AIR-BORNE DISEASES

Infectious disease spread by droplet infection have long been one of the most deadly branches of disease. 'It has been calculated that about half of all episodes of human illness are caused by respiratory viruses. Most of these are of course quite trivial infections like the most frequent of them all, the common cold.'[1] In England and Wales in 1850, infectious diseases 'were responsible for some 60 per cent of all deaths, air-borne diseases being about twice as significant as water and food-borne.'[2] "'Droplet infection'' continues as 'by far the commonest and most important in civilized countries'.[3] Add to colds and 'flu 'the fact that most of the generalized infections of childhood such as measles, chickenpox, mumps and rubella are also spread by the respiratory route and it becomes clear that, in advanced countries, droplet infection is much the most important route by which infectious diseases spread.'[4]

Smallpox.

Smallpox (variola) was a major scourge of human populations until the nineteenth century. It was a particularly painful and deadly disease. Apart from its gruesome symptoms, smallpox is particularly serious, both because of its high case fertility and because of its ability to survive outside the human host. 'Leading the pack is the smallpox virus which kills one in ten and can survive for more than a decade outside of the host.'[5] In the eighteenth century Black wrote that 'We have no vestiges, neither in history nor tradition, of this loathsome disease...before the irruption of Mahomet and his followers from the Arabian deserts, about 1,300 years ago; and from whom this extraneous contagion was first transplanted into Europe.'[6] More recently it has been stated that 'The virus first appeared in Europe

[1] Burnett, Infections, 109

[2] Schofield, Decline (xerox), 171

[3] Burnett, Infections, 107

[4] Burnett, Infections, 109

[5] Ewald, Infections, 63

[6] Black, Arithmetical, 59

before the tenth century where it probably established itself as a minor flu-like nuisance.'[7] Something happened to change this in the sixteenth and seventeenth centuries and it grew increasingly virulent, decimating parts of the New World as well as the Old.[8] The fluctuations could be quite abrupt. We are told for example that 'Smallpox mortality itself evidently rose sharply in the early decades of the eighteenth century and fell again after 1750.'[9] As Malthus observed, 'The small-pox is certainly one of the channels, and a very broad one, which nature has opened for the last thousand years to keep down the population...'[10] During the two centuries from the middle of the seventeenth, it was a major scourge. In Scotland, Malthus thought there was a smallpox epidemic every seven to eight years.[11]

Creighton provides a still useful general account of smallpox in the middle ages. [12] He believed that the earliest reliable references to smallpox in England occurred in a letter of 1514. [13] At first it was a fairly mild childhood diseases, but began to rise to prominence in the early seventeenth century. [14] The first literary reference was in 1602, and the first epidemic occurred in 1628. There were increasing references to the disease after 1660 and the horror at its seriousness mounted. Thus it is principally a disease which rose to prominence from the middle of the seventeenth century. [15]

[7] Nikiforuk, Fourth, 66

[8] For some of the terrible effects on third world peoples, see Crosby, Ecological, pp.200ff.

[9] Landers, Age Patterns, 55

[10] Malthus, Population, 183

[11] Malthus, Population i, 275

[12] Creighton, Epidemics, i, ch.ix.

[13] Creighton, Epidemics, i, 456.

[14] Creighton, Epidemics, ii, 44.

[15] Creighton, Epidemics, ii, ch.iv.

Although inoculation against smallpox had been practiced in India from remotest antiquity,[16] the technique only came into western Europe through Turkey in the early eighteenth century. In England, for instance, Lady Wortley Montague described the Turkish custom of ingrafting and inoculation, which she helped to introduce into England.[17] At first there was considerable opposition to the method. An autobiographer described how 'my children were attacked by that dreadful distemper the small-pox...' 'They had often begged to be inoculated, but as their grandparents were bitterly prejudiced against the practice, to oblige them I had forbore to do it...' Wright himself was inoculated very early, in 1736, and gives a graphic account of the operation.[18]

There is disagreement as to the effects of smallpox inoculation. Razzell once argued for an early, widespread and successful campaign. (XXX) There are, however, grounds for believing that, at least until the end of the eighteenth century, the numbers inoculated were not very large and the methods used were not very effective. While being strong advocates of inoculation, neither Malthus writing in 1811 (XXX) nor Black believed that inoculation was yet of great significance. The latter, for example wrote that 'Even in the London smallpox hospital, since its first institution, forty years ago there have not been inoculated altogether 25,000.'[19] Furthermore, Black pointed out that a situation where 'none under seven years of age are inoculated' was hardly likely to make much impact on a disease where five out of every six of those affected were under the age of seven.[20] Creighton lucidly demonstrated how the effects of smallpox inoculation were too little and too late to have had more than a marginal effect, hardly touching ordinary people.[21] From this and other evidence, it seems likely that smallpox inoculation did not become effective until early in the nineteenth century.

