DRAFT PAPER – Please do not quote

Correspondence to: per.axelsson@cesam.umu.se

Indigenous Infant Mortality in Sweden: The Key to the Demographic Transition?

Per Axelsson, Umeå University, Sweden

Peter Sköld, Umeå University, Sweden

Lena Karlsson, Umeå University, Sweden

Len Smith, National University of Australia, Australia

Paper for presented to the XXVI IUSSP International Population Conference

Marrakesh, Morocco, September 29, 2009

Acknowledgment

The present study has been funded by the Swedish Council for Working Life and Social Research (FAS) and the European Science Foundation: Eurocores Programme – BOREAS (Home, Hearth and Household)**.**

1. Introduction

We know that the Sami in present-day Sweden have an equally good life-expectancy compared to the majority population.[1] We also know that this was not the case two hundred years ago. The problem is that we know very little about the period in between. Our study focuses on the infant mortality patterns from 1750 to 1899 in a remote area of northern Sweden, occupied by indigenous groups (the Sami) and colonizers. The positive Sami experience has not been shared by many other indigenous peoples around the world. The survival disadvantages suffered by indigenous peoples today are profoundly connected to their history of colonization, which has occurred globally among all indigenous peoples. The time, extent, impact, and understanding of colonization always bring change to the indigenous cultures: sometimes positive changes, but often negative. The present study is concerned with different aspects of infant mortality, a possible key issue in the demographic transition process. Our data allows us to divide the population in the area, into Sami and non-Sami groups enabling a broadened insight into the consequences of colonization. More precise, this paper will deal with; infant mortality, seasonal infant mortality, parity, causes of deaths and an expanding health care system. Can demographic changes be understood in the light of colonization, ethnic differences, and increased medical impact? And is infant mortality the key to the Sami transition from low life-expectancy to death rates similar to the rest of Sweden?

Omran's classical essay (1971) on the epidemiologic transition described how societies over time experienced three different stages of development regarding their pattern of health and disease. The model described the change from high mortality due to infectious diseases to low mortality caused by chronic diseases. Omran focused on mortality but the general scheme also described its relation to demographic, sociologic and economic changes. Different countries could experience the stages at different times. Some of Omran's arguments were based on Swedish statistical material and portrayed Sweden as one of the Western societies that was far advanced and had completed the transition. In Omran's classic work countries in Latin America, Africa and Asia were described as delayed and had not reached the third phase (see also Caldwell 2001).

Omran's theory has had great impact on the public health community and stirred research in a variety of disciplines. Native people were not mentioned in his work but few researchers would

[1] However we are fully aware of the fact that climate change and industrial activity on the grazing lands of Sami reindeer herders have started to affect the mental and physical health of the Sami Population (Morris 2009: 15-16)

dispute that the indigenous populations of the world experience demographic transitions much later than non-indigenous populations. Therefore a discussion of an indigenous demographic or health transition is often addressed but, due to lack of longitudinal data, rarely examined (Waldram, et al. 2006, Kunitz 1994). Systematic information about health, morbidity and mortality among indigenous populations around the world is generally poor, but from what is known life-expectancy in the indigenous communities does not match the level of non-indigenous. Today poor living conditions and nutrition along with high rates of infectious diseases result in infant mortality levels much higher than among non-indigenous populations (Gracey and King 2009, King, Smith and Gracey 2009, Heaton et al 2007, Stephens et al 2006). The study of the Sami historical experience of demographic transition and its most specific features, such as infant mortality, bears a potential to thread light also on the mechanisms of the present-day situation of indigenous peoples, and its future improvement.

1.1. Historical background

The Sami were traditionally hunters and gatherers. In the mid-sixteenth century the Swedish King began tax collection in Sápmi. Most commonly taxes were paid in furs and dried fish. There was an increasing demand for furs in Europe, so the King also traded these products. Dried fish was used as payment for the soldiers that were constantly involved in different wars, but taxes alone could not cover for the needs, why the Sami also sold fish. In turn they received food products, such as butter and flour that until then had been relatively rare in the Sami culture. As a result of the improved nutritional supply the population grew considerably. However, the fur market shifted and the lakes were soon almost depleted of fish. Now the result was instead a population crisis. The Sami society could not supply the increased population with sufficient nutrition when the import of butter and flour was stopped, and there was less fish to get. At the same time, i.e. the early seventeenth century, the Sami became reindeer herders, which to a great extent can be seen as a response to the population crisis (Sköld 1992: 125-27).

