

## SMALLPOX IN LONDON: FACTORS IN THE DECLINE OF THE DISEASE IN THE NINETEENTH CENTURY

by

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THE decline of smallpox in Britain in the nineteenth century has long been recognized as a feature of the history of mortality in that period. The Royal Commission on Smallpox and Fever Hospitals of 1882, for example, traced the beginnings of this decline as far back as the 1780s.<sup>1</sup> Contemporaries, and historians subsequently, generally accepted that vaccination and its variants were the cause of the decline. Peter Razzell has suggested that "virtually all of the population" in the first half of the nineteenth century was protected by either vaccination or inoculation.<sup>2</sup> Others are more cautious: Thomas McKeown, with reservations, appears to accept the view of "most epidemiologists" that vaccination was responsible for the decline of the disease.<sup>3</sup> Gwendoline Ayers noted that while the "ebb of classical smallpox" in England can be traced as a long-term decline with peaks, the reasons for its final disappearance as a native disease have been "variously and incompletely assessed".<sup>4</sup> Cyril Dixon, in his authoritative *Smallpox*, is even more cautious, seeming to suggest a decline in the virulence of the native smallpox strain, followed, in the early years of the twentieth century, by the emergence on the American continent of a very mild strain of the disease, *variola minor*, which eventually superseded the more deadly, and hitherto dominant, *variola major*.<sup>5</sup> More recently, Stuart Fraser has described smallpox prevention in Leicester, "probably the first" community in which "measures other than vaccination were introduced successfully to eradicate the disease".<sup>6</sup>

Three elements can thus be discerned in attempting to explain the decline of the disease. First, variations in the virulence of the virus strain; second, vaccination; third, measures other than vaccination taken to control the spread of the disease. Of these, the question of virulence must in the first instance be important, even though the long confusion of smallpox and chickenpox makes accuracy difficult.<sup>7</sup> Razzell, following

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<sup>1</sup> Royal Commission on Smallpox and Fever Hospitals, Parliamentary Papers (PP), 1882, XXIX, p. vii. The figures were calculated by William Farr: for John Simon. See also, F. B. Smith, *The people's health*, London, Croom Helm, 1979, p. 156.

<sup>2</sup> Peter Razzell, 'Population change in eighteenth-century England', *Econ. Hist. Rev.*, 2nd series, 1965, 8: 312.

<sup>3</sup> Thomas McKeown, *The modern rise of population*, New York, Academic Press, 1976, p. 99.

<sup>4</sup> Gwendoline Ayers, *England's first state hospitals*, London, Wellcome Institute, 1971, p. 115.

<sup>5</sup> W. Dixon, *Smallpox*, London, Churchill, 1962, pp. 203-215.

<sup>6</sup> Stuart Fraser, 'Leicester and smallpox', *Med. Hist.*, 1980, 24: 315-332, p. 324.

<sup>7</sup> Dixon, *op. cit.*, note 5 above, pp. 187, 197.

on the work of McVail in 1919, observes a “gradual but highly significant increase in the virulence and case-fatality rate of smallpox from the late seventeenth through to the end of the nineteenth century”.<sup>8</sup> Creighton, in 1894, remarked on a similar pattern, although he saw the increase as beginning in the late seventeenth century, and the epidemic of 1837–40 as “the last in England which showed smallpox in its old colours”.<sup>9</sup> The Royal Commission on Vaccination, in its Final Report of 1896, declared the generally accepted contemporary view to be that “smallpox, introduced from the East”, began to be common in Western Europe during the fifteenth century, though perhaps existing still earlier, that it increased during the sixteenth and seventeenth centuries, and was very prevalent in the eighteenth century.<sup>10</sup> From their study of the London Bills of Mortality, the Commissioners concluded that although the disease was endemic in the capital in the eighteenth century, it retained an epidemic character, the returns in some years being much greater than in others.<sup>11</sup> The Commissioners were well aware of the drawbacks of the Bills as a statistical source,<sup>12</sup> but they claimed also to have learnt from “the incidental elements of various authors” that the fatality of the disease varied much in different years: epidemics were often spoken of as being either mild or malignant; in some epidemics many people were attacked, and the proportion of deaths was small; in others the disease was fatal to a large number of those attacked.<sup>13</sup>

The general consensus suggests that smallpox was not originally a native disease in England, although opinion varies as to the period at which the disease became endemic. Razzell, for example, accepts that smallpox was a young child’s disease, and therefore “more or less endemic” in most large towns by the early seventeenth century,<sup>14</sup> while Dixon is more wary of the evidence which Razzell accepts.<sup>15</sup> Certainly, smallpox was by no means only a child’s disease at this time. By the late seventeenth century also, contemporaries were observing that smallpox was markedly more fatal than in the past.<sup>16</sup> Recent medical research, discussed in detail by Razzell, indicates the existence of a variety of smallpox viruses, varying in virulence and with specific regional character.<sup>17</sup> Razzell suggests that, “The most likely explanation of the increase in fatality is that more virulent strains of smallpox were being introduced into the country with the growth of world trade. . . . With the growth of world trade, virulent viruses would drive out the less virulent ones . . .”.<sup>18</sup> These findings are of interest in the light of past observations: Dixon, for example, noting that “from 1695–1710 smallpox was at a low ebb”, remarks that, “as Creighton suggests, a state of war in Europe on more than one occasion produced a low incidence [of the disease]

<sup>8</sup> P. Razzell, *The conquest of smallpox*, Fittle, Sussex, Caliban Press, 1977, pp. 127–128; J. McVail, *Half a century of smallpox and vaccination*, Edinburgh, E. & S. Livingstone, 1919, p. 19.

<sup>9</sup> C. Creighton, *History of epidemics in Britain*, 2nd ed., London. Frank Cass, 1965, p. 615.

<sup>10</sup> *Royal Commission on Vaccination, Final report*, PP. 1896, XLVII, pp. 903–904.

<sup>11</sup> *Ibid.*, p. 905.

<sup>12</sup> *Ibid.*, pp. 904–905.

<sup>13</sup> *Ibid.*, p. 905.

<sup>14</sup> Razzell, *op. cit.*, note 8 above, pp. 113–114.

<sup>15</sup> Dixon, *op. cit.*, note 5 above, p. 192.

<sup>16</sup> *Ibid.*, p. 193.

<sup>17</sup> Razzell, *op. cit.*, note 8 above, pp. 34–35.

<sup>18</sup> *Ibid.*, p. 135.

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in England. This supports the view that smallpox was frequently being imported into the country. . . ."<sup>19</sup>

Although the origins of smallpox are unknown,<sup>20</sup> the evidence seems to suggest that the "native" or established strain of the disease in England, and perhaps in Europe, was a mild one. The gradual increase in virulence until 1870 charted by McVail and by Razzell may thus be associated with the greater mobility of goods and population which developed within and beyond Europe from the later fifteenth century. Throughout the eighteenth century, for example, the "native" strain of the disease in England was probably constantly refreshed from outside. By the 1780s, however, the fatality of the disease may have been mitigated by widespread inoculation,<sup>21</sup> while difficulty of travel and trade dislocation consequent on war in Europe and on the high seas may have interrupted the introduction of severer strains. Dixon notes that large-scale outbreaks of the disease only began to re-occur in 1817–19.<sup>22</sup> During the first half of the nineteenth century, generally, the smallpox strain present in Europe seems to have been a very mild one. Except during the epidemic of 1837–40 the smallpox mortality rate per thousand living fell (Table 1), although the case-fatality rate, as shown in the record of the London Smallpox Hospital, rose (Table 2). Nevertheless, observers from the mid-century on looked back to the relative mildness of the disease in these years.

TABLE 1: SMALLPOX MORTALITY RATE, 1771–1880<sup>23</sup>

<i>Period</i>	<i>Per thousand living</i>
1771–80	5
1801–10	2
1811–35	0.83
1837–40	2.3
1841–50	0.40
1851–60	0.28
1861–70	0.28
1871–80	0.46

TABLE 2: CASE-FATALITY RATE AT LONDON SMALLPOX HOSPITAL<sup>24</sup>

<i>Period</i>	<i>Total Cases</i>	<i>Percentage Deaths</i>
1746–63	6456	25½
1776–1800	7017	32
1836–51	2654	38

By the later 1850s, however, there were signs of a change: the disease was apparently gaining in virulence. Dr Munk, of the London Smallpox Hospital, told the Royal Commission in 1882 that each successive smallpox epidemic in the nineteenth century had been more severe, with a greater case-mortality:<sup>25</sup> the London medical

<sup>19</sup> Dixon, *op. cit.*, note 5 above, p. 195.

<sup>20</sup> *Ibid.*, p. 188.

<sup>21</sup> Razzell, *op. cit.*, note 8 above, Chapter 9; Dixon, *op. cit.*, note 5 above, p. 197.

<sup>22</sup> *Ibid.*

<sup>23</sup> Royal Commission on Smallpox and Fever Hospitals, PP. 1882, XXIX, pp. vii, 320.

<sup>24</sup> Razzell, *op. cit.*, note 8 above, p. 133.

<sup>25</sup> PP. 1882, XXIX, p. 261.

officers of health, appointed in 1855, were quick to note the change in the character of the disease. The MOH for St. James's, Westminster, for example, noted that the epidemic of 1860–1 was "one of the greatest attacks of smallpox that has been known since the days of Jenner".<sup>26</sup> His colleague for Mile End Old Town recorded that the disease has been "so long in abeyance" that, "we had almost ceased to look upon its existence as a matter of moment".<sup>27</sup> These reactions may have been based on the fact that, in this epidemic, the eruption was generally semi-confluent; the case-mortality was apparently low.<sup>28</sup> Nevertheless, there was a significant change from the "comparatively rare and mild disorder" evoked by John Syer Bristowe in 1858.<sup>29</sup> The report of the London Smallpox Hospital for 1864 stated the epidemic of 1862–3 to be the "severest in the memory of the present generation" in respect of both numbers of cases and their severity and fatality-rate; in 1866, both the number of cases admitted and their mortality were even greater.<sup>30</sup>

The reappearance of a more fatal form of smallpox helped to dispel any illusions contemporary medical observers might have had as to the practicality of eradicating the disease solely through universal vaccination. When vaccination was originally introduced, it had been asserted that it gave the same protection as inoculation, without the danger of spreading the disease.<sup>31</sup> It appeared to offer a simpler and surer method of exterminating smallpox than the isolation methods advocated by Haygarth and others at the end of the eighteenth century, and these consequently were abandoned, while vaccination became the "State-adopted" method of dealing with the disease.<sup>32</sup> Already in the 1830s, however, public apathy towards the operation was causing concern to interested persons. In his first letter to the Registrar-General, William Farr observed that when the poorer classes did not neglect vaccination altogether, they often deferred it for years, and that vaccination was too long delayed by all classes.<sup>33</sup> In 1848, after the first, voluntary, Vaccination Act, when smallpox was present in many districts across the country, neglect of vaccination was referred to by several registrars, for example at Leicester, Stockport, Wycombe, and Yarmouth.<sup>34</sup> Although the figures for the London Smallpox Hospital show that the percentage of vaccinated individuals among those admitted rose steadily from 32 per cent in 1825 to 72.85 per cent in 1856,<sup>35</sup> these figures are probably misleading as a general guide to the vaccination state of the population, since the element of panic protection in threatened households must be taken into account. John Simon, in his official survey of the subject, noted how the number of vaccinations had fallen off, in

<sup>26</sup> *Medical Officer's Report; St James's, Westminster*, 1862, p. 12. The annual reports of the London Medical Officers of Health are deposited in the GLC History Library, County Hall, London SE1, and are quoted by permission.

