thermia core temperature fell because of peripheral vasodilatation and sweating. Furthermore, central inhibition of shivering occurred when plasma glucose concentrations were below 2.5 mmol/l (45 mg/100 ml), resulting in more profound hypothermia. Intravenous glucose rapidly restored the shivering response.⁶

Awareness of the association between hypoglycaemia and hypothermia is clinically important. In the patient described correction of hypoglycaemia led to rapid restoration to normal body temperature. In some patients presenting with hypothermia the primary event may be hypoglycaemia. Where hypothermia and hypoglycaemia coexist the most appropriate treatment could be the immediate administration of intravenous glucose. Plasma glucose concentration should, therefore, be measured in all patients with hypothermia.

References

- ¹ Kedes LH, Field JB. Hypothermia: a clue to hypoglycaemia. *N Engl J Med* 1946;**271**:785-7.
- ² Vaidya AB, Levine RJ. Hypothermia in a patient with carcinoid syndrome during treatment with para-chlorophenylalanine. *N Engl J Med* 1971;**284**:255-7.
- ³ Strauch BS, Felig P, Baxter JD, Schimpff SC. Hypothermia in hypoglycaemia. *JAMA* 1969;**210**:345-6.
- ⁴ Anonymous. (Editorial.) *JAMA* 1969;**210**:340.
- ⁵ Freinkel M, Metzger BE, Harris E, Robinson S, Mager M. The hypothermia in hypoglycaemia. Studies with 2 deoxy-D-glucose in normal human subjects and mice. *N Engl J Med* 1972;**287**:841-5.
- ⁶ Gale EAM, Bennett T, Hilary Green J, MacDonald IA. Hypoglycaemia, hypothermia and shivering in man. *Clin Sci* 1981;**61**:463-9.

(Accepted 27 October 1983)

Green College Lectures: 1984

Medicine in the United States

GORDON WOLSTENHOLME

I have never practised in the United States; what knowledge I have of medicine there comes largely from some 25 visits. I have been singularly fortunate in knowing a great many American medical scientists; I have shared the experiences of relatives and close friends who have been gravely ill in American hospitals; and perhaps my main excuse for daring to broach this subject lies in my having undergone an emergency operation in New York, from which I recovered only after two more operations in London and months of critical illness. Hence this account of the vast subject of medical education, practice, and research in the United States cannot avoid being both largely subjective and superficial.

The true comparison is not, of course, between the United States and the United Kingdom but between the United States and western Europe, where sadly—in contrast to the United States—the wealth of talent in medical science and clinical practice is not cooperatively exploited, to the detriment both of Europeans and also of the multitude of suffering families in our fragmented, sick, and pitiless world who look in vain to Europe for understanding and relief.

America's population

The United States is big, with a population about five times bigger than that of England and Wales. The expectancy of life is around 70 years for white and 63 for black men and 78 years for white and 72 for black women. Women exceed men in the population by about six million. The birth rate is fairly stable, with white women giving birth to 14/1000 and non-white women to 22/1000 population. The proportion of elderly citizens, as in other industrialised countries is rising appreciably; those over 65 constituted 9% of the population in 1970 and 11.2% in 1979 and are expected to exceed 12% before the end of the century.

The crude death rate is higher than that reported for Japan, Canada, and Australia but lower than that for the Scandinavian countries, France, Germany, and the United Kingdom. Though deaths from heart disease and infectious diseases have decreased significantly, deaths from cancer, homicide, and suicide have continued to increase. Infant mortality has fallen considerably throughout this century, from 162/1000 live births in 1900 to 47 in 1920, 20 in 1970, and 11.02 in 1983; it would be even lower if non-white women enjoyed the same standard of care as white women.

American people are extraordinarily mobile: up to a quarter of them may change their homes every year, many by distances of thousands of miles. The average national earned income appears to be about \$17 000 a year, but perhaps as many as 40 million Americans live on or below the poverty line (\$10 000 a year for a family of four), and, whatever may be said by the politicians, these people have notably higher levels of maternal and infant morbidity and mortality, are more often addicted to drugs, and suffer disproportionately from serious crime. Also, many have malnutrition, especially iron and vitamin A deficiency.

