Economic History Review, 64, 4 (2011), pp. 1315–1335

The decline of adult smallpox in eighteenth-century London: a commentary

By PETER RAZZELL

This article is a reponse to Davenport, Schwarz, and Boulton's article, 'The decline of adult smallpox in eighteenth-century London'. It introduces new data on the parish of St Mary Whitechapel which casts doubt on the pattern of the age incidence of smallpox found by Davenport et al. However, it is concluded that there was a decline in adult smallpox in London, accompanied by a concentration of the disease among children under the age of five. Davenport et al.'s argument that the shift in the age incidence was due to the endemicization of smallpox in England is challenged, with an alternative view that these age changes can be accounted for by the practice of inoculation, both in the hinterland southern parishes of England and in London itself. A detailed discussion is carried out on the history of inoculation in London for the period 1760–1812. It is suggested that inoculation became increasingly popular in this period, rivalling in popularity the practice of vaccination. This was associated with a class conflict between the medical supporters of Jenner and the general population, with many of the latter being practitioners of the old inoculation.

Davenport, Schwarz, and Boulton have produced challenging new evidence on the history of smallpox in late eighteenth-century England, documenting in detail the decline of adult smallpox in London at the end of the century, concluding that this was the result of increasing 'endemicization' of the disease among infants and very young children.[1] This evidence is based on data for two separate parishes from different parts of London—St Martin-in-the-Fields and St Dunstan Stepney—with similar results in both parishes in terms of age patterns of smallpox mortality. However, there is additional evidence which suggests that the age incidence of smallpox in London as a whole was different to the two parishes considered by Davenport et al. The Whitechapel burial register includes detailed information on age and cause of death for the periods 1743–8 and 1760–1812.[2] The data on age are frequently to the nearest month and there is virtually a continuous record, with less than 1 per cent of data on age and cause of death missing from the burial register in the two above periods.

Table 1 summarizes a comparison of smallpox age incidence in St Martin-in-the-Fields with that in St Mary Whitechapel. There was a decline in adult smallpox deaths in Whitechapel, but it was of a lesser magnitude than that found in St Martin's. There was also an increasing concentration of smallpox mortality among children under five years old in Whitechapel, partly as a result of a decline in the five- to nine-year group. However, perhaps the most important difference is that

[1] Davenport, Schwarz, and Boulton, 'Decline'.

[2] London Metropolitan Archives (hereafter LMA), St Mary Whitechapel burial register, P93/MRY1/062–64.

Table 1. *Proportion of smallpox burials by age group, 0–50+, St Martin-in-the-Fields and St Mary Whitechapel, 1743–1812*

Period	*Age group, St Martin-in-the-Fields*						
	0	*1–4*	*5–9*	*10–19*	*20–49*	*50+*	
1752–66	13.7%	54.5%	10.9%	4.6%	15.6%	0.7%	
1775–99	23.3%	61.5%	9.4%	1.8%	3.5%	0.6%	
Period	*Age group, St Mary Whitechapel*						*Total no. of cases*
	0	*1–4*	*5–9*	*10–19*	*20–49*	*50+*	
1743–8[a]	21.1%	54.7%	10.3%	2.3%	10.0%	1.7%	351
1760–9	6.5%	66.0%	14.7%	3.5%	8.8%	0.3%	919
1770–9	18.4%	61.1%	9.4%	4.0%	6.9%	0.2%	553
1780–9	19.9%	65.1%	8.5%	1.6%	4.3%	0.5%	553
1790–9	22.3%	68.9%	4.8%	0.6%	2.5%	0.4%	479
1800–12	19.6%	70.1%	7.4%	1.0%	1.5%	0.3%	581

Note: a The period covered is from 10 April 1743 to 30 Nov. 1747.
Sources: St Martin-in-the-Fields: Davenport et al., 'Decline'; St Mary Whitechapel: LMA, St Mary Whitechapel burial register, P93/MRY1/062-64.

Table 2. *Proportion of smallpox burials by age group, 0–4, St Mary Whitechapel 1743–1812*

Period	*0*	*1*	*2*	*3*	*4*	*Total no. of cases*
1743–8[a]	27.2%	19.8%	24.3%	14.6%	14.3%	268
1760–9	9.0%	31.1%	22.3%	24.1%	13.5%	668
1770–9	23.0%	25.0%	24.8%	17.5%	9.8%	440
1780–9	23.4%	28.2%	21.4%	16.6%	10.4%	471
1790–9	24.5%	26.8%	24.7%	15.6%	8.5%	437
1800–12	21.2%	28.2%	21.2%	19.2%	10.3%	543

Note: a The period covered is from 10 April 1743 to 30 Nov. 1747.
Source: LMA, St Mary Whitechapel parish registers, P93/MRY1/062-64.

the reduction of adult smallpox deaths occurred more evenly over time in Whitechapel than in St Martin's, and this may be partly a function of the quality of the data.[3] Davenport et al. comment on the rapid decline in adult smallpox in St Martin's in the period 1769–74—from 20 per cent to 10 per cent—but note that this 'coincided with a period of poor recording of age and cause [of death]' in the St Martin's register.[4] There is no such rapid decline in adult smallpox burials in Whitechapel and this may be because there are significant gaps in the burial registers of both St Martin's and St Dunstan Stepney. In St Martin's there was a gap between 1766 and 1775—an important period according to table 1—whereas the record in Whitechapel is continuous from 1760 to 1812.

The pattern of concentration of smallpox deaths in the under-five age group is also different in Whitechapel. Davenport et al. concluded that in 'the first and second six months of life . . . smallpox burials increased by nearly 50 per cent as a proportion of all burials' in St Martin's between 1752–66 and 1775–99.[5] Table 2 reveals a different pattern in Whitechapel. There is a large dip in smallpox deaths among infants under the age of one year in the 1760s, coinciding with a rise in

[3] See Davenport et al., 'Decline', fig. 1, p. 1291.
[4] Davenport et al., 'Decline', p. 1294.
[5] Ibid., pp. 25, 45.

Table 3. *Age specific case fatality rates of smallpox in the Whitehaven Dispensary, 1783–1804*

Age group (years)	*No. of smallpox cases*	*No. of smallpox deaths*	*Case fatality rate*
Under 2	378	139	37%
2 to under 5	665	105	16%
5 to under 10	308	32	10%
10+	36	3	8%

Source: Razzell, *Conquest*, p. xviii.

overall smallpox mortality in this decade.[6] This dip may have been a function of registration problems, as there appears to have been a rounding up of ages under one year to the age of one year in the Whitechapel burial register during the 1760s.[7] Table 2 indicates that there was no significant shift in smallpox burials from the 3–4 to the under-two age group, and there is no long-term increase in smallpox deaths among infants in the under-one age group. It is possible that the growth in smallpox burials among infants found by Davenport et al. is partly a function of the dip in such burials in the 1760s.

There are also other reasons for questioning the endemicization thesis. Smallpox was much more fatal to infants than it was to older children, as evidenced by case fatality rates in Whitehaven, Cumberland, at the end of the eighteenth century (see table 3).

Smallpox was more than twice as fatal in the under-two age group than it was to those aged between two and five, and about four times more fatal to those over the age of five. There is evidence from elsewhere of a similar pattern of smallpox case fatality among children, indicating that an increasing concentration of the disease among infants would lead to growing overall smallpox mortality.[8] We will see later that this was not the case in London, where smallpox mortality fell during the late eighteenth and early nineteenth century, casting further doubt on the endemicization thesis.