<sup>27</sup> *Medical Officer's report: Mile End Old Town*, 1859, p. 7.

<sup>28</sup> *Medical Officer's report: Lambeth*, 1859, p. 12.

<sup>29</sup> *Medical Officer's report: Camberwell*, 1857–8, p. 30.

<sup>30</sup> *Medical Officer's report: Whitechapel*, 1864, appendix, footnote to Table vii.

<sup>31</sup> PP. 1896, XLVII, p. 207.

<sup>32</sup> *Ibid.*

<sup>33</sup> *First annual report of the Registrar-General*, PP. 1839, XVI, appendix, p. 68.

<sup>34</sup> *Eighth annual report of the Registrar-General*, PP. 1847–8, XXV, p. 35. Of fifty deaths in Leicester, for instance, only one showed signs of vaccination.

<sup>35</sup> *Nineteenth annual report of the Registrar-General*, PP. 1857–8, XXIII, appendix, p. 231.

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spite of the 1853 Vaccination Act, since the last epidemic of the disease had passed.<sup>36</sup> The absence of the disease removed any urgency for protection.

Although it is possible that inoculation was widely practised before being made illegal in 1840, Razzell's suggestion that "virtually all" of the population in the first half of the nineteenth century were either vaccinated or inoculated must be treated with caution. Simon spoke of the "mere indifference" of uneducated persons as being the principal obstacle to universal infant vaccination:<sup>37</sup> such indifference seems unlikely to have distinguished between vaccination and inoculation. Further, the possible consequences of inoculation in producing an eruption probably also militated against the use of the operation among the uneducated urban classes at least. In 1859, for example, the MOH for Whitechapel recorded a "deep-rooted" prejudice against vaccination "strongly manifested" in poor neighbourhoods wherever a child had suffered some eruptive disease "syphilitic, eczematous, etc., commonly associated with teething" after vaccination.<sup>38</sup> Such prejudice, with good foundation in both cases, probably extended to inoculation.<sup>39</sup>

In spite of doubts about the quality of nineteenth-century vaccination,<sup>40</sup> the crucial role of the operation in bringing about the decline of smallpox during the course of the century cannot be disputed. Vaccination greatly reduced the number of susceptibles and, by providing the preventive organization with a means of limiting the spread of the disease, was a prerequisite for the success of further control techniques. Yet vaccination alone was not entirely responsible for the reduction in smallpox mortality. The general assumption, for many years after the introduction of the operation, that its universal extension would rapidly eradicate the disease, meant that preventive efforts were entirely directed towards this end. The compulsory Vaccination Acts were the concrete expression of this belief. As noted above, however, informed contemporaries were becoming aware in the 1840s and 1850s that "*uniformly thorough infantile vaccination*"<sup>41</sup> nationally was going to be virtually impossible to achieve: the pockets of resistance and indifference were difficult to overcome. The 1872 Vaccination Act, which established national vaccination policy until 1898, and which has been accounted one of the great success stories of Victorian public health administration,<sup>42</sup> was not 100 per cent effective. Even in its first, and most effective, decade of operation, 7.68 per cent of births in London and 4.2 per cent in the rest of the country remained unaccounted for in respect of vaccination.

Yet the Vaccination Acts were, given their limitations, and the circumstances of nineteenth-century urban life that facilitated or even encouraged their evasion, notably successful. Edward Seaton, in his analysis of the 1870–1 epidemic, pointed out that in the years following the 1853 Act, the length of time between national epidemics of smallpox increased.<sup>43</sup> Although the case-fatality of the "natural" smallpox in the

<sup>36</sup> John Simon, *Papers on the history and practice of vaccination*, PP. 1857, session 2, XXV, p. 225.

<sup>37</sup> *Ibid.*

<sup>38</sup> *Medical Officer's quarterly report: Whitechapel*, 1859, p. 6.

<sup>39</sup> Smith, *op. cit.*, note 1 above, p. 162.

<sup>40</sup> *Ibid.*, pp. 162–163.

<sup>41</sup> Simon, *op. cit.*, note 36 above, p. 195.

<sup>42</sup> Royston Lambert, 'A Victorian national health service', *Hist. J.*, 1962, 5: 1–18.

<sup>43</sup> *Annual report of the Medical Officer: Local Government Board*, PP. 1875, XL, p. 52.

1870–1 epidemic was nearly double that accepted as normal for the disease (67.5 per cent as against 35 per cent), the mortality proportionate to population was less than two-thirds of the mortality of 1837–40.<sup>44</sup> The success of the Acts is also demonstrated by the remarkable shift in the age-incidence of the disease. Up until 1853, smallpox deaths at under five years of age constituted 75 per cent of the total; between 1853 and 1871, the under-fives averaged 55 per cent of the total; in 1871–2 this fell to 31 per cent.<sup>45</sup> In the years 1881–90, the under-fives' smallpox mortality was reduced to 25 per cent of the total; in 1891–1900, it rose again slightly to 31 per cent.<sup>46</sup>

TABLE 3: DEATHS FROM SMALLPOX AT CERTAIN AGE-PERIODS TO 1,000  
DEATHS FROM SMALLPOX AT ALL AGES<sup>47</sup>

<i>Period</i>	<i>Under 1</i>	<i>1–5</i>	<i>5–10</i>	<i>10–15</i>	<i>15–25</i>	<i>25–45</i>	<i>45+</i>
1848–54	251	426	130	33	75	67	18
1855–9	231	328	144	37	117	112	31
1860–4	237	313	108	42	123	133	44
1865–9	231	314	103	33	126	145	48
1870–4	143	169	140	58	200	224	66
1875–9	112	129	113	72	218	266	90
1880–4	113	122	98	68	216	286	97
1885–9	112	81	54	51	229	344	129
1890–4	166	117	50	26	131	338	172

The pattern of infant smallpox mortality in the latter part of the century closely follows that of the effectiveness of the 1872 Vaccination Act. The vaccination records kept and published by John Simon's office from 1872 onwards, show that in the first decade of its operation, the proportion of children born annually who remained unaccounted for in respect of vaccination averaged 7.68 per cent in London, 4.2 per cent in the rest of England and Wales. In the decade 1882–91, this disparity was less marked: 8.6 per cent in London, 7.5 per cent elsewhere. In the last decade of the century, however, these percentages rose strikingly, in anticipation of the findings of the Vaccination Commission,<sup>48</sup> to a peak of 33 per cent in London in 1898, and of 22.3 per cent in the rest of the country in 1896.<sup>49</sup>

Nevertheless, infant vaccination, as provided for in the Acts, could not in the long term fully protect an adult population for whom re-vaccination was entirely voluntary. In an uncertain number of cases also, the operation as originally performed was not satisfactory. John Simon observed in 1857 that there was current in England and Wales. "... not only an appreciable amount of utterly incompetent vaccination, but a very considerable proportion of second rate vaccination."<sup>50</sup>

In 1857, Seaton explained the deaths, in the 1870–1 epidemic, of nine to ten thousand adults who "in a rough and ready way" must be taken as vaccinated, as

<sup>44</sup> *Ibid.*, p. 53.

<sup>45</sup> *Ibid.*, p. 77.

<sup>46</sup> *Annual report of the Medical Officer for London*, 1900, p. 17.

<sup>47</sup> PP. 1896, XLVII, p. 914.

<sup>48</sup> *Medical Officer's report: Whitechapel*, 1892, p. 7; *Annual report of the Medical Officer for London*, 1898, p. 15.

<sup>49</sup> *Annual report of the Medical Officer: Local Government Board*, PP. 1902, XXXVI, p. 456.

<sup>50</sup> Simon, *op. cit.*, note 36 above, p. 227.

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being due to vaccination not being “thoroughly and efficiently” performed.<sup>51</sup> There thus existed, throughout the country, but particularly in London, a large concourse of poorly protected adults, and a “pabulum” of adults and children who had escaped vaccination altogether. Figures for vaccinations occurring in higher age-groups are unobtainable for most of this period, but in 1899, 81,038 were performed in England and Wales, of which 11,693 were in London.<sup>52</sup> Even so, the “pabulum” was likely to be significant.

The extent to which vaccination mitigated the severity of smallpox was discussed with great interest by contemporaries, despite recognized difficulties with vaccination statistics collected where the disease was present. It was said, for example, that the confusion which the eruption of an epidemic occasioned in the smallpox hospitals made the statistical collection procedures unreliable.<sup>53</sup> Further, in nearly all fatal cases a profuse eruption tended to hide vaccination scars if they existed, and observations by nurses and doctors in these circumstances were not reliable.<sup>54</sup> Such criticism was to some extent met by the “doubtfully vaccinated” category which began to appear in, for example, the Metropolitan Asylums Board’s tables from the later 1880s, but these qualifications must be borne in mind in this context, as in discussions of case-mortality. Such cautions apart, it was almost impossible to gauge the extent of protection conferred by previous vaccination on a national scale. Of a total of 4,058 smallpox deaths registered in England and Wales in the decade 1891–1900, only 34 per cent of medical certificates stated vaccination condition. In the previous decade, 44 per cent did so. In this respect, medical practitioners in London were more conscientious, or bolder in their assessments, than their provincial colleagues: in London, the proportion of fatal cases reported without statement as to vaccination condition was not more than 30 per cent, in the provinces it exceeded 70 per cent.<sup>55</sup>

Local and individual hospital studies therefore constitute the only, patchy, source for the study of this question. Seaton, for example, among various other cases, cited a “careful study” by the MOH for Merthyr Tydfil, which showed that the death rate among “vaccinated” smallpox patients diminished in proportion to the number of vaccination scars.<sup>56</sup>

TABLE 4: SMALLPOX VICTIMS IN MERTHYR TYDFIL, 1870–1

No. scars:	1	2	3	4	4+	Unvaccinated
Death-rate %:	8.5	6	3.7	1.5	0	51.1

Thirty years later, it was noted that in the decade 1891–1900, in the metropolitan hospitals, 30 per cent of smallpox deaths were of persons said to be vaccinated; in the provinces only 12 per cent. In the former, the vaccinated were said to constitute 40 per

<sup>51</sup> PP. 1875, XL, appendix 5, p. 88.

