Lessons from the Past, Warnings for the Future
Transcript

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The history of medicine used to be told as a history of the march of science, led by great men who conquered disease; and nobody would want to deny that there is some truth in this view. I have already told in this series of lectures the stories of the great discoveries of men like Robert Koch and Charles Nicolle, the brilliance of the age of bacteriology and the effects of antibiotics after 1945. Let me illustrate these points briefly by discussing what is perhaps the classic example of the achievements of medical science: smallpox, a disfiguring viral skin disease transmitted by droplet infection or infected bedding or clothing; as well as bringing out a rash and then blisters on the skin it also affects internal organs and leads to death on average in just under a third of people who catch it. Smallpox is an old disease, with evidence of its presence in Egyptian mummies, and major epidemics reported in many areas and at many times; one of the most notable was the epidemic of 735–7 AD that killed around a third of the population of Japan; the mythical figure of the smallpox demon reflected continuing Japanese fear of the disease long afterwards. As this suggests, isolation from other parts of the world lowered resistance and increased the severity of smallpox, and this was clearly a feature in its devastating impact on the native population of the Americas when it was brought over by the Spanish in 1518 and spread across the continent, as in this illustration from the 1540s.

But even where it was common, it caused large numbers of deaths; in the late 18th century as many as 200,000 a year in Europe alone. The disease was no respected of dignity or rank; among those it killed were for example the son and heir of the English Queen Anne in 1700, thus leading to the Hanoverian succession, and numerous members of the aristocracy and upper classes including Louis XV of France, and Queen Mary II of England.

Yet relatively early on it was recognized in China, in the 10th century and possibly India even earlier, that infection with a small dose via the nose or a scratch on the skin could provide immunity, and even though a proportion actually caught the infection as a result, the death rate, at two per cent, was far lower than among normal sufferers from the disease. The practice was introduced to Europe via the Ottoman Empire in the mid-eighteenth century, and revolutionized at the end of the century, in 1798, by an English country doctor, Edward Jenner, who noticed that milkmaids never caught smallpox, and concluded that the reason for their immunity lay in the fact that they had already caught the related disease, cowpox, which did not pose any threat to humans. Jenner’s new preventive treatment, which he called vaccination, after the Latin for ‘cow’, soon became widely practised and state authorities began to try to make it compulsory. By the middle of the nineteenth century for example the Kingdom of Prussia had passed laws refusing to admit young people to school, apprenticeships, employment or the army without a vaccination certificate. By then, there were 66 vaccinations recorded in Prussia annually for every 100 births.

In France by contrast the government had been far less successful; and in 1870–71 the results were seen as a fresh epidemic swept Europe, carried by the opposing armies in the Franco-Prussian War – another disease spread by military movements like bubonic plague, syphilis, typhus or cholera. 125,000 French troops caught the disease, of whom some 28,000 died, in contrast to 8,500 cases and a mere 400 deaths amongst the Prussians and their allies. So disease played a part in determining the outcome of the war. After the troops returned home, smallpox spread across Europe, killing a total of half a million people by the mid-1870s; the city of Hamburg, which had refused to implement compulsory vaccination, suffered 3,600 deaths, proportionately even more than in the great cholera epidemic of 1892. The disease even struck the United Kingdom, and a special smallpox hospital was opened in Hampstead in 1870. In 1871 the British government made vaccination compulsory as a result.

Yet the disease continued to rage in other parts of the world despite the efforts of officials to introduce compulsory vaccination in the British, French and other global empires. There were 50 million new cases in 1950 alone. In 1958 the World Health Organisation, funded initially by the USA and USSR, began a strategy of isolating cases and vaccinating everyone in the vicinity, and by the late 1960s the number of new cases had fallen to two million. The last major reservoirs were in strife-torn Ethiopia and Somalia, where the last known naturally occurring case was recorded in 1977. As the World Health Organisation prepared to confirm the complete eradication of the disease, a medical photographer in Birmingham, Janet Parker, caught smallpox and died on 11 September 1978, achieving the dubious distinction of being the last smallpox victim in history. The head of the laboratory, Professor Henry Bedson, committed suicide. The World Health Organisation ordered remaining stocks of the virus to be held in only two centres, in Russia and the USA, and is currently trying to have them destroyed.