In the beginning of this century the Swedish states began paying interest to the distant regions in the north. Churches were built with the ambition to convert the Sami to Christianity. Courts were held annually, market places were built, and the first printed books in the Sami language appeared. During the seventeenth and eighteenth centuries, the Sami were forbidden, on pain of death, to practise their religion, which was characterized by a cult of the dead, the worship of gods and goddesses, sacrifice, pantheism, and shamanism (Rydving 1993). Foreign regents who had blamed their defeat

during the Thirty Years' War on Sami witchcraft caused the affronted Swedish government to act against the Sami. Also declaring that the Sami had to be saved from the effects of alcohol use, in 1723 the government passed a law prohibiting the import of hard liquor into the area and banned its sale throughout the province, the legislation was not repealed until 1898 (Kvist 1992). Further interest in the area was stirred in the late seventeenth-century by the discovery of silver, but the mining epoch lasted for only 50 years. The Sami remained very isolated, not only because of their economy and culture but also because of the great distances between households and the intense cold of the region for most of the year. At the end of the seventeenth century the state also tried to encourage settlers to move to the area, offering free land and fifteen years free from taxes. This had, however, a limited impact on the in-migration, a trend that did not shift until the mid-eighteenth century. From this time the process of colonization can be said to begin, and during the next hundred years the ethnic balance in Sápmi changed, turning the Sami into a position as minority. Their culture and society underwent major changes as well (Nordin 2009, 25-42).

1.2. Data and research methods

The main source material used for the present study is a set of data files from the Demographic Data Base (DDB) at Umeå University, the largest historical data base in Europe. In the autumn of 2001, the DDB started a project of digitizing the eighteenth and nineteenth century parish records from the northern parts of Sweden – Sápmi – where the Sami people have lived traditionally. The Northern Population Data Base covers approximatively 150 years, 1750-1900, and the records include every individual in the parishes. This is also the period in which the area was colonized, largely by Swedish settlers, and the Sami population changed from a majority to a minority population. The longitudinal database is the first of its kind in the world, based on an indigenous population. The source material is not based on self-identification but it separates the Sami and the settler populations and contains information on, for instance, gender, age, cause of death, migration and fertility. Each individual can be followed from the cradle to the grave allowing the reconstruction of life biographies and family composition based on ethnic categorization.

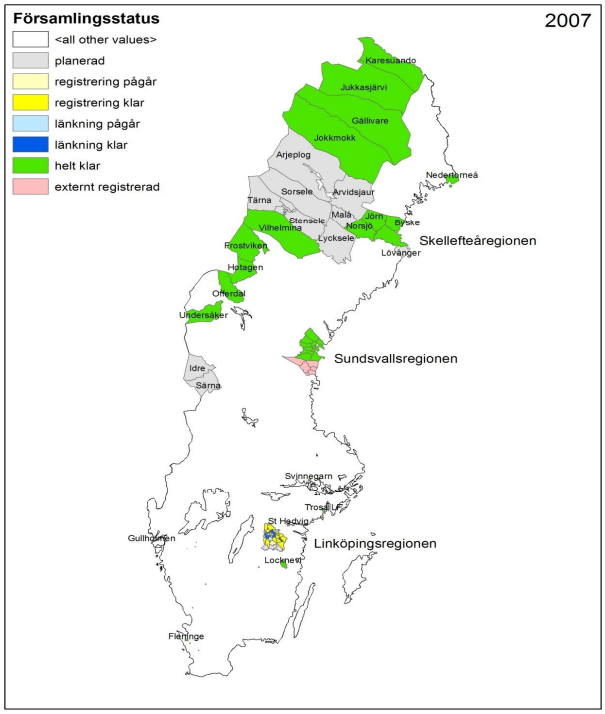
Table 1. Working sample and missing cases

	Jokkmokk	Jukkasjärvi	Föllinge
Sample	10808	9630	9368
Working sample[a]	9813	8439	8557
Missing cases Unknown date of birth and/or Not born in the parish	3247	1888	2873
Total working sample	6566	6551	5684

[a] Individuals born 1750-1895

In order to improve the data quality the time period has been restricted to 1750-1895. Only infants born within the study area and with a given birth day have been included. The total working sample is constituted of 18,801 births in three different parishes.

Figure 1. DDB digitized area



The traditional Sami area (Sápmi) is culturally very complex. Sami live in four countries, speak nine different languages and are diversified by reindeer herding techniques, social organization and economic resources. The Swedish part of Sápmi was slowly colonized by settlers from the mid-seventeenth century. Initially the Sami land rights were legally protected, but from the early-nineteenth century they experienced a more repressive State policy, and their traditional division and use of land was replaced by the national administrative system. The Swedish parish registers and national statistics at parish level appear at a time when colonization moves into a more intensive phase. Notably also Sami were involved in settlements, sometimes as a way to protect their land rights.