<sup>52</sup> *Annual report of Medical Officer: Local Government Board*, PP. 1901, XXVI, p. 23.

<sup>53</sup> PP. 1896, XLVII, p. 179.

<sup>54</sup> *Ibid.*

<sup>55</sup> *Sixty-fifth annual report of the Registrar-General*, PP. 1905, XVIII, supplement, part 1, p. 75.

<sup>56</sup> PP. 1875, XL, appendix 5, p. 91.

cent of cases, in the latter, 18 per cent.<sup>57</sup> In the years 1881–90, before the great decline in infant vaccination set in, it was estimated that for every child with vaccination scars attacked by smallpox, there were 82 who had none. Mortality among the former was nil per million, among the latter, 525 per million.<sup>58</sup> The implications of such studies were taken seriously by those concerned with prevention: the London MOHs, from the earliest days of their appointment, used the modifying effects of vaccination as a principal weapon in their efforts to extend vaccination among the population.<sup>59</sup> As late as 1896, and despite the reservations outlined above, the Royal Commission on Vaccination offered the following analysis of mild or severe smallpox according to vaccination condition:<sup>60</sup>

TABLE 5: SMALLPOX CHARACTERISTICS AND VACCINATION  
IN THE EPIDEMICS OF 1887–8, 1892–3

City	Condition	% Milder Cases	% Severer Cases
Sheffield	Vaccinated	82.8	17.2
	Unvaccinated	18.5	81.5
Dewsbury	Vaccinated	82.0	18.0
	Unvaccinated	23.1	76.9
Leicester	Vaccinated	81.4	18.6
	Unvaccinated	27.2	72.8
Warrington	Vaccinated	78.2	21.8
	Unvaccinated	29.4	70.6

In all analyses of nineteenth-century smallpox data, some allowance should be made for incorrect diagnosis. Such cases undoubtedly did occur, and are mentioned occasionally in local preventive records.<sup>61</sup> Despite possible lingering confusion between smallpox and chickenpox, and the Registrar-General's failure to distinguish between the two until 1854, there are indications that this problem is more likely to affect figures from the closing years of the century, when the younger generation of doctors became increasingly unfamiliar with the disease, than earlier in the period, when it was much more widespread. In 1898, for example, the increasing proportion of misdiagnosed cases arriving at the hospitals of the Metropolitan Asylums Board led the latter's Statistical Committee to remark that, "It is evident that the ordinary practitioner in London practically never sees smallpox or typhus".<sup>62</sup> The MAB's figures for mistaken diagnosis provide an indication of the extent of the diagnostic problem and its changing pattern. The authority first seems to have become aware of misdiagnosis as a problem in 1891, in which year it observed that errors in diagnosis of patients sent to the hospitals had increased in the past five years from 2.4 per cent to

<sup>57</sup> *Annual report of the Medical Officer: Local Government Board*, PP. 1905, XVIII, supplement, part 1, p. 75.

<sup>58</sup> *Annual report of the Medical Officer for London*, 1900, p. 18.

<sup>59</sup> *Medical Officers' annual reports: Mile End Old Town*, 1859, p. 8; *Shoreditch*, 1859–60, p. 18; *St George-in-the-East*, 1876, p. 46.

<sup>60</sup> PP. 1896, XLVII, p. 69.

<sup>61</sup> Camberwell Vestry, *Sewers and Sanitary Committee minutes*, (John Harvard Library), 17 September 1895.

<sup>62</sup> *Annual report of the Statistical Committee of the Metropolitan Asylums Board*, 1898, p. 30.



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6.2 per cent.<sup>63</sup> Thereafter, the Board kept increasingly detailed records of misdiagnosed cases.

TABLE 6: MISDIAGNOSED CASES AT THE METROPOLITAN ASYLUMS BOARD HOSPITALS<sup>64</sup>

<i>Year</i>	<i>Misdiagnoses per cent of total admissions</i>	<i>Misdiagnoses per cent of smallpox cases admitted</i>	
1887	2.4	not available	
1891	6.2	not available	
1892	4.4	6.3	
1893	3.9	3.3	
		Admitted to hospital ships	Patients at South Wharf
1894	5.2	0.8	12.2
	Fever Cases		
1895	7.6	0.5	11.3
1896	5.3	1.5	28.7
1897	6.02	2.8	42.9
1898	7.2	1 case of 5	83.3
1899	6.3	0	64.3
1900	7.8	0	32.0
1901	9.2	0	13.3
1902	8.6	0	7.7
1903	20.4	0	18.2

This pattern of misdiagnoses suggests that the MAB were probably right in their assessment of the reasons behind it. The diminishing number of smallpox cases notified in the years 1895–1899, combined with continuing anxiety about invasions of the disease, may have driven the misdiagnosis level up. The fall in mis-diagnosed cases in 1901 coincides with a marked increase in notifications in that year.

TABLE 7: SMALLPOX CASES NOTIFIED IN LONDON, UNCORRECTED FOR MISDIAGNOSIS 1890–1903<sup>65</sup>

1890	60	1895	979	1900	87
1891	114	1896	225	1901	1,700
1892	423	1897	104	1902	7,796
1893	2,813	1898	32	1903	416
1894	1,192	1899	29		

The records of the Metropolitan Asylums Board show that, while smallpox continued to be present in London in the 1890s, it had become much less serious in character than earlier in the century, and this was reflected both in the annual aggregate admissions, and in the case-fatality figures (see Table 13).<sup>66</sup> Creighton, in his classic account of the history of the disease in England up to 1893, summarized that history as follows: “. . . it first left the richer classes, then it left the villages, then it

<sup>63</sup> *Ibid.*, 1891, p. 13.

<sup>64</sup> *Ibid.*, 1891–1903.

<sup>65</sup> *Ibid.*

<sup>66</sup> *Ibid.*, 1903, p. 27.

left the provincial towns to centre itself in the capital; at the same time it was leaving the age of infancy and childhood . . . dying . . . gradually, from the extremities to the heart.”<sup>67</sup> Creighton’s remarks on this, as on other aspects of the decline of the disease in his day, can be misleading. For example, his account of the shift in the age-incidence of the disease nowhere mentions the element of infant vaccination. Nevertheless, from the vantage-point of 1894, his model of the geographical decline of the disease is acceptable. The mortality pattern set out in the Registrar-General’s reports up to 1893 reveals smallpox constantly present in London (except in 1889) and notably epidemic in the provinces.

Examination of the pattern of smallpox mortality given by the Registrar-General for the years 1894–1910, and the study of the statistical reports of the MAB, suggest that Creighton’s model may be in need of some modification. The disease was very sparsely present in the capital after 1888, except for the epidemic years, which contemporaries counted as 1892–5.<sup>68</sup> During this period, there was very little smallpox in the south-east of England,<sup>69</sup> or in the rest of the country. In 1898–1900, the disease was epidemic in Middlesbrough, Doncaster, and Sculcoates, in the York division. In 1901–2, when the disease in a “severe” form was epidemic in London, not only was the provincial epidemic delayed in appearance, but the manifestation of the disease was much milder; the London epidemic had come to an end by August 1902. At this time, there was little smallpox in the provinces, except in certain ports in Lancashire, the West Riding, and South Wales. In September, the disease began to grow in the provinces, and by the end of the year was seriously affecting the North and West Midlands, the North-West, and Yorkshire. Nevertheless, the notable feature of this provincial epidemic was the “extraordinary mildness” of the disease, in which sense it “differed widely” from the type observed in London, and its “inferior infective quality”. This latter feature made the provincial epidemic more amenable to control than the Metropolitan.<sup>70</sup>

The marked decline in smallpox mortality in both London, and England and Wales, during the course of the nineteenth century, but particularly in the last decade of the century, together with the startling reversal of London’s pre-eminent mortality position in that decade, can best be traced in comparative mortality figures:

TABLE 8: SMALLPOX MORTALITY PER MILLION LIVING IN LONDON AND THE PROVINCES<sup>71</sup>

Period:	1838–42	1847–9	1851–60	1861–70	1871–80	1881–90	1891–1900
London	755	460	280	276	457	145	10
Provinces	547	274	222	162	245	46	13

London’s share of the annual aggregate of smallpox deaths is also of some interest. The actual percentage of national smallpox mortality occurring in London varied widely, and while a sustained increase in London’s relative share of mortality can be

<sup>67</sup> Creighton, *op. cit.*, note 9 above, p. 617.

<sup>68</sup> McVail, *op. cit.*, note 8 above, pp. 3–4.

<sup>69</sup> *Registrar-General’s annual reports*.

<sup>70</sup> PP. 1904, XXVI, pp. xxxiii, xxxviii.

<sup>71</sup> PP. 1886, XXXI, p. 485; PP. 1901, XV, Table 24, p. civ, Table 25, p. cv.

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seen in the years 1876–1885, the sharp decrease after 1885 is also clear (Table 9).