Smallpox was exceptional in a number of respects, however. First, it was spread exclusively from human to human; other creatures like rats, lice or mosquitoes did not play a role. This made it easier than almost any other epidemic disease to eradicate. And secondly, an effective method of prevention was discovered and developed far earlier than in the case of other diseases, dating back as I have noted to the end of the eighteenth century.
This meant, thirdly, that smallpox was the only major disease of the ones I have been discussing so far to have been defeated by direct medical intervention. In other cases, such as for example malaria, eradication has been hampered by the lack of an effective vaccine, or in the case of yellow fever, by the difficulty of deploying a vaccine effectively in areas torn by civil strife, notably in Africa; and in both cases elimination of the disease-carrying mosquito has proved too huge a task for medical and state authorities to master. Measles, which has a relatively low death rate in previously exposed populations, can have devastating effects where it is newly introduced, as in Fiji in 1875, when a quarter of the population died, but it too is easily preventable by inoculation, which has an immediate effect in reducing its incidence. There were still 800,000 deaths being reported worldwide at the end of the twentieth century.

Nevertheless it seemed clear that medical science had developed effective ways of preventing and, with the introduction of antibiotics, curing a vast range of infectious diseases. The problem usually lay in implementing these methods, especially in parts of the world with poor communications, weak state infrastructure, or war and civil strife, not in the methods themselves. Even before medical intervention began to become effective, medical advice mingled with civic pride and bourgeois fastidiousness had prompted the great clean-up of European cities known to posterity as the hygienic revolution: the introduction of properly filtrated water supplies and sewage disposal and processing systems, the education of the population in habits of cleanliness, slum clearance and urban renewal, spreading to other parts of the world first with empire then with the growth of national pride and modernization schemes in newly independent states.

It was, for example, this set of developments that reduced the incidence of typhoid, the fever discovered in the mid-nineteenth century to be a waterborne disease. Growing pollution of cities as populations increased under the impact of industrialization boosted death rates, for example from 87 per 100,000 in London in the 1850s to 89 in the following decade. By the eve of the First World War, the rate had fallen to less than nine following the great clean up of the city in the late Victorian era. The effect of filtration can clearly be seen in these statistics of typhoid deaths in the American city of Philadelphia. The discovery of the bacterial causative agent by German scientists in Robert Koch’s laboratory in the early 1880s led quickly to the conclusion that it could be carried by people like the famous ‘Typhoid Mary’, who in the 1900s caused epidemics wherever she went despite the fact that she did not appear to suffer from the disease herself. A cook by profession, she infected the families with whom she worked even though the water supplies they drank were properly filtered and free from disease. Public health campaigns duly took account of this fact, soon confirmed in a number of other diseases too, including notably diphtheria, as well as scarlet fever, meningitis, polio and typhoid, all of which could be carried in fresh milk as well as in water. Education in personal cleanliness combined with public health measures such as water purification were the most effective way of preventing diseases of this kind, portrayed in this public health poster from Virginia in the early twentieth century as a kind of synthesis of a river and a dragon.