The dangers caused by inoculation were considerable. As Petersen says, 'Administered without asepsis, the inoculation could infect the patient with other germs, and unless he was segregated during its course he could spread smallpox to others. In one instance, a single inoculated child infected

[16] Philistines, 124

[17] Letters i, 303

[18] Wright, Autobiography, 152, 21

[19] Black, Arithmetical, 61

[20] Black, Arithmetical, 265

[21] Creighton, ii, 511, 504 ff.

seventeenth persons, of whom eight died of the disease.'[22] A similar point was made by Chambers's Encyclopaedia in 1896. 'Smallpox - Inoculation protected the individual, but, by spreading the disease, increased rather than diminished the total number of deaths...'[23] It may not have been until Jenner's introduction of 'vaccination' in 1796-8 that this type of preventive method spread widely and made a really significant impact. As Heberden commented at the time, 'however beneficial inoculation prove to individuals, or indeed to the nation at large, the bills of mortality incontestably show, that in London more persons have died of the small pox since the introduction of that practice.' One reason for this, he thought, was that 'while the inoculation of the wealthy keeps up a perpetual source of infection, many others who either cannot afford, or do not use, to adopt the same method, are continually exposed to the distemper.'[24]

Another question concerns the degree to which smallpox constituted the major cause of illness in eighteenth century England and hence its control would make a huge difference. The extreme statement of the argument was put long ago by Razzell, when he argued that 'Inoculation against smallpox could theoretically explain the whole of the increase in population...'[25] Razzell has now modified his views arguing that smallpox inoculation probably played only a minor part in the mortality changes of the eighteenth century.[26] Nevertheless his early views continue to find echoes in general works. For instance, Mercer wrote recently that 'there is evidence that the introduction of inoculation - which coincided with the changed pattern of mortality crises after the 1740s - could also have contributed significantly in the initial stages of mortality decline in the second half of the eighteenth century in England.'[27]

Some estimates of mortality from smallpox and other diseases can be derived from bills of mortality. They suggest that whilst important, smallpox was only one of many causes of mortality and not the most important of them. Some figures for eighteenth century England suggest that about 15 percent of deaths

[22] Malthus, Population, 160

[23] Chambers's Encyclopaedia

[24] Heberden, Observations, 35-6.

[25] Drake (ed), Industrialization, 154

[26] Razzell, Essays,3, 150, 220

[27] Transition, 45

were due to smallpox.[28] Landers, however, thought that 'The proportion of all deaths were are recorded as due to smallpox...over the period (XXX) (in London) as a whole is 7.6 per cent.'[29]

What seems to have happened is that the pattern of smallpox changed. It increasingly became a disease of towns and childhood. This point was made by Creighton long ago and Burnet believed, according to Chambers, that by 1750 almost every child born in London or larger provincial towns must have been exposed to smallpox.' 'It then became almost entirely a disease of childhood where the level of immunity was at its lowest.'[30]

There are still considerable puzzles as to the reasons for the decline of smallpox. It clearly did decline in the eighteenth century yet this was not the result of inoculation. Nor can it have been the result of vaccination. It is true that well before Jenner, a Dorset farmer in 1774 had been using vaccination, [31] yet it was not until the early nineteenth century that vaccination became widespread and can have had a significant effect. Plane noted that 'the decrease of burials took place some years before that notable discovery' (i.e. vaccination). [32]

At the other end of the world, smallpox was the most deadly of Japanese epidemic diseases. 'If the importance of a disease can be judged from the attention it received in contemporary literature, smallpox seems to have been the most important acute infectious disease in early modern Japan.'[33]Japan was relatively heavily populated well before Europe and this may help to explain why smallpox became prevalent there a good deal earlier. The first recorded smallpox epidemic in China occurred around A.D. 495, and it was taken to Japan by Buddhist missionaries in about A.D. 552. There were a series of epidemics from that year to 582.[34] The native Japanese terms of **toso** or **hoso** were first used of the

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[28] Razzell, in Drake(ed), Industrialization, 146

[29] Landers, Metropolis (xerox), 72

[30]4 eighton, Epidemics, ii, 556; Chambers, Economy, 102

[31]Creighton, Epidemics, ii, 558.

[32]Blane, Dissertations, 172.

[33] Janetta, 70

[34] Kiple, Diseases, 375

disease in 735,[35] when an unusually severe epidemic of smallpox spread through Japan.[36]We are told that 'In the year 737 alone, the province of Izumi near the capital lost 44 percent of its adult populace, while Bungo in northern Kyushu and Suruga in eastern Japan sustained death rates of about 30 percent.'[37] In the epidemic of 812-814 'almost half' of the population died.[38] Over the next eleven centuries it occurred with increasing frequency.[39] 'In the early centuries the intervals between epidemics were relatively long, and the smallpox virus probably died out between epidemics.' But in later centuries, epidemics became more frequent and 'at some point fairly early in Japanese history, smallpox became an endemic disease.'[40] This probably occurred before the twelfth century, according to Jannetta.[41]

Several characteristics of the smallpox epidemics in Japan are worth noting. Firstly, its incidence was very erratic. It would appear in a group of villages or one part of the country and not in others; in Sendai for instance, 'smallpox was epidemic in different villages and towns at different times.'[42] The length of an outbreak was also erratic; sometimes it lasted for two months, sometimes for more than two years.[43] Thirdly, it tended to be concentrated in major cities. Fourthly, smallpox became 'primarily a disease of children',[44] as in England, where 'records suggest that smallpox was a disease of children in London by

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[35] Fukikawa, Diseases, thanks to Saito

[36] For further accounts of the eight century epidemic, see Farris, Population (xerox), p.53ff.

