

4. Bensaleh H, Perney P, Dereure O, Guillou JJ, Guillot B. Merkel cell carcinoma in a liver transplant recipient. *Am J Clin Dermatol*. 2007;8:239–41. DOI: 10.2165/00128071-200708040-00006
5. Miller RW, Rabkin CS. Merkel cell carcinoma and melanoma: etiological similarities and differences. *Cancer Epidemiol Biomarkers Prev*. 1999;8:153–8.
6. Engels EA, Frisch M, Goedert JJ, Biggar RJ, Miller RW. Merkel cell carcinoma and HIV infection. *Lancet*. 2002;359:497–8. DOI: 10.1016/S0140-6736(02)07668-7
7. Feng H, Shuda M, Chang Y, Moore PS. Clonal integration of a polyomavirus in human Merkel cell carcinoma. *Science*. 2008;319:1096–100. DOI: 10.1126/science.1152586
8. Das BC, Sharma JK, Gopalakrishna V, Luthra UK. Analysis by polymerase chain reaction of the physical state of human papillomavirus type 16 DNA in cervical preneoplastic and neoplastic lesions. *J Gen Virol*. 1992;73:2327–36. DOI: 10.1099/0022-1317-73-9-2327

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Worldwide Prevalence of Head Lice

To the Editor: Pediculosis capitis has been well-known since antiquity (1). Human infestation can result in psychological frustration for parents and children (2); furthermore, preventive and therapeutic practices, such as head shaving and the “no-nit” policy of excluding infected children from school, can also induce social stress.

We sought to synthesize the available evidence regarding the worldwide prevalence of lice infestation in the 21st century by conducting a literature search of PubMed and Scopus databases in which we searched for the term *pediculosis*. We also searched Google for the terms *head lice/pediculosis capitis* and individual country names and evaluated references of the articles and reports retrieved through this search. Eligible studies were archived from January 1, 2000, to January 18, 2008.

We retrieved 55 studies (online Technical Appendix, available from www.cdc.gov/EID/content/14/9/1493-Techapp.pdf). Most studies referred to schoolchildren, but some involved refugees, urban slums, child labor, jails, orphanages, and fishing communities.

Most studies had been conducted in Asia; Turkey was overrepresented. Prevalence varied from 0.7% to 59% and was higher in girls and women. Of the 29 studies, 24 involved schoolchildren; the other studies involved refugee children, child laborers, the general population, street children, jail inmates, and children accompanying their mothers in prison.

In Europe, prevalence varied from 0.48% to 22.4%. However, 1 study reported a much higher annual incidence (37.4%) in England (3). A study in the Ukraine showed increasing adult representation in the overall affected population (4). Six studies involved schoolchildren; the remaining studies

involved refugees, homeless persons, and the general population.

Data from Africa, with the exception of 1 study in South Africa, were derived from Egypt. Prevalence varied from 0% to 58.9% and was higher in females. The study in South Africa (5) challenges the generally accepted concept that head lice infestation refers to lower socioeconomic status; of 2 schools, 1 in a low socioeconomic status area, populated by black students only, and the other in a high socioeconomic status area, populated by students of various races, head lice infestation was found only in the second school, solely among white pupils. Of 6 studies in Egypt, 4 involved diverse populations: urban poor preschool children, orphanage children, and the general population.

Most studies in the Americas were conducted in Brazil, although we also found data from the United States, Cuba, and Argentina. Prevalence varied from 3.6% to 61.4% and was higher in females. Of 7 studies, 4 involved populations other than schoolchildren to some extent: urban slum residents, fishing community residents, adolescents and adults sampled randomly from the general population, elderly nursing home residents, and persons living with repeatedly infested children. A recent study in Brazil (6) noted that prevalence rates determined by visual inspection are twice that of rates determined by hair analysis.

Only 1 study has been performed in Oceania. This study in Australia reported prevalence of 13% and that girls were more likely to have active infection.

Our review shows that pediculosis capitis is widespread throughout the world and does not discriminate on socioeconomic status grounds. The traditional perception of head lice as a parasitosis exclusively associated with schoolchildren of low socioeconomic status is challenged by some of the reports (online Technical Appendix).

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Most studies underestimate overall prevalence by assessing it in a specific timeframe; to the contrary, head lice infestation is a dynamic process that can spread hypergeometrically in closed environments such as schools and in the community (7). The point-prevalence reported by Heukelbach et al (8) may represent a more accurate indicator.