By the First World War, therefore, belief that the march of science and hygiene would lead to the conquest of disease was firmly entrenched in Europe. Medical optimism was barely dented by the great influenza epidemic of 1918-19, in which perhaps 50 million people died, up to half of them in India, spread partly by American troops going to Europe to join the war, then in a second wave spread back to America and southwards to Africa and across the Pacific, where isolated communities suffered death rates of extraordinary severity – 8,500 out of a population of 36,000 in Western Samoa, for example, or 1,000 out of a population of 15,000 in Tonga. ‘We have been averaging 100 deaths per day’, wrote one navy physician in the USA: ‘It takes special trains to carry away the dead. For several days there were no coffins and the bodies piled up something fierce.’ Treatment was ineffective; all that health authorities could do was to advise sufferers to go home and take to their beds. Although this has some cause in terms of the absolute number of deaths to be the greatest epidemic in history, it was very short-lived, it bated down on to populations weakened by wartime hunger and deprivation, and the public attention it aroused, such as it was, paled in comparison to the horror and devastation of the war itself, even though the number of deaths it caused was considerably greater. It became, as the historian Alfred Crosby called it, a ‘forgotten pandemic’. Subsequent epidemics of influenza had nothing like this impact; ‘flu’ became a manageable disease, nowadays often used as a synonym for the common cold; compared to the death rates year in, year out, from TB and other major infections, its long-term impact seemed unimportant. And the experience of 1918 was not repeated during the Second World War.

The advent of antibiotics after the war merely increased medical optimism. The march of medical progress, the improvement of public health, the conquest of disease, the triumph of prevention, the worldwide reduction of suffering and death thus seemed, for all the obstacles in their way, to be inevitable by the 1970s. The most striking of all medical triumphs in this field was with the disease poliomyelitis, or infantile paralysis, known since ancient times but first recognized as a distinct condition in 1840 but relatively uncommon up to the late nineteenth century. This is an infection of the spinal cord or in severe cases the brainstem, spread in much the same way as cholera, which in a small minority of cases leads to paralysis, usually of one or both limbs on one side of the body; in a few severe cases the patient requires an iron lung to breathe, and the condition can be fatal. Recovery often occurs but in up to half these cases after-effects develop, sometimes decades later, including tiredness and weakness of the muscles. Ironically, the great clean-up of European and North American cities in the mid-to-late Victorian era drastically reduced the incidence of the disease, which in over 90 per cent of cases does not lead to any symptoms developing, so infant populations stopped acquiring immunity to its more severe forms since the virus that causes it – discovered in 1908 – was no longer present in water supplies. Epidemics began to occur, and by the middle of the twentieth century polo was perhaps the most feared of all diseases, with 58,000 cases reported in the USA in 1952 causing over 3,000 deaths and permanently partially
paralyzing over 21,000 victims; two-thirds of the victims were under the age of fifteen. The polio epidemics of the early 1950s caused widespread panic, much like earlier epidemics in history. Newspapers spread alarm when cases were reported in a locality, as these newspaper clippings illustrate, while public health authorities placed warnings and advertisements in children’s comics to try and alert their young readers to the dangers of the disease.

It was to cater for the inrush of polio patients that hospitals first developed intensive care units, that medical fundraising (initially for iron lung machines) became an accepted part of health care, and that rehabilitation therapy became a normal part of hospital treatment. The scale of the epidemic was considerable, as suggested by this photo of an iron lung ward in an American hospital in the early 1950s. It has been calculated that in 1977 there were some 254,000 people in the USA alone living with partial paralysis caused by polio; 40,000 in Germany, 30,000 in France, 12,000 in the UK, and at least ten million worldwide. It was these victims who effectively launched the modern disability rights campaign. The search for a cure still goes on. It was in the field of prevention that medicine celebrated its real triumph, with the development of effective vaccines first by Jonas Salk at the University of Pittsburgh in 1954 then by another American researcher, Albert Sabin, the following year; mass immunization programmes were put into effect led by the World Health Organisation. Though their implementation met with setbacks, especially in areas with a poor health infrastructure, substantial progress was made within a few decades. By the late 1990s fewer than 4,000 new cases of polio were being reported worldwide each year; in 2011 there were only a few score, and all countries apart from Nigeria, Chad, Afghanistan and Pakistan were certified polio-free. Thus polio is on the way to being the third disease after smallpox and the cattle plague Rinderpest to being completely eradicated. As the vaccine began to produce a dramatic decline of the disease in the 1960s and 1970s, it seemed yet another chapter in the inexorable onward march of modern medicine.