The gross national product of this huge, industrious nation is about \$2650 billion (nearly 35% of the world's gross national product); 10% of this has been estimated as the amount spent annually on health—a sum, for a population five times the size of that of England and Wales, equivalent to about £175 billion. Britain's National Health Service now costs around £14 billion a year, and that does not include the amount of money spent privately; but expenditure is not, of course, a full and accurate reflection of the quality and availability of care. Nevertheless, Americans do spend an extraordinarily large amount of money on doctors and hospitals.

Health problems

The main health problems in the United States are those to be expected in an industrialised, comparatively prosperous society. Heart disease is the chief killer, but individual Americans' self care, by controlling diet, taking exercise, and abstaining

from smoking, is beginning to pay off handsomely. Deaths from cancer amount to 20% of all deaths, and some three quarters of a million new cases are detected each year, half of these affecting the lungs, the large intestine, or the breast. Mental illness affects one American in 10 at some stage in their lives, and care of the mentally ill absorbs at least \$20 billion a year of health expenditure despite a huge transfer of care from hospitals to the community in recent years; according to some estimates alcoholism alone accounts for an expenditure of \$15 billion a year. Diabetes ranks third as a killer, and there may well be 10 million diabetics in America, half of whom are perhaps still undetected.

Dependence on heroin, cocaine, and amphetamines is a major curse of modern American society, and there is mass consumption of marijuana. Whereas abuse of drugs has spread like a heath fire, the use of effective drugs in medical treatment has come under such strict control that hardly any risk of undesirable side effects is tolerated. Since 1962 all new drugs for use in man have required approval from the Food and Drug Administration. The introduction of new drugs dropped sharply as soon as the Act was passed and has continued to decline, from 89 a year before the Act to 17 a year by 1979. Much pride was taken in the United States in the, perhaps largely fortuitous, avoidance of thalidomide. Since then thorough testing of a new drug in Europe has not been considered to be sufficient, and many British doctors must have had the experience of privately supplying a new British drug to colleagues in the United States before it gained official acceptance there. Unfortunately there have been careless or even deliberate false claims for new drugs by a few firms in the United States, and the smallest error is made unforgivable by the media. Protection of the public is absolutely necessary, but the American public tends to suffer from the inflexibility of regulations that avoid all risks; a broader assessment of benefits and risks seems more appropriate for the practice of medicine.

Medical practice

A feature of medical practice in the United States is the frequency with which people seek a medical check up when they are in normal health; this is the leading reason for a visit to the family practitioner. Another major characteristic of American medicine is that American medical students appear to be fed a rich diet of high technology, to which most of them become addicted for the rest of their professional lives. The more advanced the technology the more the practice of medicine is thought to be improved. For years the public enthusiastically went along with this view, but recently the pendulum of public opinion has swung as violently in the opposite direction, in favour of many forms of alternative medicine.

The United States has around 350 000 registered doctors, of whom about 17 000 are osteopaths. At any time about 6.2% of these doctors are retired or inactive, and according to a spokesman of the American Medical Association, a further 5% of doctors are incompetent through failure to keep up to date or through drug abuse or alcoholism. Nevertheless, this is a formidable army of doctors to conquer disease on behalf of the American people. Across the country there is one doctor to every 360 people, in California one to 240, and in San Diego one to only 190. No fewer than one fifth of the doctors are foreign medical graduates, about half of whom are employed in hospitals, mostly in the less popular appointments in radiology, anaesthetics, and clinical pathology. These foreign graduates also tend to work in the worst areas. The number of foreign medical graduates is falling and is likely to drop considerably with the advent of a new examination for foreign graduates later this year.

These cohorts of doctors are aided by another army of auxiliary, paramedical health workers. The American Medical Association lists 26 types of intermediate health worker, notably nurses, nurse practitioners, paediatric nurse practitioners, and physician

assistants. A doctor now has an average annual income of about \$90 000, and the paramedics earn between \$10 000 and \$35 000. The ratio of doctors to other health staff was two to three at the beginning of this century, one to 10 by 1960, and one to 14 in 1975.