[37] Kiple (ed), Diseases, 387

[38] idem

[39] Janetta, 65

[40] Janetta, 67

[41] Janetta, 104

[42] Janetta, 73

[43] Janetta, 86

[44] Janeta, 104

the end of the sixteenth century.'[45] The difference was that, with its much earlier urban growth and larger cities, this happened in Japan about four centuries earlier, probably by the twelfth century.[46]

The impact of the disease on children was considerable. It was the 'most important epidemic disease in the Hida villages and a major cause of premature deaths.'[47] In the period between 1771 and 1852 in the Hida province in Japan, smallpox deaths constituted some 10 to 12 percent of all deaths.[48] Furthermore, 'Smallpox accounted for 26 percent of the deaths of all children who died before the age of 10. It was the most important identifiable cause of death in early childhood.'[49] Jannetta estimates that perhaps '10 percent of all children born died of smallpox.'[50] Almost all children had smallpox and indeed there is some evidence that in order to prevent them dying of it as adults, children were deliberately infected at an early age.[51]

Visitors noted their varying impressions of the ubiquity of the disease with its tell-tale scarring. In the sixteenth century the Portuguese missionary Frois 'wrote that nearly all Japanese bore pockmarks from smallpox, and he believed that the ailment was more severe among the Japanese than the Europeans.'[52] Rather curiously the German doctor Kaempfer does not note smallpox as a special problem in his very detailed account of Japan at the end of the seventeenth century (check XXX). A century later Thunberg commented that 'The **Smallpox** and the **Measles** have been long prevalent in this country, and are not more dreaded here than in other places. I did not see a great many people that were much defaced by them: they are unacquainted with Inoculation.'[53] On Lord Elgin's mission to the country in (XXX), it was

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[45] Janetta, 106

[46] Kiple (ed), Diseases, 381

[47] Janetta, 76

[48] Janetta, 77

[49] Janetta, 91

[50] Janetta, 92

[51] Janetta, 92

[52] Kiple (ed), Diseases, 383

[53] Thunberg, Travels, iv, 77

noted that 'From the numbers of people marked with small-pox, that disease must rage with virulence in Japan, but the appalling sights so familiar in China are unknown there.'[54]Griffis in the 1870s wrote that 'in older days...fully one-third of the living had pitted faces...'[55] and Isabella Bird found that 'fully 30 percent of the village people are badly seamed with smallpox.'[56] This estimate of a third of the inhabitants with marked faces is identical to that given earlier in the century by Wittermans, 'Nowhere can one see so many people disfigured by smallpox as in Japan; I would say that almost one-third of the population carries the signs of the disease.'[57]

It is likely that Japan had the disease for longer and with greater virulence than Europe. Viral diseases of this kind could not be held out by any man-made defences; the sea was no barrier against the early visitations and was irrelevant once the disease became endemic. Hygiene and sanitation were no deterrent.

The Japanese did what they could. As early as the 737 A.D. outbreak they made forceful attempts to try to contain the disease. [58]We have seen that they had no idea of inoculation by the 1790s. In the middle of the nineteenth century (???) we are told that 'When his town was ravaged by smallpox, Ogata, following the technique that he had learned in a Chinese medical text, powdered the scabs from patients and used the product for successful vaccinations.'[59] Yet this cannot have been widely done before this period, for it was von Siebold and other foreign doctors who started to propagate the new method of vaccinations. When von Seibold arrived in 1823, 'smallpox was widespread and he brought a small batch of immunizing lymph from Batavia to demonstrate the value of vaccination.' Unfortunately, the lymph had lost its potency in the journey, and no vaccinia resulted.[60] Vaccination seems to have

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[54] Elgin, Mission, 206

[55] Griffis, Mikado, 662

[56] Bird, Tracks, 130

[57] Wittermans, Pompe, 110

[58]Farris, Population (xerox), pp.60-1.

