Changing patterns of communicable disease in England and Wales

Part II — Disappearing and declining diseases

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Many of the traditional infectious diseases have declined or even disappeared and others have shown a change in their epidemiology in England and Wales over the past 20 years. Diphtheria, poliomyelitis, and smallpox have almost disappeared, while brucellosis, dysentery, hepatitis, measles, staphylococcal infections, tetanus, and tuberculosis have declined. There have been other changes in the epidemiology of some of these diseases. Staphylococcal infections in hospitals have decreased dramatically although there is no continuous quantitative measure of this condition.

Diphtheria

After the introduction of mass immunisation against diphtheria in 1940 notifications declined rapidly from nearly 50 000 in 1940 to under 1000 in 1950. By 1960 this figure had dropped to 49 and by 1978 to nil (table I). Since the early 1960s national

TABLE I—Disappearing infectious diseases, England and Wales 1960-79

Year	Diphtheria		Poliomyelitis notifications		Smallpox	
	Notifi- cations	Deaths	Paralytic	Non- paralytic	Notifi- cations	Deaths
1960	49	5	257	121	1	0
1961	52	10	707	169	2	1
1962	16	2	212	59	66	24
1963	33	2	39	12	0	
1964	20	0	29	8	0	
1965	25	0	55	36	0	
1966	20	5	19	4	62	0
1967	6	0	16	3	2	0
1968	15	1	19	5	1	0
1969	13	0	9	1	0	
1970	22	3	6	0	0	
1971	17	1	6	1	0	
1972	4	0	3	2	0	
1973	2	0	4	1	5	2
1974	3	0	5	1	0	
1975	11	1	2	1	0	
1976	2	0	10	3	0	
1977	2	0	15	1	0	
1978	0		3	0	2	1
1979	0*		6*	2*	0*	

*Provisional figures

immunisation acceptance rates have been maintained at 70% to 80% (the number of children completing a primary course of three doses of diphtheria toxoid by the age of 2 years expressed as a proportion of the total annual number of births) and appear to have provided adequate population immunity to prevent the re-establishment of diphtheria in the community.

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past 20 years indicate that at least seven incidents were due to imported infections, the last of which was an outbreak of five cases in unimmunised children in 1975 which was traced to a carrier recently arrived from Bangladesh.¹ The disease affects mainly the unimmunised or inadequately immunised: of 236 notified cases in 1960-8 205 (87%) were in children who had not been immunised or had had incomplete courses of toxoid. Its severity has changed little: from 1960 to 1969 there were 249 notifications and 25 deaths, a fatality rate of 10%, and from 1970 to 1979 there were 63 notifications and five deaths, a fatality rate of 8%.

Thus although two years have passed without a single notification of diphtheria in England and Wales, the disease remains common in many parts of the world and importation from time to time remains probable. Furthermore, it is possible that virulent toxigenic strains of *Corynebacterium diphtheriae* may originate in the community in the United Kingdom from non-toxigenic strains.² When an incident occurs the infection is likely to spread to inadequately immunised contacts. The control measures of "ring" swabbing and immunisation are effective,³ but maintaining high levels of population immunity is now perhaps even more essential because of the increased risk of importing the disease resulting from increased international air travel.⁴

Poliomyelitis

Immunisation with killed vaccine (Salk) began in England and Wales in 1956, and in 1962 killed vaccine was replaced for routine use by live attenuated (Sabin) vaccine. Since the early 1960s national acceptance rates of 70% to 80% have been maintained with this vaccine. There were nearly 4000 notifications of paralytic poliomyelitis in 1955, 257 in 1960, and only six in 1979; two of these cases were infected in the United Kingdom (table I).

