of AOE.

current otitis media provides a conservative estimate for the actual burden of AOE. The finding of 2.4 million annual visits (8.1 visits per 1,000 population) is consistent with previous reports. As expected, general population rate estimates are slightly lower than in previous reports limited to children aged <18 years (9.9-13.9 per 1,000 population)⁶ or when concurrent otitis media was not excluded (3.3 million U.S. outpatient visits).⁷

AOE must be distinguished from other painful ear conditions, such as acute otitis media, because treatment and prevention are different. Although both commonly are caused by bacteria (particularly *Pseudomonas aeruginosa* or *Staphylococcus* species in the case of AOE), uncomplicated cases of AOE usually respond favorably to topical antimicrobials (with or without a topical corticosteroid).^{3,8}

Box. Preventing acute otitis externa (AOE) (swimmer's ear)*

- Keep your ears as dry as possible.
- Use a bathing cap, ear plugs, or custom-fitted swim molds when swimming to keep water out of your ears.
- Dry your ears thoroughly after swimming or showering.
- Use a towel to dry your ears well.
- Tilt your head to hold each ear facing down to allow water to escape the ear canal.
- Pull your earlobe in different directions while your ear is faced down to help water drain out.
- If you still have water in your ears, consider using a hair dryer to move air within the ear canal.
 - Be sure the hair dryer is on the lowest heat and speed/fan setting.
 - Hold the hair dryer several inches from your ear.
- Do not put objects in your ear canal (including cotton-tip swabs, pencils, paperclips, or fingers).
- Do not try to remove ear wax. Ear wax helps protect your ear canal from infection.
- If you think your ear canal is blocked by ear wax, consult your health-care provider rather than trying to remove it yourself.
- Consult your health-care provider about using commercial, alcohol-based ear drops or a 1:1 mixture of rubbing alcohol and white vinegar after swimming.
- Persons with ear tubes, damaged ear drums, outer ear infection, or ear drainage (pus or liquid coming from the ear) should not use drops.
- Consult your health-care provider if your ears are itchy, flaky, swollen, or painful, or if you have drainage from your ears.
- Ask your pool or hot tub operator if disinfectant and pH levels are checked at least twice per day.
 - Hot tubs and pools with proper disinfectant and pH levels are less likely to spread germs.
 - Use pool test strips to check the pool or hot tub yourself for adequate disinfectant and pH levels.

*Conclusive published evidence of the effectiveness of any intervention for the prevention of AOE is lacking. The prevention recommendations in this box are the consensus of three experts consulted by CDC staff: Michael T. Brady, MD, representing the American Academy of Pediatrics and Evelyn A. Kluka, MD, and Ken Kazahaya, MD, both representing the American Academy of Otolaryngology -- Head and Neck Surgery. Additional information is available at <http://www.cdc.gov/healthywater/swimming/rwi/illnesses/swimmers-ear.html>.

Systemic antimicrobials usually are not indicated unless the AOE infection is complicated by an associated cellulitis of the surrounding skin, or other conditions (e.g., diabetes or immunosuppression).^{3,4} Although AOE generally is a mild illness, it is a frequently diagnosed condition responsible for a substantial health-care burden, with estimated costs of \$0.5 billion and nearly 600,000 hours of clinicians' time annually. Development and dissemination of prevention messages potentially could lower the incidence of AOE and reduce the health-care burden.

The findings in this report are subject to at least two limitations. First, return visits for the same illness episode could not be excluded, and 3.6% of ambulatory-care visits for AOE resulted in referral, leading to a potential overestimate of AOE incidence; however, because AOE generally responds quickly to appropriate treatment, the proportion of return visits likely was minimal. Regardless, each visit (whether initial or return) places a burden on the health-care system in health-care costs and clinicians' time. Finally, this analysis used a commercial insurance database to determine average costs. Visit

costs might differ for persons with a different insurance provider (i.e., Medicaid or Medicare) or persons without insurance. Overall AOE costs likely are higher than estimated because visits to federal facilities and inpatient visits were not included in the analysis, nor were additional costs such as lost wages, school absence, or caretakers' time.