Tables 1 and 2 indicate that smallpox disappeared among adults in the period 1743–1812, and became more concentrated among children under the age of five. To this extent the findings for St Mary Whitechapel are similar to those for St Martin's and St Dunstan Stepney, but there is a divergence of results regarding the concentration of the disease among young infants. However, the elimination of adult smallpox and its concentration among young children require explanation. Davenport et al. propose two possible reasons for the virtual elimination of adult smallpox in London: firstly, an increase in childhood exposure to smallpox throughout London's migrant catchment area; and secondly, inoculation and later vaccination of virtually all London migrants.[9] The first explanation is linked to the argument that there was an increase in the infectivity of smallpox:

[6] There was also a similar rise in smallpox mortality in St Martin's and elsewhere in London. See Davenport et al., 'Decline', p. 1295.

[7] See LMA, St Mary Whitechapel burial register. There appears also to have been some rounding up of ages in the St Martin's register. See Westminster City Archive, St Martin-in-the-Fields Sexton's Burial Day Book.

[8] Razzell, *Conquest*, pp. xvii, xviii.

[9] See Davenport et al., 'Decline', p. 1297.

> An increase in infectiousness would have raised the chances of infection in infancy and early childhood in large urban populations, and at the same time promoted the circulation of smallpox in rural communities . . . [and as a result] the vulnerability of adult migrants would have declined, and smallpox would have become a disease of childhood in both London and its hinterland.[10]

Davenport et al. cite evidence on changes in the age pattern of smallpox among children in London in support of this first hypothesis: 'infant smallpox mortality rate doubled, while rates in older children probably declined',[11] suggesting a 'process of smallpox endemicization in the English population'.[12] This process of concentration of smallpox in young infants did not occur in Whitechapel, raising doubts about the endemicization thesis. Also, there is an alternative explanation for the changes in the age structure of smallpox in London, but first it is necessary to consider the evidence for an increase in infectivity of smallpox at the end of the eighteenth century.

I

There are no references to increasing infectivity of smallpox by medical writers in the late eighteenth century, although this is not in itself conclusive.[13] There is a theoretical relationship between the virulence of smallpox and its infectiousness, and there is evidence that the virulence of the disease was increasing during the late eighteenth and early nineteenth century.[14] However, the link between virulence and infectiousness is problematic, as indicated by evidence on smallpox mortality in sixteenth-century London. The case fatality rate was probably less than 4 per cent at this time, and yet the great majority of people dying in two London parishes were children under the age of 10,[15] suggesting that the disease could be endemic even when it was very mild in its virulence.

There are data to suggest that there were no significant changes in infectiousness at the end of the eighteenth century, both in England and abroad. There are no national data on smallpox epidemics in England during the late eighteenth century, but evidence is available for Sweden in the period 1776–1805, although the two countries are not strictly comparable. Smallpox was largely confined to children in Sweden, whereas it was a disease of both adults and children in England, at least in the south of the country. Table 4 summarizes data on the age incidence of the disease in Sweden which is largely a reflection of the periodicity of epidemics.[16]

There is a slight tendency for smallpox deaths to occur at an earlier age, but it is not sufficiently large to bring about the significant changes found in London at

[10] Ibid., p. 1308.
[11] Ibid., p. 1304.
[12] Ibid., abstract, p. 1289.
[13] There are examples of medical writers noting changes in the nature of smallpox such as the comments on the increasing virulence of smallpox in the 1660s and 1720s, confirming statistical evidence on the subject. See Creighton, *History*, p. 436; Miller, *Adoption*, p. 30; Razzell, *Conquest*, pp. 169, 176.
[14] Razzell, *Conquest*, pp. 176, 177.
[15] Razzell and Spence, 'History', p. 291, n. 43.
[16] Sköld, *Two faces*, p. 166. The slight shift in age structure may have been due to the practice of inoculation in Sweden, although the exact extent of the practice is unknown. The effect of inoculation on age structure is discussed later in this article.

Table 4. *Smallpox mortality age distribution (%), Sweden 1776–1805*

Period	*<1 years*	*1–2 years*	*3–4 years*	*5–9 years*	*10–24 years*	*25+ years*	*Total*
1776–85	25.5%	30.9%	22.9%	14.6%	5.8%	0.3%	100%
1786–95	30.1%	31.8%	18.8%	14.3%	4.7%	0.3%	100%
1796–1805	28.2%	33.2%	19.7%	14.1%	4.4%	0.4%	100%

Source: Sköld, *Two faces*, p. 166.

Table 5. *General inoculations in the south of England, 1778–98*

Place	*Date of general inoculation*	*Nos. inoculated*	*Population size in 1801*
Irthlingborough, Northamptonshire	1778	Above 500	811
Diss, Norfolk	1784	1,100	2,246
Painswick, Gloucestershire	1785	738	3,150
Brighton, Sussex	1786	1,887	3,620 (1785 population)
Brighton, Sussex	1794	2,113	5,669 (1794 population)
Lewes, Sussex	1794	2,890	4,909
Dursley, Gloucestershire	1797	1,475	2,379
Tenterden, Kent	1798	1,167	2,370

Source: Razzell, *Conquest*, p. 189.

this time. Table 4 suggests that smallpox remained at a roughly similar level of infectiousness during the period 1776–1805.

There is piecemeal evidence to suggest that smallpox remained an adult as well as a childhood disease in the late eighteenth century in the south of England. In Horton Kerbie, Kent, there were just eight deaths from smallpox in 1772–1801, and the descriptions of those dying from the disease were as follows: 'a young woman', 'married', 'aged 61', 'aged 54', 'wife', 'aged 61', 'wife', and 'aged 55'.[17] There were only 12 smallpox deaths in the small and isolated parish of Breamore, Hampshire, in the period 1720–1803, and 10 of these were adults.[18] The mean age of the 10 people dying from smallpox in Sutton Courtney, Berkshire, in 1782–1811 was 38 years, compared to the average age of the six measles deaths—six years.[19] Some of this age distribution may have been influenced by the practice of inoculation, but evidence from general inoculations suggest that even at the end of the eighteenth century, a large proportion of vulnerable people in the south of England were adults. Table 5 summarizes numbers inoculated and population size in 1801.

Many of these general inoculations covered a half and more of the total population, and many of them would have been adults. Those inoculated in Brighton in 1786 were described as 'Persons of all ages from one day to Near Fourscore Years old', and those in Dursley in 1797 as 'of all ages, from a fortnight old to seventy years'.[20] Many militiamen and members of the army were inoculated for smallpox in the 1790s, indicating that adults were still vulnerable to the disease. *Woodfall's Register* reported in 1793 that 'many of the Sussex militiamen . . . are under inoculation', and in the following year it was reported that 'there are now 60 of the

[17] Razzell, *Conquest*, pp. xiv, xv.
[18] Ibid., pp. xii, xiv.
[19] Ibid., p. 26.
[20] Barron, 'Gleanings', p. 606; Crookshank, *History*, vol. 2, p. 182.

Essex Cavalry under inoculation of the small pox'.[21] Likewise, the surgeon of the North Gloucester Militia vaccinated 'several hundreds of all ages' in 1800, and Jenner vaccinated in the same year the 85th Regiment, and 'scarcely a man was off duty during the whole progress'.[22]

These provincial populations in the south of England were the source of the majority of migrants in London, and the above evidence does not suggest that there was an increase in the infectiousness of smallpox in these London hinterlands. Although adults continued to be vulnerable to smallpox in these rural areas, general inoculations brought about a shift in the age structure of the disease as a result of inoculation, as evidenced by a Mr Wayte, a surgeon who practised at Calne in Wiltshire:

> in September, 1793, when the poor of the parish were inoculated . . . we inoculated six hundred and upwards . . . Besides the poor, I inoculated about two hundred [private] patients . . . Now in inoculating a whole parish, we have no choice of patients, all ages, and the sickly as well as others, were inoculated, but these were mostly children, as I assisted in inoculating the whole parish, about twelve or thirteen years ago.[23]

II

There is plenty of evidence that inoculation was practised very widely in the south of England in the period after 1765.[24] Howlett summed up the general position in 1781 with reference to the extent of inoculation: 'In provincial towns and villages, as soon as this disorder [smallpox] makes its appearance, inoculation takes place amongst all ranks of people; the rich and poor, from either choice or necessity, almost have recourse to it'.[25]

The position in London is much less clear. Previously it was thought that inoculation made little headway in this period,[26] and Davenport et al. conclude that 'inoculation remained unpopular in London in the eighteenth century'.[27] However, this conclusion is based on fragmentary and limited evidence. In order to assess the practice of inoculation in London it is necessary to review in detail its history from the 1760s onwards.