The present study includes three parishes where Sami were in a great majority around 1750. The church registers of Jukkasjärvi and Jokkmokk in the North Sami area contained both Sami and Swedish settlers, while Föllinge Sami parish in the South Sami area was an administrative construction exclusive for the indigenous population in the area. There was, however, also a corresponding parish register for the settlers of Föllinge. The magnitude and timing of colonization differed between the parishes. In the northernmost parish of Jukkasjärvi Sami were in majority throughout the period 1750-1900. Until 1850 there are around 400 non-Sami and 1000 Sami, both groups experience a population increase from 1880, settlers more than the indigenous. The parish of Jokkmokk is more representative for the Sami parishes in general, where an ethnic majority shift occurred around 1830. Actually the majority shift seems to move in a frontier wave from the south to the north. Previous research has to a large extent exclusively counted the reindeer herding nomads into the Sami group. There is, however, an ethnic complexity in the north already during the early stages of colonization, where large groups of Sami were hunters or farmers. They are registered as Sami in our study, why the Sami population increases. This has been done in order to create a more 'in situ' oriented demography (Taylor 2009). As we have already stressed all Sami were not nomadic reindeer herders and during the period many of them took up settlements, becoming settlers but still Sami. Often they continued to be registered as Sami in the parish registers, sometimes with a note that they were "Sami-settlers" [lappnybyggare]. In the present study we have made a division between Sami and non-Sami populations that mean that both nomadic and settled Sami are coded as belonging to the Sami population. Further studies in our project will try and find ways to make Sami categorization more incisive.[2]

[2] Our research group at the Centre for Sami Research, Umeå University has several ongoing studies on the historical demography of the Sápmi region.

Regarding how to best make use of the ethnic markers in the sources we have used a system designed by historian Gabriella Nordin (2009) in her recent dissertation on marriage patterns in Sápmi 1750-1900 and also presented in Sköld and Axelsson (2008: 31-34).

In the parish of Föllinge the ethnic majority shift came earlier, from the late eighteenth century there were more non-Sami than Sami in the area. The proportions were increasingly pronounced, and at the end of the period there were almost ten times as many Swedish persons. The conflicts between reindeer herders and settlers were intensive in the area.

A complementary source has been the annual reports of the district physicians in the area. The doctors were not well acquainted with the conditions among the Sami, and the reports often give laconic and judgemental descriptions of Sami health.

Previous studies of Sami mortality have revealed considerably higher rates 1750-1900 compared to non-Sami persons, both in Sápmi and in Sweden generally (Sköld 2004; Sköld and Axelsson 2008, Edvinsson, Gardarsdottir and Thorvaldsen 2008). Nevertheless, the last fifty years show no ethnic mortality differences in the area (Hassler 2005). Indigenous people have experienced a delayed demographic and epidemiologic transition (Trovato 2001), and infant mortality has been highlighted as one of the early indicators of intensified change. Our study aims to find evidence for declining infant mortality rates among the Sami before 1900, that could be interpreted as a forerunning development of the general transition. Long-term infant mortality trends are analyzed in order to compare Sami and non-Sami groups in the three parishes. By using both northern and southern Sami areas the cultural complexity of the Sami society is concerned. Infant mortality generally has showed great geographic variations (Brändström, Edvinsson and Rogers 2000). Sex differences, seasonality, and neonatal mortality are included parameters, which are interpreted in perspective of the varying work intensity of the reindeer nomads. Parity, causes of death and change over time are additional variables that complete the study together with an estimation of health care program impact. The results are discussed from the perspective of source quality, methodological considerations and the general demographic transition in Sweden.

2. Infant mortality in Sápmi

From the mid-eighteenth century the Swedish medical health care system tried to reduce the very high infant mortality in the country. In Stockholm and other urban areas sometimes more than half of the newborn children died within their first year of living. Medical instructions were published