The last focal outbreak was in Blackburn in 1965, in which half the cases were unimmunised.⁵ Another increase in 1976 and 1977 was due to widely geographically spread cases of type 1 infection, although at least six of the cases were in itinerant families who met together occasionally. All but two of the 20 cases were in unvaccinated people.⁶ These cases were of particular interest because they appeared to be part of a large widespread international outbreak of type 1 poliomyelitis affecting unvaccinated groups in Western Europe, especially the Netherlands, and North America.⁷

Poliovirus infection remains endemic in many parts of the world, and the experience in 1976 and 1977 showed that even in well-vaccinated communities wild virus may spread and cause disease in unvaccinated groups. Thus high levels of infant vaccination must be maintained and everyone travelling to endemic areas should be adequately protected. One of the factors which may militate against achieving these high acceptance rates is "vaccine-associated" poliomyelitis, a term used to mean poliomyelitis occurring in vaccinees within 28 days of vaccination or in contacts within 60 days⁸ but sometimes misinterpreted to mean vaccine-induced disease. There were published reports of 72 "vaccine-associated" cases of paralytic poliomyelitis from 1962 to 1977, but few if any of these can with

certainly be considered vaccine-induced. Epidemiological assessment of 31 of these cases occurring in 1962-4 showed that apart from the chronological association with vaccination they differed little from other cases of poliomyelitis,⁸ indicating that most of them were not vaccine-induced. It would be an advantage, therefore, to discard the term "vaccine-associated" in poliomyelitis surveillance and to study all cases of poliomyelitis together rather than in two groups defined arbitrarily on their vaccination history.

Smallpox

From 1960 to 1979 there were 141 reported cases of smallpox with 28 deaths (table I). There were nine importations of *Variola major* in 1960, 1961, 1962, 1967, 1968, and 1973; the two in 1961-2 resulted in outbreaks in West Yorkshire and South Wales but in the other seven there was either no spread or only one secondary case. There were three possibly laboratory-associated outbreaks of infection—*V minor* in 1966⁹ and *V major* in 1973¹⁰ and 1978.¹¹ The World Health Organisation smallpox eradication programme began in 1967 and achieved remarkable success; apart from the two cases in the 1978 laboratory-associated outbreak there have been no reported cases anywhere in the world since October 1977.¹²

Routine vaccination against smallpox was discontinued in England and Wales in 1971 and the only medical indications for vaccination that remain, apart from contacts of suspected cases of smallpox, are in certain Health Service staff, and this will probably be restricted soon to laboratory workers in pox virus laboratories. There is now no medical justification for vaccinating travellers, and the issue of waiver letters by doctors authenticated by the local authority stamp is recommended, especially for travellers who have never been previously vaccinated. Should smallpox recur the control measures used successfully in the past will be applied—namely, the rapid identification of all contacts, and their vaccination and surveillance.¹³ Mass vaccination has been shown to be of little value and dangerous—for example, in the 1961-2 *V major* outbreaks, when mass vaccination was last used in Britain, at least 15 deaths were attributed to vaccination compared with 24 deaths caused by smallpox.¹⁴

Brucellosis

The trends in incidence of brucellosis were measured by laboratory reports to the Communicable Disease Surveillance Centre (CDSC) (table II). These increased in the 1960s, probably because of greater awareness of the disease, improved laboratory

facilities and better reporting, but then declined in the 1970s. This decline was probably real because it corresponded both in time and geographically with the progress of brucellosis eradication in cattle by the Ministry of Agriculture, Fisheries, and Food. The causative organism in both cattle and man was *Brucella abortus*, and most of the human cases were in young men working in agriculture or veterinary medicine. With the implementation of an eradication scheme covering the whole country in November 1979, it is expected that brucellosis will cease to be endemic in the United Kingdom, but imported cases are likely to continue. These are often due to *B melitensis*, but few cases have been reported.

Dysentery

Notifications of dysentery fell from over 40 000 in 1960 to about 3000 in 1979, a decline of over 90% (table II). The fall in notifications was mirrored by a decline in laboratory reports of isolations of *Shigella sonnei* over the same period; these fell from 38 169 in 1960 to 2167 in 1979. Laboratory reports of isolations of *S flexneri*, although much fewer, increased over the same period from just under 400 in 1960 to over 713 in 1979, comprising 1% of laboratory reports of all shigellae in 1960 but 24.2% in 1979. The other two subgroups of shigellae, *S dysenteriae* and *S boydii*, accounted for fewer than 100 laboratory reports in each year.

