

in both CJD⁴ and Gerstmann-Straussler syndrome,⁵ and there is evidence of increased mRNA expression in scrapie.⁶ APOE may influence the pathogenesis of prion diseases, perhaps by an interaction with prion protein which affects protein conformation. Whatever the mechanism, the identification of APOE as a determinant of disease phenotype in CJD adds to the evidence for an influence of host genetic factors in human prion diseases. Familial CJD is associated with, and perhaps caused by, mutation of the PRNP gene, and the clinical phenotype in these pedigrees, including age at onset and disease duration, varies with specific PRNP mutations.⁷ Homozygosity at codon 129 of the PRNP gene influences susceptibility to both sporadic and iatrogenic CJD,^{8,9} and the disease phenotype in association with the codon 178 mutation is determined by the genotype at the 129 locus.¹⁰ Methionine at position 129 produces fatal familial insomnia, while valine at that site results in typical CJD. There is also preliminary evidence of a genetic influence on the neuropathology of CJD, with a relation between a valine at position 129 and prion protein plaques.¹¹

Genetic factors, which may now include APOE alleles, influence susceptibility to disease, duration of disease, age at onset of clinical signs, type of clinical presentation, and, perhaps, the distribution and type of lesions in both sporadic and familial CJD. As in scrapie,¹² other areas of the genome may act as determinants of disease susceptibility or expression in human prion diseases, and further definition of susceptibility genes could prove to be important in assessing the risk of exogenous infection (eg, in patients given human pituitary growth hormone). However, clinicopathological variation in CJD may not be determined by genetic factors alone. In scrapie the influence of host genotype on disease is better defined than it is for human disease, and this may allow the selective breeding of low-susceptibility sheep.¹³ There are also distinct strains of scrapie agent, with consistent biological characteristics independent of the host genotype, and the existence of similar strains of infectious agent has been suggested in CJD too.

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Handwashing—the Semmelweis lesson forgotten?

Hospital-acquired infection is still a major cause of morbidity and mortality throughout the world. As hospitals admit more severely ill patients and as use of invasive procedures and devices becomes more frequent, the risk of transmission of pathogens from patient to patient via the hands of health care workers (HCWs) increases. A simple and effective method of preventing this is handwashing. However, studies repeatedly show that doctors, nurses, and others do not always wash their hands before and between all patient contacts. This failure is reminiscent of the situation faced by Ignaz Semmelweis. In 1847 in Vienna, he noted that puerperal fever was more common on a maternity ward where medical students worked than it was on the ward where midwives provided care.¹ He believed that the students were contaminating their hands while dissecting cadavers. He ordered that students wash their hands in chlorinated lime after dissection and before examining patients; the rate of infection fell sharply, as did the mortality rate. When 12 women had puerperal fever on a ward where the students had no contact with cadavers, Semmelweis deduced that infection was also transmitted by living organisms; he then insisted on handwashing with chlorinated lime between all patient examinations. At that time few doctors believed Semmelweis' theory. Unfortunately, he refused to publish his findings. In 1851, and again in 1855, he was appointed to hospitals with high infection and mortality rates—and his hand antisepsis methods resulted in significant decreases in infection and mortality. Only in 1857 did Semmelweis report some of his own findings, but when he died in 1865 his beliefs were still largely ignored by clinicians.

Despite advances in hospital epidemiology and infection control, translating Semmelweis' theory into practice remains a challenge. In the early 1970s hospital infection control programmes were established and they decreased the emphasis on environmental culturing and disinfection and stressed the role of patient-based active surveillance for infection detection and the implementation of prevention measures, notably handwashing. By then we knew the important role that HCWs' hands have in the transmission of nosocomial pathogens,²⁻⁴ and others confirmed the association between handwashing and the reduction in hand microbial flora.⁵ These studies showed that handwashing with bland soap at best removes some of the transient microbes mechanically whereas preparations containing

antiseptic or antibacterial agents not only remove transient microbes mechanically but also chemically killed contaminating and colonising flora and have long-term residual activity.