TABLE 9: SMALLPOX DEATHS IN LONDON, PER CENT OF SMALLPOX DEATHS  
IN ENGLAND AND WALES, 1854–1905<sup>72</sup>

1854	24.71	1880	72.69
1855	45.63	1881	76.40
1856	23.32	1882	32.65
1857	3.96	1883	14.21
1858	3.75	1884	55.32
1859	30.09	1885	50.19
		1886	8.73
1860	32.67	1887	1.78
1861	16.44	1888	0.87
1862	22.48	1889	0
1863	50.35		
1864	7.12	1890	25.00
1865	9.98	1891	16.33
1866	45.92	1892	9.51
1867	53.52	1893	14.41
1868	29.09	1894	10.85
1869	17.57	1895	24.66
		1896	1.66
1870	37.14	1897	64.00
1871	34.21	1898	0.40
1872	9.35	1899	1.72
1873	4.78		
1874	2.64	1900	4.71
1875	4.84	1901	64.32
1876	30.56	1902	53.33
1877	59.63	1903	1.71
1878	76.34	1904	4.93
1879	83.95	1905	8.62

The history of smallpox in the later years of the nineteenth century does not support the contention that vaccination was fully or finally responsible for the eventual disappearance of the disease in Britain. It was in these years, in fact, that there was developed the system for control of the disease that became the basis of the successful modern campaign for its eradication. By the mid-century, the early ideal of the eradication of the disease by universal vaccination had been regretfully abandoned in view of the difficulties of achieving this desirable state. In 1858, for example, the *Lancet* noted that when smallpox appeared in a locality where vaccination had been neglected, prompt and proper measures, such as the isolation of victims and the vaccination of contacts, must be taken to prevent its spread. “No delay must be tolerated now”, the journal emphasized, “days are of more importance than weeks at any other period.”<sup>73</sup>

There are no indications in the literature that the more virulent smallpox of

<sup>72</sup> This table has been compiled from the figures given by the Registrar-General. After 1884, the figures are corrected to include deaths from smallpox properly belonging to the London registration districts, but occurring at the MAB hospital ships in the Dartford registration district.

<sup>73</sup> *Lancet*, 8 May 1858, p. 461.

1859–66 was imported from abroad: however, it seems likely that the central medical authority (the Medical Department of the Privy Council, at this time directed by John Simon) was not yet aware of the importance of international connexions in transmitting the disease.<sup>74</sup> Until after the cholera epidemic of 1866, and the epidemics of cattle plague and meningitis that so forcefully re-introduced the lesson of international connexion in that year, in the face of stubborn opposition from the medical establishment,<sup>75</sup> the references to foreign disease movements are no more than passing. The reappearance of a more fatal form of smallpox nevertheless helped to dispel any illusions that were still held as to the practicality of eradicating the disease in the relatively short-term solely through vaccination, and the epidemic of rinderpest, imported from Russia, which struck the country in 1865 provided in this respect a stimulating example. It inspired Sir James Young Simpson, the distinguished obstetrician and gynaecologist,<sup>76</sup> to write one of the most influential preventive essays of the period, 'A proposal to stamp out smallpox', published in 1868.<sup>77</sup> Here, the elements of smallpox prevention which later came to constitute the so-called "Leicester system" were laid out in detail.

Simpson's proposals for smallpox control were not strictly original, since he suggested a return to the isolation policies of the previous century, but it was widely accepted by contemporaries that his work was crucial in re-introducing the idea of isolation to the preventive medical world.<sup>78</sup> Simpson pointed out that, although a stricter enforcement of the new compulsory vaccination law and a greater attention to the proper performance of the operation with proper matter, would no doubt in time diminish the susceptible group; in the meantime, smallpox "still revels with fatal power among our population". Reliance on vaccination alone would not arrest the progress of the disease, but vaccination supplemented by other measures might. He pointed out that in the "last two or three years" the public mind had become familiarized with the idea of "stamping out" a disease – the policy which had been employed in eliminating the scourge of rinderpest.<sup>79</sup> This was not to imply that the destruction of affected individuals should be used to eliminate smallpox: in the human context the parallel demonstrated that "isolation is the chief and leading measure required to stamp out smallpox".<sup>80</sup> The rules for stamping out which Simpson propounded were elementary in their simplicity: deceptively so in view of the difficulty of implementing them in a Victorian city. The first essential was the earliest possible notification of cases; the second, the "seclusion" of affected individuals at home or in hospital until all danger of infection was passed. Nurses and attendants must be

<sup>74</sup> The reports of the Medical Officer to the Privy Council, later to the Local Government Board, are perhaps the best sources for tracing developments in public health thinking in this period.

<sup>75</sup> Sherwin A. Hall, 'The cattle plague of 1865', *Med. Hist.*, 1962, 6: 45–58.

<sup>76</sup> *Dictionary of national biography*, vol. 18, p. 272.

<sup>77</sup> Sir James Y. Simpson, 'A proposal to stamp out smallpox', Edinburgh, Edmonton and Douglas, 1868. The essay was first published in the *Medical Times and Gazette*, 4 January 1868.

<sup>78</sup> *Final report of the Royal Commission on Vaccination*, PP. 1896, XLVII, p. 207; McVail, *op. cit.*, note 8 above, p. 56.

<sup>79</sup> Simpson, *op. cit.*, note 77 above, p. 5. The phrase "stamping out" was first applied, in connexion with a disease, to rinderpest. *International Royal Agricultural Society*, series II, 1866, 1: 271; T. Gamgee, *The cattle plague*, London, Robert Hardwicke, 1866, p. vi.

<sup>80</sup> Simpson, *op. cit.*, note 77 above, p. 6.

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vaccinated, and after the disease was over, all beds, sheets, clothing, utensils, bedrooms, etc., must be thoroughly purified with water, chlorine, carbolic acid, and sulphurous acid.<sup>81</sup> Although Simpson did not mention the vaccination of contacts, perhaps because this was not a measure which, in the existing state of the law, could be enforced by preventive authorities, this quickly came into practice as part of the preventive package, so that vaccination or re-vaccination was offered, at least to contacts.<sup>82</sup>

The effect of Simpson's pamphlet can clearly be seen in the changed tactics of the London medical officers between 1863 and 1871. In the years 1859–64, their efforts were chiefly directed towards publicizing vaccination.<sup>83</sup> They published and issued thousands of handbills and posters advertising the advantages of vaccination and re-vaccination, and where these might be obtained; they went from house to house through their districts, inquiring as to the vaccination state of the inhabitants, and urging the operation where required. They personally examined thousands of schoolchildren for evidence of vaccination, and supervised the cleansing and whitewashing of the poorest houses and streets in the localities. By 1871, however, the concentration on vaccination publicity had substantially diminished. Although posters and handbills were issued in quantity (as they were in every major epidemic of communicable disease), the principal efforts of the sanitary departments focused on the tracing of victims, and on preventive measures taken in response to identified cases. These consisted in the isolation of the patient, or his removal to hospital where possible; the tracing and vaccination of contacts; and the cleansing and disinfection of all necessary rooms, furniture, clothes, and bedding. Many London authorities had established disinfecting arrangements during the 1860s, and where this was not the case, arrangements were hastily made in 1871 as the scale of the epidemic became clear.

The endeavours of the medical officers to limit the spread of the disease by "other methods" were assisted by the establishment at this time of the Metropolitan Asylums Board, and the erection of isolation hospitals under its management.<sup>84</sup> The MAB hospitals proved something of a mixed blessing in the areas in which they were situated, since it soon became clear that the organization of staff, visitors, laundry, and ambulances provided ample opportunities for infection of the population inhabiting streets in the immediate (within half a mile radius) vicinity. Although the major contemporary debate centred on the ability of the disease to travel distances by aerial convection, it seems clear that it was spread largely by personal contact.<sup>85</sup> The experience of the epidemics of 1876–7, 1881, and 1884 served to confirm that the location of hospitals for dangerous infectious diseases in built-up areas exposed the local residents to too many risks. In 1884, the MAB removed all smallpox cases from the

<sup>81</sup> *Ibid.*

<sup>82</sup> PP. 1864, XXVII, p. 110.

<sup>83</sup> *Annual reports of Medical Officers: Camberwell, 1858–9; Lambeth, 1863; St Pancras, 1859; Islington, 1863; St Giles, 1859; Paddington, 1862–3.*

<sup>84</sup> Ayers, *op. cit.*, note 4 above, Chapter 10.

<sup>85</sup> *Annual report of Medical Officer: Hackney, 1880, p. 16.* For more recent evidence, see D. Baxby, *Jenner's smallpox vaccine: the riddle of vaccinia virus and its origin*, London, Heinemann Educational, 1981, pp. 18–19, 23.

city hospitals to newly-acquired hospital ships at Long Reach in the Thames Estuary. Thereafter, not only did the number of smallpox deaths registered in the London registration districts fall away in a most dramatic fashion, but London's position as the harbour of endemic smallpox and principal source of infection for the rest of the country was undermined.

The decline of smallpox in London cannot, however, be entirely ascribed to the success of "other measures", as described above, even the hospital ships. Although the activities of the London sanitary authorities in 1871 make it clear that the "Leicester system", which was first instituted in 1877, was by no means original, nor, in its principles and practice, exclusive to Leicester, the records of the London medical officers also reveal the reason for Leicester's greater success. The simple and essential distinction between Leicester and London lay in the achievement of the former in introducing an effective system of smallpox notification. This was possible because of the unstinted support of the local authority for the measure.<sup>86</sup> The importance of notification was widely recognized beyond Leicester before 1877,<sup>87</sup> but social and political pressures hindered its introduction in many areas, and in London the multiplicity of sanitary authorities and vast population made anything less than universal compulsory notification (something which could only be achieved by legislation) unsatisfactory.

The London medical officers were dependent on local sources for information about infectious disease cases, notably on the Poor Law medical officers and local dispensaries, with local practitioners and private individuals also contributing. Much more information was thus available about disease movements among the poorer classes. In 1871, the *Lancet* observed that the London medical officers were "without exception" entirely ignorant of the cases attended by private practitioners. Dr Ballard of Islington, however, learnt enough from private sources to satisfy him that smallpox was widely sown among all classes of the community; but that the upper classes were very generally protecting themselves by re-vaccination.<sup>88</sup> Although a medical officer of such exceptional energy and calibre as Dudfield of Kensington might strive over fifteen years to establish a system of voluntary notification in his district,<sup>89</sup> for the most part familiarity with the general disease condition of the poorer quarters had to be accepted as sufficient. Until the Infectious Diseases Notification Act came into operation in 1890, therefore, the London preventive organization was without reliable official information on disease incidence in the capital, other than what could be deduced from mortality statistics.

The absence of notification was well recognized as a serious obstacle to the success of the "stamping out" policy in London,<sup>90</sup> and pressure mounted for its institution on a compulsory, national basis from the early 1870s.<sup>91</sup> In the meantime, however, a

<sup>86</sup> Fraser, *op. cit.*, note 6 above, pp. 315, 325. Leicester was also a much smaller city than London, and control correspondingly easier.