III

Daniel Sutton's family was responsible for the simplification and improvement of inoculation, and played a major role in its success, including its practice in London. According to Woodville:

> In 1767, Mr D. Sutton removed to London, where he hoped to profit by his profession still more than he had done in the country; but his practice fell far short of his

[21] *Woodfall's Register*, 19 June 1793; *St James Chronicle*, 16 Oct. 1794.
[22] *Whitehall Evening Post*, 10 April 1800; *General Evening Post*, 12 June 1800.
[23] Cited in Beddoes, 'Queries', pp. 56–9.
[24] See Razzell, *Conquest*; Smith, *Speckled monster*; Brunton, 'Pox Britannica'; Mercer, *Disease*.
[25] Howlett, *Examination*, p. 94.
[26] Razzell, *Conquest*, p. 96.
[27] Davenport et al., 'Decline', p. 1302.

expectations; and the two houses, one at Kensington Gore, and another at Brentford, which were procured for his inoculated patients, were soon abandoned.[28]

Sutton practised inoculation in Kensington for 10 years, charging his wealthy patients 10 guineas for each inoculation—this included board and accommodation—and servants 'and others of that class', five guineas.[29] Sutton's partner, Mr Bond, set up house in 1769 in Pond Street, Hampstead, London, but charged somewhat less—'from three to ten guineas according to the apartments wanted'.[30] Daniel Sutton's brother, William, also practised in London, occupying premises in 1772 in Goodge Street, resulting in a dispute between the brothers about the right to claim the practice of 'Suttonian' inoculation.[31]

Daniel Sutton moved from Kensington to Lisle Street, Leicester Fields, in London, in 1777, advertising that 'Kensington Gore having been found exceeding inconvenient to many desirous of embracing Inoculation, especially the numerous Poor . . . Mr Sutton, as he has ever done, means to adapt his Terms to the Abilities of the Patient'.[32] This shift down-market was probably the result of Sutton's failure to compete effectively with the eminent physician Baron Dimsdale for the custom of the wealthy and fashionable.[33] As a result, Sutton was forced to reduce his prices, reflected in the following account of his new practice: 'The terms of Sutton are so moderate that men in mean circumstances, men of low education and dissolute life, repair to his house, which is so confused and disorderly that one would admire one-tenth part of his patients do not perish by their irregularities'.[34]

Sutton had from an early stage promoted inoculation among the London poor. He advertised in a London newspaper in January 1770 a plan of 'universal Inoculation at the Patient's own Habitations'. The plan was 'principally intended for the benefit of the industrious poor; such as the families of articifers, handicraftsmen, servants, labourers, etc.'. Special inoculation houses were to be set up in various parts of London staffed by surgeons and apothecaries trained in the Suttonian method. Patients would attend with a letter of recommendation from a subscriber, and would then be given preparatory medicines before returning after an appropriate interval to be inoculated.[35]

Daniel's father, Robert Sutton, also practised inoculation in London, arriving in the city in 1783, and joining his son William as a partner. He advertised that he was the 'original improver of the art of inoculation . . . and proposes carrying on . . . [inoculation] in conjunction with his son [William], on the most reasonable terms. The poor will be inoculated gratis, without any recommendation whatsoever'.[36] The Suttons had used this method of attracting business—offering free inoculation of the poor—in exchange for an agreement to inoculate all private patients within a particular parish. It is not known how this operated in

[28] Woodville, *History*, p. 350.
[29] *St James Chronicle*, 9 Feb. 1768.
[30] *Public Advertiser*, 21 April 1769.
[31] Ibid., 20 Oct. 1772.
[32] *Daily Advertiser*, 1 Oct. 1777.
[33] Dimsdale was an influential physician who practised Suttonian inoculation among wealthy families, including that of Catherine the Great, who conferred a barony on Dimsdale as a result of the successful inoculation of her son. See Fox, *Dr John Fothergill*, pp. 79–98.
[34] Abraham, *Lettsom*, p. 195, n. 2.
[35] Brunton, 'Pox Britannica', p. 155.
[36] *Morning Herald*, 6 Feb. 1783.

London—perhaps through agreements with parish authorities to inoculate workhouse occupants at a set a fee, and allowing the poor of the parish to be inoculated free.[37] In 1785 Robert and William Sutton placed the following advertisement in a London newspaper:

> Mess. Sutton (Father and Son) of Charlotte Street . . . continue the practice of Inoculation in London, and to the distance of twenty miles around it . . . they have never lost a single patient in fifteen years practice, during which time they have inoculated several thousand persons . . . Their medicines for the small-pox are sold, wholesale and retail, at their house, no. 96 Charlotte Street . . . in Five Shilling packets, with full instructions that will enable parents to inoculate their families without any other assistance. N.B. The poor are inoculated gratis.[38]

The importance of this advertisement is not just the account of the Suttons' practice of inoculation in London, but the way it had become popularized through the sale of medicines and advice enabling family self-inoculation. The sale of medicines both wholesale and retail suggests that inoculation was being practised by non-professionals, which we will see later consisted not only of parents, but other amateur inoculators with a range of different occupations. Competition between amateurs and professionals had driven down the price of inoculation in rural areas, particularly where general inoculations were carried out.[39] Given the more gradual uptake of inoculation in London, it remained a major market, perhaps accounting for Robert Sutton Senior's move to London in 1783.

In 1786, Daniel Sutton advertised in London newspapers that he was practising at a General Inoculation Dispensary, both inoculating patients and giving a series of practical lectures on inoculation.[40] In April 1788 he and his brothers were described as being 'very eminent in the practice', two of whom, including Daniel, were active in London.[41] He claimed in 1796 that there were 'near one hundred thousand instances of inoculation in which I have been immediately employed, or have some concern, in consultation with others'.[42]

Daniel Sutton continued to live and work in London,[43] dying in Hart Street, Bloomsbury Square, in February 1819.[44] In a short obituary in the March issue of the *Gentleman's Magazine* he was credited with having carried out inoculation 'to an immense extent, with extraordinary success at Ingatestone, and subsequently in the Metropolis'.[45] Likewise, an obituary in Gorton's *Biographical Dictionary* stated that Sutton had 'settled first at Ingatestone, Essex, and afterwards in London, where he was very successful'.[46] No exact numbers are available of the number of children that the Suttons inoculated in London, although Lipscomb claimed in

[37] Robert Sutton died in Norfolk in April 1788; *Felix Farley's British Journal*, 26 April 1788.
[38] *Morning Post*, 15 Feb. 1785.
[39] Razzell, *Conquest*, pp. 67–9.
[40] *Morning Herald*, 9 Jan. 1786; *Morning Post* and *Daily Advertiser*, 25 Oct. 1786.
[41] Smith, *Speckled monster*, p. 90.
[42] Sutton, *Inoculator*, p. viii.
[43] See the *Star*, 1 June 1798, where a father describes in detail the successful inoculation by Sutton of his three children. Daniel Sutton placed an advertisement in the *Morning Post* on 17 Feb. 1807, stating that 'Cowpox [Was] No Security Against Small-Pox'. He claimed that he had been able successfully to inoculate patients who had been previously vaccinated, offering to waive his usual fees in cases of failure.
[44] *Gentleman's Magazine*, 89, 1 (1819), p. 281.
[45] Ibid.
[46] Gorton, *Dictionary*, vol. II, p. 975.