[59] Bowers, Pioneers, 110

[60] Bowers, Pioneers, 110

been successfully introduced from Russia in about 1824.[61]

Once the idea of vaccination was introduced, the Japanese took to it with enthusiasm. 'The Japanese have been amenable to vaccination. In this respect they again show that they willingly adopt from the European what is to their advantage', wrote Pompe in the middle of the nineteenth century.[62] He reported that 'In some provinces the Daimios have made vaccination compulsory, and in Satsuma every child two years of age has to be inoculated. If this has not been done, it will be done forcefully. In Jedo there is an establishment where poor people can have their children inoculated.'[63]

Some were dismissive of the efforts,[64] and others noted that some of the early measures were ineffective. 'The smallpox epidemics became more severe, and the mortality must have been very high in 1854 and 1855. Part of this was the result of the inefficient way of taking care of smallpox patients; patients were allowed to leave the bed, the room, indeed the house, too soon, long before the illness was entirely gone.'[65] Thus it is clear that it did indeed take time for the new treatments to take effect. In 1863, Willis noted that 'the fleet has smallpox; at present it is spreading; if it increases, it may go far to cripple the efficiency of the force.' Two weeks later, however, he reported that the smallpox in the fleet had 'disappeared'.[66] A year later Willis reported that 'Smallpox is very common against the Japanese just now and some foreigners have it.'[67]

Yet by the 1870s a remarkable change was beginning to be observed. Griffis, who spent several years in Japan at that time wrote that 'so great has been the triumph of the hygienic art in Japan that...whereas...one-third of the living had pitted faces, the average crowd in Japan of today shows no more visible traces of this horrible disease than the same number of human beings in other civilized

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[61] Veight, Mutual Indebtedness, xerox,397.

[62] Pompe, 110

[63] Wittermans, Pompe, 111

[64] Hane, 45

[65] Pompe, Wittermans, 111

[66] Cortazzi, Willis, 59

[67] Cortazzi, Willis, 59

countries.'[68]Morse noted some beggars who had 'been rendered blind by smallpox', but commented that 'since the common sense of the nation saw the merits of vaccination and promptly adopted it this loathsome disease has been banished forever from the country.'[69] He commented on a blind masseur 'The amma was made blind by smallpox, at one time a dreadful scourge in the country, but now happily unknown.'[70]Whereas smallpox had always been a greater catastrophe in Japan than most countries, the reaction once a cure was found was more impressive, he thought. 'Smallpox, which has always been epidemic, is now coming under control, the government taking vigorous measures to secure general vaccination and maintaining a vaccine farm for this purpose. In this matter as in many others, the Japanese are far ahead of occidental nations.'[71] In the more remote areas the shortage of vaccine held up the vaccination programme. We are told that 'It was not until 1885 that the vaccine was introduced to Takayama and nearby Hida villages. If we compare patterns of child mortality in the Ogen-ji register before and after 1885, the success of this new preventive therapy appears to have been remarkable.'[72]

Measles

Measles is another epidemic disease which has often decimated populations and over which humans had very little control before the discovery of the virus and hence the preventive inoculation in (XXX).

In relation to western Europe and England, we are reminded that in eighteenth and nineteenth century western Europe, 'measles resembled the severe disease that is found today in underdeveloped and isolated countries.'[73]It was far more virulent than it is today and could cause heavy mortality.[74] 'Measles is a disease that is highly dependent on a large, densely settled population' for the virus can only survive for a few hours outside its human host (REF). The measles virus 'is very fragile, and unlike smallpox, its infectivity dissipates rapidly outside the human host.' It has to be passed quickly from person to person,

[68] Griffis, Mikado, 662

[69] Morse, i, 21

[70] Morse, i, 219-220

[71] Morse, i, 39

[72] Bowman, Two Centuries (xerox), 431

[73] Janetta, 112

[74] e.g. Shrewsbury, Philistines, 93

within a few days, or else it dies out. The infectious period is short. 'In measles the virus appears to be liberated into the secretions of mouth and nose for only a few days during the stage just before and just after the appearance of the rash, so that infection can be spread only during that period.' (REF) A pool of at least three to five hundred thousand individuals living in close proximity are needed in order for measles to become an endemic disease. [75] Measles is one of the very best illustrations of the type of negative feed-back Malthus wrote about. Countries with light population densities would avoid measles, unless it was introduced to them, often with such devastating effects as in the conquest of South America or in other remote trivial areas. Yet as the populations built up in Europe countries would reach levels which would begin to give shelter to endemic measles.

Its severity and fluctuations are, however, still a mystery.[76] As Dubos noted, there is evidence that it became **more** virulent in England in certain periods. 'William Heberden asserted in 1785 that measles 'are usually attended with very little danger; it is not often that a physician is employed in this distemper.' Black in (XXX) thought that 'Few escape this exotick contagion, especially in childhood and in cities.' But he estimated that the mortality rate of measles was only between one tenth and one twelfth that of smallpox. He thought that the case fatality was 'at 1 of 77 whom it attacks.'[77] Creighton noted that measles was epidemic in seventeenth and eighteenth century England, but that it was less virulent than in the nineteenth century. [78]latter in 1808. 'In 1804 measles caused as many deaths, chiefly among adults, as did smallpox, and actually surpassed the latter in 1808.'[79] Having apparently become more virulent, it then changed again, also for unknown reasons. Zinsser noted that along with other diseases, measles became less serious after about 1880, both in incidence and mortality. 'The change began well before modern preventive methods had exerted any noticeable influence.'[80] Its curious behaviour is well illustrated by the Japanese case.

