What is already known on this topic

University students have been shown to be at greater risk of invasive meningococcal disease than other people of the same age

Meningococci have been shown to spread rapidly among military recruits and this is associated with increased rates of invasive disease

What this study adds

Meningococci spread rapidly among university students, probably due to social mixing

This explains the higher rates of invasive disease found among students each autumn during the first term of university and supports the recent introduction of meningococcal vaccination

meningococci, and typically less than 1% even in outbreaks,[12 14 17] our study found serogroup carriage rates of 3% by December. This level increases the risk of outbreaks. Serogroup C disease is of particular importance as it is preventable by vaccine and has previously been linked to large clusters of disease among university students.[5 6]

The large comparative increase in the C:2a:P1.5 (P1.2) strains is noteworthy. This strain is known to be virulent and has been implicated in several major outbreaks[3 5 6]; it represented 6.3% of all acquired strains in our study but only 1% of index strains identified in October. This illustrates the ability of highly virulent clones to transmit readily among students. Indeed the preferential transmission of this strain from a low baseline carriage rate may explain the 3-5 week delay usually observed between the start of university term and the peak incidence of cases and outbreaks.

During the beginning of university terms there is a rapid spread of meningococci in first year students, which is probably associated with social mixing, especially in catered halls. Our findings support the recent introduction of meningococcal vaccination for university students.

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Contributors: KRN initiated the study; he will act as guarantor for the paper. KRN, JSN-V-T, and DAAA'A supervised the study. KRN, JSN-V-T, NJ, KJ, RCBS, and RJM designed the study protocol. KRN and NJ analysed the data. All investigators contributed to the final paper.

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1 Hubert B, Caugant DA. Recent changes in meningococcal disease in Europe. *Euro Surveillance* 1997;2: 69-71.
2 Whalen CM, Hockin JC, Ryan A, Ashton F. The changing epidemiology of invasive meningococcal disease in Canada, 1985 through 1992. Emergence of a virulent clone of Neisseria meningitidis. *JAMA* 1995;273:390-4.
3 Jackson LA, Schuchat A, Reeves MW, Wenger JD. Serogroup C meningococcal outbreaks in the United States. An emerging threat. *JAMA* 1995;273:383-9.
4 Neal KR, Nguyen-Van-Tam JS, Monk P, O'Brien SJ, Stuart J, Ramsay M. Invasive meningococcal disease among university undergraduates: association with catered halls of residence. *Epidemiol Infect* 1999;122:351-8.
5 Anon. Outbreak of meningococcal disease in students in Cardiff. *Commun Disease Rep* 1996;6:425.
6 Anon. Clusters of meningococcal disease in university students. *Commun Disease Rep* 1997;7:393.
7 Jackson LA, Schuchat A, Gorsky RD, Wenger JD. Should college students be vaccinated against meningococcal disease? A cost-benefit analysis. *Am J Public Health* 1995;85:843-5.
8 Formic, an integrated questionnaire design and scanning package. www.formic.co.uk. (Accessed 7 September 1999.)
9 Anderson J, Berthelson L, Jensen BB, Lind I. Dynamics of the meningococcal carrier state and characteristics of the carrier strains: a longitudinal study within three cohorts of military recruits. *Epidemiol Infect* 1998;121:85-94.
10 Devine LF, Pierce WE, Floyd TM, Rhode SL, Edwards EA, Siess EE, et al. Evaluation of group C meningococcal polysaccharide vaccine in marine recruits, San Diego, California. *Am J Epidemiol* 1970;92:25-32.
11 Melton LJ, Edwards EA, Devine EA, Devine LF. Differences between the sexes in the nasopharyngeal carriage of Neisseria meningitidis. *Am J Epidemiol* 1977;106:215-21.
12 Neal KR, Irwin DJ, Davies S, Kaczmarski EB, Wale MCJ. Sustained reduction in the carriage of Neisseria meningitidis as a result of a community meningococcal disease control programme. *Epidemiol Infect* 1998;121:487-93.
13 Stuart JM, Cartwright KAV, Robinson PM, Noah ND. Effect of smoking on meningococcal carriage. *Lancet* 1989;ii:723-5.
14 Rønne T, Berthelesen L, Buhl LH, Lind I. Comparative studies on pharnygeal carriage of Neisseria meningitidis during a localized outbreak of serogroup C meningococcal disease. *Scand J Infect Dis* 1993;25:331-9.
15 Imrey PB, Jackson LA, Ludwinski PH, England III AC, Fella GA, Fox BC, et al. Outbreak of serogroup C meningococcal disease associated with campus bar patronage. *Am J Epidemiol* 1996;143:624-30.
16 Jelfs J, Jaluludin B, Munro R, Patel R, Kerr M, Daley D, et al. A cluster of meningococcal disease in western Sydney, Australia initially associated with a nightclub. *Epidemiol Infect* 1998;120:263-70.
17 Le Saux N, Ashton F, Rahman F, Ryan A, Ellis E, Tamblyn S, et al. Carriage of Neisseria species in communities with different rates of meningococcal disease. *Can J Infect Dis* 1992;3:60-4.

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A memorable patient

A surprising diagnosis

The elderly woman was already frail when she came to me complaining of a cough and weight loss. Alarm bells rang as I examined her and arranged for blood tests and a chest *x* ray examination. As I feared, the chest radiograph was suspicious, and referral was advised.

The chest physician concluded that bronchial carcinoma was almost certain and recommended awaiting the outcome of events, rather than subjecting her to an unpleasant bronchoscopy. Rather to my surprise neither she nor her family agreed, and she came back to me insisting on further investigation.

Some time later I rather hesitantly explained the eventual diagnosis of tuberculosis to her and was astonished by her calm response. "I rather thought it might be that, doctor," she said, "after that trouble I had years ago. Didn't I ever tell you I'd had tuberculosis as a child?" Red faces all round, but a well, elderly patient five years later.

Catherine Harkness *general practitioner, Willey, Warwickshire*

We welcome articles of up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake*, or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.