<sup>87</sup> *Annual reports of Medical Officers: Paddington, 1870-1*, p. 11; *St George's, Hanover Square, 1871-2*, p. 63.

<sup>88</sup> *Lancet*, 25 February 1871, p. 284.

<sup>89</sup> *Annual report of Medical Officer: Kensington, 1885*, p. 62-63.

<sup>90</sup> Thomas Orme Dudfield, *Two sanitary addresses*, London, 1889, pp. 5, 11.

<sup>91</sup> J. L. Brand, *Doctors and the state*, Baltimore, Md., Johns Hopkins Press, 1965, p. 60.

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group of London medical officers had gained a signal victory in the cause of prevention, which was to be of the greatest importance in the public health history of London, not only in respect of smallpox, but also in respect of cholera and bubonic plague. In 1866, under the threat of an imminent cholera epidemic, a sanitary act had been passed which, among other measures, gave to the riverside sanitary authorities responsibility for the sanitary condition of shipping within allocated sections of the river.<sup>92</sup> The City of London, the only authority to do so, immediately appointed a special officer to inspect the shipping within its jurisdiction, which covered the northern half of the Thames, between the Temple and the Tower. The City medical officer, and the medical officers of both the *Dreadnought* hospital ship and the Customs, were already convinced of the need for uniformity of action along the whole course of the river, relating particularly to the sanitary condition of ships, and to the importation of communicable disease.<sup>93</sup>

In 1871, when cholera was epidemic in Eastern Europe, and there were serious fears of its importation, the sanitary authorities abutting on the Thames tried to meet the "shipping difficulty" by joint action, providing a staff of officers and a hospital ship in case of need. However, because of the faulty drafting, the common drawback to nineteenth-century sanitary legislation, their actions proved to be illegal, a difficulty that they were unable to overcome. An appeal to the President of the Local Government Board resulted, by section 20 of the 1872 Public Health Act, in the establishment of port sanitary authorities,<sup>94</sup> including the Port of London Sanitary Authority, which entered on its duties in mid-1873. The establishment of the port sanitary authority filled a crucial gap in the capital's sanitary defences. Already in July 1873, the medical officer prevented an outbreak of cholera in East London, when the steamship *Iris* from Hamburg came into port with cholera cases on board.<sup>95</sup> The task of sanitary inspection and disease prevention that he had undertaken was no mean one: at this time some 25,000 vessels arrived in the Port yearly, in addition to which there were some 2,300 sailing vessels and 4,000 "dumb-barges" belonging to the port.<sup>96</sup> In its first full year of activity, the port sanitary authority inspected a total of 13,846 vessels.<sup>97</sup>

The proceedings of the port sanitary authority in the first ten years of its existence were more exploratory and experimental than coherent in pursuit of an established policy. In these years, the rapid development of communications, with the opening of the Suez Canal, the extension of the world railway system, and the emergence of the steamship to dominance on the seas, demonstrated the need for a comprehensive and flexible system of health controls as an integral part of port entry procedure. London was at this time, by way of the Thames, in "almost hourly communication" with the Baltic and Mediterranean ports,<sup>98</sup> while experience showed that infectious diseases cheerfully travelled 14,000 miles (from Melbourne or Calcutta, for instance) by

<sup>92</sup> Sanitary Act (1866), 29 & 30 Vict. c. 90, sec. 32.

<sup>93</sup> Henry Letheby, *Report on the sanitary inspection of shipping*, 1868, pp. 6, 9.

<sup>94</sup> *Annual report of Medical Officer: City of London*, 1870-1, p. 50.

<sup>95</sup> *Half-yearly report of Medical Officer: Port of London*, December 1873, p. 11.

<sup>96</sup> *Annual report of Medical Officer: City of London*, 1870-1, p. 50.

<sup>97</sup> *Half-yearly report of Medical Officer: Port of London*, December 1874, appendix D.

<sup>98</sup> *Ibid.*, December 1873, p. 21.

steamship, keeping active by propagation among crew and passengers during the voyage.<sup>99</sup> Early in his appointment, the port medical officer became aware that London was being made a port-of-call for large emigrant ships, which came from Continental ports where cholera was known to be present: at his request, the ship's brokers were to inform him promptly of the arrival of ships, so that he might board them between Southend and Gravesend, to examine systematically both crew and passengers without complicating commercial interests by detaining the ship; in these years, working relations were also established with the Metropolitan Asylums Board.<sup>100</sup> From time to time, during these years, the medical officer complained of the inadequacy of his staff:<sup>101</sup> it was not until 1884 that the staff and facilities at his disposal were arranged to his satisfaction.

The establishment of the port sanitary authorities was one of the two great administrative advances in preventive medicine under the 1872 Public Health Act, the other being the creation of the provincial medical officerships under the aegis of new urban and rural sanitary authorities.<sup>102</sup> The impact of the new medical officers on the public health outside London remains, as yet, an unexplored field. The London MOHs were, however, within a decade, drawing attention to the superiority of the provincial administration over that of the capital in the area of disease control.<sup>103</sup> The provincial cities were at an advantage because they possessed a unified sanitary administration supervised and controlled by the city MOH and under the ultimate control of the town council, whereas the administration of the sanitary acts in London was divided between some forty local authorities, and more MOHs. Dr Dudfield, for example, giving evidence before the Royal Commission on Smallpox and Fever Hospitals in 1882, stated that in his judgement the "long continuance" of smallpox in London was due, among other things, "generally to the lack of solidarity in the sanitary administration of the capital".<sup>104</sup> Every other large centre of population had but one sanitary authority. In the provinces, cases of smallpox were reported and isolated, and the epidemic prevalence of the disease prevented, with the result that, since MOHs were appointed to all parts, smallpox had not, to his knowledge, been prevalent in any town or other place with the severity so common in the absence of such arrangements in the epidemic of 1870–3. "Everyone", he observed, "is interested in stamping out smallpox."<sup>105</sup>

In those towns incorporating a port sanitary authority, the interest in stamping out smallpox extended to an even wider area than elsewhere. Except where special port sanitary authorities were constituted by the Local Government Board, the local town council or equivalent took over responsibility for the sanitary arrangements of the port. Thus the town councils of Bristol and Liverpool, for example, were also the sanitary authorities for those ports,<sup>106</sup> while the specially constituted Tyne Port Sanitary

<sup>99</sup> *Ibid.*, June 1877, pp. 13–14.

<sup>100</sup> *Ibid.*, December 1874, p. 90.

<sup>101</sup> *Ibid.*, December 1873, p. 10; June 1875, p. 11.

<sup>102</sup> Public Health Act (1872), 75 & 76 Vict. c. 79, sec. 3, 20.

<sup>103</sup> Dudfield, *op. cit.*, note 90 above, p. 12.

<sup>104</sup> PP. 1882, XXIX, p. 362.

<sup>105</sup> *Ibid.*

<sup>106</sup> *Fifteenth annual report of the Local Government Board*, PP. 1886, XXXI, appendix K, Table 89, pp. 287–291.



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Authority (1881) covered the ports of Newcastle, Gateshead, Tynemouth, Jarrow, and South Shields.<sup>107</sup> Under both types of authority, however, the town's MOH generally also held the medical officership of the port, as did David Davies at Bristol; for the Tyne ports, the MOH for Newcastle was in charge of port sanitary affairs. For the first decade of their existence, the port sanitary authorities operated on an experimental basis.

The powers which the port sanitary authorities exercised in cases of infectious disease were greater in several respects than those of the authorities on land at this period. Under the Quarantine Act, all infectious disease on board vessels (excluding coasters) entering a port was to be reported to Customs, who detained such vessels until their release was recommended by the officer of the sanitary authority.<sup>108</sup> The Public Health Act 1875 made possible the compulsory removal to hospital of every patient suffering from an infectious disease on shipboard, and enabled the port sanitary authorities, subject to the approval of the Local Government Board, to make regulations for the compulsory notification and isolation of infectious disease cases, and disinfection. Ships and vessels in harbour were subject to the jurisdiction of the local sanitary authority in the same manner as houses. Finally, in 1885, the Public Health (Shipping) Act explicitly extended the ordinary powers of the local authorities in respect of infectious disease, granted in the 1875 Act, to the port sanitary authorities. These provisions enabled port medical officers to cleanse and disinfect where they considered it necessary to check the spread of infectious diseases; to destroy infected bedding, etc.; to remove those without proper lodging or accommodation to hospital when suffering from a dangerous infectious disease. Port sanitary authorities could make regulations for the removal to hospital of infected persons brought in by ships; might impose a penalty for the exposure of infected persons and articles, and for the letting of lodgings in houses where infectious disease existed. They were empowered to provide hospitals; to recover the cost of hospital maintenance from patients; and to provide freely a temporary supply of medicine and medical attendance for poor persons in their districts.<sup>109</sup>

The success of the port sanitary authorities in controlling the entry of dangerous infectious diseases into their districts is not easy to assess without further local research. The annual published mortality figures of the Registrar-General, which clearly indicate that smallpox was epidemic rather than endemic in most provincial ports except Liverpool by 1870, and in all such ports after 1877, are often misleading. The case of Liverpool illustrates the point. The Registrar-General's figures suggest that the disease was all but absent in the period 1877–1906. There are some half-dozen deaths recorded in 1882–6, and a few in 1902. These figures, however, relate to the Liverpool registration district only, and must be considered in conjunction with the figures for Toxteth Park and West Derby, both of which contained workhouse hospitals used by Liverpool Corporation for infectious disease cases. According to the

<sup>107</sup> H. E. Armstrong, *Port sanitary administration on the Tyne*, 1888, p. 3. This essay previously appeared as an article in *Public Health*, June 1888.

<sup>108</sup> Quarantine Act (1825), 6° George IV c. 78, secs. IX, XIV, XVI; Armstrong, *op. cit.*, note 107 above, p. 2.

<sup>109</sup> Public Health Act (1875), 38 & 39 Vict. c. 55, secs. 110, 120, 121, 124–126, 128, 130, 131–133. Public Health (Shipping) Act (1885), 48 & 49 Vict. c. 35.

mortality and notification records of the city's MOH, smallpox was very constantly present in Liverpool in the years after 1877, and the dangers of imported disease for the city were clearly recognized: in 1871, for example, smallpox had been introduced by Spanish sailors.<sup>110</sup> Local trends in mortality as they appear in the Registrar-General's annual reports should be treated with caution.