The fall in numbers of notifications of dysentery from 1960 to 1978 was accompanied by changes in the age and seasonal distributions: the proportion of total notifications in school-children, 5 to 14 years, declined by about one-third but that in people aged 15 years and over increased by a similar amount, the proportion being greatest in 15-24 year olds. In 1960 about three-quarters of the notifications were in the first two quarters of the year but in 1978 this had fallen to about one-half. This change in seasonal pattern was most evident in adults (15 years and over) in whom about 60% of the notifications were in the summer and autumn quarters of 1978, compared with about 40% in those under 15 years.

These changes may be explained by a large fall in *S sonnei* dysentery, a disease mainly of school-aged and younger children¹⁵, probably due to improved hygiene and sanitation, and an increase in *S flexneri* dysentery due to imported disease.¹⁶

Hepatitis

Infective jaundice became notifiable in England and Wales in 1968, and in 1969, the first full year of notification, there were 23 569 cases. By 1979 this had fallen by over 85% to 3203, a decline which followed closely that of dysentery (table II). There was a similar but less striking decline in hospital inpatients with infectious hepatitis over a similar period; the Hospital Inpatient Enquiry (HIPE) of the Office of Population Censuses and Surveys (OPCS) estimated that there were 4-5000 discharges and deaths from this disease each year from 1966 to 1970, but by 1976, the latest year for which data are available, this had fallen by half to less than 2000. Laboratory reporting of hepatitis B antigen and antibody began in 1972; in that year there were 351 reports of acute hepatitis due to hepatitis B; this figure rose to 1062 in 1976, and has since remained at about 1000 a year.

The decline in notified infective jaundice was accompanied by a change in age distribution similar to that described for dysentery, the decline being greatest in schoolchildren and least in adults. This suggests that the decrease in incidence evident also in the fall in infectious hepatitis in hospital inpatients was due to a decline in hepatitis A, a disease mainly of children and usually spread by the faecal-oral route. Improved hygiene and sanitation were probably the main causes for this change and for the fall in *S sonnei* dysentery. The incidence of hepatitis B probably has not changed substantially in recent years but the

TABLE II—Declining infectious diseases, England and Wales 1960-79

Year	Brucellosis laboratory reports	Dysentery notifications	Hepatitis† notifications	Measles notifications	Tetanus deaths
1960	84	43 285		159 364	18
1961	101	20 418		765 531	24
1962	96	30 924		184 895	19
1963	133	31 759		601 255	13
1964	124	20 204		306 801	21
1965	120	26 183		502 209	21
1966	168	21 567		343 642	18
1967	240	22 048		460 407	18
1968	224	19 491		236 154	13
1969	207	22 117	23 569	142 111	6
1970	352	10 775	21 563	307 408	9
1971	266	10 680	14 118	135 241	5
1972	266	9 048	12 233	145 916	4
1973	209	8 138	8 051	152 578	7
1974	162	8 211	7 609	109 636	3
1975	169	7 923	5 749	143 072	10
1976	100	6 217	5 953	55 502	6
1977	58	6 208	5 104	173 361	1
1978	39	4 332	4 663	124 067	2
1979	37*	2 786*	3 203*	77 386*	

*Provisional figures.

†Notified as "infective jaundice."

disease has become proportionately more prominent as a cause of notified infective jaundice. The disease is commoner in adults than in children and in men than in women¹⁷ and this is reflected in the proportionate increase in notifications in adults, which was most apparent in men aged 25 years and over. A recent outbreak of hepatitis A affecting adults, especially men, was traced to shellfish,¹⁸ and other similar incidents of food-borne hepatitis A in adults may have escaped detection and could account for some of this increase. The tests for hepatitis A and B now available should allow the relative proportion of cases of infective jaundice due to these viruses to be determined as well as identifying that segment due to non A, non B viruses.