Yet in 1981 all this was called into question. During the summer reports began to appear in the journal of the Center for Disease Control in Atlanta, Georgia, of outbreaks of rate types of cancer and pneumonia among apparently healthy men in New York and California. Researchers concluded that the victims succumbed because their immune systems had collapsed. 189 cases had been reported by the end of 1981; 650 in 1982; more than 2,100 in 1983; over 4,500 in 1984, more than 15,000 in 1985. To begin with, since it was noted that the victims were overwhelmingly gay men, the new condition was called Gay-Related Immune Deficiency (GRID), and moral conservatives began to talk of a ‘gay plague’. At the same time, however, it was noted that some victims contracted the condition through contaminated blood transfusions, while intravenous drug users were also falling victims to it (leading to a debate over whether making clean needles available or educating drug users in the dangers of sharing needles was encouraging dependency on hard drugs or whether this was preferable to condemning substantial numbers of users to death).

Heterosexuals in Haiti also began to succumb – leading to the question posed in the Journal of the American Medical Association in 1986, ‘Do necromantic zombiists transmit [HIV] during voodooistic rituals?’ Widespread panic led not only to fantasies such as this one, but also to a collapse of American tourism to Haiti. Delta Airlines proposed to ban AIDS sufferers from their flights (though this was not in fact implemented); the conservative US Senator Pat Buchanan demanded that gay men be banned from jobs that involved handling food; the Screen Actors’ Guild told its members they could refuse if asked to take part in a screen kiss; the Washington National Cathedral offered an alternative to the common cup in communion services; a postman in Charleston, West Virginia, refused to deliver mail to an AIDS victim’s home. Public discussion began to become possible only with the very public death of the movie star Rock Hudson from an AIDS-related illness in 1985 and the open sympathy expressed by his former colleague, US President Ronald Reagan.

Given the spread of the condition to a variety of different populations, the official name of the condition was changed to Acquired Immune Deficiency System or AIDS in 1982.

Medical research moved fast, and in 1983 two teams, one at the Pasteur Institute in Paris and the other at the National Institutes of Health in the USA agreed on the cause, labelled the next year the Human Immunodeficiency Virus, or HIV. This was a retrovirus, which worked by invading the host’s DNA and using it to replicate itself; discovery thus reflected advances in biology and would not have been possible even a couple of decades before. Infection with HIV did not necessarily mean that the victim would develop AIDS. It became possible to test for its presence in a subject. Alarmingly, tests revealed that nearly a million Americans were suffering from the condition, and indeed by 1990 the number of cases where the condition had developed into AIDS numbered 160,000, with the annual death toll in the USA peaking at 50,000 in 1995. By this stage the condition was no longer mainly affecting gay men, but had moved into the heterosexual population as well. Transmission was by the exchange of body fluids, including blood; and health education rapidly reacted by unfolding health and sex education programmes. Condom use during sexual intercourse was strongly recommended as a barrier to infection by many organizations and governments, including the Conservative government in the UK led by Margaret Thatcher, and the United Nations organizations distributed millions of condoms to potential victims, above all in Africa. If anyone had any doubt about the wisdom of unprotected sex with a new partner, they were also advised to get themselves tested for HIV before going any further.

This approach obviously implied an acceptance of the sexual freedom that had become common in many parts of the world since the development of the contraceptive pill in the 1960s. So it ran up against religious and moral objections from people and organizations that considered sexual freedom outside marriage to be sinful or
morally wrong, and condoms as contrary to God’s purpose in using sex to bring new souls into the world. Urging young people to practise ‘safe sex’ was condemned as ‘politically correct’; condoms were dismissed as ineffective; the only effective way to stop the spread of AIDS was to stop having sex. Some US organizations attempted to halt the spread of AIDS in Africa by abstinence campaigns. But this line was simply not realistic. Studies showed that the abstinence campaign in the USA failed to reduce infection rates. Teenagers who went to abstinence education classes or belonged to abstinence groups had in fact the same rate of sexual intercourse and the same number of partners as those who did not (so somebody was clearly being economical with the truth). United Nations Organizations continued to back the use of condoms, which was endorsed by US President Bush in a meeting with Ugandan President Museveni.