1806 that the family had in total 'inoculated more than five hundred thousand persons'.[47] The Suttons had been so successful in carrying out inoculation, and their methods had become so influential in the late eighteenth and early nineteenth century, that a Parliamentary Bill in 1808 referred to 'the Suttonian inoculation' in order to distinguish it from 'cowpox inoculation'.[48]

IV

The improvement in inoculation made by Daniel Sutton influenced the practices of the London Smallpox Hospital. The hospital began to inoculate children under seven as out-patients in March 1771, placing the following advertisement in the *Public Advertiser*:

> As no Patient is admitted into the House of the Hospitals for Small-Pox and Inoculation, under the Age of seven Years, and some of the Governors being willing to give the Benefit of Inoculation to those of the Poor, who may desire it, tho' not so old. Notice is hereby given that they may be inoculated by the Physician of the said Hospitals, be under his Care, and have Medicines gratis provided they apply at their House in Cold Bath Fields, or at Pancras, when they will be informed how to proceed.[49]

The hospital appealed for more charitable donations, explaining the reasons for its change of practice, stating that 'the Governors of this Charity being more and more convinced, by daily Experience of its great Utility, from the Disposition which now generally prevails in favour of Inoculation'.[50] According to Squirrell, apothecary to the hospital, 'Dr Archer, who had been physician to that institution for more than twenty years . . . had inoculated about 20,000 patients, besides the great number that he was daily in the habit of inoculating at the hospital, and who were called out-door patients. His private practice . . . also [amounted] to many thousands more . . .'.[51] Archer continued as physician to the hospital until his death in 1789,[52] indicating that an annual average of about 1,100 out-patient inoculations were carried out on children in the period 1771–89.

The rules of the hospital published in 1786 stipulated that '[a] Person under the Age of Seven Years . . . if brought to the Hospital at *Pancras* any Morning before Nine o'clock, will be inoculated and furnished with medicines, as an Out-Patient, subject to the Directions of the Physicians'.[53] By 1796, the age at which children could be inoculated as out-patients had been reduced to five years, suggesting that children aged six to seven were no longer permitted to be inoculated.[54] It appears that 'out-door' patients did not require a recommendation from a governor of the

[47] Lipscomb, *Manual*, p. 30.
[48] Creighton, *History*, p. 495.
[49] *Public Advertiser*, 9 March 1771.
[50] *Public Advertiser*, 12 April 1771. The hospital stated that for an annual donation of five guineas, a person could become a governor recommending 12 or 13 in-patients for inoculation.
[51] Squirrell, *Observations*, p. 23.
[52] http://munksroll.rcplondon.ac.uk/Biography/Details/119 (entry for Edward Archer).
[53] *Rules and orders* (1786), p. 12.
[54] *Rules and orders* (1796), p. 16. Many poor families refused to attend the hospital for check-ups, for, as Moore, *History*, p. 63, stated, 'it is found difficult to induce poor people to attend their surgeon regularly at the hospital'.

hospital, and Moore, who was hostile towards inoculation, described how 'all who appeared at the gates of the hospital were promiscuously inoculated with the Small Pox, and suffered to wander abroad'.[55]

The overall numbers of inoculations carried out in the hospital were relatively small—there were a total of 47,471 inoculations between 1746 and 1808.[56] The importance of these cases was not so much the numbers involved, but the knowledge that the London poor acquired the benefits of inoculation through its wide practice on out-patient children.

Adult migrants appear to have made use of the hospital when an epidemic threatened. Willan wrote in 1801: 'Patients admitted into the Inoculation-Hospital . . . are mostly persons from the country, who, alarmed on finding some of the inhabitants of the houses where they lodge, or visit, affected with the Small-pox, endeavour to anticipate the disorder by means of inoculation'.[57] No exact numbers are available for adults inoculated in the hospital in the late eighteenth century, but Willan stated that 514 people were admitted as in-patients in 1797, and most of these were probably adults.[58] A total of 1,300 patients were inoculated at the hospital in that year,[59] nearly double the average of those carried out in 1746–1808 (766). This suggests that there was an acceleration in numbers at the end of the century, but it is doubtful that this could account for more than a small proportion of the decline in adult smallpox mortality at this time. Over 16 per cent of all smallpox deaths were among adults over 20 years of age in St Martin's in the period 1752–66, which fell to about 4 per cent in 1775–99. There were about 21,000 smallpox deaths in London in the first period,[60] and if the proportion were similar to that in St Martin's then 16 per cent of these (3,400) would have been adults. The St Mary Whitechapel proportion was of the order of 10 per cent in this period, indicating the number of smallpox deaths was about 2,100. Case fatality rates among adults in London at this time were probably about 25 per cent,[61] suggesting that the vulnerable adult population was between 8,400 to 13,000 people in any one year. Adult inoculation at the hospital probably covered only between 4 and 6 per cent of this vulnerable population—500 of 8,400 to 13,000 people. However, private inoculation of adults was also probably practised in London, further reducing adult smallpox mortality during this period, although the scale of this contribution to the reduction of smallpox is unknown.

As well as the London Smallpox Hospital and dispensaries to be discussed later, there were a number of other institutions that practised inoculation in the eighteenth century. Davenport et al. have mentioned individual workhouses inoculating their children, and the Marine Society inoculated all the boys recruited by them and placed in both the Royal and Merchant Navies.[62] Likewise, the Foundling Hospital made it a standing rule in 1749 that all children should be inoculated before entry.[63] It was not the absolute numbers of inoculations carried out by these

[55] Moore, *History*, p. 250.
[56] Razzell, *Conquest*, p. 96.
[57] Willan, *Reports*, pp. 174, 318 (quotation).
[58] Ibid., p. 141.
[59] Ibid., p. 141.
[60] Razzell, *Conquest*, p. 198.
[61] Ibid., p. 176.
[62] Razzell, 'Did smallpox reduce height?', p. 358.
[63] Creighton, *History*, p. 514.

institutions that were important, but the experience that the ordinary population had of the success of inoculation in preventing attacks of natural smallpox.

The other major medical influence on the practice of inoculation in London was the work of Lettsom and his colleagues. In 1775 they established a London 'society for inoculating the poor in their own homes'.[64] Lettsom described the background to the events leading up to the establishment of the society and its effects as follows:

> to a very useful, and the most numerous part of the [London] community, the advantages resulting from it [inoculation] have hitherto in great measure been lost, either from the confined circumstances of the poor, or from their prejudices against so extraordinary an innovation in practice. At length, however, examples of the dreadful effects of the natural, and the wonderful success of the artificial disease [inoculation], have overcome these ill-founded prejudices, and nothing seemed wanting, to enable the poor to reap the benefit of this practice, but an establishment suited to their condition and circumstances . . . no Institution for that purpose existed here till the year 1775, when the Society for General Inoculation of the Poor was first established . . . The poor, however, though slow in admitting new improvements, and not soon to be reasoned out of self-evident facts, and their willingness to try Inoculation continues to augment with the success of the practice.[65]

This plan was opposed by Dimsdale, on the grounds that 'partial' inoculation of people in their own homes would spread smallpox to vulnerable people.[66] In response to Dimsdale's criticisms, Lettsom and colleagues founded in 1777 a Dispensary for General Inoculation, which provided free inoculation to patients recommended by subscribers. In 1779, Lettsom reported that the Dispensary was 'flourishing', and it was listed in Simmon's *Medical Register* for 1780.[67] Little is known, however, of its long-term success.