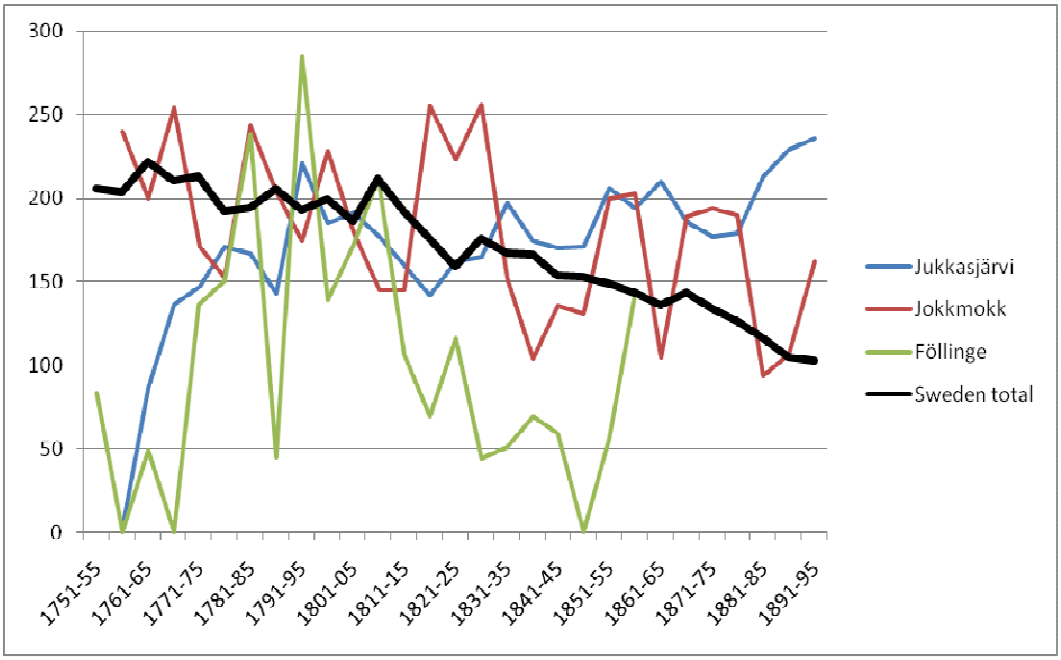
concerning the care of infants, and district doctors were employed even if it was still in the 1870s a rare event for someone in northern Sweden to have a visit by the doctor (Brändström 1990: 314-16).

The clergy took a great responsibility for health care, but during the nineteenth century they became less and less involved. They were officially released from health duties in 1830, and after this their participation in medical issues in the parish was not obvious. Nevertheless, many clergy continued to assist with medical advice. From this time midwifery increased, even if many parishes resisted official requests to employ a midwife due to economic weaknesses (Sköld 2001).

In the early nineteenth century the northern parishes had among the highest infant mortality in Sweden. Also the region around Stockholm suffered from extremely high death rates for the youngest. The infant mortality rates declined over the nineteenth century. This had much to do with improved hygiene, and increased breast-feeding. In many places in Sweden it was not common to breast-feed the babies. Instead a widespread culture of artificial feeding, where undiluted and unboiled cow milk, often sour and of bad quality, replaced breast-feeding. Different sorts of diarrhoea were common in those areas, especially during the warm summer months. The combination of hard agricultural work that often prohibited the mothers to breast-feed their infants and the difficulties to preserve the fresh milk resulted in repeated mortality peaks from June to August. Nevertheless, many areas in northern Sweden experienced great reduction in infant mortality during the nineteenth century. In some parishes it dropped from over 50% to below 18% fifty years later (Brändström 1990: 321-24).

The Swedish observers in the eighteenth century believed that Lapland was one of the healthiest places someone could live in. The fresh air guaranteed a long and strong life. This was supposed to be true also for the Sami. Thus, some clergy were afraid that the nomadic life that begun soon after the birth was harmful, as were the drinking habits of the women. It was not until Hellstenius in 1884 published an article on infant mortality in the counties of Jämtland and Härjedalen, including the South Sami area, that the extremely high infant mortality among the Sami was revealed. However, Hellstenius gave no more explanation than vague ideas about racial differences Later Wahlund showed a similar infant mortality among Sami parishes in the northern area, twice as high as the settlers. Children and adults showed no corresponding increased mortality (Hellstenius 1884; Wahlund 1932).

Figure 2. Sami infant mortality in Jukkasjärvi, Jokkmokk, Föllinge, and Sweden 1751-1895



Registration before 1780 is often incomplete and the IMR is unreliable. Sami infant mortality was at the end of the eighteenth century at the same high level as the rest of Sweden, and occasionally even higher. When IMR declines generally in Sweden from 1810 the Sami in Jukkasjärvi and Jokkmokk stayed at high rates. The parish of Föllinge shows considerably lower rates than the Sami in the other two parishes, and until 1850 Sami infants in Föllinge had much lower mortality than in the rest of Sweden. The IMR during the second half of the nineteenth century is difficult to estimate from the church registers, but Hellstenius showed that the Sami in region had higher mortality than the Swedish settlers between 1860 and 1884.