Meanwhile, AIDS continued to spread with alarming rapidity. By 1991 some 800,000 people had been diagnosed with AIDS, and in 1992 it was reckoned that 6.5 million had been infected with HIV. In 1999, the number of those infected rose to 25 million; by the end of 2004, there were more than 39 million cases worldwide, with more than three million deaths and nearly four million new cases in that year alone. AIDS was the leading cause of death for people aged fifteen to 49 and had killed more people than the influenza epidemic of 1918-19. The highest incidence was in Sub-Saharan Africa, as on this map, where the darkest shade indicates a presence of HIV in twenty to 30 per cent of the population, orange five to ten per cent, light brown ten to twenty per cent, pink one to five per cent, and grey below one per cent. In the early 21st century 30 per cent of the adult population of Botswana was HIV-positive in 1997, and the number of AIDS cases per 100,000 population exceeded 500 in Zimbabwe, Zambia and Malawi. Rates were particularly high among pregnant women, who passed on the infection to their children. HIV/AIDS was threatening to overwhelm the continent. Yet the incidence of HIV/AIDS in Sub-Saharan Africa was far from uniform, and was bound up not only with cultural factors such as attitudes to sex, but as with other diseases in the past, with war and politics as well. Let me illustrate this by reference to two countries, Uganda and South Africa.

AIDS already surfaced in Uganda in 1982, where it was first known as ‘slim disease’. Its spread was accelerated by the ongoing civil war, involving, as so often in the history of disease, the movement of large numbers of young men across the country. By the time the war ended in 1986, infection rates in Ugandan towns were as high as 29 per cent. The new government began a prevention and education programme, emphasizing the easily understandable ‘ABC’ formula – Abstinence, Faithfulness, Condoms– thus combining all the different recommended preventive measures in a single slogan. From a peak of infection rates of fifteen per cent of all adults in 1991, the prevalence of HIV/AIDS fell to five per cent by 2001. While the government proclaimed the decline as a result of its encouragement of abstinence, local studies showed in fact that the increased use of condoms had been the major factor. There was some criticism of the government’s claims as exaggerated, but at least official figures indicated that its energetic intervention, backed by international organizations, was having some effect.

The experience of South Africa provides a startling contrast. Health care remained an eminently political issue, especially where some political movements identified the medical profession for historical reasons with colonialism, with multinational drug companies, or with the long history of an oppressive regime that denied adequate health care to the majority of citizens on racial grounds. The first therapeutic drug for AIDS, known as AZT, was made available as early as 1987, and was later joined by a number of other drugs, which used as a ‘cocktail’ together have had the effect of making AIDS manageable, slowing or stopping the replication of HIV in the body and prolonging the life of victims as well as improving its quality. However, these drugs were very expensive: 600 USA dollars a month for example in South Africa in the year 2000, far beyond the means of the vast majority of sufferers, and posing a huge potential financial burden on the government if it decided to buy them and distribute them free or at an affordable cost. Worse still, major drug companies brought lawsuits to block the importation and sale of cheap generic versions of AIDS medication, arguing they needed to recoup the enormous costs of research and development.

In the Republic of South Africa, AIDS began to affect the population, as elsewhere, in the 1980s. At this point the white minority Afrikaner government, practicing the system of racial separation, or apartheid, was still in power, and the African National Congress, the outlawed organization representing the majority of the population, condemned it as the product of a plan by the white-supremacist South African government to reduce the numbers of the black majority population, in an obvious parallel to the suspicions articulated in nineteenth-century European cholera riots. The lack of any effective treatment, and the widespread publicity given to a small number of medical scientists who denied the connection between HIV and AIDS allowed these suspicions to harden into a political decision to reject the first effective therapy – AZT, made available in 1998 – as an expensive confidence trick by drug companies and agents of “western medicine”.