Clare, a surgeon living in London, wrote in 1781 that 'Dispensaries for Inoculation are beginning to be provided in this metropolis'.[68] Details of these dispensaries are not available, except for individual advertisements placed in local newspapers. The St Mary-Le-Bone General Dispensary located in Wells Street was founded in 1785, and stated in 1791 that 'a Subscriber of One Guinea annually becomes a Governor, and entitled to one Patient constantly on the Books as well as for Inoculation'.[69] Likewise, the Infant Poor Charity, for Inoculation, and General Dispensary for Relief of the Infant Poor in Wardour Street, Soho, advertised in 1788 that one of its aims was 'to make the advantages of inoculation as general as possible'.[70] The Western Dispensary in Charles Street, Westminster, was established in 1789 'for the Relief of the Sick, Poor, and for Inoculation', and continued in operation until at least 1814.[71]

Watkinson, a medical supporter of inoculation, wrote in 1777 that 'since the year 1755 . . . inoculation, tho' much practised in the country parts of England, made

[64] Lettsom, *Answer*, p. 42.
[65] Lettsom, *Letter*, p. 43.
[66] Razzell, *Conquest*, p. 96.
[67] Brunton, 'Pox Britannica', p. 162.
[68] Clare, *Observations*, p. 55.
[69] *E. Johnson's British Gazette*, 8 May 1791.
[70] *World*, 27 Feb. 1788.
[71] *True Briton*, 29 April 1797; Highmore, *Pietas Londinensis*, p. 303.

no progress in the capital'—but went on to add that 'inoculation has become very fashionable' in London during 'the last four years'.[72] However, Black, a physician and an influential advocate of inoculation, writing in 1781, stated that inoculation 'has made very little progress in London', although this statement may have been made because of his frustration with the slow growth of inoculation in London.[73]

Black opposed Dimsdale's arguments by pointing out that 'in great cities no persons can flatter themselves with hopes of escaping the disease . . . and sooner or later [smallpox] is sure to prowl through every street, lane and alley'.[74] More tellingly, Black observed that 'few physicians Inoculated so many at private houses . . . of the rich and gentry . . . in this city [of London], and its neighbourhood, as [Dimsdale] himself'.[75] Black claimed that as a result of these criticisms, Dimsdale issued a further edition of his work, which concluded with a hope 'that Inoculation may become general at private houses in cities'.[76] Black and allies additionally launched a newspaper campaign criticizing Dimsdale,[77] which included letters from 'A Friend to General Inoculation in London', claiming that Dimsdale had sent his newly edited work 'gratis . . . with uncommon profusion amongst the Medical Gentlemen in London'.[78]

Inoculation in the homes of patients was not only practised by Dimsdale, but by other inoculators operating in London. In 1769 the following advertisement appeared in the *Public Advertiser*:

> The Inoculation at Hackney is removed to another Place: such as are desirous of being accommodated, or of being inoculated at their own Houses in either Town or Country, may please apply, as before, in Mare-street, Hackney, or at no. 36 Throgmorton-street, near the Exchange, London.[79]

The controversy between Dimsdale and Lettsom did not result in the practice of general inoculation in London, but it did further encourage inoculators such as Daniel Sutton and others to practise inoculation on patients who were no longer confined to special isolation hospitals. For example, in 1785, three physicians advertised that they would inoculate in Sydenham, Kent, which was on the outskirts of London, promising 'to attend patients at their own houses, either to Inoculate, or in the natural small-pox'.[80]

However, John Franks, a London surgeon, indicated in 1800 that the London poor continued to resist the practice:

> . . . when small-pox is in a house where there are many children and adults liable to the disease, the proposal to inoculate, gratuitously, all those who are not exempt, is too often disregarded by themselves or relations. It is in vain that we expostulate in these situations, and endeavour to convince them of the non-existence of a double infection [that

[72] Watkinson, *Examination*, p. 28.
[73] Black, *Observations*, p. 2.
[74] Ibid., p. 81.
[75] Ibid., pp. 54, 81.
[76] Ibid., app., p. 2.
[77] See, for example, *Lloyd's Evening Post*, 20 and 24 Aug. 1781.
[78] Ibid., 31 Aug. 1781.
[79] *Public Advertizer*, 20 April 1769.
[80] *Morning Herald*, 10 June 1785. For other examples of private inoculations in 1785, see Whately, 'Case of two children', p. 159.

> inoculated children would later catch smallpox], or of an accumulation of disease; for the contrary opinion is too firmly impressed to be easily obliterated.[81]

Like Black, Franks was probably overstating his case because of the difficulties in establishing general inoculation in London He contested the notion that inoculation spread smallpox, arguing that:

> the increase of mortality from Small-pox [in London] commenced long before the introduction of inoculation; and, that it continued to increase by a regular progression, until, from the prevalence of the practice, a decrease became observable . . . [it] is at present (*id. est.* more than twenty years ago) considerably declining.[82]

This is parallel to the situation in Whitehaven, Cumberland, where the poor were reported to be opposed to inoculation, yet the practice of inoculation reduced smallpox mortality by about two-thirds in the last two decades of the eighteenth century.[83]

V

Much of the evidence for inoculation in London is from indirect sources. In a letter written by Dr C. Dennet in support of vaccination in early 1803, he revealed his own practice of inoculation in London at an earlier period:

> . . . great success . . . attended a very extensive inoculation for the Small-Pox, having inoculated, and seen treated by my father, between six and seven thousand patients . . . [and] those parents who had witnessed the mildness of the disease under my particular treatment, would not permit me to use the Vaccine . . . I vaccinated my last child, and strenuously endeavoured to persuade every parent to have used it, but cannot always prevail.[84]

Similar types of evidence are to be found in the writings of Jenner and his supporters, frustrated by the opposition to vaccination. According to a report in the *Gentleman's Magazine* in 1803, 'Mr Wilberforce observed on the popular prejudice, that out of 100 who had been vaccinated at the Smallpox Hospital, not five would have submitted, had they not supposed it to have been the old-fashioned mode of inoculation'.[85] In fact some of the opposition to vaccination was fuelled by the realization as early as 1800 that it gave a more limited protection against future attacks of smallpox than the old inoculation.[86] In October 1805, a correspondent wrote from London to an Edinburgh journal: 'The many late failures of supposed cowpock to prevent the smallpox have excited in some parts so much clamour among the lower orders of people that they insist upon being inoculated for the smallpox at some of the public institutions'.[87] As a result of this clamour, the London Smallpox Hospital, which had abandoned the inoculation of out-patients, was forced to reinstate it in 1805, before banning it again in 1808.[88]

[81] Franks, 'Letter from John Franks', p. 519.
[82] 'Mr Franks on variolous contagion', pp. 84, 149.
[83] Razzell, *Conquest*, p. xxi.
[84] Dennett, 'Letter from Dr C. Dennett', p. 363.
[85] *Gentleman's Magazine*, 58, ii (1803), p. 71.
[86] 'Letter from physicians and surgeons', p. 187; *Gentleman's Magazine*, 58, ii (1803), p. 71.
[87] Creighton, *History*, p. 589.
[88] Abraham, *Lettsom*, p. 355; Gregory, *Some account*, p. 10.