Table 2. Infant mortality (per 1000) in Jukkasjärvi, Jokkmokk and Föllinge 1750-1899

	1750-99	1800-49	1850-99	Total	N
Jukkasjärvi					
Sami	64	233	136	152	4803
Non-Sami	47	123	155	138	1740
Jokkmokk					
Sami	206	175	161	176	3245
Non-Sami	95	97	117	111	3321
Föllinge					
Sami	24	110	71	74	808
Non-Sami	79	65	79	75	4876

There is a general trend of decreasing Sami infant mortality 1750-1899. In the northern parish of Jukkasjärvi Sami has constantly higher IMR than the rest of Sweden, but the difference decreases over time. Until 1850 they also have higher rates than the non-Sami in the parish, but during the second half of the century the situation is the opposite. The non-Sami in Jukkasjärvi experience increased infant mortality over time. Before 1850 their IMR is lower than in Sweden, thereafter higher. The non-Sami in Jokkmokk also have lower IMR than Sweden until the mid-nineteenth century. They have an increasing IMR trend over time, nevertheless lower rates than the Sami throughout the period. In Föllinge there are insignificant IMR differences between Sami and non-Sami, both groups are well below the Swedish average. There is an excess infant mortality for males in all three parishes, and for both Sami and non-Sami (except for non-Sami in Föllinge). Thus the sex difference was greater among the Sami.

Table 3. Male and female infant mortality (per 1000) in Jukkasjärvi, Jokkmokk and Föllinge 1750-1899

	Male	Female	Total	N
Jukkasjärvi				
Sami	165	139	152	4800
Non-Sami	146	130	138	1738
Jokkmokk				
Sami	190	163	176	3242
Non-Sami	118	104	111	3321
Föllinge				
Sami	84	66	74	799
Non-Sami	75	75	75	4875

The higher male IMR is significant in Jukkasjärvi, and in Jokkmokk during the latter half of the nineteenth century. The sex difference declines to a great degree in Jukkasjärvi. There is, however, no reason to believe that these differences have any explanatory value for the demographic transition in Sápmi.

2.1. Seasonal infant mortality - The impact of nomadism

Reindeer herding was difficult and fragile. The scientists were aware that a year with pestilence among the reindeer meant that several Sami should become severely impoverished, since the reindeer was the only possession with a monetary value they had. It had become illegal for poor Sami on the Swedish side to move to the Norwegian coast and become fishers (Marelius 1772). During the late-17th- and early-eighteenth-centuries the reindeer herding in Jokkmokk experienced a number of difficult years. Especially the years 1756, 1786, 1796, 1813-1816, 1830-1837 and 1843 seem to have been very harsh. Crucial for the situation was pasture and snow conditions, diseases and predators. Kvist shows that emigration, preferably to Norway, was a consequence of bad years for the reindeer herding. In a Sami perspective this was not considered to be emigration. In their more holistic perspective the Norwegian coast was a temporary alternative for living when the reindeer herd had decreased. When the circumstances allowed they returned if possible. The Sami

from Sweden who lived in Norway could keep their Swedish citizenship as long as they visited the summer service once a year (Kvist 1989: 19-21).

Brändström (1990: 333-41 and 1988, 349-354) stated that there was a relation between the work intensity in the Sami society and the infant mortality rates finding the summer months to be the hardest. Already Hellstenius had assumed that the harsh condition of the reindeer herders was the most prominent explanation to their high mortality rates. The reindeer herding years is traditionally divided into eight different seasons that illustrate the shifting conditions and work intensity. They follow the reindeers in a cycle that takes them from the eastern coast regions of Sweden during the coldest winter months to the Norwegian mountain area during the summer months.

Table 4. Seasonal infant mortality (per 1000) in Jukkasjärvi, Jokkmokk and Föllinge 1750-1899

	January-March	**April-June**	**July-September**	**October-December**	**N**
Jukkasjärvi					
Sami	198	191	157	188	3846
Non-Sami	126	169	172	140	1595
Jokkmokk					
Sami	169	180	167	194	3050
Non-Sami	118	110	118	115	3262
Föllinge					
Sami	99	46	116	114	561
Non-Sami	96	68	61	75	4800

During the period 1750-1899 the Sami in Jukkasjärvi and Jokkmokk had lowest IMR during the months July to September. This might be explained with favourable temperatures and weather conditions. An increased risk for infant mortality during these months has a high explanatory value and is statistically significant. The Sami in Föllinge has extremely low infant mortality during the spring months April-June. The non-Sami population in all three parishes have an insignificant seasonal variation in infant mortality. An extreme artificial feeding of infants increases the infant mortality risk during the summer. The low Sami IMR indicates that the contemporary observers were right when stating that the Sami women breast-fed their children for a long time, sometimes as

long as three or four years. The relatively high Sami IMR during the autumn months October to December could be connected to a high frequency of chest diseases and colds (Brändström 1990: 333).

It was often claimed that Sami families were smaller than non-Sami families in the area (von Düben 1873: 446-51). The statements were often based on an assumption that a large family was an obstacle to the nomadic life of the reindeer herders.

