

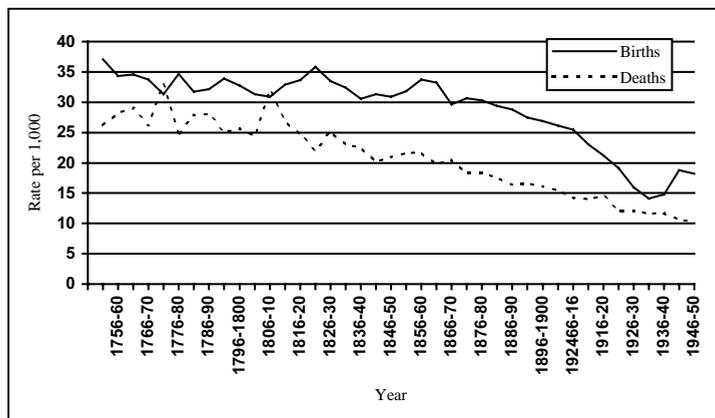
THE HISTORY OF SMALLPOX AND ITS PREVENTION IN SWEDEN

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The demographic transition in Sweden fits well into the models that describe more general West European conditions. This is true for social, political, economic and religious changes, but also for explicit demographic transformations. Mostly because of the unique sources, researchers have most often referred to the population changes in Sweden¹. Swedish mortality rates start a sharp decline in the early eighteenth century - which apparently was not followed by a corresponding decrease in fertility rates until the end of the century.

FIGURE 1. Crude birth and death rates, Sweden 1750-1950

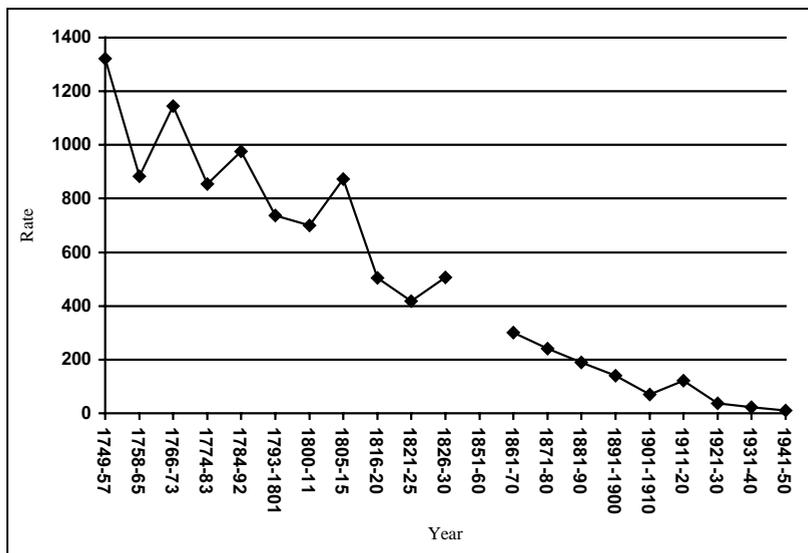


Source: *Historisk statistik för Sverige*. Del 1. Befolkning 1720-1967. 2nd edition. Stockholm 1969, pp 89-91.

¹ OMRAN, A. M. (1971), «The epidemiologic transition. A theory of the epidemiology of population change», *Millbank Memorial Fund Quarterly*, 49:4, pp. 513-15. LANDERS, J. (1992), «Introduction. Historical epidemiology and the health transition», *Health Transition Review*, Supplement to vol. 2, 509-38; pp. 5-6.

Six to seven causes of death dominated mortality between 1750 and 1800; with the exception of infirmities of old age and stroke, none had a great impact on mortality fifty years later. Many causes of death were epidemic infectious diseases, such as smallpox, measles, fevers and unknown diseases that can be grouped under the name of epidemic mortality².

FIGURE 2. Epidemic mortality per 100,000 population, Sweden 1749-1801 and 1851-1950

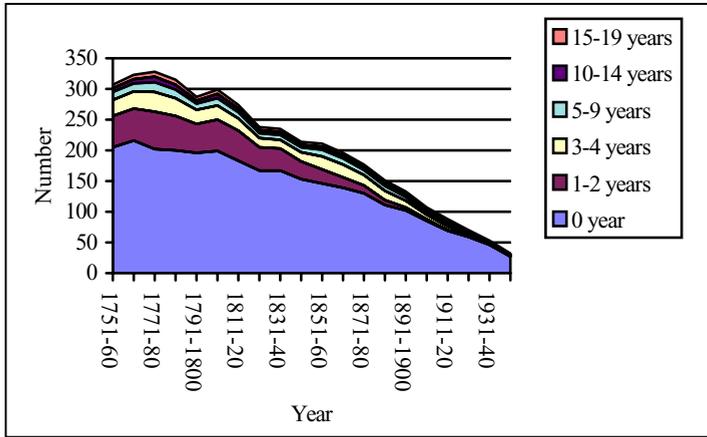


Sources: Mortality records. The older archive of the Table commission. National archives. Bergman, Rolf. *De epidemiska sjukdomarna och deras bekämpande. Medicinalväsendet i Sverige 1813-1962* (ed. Wolfram Kock). Stockholm 1963, p 334-5.

During the following century, epidemic mortality decreased considerably, so that by mid-twentieth century they represented an insignificant part of total mortality. Other factors that are considered important and general in this context are more positive mortality trends among children and women - also true for Sweden.