The popularity of inoculation and hostility towards vaccination were reflected in the number of the two different operations carried out in the hospital: 'At the . . . Hospital the number of vaccinations declined after 1805 from two thousand to sixteen hundred, while inoculations doubled from two to over four thousand five hundred. However, the trend was short-lived. By 1808, vaccination and inoculation were again equally popular'.[89]

In a letter to Lettsom, dated July 1807, Jenner wrote: 'You will be sorry to hear the result of my interview with the Minister, Mr Perceval. I solicited . . . whether it was the intention of government to give check to the licentious manner in which small-pox inoculation is at this time conducted in the metropolis . . . [associated with] the capricious and prejudices of the misguided poor'.[90] Murray, a London physician, pointed out in 1808 that these inoculations were carried out 'in every street, court and alley, in the metropolis'.[91]

The continuing popularity of inoculation in London is revealed by the reports of the Vaccine Establishment in the 1810s. The Board of the Establishment was made up of members of the medical profession who were supporters of Jenner. In the conflict between vaccination and inoculation, the supporters of the former used the continuation of smallpox in London as a basis for attack against inoculation, arguing that the latter was spreading the disease through secondary contagion. This was irrelevant in London, where smallpox affected most native-born Londoners in childhood. In 1811 the report of the Vaccine Establishment concluded:

> The Board are persuaded that the [smallpox] mortality [in 1810] has arisen from contagion having been propagated by inoculation persons, of the poorer classes, whose prejudices against Vaccination are kept alive by false and mischievous hand bills, denouncing various imaginary and feigned diseases against all those who have undergone Vaccination: and the Board has reason to believe, that these bills are issued by persons, in several parts of London, who desire emolument from small pox inoculation.[92]

Likewise in the following year, the Board claimed that 'the increase [in smallpox mortality] we . . . ascribe to the rash and inconsistent manner in which great numbers are still inoculated for the smallpox, and afterwards required to attend two or three times a week, at the place of Inoculation'.[93] This procedure suggests that the plan drawn up by Sutton was still in operation, and continued to influence the medical practice of inoculation in London.

VI

The cost of inoculation inhibited its uptake among the poor,[94] and there were radical changes in its practice which enabled it to become widely available. To understand these it is necessary briefly to explore the history of amateur inoculation in England. It was practised by amateurs in Scotland and Wales even before

[89] Brunton, 'Pox Britannica', p. 202.
[90] Baron, *Life*, pp. 69, 70.
[91] Murray, *Answer*, p. 3.
[92] *Report from the Vaccine Establishment* (1811), p. 2.
[93] *Report from the Vaccine Establishment* (1812), p. 1.
[94] Cooper, *Vaccination*, p. 51.

it was introduced by the medical profession in 1721.[95] Amateur inoculation was also practised in Devon by itinerant inoculators in the early 1760s,[96] but there appears to have been an upsurge after the innovations introduced by Daniel Sutton. According to the resident surgeon of the Foundling Hospital in London in 1768, 'very great success has likewise attended inoculation in many parts of this kingdom: even though it has of late descended into very illiterate hands (a livery servant, belonging to a friend of the author's left his master's service, not a great while since, to practice inoculation)'.[97]

In a somewhat humorous letter written on 4 March 1768 to the *Chelmsford and Colchester Chronicle*, it was stated that:

> All the villages in our neighbourhood [in Northamptonshire] are at present under inoculation. We have a great variety of practitioners, from the pompous Tye-Wigg down to the greasy night Cap; even boys of seven or eight years perform the operation for a halfpenny a-piece, and succeed surprisingly . . . Giles Wilcox, the sowgelder, who lives near the pinfold, is by far the most in vogue. What the method is I cannot learn, but 'tis said to be preferable to the Suttonian or any other wholesale operator we have yet seen.[98]

William Buchan in the 1769 edition of his *Domestic medicine* recommended that 'should all other methods fail, we would recommend it to parents to perform the operation [of inoculation] themselves . . . I have known many instances even of mothers performing the operation'.[99]

Dimsdale in 1776 acknowledged the successful role of non-professional inoculators, stating that 'many instances can be produced, where whole parishes of poor have been inoculated, and have succeeded very well, under the care of persons who were totally unacquainted with medicine'.[100] In 1782, an anonymous author published a letter in which he stated that 'I have known many instances of mothers performing the operation, and never heard of one bad consequence . . . Common mechanics have often, to my knowledge, performed the operation, with as good success as physicians'.[101] Clare, the surgeon, published a similar letter in the same year justifying parental inoculation, claiming that unlike the inoculation practised by Dimsdale and other medical professionals, 'preparation is unnecessary, and that it has frequently proved detrimental'.[102] Buchan in the 1797 edition of his *Domestic medicine* concluded that 'of late many [mothers] . . . have performed this operation [of inoculation] with their own hands; and as their success has been equal to that of the most dignified inoculators, there is little reason to doubt that the practice will become general'.[103]

Inoculation continued to be practised by amateurs well into the nineteenth century, by farmers, knife-grinders, fishmongers, whitesmiths, blacksmiths,

[95] Razzell, *Conquest*, pp. 7, 8. One account described how itinerant gypsies travelled Wales carrying the smallpox matter 'in a Quill, and scratched the Arm with a Pin or Needle', anticipating modern techniques of vaccination. See *St James's Chronicle*, 18 Sept. 1781.
[96] Razzell, *Conquest*, p. 69.
[97] Watson, *Account*, pp. 71, 72.
[98] *Chelmsford and Colchester Chronicle*, 4 March 1768.
[99] Buchan, *Domestic medicine*, p. 267.
[100] Dimsdale, *Thoughts*, pp. 63–4.
[101] *Parker's General Advertiser*, 2 July 1782.
[102] Ibid., 19 Sept. 1782.
[103] Buchan, *Domestic medicine*, p. xvii.

paupers, nurses, farriers, publicans, tailors, shoemakers, and parents.[104] The medical profession was usually scathing of these amateur operators, but the latter were largely responsible for simplifying the operation to a format very similar to vaccination,[105] achieving very successful results.[106] Physicians and medical practitioners insisted on long periods of preparation, which included bleeding, purging, and the use of a special diet, as well as expensive aftercare, whereas amateur inoculators dispensed with these unnecessary extras.[107] The practices of the medical profession were in fact dangerous, not only through the risk of secondary infection through the bleeding of patients, but also exposing those inoculated to the risk of natural smallpox during the period of preparation.

In 1818 the report of the Vaccine Institute included the following account of the activities of amateur inoculators in London:

> The pernicious practice of Small Pox Inoculation . . . is now performed for gain, by itinerant Empirics, Farriers, Publicans, Nurses, low cunning people of both sexes, and of various descriptions. And such is the infatuation of the poor and ignorant, that many of them carry their infants to be inoculated by those [carrying out this practice] . . . this iniquitous conduct prevails much in London . . . Complaints of the same injurious practices have been sent to the Board from various parts of England . . .[108]

Itinerant inoculators probably played a major role in providing inoculation in London, which represented a significant market for their operations, and their practice grew from the date of the Suttonian innovations in the 1760s.[109] There is also evidence that the London Smallpox Hospital played a part in the amateur practice of inoculation, not only through the provision of out-patient inoculation, but also the supply of smallpox virus to non-professionals. In 1808, the hospital's committee 'received a communication from their president . . . recommending them to rescind the practice of the delivery of lancets, charged with variolous matter, indiscriminately, and an ensuing court [of the hospital] restricted this practice to physicians and surgeons'.[110] This seems to have been associated with the provision of inoculation to out-patients, for the hospital's committee noted 'that of all cases which applied, the medical officers succeeded with fifty only in recommending vaccination; and more than two hundred others refused to listen to any explanation or argument; and declared, that if their children were not inoculated with smallpox, they should take their chance'.[111]

This use of inoculation by the ordinary population appears to have threatened the medical profession, resulting at times in almost a state of class war. In a letter to James Moore on 26 February 1810, Jenner wrote referring to the year 1807 that 'John Gale Jones . . . had once the impudence to desire a man to call on me in Bedford Place to say, that he, Jones, would advise me immediately to quit London,

[104] Dimsdale, *Thoughts*, pp. 62, 63; Cross, *History*, pp. 13, 269, 272; Forbes, 'Some account', pp. 213, 219, 220; Carter, 'General report', p. 268.
[105] See, for example, Sinclair, *Statistical account*, pp. 569–71.
[106] Dimsdale, *Thoughts*, p. 63; Razzell, *Conquest*, pp. 35, 107, 108.
[107] Razzell, *Conquest*, pp. 35, 36.
[108] *Report from the Vaccine Establishment* (1818), p. 3.
[109] Razzell, *Conquest*, pp. 68–70.
[110] Highmore, *Pietas Londinensis*, p. 303.
[111] Ibid., p. 303.

