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environmental influences.⁶ Other determinants include small maternal stature, poor prepregnancy nutritional state, maternal exposure to cooking or tobacco smoke and alcohol, maternal infections, such as malaria and HIV, and the sex of the child (girls are smaller).

If improving micronutrient intake during pregnancy does contribute to infant survival, there is the challenge of how best to improve such intake. There are three possibilities: regular supplements, food fortification, and food-based strategies. The choice has practical, economic, and philosophical dimensions. Birthweight and the delivery of supplements are easy to measure, and so this intervention tends to be attractive to donors and policymakers. But the delivery of supplements is expensive, logistically difficult, and depends on high attendance rates for antenatal care. Fortification of common foods, such as flour, sugar, salt, and margarine, has been effective in developed countries for decades. But it is difficult to target the specific needs of pregnant women and to ensure intakes at safe levels. The recently described innovation of home fortification with sachets of multiple-micronutrient “Sprinkles” could be adapted for pregnant women.⁷ Food-based approaches that are more sustainable require collaboration with the agriculture and education sectors, and require a long-term outlook.⁸ There are problems of bioavailability of micronutrients in foods available to poor people, and seasonal shortages.

There are decisions to be made about the allocation of resources between interventions aimed at increasing birthweight, and efforts to reduce neonatal deaths from

asphyxia and infections. Viewing low birthweight as the starting point in a cycle of disadvantage highlights the need for broad strategies to improve the health and nutrition of girls and women from birth to old age.⁹ We do not know enough about cost-effective strategies to tackle the problem of unacceptable neonatal mortality, which is an important puzzle to tease apart. Meanwhile, Osrin and co-workers should be congratulated for adding to one piece of the puzzle—it is not easy to do good trials in such settings—and for flagging the maze ahead. More prospective studies in poor countries of the health outcomes of low-birthweight babies would provide even more clarity.

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- 1 Brems S, Berg A. Eating down during pregnancy: nutrition, obstetric and cultural considerations in the third world. Discussion paper for United Nations Administration Coordination Committee/Subcommittee on Nutrition. Washington, DC: World Bank, 1988.
- 2 Barker D. Fetal origins of coronary heart disease. *BMJ* 1995; **311**: 171–74.
- 3 Wilcox A. On the importance—and the unimportance—of birthweight. *Int J Epidemiol* 2001; **30**: 1233–41.
- 4 Yasmin S, Osrin D, Paul E, Costello A. Neonatal mortality of low-birthweight infants in Bangladesh. *Bull World Health Organ* 2001; **79**: 608–14.
- 5 Nichter M, Nichter M. The ethnophysiology and folk dietetics of pregnancy. *Hum Organization* 1983; **42**: 235–46.
- 6 Harding JE. The nutritional basis of the fetal origins of adult disease. *Int J Epidemiol* 2001; **30**: 15–23.
- 7 Zlotkin SH, Schauer C, Christofi des A, et al. Micronutrient Sprinkles to control childhood anaemia. *PLoS Med* 2005; **2**: e1.
- 8 Ruel MT. Can food-based strategies help reduce vitamin A and iron deficiencies? A review of recent evidence. Washington, DC: International Food Policy Research Institute, December, 2001.
- 9 Ramakrishnan U. Nutrition and low birth weight: from research to practice. *Am J Clin Nutr* 2004; **79**: 17–21.

Ticket to ride: spreading germs a mile high

Many of us believe air travel is also a lottery ticket for an upper respiratory infection. Breathing recirculated air while strapped into a seat for hours next to a stranger seems the ideal recipe for the transmission of an infectious disease. But to what extent does scientific evidence support these fears? In this issue of *The Lancet*, Mark Gendreau and Alexandra Mangili describe what we know about a topic of substantial interest to doctors, their patients, family and friends, and to public-health officials everywhere.