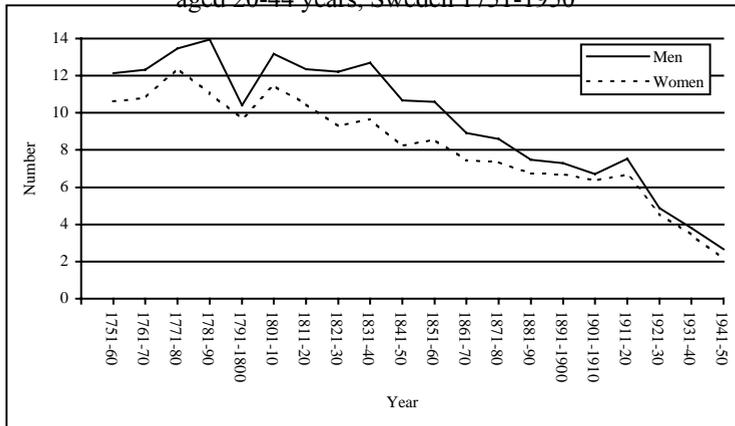
² WALLIS, C. (1888), *Dödlighetens aftagande i Sverige och orsakerna därtill*, Studentföreningen. Verdandis småskrifter 2, Stockholm, pp. 5-15.

FIGURE 3. Crude death rates for age-groups 0-19 years, Swedish mortality 1751-1900



Source: *Historisk Statistik för Sverige. Del 1. Befolkning 1720-1967.* 2nd edition. Stockholm 1969, pp. 111-14.

FIGURE 4. Age-specific crude death rates (per 100,000), men and women aged 20-44 years, Sweden 1751-1950



Source: Sundbärg, G. (1905). *Döde efter kön, ålder och civilstånd i Sverige för åren 1751/1900 samt medelfolkvärdet efter kön och ålder under femårsperioderna för samma tid.* pp. 107-62.

During the epidemiologic transition infants and children contributed a successively lower proportion of total mortality, while adults over 60 years contributed a greater proportion. This is logical when we know that life expectancy increased. It is also likely that the important changes in total mortality took place in the younger age-groups. We can see that crude death rates declined continuously between 1750 and 1900 for those under twenty³.

The extensive decline in nineteenth-century mortality has partly epidemiologic and virologic explanations, but the active part played by society has also been important. The enlargement of the health organization and a growing and more competent corps of physicians were also important. However, improvements in sanitation and hygiene, together with public health measures, were as important as the other factors.⁴ Thomas McKeown argued that medicine was not important for the mortality decline until the 1930s⁵, but this has been strongly criticized in recent years.⁶ There is ambivalence how to define the term medicine, but certain difficulties also appear when the relation between public health measures and demographic changes must be estimated⁷. The main problem is that we have to deal with attitudes that are very difficult to measure during the eighteenth- and nineteenth centuries. However, a simple graph giving the number of health related laws and decrees clearly indicates that public health is related to the changing mortality rates. We can see that there is a great increase of laws in the beginning of the nineteenth century. At the same time overall mortality in Sweden decreased sharply.

³ SKÖLD, P. (1996a), *The Two Faces of Smallpox. A Disease and its Prevention in Eighteenth- and Nineteenth-Century Sweden*, Umeå, pp. 27-36.

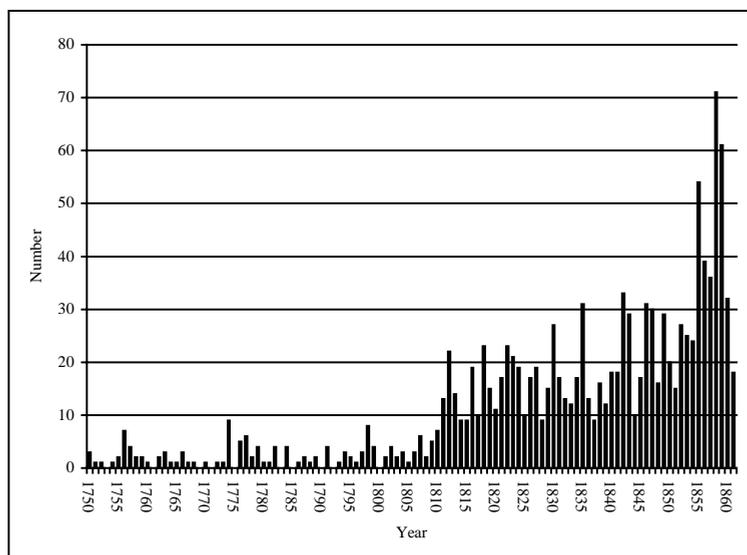
⁴ CALDWELL, J. C. (1992), «Old and new factors in health transitions», *Health Transition Review*, supplement to vol. 2, pp. 205-16.

⁵ MCKEOWN, T. (1977), *The Modern Rise of Population*, London, pp. 138-55.

⁶ JOHANSSON, S. R. (1994), «Food for thought. Rhetoric and reality in modern mortality history», *Historical Methods*, 27: 3, 101-25; pp. 105-10. KEARNS, G. (1988), «The urban penalty and the population history of England», *Society, Health, and Population During the Demographic Transition* (eds. A. Brändström and L-G. Tedebrand), Umeå, pp. 213-36.

⁷ FEE, E. and PORTER, D. (1991), «Public health, preventive medicine, and professionalization: Britain and the United States in the nineteenth century», *A History of Education in Public Health. Health That Mocks the Doctors' Rules* (eds. E. Fee and R. M. Acheson), Oxford, 249-76; pp. 15-20. FRASER, D. (1973), *The Evolution of the British Welfare State. A History of Social Policy Since the Industrial Revolution*, London, pp. 57-80. For a discussion of the relevance of public health laws and lower mortality, see LOUDON, I. (1992), «Medical practitioners 1750-1850 and the period of medical reform in Britain», *Medicine in Society. Historical Essays* (ed. A. Wear), Cambridge, pp. 219-47.