With its enormous cities surrounded by crowded villages, Japan was probably the most densely

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[75] Cohen, Health, 49.

[76] For a still useful general account, see Creighton, Epidemics, ii, ch.v.

[77] Black, Arithmetical, 64

[78]Creighton, Epidemics, ii, 647.

[79] Dubos, Adapting, 168

[80] Zinsser, Rats, 67

populated area in the world in the eighteenth and nineteenth centuries and hence 'one would expect to find epidemics occurring frequently.'[81] It is one of the major surprises of Jannetta's book, and the principal finding of theoretical importance in the field of epidemiology, that this was not so. The Japanese sources 'indicate that during the Tokugawa period measles epidemics were infrequent, occurring at intervals of about twenty or thirty years.'[82] It is clear that measles is a very old disease in Japan. We are told that there were two epidemics of the 'red pox' (**akama-ogasa**) in 998 and 1015 A.D.[83] Fukikawa however gives the first certain reference to measles (**hashika**) as occurring in the Kamakura era; before then it tended to be conflated with smallpox.[84] There were some thirty-six epidemics between 998 and 1868, and 'there is no evidence of a trend toward more frequent epidemics as the Japanese population grew larger.'[85] One can trace the route of some of the later epidemics. They moved from southwest to northeast, usually starting at the port of Nagasaki. They 'did not start in the largest cities and radiate outward to other parts of the country, but invariably moved from Negasaki...'[86] In other words they were imported. Despite its dense population, Japan did not develop endemic measles.

It would also appear that while a serious illness, the disease was not a major killer: '...although measles was considered a very serious illness, it was normally not a fatal one...' One observer wrote that '...the average fatality was only three to five persons per hundred cases.'[87] Not everyone, of course, caught the disease; a study of a particular area, for instance, showed that '...measles had little impact on mortality in the Hida villages...Measles deaths accounted for only .004 percent of all deaths.'[88] Consequently, Jannetta suggests that 'measles mortality in early modern Japan may have been considerably lower than

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[81] Janetta, 109

[82] Janetta, 109

[83] Kiple (ed), Diseases, 379

[84] Fujikawa, thanks to Saito

[85] Janetta, 116

[86] Janetta, 133

[87] Janetta, 138

[88] Janetta, 139

in either early modern Europe or present-day West Africa.'[89]

Any explanation for this muted epidemic has to take into account several factors. Obviously Japan's sea-barrier and conscious policy of isolation was important and 'reduced her exposure to one of the major epidemic diseases of the early modern period.'[90] Yet this does not explain why, once it reached Japan, measles did not become endemic. This is a puzzle which still needs a solution. Given its adaption to north European climates it cannot be that southern Japan was too cold for the virus. Something about the living patterns meant that it died out quickly after each new arrival from outside.

It has been suggested that there may be some correlation with living standards; 'People who are malnourished are believed to be more susceptible to the secondary infections and complications that are the major causes of measles mortality.'[91] Yet, as the same author points out, the patterns in late nineteenth century Europe, which were particularly severe, do not suggest a straight association with wealth or nutrition. We do not know why measles did not become endemic and why the periodic invasions of the virus did not kill more people.

Tuberculosis

'Tuberculosis' is one of the most important causes of mortality in early modern societies and may indeed by the 'captain of these men of death' as John Bunyan called it.[92] There are three types, the human, the bovine and, rarely, the avian. The bacillus is 'a rod-shaped acid-fast organism', which may enter the body by 'inhalation, ingestion, or direct inoculation. Inhalation of bacilli spread in droplet form by coughing, sneezing, or expectorations from tuberculous patients with open cavities is by far the most common method of spread...Intestinal infection also may result from ingestion of milk-borne bovine bacilli.'[93]

It is likely that tuberculosis is now widespread in the human population of urban societies. For instance, we are told that 'Autopsies showed that close to 100 percent of some urban populations, such as those of London, Paris, and other major industrial cities, had at some point in their lives developed the

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[89] Janetta, 144

[90] Janetta, 144

[91] Janetta, 112

[92] Chalkin, C17 Kent, 38 - see Bunyan

[93] Merck, Manual, 1335; cf also Kiple (ed), Diseases, 1059

disease, although they had died of some other cause.'[94] Cohen also notes that most people have tuberculos, which is only activated in situations of malnutrition of stress. [95]

Tuberculosis is probably a very ancient disease, 'one of the oldest diseases known to humanity'[96] was known in Britain by Saxon times.[97], but it was from the seventeenth century that it became a major killer. We are told that 'In the seventeenth and eighteenth centuries it was responsible for about one-fifth of all deaths in London, except during years when epidemics of plague raged.'[98] There was widespread awareness of both its serious nature and of the difficulty of disentangling its different forms. The latter difficulty is shown in the terminology. 'For example the pulmonary forms were commonly called phthisis or pulmonary consumption; infections of the lymph glands surrounding the neck were termed scrofula; and those of the skin referred to as lupus vulgaris.'[99] Black in the eighteenth century noted both the seriousness and the vagueness. 'From one fifth to one sixth of all the mortality in London is from consumption; which is nearly double to that even of smallpox. But consumption is a term too lax and indefinite. Into this gulph, no doubt, are thrown many febrile and slow hectick emaciations. From infancy to old age, in both sexes; and there are few diseases from acute and chronic sources, especially in their fatal termination, without termination, without emaciation and cachexy.'[100]