The picture that emerges is both reassuring and troubling. An aeroplane cabin provides the smallest

volume of available air per person of any public space,¹ but air movement is predominantly transverse, not front to back. Large commercial aircraft typically recirculate about 50% of cabin air, passing it first through high efficiency particulate air (HEPA) filters. It is often said that these filters are effective for viruses,² although supporting data seem insufficient and have been questioned.³ Moreover there is no regulation requiring carriers to use HEPA filters, and only 85% of commercial airliners that carry more than 100 passengers in the current US fleet and recirculate cabin air are equipped with them.⁴ Many fewer of the

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smaller regional jets that recirculate cabin air use HEPA filters.

Although contagious diseases such as tuberculosis, severe acute respiratory syndrome, measles, and influenza have been transmitted during commercial air travel, published reports of this happening are uncommon. The conventional wisdom is that any risk of contagion is related to the proximity of the index case (plus or minus two rows),⁵ which might be little comfort if you are sitting next to, in front of, or behind someone with a hacking cough or explosive sneeze. But at least in this regard aeroplanes are not much different from other public places or forms of mass transit.

Nevertheless, as severe acute respiratory syndrome aboard Air China Flight 112 showed, we still have much to learn, because cases occurred in passengers at least seven rows in front of and five rows behind the index case (almost the entire length of the coach cabin).⁶ There was spread to as many as 25 passengers.⁷ How often such spread occurs with other infectious diseases is hard to say, because outbreak investigations are inherently difficult. The exposed population disperses widely and becomes sick days or weeks later with non-specific and non-reportable symptoms. Gendreau and Mangili, and others,⁸ appropriately call for intensified study to estimate the risks of disease transmission aboard commercial aircraft, and the effects of mitigating measures such as ventilation.

But more is needed. If a contagious disease were only transmitted locally, it would take a considerable time to

reach global dimensions. In 14th century Europe, it took 3 years for bubonic plague to diffuse from southern Italy to Britain on the backs of rats. But if influenza H5N1 makes the transition to person-to-person contagion, it will have a ticket to ride. Our world is now interconnected to an unprecedented, perhaps qualitatively different, extent. From a public-health standpoint, air travel is one of the most important kinds of interconnections. Network theory shows that shortcuts between local enclaves can dramatically shrink the average path-length between individuals, giving rise to the so-called small-world phenomenon in which each of us is related to anyone else on average by, at most, six degrees of separation.^{9,10} Consider that airline networks are arranged in a hub and spoke pattern, and that some people such as cabin attendants or frequent travellers come in contact with a vastly larger number of geographically separated people than most of us. We are just now beginning to realise the influence of specific kinds of network topologies on the ease and speed with which disease is spread. Sophisticated analysis might show which nodes to apply our preventive measures to first or most vigorously.⁷ Like many difficult public-health problems, air travel as a disease vector will only yield to an intensive interdisciplinary research effort, bringing together ventilation and infectious disease experts, mathematicians, and others. Unlike many other problems, however, there is an urgency here that begs for immediate attention.

Regulations requiring HEPA filters for any aeroplane that recirculates air should be seriously considered. Advice on what an individual can do remains generic: good personal hygiene to protect yourself (wash hands frequently, particularly before eating), cover nose and mouth when sneezing or coughing, and wash hands afterwards to protect others. Beyond that, might we suggest one of the many magic little rituals the public uses to allay their general anxiety when flying. When Niels Bohr was asked by a reporter if he was superstitious because he had a horseshoe over his laboratory bench, he said of course not. He was a scientist. But he understood it worked even if you did not believe in it.