FIGURE 5. Public health related acts in Sweden 1750-1861



Source: Wistrand, A. H. (1861). *Författningar angående medicinalväsendet i Sverige*. Band 2. Stockholm.

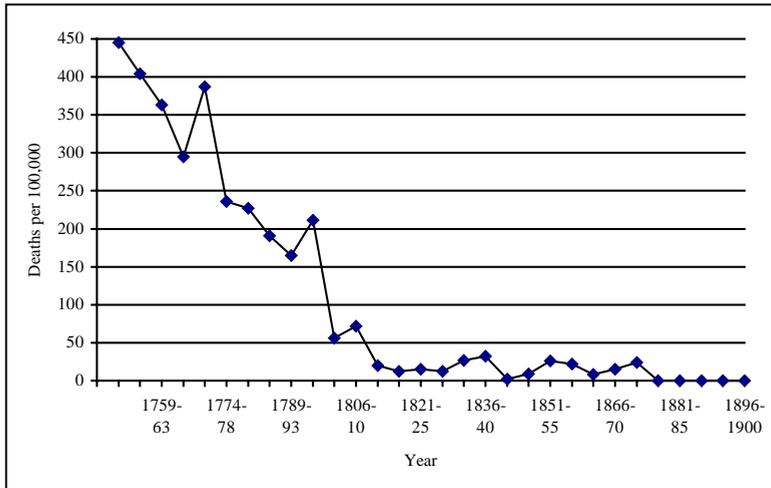
The epidemiologic transition is a very complex process. It does not follow the same pattern in different places and its chronology also differs. There are great difficulties in discussing the whole problem since so many different factors are involved. One way of dealing with this dilemma is to search for a useful indicator. Certain changes are general and crucial for the proceeding of the transition. When trying to scrutinize the character of the epidemiologic transition, smallpox is a worthwhile case to study.

INOCULATION AND VACCINATION

Smallpox was the worst epidemic infectious disease during the eighteenth century. Despite high peaks in smallpox mortality during the worst epidemic years, the disease was endemic in Sweden until the end of the nineteenth century. Between 1750 and 1900 almost 300,000 persons died from the disease. In the beginning of the nineteenth century a sharp decline appears which is maintained and even increased during the period. In the twentieth century smallpox has been a very rare cause of

death and when the WHO declared it eradicated in 1981 it had been absent in Sweden for many years, as in other developed countries⁸.

FIGURE 6. Smallpox mortality per 100,000 of population in Sweden 1750-1900 (five year averages)



Source: Mortality records. Research archive. Umeå University.
 Bidrag till Sveriges officiella statistik (*BiSOS*) 1860-1900.

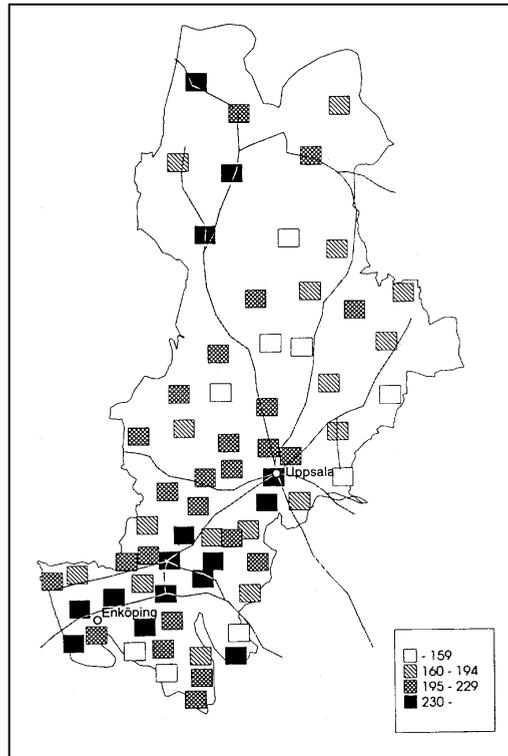
Smallpox was an infectious disease that usually was spread through the respiratory system. After an incubation time of fourteen days rashes appeared in the skin. These developed to blisters and later pocks that were filled with matter. In severe cases the pocks were filled with blood, and these patients never survived the infection. Smallpox was a terrible disease which literally ate its victims⁹.

⁸ SKÖLD (1996a), pp. 65-67. FENNER, F. *et al.* (1988), *Smallpox and its Eradication*, Geneva. For more information about smallpox mortality in European countries see *First Report of the Royal Commission Appointed to inquire into the subject of Vaccination; with Minutes of Evidence and Appendices*, London 1889. CROOKSHANK, E. M. (1889), *History and Pathology of Vaccination. Vol. 1*, London. SILJESTRÖM, P. A. (1885), *En studie i sjukdomsstatistik*, Stockholm. CREIGHTON, C. (1965 [1894]), *A History of Epidemics in Britain*, vol. 2, 2nd edition, London.

⁹ BRACHMAN, P. S. (1990), «Transmission and principles of control», *Principles and Practises of Infectious Diseases*. Third edition (eds. G. L. Mandell, R. G. Douglas Jr and J. E. Bennett). New York, 155-58; p. 155. NEFF, J. M. (1990), «Variola (smallpox) and monkeypox viruses», *Principles and Prac-*

Cultural variables are not the most important when dealing with smallpox epidemiology. Instead, a regional analysis shows great impact of geographical position and population density. And possibly most important of all communications appears as a factor, especially if analyzed at the local level. In the county of Uppland we can see how the parishes in connection with the country-road system were more severely affected by smallpox mortality.