The family doctor, giving primary care, has rapidly been becoming extinct: in 1940, 63% of the profession were in family practice; by 1950 the proportion was 46%; by 1963, 26%; and by 1973, only 15%. For every doctor working in hospital, however, there are two doctors who practise on an office basis. Specialism can only be described as rampant, involving perhaps 85% of practising doctors. There are many anecdotes about the inability of specialists to observe gross signs and symptoms of diseases other than those covered by their special interest, but these doctors are often aggressively competent in their own small spheres. Even more than in other countries, American patients appear to suffer appreciably, and often tragically, from the disappearance of physicians with a high general competence, although emergency physicians often are comprehensively skilled and effective.

Within specialties there is a mass, competitive eagerness to continue medical education throughout life. In 1975, 222 000 doctors enrolled for courses of further instruction. The American Board of Medical Specialties unites no fewer than 24 specialist boards across the nation. All the boards have accepted the principle of periodic recertification, either mandatory or voluntary. Boards such as those for family practice, surgery, colon and rectal surgery, and thoracic surgery insist on recertification at intervals of five to six years; and many specialist societies—for example, those for neurosurgery, emergency medicine, radiology, and psychiatry—make attendance at postgraduate refresher courses a necessary condition of continuing membership. August bodies such as the American College of Physicians provide a self assessment programme consisting of no fewer than 720 medical problems to be solved.

Competition may be the spur to the acquisition of new knowledge and techniques, but the overwhelming threat to inadequate or negligent practice comes from the courts of law. Apparently, when "no fault" compensation for car accidents came in many lawyers were left with so little to do that they stopped chasing ambulances and began to chase surgeons. In California, which usually leads in such matters, one in four of the state's doctors are said to have been sued for malpractice in 1975. Lawyers work on a contingency fee basis, which is regarded as the poor man's door to justice, but the lawyer may pocket up to half of any compensation obtained, and I understand that less than 20% of the enormous sums paid in insurance premiums against such actions ends up in the hands of the victims. American judges periodically come up for re-election, and this induces many of them to grant ever more spectacular awards than their political rivals. The main results of these increasing awards are that doctors pay premiums of \$10 000-75 000 or more a year; a few big insurance companies will not accept doctors even with such premiums; some doctors decide to take a chance and, as the saying goes, "go bare"; and some states are setting upper limits on compensation. The overall effect, however, is to encourage a mode of defensive practice that is wasteful and robs the doctor of much valued clinical responsibility and judgment. Radiographs are taken of every injury however minimal; batteries of laboratory tests are carried out in case something is overlooked; the more hazardous operations are not attempted; and the length of stay under observation in hospital may be extended. The risk of a malpractice suit does not end with retirement, or even at the death of the respondent doctor, when his estate may be sued. Moderation is a rare quality in the United States; Britain could perhaps do with a little less moderation and toleration, and a small increase in claims for negligence might not be a bad thing.

In many respects American medicine is as socialised as our own. The large Veterans' Administration provides medical cover for ex-service men and women and their dependents, an immense number of people after the second world war, Korea,

and Vietnam. Medicare and Medicaid, introduced in 1972, go a long way, if not far enough, to alleviate the financial disasters of illness; Medicare provides hospital and ambulatory services for people aged over 65, and Medicaid provides them for the indigent poor, assessed as such on widely varying scales by the different states. There are also big schemes, such as the Kaiser-Permanente Health Plan, a non-profit-making agency that provides comprehensive health care on a prepaid basis for about two million clients. The Federal Employees' Health Benefits Program gives health cover for some eight million government employees. Millions of people enrol in the Blue Cross and Blue Shield private health schemes, with Blue Cross to cover the expenses of admission to hospital and Blue Shield to cover doctors' fees. The combined "Blues" provide considerable medical cover to upwards of 100 million people and have such financial power that the costs of medical care in America are influenced considerably by what the Blues are prepared to pay to hospitals and doctors. Altogether health finance in America is pluralistic, complex, and not comprehensive; much responsibility is left to the individual. This often results in great anxiety, and I have known a doctor's wife, with small children, go despairingly into debt during the terminal irreversible illness of her husband.