Yet there can be little doubt as to its seriousness. 'Behold here one of the great caravans of dead to the stygian ferry; and tottering myriads crowding to the same shambles. Every introspection of morbid registers, and the unanimous observations of the medical profession, concord in proclaiming the notoriety of the consumptive throng, and their ruinous domination.'[101] In the middle of the nineteenth

[94] Kiple (ed), Diseases, 1063

[95](Cohen, Health, 11.

[96] Kiple (ed), Diseases, 379

[97] Howe, Environment, 103

[98] Clarkson, Disease, 39

[99] Kiple (ed), Diseases, 1061

[100] Black, Arithmetical, 93

[101] Black, Arithmetical, 92

century, various authorities estimated that between one quarter and one third of all deaths were caused by consumption.[102] For instance, as one authority put it 'As killers, both cholera and typhus were dwarfed by tuberculosis...'[103] It was reckoned by contemporaries to be 'the most lethal disease of the nineteenth century, and probably of several centuries before.'[104] Flinn states that 'There is evidence that this disease accounted for a higher proportion of all deaths in some European countries than any other cause of death by the early nineteenth century, so that it is clear that already by the eighteenth century it was a major killer, if not **the** major killer.'[105]

Although tuberculosis pre-dated industrialization, it does seem to be closely associated with both that process and urbanization.[106] This explains why 'Physicians on the continent alleged that phthisis is more prevalent in Britain than in any other Kingdom of Europe.'[107] At the end of the eighteenth century, Place noted that 'The only fatal disease which seems to have much increased in London, is consumption...'.[108]The reasons were known to contemporaries. 'Tuberculosis thrives in deprived bodies: its allies are undernourishment, debilitation, unventilated living and working accommodation, and squalor. Until the end of the nineteenth century it was almost exclusively an urban disease.'[109] As a contemporary put it, 'Between the sexes no distinction seems to be made. I conceive, however, that amongst the lower orders universally, and more especially those penned up in the foul atmosphere of cities, that phthisis is more fatal than amongst those who browse in the pure air of the country. In accommodation, clothing, noxious trades, etc. the indigent have also the disadvantage; and during sickness, from the same causes, their recovery is more desperate. With respect to seasons, winter and

[102] Greenhow, Papers, 47

[103] Chadwick, Report, 11

[104]Idem; cf also Larsger in Heer (ed), Readings, 5

[105] Flinn, European (xerox), 62

[106] Kiple, Diseases, 1059

[107] Black, Arithmetical, 93

[108] Place, Illustrations,251.

[109] Chadwick, Report, 11

autumn in our climate is the most pernicious to pulmonick maladies.'[110]

It was noticed that 'The pulmonary death-rate is usually excessive in towns where both males and females are largely employed in the manufacture of textile fabric...'[111] But other occupations were also particularly dangerous. 'Textile mill laborers, masons, pottery factory operatives,metal grinders, and other workers in the 'dusty trades' inhale particulate matter than inflames the lungs and increases their risk of developing the disease. The physical exertion and stress of exhausting work also magnify an individual's risk of developing tuberculosis, as does smoking.'[112] As Mercer summarized the situation. 'Poor diet, crowded conditions in housing and at work and poor ventilation contribute to high tuberculosis mortality.'[113] In relation to diet, for example, there is considerable evidence of 'the importance of protein in resistance to tuberculosis.'[114]

The decline of tuberculosis is consistent with the view that it is the environment which is the important factor. It is agreed that 'In most European countries...the tuberculosis mortality has been declining at an almost constant rate for more than a century without the benefit of vaccination or antimycobacterial drugs.'[115] Or as Burnett puts it 'In the light of present-day knowledge it is most unlikely that medical treatment as such had anything to do with the slow but persistent fall in mortality up to 1939. It is doubtful whether treatment ever did more than delay the fatal event in those who would have died without treatment.'[116] What changed were living conditions. 'In all probability the diminution resulted mainly from the steady advance in the standard of living over the period. By 1939 the average person in a civilized community was eating more and better food, was housed in greater comfort, had more opportunity for fresh air and sunlight, and was more cleanly in his habits than in the nineteenth century.'[117] The result has been that while most still have the infection 'Today most of the cases and the

[110] Black, Arithmetical, 94

[111] Greenhow, Papers, 74

[112] Kiple (ed), Diseases, 1061

[113] Mercer, Transition, 104

[114] Kiple (ed), Diseases, 1061

[115] Dubos, Adapting, 236

[116] Burnett, Infections, 218

[117] Burnett, Infections, 218

deaths in Western countries, occur in old men, often derelicts and drunkards from the city slums.'[118] An added category are now those with AIDS. As Greenwood noted, tuberculosis was not conquered, just held in abeyance. [119]