FIGURE 7. Country roads and smallpox death rates per 100,000 for the parishes of Uppsala country, 1776-1810



Source: Demographic Data Base, Umeå University.

tise of Infectious Diseases, Third edition (eds. G. L. Mandell, R. G. Douglas Jr. and J. E. Bennett), New York, pp. 1137-38. For detailed descriptions of clinical features of smallpox see FENNER *et al*, pp. 4-42. A contemporary description of the development of the disease in patients is given by Bergius in 1755. BERGIUS, P. J. (1755), *Försök Til de uti Sverige gångbara sjukdomars utrönande, för år 1754. Til det allmännas tjänst, på Kongl. Collegii Medici anmodan, uppsatt*, Stockholm, pp. 26-28.

There were, however, unique possibilities for people to take an active part in the scenario during the eighteenth century. Smallpox was the first—and for a long time the only— infectious disease that humans found a way to protect themselves from in an efficient way, namely inoculation. Although this medical innovation faced great problems all over Europe, it must be understood as a very important public health intervention¹⁰.

The people and parishes that first accepted the method can certainly be described as moving parts of a mental and cultural process that seriously marked a break with the fatalism previously so dominating¹¹.

With its roots in eastern folk medicine inoculation had been practised in several places outside Europe for hundreds of years. The principle was to give a slight infection by putting smallpox matter into a scar in the skin but still get a lifelong immunity¹². In 1754 the young doctor David Schultz was sent to England in purpose to study inoculation and paediatrics. The Medical Board refused requests to try the method and wanted to wait for the home-coming of dr Schultz. The method of inoculation came to be a weapon in the struggle of positions and influence. The doctors in the Medical Board felt an urgency to do something two years later, in order to forestall the surgeons to pick up the practise. In 1766 the first Inoculation House in Stockholm was opened and pioneer inoculations had been performed in all Swedish district, even of most of them only had made a immunized a few persons¹³.

Eighteenth-century physicians did not keep records over the inoculated persons. It is therefore difficult to estimate the extent of inoculation in Sweden. However, it is clear that the method never became popular. Nevertheless, some districts were more successful than others. Northern Sweden was closely related to Finland, where inoculation was more widespread. This had a positive impact also on the Swedish side of the boarder. Qualitative sources like the physicians annual reports to the Medical Board are not always reliable. From the district of Gotland, for example, it was reported in the 1760s that inoculation was very successful. In the end of the report, however, the names of the only four immunized children were given.¹⁴

¹⁰ MILLER, G. (1957), *The Adaption of Inoculation for Smallpox in England and France*, Philadelphia. RAZZELL, P. (1977), *The Conquest of Smallpox. The Impact of Inoculation in Eighteenth Century Britain*, Firlie.

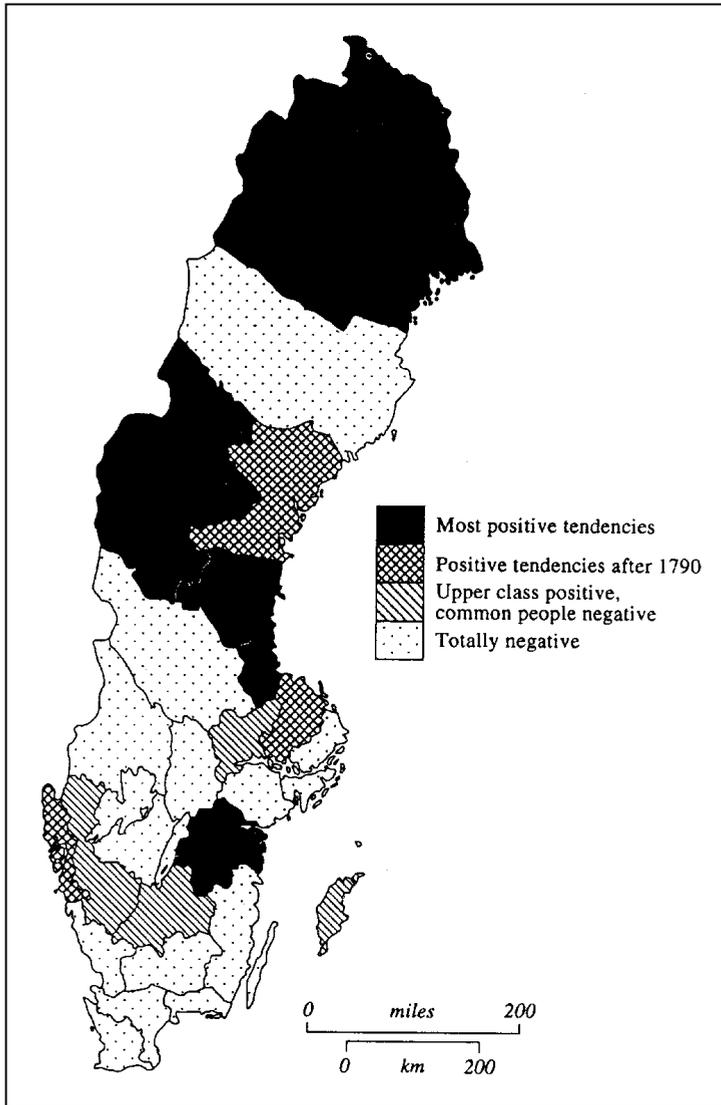
¹¹ SKÖLD, P. (1997), «Offer and request: preventive measures against smallpox in Sweden 1750-1900», *Health Transition Review*, vol. 7, 75-82; pp. 75-82.