for there was no knowing what an enraged population might do'.[112] Gale Jones was a surgeon and apothecary, who was a political radical—he had been a leading member of the London Corresponding Society[113]—and his threat to Jenner suggests that the differences between the supporters of vaccination and inoculation had become associated with the class hostilities that emerged at the beginning of the nineteenth century.[114]

Jenner's biographer, John Baron, confirmed this in 1822: 'In consequence of the adoption of vaccination by most respectable medical men, many of the lower classes took up the small-pox lancet'.[115] In fact, as we saw from Wilberforce's comment on the support in London for the old inoculation, the potential for opposition to vaccination existed before its advent at the beginning of the nineteenth century. In 1812 the Vaccine Establishment lamented that the take-up of vaccination in London lagged badly behind its practice in other towns and cities, particularly abroad, a conclusion confirmed by Baron in his biography of Jenner.[116]

The physician to the Smallpox Hospital, Dr George Gregory, in discussing in 1830 the pattern of smallpox in London during the eighteenth century, summarized the practice of inoculation in the late eighteenth century: 'the Small Pox Hospital was established [in 1746] . . . From that date, Inoculation for the Small Pox began to be generally adopted by all classes of persons throughout England, and the success of the practice at this Hospital was very instrumental in promoting the measure'.[117]

VII

There is no direct evidence of the impact of inoculation on smallpox in London, and there are no reliable statistical data on the extent of the practice of inoculation. Evidence from the London Bills of Mortality is not wholly reliable, but it gives an indication of the long-term pattern of mortality.[118] Davenport et al. have calculated mortality rates from their parish sources and the Bills of Mortality, but these are mainly based on the number of smallpox deaths as a proportion of the total number of all-cause burials. As smallpox was mainly a disease of very young children, it is more appropriate to express the number of smallpox deaths as a proportion of the number of baptisms. The trend of this latter ratio in St Martin's depicted in figure 4a of 'The decline of adult smallpox' is very different from that found in the whole of London according to the Bills of Mortality.[119]

According to table 6, mortality in London as a whole began to fall in the 1770s, halving between 1760 and 1809. Some of this fall in mortality was due to the gradual elimination of adult smallpox, but the latter probably only accounted for

[112] Jenner, cited in Baron, *Life*, pp. 367, 368.
[113] *Morning Chronicle*, 1 July 1799; 22 Feb. 1810.
[114] See Thompson, *Making*.
[115] Baron, *Life*, p. 193.
[116] *Report from the Vaccine Establishment* (1812), p. 3; Baron, *Life*, p. 10.
[117] Gregory, *Some account*, pp. 6, 7.
[118] See P. Razzell, 'Infant mortality in London, 1550–1850: a methodological study', unpub. paper.
[119] Razzell, *Conquest*, p. 198. Davenport et al. have also highlighted the introduction of vaccination at the beginning of the 1800s, but from evidence reviewed in this article inoculation was probably more prevalent in London than vaccination in the following decade.

Table 6. *Smallpox mortality in London, 1740–1809*

Period	*Smallpox burials per 100 baptisms*
1740–9	13.7%
1750–9	13.3%
1760–9	13.8%
1770–9	12.1%
1780–9	9.6%
1790–9	8.9%
1800–9	6.9%

Source: Razzell, *Conquest*, p. 198.

Table 7. *Smallpox mortality in St Mary Whitechapel, 1760–1812*

Period	*No. of smallpox deaths under 10*	*No. of baptisms*	*Child mortality rate from smallpox per 1,000 baptisms*
1760–9	803	7,401	108
1770–9	492	7,977	62
1780–9	517	7,724	67
1790–9	462	7,915	58
1800–9	448	7,267	62
1810–12	116	2,235	52

Source: LMA, St Mary Whitechapel parish registers, P93/MRY1/062-64.

about a fifth of the total reduction.[120] The Whitechapel data (table 7) allow us to express child smallpox deaths as a proportion of baptisms, which is perhaps a more accurate measure of changing smallpox mortality, although for a much more limited sample.[121]

The fall in child smallpox mortality was much less linear in Whitechapel than in London as a whole, and this is probably the result of sample size and the characteristics of an individual parish. Nevertheless, child mortality halved in Whitechapel between 1760 and 1812, similar to the reduction depicted for the whole of London in table 6. The reduction in mortality occurred at a time when smallpox was becoming more virulent, with case fatality rates at the London Smallpox Hospital increasing from 26 per cent in 1746–63 to 38 per cent in 1836–51.[122] The fall in mortality in 1760–1812 coincides with the increasing practice of inoculation, including the decade of 1800–9 when inoculation was probably more popular in London than vaccination.

[120] The fall in adult mortality according to the St Martin's and St Mary Whitechapel data was about 10% of all smallpox deaths, whereas the reduction of overall smallpox mortality in tab. 4 was approximately 50% between 1760 and 1809.

[121] All parish register data are subject to a degree of uncertainty because of the under-registration of births and deaths. New research using a number of different methods of measuring parish register reliability in London suggests that about a quarter of all births and deaths were unregistered in the eighteenth century, although this varied significantly from parish to parish, probably as a result of clerical negligence. See Razzell and Spence, 'History', pp. 279–82, and Razzell, 'Infant mortality'.

[122] Razzell and Spence, 'History', p. 176. This was a part of a long-term increase in virulence, with under 4% of children dying from smallpox in London in the sixteenth century, increasing to over 45% among unprotected London children in the 1880s. See Razzell, *Conquest*, pp. 168, 169; Forbes, *Chronicle*; Hovenden, ed., *Register*.

The increasing use of inoculation explains the age shift of smallpox deaths in London at the end of the eighteenth century. Both inoculation and vaccination were neglected until the threat of an epidemic, described by the Royal College of Physicians as follows: 'Unless . . . from the immediate dread of epidemic Smallpox, neither Vaccination nor Inoculation appear to have been general, and when the cause of the terror has passed by, the Public have relapsed again into a state of indifference and apathy, and the salutary practice has come to a stand'.[123] Davenport et al. have pointed out that epidemics of smallpox peaked 'every two to three years' in London during the late eighteenth century, although smallpox was present in every year in the city during this period.[124] It would be during these peak periods that inoculation was mainly carried out, concentrating on the young children not previously infected. General inoculations shifted the age incidence of smallpox from adults to children in rural areas, and it is likely that inoculation accounts for changes in the age of children dying from the disease in London. As we have seen, there is uncertainty about the exact change in the ages of children dying from smallpox, but the practice of inoculation would account for the increasing concentration of the disease among children aged five and under.

VIII

Davenport et al. have established a significant new finding on the history of smallpox, stimulating scholarship and requiring novel thinking in order to explain the decline of adult smallpox in London. On the balance of evidence, it appears that there was no increase in the infectiousness of smallpox, but that there was a growth in the practice of inoculation in London during the latter half of the eighteenth and the beginning of the nineteenth century. The spread of the practice probably occurred gradually in London between 1760 and 1812, which is consistent with the changing age patterns of the disease in Whitechapel and the overall decline of childhood smallpox mortality in the same period. The evidence also suggests that there was widespread resort to general inoculations in the provincial areas of southern England, which were the main reservoirs of adult smallpox in London. The elimination of smallpox from these areas and the gradual reduction of childhood smallpox resulting from the practice of inoculation are the most plausible explanations for the changing age patterns of smallpox mortality in London.