In the 1980s the US Centers for Disease Control published guidelines that included recommendations on handwashing⁶ ("generally considered the most important procedure for preventing nosocomial infections").⁶ Despite this recommendation, studies in the USA (the latest evidence comes from an emergency department⁷) found that HCWs, in intensive care units and in outpatient clinics, seldom wash their hands before patient contacts.⁷⁻¹² Physicians, it seems, wash their hands no more frequently than nurses do (rates for physicians were 14-59%, while for nurses they were 25-45%, and for other HCWs they were 23-73%). Attempts to improve compliance—eg, by in-service education, distribution of leaflets, lectures, automated dispensers, and feedback on handwashing rates⁹⁻¹²—have been associated with at best transient improvement. The most effective measure has been routine observation and feedback,^{10,11} but no intervention has had a long-term impact on handwashing practice.

Why do HCWs not comply when handwashing is known to reduce nosocomial infection?¹³ Excuses include being too busy, skin irritation, wearing gloves, or not thinking about it.¹¹ Some HCWs believe that they have washed their hands when necessary even when observations indicate that they have not.¹¹ Multidrug-resistant pathogens are increasing in frequency and are now a major threat to public health; these pathogens (eg, vancomycin-resistant enterococci) have been recovered from the environment around infected or colonised patients and from the hands of HCWs caring for them. If HCWs cannot be educated to comply perhaps we should tell patients about the importance of handwashing: how many doctors and nurses would ignore a patient's request that they wash their hands first?

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Behavioural science in the AIDS epidemic

Behavioural interventions remain our principal tool for AIDS prevention. This point was driven home once again at the latest International AIDS Conference held in Yokohama in August (*Lancet* 1994; **344**: 535). While biological science continues to unravel the secrets of the human immunodeficiency virus (HIV), behavioural science has contributed much to our understanding of its prevalence, incidence, and distribution, the behaviours most implicated in its transmission, possible strategies and options for disease prevention programmes, and the feasibility, cost, and effectiveness of these interventions. In the USA, studies of homosexual men show rapid reductions in high-risk behaviour and falling incidence of infectious diseases, including HIV, as the result of public health interventions.¹⁻⁴ Moreover, there is accumulating evidence that public health measures such as outreach programmes for injected-drug users and increased access to supplies of sterile needles have reduced the frequency of behaviours known to transmit bloodborne diseases.^{5,6} Other studies have shown a lower incidence of infectious diseases among injected-drug users with ready access to clean syringes. In a Baltimore cohort, diabetic drug users were less likely to seroconvert for HIV than were non-diabetics,⁷ and in a Tacoma case-control study, drug users who participated in the syringe exchange scheme were less likely to acquire hepatitis B.⁸ A joint National Research Council/Institute of Medicine report on AIDS prevention⁹ accords with these findings, and includes a section on mathematical modelling to illustrate reduced HIV incidence through syringe exchange programmes.

Despite such achievements, behavioural science is often viewed with scepticism by practitioners of biomedical science. Studies that rely on "self-reports" of participants and research designs that lack random assignment to isolated conditions are viewed as weaker than true experiments that incorporate biological markers as outcomes.¹⁰ However, traditional experimental methods are often hopelessly inapplicable to studies of risk behaviour as practised and of limited feasibility in the evaluation of fledgling community public health programmes. It is impossible, for example, to draw a truly random sample of injected-drug users owing to the clandestine, illegal, and socially proscribed nature of illicit drug use. The use of biological outcomes (eg, HIV incidence) in prevention research is feasible only in places where there are substantial rates of new infection and large compliant study populations. Behavioural science provides realistic and feasible alternatives to true experimentation with such options as urban ethnography and quasi-experimentation. Moreover, by linking interventions and research, natural experiments can be constructed. When it is done successfully, both prevention and scientific objectives can be simultaneously served.^{9,11} Yet the future of intervention research is cloudy. As part of a 1992 reorganisation plan,