¹² FENNER et al., pp. 245-56. CARTWRIGHT, F. F. (1977), *A Social History of Medicine*, London, pp. 79-80. HOPKINS, D. R. (1983), *Princes and Peasants. Smallpox in History*, Chicago, pp. 109-24.

¹³ SKÖLD, P. (1996b), «From inoculation to vaccination: Smallpox in Sweden in the eighteenth and nineteenth centuries», *Population Studies*, 50:4, 247-62; pp. 249-50.

¹⁴ SKÖLD (1996a), pp. 259-88.

FIGURE 8. Aproximate extent of inoculation in Sweden 1756-1800



Source: Annual reports from district medical officers. Department of Health Records 1750-1800. Archive of the Department of Health. National Archives. *Inrikes Tidningar* 1756-1768. *Dageligt Allehanda* 1756-1768. *Wecko-Skrift för Läkare och Naturforskare* 1783-1807.

If the cut in the skin was made too deep a certain risk of serious smallpox appeared. This was the main reason why the doctors did not want amateurs to inoculate. Another main risk was that immunized persons could infect others who then risked a serious attack. This might even start an epidemic, something the doctors were very afraid of being accused for¹⁵. Ambivalence was obvious among the doctors, they did not want to lose their positions and take any risks. As a matter of fact several of them express a relief when vaccination was introduced and the old risks eliminated.

It was mostly the physician's monopoly and an imperfect organization that stopped inoculation from being widely practised. Vaccination—which was introduced into Sweden in 1801—solved these problems by letting the clergy and their assistants convince the public in their parishes that this method was safe and effective. The clergy were also much involved and responsible for the practise of vaccination. Further efficiency was gained when vaccination became compulsory in 1816. Vaccination soon became so popular that regional differences were small. During the first years of practise, however, there is a strong relation between adaptation of this preventive method and the recent experience of smallpox epidemics¹⁶. The regions with highest smallpox mortality during the last years of the eighteenth century were also the first to accept vaccination.

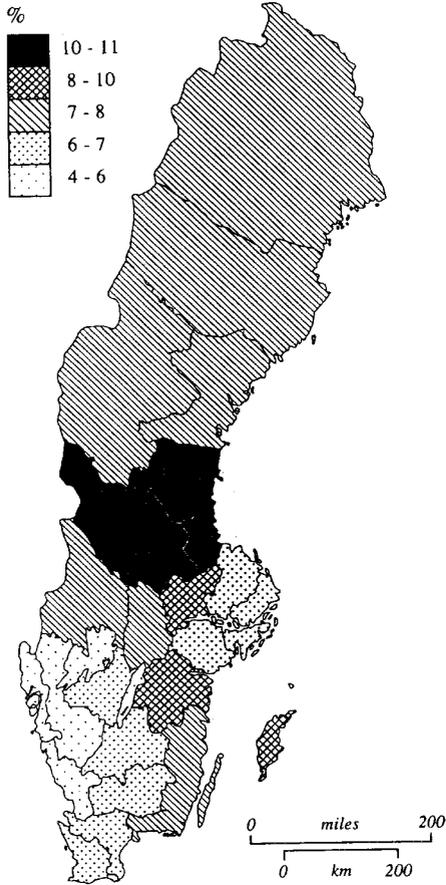
Vaccination can be interpreted as an expression of parental concern for their children. It is, however, not possible to find any significant relation between low vaccination rates and high infant mortality, many children choked to death or a high proportion illegitimate. But there was a relevant and significant relation between high vaccination rates and the proportion of clergy and their assistants in the different districts. The highest vaccination rates were found in the districts with most clergy, further demonstrating the importance of organization¹⁷.

¹⁵ RAZZELL, pp. 20-22. BRUNTON, D. (1990), *Pox Britannica: Smallpox Inoculation in Britain, 1721-1830*, PhD Diss. University of Pennsylvania, p 103. SMITH, J. R. (1987), *The Speckled Monster. Smallpox in England, 1670-1970, with Particular Reference to Essex*, Chelmsford, p. 35. MARBLE, A. E. (1993), *Surgeons, Smallpox and the Poor. A History of Medicine and Social Conditions in Nova Scotia, 1749-1799*, Montreal, pp. 102-06.

¹⁶ SKÖLD (1996b), pp. 254-57.

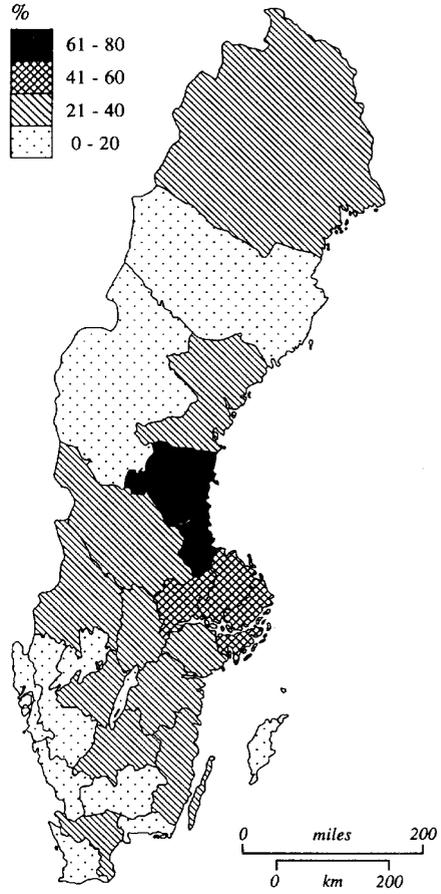
¹⁷ SKÖLD (1996a), pp. 520-26.