Since tuberculosis was so obviously associated with urbanism and industrialism in the West, it is of considerable interest to see the long-term pattern in Japan. It looks as if pulmonary tuberculosis may have been present in tenth and eleventh century Japan, as there are possible references in the **Genji** and other literature and in excerpts from Chinese medical books.[120] The word for respiratory TB, **Kekkaku (hai-kekkaku)** is a native Japanese term and not a European loan word. Yet in the ensuing centuries, despite the fact that huge cities grew on these highly crowded islands, and despite the presence of many 'dusty trades', particularly textiles and pottery, what seems remarkable in the relative absence of widespread tuberculosis mortality in Japan until very late. For example, in her book on epidemics in Japan, Jannetta does not even include tuberculosis in the index, let alone discuss it (check XXX) Equally significant is the fact that tuberculosis is not one of the nine diseases to which a chapter is devoted in Fujikawa's classic **History of Diseases in Japan**. Chicken pox, German measles, Influenza and other ailments are there, but not TB. It may be, however, that phthisis became a serious disease in certain cities, for instance Edo, in the seventeenth century. [121]

It would appear that it was from about the middle of the nineteenth century, as western contact increased and Japan began to move into its industrial phase, that tuberculosis began to increase. In the middle of the century, Willis did not single out tuberculosis or associated diseases as especially prevalent. In his account 'the principal diseases appear to have been those of a venereal character, eye disease, and leprosy.'[122] In the 1870s Morse wrote that 'phthisis (tuberculosis of the lung) is not more common than in the Middle States of our country.'[123] On the other hand, Pompe, wrote (in XXX) that

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[118] Burnett, Infections, 216

[119] Greenwood, Crowd Diseases, 360.

[120] Kiple (ed), Diseases, 374

[121] Kiple (ed), Diseases, 1063

[122] Cortazzi, Willis, 259

[123] Morse, i, 39

'By far the most prevalent diseases found in Japan are those of the chest including the lungs, the bronchial tubes, and the heart. Lung tuberculosis occurs quite frequently in all its varieties and also bronchial diseases.' Some statistical impression of what 'quite frequently' means is given when we are told that 'Of 700 patients seen by Pompe, 42 were diagnosed as tuberculosis, and of this number, 36 died.' (REF) Pompe's theories as to what caused tuberculosis and other chest afflictions throw some light on the degree of medical knowledge of a well trained foreign doctor in the middle of the nineteenth century. The editor of his work states that 'As with many other diseases, Pompe attributed tuberculosis to drinking sake.'[124] Excess was thought to be the cause of much disease. 'The frequency with which heart diseases occur I would attribute mainly to excesses, among which liquor abuses, baths that are too hot, and various illicit pursuits are the main offenders.'[125] Pompe wrote that 'The considerable differences in temperature within one day and the unsuitable clothing which leaves the neck and chest uncovered give rise to many chest afflictions. Heredity also plays a very important role here.'[126]

The situation appears to have become much worse towards the end of the nineteenth century. We are told that 'tuberculosis epidemics were just started at the end of the nineteenth century.'[127] This may have been related to the entry of large numbers of young women into the labour force, where they worked and lived in crowded workshops and dormitories.[128] Certainly by the 1905 edition of **Japanese Things**, Chamberlain thought that consumption was one of the three most serious diseases in Japan.[129] Hane provides some figures for this period. 'In 1889, 0.15 percent of the population died of the disease; in 1900, 0.17 percent; in 1904, 0.185 percent; and in 1935, 0.19 percent.'[130] Although the absolute numbers and the percentages are still small, it was clearly an important source of illness and death.[131]

[124] Wittermans, Pompe, 109

[125] Wittermans, Pompe, 109

[126] idem

[127] Kiple (ed), Diseases, 1063

[128] Bowman, Two Centuries (xerox), 432-3

[129] Things, 251

[130] Hane, 46

[131] For other figures see Kiple (ed), Diseases, 1066

After 1945 the rates began to drop, again probably more the result of improved living conditions than medical treatment,.[132] though Maraini in XXX still found the death rate for tuberculosis 'very high', particularly in the towns. [133]

A particular difference between England and Japan is worth noting. We have been considering pulmonary tuberculosis. The other main form, bovine tuberculosis is, of course, associated with cattle. The widespread keeping of cows and use of dairy products in England clearly raised the tuberculosis level. Even as late as the early twentieth century, Lane-Claypon thought that 'Tuberculosis is certainly the most serious infection owing to the wide prevalence of the disease among cows.' She thought that at least a quarter of the cows were infected.[134] On the other hand, the virtual absence of cows from Japan until the later nineteenth century, and the correlated absence of dairy products, must have eliminated this potent cause of one branch of tuberculosis.

Conclusion.