Measles

Measles has often been considered a mild childhood disease in England and Wales, but a national study of complications of disease in 1963 showed that 1 in 15 people with measles suffered from a potentially serious complication.¹⁹ When effective and safe vaccines became available, mass vaccination was recommended. The national vaccination programme began in 1968 and in the following year the expected biennial epidemic did not take place, the number of notifications (142 111) being less than in any previous non-epidemic year. Since 1968 measles vaccination rates have remained low at about 50% and the biennial pattern of measles notifications has become re-established at a lower level (table II). In the nine years following the introduction of vaccination, 1969 to 1977, the total number of notifications was about 60% less than for the previous nine years, 1960 to 1968. This fall in notifications was greatest in the 1-4 year age group and least in schoolchildren aged 5 to 14 years. In 1968 35% of the notifications were in the latter age group but in 1977 the proportion had increased to 47%.

A continuing vaccination rate of about 50% is likely to lead to a further decline in measles in young children, but an absolute increase in the disease in older children and adults may follow.²⁰ Measles encephalitis, one of the most serious complications which the vaccination campaign was designed to prevent, is more frequent in older age groups.¹⁹ The changing age distribution of measles may, therefore, lead to an increased incidence of this complication. Vaccination rates of 80% to 90% are probably necessary to eliminate measles and prevent this rise in incidence of the disease in older children and adults.²¹ It has been suggested that if experience shows this to be unattainable in England and Wales it might be preferable not to encourage general vaccination but to restrict it to "at risk" groups such as the handicapped and the malnourished²² so that only a small proportion of children are vaccinated and most others continue to gain immunity by natural infection at an early age.

Staphylococcus aureus

Outbreaks of hospital infection due to penicillin-resistant *Staphylococcus aureus* in the 1950s led to fears that staphylococcal infections might become uncontrollable. Although penicillin-resistance is now a feature of staphylococcal infections seen in general practice, other antibiotic resistance has declined in at least some hospitals.²³ This may be due to better prevention of cross infection, including infection from staff to patients, to the efficacy of cloxacillin and other penicillinase-resistant antibiotics, and perhaps to the more rational use of antibiotics. On the other hand, multiple-antibiotic resistance has generally increased in the Gram-negative bacilli associated with hospital-acquired infection. Staphylococcal resistance to cloxacillin and gentamicin is rare, and the outbreaks of clinical infection by such organisms have been small. Multiple-drug resistance may be a property acquired at the cost of some infective potential. Antibiotic resistance apart, *Staph aureus* retains its ability to cause fulminating infections, especially in patients on steroids or cytotoxic drugs and with leukaemia. Staphylococcal pneumonias

continue to be associated with epidemics of influenza, especially those affecting elderly patients.

Tetanus

Certified deaths due to tetanus fell from 18 in 1960 to 2 in 1978 (table II). The disease was made notifiable in 1968, and in the following five years 1969-73 there were 107 notifications, which fell to 86 in the five years 1974-8, mainly because of a fall in notifications in children aged under 15 years. In these two five-year periods the case fatality rates were 29% and 24% respectively, a fall which may have reflected improved intensive care. The decline in certified deaths since the early 1960s, however, probably represents a real decline in the incidence of the disease as well as a fall in case fatality. This is confirmed by data available from HIPE, which give an estimate of about 150 hospital discharges and deaths a year from 1960 to 1969 and about 90 a year from 1970 to 1975.

Tetanus toxoid immunisation was introduced into the childhood immunisation and vaccination schedule in the early 1960s, which probably accounts for the fall in notifications in children aged under 15 years—22 in 1969-73 and 5 in 1974-8. Tetanus antitoxin persists for long periods after primary immunisation²⁴ and the incidence of tetanus in older age groups should decline in the next decade. Notifications of tetanus were higher in men than women, but the ratio was different in age groups. In children and adults under 45 years the male:female ratio was 2.5:1 but at 45 years and over this was reversed 0.6:1. This unusual sex ratio over 45 years may have been due to the extensive immunisation with tetanus toxoid of men in the services during the 1939-45 war; Evans²⁵ reported that people immunised with two doses of toxoid in 1940 still had detectable antitoxin levels 20 years later.

These findings suggest that adequate immunity to tetanus is probably achieved by primary immunisation in infancy with a reinforcing dose at school entry and that the recommended reinforcing dose on school leaving may be unnecessary. Furthermore, reactions are common in 15- to 16-year-old children²⁶ and may lead to low acceptance rates not only of tetanus toxoid but also of oral poliovaccine at this age. It would be preferable to omit this reinforcing dose of tetanus toxoid rather than prejudice the uptake of oral poliovaccine in school leavers.