FIGURE 9. Smallpox mortality in Swedish districts 1796-1803.



Source: Sköld 1996b, 256

FIGURE 10. Vaccinations in Swedish districts 1804-1810.



Source: Sköld 1996b, 255

TABLE 1. Correlation coefficients and p-values for demographic, organizational and behavioural variables compared to vaccination in 24 Swedish counties 1816-1820

Variable	Correlation	P-value
Inhabitants per square mile	0,0337	0,786
Clergy	0,5454	0,006
Church assistants	0,4987	0,013
Physicians and surgeons	0,0493	0,819
Infant mortality rate	-0,2638	0,213
Children choked to death	0,2525	0,234
Illegitimate children	0,1855	0,385
Deaths from unknown disease	-0,0595	0,782

Source: Population records and mortality records for Sweden 1816-1820. Research archive. Umeå university. Forsell, C. af (1978 [1833]). Statistik öfver Sverige. Grundad på offentliga handlingar. Facsimile 1833, 2nd edition. Stockholm.
 • numbers printed in extra bold type are statistically significant.

Smallpox mortality decreased enormously after the introduction of vaccination in Sweden. The time-limited effect of vaccination with cowpox was unknown until the 1830s, and this together with problems concerning revaccination affected the age-distribution of smallpox mortality.

TABLE 2. Smallpox mortality age distribution (per cent), Sweden 1776-1875

	0 year	1-2 years	3-4 years	5-9 years	10-24 years	25-49 years	50 - years	Total
1776-1785	25,5	30,9	22,9	14,6	5,8	0,28	0,02	100
1786-1795	30,1	31,8	18,8	14,3	4,7	0,28	0,02	100
1796-1805	28,2	33,2	19,7	14,1	4,4	0,34	0,06	100
1806-1815	28,5	31,2	17,5	15,8	6,2	0,5	0,3	100
1816-1825	33,4	20,7	9,7	10,9	18,9	6,3	0,1	100
1826-1835	42,2	17,7	6,4	5,9	12,3	14,8	0,7	100
1836-1845	37,0	15,1	6,6	8,1	12,7	19,3	1,2	100
1846-1855	34,8	11,1	4,2	5,8	15,7	25,3	3,1	100
1856-1865	34,0	9,5	3,5	3,6	12,1	30,9	6,4	100
1866-1875	31,2	10,1	3,5	4,1	10,6	30,6	9,9	100

Source: Pettersson, A. Smittkoppsdödligheten i Sverige under åren 1776-1875. *Hygienisk Tidskrift* 1912, pp. 11-12.

Smallpox was no longer just a disease of children - during the nineteenth century as many adults died from this disease.

SOCIAL CONSEQUENCES - FERTILITY AND MARRIAGE

Fertility changes have been given many different explanations. Some of these stress cultural differences as important, birth control for example. Smallpox is often claimed to be a factor in male infertility. Razzell has stressed the importance of inoculation in controlling smallpox, thereby giving rise to increased fertility at least amongst the aristocracy¹⁸. The same has been put forward as a reason for the change in population in the whole of Europe¹⁹.

I realized that I had a great opportunity to study the impact of smallpox on fertility using the Swedish parish records. Firstly it definitely seemed as there was proof for a significant decrease in fertility among the infected. These women gave birth to an average of 3,86 children while women who never had experienced smallpox gave birth to an average of 6,45 children. This is an extra-ordinary difference, seldom seen in fertility research. But fortunately I brought marriages into the study.

TABLE 3. Fertility in Skellefteå by smallpox immunity status, women born 1780-1785 and 1811

	Infected	Vaccinated
Age at marriage	31,5	25,3
Age at birth of first child	32,9	26,5
Age at birth of last child	40,1	39,5
Fertile years within marriage	13,5	19,7
Fertility rate	3,86	6,45
Annual average fertility within marriage	0,29	0,31

Source: CD-ROM «Skellefteåbor under 200 år». Research archive. Umeå university.

¹⁸ RAZZELL, pp. 109-11.

¹⁹ ANDERSON, M. (1988), *Population Change in North-Western Europe 1550-1850*, London, pp. 43-44. It has also been claimed that smallpox infection reduced height. VOTH, H-J. and LEUNIG, T. (1996), «Did smallpox reduce height? Stature and the standard of living in London, 1770-1873», *Economic History Review*, 49: 3, pp. 541-60.

The difference in fertility between infected and non-infected persons can be explained by variation in age at marriage. Women who were previously infected with smallpox had an average marriage age more than six years higher than women who had not experienced smallpox. This - of course - resulted in a shorter period of fertility within marriage for the previously infected women. If the average number of births instead is calculated for each fertile year within marriage the difference between infected and non-infected has disappeared. It is not possible to prove that smallpox infection had a negative impact on fertility. Sterility, however, seems to be one risk for those who survived smallpox. It looks as smallpox infections more than doubled the risk for sterility²⁰.

If we conclude that smallpox was not an important factor for fertility changes—except from sterility—we are nevertheless left with another problem; the difference in age of marriage between infected and non-infected. Why then should previously infected persons have less chance of marriage or at least an early marriage? There is one factor that immediately comes to mind, disfiguring pockmarks. During the 1960s between 65 and 80 per cent of those infected by ordinary-type variola major had facial pockmarks. The number of scars could be between one and several hundred, with most occurring in the face²¹. Disfiguring pockmarks are perhaps the best known of all smallpox complications²². A smallpox infection brought not only physical but also psychological consequences²³. Hopkins tells of a young girl of seventeen years who had her life and beauty ruined by smallpox, her memorial monument stated that she was released by death at the age of 32. In Nepal the King's Brahman mistress committed suicide because she had lost her beauty after a smallpox infection²⁴. Could it be so that ruined beauty caused social stigmata in the marriage market, and that young people knew this?