In considering the general patterns of air-borne diseases, it is important to remember that 'infectious diseases are not static conditions, but depend upon a constantly changing relationship between parasite and invaded species, which is bound to result in modifications both of clinical and of epidemiological manifestations.'[135] One particular manifestation of this seems to be the way in which certain diseases which begin as epidemics, destroying large numbers, later become less virulent. As Kunitz explains, 'in large populations these crowd diseases (measles and smallpox) will turn into childhood diseases.'[136] Kunitz continues in relation to North America, that 'Smallpox and measles began to recede in the late eighteenth century for the same reasons as in Europe: with the growth of population and development of communications, they increasingly afflicted children rather than adults.'[137] Thus growing contact among parts of England and the rise in population size...meant that measles and smallpox became endemic and

[132] idem

[133] Maraini, Meeting, 68.

[134] Lane-Claypon, Hygiene, 235

[135] Zinsser, Rats, 88

[136] Speculations, 354

[137] in Coleman, (ed) Population, 285

affected primarily younger age groups.'[138] These 'density-dependent crowd diseases' became 'childhood diseases'.[139] The same point has been elaborated by Cohen, who shows the advantages of a large population and the consequent change of certain epidemic diseases into childhood complaints in Europe.[140] Likewise Kiple has argued that the 'taming of diseases by rendering them endemic' is 'the next great change in the ecology of human disease' after the transition to sedentary populations. He suggests that 'Such a phenomenon ccurred gradually for...between 5,000 and 40,000 new hosts are required annually for it to become endemic. But, sooner or later, cities that had previously suffered from epidemics...became populous enough to produce through births enough non-immune individuals to retain the diseases permanently.'[141]

It could be argued that there is a threshold of population density in certain diseases, for instance smallpox and measles, beyond which they become endemic and less disastrous. This seems to be particularly the case with the three main viral diseases - smallpox, measles and influenza. It may be that Japan passed through this threshold very early, in the eighth to eleventh century, and thereafter a number of common diseases were less virulent. In England, this may have happened somewhat later, between the end of the sixteenth century and the mid eighteenth century.' This is a possible background factor, yet it can only explain a little of the puzzle of the fluctuations in these diseases.

There are still many mysteries in relation to the major air-borne diseases. Viruses are notoriously volatile and some of the puzzles may in this case be explained by changes in the strain. The sudden influenza epidemics, the suddenly increasingly virulent attacks of smallpox and measles, and the equally sudden decline of measles, all these are possibly partly explained by viral transformations.

It is also not clear to what extent the prevalence and case mortality rates are influenced by changes in the environment. On the one hand, it could be argued that air-borne diseases are the least susceptible to external environmental changes. On the other hand it is likely that the case mortality, particularly of measles and tuberculosis are considerably affected by the standard of living of the population. A well fed and generally healthy population may be much less prone to high mortality.

I will conclude by suggesting a very simple model of what may have happened. In Japan, the great period of viral epidemics was between the eighth and twelfth centuries.[142] Yet, somehow, an already

[138] Kunitz, Speculations, 354

[139] ibid

[140] Cohen Health, 54.

[141] Kiple, Ecology (xerox), pp.364-5.

[142] Kiple (ed),Diseases, 377

unusually dense population managed to pass through this critical period. Many of the diseases became contained - less lethal, childhood diseases. The same thing happened in England in the seventeenth and early eighteenth centuries and it managed to pass over the summit and move into a more benign environment. As Dobson, for instance, has put it 'The adverse epidemiological circumstances of the seventeenth and early eighteenth centuries gave way, in the following decades, to a period of less widespread human and pathogenic contact, as familiar infections settled down to become the more benign diseases of childhood and infancy.'[143]

Putting the two cases together shows that medical improvements, for instance vaccination, are probably of very minor significance in this first transition. How was it that these two countries managed to pass across this particular hump, whereas in so many cases civilizations were trapped in the negative feed-back of high population leading to increased viral respiratory epidemics? Two tentative suggestions may be made. The first was in their island position. In particular in Japan, certain diseases, for instance measles and perhaps influenza and tuberculosis, never became 'naturalized'. They were brought in often enough to help immunize the population, but new strains were not constantly decimating the population. To a minor extent this may also have been true of England.

Another type of argument might be termed the 'disease load' theory. As we have seen, respiratory diseases interact with **other** diseases. Now if a country becomes densely populated, for instance as in much of Mediterranean Europe or India, it is likely to suffer from numerous diseases of density - including a wide range of bacterial, ricketsial and viral infections. Each exacerbates the other. The non-respiratory tract diseases are much more 'controllable' through changes in the physical environment. If, as I have argued, England and Japan were able to control vector-borne and water-borne diseases unusually early, the indirect effect would be to make it possible for them to go through and emerge on the other side of the period of respiratory epidemics. Furthermore if, as I shall argue, among the reasons for control of bacterial and other infection were unusually high standards of living, this would also directly effect the case mortality, if not the infection rates, of respiratory infections.

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[143] Dobson, Hiccup (xerox), 421