Table 5. Infant mortality (per 1000) after parity in Jukkasjärvi, Jokkmokk and Föllinge 1750-1899

Birth order	**1**	**2-4**	**5+**	**Total**	**N**
Jukkasjärvi					
Sami	151	120	192	152	4803
Non-Sami	166	105	156	138	1740
Jokkmokk					
Sami	184	156	200	176	3245
Non-Sami	151	97	99	111	3321
Föllinge					
Sami	71	56	113	74	808
Non-Sami	82	61	90	75	4876

In all three parishes Sami infants that were born as child number five or more suffered from the highest risk of dying. Even if we cannot control for the number of older siblings that were actually alive it is obvious that there is support for the idea that large families had worse possibilities to avoid infant mortality. Supposedly the mothers that gave birth for the fifth time or more were at older ages than the first time birth givers. The health status of the mother had an important impact for survival, especially during the first week. Among the Sami first born infants had the second largest risk of dying, among the non-Sami they experienced the greatest risk. Both ethnic groups in all parishes had the lowest risks for mortality for infants born as number two, three or four in the birth order of the mother.

2.2. Neonatal mortality

Most indigenous peoples still suffer from much higher IMR than the majority societies. Changing socioeconomic and ecological conditions, relocation, diminishing traditional life-forms, poverty, malnutrition, and an increased susceptibility for diseases are all stressed as important causes (Gracey and King 2009, King, Smith and Gracey 2009, Heaton et al 2007, Stephens et al 2006, Hacker and Haines 2005). Poor conditions and starvation are related to environmental change, and they have a greater impact on post-neonatal mortality (Moffat and Herring 1999: 1827-28).

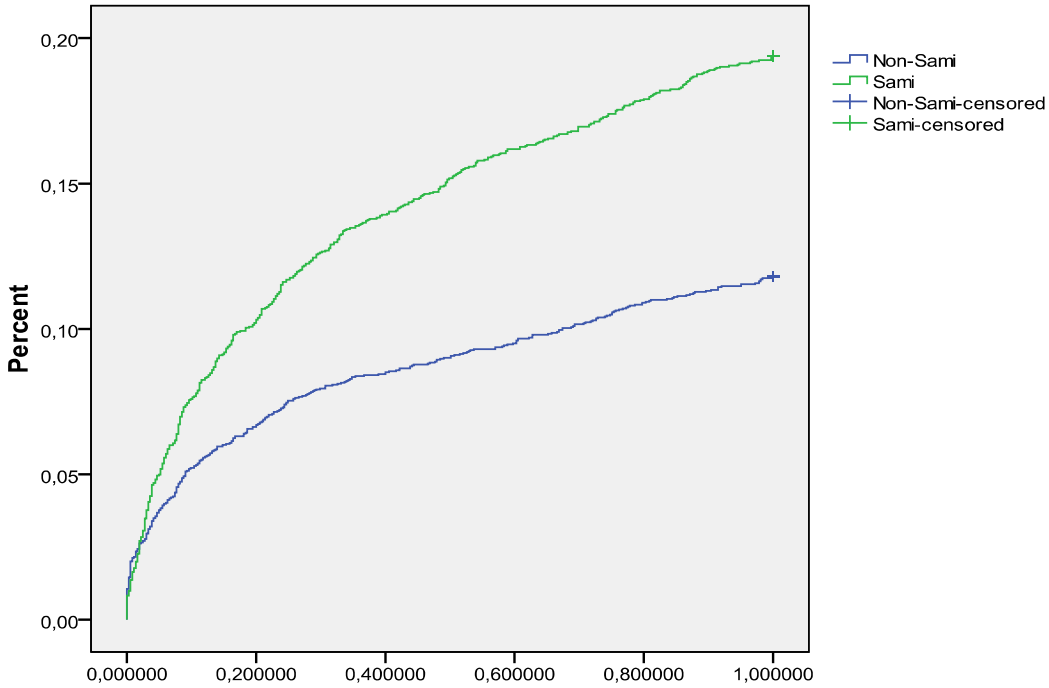
Table 6. Neonatal mortality proportion of total infant mortality (per 1000) in Jukkasjärvi, Jokkmokk and Föllinge 1750-1899

	1 day	**1 week**	**1 month**	**Total IMR**
Jukkasjärvi				
Sami	34	141	464	152
Non-Sami	54	146	363	138
Jokkmokk				
Sami	47	128	369	176
Non-Sami	95	216	411	111
Föllinge				
Sami	50	133	283	74
Non-Sami	90	197	380	75

The Sami experienced generally lower rates of neonatal mortality. This seems to indicate that environmental factors and infectious disease had less impact on Sami infant mortality than has been the case among many other present-day indigenous populations (Heaton et al. 2007). Perhaps traditional knowledge made the Sami more competent than settlers in the area to handle the critical situation of birth giving and child care during the first weeks, in harsh and cold conditions. The more even distribution of infant mortality over the first year of living among the Sami could partly be a

result of less accurate information on the actual date of death, since the clergy only met the Sami a couple of times a year.