Once Nelson Mandela was replaced by Thabo Mbeki as President and leader of the ANC, the ANC government’s identification with AIDS denialism became complete, with the Health Minister advocating the use of garlic, beetroot and lemon juice as treatment and encouraging a wide variety of alternative therapies. Mbeki claimed AZT was a poison that caused deformities in babies and refused to allow its distribution, calling together instead a scientific advisory panel on AIDS consisting almost exclusively of hard-line denialists including some who claimed AZT actually caused AIDS. For Mbeki and his supporters, the idea that AIDS was spread by sexual contact was an expression of western stereotypes about African sexuality. Yet his dismissal of “western” medical science was not backed by many of the ANC’s supporters, such as the powerful trade union movement, and it was widely ridiculed in the press, particularly after the South African delegate attempted to justify the
government’s position at a World AIDS Conference. Mbeki’s stance had a good deal to do with his reluctance to lose prestige by admitting he was wrong.

The result was that AIDS spread unchecked in South Africa until in 2007 the number of South Africans with AIDS reached an estimated 5,700,000 or twelve per cent of the population, the largest number in any country in the world, with the next five highest incidence of HIV/AIDS all being countries in southern Africa as well. More than 300,000 people were dying of AIDS each year in the mid-to-late 2000s, while in KwaZulu-Natal province the rate of infection in women who attended antenatal clinics was 40%. Massive pressure by the international medical community did succeed in persuading the cabinet to transfer responsibility for the issue to the Deputy President, while the health minister’s absence through illness put her non-denialist deputy in charge, resulting in a new plan to take effective action. The proportion of South Africans with advanced HIV/AIDS who received anti-retroviral treatment increased from a mere four per cent in 2004 to 28 per cent four years later. Yet, when the health minister returned, her deputy was sacked and the plan put into reverse, and it was only with the defeat of Mbeki in the 2008 election and the replacement of his health minister that the government’s position began to change. Once more, particular political circumstances were at work in determining reactions to a major epidemic.

The spread of HIV/AIDS was a complex process, filtered through many different aspects of human society and culture. To take just one example, when US President Nixon declared a war on drugs, alarmed by the spread of drug abuse among US troops in Vietnam, heavy prison sentences for possession and trafficking were a major factor in boosting the American prison population, which since that point included a disproportionate number of drug abusers; in the 1980s and afterwards prisons thus became centres of the spread of HIV/AIDS infection. Or to take another example, the hedonistic gay culture of New York and San Francisco in the 1980s became another locus of infection, as pointed out by gay activists as an impassioned debate on the causes of AIDS began in the community that was initially at least the most affected.

The origins of the disease itself seemed shrouded in mystery, but there seems at least some measure of agreement that it began by transmission from chimpanzees, suffering from a closely related condition known as SIV or simian immunodeficiency virus, to humans in Africa, perhaps with colonial doctors using contaminated needles during mass inoculation programmes for syphilis and other diseases. Geneticists have shown that the SIV virus existed in apes at least 32,000 years ago, and that they gradually adapted to it and learned to live with it, leading somewhat depressingly to the conclusion that it is likely to be around 32,000 years at least until the same happens with human beings.

AIDS thus belongs to a category of disease that crosses species boundaries, and it is not the first one. In the 1990s frozen corpses in Alaska yielded samples of the 1918-19 influenza virus, reconstructed by the US Center for Disease Control and Prevention in 2005, and establishing it as a virus that jumped directly from birds to humans. More recently a small number of deaths from a strain of avian influenza, H5N1, passed from birds to humans, and reported in China from 2003 onwards, has caused a worldwide panic, with some medical commentators issuing warnings about an imminent global pandemic causing millions of deaths, and large numbers of travellers especially from Asia taking the precaution of wearing face masks when mixing with crowds, a useless measure against a virus of course. Health and safety authorities leapt into action, disinfectants were distributed everywhere, reporting procedures activated, millions of dollars spent, all it seems to no avail; so far the epidemic has not occurred, giving cartoonists a golden opportunity to exercise their wit.