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- 1 Hocking MB. Indoor air quality: recommendations relevant to aircraft passenger cabins. *Am Ind Hyg Assoc J* 1998; **59**: 446–45.
- 2 Miller, JD. Defensive filtration. *ASHRAE J* 2002; **44**: 18–23.
- 3 Gammaitoni, L, Nucci MC. Using a mathematical model to evaluate the efficacy of TB control measures. *Emerg Infect Dis* 1997; **3**: 335–42.
- 4 United States General Accounting Office. Aviation safety: more research needed on the effects of air quality on airliner cabin occupants. January 2004, Washington, DC, USA. <http://www.gao.gov/new.items/d0454.pdf> (accessed Jan 27, 2005).
- 5 International Civil Aviation Organization. Severe acute respiratory syndrome (SARS). <http://www.icao.int/icao/en/trivia/avmedsars.htm>(accessed Jan 22, 2004).
- 6 Olsen SJ, Chang HL, Cheung TY, et al. Transmission of severe acute respiratory syndrome on aircraft. *N Engl J Med* 2003; **349**: 2416–22.
- 7 World Health Organization. Consensus document on the epidemiology of severe acute respiratory syndrome (SARS). Geneva: WHO, May, 2003. <http://www.who.int/csr/sars/en/WHOconsensus.pdf> (accessed Jan 27, 2005).
- 8 United Kingdom Parliament Select Committee on Science and Technology. Air travel and health: fifth report. London: November 2000. <http://www.publications.parliament.uk/pa/ld199900/ldselect/ldstech/121/12101.htm> (accessed Jan 27, 2005).
- 9 Watts DJ. Six Degrees: The science of a connected age, with a new Chapter. New York: W W Norton, 2003.
- 10 Barabasi AJ. Linked: The new science of networks. Cambridge, Massachusetts: Perseus; 2002.

Placing principle before expediency: the Shipman Inquiry

Being a doctor involves adoption of a moral principle that commands the doctor to place the needs of patients before his or her own convenience or interests. The UK's General Medical Council (GMC) expresses this principle in the *Duties of a Doctor*: "you must make the care of your patient your first concern".¹ Most doctors act on this principle every working day, as countless patients will confirm.

Yet Janet Smith, chair of the inquiry into Harold Shipman, the UK general practitioner who unlawfully killed about 250 of his patients, concludes that the GMC has not in the past succeeded in its primary purpose of protecting patients but instead has sometimes acted in the interests of doctors.² She ascribed the imbalance between the protection of patients and fairness to doctors to the culture of the GMC. Although the GMC has been in a state of transition and has made a number of beneficial changes, it has not radically changed its culture. For example, the decision that revalidation should not involve assessment of fitness to practise was taken on the grounds of expediency and not principle. In developing its new procedures for fitness to practise, the GMC lost sight of its original vision of protection for patients and fairness to doctors. Smith observed that one of the fundamental problems for the GMC is the perception shared by many doctors that it is supposed to be "representing" them when in fact its purpose is to regulate them.

How does the doctor who strives to practise in accordance with the principle of the patient as the first concern respond to Smith's judgment on the GMC? The disparity between their own experience and the apparent culture of the GMC is so wide that many doctors will reject the inquiry's conclusion. However,

those who take the trouble to read the report in full and to peruse the transcripts on the inquiry's website² will find it impossible to disagree with the inquiry. From my experience as a witness to the inquiry, preparing reports at its request, and being a member of several of its seminars, I can testify to the inquiry's fairness and thoroughness. The evidence is powerful and the verdict withstands scrutiny. Having accepted the truth of Smith's conclusion, possible reactions include dread of and resistance to further monitoring of clinical performance, or the allocation of all blame to the GMC. Both reactions would be wrong.

Insensitive monitoring in an atmosphere of suspicion and fear can be damaging. In 2004, a general practitioner whose hospital referral rates had been under investigation by the local primary-care trust was found dead. The subsequent review by the strategic health authority recommended that in inquiries the health of doctors involved should be checked first and that primary-care trusts should ensure they have the capacity to interpret information from monitoring health-service indicators such as referral rates.³ Increased accountability introduced in reaction to a perceived decline in trust can lead to intense monitoring, although many of the available performance indicators are imperfect and the findings from monitoring can sometimes be misleading and therefore distort aspects of professional practice. O'Neill argued that the obsession for detailed monitoring should be replaced by intelligent accountability, in which the emphasis is on self-governance rather than external control.⁴ Excessive monitoring accompanied by micromanagement of doctors' clinical decisions restricts the discretion doctors require to meet the unique needs of each patient, a process that weakens professionalism.⁵