Although socioeconomic status seems to be an indicator of the magnitude of lice infestation, more specific determinants are the dynamic processes of hygienic status and overcrowding. A recent study in Turkey compared 2 neighboring villages with different socioeconomic status. The only factor that was statistically significantly related to pediculosis capitis was size of the household; ≥ 6 inhabitants was associated with increased prevalence (9).

Another parameter that may indirectly influence overall prevalence and account for the leveling of the prevalence gradient between rich and poor is awareness of head lice and preventive and therapeutic practices. A study in Australia showed that although parents prefer to play a major role in prevention and treatment, they may lack insight into recent advances and dilemmas regarding these measures (10).

Variations in reported prevalence were found even in data from the same country. These differences can result from surveys being conducted during different seasons, various examination techniques, reporting of active infestation or presence of nits, and potential introduction of effective pediculicides.

Although head lice account for a substantial number of missed schooldays in children, among others, it is surprising that pediculosis capitis is not monitored and prevalence is not regularly reported. Although we cannot extinguish the parasite, effective monitoring and planning will enable us to limit the prevalence and distribution of this parasitosis.

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References

1. Fournier PE, Ndiokubwayo JB, Guidran J, Kelly PJ, Raoult D. Human pathogens in body and head lice. *Emerg Infect Dis*. 2002;8:1515–8.
2. Mumcuoglu KY, Meinking TA, Burkhart CN, Burkhart CG. Head louse infestations: the “no nit” policy and its consequences. *Int J Dermatol*. 2006;45:891–6. DOI: 10.1111/j.1365-4632.2006.02827.x
3. Harris J, Crawshaw JG, Millership S. Incidence and prevalence of head lice in a district health authority area. *Commun Dis Public Health*. 2003;6:246–9.
4. Kurhanova I. Lice infestation and lice control remedies in the Ukraine. *Ann N Y Acad Sci*. 2006;1078:357–60. DOI: 10.1196/annals.1374.070
5. Govere JM, Speare R, Durrheim DN. The prevalence of pediculosis in rural South African schoolchildren. *S Afr J Sci*. 2003;99:21–3 [cited 2008 Jul 17]. Available from <http://www.jcu.edu.au/school/phtm/PHTM/hlice/papers/govere-2003.pdf>
6. Borges R, Silva JJ, Rodrigues RM, Mendes J. Prevalence and monthly distribution of head lice using two diagnostic procedures in several age groups in Uberlandia, State of Minas Gerais, Southeastern Brazil. *Rev Soc Bras Med Trop*. 2007;40:247–9.
7. Stone P, Wilkinson-Herbots H, Isham V. A stochastic model for head lice infections. *J Math Biol*. 2008;56:743–63. DOI: 10.1007/s00285-007-0136-0
8. Heukelbach J, van HE, Rump B, Wilcke T, Moura RC, Feldmeier H. Parasitic skin diseases: health care-seeking in a slum in north-east Brazil. *Trop Med Int Health*. 2003;8:368–73. DOI: 10.1046/j.1365-3156.2003.01038.x
9. Balcioglu IC, Kurt O, Limoncu ME, Dinç G, Gümüş M, Kilimcioglu AA, et al. Rural life, lower socioeconomic status and

parasitic infections. *Parasitol Int*. 2007;56:129–33. DOI: 10.1016/j.parint.2007.01.005

10. Counahan ML, Andrews RM, Weld H, Helen W, Speare R. What parents in Australia know and do about head lice. *Rural Remote Health*. 2007;7:687.

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Texas Isolates Closely Related to *Bacillus anthracis* Ames

To the Editor: Forensic and epidemiologic investigation of the 2001 bioterrorism-associated anthrax attacks used multiple-locus variable-number tandem-repeat analysis (MLVA) to identify the attack strain as Ames (1). Strain identity was essential for subsequent molecular epidemiologic and forensic investigations of this biocrime. To more easily identify this particular strain, comparative whole-genome sequencing (2) and phylogenetic analyses were used to identify single-nucleotide polymorphisms (SNPs) that seem highly specific for Ames strain identification (3). Because *Bacillus anthracis* is a recently emerged clonal pathogen, these SNPs represent highly evolutionarily stable markers (4) that are amenable to many rapid and cost-effective analytical techniques.

MLVA and the Ames-specific SNP assay indicate that the Ames strain has been isolated from nature only 1 time, in southern Texas, USA. Several lineages of *B. anthracis* (5) have been ecologically established in North America. The A.Br.009 clade is the most successful and widely dispersed in North America, but it is not closely related to the Ames