TABLE 10: SMALLPOX DEATHS IN LIVERPOOL 1871-1881, ACCORDING TO DIFFERENT AUTHORITIES

	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881
Registrar-General	819	14	6	7	10	70	37	-	-	-	-
1882 Commission	1,919	50	10	30	29	386	299	3	-	-	44
MOH, 1896	1,919	50	10	30	29	386	299	3	-	2	34

With this reservation, the incidence of smallpox in the ports of England and Wales is still interesting, because, especially after the end of the epidemic of 1870-3, the disease often appears in the ports when it is absent (according to the mortality figures at least) from their hinterland. Thus, in 1887-8, when there was a total of 85 deaths in Bristol/Barton Regis, there were no deaths from the disease elsewhere in Gloucestershire. The 163 smallpox deaths in Swansea in 1870 were unique in South Wales. In all, the outbreaks of smallpox recorded in the mortality statistics were increasingly confined to the ports and the manufacturing towns in the latter years of the century. In the years after 1884, also, the previously persistent smallpox mortality across the London hinterland fades away, suggesting that control measures taken in the capital were indeed limiting the spread of the disease, when it occurred, beyond the city.

The activity of the port sanitary authorities in respect of the dangerous communicable diseases may well have been most effective. The absence of cholera after 1866, and the failure of plague to spread in the country at the turn of the century, are both important illustrations of their effectiveness. The Port and Riparian Sanitary Survey, undertaken by the Local Government Board in the shadow of the cholera scare of 1893, found that although general sanitary arrangements could only be called satisfactory in two-thirds of the sixty port sanitary districts, the arrangements for the medical inspection of vessels and persons were satisfactory in all but five. In certain districts, among which were numbered London, Tyne, Hull and Goole, Southampton, Plymouth, Bristol, Cardiff, Swansea, and Liverpool, the arrangements were not only "highly satisfactory" in themselves, but were carried out with a "devotion to duty on the part of the medical officers of health" such as was regarded as contributing to the "marked success" with which imported cholera was controlled at all English ports in 1892 and 1893.<sup>111</sup> The port medical officers, then, could be very effective when the occasion demanded, and the evidence suggests that smallpox was a focus of their vigilance and concern throughout the period, even if they were not always successful in preventing the entry of the disease. The MOH for Hull, for example, observed sadly, after a severe type of smallpox had become epidemic in the city in 1899, that, "The

<sup>110</sup> *Royal Commission on Vaccination, Final report*, appendix XIII, PP. 1897, XLVI, pp. 284, 286.

<sup>111</sup> *Port and riparian sanitary survey*, PP. 1895, LII, pp. vi-vii.

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great emigrant traffic through this city and port, especially from Southern Russia, may, in spite of all the vigilance of the authority, have contributed a source of infection, for among the emigrants, persons had been frequently recognised as having recently had smallpox, and possibly the means of their disinfection had not been altogether efficient."<sup>112</sup>

The sphere of interest of the port sanitary authorities extended widely beyond the confines of their ports. Dr Collingridge of the Port of London, for example, visited Le Havre, Antwerp, and Rotterdam in 1874, to discover what kind of disease procedures operated in the ports of France, Holland, and Belgium.<sup>113</sup> Careful attention was paid to the disease condition in ports of contact both at home and abroad. On the Tyne, for example, the medical and daily press, the *Shipping Gazette*, and other journals were examined daily for information of disease abroad. A list of vessels bound for the Tyne from infected ports was kept, in which was entered the name of the ship, the date of her passing different ports on the voyage, and her expected time of arrival. Ships on this register were visited without delay on arrival by the sanitary officers. On boarding any vessel, they also interrogated the captain for information of infectious disease in his port of origin.<sup>114</sup>

Under normal circumstances, however, the sanitary authorities relied upon the officers of Customs for information about suspicious cases on ships entering port. Henry Armstrong, the highly efficient Medical Officer for the Tyne ports, recorded in vivid note form the details of this procedure. Once notified by Customs,

The assistant on duty calls up the chief inspector, goes for the assistant medical officer and calls on the crew of the launch to get up steam. The chief inspector accompanies the assistant medical officer to the vessel, who finding the case to be one, e.g. of smallpox, gives certificate and order for its removal to hospital, and after examining the crew, recommends re-vaccination, which, if agreed to, he performs. The chief inspector gives instructions to the captain that none of the ship's company is to leave the vessel; takes the assistant medical officer on shore; puts fumigation materials (sulphur, charcoal, and a brazier) into launch; telephones the medical officer of health, and sends word to the hospital to prepare; visits the ship with an assistant; removes the patient and his effects to hospital in the launch, leaving the assistant to fumigate. Afterwards meets the medical officer of health and takes him in the launch to the hospital to see the patient. Gives him history of the case as obtained from the captain, and receives his instructions. Lands the M.O.H. [*sic*]; returns to the ship and obtains the captain's guarantee for maintenance of the patient. When fumigation is completed, gives a certificate to that effect to the captain, and leaves at the Custom House a similar certificate, so that the vessel may be cleared. The fore-cabin of the launch in which the patient is removed is then fumigated. Sees to the thorough cleansing of the vessel from which the case came; keeps her under supervision whilst in port; and advises the authorities of the British port, or the British Consul of the foreign port, for which she sets sail on leaving the Tyne.<sup>115</sup>

The procedure followed by other port sanitary authorities was probably very similar. Among the duties that the MOH for the Port of London listed for his department (a list that became a textbook to outport sanitary authorities throughout the kingdom), were: the inspection of all inhabited vessels in the port with respect to the cleanliness of the crew's quarters, ventilation, closet accommodation and state of bilges, drinking-water supply, and water tanks; the removal of cases of infectious or contagious disease; the removal, if required, of vessels to isolated moorings; fumigation of vessels; disinfection of clothing; and disinfection of persons dead at sea or

<sup>112</sup> McVail, op. cit., note 8 above, p. 11.

<sup>113</sup> *Half-yearly report of Medical Officer: Port of London*, June 1874, p. 62.

<sup>114</sup> Armstrong, op. cit., note 107 above, p. 16.

<sup>115</sup> *Ibid.*, p. 13.

abroad of infectious or contagious disease.<sup>116</sup> The immensity of such a task becomes apparent when the numbers of ships passing through the Port of London is considered. In the 1870s, an average of 14,000 vessels were inspected annually in the Port; in the early 1880s this rose to 22,000, but fell again to around 14,000 by the end of the decade. From the second part of 1893, numbers began to increase again, and by the end of the century over 30,000 ships were inspected annually.<sup>117</sup>

After cholera, smallpox was perhaps the most urgent concern of the port sanitary authorities. Most of the examples of the work of his authority given by Armstrong relate to smallpox, while the disease figures repeatedly in the annual reports of Dr Collingridge. Armstrong, relating the work of his department in the years 1881–7, catalogued the principal preventive concerns of these years. In 1881, smallpox seemed likely to be brought to the Tyne from Yarmouth and elsewhere; enteric fever from Middlesbrough. In 1882, and for some years subsequently, watch was kept for ships from cholera-infected localities. In this year, the department was warned of a ship which had landed a smallpox case at Falmouth and was proceeding to the Tyne, where one of the crew was found to have the disease. Similar information about smallpox came from London and Yarmouth, and because of information received from the newspapers and from captains, watch was kept for the disease on vessels arriving from Rouen, Bilbao, and Fécamp. In 1883, two coasting vessels brought two cases of smallpox into Newcastle by way of the river, and watch was also kept for the disease from Rotterdam and Riga, as well as cholera from the East. In 1884, five ships arrived from cholera ports, and one infected with “African coast fever”. In 1885, the prevalence of smallpox and yellow and enteric fevers gave much extra work in watching out for arrivals. In 1886, the notification of infectious disease by masters of vessels was made compulsory on the Tyne. In 1887, several incoming ships were infected with smallpox.<sup>118</sup>

The constant anxiety over the introduction of smallpox through the Tyne ports undoubtedly sprang from fear of epidemic consequences in the local population: Armstrong specifically noted the “danger of infection being brought to the population of Tyneside”.<sup>119</sup> This anxiety may not seem to be totally substantiated by the figures presented: between 1881 and 1887, there were seventeen smallpox cases admitted to the Floating Hospital, with three deaths. However, if the high infectivity of the disease is borne in mind, these figures take on more significance: in 1884, for example, the medical officer for the London parish of Newington traced seventy-nine cases of smallpox originating from two cases in one household.<sup>120</sup> The figures for infectious disease cases in the Port of London, similarly, do not seem strikingly high, in view of the number of incoming vessels (Table 11).

The role of the ports in providing a means of entry for smallpox into Britain was indirectly discussed by McVail in 1919. McVail, discussing the existence of two different types of imported smallpox in the British epidemics of the early twentieth century (a severe strain from Africa that probably travelled by way of Europe to

<sup>116</sup> *Half-yearly report of the Medical Officer: Port of London*, June 1874, p. 56–57.

<sup>117</sup> *Half-yearly reports of the Medical Officer: Port of London*.

<sup>118</sup> Armstrong, *op. cit.*, note 107 above, p. 16–18.

<sup>119</sup> *Ibid.*, p. 18.

<sup>120</sup> *Annual report of the Medical Officer: Newington*, 1884–5, p. 126.

## *Smallpox in London*

TABLE 11: CASES OF SMALLPOX IN THE PORT OF LONDON, 1884–1901<sup>121</sup>

1884	21	1893	31
1885	21	1894	16
1886	10	1895	30
1887	27	1896	15
1888	12	1897	27
1889	5	1898	12
1890	10	1899	12
1891	22	1900	16
1892	17	1901	14

England, and a very mild strain originating in America), gave a number of examples of their introduction in the years after 1900.<sup>122</sup> He also recorded a rough geographical breakdown of the smallpox cases notified in Britain in the years 1911–1917, although he gave no further explanation of the figures with respect to, for example, the number of primary and secondary cases.