There is a parallel between the development of medical and industrial technologies during this period. Most of the improvements in inoculation were made by 'empirics', such as Daniel Sutton and the various amateur inoculators who simplified and improved techniques of inoculation.[125] Likewise, many of the improvements in industrial technology were made by men without academic qualifications, such as Arkwright, Hargreaves, and Trevithick.[126] All these innovators were practical men relying on empirical observation to increase the profitability of their operations in a growing capitalist economy. Physicians and surgeons

[123] *Report of the Royal College of Physicians*, p. 7; see also Razzell, *Conquest*, p. 73.
[124] Davenport et al., *Decline*, p. 1290.
[125] There is evidence that early vaccination was a form of attenuated smallpox identical to a radically simplified form of inoculation; Razzell, *Edward Jenner*.
[126] Weightman, *Industrial revolutionaries*.

were often hampered by their theoretical notions which were not empirically based, but provided them with a monopoly of classical knowledge, enhancing their prosperity until challenged by the Suttons and other 'empirics'.

These conclusions will have to be assessed through future research, but Davenport et al. have provided evidence for a major change in disease incidence and medical practice. The elimination of smallpox is one element in a process of change, forming part of the relationship between medical, demographic, and economic development in the eighteenth century, transforming English society in its economic, social, and political structure.[127]

Date submitted *8 December 2010*
Revised version submitted *27 January 2011*
Accepted *29 March 2011*

DOI: 10.1111/j.1468-0289.2011.00620.x

[127] Razzell, *Population and disease.*

Footnote references

Abraham, J. J., *Lettsom: his life, times, friends and descendants* (1933).
Baron, J., *Life of Edward Jenner*, vol. 2 (1838).
Barron, W. A., 'Gleanings from Sussex archives: Brighton and the smallpox', *Sussex County Magazine*, 26 (1952), pp. 605–6.
Beddoes, T., 'Queries respecting a safer method of performing inoculation', in D. A. de Gimbernat, *A new method for the general hernia* (1795), pp. 56–9.
Black, W., *Observations medical and political on the small pox and inoculation* (1781).
Brunton, D. C., 'Pox Britannica: smallpox inoculation in Great Britain, 1721–1830' (unpub. Ph.D. thesis, Univ. of Pennsylvania, 1990).
Buchan, W., *Domestic medicine: or a treatise on the prevention and cure of diseases by regimen and simple medicines* (1769).
Carter, H. W., 'General report of medical diseases treated at the Kent and Canterbury Hospital, 1824', *London Medical Repository*, 18 (1822), pp. 267–9.
Clare, P., *Observations on the nature of treatment of the variolous abscess, with remarks on the modern practice of inoculation, and a review of the principal writers on that important subject . . . In a letter to Dr Buchan* (1781).
Cooper, J., *Vaccinated vindicated, or an Address to the people of England, upon the important subject of vaccine inoculation, with remarks on the necessity, in its behalf, of legislative and clerical interference* (1811).
Creighton, C., *A history of epidemics in Britain*, II, *From the extinction of the plague to the present time* (Cambridge, 1965).
Crookshank, E. M., *History and pathology of vaccination*, vol. 2 (1889).
Cross, J., *A history of the variolous epidemic which occurred in Norwich* (1820).
Davenport, R., Schwarz, L., and Boulton, J., 'The decline of adult smallpox in eighteenth-century London', *Economic History Review*, 64 (2011), pp. 1289–314.
Dennett, C., 'Letter from Dr C. Dennett, Soho Square, January 22', *Medical and Physical Journal*, 5 (1800), pp. 363–4.
Dimsdale, T., *Thoughts on general and partial inoculations* (1776).
Forbes, J., 'Some account of the small-pox lately prevalent in Chichester and its vicinity', *London Medical Repository*, 18 (1822), pp. 208–20.
Forbes, T. R., *Chronicle from Aldgate* (New Haven, Conn. 1971).
Fox, R. H., *Dr John Fothergill and his friends: chapters in eighteenth century life* (1919).
Franks, J., 'Letter from John Franks, Smith Street, Westminster, November 7, 1800', *Medical and Physical Journal*, IV (1800), pp. 518–21.
Gorton, J., *A general biographical dictionary*, vol. 2 (1828).
Gregory, G., *Some account of the hospital for small pox & vaccination, at Battle Bridge, St Pancras* (1830).
Highmore, A., *Pietas Londinensis: the history, design, and present state of the various public charities in and near London* (1814).
Hovenden, R., ed., *The register of christenings, marriages and burials of the parish of Allhallow London Wall, 1559–1675* (1878).
Howlett, J., *An examination of Dr Price's essay on the population of England and Wales* (Maidstone, 1781).

'Letter from physicians and surgeons', *Medical and Physical Journal*, 4 (1800), p. 187.
Lettsom, J. C., *A letter to Sir Robert Baker and George Stacpole Esq. upon general inoculation* (1778).
Lettsom, J. C., *An answer to Baron Dimsdale's review of Dr Lettsom's Observations* (1779).
Lipscomb, G., *A manual of inoculation* (1806).
Mercer, A., *Disease, mortality and population in transition* (Leicester, 1990).
Miller, G., *The adoption of inoculation for smallpox in England and France* (Philadelphia, Pa., 1957).
Moore, J., *The history of the smallpox* (1815). http://munksroll.rcplondon.ac.uk/Biography/Details/119 (entry for Edward Archer, accessed 29 Jan. 2011).
'Mr Franks on variolous contagion', *Medical and Physical Journal*, 5 (1801), pp. 81–6.
Murray, C., *An answer to Mr Highmore's objections to the bill before Parliament to prevent the spreading of the infection of the small-pox* (1808).
Razzell, P., *Edward Jenner's cowpox vaccine: the history of a medical myth* (Firle, 1977).
Razzell, P., 'Did smallpox reduce height?', *Economic History Review*, LI (1998), pp. 351–9.
Razzell, P., *The conquest of smallpox: the impact of inoculation on smallpox mortality in eighteenth century Britain* (2003).
Razzell, P., *Population and disease: transforming English society, 1550–1850* (2007).
Razzell, P., 'Infant mortality in London, 1550–1850: a methodological study', submitted to *Local Population Studies*.
Razzell, P. and Spence, C., 'The history of infant, child and adult mortality in London, 1550–1850', *London Journal*, 32 (2007), pp. 271–92.
Report from the Vaccine Establishment (1811).
Report from the Vaccine Establishment (1812).
Report from the Vaccine Establishment (1818).
Report of the Royal College of Physicians of London on vaccination (1807).
Rules and orders of the hospitals for the small-pox and inoculation (1786).
Rules and orders of the hospitals for the small-pox and inoculation (1796).
Sinclair, J. *The statistical account of Scotland: drawn up from the communications of the ministers of the different parishes*, vol. II (1792).
Sköld, P., *The two faces of smallpox: a disease and its prevention in eighteenth and nineteenth-century Sweden* (Umeå, 1996).
Smith, J. R., *The speckled monster* (Chelmsford, 1987).
Squirrell, R., *Observations addressed to the public in general on the cow-pox* (1805).
Sutton, D., *The inoculator; or, Suttonian system of inoculation* (1796).
Thompson, E. P., *The making of the English working class* (1963).
Watkinson, J., *An examination of a charge brought against inoculation* (1777).
Watson, W., *An account of a series of experiments instituted with a view of ascertaining the most successful method of inoculating the smallpox* (1768).
Weightman, G., *The industrial revolutionaries: the making of the modern world, 1776–1914* (2007).
Whately, T., 'The case of two children who received the smallpox by inoculation', *Memoirs of the Medical Society of London*, 5 (1799), pp. 159–64.
Willan, R., *Reports on the diseases in London, particularly during the years 1796, 97, 98, 99, and 1800* (1801).
Woodville, W., *The history of inoculation of the smallpox in Great Britain* (1796).