Medical education

In America state legislatures are increasingly laying down regulations on medical matters—for example, insisting on the inclusion of teaching on medical ethics, human sexuality, and the recognition of child abuse; insisting on peer review of professional standards; imposing hospital audits; and taking a hand in inquiries into allegations of professional misconduct. California is now demanding original documentary evidence of every detail of school and residency training from out of state and foreign graduates, and other states are certain to follow this lead. A new exhaustive written examination in two parts, set by the Education Council for Foreign Medical Graduates and covering both preclinical and clinical training, will come into effect in July this year. All those who qualify outside the United States will have to pass it before gaining employment anywhere in the medical services in America. States differ widely in their attitude to licensure: some years ago one eminent surgeon who was with difficulty persuaded to move from the east coast to the west was then asked to requalify, starting with biochemistry.

Is it then still worth the expense and effort of training to be a doctor in America? The high financial rewards are envied but not apparently greatly resented by other Americans. In 1976, 43 000 boys and girls put in 360 000 applications to 114 medical schools for about 16 000 places, and 5000 of those who failed went off to find places overseas, suggesting that medicine is still seen as a desirable career.

Studying medicine costs about \$40 000 a year, with a further \$300 000 estimated as the cost of completing training as a specialist. Many students qualify with debts of around \$100 000, but they can count on a basic salary of \$15 000 a year from the beginning of their residency training. The best of American medical schools are superb, providing gruelling tuition in the basic sciences, profound clinical experience, and research opportunities. "To those who have, shall be given . . ."—the top schools receive much enthusiastic support (witness the recent anonymous gift of \$50 million to Cornell) whereas the worst schools appear to be appalling. Some are surprisingly accredited even when they have hopelessly inadequate staffing and facilities.

Despite the inequalities of distribution many people believe that the United States already has a glut of doctors. Opinion differs politically on whether additional doctors will increase health expenditure—each practising doctor is thought to account for about \$300 000 of health expenditure a year—or instead will lead by competition and unemployment to much

lower professional incomes. In my own opinion, there is still a long way to go before the public in general can hope to get medical care and advice of the quality provided at present by only a few doctors. In addition, all the American medical gluttony is self centred and concentrated within the United States, where medicine is practised in total indifference to the state of half the population of the globe. If there really are already too many physicians in the United States their services are more than needed in the remote valleys of Columbia and Peru, and the mountain ranges of Ethiopia or Bhutan, not to mention the urban wildernesses of Mexico City, Sao Paulo, Cairo, Calcutta, and the like.

Research

Not even this superficial account of medicine in the United States would be complete without reference to medical research, in which the United States probably exceeds—admittedly often with the help of expatriate medical scientists—the efforts of all other countries combined. The 11 National Institutes of Health and the support they give to research throughout the country, account for a staggering expenditure of \$3.5 billion a year. The institutes tend to bear descriptions, such as child health and human development, cancer, aging, heart lung and blood, and allergy and infectious diseases, which appeal to those in Congress who vote such large sums for their support, but in any one institute fundamental research may be done that is of much wider importance than the title of the institute would suggest. The National Institutes of Health also have the greatest of medical information services, the Medical Library of Congress.

Many fine centres for biomedical research exist at universities, at medical schools, and in separate establishments, but for a doctor to enter on a career in research demands dedication; after three years in residencies earning at least \$15 000 a year he will be fortunate to start at \$13 000 a year in research. Although Britain has a particularly fine record in winning Nobel prizes, scientists working in the United States have now won 56 prizes in physiology and medicine whereas 18 other countries have gained a total of only 75 between them in these subjects. This is evidence enough of the great intellectual and technical opportunities offered in American research institutes. Of the first 67 winners of Nobel prizes for physiology and medicine, 31 had grants from the Rockefeller Foundation. In the United States nothing is ever considered to be impossible—no doubt within a short period they will have a functioning hospital in space.

Conclusion

I hope that I have said enough to indicate that medicine in the United States is exciting. There is a great difference between the best and the worst and much anxiety over the financial cost of illness; but overall there is a zest for improvement, for greater benefits, and for healthier ways of living. We have something to learn from America.

If a member of staff of a hospital caring for mentally subnormal individuals declines to be immunised against hepatitis B does this relieve the health authority of liability under the industrial injury benefit scheme should that staff member subsequently contract hepatitis from a patient?

Immunisation against hepatitis B is not mandatory for any individual or group. Previous non-acceptance of an offer of hepatitis B immunisation should not, therefore, affect the entitlement to industrial injury benefit of an individual employed in the health service who contracts hepatitis from a patient.—SHEILA POLAKOFF, consultant epidemiologist, London.