TABLE 12: SMALLPOX CASES NOTIFIED IN BRITAIN, 1911–1917<sup>123</sup>

<i>Year</i>	<i>1911</i>	<i>1912</i>	<i>1913</i>	<i>1914</i>	<i>1915</i>	<i>1916</i>	<i>1917</i>
Total	295	123	115	65	90	149	5
No. in port towns	20	72	48	10	31	55	2
No. in port sanitary districts	30	12	25	7	12	14	1

These figures, according to McVail, provide “very striking evidence” of the reduced infectivity of smallpox: the disease obtained almost no hold in the country, although repeatedly introduced at seaports.<sup>124</sup> It might also be suggested that the efficiency of the port sanitary authorities contributed in limiting the possibilities of infection. The rediscovery of the importance of international communication in the transmission of disease occurred at a time when technological improvements were beginning to accelerate the pace of such activity. From the early 1870s, British sanitary observers were able to trace the progress of epidemic disease across the world with greater accuracy than ever before. Local monitoring of foreign disease movements, as described above, was made possible, for example, by the development of the telegraph, which immeasurably increased the speed with which information of disease outbreaks could travel. Further, the Registrar-General, after “persevering application”, succeeded in inducing the authorities of Paris, Rome, Berlin, Vienna, Bombay, Madras, Calcutta, and New York to furnish him with weekly mortality returns similar to, though “less complete” than, those of London. Thus, “immediate intimation is given of any epidemic arising in [*sic*] the horizon, even when the cloud is no bigger than a man’s hand.”<sup>125</sup> This new source of information, combined with the institution of port sanitary authorities and of the provincial medical officers of health, finally completed the basic structure of British sanitary protection. As a result, and

<sup>121</sup> *Half-yearly reports of the Medical Officer: Port of London.*

<sup>122</sup> McVail, *op. cit.*, note 8 above, pp. 9–12.

<sup>123</sup> *Ibid.*, p. 24.

<sup>124</sup> *Ibid.*

<sup>125</sup> *Thirty-fourth annual report of the Registrar-General*, PP. 1873, XX, p. 48.

because of the novelty of these arrangements, the late 1870s and early 1880s were a period of particular anxiety for the preventive authorities.

The connexion between seaports and smallpox was first specifically observed in England in the epidemic of 1870–2. This epidemic was the worst since registration began, certainly the worst since the first establishment of preventive authorities. Although the severity of the disease had been increasing in England in the 1860s, no previous experience had prepared even experienced medical men for the mortality of 1871. The virulent strain of 1871 was undoubtedly introduced from abroad. The disease was violently epidemic in France at this time: the Registrar-General noted that the epidemic might be traced “to foreign communications beyond doubt”, instancing more particularly the “large arrivals” of refugees (from the Franco-Prussian War) in the late autumn of 1870, and “distinct evidence” of the introduction of the disease into seaside towns, especially Southampton and Grimsby. Significantly, London and Liverpool were the first places of any importance to feel the effects of the epidemic.<sup>126</sup> Smallpox was epidemic again in London in 1876–7, 1881, and 1884–5. On these occasions, there are no indications of the disease being introduced from abroad. In December 1876, the port medical officer reported that although smallpox was widely epidemic in London, it had so far manifested itself in the floating population to “an infinitesimal extent”.<sup>127</sup> Nevertheless, at this time, “even in ordinary circumstances”, the port sanitary staff, however hard they tried, could not cover all the arrivals as the medical officer thought they should:<sup>128</sup> evidently there was scope here for the introduction of infection from abroad. In 1881, although smallpox was epidemic in the metropolis, the cases occurring in the port were few in number and “quite isolated”. There were six imported cases.<sup>129</sup>

The smallpox epidemics occurring in London in 1876, 1881, and 1884 cannot with certainty be traced to infection from abroad: it is possible that the strain introduced in 1870 was working itself out with diminishing virulence, and that the port sanitary authorities were successful in preventing its refreshment from abroad. In 1878 and 1882, they were almost certainly instrumental in preventing the entry of severe foreign strains of the disease. In 1878, there was a “fearful epidemic” in several Brazilian ports, and as many vessels from ports on the north-east coast of South America came to London to discharge at the Victoria or South West India docks, there was some alarm.<sup>130</sup> In the late summer of 1882, much anxiety was caused by an epidemic of severe smallpox (designated “blackpox” by the port medical officer) at the Cape of Good Hope. Again, a large amount of shipping was constantly arriving from the colony, but there is no evidence of the disease being spread into London or its hinterland.<sup>131</sup> The difficulty with which such a result was achieved is suggested by an instance in 1883, when a vessel from Seaham Harbour, County Durham, came into port with a case of semi-confluent smallpox on board. The vessel was fumigated, and vaccination offered to the crew, who “as usual” refused.<sup>132</sup>

<sup>126</sup> *Ibid.*, p. 31.

<sup>127</sup> *Half-yearly report of the Medical Officer: Port of London*, December 1876, p. 9.

<sup>128</sup> *Ibid.*

<sup>129</sup> *Ibid.*, June 1881, p. 4.

<sup>131</sup> *Ibid.*, December 1882, p. 8.

<sup>130</sup> *Ibid.*, December 1878, p. 15.

<sup>132</sup> *Ibid.*, June 1883, p. 14.

### *Smallpox in London*

The alarms caused by smallpox in 1878 and 1882, by plague in 1878, and by cholera in 1883, resulted, at the beginning of 1884, in the institution of a system designed specifically to detect all cases of infectious disease entering the port. Co-operation between port authorities across the country was well established, and producing extremely good results: no vessel could free itself from sanitary inspection by leaving one port for another, since her port of destination would be notified before arrival.<sup>133</sup> Nevertheless, one of the greatest difficulties of the port medical officer remained the "short-sighted policy of masters of vessels in attempting to conceal cases of infectious disease".<sup>134</sup> From the beginning of 1884, compulsory notification of all cases of infectious disease within two hours of their appearance was introduced, reinforced by a £5 penalty in the port sanitary district. Copies of these regulations were distributed by the Customs on boarding at Gravesend. In the first six months of the operation of the scheme, the medical officer had no cases of wilful concealment to report.<sup>135</sup> Armstrong, in Newcastle, reported similar experiences, and, apparently, similar success with notification.<sup>136</sup>

The establishment of a system of compulsory notification in the Port of London in 1884 had little effect on the epidemic of smallpox that began in east London in late 1883. Again, there is no indication that the disease was introduced from abroad, but it might easily have been. The evidence of the 1884–5 epidemic, indeed, underlines the difficulty, previous to universal compulsory notification, of controlling smallpox once it had become established in the capital, before the epidemic had run its natural course. Although the Metropolitan Asylums Board reorganized their services and introduced the hospital ships in March 1884, the total mortality figures for London show that the disease continued to be very active in 1885, although escalation was minimal. The remarkable reduction in smallpox mortality that occurred in 1886, and continued with interruptions thereafter, is coincident not only with the introduction of the hospital ships, but also with the introduction of compulsory notification in the Port of London, and with generally tighter preventive controls on shipping entering British ports with the implementation of the Public Health (Shipping) Act of 1885.

Unfortunately, the elucidation of differing mortality in different years, especially with regard to individual cities, is difficult, given the absence of systematic statistical mortality plus incidence series in this period. Various sets of official figures dealing with differential mortality in local epidemics exist, such as for the outbreaks of smallpox at Sheffield (1887–8), and in Leicester, Gloucester, Dewsbury, and Warrington in 1892–3.<sup>137</sup> None of these cities is a port, however, and although further local studies may discover such data for Bristol, Liverpool, or Newcastle, the series of the MAB for London seems to be the only readily accessible source for the examination of specific case-mortality from smallpox in non-epidemic years. Although the reliability of the figures in the following table may be affected by the decreasing rigour of the Managers' admissions policy,<sup>138</sup> the general trend remains of interest.

<sup>133</sup> *Ibid.*

<sup>134</sup> *Ibid.*, June 1884, p. 9.

<sup>135</sup> *Ibid.*

<sup>136</sup> Armstrong, *op. cit.*, note 107 above, p. 17–18.

<sup>137</sup> PP. 1896, XLVII, pp. 55–58, 69.

<sup>138</sup> Ayers, *op. cit.*, note 4 above, p. 118. From 1871 to 1878, admissions to the hospitals were legally limited to the destitute; 1879–86, regulations relaxed slightly; 1887–91, regulations further relaxed; 1892–1900, all restrictive regulations removed.

TABLE 13: ADMISSIONS OF SMALLPOX PATIENTS, AND MORTALITY PER CENT OF SMALLPOX PATIENTS TREATED IN THE MAB HOSPITALS, 1871-1903<sup>139</sup>

Year	Admissions	Mortality %
1870-1 (2 months)	582	20.81
1871-2	13,139	18.95
1872-3	2,359	17.84
1873-4	174	17.02
1874	112	
1875	89	
1876	2,134	
1877	6,516	21.64
1878	4,558	17.92
1879	1,628	17.99
1880	1,982	15.69
1881	8,551	15.95
1882	1,799	16.61
1883	598	12.96
1884	6,363	16.06
1885	6,146	15.98
1886	99	15.80
1887	36	22.22
1888	62	0
1889	5	12.90
1890	22	0
1891	63	13.64
1892	325	12.70
1893	2,376	11.29
1894	1,117	7.64
1895	941	8.87
1896	190	6.36
1897	70	4.01
1898	5	18.44
1899	18	0
1900	66	20.69
1901	1,743	4.3
1902	7,916	18.51
1903	355	16.60
		3.4

The fluctuations in the apparent fatality of the disease as shown in this table become much more marked after 1886, and this pattern is generally confirmed (although the two groups, total admissions and unvaccinated, do not necessarily conform to a consistent pattern) if the available case-mortality figures for “unvaccinated” patients are examined (Table 14).

In general, the case-mortality of total admissions in the period 1870-1888 seems to reflect the endemic character of the disease in London; fatality lifts at the beginning of the epidemic in 1876, as it had presumably done in the period 1 December 1870 to 3 February 1871, at the start of the great epidemic of 1870. The epidemic of 1881, however, shows only a slightly increased fatality rate; in 1884 the fatality of the disease diminished, despite a markedly increased prevalence. The general level of

<sup>139</sup> *Annual reports of the Statistical Committee of the Metropolitan Asylums Board, 1886-1903.*



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TABLE 14: CASE-MORTALITY AMONG UNVACCINATED PATIENTS AT THE MAB HOSPITALS, 1888–1903<sup>140</sup>

<i>Year</i>	<i>Mortality per cent of "unvaccinated" cases (not including "doubtfully vaccinated")</i>
1888	27.2
1889	0
1890	0
1891	31.25
1892	27.41
1893	18.8
1894	22.2
1895	13.6
1896	12.5
1897	30.76
1898	0
1899	0
1900	14.28
1901	31.99
1902	33.06
1903	4.6

fatality at this period, at around 15–17 per cent, is noticeably higher, as well as more consistent, than the fatality rate in the years after 1886–7. Some extraordinary influence may have been at work in 1886: the MAB themselves appear to have considered the years 1886–1891 inclusive as uncharacteristic, since the table which provides the source for these figures gives only an average fatality rate (14.28 per cent) for these years.<sup>141</sup> The fact that this period was one in which the admissions policy was more relaxed than formerly, but still operating under restrictive regulations as it did not after 1892, may be relevant, but it is perhaps more likely that the average was considered to give a better indication of the general trend of smallpox mortality after 1885.