Severe acute respiratory syndrome or SARS was first reported in China in November 2002 but like many other governments before them, the Chinese authorities at first tried to conceal the epidemic, not informing the World Health Organisation until February 2003 when an American businessman travelling in China caught the disease. As cases and deaths mounted, panic began to spread, with people in Beijing avoiding public transport like, as the saying goes, the plague. The FIFA women’s world cup was moved from China to the USA and the women’s world ice hockey championship, due to be held in Beijing, was cancelled. More than 8,000 cases were attributed directly or indirectly to SARS, with a mortality rate of over ten per cent, climbing steeply from one per cent among the under-25’s to 50 per cent among the over-65’s; but the World Health Organisation’s declaration of a global health emergency and the implementation of quarantine measures in many countries contained the epidemic rapidly, and the last case was reported in June 2003. By this time the virus responsible had been identified and genetically sequenced, and the outbreak traced to another breaking of the species barrier, this time with palm civets, a kind of wild cat whose meat was being sold in local markets, being held responsible, along with bats; 10,000 palm civets were destroyed in one Chinese province alone but it is likely the virus remains in its animal host reservoir.

Are these panics justifiable? Does the future hold the prospect of devastating epidemics sweeping across the world, helped by cheap and frequent air travel? Is mass urbanization, the crowding-together of billions of people in great, sprawling, often overcrowded conurbations, another factor making new epidemics more likely? Is globalization and the increasing intensity of world trade patterns going to contribute further to these new threats? Is there a potentially lethal problem in the fact that a number of pathogens have developed resistance to antibiotics? It is reassuring, as the most recent epidemic threats suggest, that the World Health Organisation and other agencies have become very effective in co-ordinating the monitoring and reporting of unusual outbreaks of unusual diseases, and that the discovery of the causative agents by medical science has become amazingly rapid and efficient, as the example of SARS suggests. Medical science is hard at work finding ways of dealing with drug-resistant strains of tuberculosis and other diseases.
The biggest threats remain in fact war and civil strife, with populations vulnerable in areas, particularly in Africa, where conflict drives million of refugees into makeshift, insanitary and overcrowded camps and destabilized governments are unable to provide basic or comprehensive health care and emergency responses. Poverty and poor education are even greater obstacles to the medicalization of the population that is the only real basis for preventive hygiene, both personal and collective. Over a billion people across the world, above all in Africa, still lack access to clean and safe drinking water; over a million die each year worldwide from waterborne diseases, above all infants and small children. As in nineteenth-century Europe, solving these larger social and environmental problems is just as important as funding medical research, and that is because, as I have been arguing throughout this series of lectures, plagues and epidemics are deeply rooted in human society, closely connected to its development, and anchored in long-term patterns of human behaviour. If there is one case that would serve to demonstrate this point, it is the latest epidemic to arouse the concern of the World Health Organisation, the epidemic of obesity sweeping across the world, with more than 300 million clinically obese, with a Body-Mass Index of more than 30 - a third of them in developing countries. A third of all Americans, a quarter of all Mexicans, and more than a fifth of all Britons fall into this category. Obesity brings with it a host of conditions, ranging from heart disease and osteoarthritis to cancer and diabetes; it shortens life and reduces its quality too. Yet unlike the great plagues of the past, or more recent threats like bird flu and SARS, obesity does not create mass panic or spark emergency preventive measures. Indeed there is massive public resistance to regarding it as a problem at all.

In the second decade of the twenty-first century we are all a lot more cautious about the ability of medicine to conquer disease than we were perhaps half a century ago. Yet there is no reason for despair, so long as we remember that improvements in health depend at least as much on social, economic and political factors as they do on medical ones. I hope this series of lectures has shown that it is not just up to the doctors to improve the health and life expectancy of human society: it is up to us all.

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