Figure 3. Infant mortality annual distribution, Jokkmokk 1751-1895



Neonatal mortality is important when explaining Sami infant mortality. Previous research have stressed that extreme artificial feeding of the infants leads to higher mortality during the summer months among (Brändström 1990: 333).

Table 7. Neonatal mortality rate, Jukkasjärvi and Jokkmokk 1750-1895

Month	Jukkasjärvi		Jokkmokk	
	Sami	Non-Sami	Sami	Non-Sami
January	108	49	74	51
February	98	39	107	83
March	106	58	43	47
April	93	10	66	34
May	103	103	66	34
June	74	65	56	45
July	57	56	51	27
August	44	43	60	57
September	85	71	61	49
October	73	64	71	39
November	84	56	80	42
December	90	43	62	47

The Sami in the northern parish Jukkasjärvi had the highest IMR during the winter-spring period from December to May. The lowest rates appear during the summer. In Jokkmokk the month of February showed the highest neonatal IMR. Sami neonatal mortality has a connection to the cold period of the year, when conditions both outdoors and inside the hut were more problematic. The warm period, when cow milk became sour and infections flourished seem less severe for Sami infants. The non-Sami had an equally low neonatal IMR during the summer, and a more even distribution over the year. However, individual months show extreme high rates for the non Sami; February in Jokkmokk and May in Jukkasjärvi. The monthly rates of neonatal mortality support the statements of the contemporary written sources that the Sami to a very large extent breast-fed their infants.

2.3. The health care system and causes of death

In the mid-eighteenth century Sweden had established a system of district physicians. The northern parts were, however, sparsely covered and the physician had responsibility for a vast area where transports often met great problems. The physicians did not meet the Sami very often, occasional visits to their herding areas and opportunities during the winter market were among the rare opportunities. Sami were often described with a derogative attitude and we have reasons to believe that the physicians knew rather little about the health conditions of the Sami.

The annual reports of the district physicians have not provided much information concerning the Sami. It was generally noted that they suffered from eye diseases, which were assumed to be caused by the smoke in the huts and the strong light from the combination of snow and sunshine. Vaccination was difficult to establish, and the physicians complained over hazardous travels, lack of medicine, a suspicious attitude of the Sami, and a non-excising economy for health care in the northern parishes. One doctor concluded laconically that there was a state support for healthcare of the reindeer, but not for the Sami (Annual Report 1851). The consummation of coffee and alcohol was often blamed to cause health problems. Thus, the Sami were generally described as healthy, the children were given frequent baths and infants were breast-fed for several years.

Alcohol was prohibited in the Northern provinces during the entire nineteenth century, but illegal trade was common among non-Sami. During the winter market trade and social partnerships gave frequent opportunities to drink alcohol. Since many Swedish observers met the Sami only at this time of year, the descriptions of heavy alcohol abuse have often exaggerated. Previous research (Sköld and Kvist 1988) has concluded that the Sami did not consume much alcohol over the year, the winter markets being the exception. Some Sami women consumed alcohol during pregnancy, but not during the last days before birth giving. However, when the infant was born the woman was encouraged to drink quite a lot of alcohol (Serning 1950: 60-63).

Studies of Sami in other parishes within Sápmi have concluded that Sami had higher mortality rates for diseases such as tuberculosis, pneumonia, nerve fever, influenza, and diarrhoea. The Swedish settlers on the other hand had higher mortality rates for dysentery, respiratory diseases, laryngitis, and typhus (Sköld 2001). It has also been revealed that Sami generally suffered less from infectious diseases. Smallpox was avoided to a great extent since the Sami escaped from the area when an epidemic was reported. They had a most pragmatic understanding of the disease, giving them a concrete opportunity to act against the disease instead of a fatalistic approach making a disease such as smallpox inevitable, which was held by the non-Sami (Sköld 1997).

Causes of death in the Swedish mortality registers were given by the clergy, who had possibilities to make an additional note in the burial register, from 1749 they were also obliged to send in 5 year compilations on causes of deaths to the Table Commission (Sköld 2001). The clergy were not medically trained, but had often access to medical books and articles. The accuracy and frequency of cause of death statements varied between parishes and between individual clergymen. In the sparsely populated north of Sweden the greater distances may have influenced the level of reporting. And due to more frequent contact with the clergy we may assume that there were fewer reports of Sami that non-Sami deaths in all three parishes. Consequently, we have an interest to investigate the levels of cause of infant death reporting in the three parishes.