Tuberculosis

The incidence of tuberculosis has been monitored in recent years using three main sources of data: deaths, notifications, and chest clinic reports. The information has been brought together in a series of valuable reports published in the *Annual Reports of the Chief Medical Officer*.

In 1913, when notification of tuberculosis began, there were over 117 000 notifications and nearly 50 000 deaths from all types of tuberculosis; by 1950 these figures had fallen by nearly two-thirds to about 50 000 notifications and 16 000 deaths. The decline in the following decade, however, during which chemotherapy, mass-miniature radiography, and BCG vaccination were introduced, was much more striking. In the ten years 1951-60 notifications more than halved to under 24 000 and deaths fell to below 3500, less than one quarter of the 1950 figure. Since 1960 the rate of decline has been less rapid. By 1978 notifications had fallen to 9688, less than half the 1960 figure, most of this fall being in notifications of respiratory disease, and deaths fell to less than 1000, under one-third of the 1950 figure (figure).

Age- and sex-specific notification rates for respiratory tuberculosis showed a continuing incidence in men about twice that in women, although the rates in both sexes declined by about two-thirds from 1960 to 1978. The notification rates in 1978 were highest in elderly men, 31 per 100 000, and lowest in elderly women and children under 15 years, 5 to 8 per 100 000. The

decline in notification rates of respiratory tuberculosis in 1960-78 was greatest in those aged 15-34 years, a trend which has been noted in previous years since the late 1950s and attributed partly to BCG vaccination of 13-year-old schoolchildren introduced in 1953.²⁷

Notifications of non-respiratory tuberculosis declined by less than 10% from 1960 to 1978 (figure). Age- and sex-specific notification rates showed higher rates in women than men but similar changes within age groups. Over the period the notification rates showed no decline in people aged 45 years and over, and falls of about one-third in those aged 15 to 45 years and nearly two-thirds in those aged under 15.

Incidence of tuberculosis in England and Wales 1960-78.

Some of the changes in the incidence of both respiratory and non-respiratory tuberculosis were due to the influx of Asian immigrants from the Indian subcontinent and Kenya in the late 1960s and early 1970s, who experienced a much higher incidence of the disease with a greater proportion of non-respiratory disease than the indigenous population.²⁸ This high incidence of disease in immigrants, which does not appear to have spread to the indigenous population, has obscured the continuing, though less rapid, decline that was seen in the native-born population in the 1950s.²⁹ An estimate of the size of the infectious pool of tuberculosis can be gained from chest clinic returns of bacteriologically confirmed new cases (figure). Although the numbers declined by nearly two-thirds from 1960 to 1978, there were still 3677 cases in 1978, over 2000 of which were sputum-smear positive. This figure is likely to be an underestimate because cases escape detection and not all cases are reported; for example, Clarke *et al.*³⁰ found that in Leicestershire in 1975 only 84% of all cases of tuberculosis in hospitals were notified and the proportion of non-Asian cases notified was even lower at 68%.

The role of continuing mass BCG vaccination has been questioned because the return, measured by the estimated number of cases of tuberculosis prevented, may no longer appear to be economically justified.³¹ Nevertheless, Heaf and Rusby³² pointed out that without BCG vaccination in a population experiencing decreasing exposure to natural infection, the innate native resistance to the disease will eventually be all that is left to confront infection, a situation similar to that in communities where tuberculosis is unknown. In these circumstances the occurrence of spasmodic minor epidemics around isolated foci of infection might be expected. Indeed, this has now taken place in England and Wales; two outbreaks in children were reported in 1979, in Uppingham, Leicestershire, and Sandwell, West Midlands,³³ in which there were over 50 cases of tuberculosis

including three cases of tuberculous meningitis. Routine BCG vaccination of all children should, therefore, continue until the infectious pool of sputum-smear positive pulmonary tuberculosis is greatly reduced and there is improved detection and notification of all forms of the disease.

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