«Pockmarked» occurs frequently as a description in eighteenth and nineteenth century literature²⁵. In the novel *Gösta Berlings saga* by the Nobel Prize winner Selma Lagerlöf 'the beautiful Marianne Sinclair of Ekeby' is one of the main characters. She is extremely good looking and suitors were courting her all the time. Marianne eventually decided to marry the young priest Gösta Berling when she was infected by smallpox:

²⁰ SKÖLD (1996a), pp. 200-05.

²¹ FENNER *et al.*, pp. 49-50. See also SCHULTZ, D. (1756), *Berättelse om koppors ympande, öfverlemnad till högloflige Kongl. Sundhets-Commissionen*, Stockholm, p. 45.

²² HOPKINS, J. W. (1989), *The Eradication of Smallpox. Organizational Learning and Innovation in International Health*. Boulder, Colorado, p. 13. MAGNER, L. (1992), *A History of Medicine*, New York, pp. 101-03.

²³ BAXBY, D. (1981), *Jenner's Smallpox Vaccine. The Riddle of Vaccinia Virus and its Origin*, London, pp. 10-13. DIXON, pp. 90-95. MAGNER, pp. 139-40.

²⁴ HOPKINS, D. R., p. 75 and p. 150.

²⁵ See for example MELVILLE, H. (1994), *Moby Dick eller valen*, Stockholm, p. 98. NILSSON-PIRATEN, F. (1992 [1946]), *Bombi Bitt och Nick Carter*, Stockholm, p. 165. BERGMARK, M. (1957), *Från pest till polio*, Stockholm, p. 115.

The terrible disease had in all its fury attacked her, who had a severe cold and was worn out. Death had come close to her, but at the end of the month she recovered. She was still weak and very disfigured. She should never more be called the beautiful Marianne²⁶.

The young woman forbid her servants to tell anyone that she had smallpox and when she had recovered she sent for Gösta Berling. He was filled with strong feelings and on his way to her house he thought of her beauty and of every sentence filled with love he should address to her. The room was darkened when he entered and at first he could not see her, but he recalled from his memory every detail of her face and character.

He fell on his knees at her bed, and took her head in his hands and kissed her, but then he found no words. The heart started to beat furiously, as it wanted to burst his chest. Smallpox had raged her beautiful face. The skin had become rough and filled with scars. Never more should the red blood shimmer on her cheek, or the fine blue veins appear at her temple. The eyes lay fainted under swollen eyelids. The eyebrows were fallen of, and the enamel lustre of the eye was broken with yellow. Everything was destroyed²⁷.

This scene could have been taken from real life. When a nephew of the Russian tsarina Elizabeth, later Peter III, was infected by smallpox his fiancée, later Catherine the great, did not see him during his illness. Hopkins writes:

Elizabeth arranged the reunion of the couple in a dim room at the palace in an attempt to soften the impact of Peter's appearance. Unhappy as his childhood had been, Peter's real tragedy probably dated from his smallpox, which eroded his self-confidence by destroying his appearance²⁸.

If this assessment is correct, this was one of the most important scarrings in history. The only difference between Lagerlöf's book and what happened at the Russian court is that Gösta Berling still loved Marianne and married her while Catherine rejected Peter.

Also Lady Mary Wortley Montagu, who introduced inoculation into England, was left disfigured after an attack of smallpox in 1715. She had been greatly admired for her beauty and expressed her anguish in verse²⁹. Preserving the beauty of young girls was used as an argument in favour of inoculation. Voltaire told that the Circassians sold young women to Turkey and Persia, but this trade was seriously threatened when smallpox became more common in the country, and beautiful girls died or were disfigured by the disease. At this moment the practise of inoculation started³⁰.

²⁶ LAGERLÖF, S. (1961 [1891]), *Gösta Berlings saga*, Stockholm, p. 115.

²⁷ *Ibid*, p. 126.

²⁸ HOPKINS, D. R., p. 58.

²⁹ SMITH, J. R., p. 19. *The Faber Book of Fevers and Frets* (ed. A. S. Enright), London 1989, pp. 29-31.

³⁰ VOLTAIRE, F. (1745 [1734]), *Den Berömde Herr Woltaires ellofte Philosophiske Bref, Om Kop-pornes Ympning eller Sättet att uti Barnens yngre år, flytta dem ifrån den ena till den andra, förr än de*

In Sweden physicians often mentioned the disfigured faces of the survivors as an argument for public acceptance of inoculation³¹. In his teachings of the young prince Gustav, later Gustav III, Carl-Gustav Tessin gave arguments for the practise of inoculation. In the third paragraph he wrote: «*That never any face will be disfigured, so that no wife has to fear a changed temperament of her husband, or any maid is afflicted by a loss of suitors*»³².

Tessin's letter clearly indicates that pockmarked persons, especially women, were less likely to get married. Also Nils Rosén von Rosenstein stressed that women had better reasons for accepting inoculation, since they risked loosing their beauty, or as Geneviève Miller puts it, to «*turn into unsightly monsters*»³³.

There was also a greater risk of being unmarried for previously infected persons. This was especially true for women.