With the substantial costs imposed by AOE in health-care expenditures and clinicians' time, prevention of AOE could yield considerable savings. Few studies exist on AOE prevention, and controlled trials of potential prevention measures are needed. Current clinical recommendations are intended to reduce factors known to increase risk for AOE, such as prolonged water exposure and trauma to the skin of the ear canal.^{1,2,4,5,9} Prevention messages emphasize exclusion of water from the ear canal, drying ears thoroughly after water exposure, and avoiding insertion of solid objects into the ear canal (BOX). Clinicians also might consider recommending the use of alcohol-based ear solutions after water exposure for persons with recurring episodes of AOE. Given that AOE's seasonality coincides with the traditional summer swim season (Memorial Day through Labor Day), prevention messages should be directed at swimmers. To optimize their effectiveness, these messages should be stressed before and during the summer swim season and target swimmers in the South, Northeast, and Midwest, particularly those aged 5-14 years, and their caregivers. Additionally, pool operators can help prevent transmission of *Pseudomonas* and other common causes of infectious AOE in treated recreational water venues (e.g., pools, interactive fountains, and water parks) by maintaining proper chlorine and pH levels.¹⁰

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REFERENCES

10 Available.

*A national sample of visits to nonfederally employed, office-based physicians from CDC's National Center for Health Statistics.

†A national sample of hospital-based ED visits from the Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality.

‡Range is derived by summing respective 95% confidence limit upper and lower bounds, but does not represent a 95% confidence limit for the summary estimate.

§The Marketscan Commercial Claims and Encounters database, from Thomson Reuters, includes insurance claims and payments for commercially insured patients only, unlike the other databases used in this analysis, which include data on patients with all types of insurance and the uninsured. Costs (the sum of insurer and out-of-pocket payments, including prescription drug costs) are in 2007 dollars.

||AOE includes *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes 380.10, 380.12, and 380.14; otitis media includes codes 381.0-382.9. Concurrent otitis media was diagnosed in 16.5% of total ambulatory-care AOE visits before exclusion.

¶Based on U.S. Census Bureau population data. Available at <http://www.census.gov/popest/estimates.html>.

#In the Marketscan database used for average cost estimation, approximately 1.5% of patients had both an ED and ambulatory-care visit for AOE, and some repeat visits by the same person might have been accounted for by a new infection episode rather than a return visit for the same infection.

Neisseria gonorrhoeae With Reduced Susceptibility to Azithromycin—San Diego County, California, 2009

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A SINGLE 2 G DOSE OF AZITHROMYCIN EFFECTIVELY treats genitourinary infections caused by susceptible *Neisseria gonorrhoeae* and has been used to treat uncomplicated gonorrhea in persons with cephalosporin allergy. However, azithromycin is not recommended as monotherapy because of concern over the emergence of resistance. Instead, a 1 g dose of azithromycin is recommended as a component of dual therapy for gonorrhea, in conjunction with a cephalosporin (i.e., 250 mg of ceftriaxone or 400 mg of cefixime, if ceftriaxone is not an

option). During January 1992–July 2009, of 87,566 *N. gonorrhoeae* isolates tested for azithromycin susceptibility by CDC's national Gonococcal Isolate Surveillance Project (GISP), only 39 (0.04%) had minimum inhibitory concentrations (MICs) ≥ 8 $\mu\text{g/mL}$ (including 25 with 8 $\mu\text{g/mL}$ and 14 with 16 $\mu\text{g/mL}$), indicating reduced susceptibility; none of the isolates were collected in San Diego County, California (CDC, unpublished data, 2011). During August–October 2009, five of 55 (9.1%) *N. gonorrhoeae* isolates obtained from men with symptomatic urethritis tested at San Diego County's main municipal sexually transmitted disease (STD) clinic had high azithromycin MICs: three with 8 $\mu\text{g/mL}$ and two with 16 $\mu\text{g/mL}$. This report summarizes the laboratory and epidemiologic findings associated with this reduced susceptibility to azithromycin. In San Diego County, clinicians treating cephalosporin-allergic patients with a 2 g dose of azithromycin for uncomplicated gonorrhea are advised to obtain tests of cure 3 weeks after treatment and to recommend sexual abstinence until a negative test result for gonorrhea is achieved. Continued surveillance for antibiotic resistance and effective control efforts are critical for gonorrhea prevention.

GISP conducts susceptibility testing of urethral *N. gonorrhoeae* isolates obtained from men with symptomatic urethritis seeking care at 29 U.S. STD clinics, including San Diego County's main municipal STD clinic. MICs to eight antibiotics, including azithromycin, are determined by agar dilution.¹ Additionally, in San Diego County, nucleic acid amplification tests (NAATs) are used to test for urethral, pharyngeal, and rectal gonorrhea and chlamydia infections at the county's public health laboratory. Patients are interviewed and asked to inform their recent sex partners (i.e., preceding 3 months) of their infections or bring them in for treatment.

Case Reports

During August–October 2009, five cases of urethral gonorrhea with high MICs to azithromycin (three with 8