The case-fatality figures for the "unvaccinated" appear to demonstrate that the disease, although diminished in prevalence, the number of cases being small relative to previous experience, still operated in a virulent form in certain years, notably in 1891–2, 1897, and 1901–2. It may be that other factors were at work in 1891 at least, since the average case-fatality rate is not especially high in that year: perhaps the prevalence of the disease among the vagrant class in London, striking at an almost certainly undernourished group with diminished resistance, raised the fatality rate among the "unvaccinated" into which group the majority of such victims probably fell.

The examples presented by McVail suggest that smallpox was no longer indigenous by the beginning of the twentieth century. The epidemic outbreaks to which he refers were all reported to be imported. The case-fatality rate in the Hull epidemic of 1899–1900, described above, was 17.3 per cent; in 1903–4, Hull, sharing in the

<sup>140</sup> Ibid.

<sup>141</sup> Ibid.

provincial epidemic, suffered a case-fatality rate of only 5.4 per cent. In Glasgow the epidemic of 1900, imported from Bombay, had a fatality of 12.5 per cent; but that which began in September 1903, introduced by navvies from Peeblesshire, had a fatality of 7.6 per cent. Severe smallpox at Bristol in 1908 was imported from the Sea of Azov, in 1915 from Spain. Very mild smallpox was imported into Nottingham from America in 1901 by visitors to the Mormon conference there. In Lancashire at this time it was recorded that smallpox outbreaks could be traced to two sources: to cases imported from America, which were of a mild type, and to an infection that came from Paris via London, which was much more severe.<sup>142</sup> Smallpox at Liverpool in 1902 was principally introduced by men from American cattle ships, which traded regularly with the city. The disease was introduced by way of the port in December 1901, but, because of the "excellent sanitary arrangements" of the Liverpool health department, it made little headway until November 1902, when a concealed or unnotified case in a poor part of the town led to a local outbreak. Although the sanitary authority took "prompt measures", these failed to control the disease, which by early 1903 assumed epidemic proportions. From 6 December 1901 to the end of 1902, some 552 cases of smallpox became known; between January and June 1903, 1,585; from June to December 1903, 141. These figures do not include some thirty-three cases found on vessels arriving at Liverpool port, although these cases were removed from their ships to the city's infectious disease hospital.<sup>143</sup> During the epidemic outbreak, four Corporation hospitals were used for smallpox cases: it was considered that these were, in a "material degree", responsible for the considerable and sustained prevalence of the disease in the city.<sup>144</sup>

The pattern of smallpox incidence in London and the provinces in the 1890s and the early years of the twentieth century suggests that the disease probably still occasionally entered the country undetected resulting in sporadic outbreaks, but that, as an endemic disease, it was exerting very little or no influence. In London, the six years of very low incidence and further diminished mortality between the epidemics of 1884-5 and 1892-4, together with the unprecedented nil mortality of 1889, mark a decided change in the character of smallpox in the city. The admissions to the MAB hospitals in 1893, at the peak of this epidemic, would not have ranked as of epidemic proportions in the 1870s. After 1894, there was a further period of six years before smallpox, this time indisputably introduced from abroad, again became epidemic. The experience of London in the epidemic outbreak of 1901 suggests the feasibility of this interpretation. The history of the epidemic reveals both the strengths and weaknesses of the London preventive organization in respect of smallpox. A severe strain of the disease reached epidemic proportions on the Continent, particularly in Paris, during 1901. The London preventive organization was put on special alert against the introduction of the disease; a precaution which resulted more than once in the course of the summer in the detection of imported smallpox, and the speedy limitation of its spread.<sup>145</sup> Severe strains of the disease had been threatening Britain since at least

<sup>142</sup> McVail, *op. cit.*, note 8 above, pp. 9-12.

<sup>143</sup> *Annual report of the Medical Officer: Local Government Board*, PP. 1906, XXXVI, appendix A, no. 10, p. 157.

<sup>144</sup> *Ibid.*, p. 176.

<sup>145</sup> *Annual report of the Medical Officer: Local Government Board*, PP. 1902, XXXVII, p. 435.

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1895, when there was a serious outbreak in Calcutta, and by 1900 it was ravaging Bombay and Cairo. Already in 1900 a group of eighteen cases in Hackney had been found to have their origin in Jerusalem,<sup>146</sup> while the London notification records showed that the greater number of primary cases occurring in the years 1900–1 were imported from abroad.<sup>147</sup>

While the introduction of severe smallpox into London in 1901 was perhaps not inevitable, the events in Liverpool in 1902 related above illustrate the real difficulty of successfully maintaining a sustained preventive cordon against the repeated challenges of a highly infectious disease like smallpox. In August 1901, there finally occurred, in the south of St Pancras parish and contiguous areas, an outbreak of smallpox whose source could not with certainty be traced. From this base, the epidemic spread outward to affect many, though not all, of the metropolitan boroughs. North of the river, those principally affected were St Pancras, St Marylebone, Shoreditch, Bethnal Green, Stepney, Poplar, and Hackney; south of the river, Bermondsey, Southwark, Battersea, and Camberwell.<sup>148</sup> In this emergency, the London preventive organization proved fully adequate to limiting the disease not only to metropolitan London, but even to areas within the city. Not a few boroughs were virtually exempt from the disease throughout the epidemic, and the medical officer of the Local Government Board felt that there could “indeed be no doubt at all” that the efficiency of the MAB as both hospital authority and ambulance service contributed largely to the success in combating London smallpox. The epidemic was virtually over by August 1902.<sup>149</sup>

Although smallpox did succeed in entering London and establishing a hold upon the community in 1901, it did so only after repeated attempts, and at a time when the port preventive service was under considerable strain. There was very grave concern at this time that plague or cholera, or both, both epidemic in places within the London trading area, might be imported.<sup>150</sup> In addition, the infectious nature of smallpox, combined with its twelve-day incubation period, made it a more difficult subject for preventive control than the other two diseases. The vigilance of the port sanitary authorities was sharpened by the experiences of 1901–3. Although the American type of smallpox (*variola minor alastrim*) became increasingly dominant globally, and indeed began to extend in Britain from 1919, to reach epidemic proportions in 1923,<sup>151</sup> *variola major* did not again become seriously epidemic. Severe types of smallpox continued to be active in various European countries in the early decades of the twentieth century, notably in Spain, Portugal, Italy, Austria, Hungary, and Russia,<sup>152</sup> and continued to be recognized as a danger to Britain. McVail warned that, “. . . constant intercourse between the United Kingdom and the Continent maintains a degree of risk which prevents any sense of security against successful invasion by the disease.”<sup>153</sup> The

<sup>146</sup> *Annual report of the Medical Officer for London*, 1900, p. 16.

<sup>147</sup> J. F. J. Sykes, *Smallpox in London*, London, P. S. King, 1901, pp. 3–5.

<sup>148</sup> *Annual report of the Medical Officer: Local Government Board*, PP. 1902, XXXVI, p. 436.

<sup>149</sup> *Ibid.*, p. 439.

<sup>150</sup> *Annual report of Medical Officer: Local Government Board*, PP. 1902, XXXVII, pp. xlii–xlv; appendix A, nos. 18–20.

<sup>151</sup> Dixon, *op. cit.*, note 5 above, p. 211.

<sup>152</sup> McVail, *op. cit.*, note 8 above, p. 25–26.

<sup>153</sup> *Ibid.*, p. 26.

British preventive establishment in the early twentieth century continued to be alert to the possible import of virulent smallpox from abroad.

There can be little doubt that the story of the decline of smallpox mortality in Britain is more complex than allowed for by those who accept the simple vaccination explanation. The variations in virulence of the disease certainly complicate the elucidation of the problem of the other factors involved. It is clear, however, that vaccination (and inoculation) *per se*, because of prejudice, apathy, ignorance, and absence of enforced re-vaccination, could never have been the sole instrument in the disappearance of the disease. Other measures were widely used to control the spread of smallpox in the last thirty years of the nineteenth century; and were generally accepted in preventive circles as being essential in achieving any degree of success. As late as 1901, the principal measure against smallpox in England was still the "isolation *in detail*" of sick persons.<sup>154</sup> The establishment in the 1870s and early 1880s of a coherent national preventive structure was probably crucial in limiting the opportunities for entry of virulent disease strains, and in raising the efficiency level of local preventive measures. The Infectious Diseases Notification Act of 1899, which made notification compulsory for the infectious diseases, including smallpox, nationally, finally completed this structure.<sup>155</sup> The institution of the port sanitary authorities was one feature of outstanding importance. Without these authorities, it is probable that Britain would have experienced epidemics of cholera, and perhaps of plague, in the later nineteenth century, and that the battle against endemic and epidemic smallpox in its more virulent forms would have been prolonged beyond the early twentieth century.

#### SUMMARY

There can be little doubt that the story of the decline of smallpox mortality in Britain is more complex than allowed for by those who accept the simple vaccination explanation. The variations in virulence of the disease complicate the elucidation of the problem of other factors involved. Smallpox was in all probability not a native British disease, but only became endemic in the late seventeenth or early eighteenth century, and the "native strain" was probably a mild one. Mortality may probably have been significantly increased through the introduction of more virulent strains from abroad. It seems reasonably clear that vaccination (and inoculation) *per se* could not have been the sole instrument in the disappearance of the disease, because of prejudice, apathy, ignorance, and absence of enforced re-vaccination. Other measures were widely used to control the spread of smallpox in the last thirty years of the nineteenth century; and were generally accepted in preventive circles as being essential in achieving any degree of success. The establishment in the 1870s and 1880s of a coherent national preventive structure was quite possibly a decisive factor in finally limiting the opportunities for entry of virulent disease strains, and in raising the efficiency level of local preventive measures. The establishment of the port sanitary authorities was a critical factor.

<sup>154</sup> Sykes, *op. cit.*, note 147 above, p. 9.

<sup>155</sup> Infectious Diseases Notification Act (1899), 62 & 63 Vict. c. 8.