TABLE 6. Per cent of unmarried persons in cohorts by smallpox immunity status in five Swedish parishes, men and women born 1750-1825 and older than 45 years (N=3634)

	ATTMAR	NEDERTORNEÅ	SÄTNA	INDAL	TUNA	TOTAL
Total						
Infected	14,5	25,4	14,0	10,3	11,0	14,0
Vaccinated	7,3	10,7	5,7	4,5	16,0	8,3
Men						
Infected	10,9	23,8	12,8	6,3	4,8	10,9
Vaccinated	5,3	9,7	6,0	5,4	13,0	7,4
Women						
Infected	17,4	26,8	15,0	14,0	15,8	17,4
Vaccinated	9,1	11,5	5,5	3,4	18,9	9,2

Source: Demographic Database, Umeå university.

komma af sig sjelfwe, på det att de skola undwika den faran, som dem i äldre åren förestår däraf. Tryckt i Rouan på Fransöska år 1734, Stockholm.

³¹ *Inrikes Tidningar*, n° 15, 1765. Salberg, Johan, *Tankar i medicin*, Unprinted manuscript 1781, pp. 62-64. Ms 465. Archive of unprinted sources. Karolinska Institute.

³² TESSIN, C.-G. (1756), *En gammal mans bref till en ung prints*, Latter part, letter n° 18, Stockholm, pp. 190-91.

³³ MILLER (1957), p. 31.

The proportion of unmarried was more than twice as big among women who had experienced a smallpox infection. The disease also had a segregating effect in society, as there is clear evidence that infected persons married each other. It is a striking difference that appears, where we can see that smallpox immunity status was identical for both partners in almost 90 per cent of all marriages.

EPILOGUE: THE ERADICATION OF SMALLPOX

In the end of the nineteenth century smallpox had become a very rare disease. 1895 was the first year when no smallpox deaths were reported in Sweden. This has also been true for the twentieth century. In the 1930s a small epidemic occurred and in 1963 four persons died in what must be expected to have been the last outbreak of smallpox in Sweden³⁴.

In 1980 the WHO declared that smallpox had been eradicated, but this was stated in journals soon after what proved to be the last infected person, a hospital worker in Somalia in 1977³⁵. Nevertheless, it is relevant to ask if it is possible that the disease could return or if any other virus or disease could cause the same damage to the world's population, as smallpox did over several centuries?

The miasmatic theory of disease emerged into practical vitality in the 1850s, so that filth was recognized as the medium by which contagion was transmitted and not as the source of infection. The conception of contagious elements as a particular living organism clarified the picture. This was done by careful studies by a few epidemiologists and by Pasteur's development of germ theory³⁶. In the 1880s medical authorities throughout the world were primarily concerned with keeping smallpox away from urban areas, where most people lived³⁷. In Europe few died from the disease, but epidemics still occurred in cities like Sheffield, London and Liverpool³⁸. In 1947 when New York was threatened by a smallpox epidemic chaos nearly ensued and 6,35 million inhabitants were immediately vaccinated. Only twelve persons were eventually infected³⁹.

³⁴ STRÖM, J. and ZETTERBERG, B. (1966), «Smallpox outbreak and vaccination problems in Stockholm, Sweden 1963», *Acta Medica Scandinavica*, Supplementum 464, Stockholm.

³⁵ «The death of one killer», *The Economist*, 1977:17, p. 23.

³⁶ WINSLOW, C. E. A. (1944), *The Conquest of Epidemic Disease*, Princetown, pp. 236-65.

³⁷ MAYNE, A. (1988), «'The dreadful scourge': responses to smallpox in Sydney and Melbourne, 1881-2», *Disease, Medicine, and Empire. Perspectives on Western Medicine and the Experience of European Expansion*, London, pp. 219-41. MARKS, S. and ANDERSSON, N. (1988), «Typhus and social control: South Africa: 1917-1950», *Disease, Medicine, and Empire. Perspectives on Western Medicine and the Experience of European Expansion*, London, pp. 262-64.

³⁸ DIXON, C. W., pp. 308-18.

³⁹ *World Health Day*, vol. 7, Geneva 1965, pp. 2-3.

In 1959, after an initiative from the Soviet Union, the WHO decided to start a global eradication campaign. Ten years later the organizers knew that their goal would be achieved, and their success was not only medical and organizational, but also financial. The total cost of the eradication campaign was 313 million dollars, compared to the 1,000 million dollars that every year had been spent on controlling the disease⁴⁰. Control measures became effective in reducing further spread of smallpox and in the early 1970s it was stated that the possibility of a large outbreak having imported into the USA or Europe was almost non-existent. Vaccination was no longer carried out on all children, since the risks associated with the method outweighed the threat posed by the disease itself⁴¹.

The eradication of smallpox is considered to be a milestone in the history of medicine. Henderson wrote:

It will have demonstrated what can be achieved when governments throughout the world join an international organization in a common purpose. In perspective, however, the campaign must be seen as representing only a small first step toward achieving a tolerable level of public health throughout the world⁴².

The practise of vaccination finally eradicated smallpox, but we do not have vaccines against all viruses. Even if medicine and technology develops, organizational management improves, and collaboration between states increase we can never be sure that a new virus will not appear, with a similar dreadful capacity as smallpox once showed. Maybe it is the corrective of nature to replace one eradicated disease with a new disease, or maybe it will be possible for us in the future also to control this part of life.

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⁴⁰ Britton, S. (1989), «WHO-inriktning inför 2000-talet: Utrotningskampanjer och hälsa åt alla», *Läkartidningen*, 86: 6, pp. 442-44.

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