Results show that Jokkmokk had the lowest level of cause of death reporting with only 42% , Jukkasjärvi on the other hand a 72% coverage. The picture more blurred by the fact that the most common remark in the column for cause of death was 'unknown child disease'. In Jokkmokk it represented half of the observations, and in Jukkasjärvi as much as 73%. We can conclude that we are left with rather rudimentary information on specific diseases and other causes of death in the northern area. The available information indicates that infectious and respiratory diseases were more common among the non-Sami, and that Sami had a larger extent of cardiovascular diseases. Different occupations are to some extent mirrored in the fact that more Sami froze to death. Fishing was important to the Sami, and some transportation was on water. It is therefore logical that the Sami had more drowning accidents.

2.4. Long-term development

Our study covers 150 years in three parishes. The period covers great social, political, economic, demographic, and environmental changes. The results have been distributed on the three half-centuries involved in order to study a shifting impact and character of infant mortality.

Table 8. Cox regression of sex, seasonality, ethnicity, and parity in Jokkmokk 1750-1799

	B	SE	Wald	df	Sig.	Exp(B)
Male	,000	,169	,000	1	,996	,999
Season			3,524	3	,318	
April-June	,384	,231	2,760	1	,097	1,469
July-Sep	-,028	,250	,013	1	,910	,972
Oct-Dec	,140	,223	,394	1	,530	1,150
Sami	,766	,234	10,731	1	,001	2,151
Birth order			5,438	2	,066	
2-4	,350	,247	2,019	1	,155	1,420
5+	,589	,256	5,298	1	,021	1,802

Reference categories: female, born January-March, non-Sami and parity 1. N=766

Differences in infant mortality in Jokkmokk during the second half of the eighteenth century is best understood in perspective of ethnicity, where Sami had a 2,151 increased risk to die. Also infants with a parity of 5 or higher experienced a significantly increased risk (1,802). In Jukkasjärvi births during summer had a lower risk (0,360) and infants with a parity of 2-4 were only half as likely to die compared to infants born during the three first months of the year.

During the first half of the nineteenth century ethnicity continued to be the parameter with the highest explanatory value in the parish of Jokkmokk, and now also for Jukkasjärvi.

Table 9. Cox regression of sex, seasonality, ethnicity, and parity in Jukkasjärvi 1800-1849

	B	SE	Wald	df	Sig.	Exp(B)
Male	,333	,097	11,741	1	,001	1,395
Birth order			18,215	2	,000	
2-4	-,174	,140	1,549	1	,213	,841
5+	,282	,132	4,581	1	,032	1,326
Season			1,869	3	,600	
April-June	,082	,128	,411	1	,521	1,086
July-Sep	-,108	,140	,602	1	,438	,897
Oct-Dec	-,053	,129	,168	1	,682	,948
Sami	,684	,163	17,660	1	,000	1,982

Reference categories: female, born January-March, non-Sami and parity 1. N=1996

Sami had an almost twice as big risk to experience infant mortality than the non-Sami in the area. In Jukkasjärvi male infants had a higher risk together with parity 5 or more. Föllinge had the greatest explanatory value for lower risk during the summer months. A similar pattern continued during the second half of the century; Sami had higher risk for infant mortality (but the difference towards non-Sami decreased), male infants were disfavored, the summer months experienced less infant mortality, and the risk increased from birth order 5 or more.

The second half of the nineteenth century witnessed a continued higher infant mortality (male higher than female) among the Sami, especially in Jokkmokk. The lower mortality among parity 2-4 sustained, and among the Jokkmokk Sami it applied also for parity five and higher.

2.5 Cultural differences

The Sami have lived in Sápmi for thousands of years and have learned to adapt to the often unkind conditions. Nevertheless, the nomadic Sami lifestyle, the hazardous character of reindeer herding, and a shifting food resources caused them a high mortality, including infant mortality. Thus these Sami had developed techniques of carefulness during pregnancy, delivery and child care. They were generally described as loving parents with strong emotions and traditions attached to their children. Distinct cultural differences occurred among the Sami, but usually women were recommended to move, but not to work hard. Birth was given in a standing or knee heeling position. Men were considered to be excellent mid-wives with their experiences from reindeer. The newborn child was put in a skin from a correspondingly newborn reindeer calf. The child was believed to be endangered by evil spirits and other dangers. A a piece of steel was put close to the infant to protect it (Serning 1950: 57-71).

Breast-feeding was to only nutritional opportunity for Sami mothers. There is a unified opinion of the clergy, the physicians, travelers, politicians and later also expressed by the Sami themselves that Sami children were breast-fed for at least two years, and sometimes for as long as four years. During the first days after birth, before the mother produced milk, the infant was given a piece of sugar or reindeer fat in a small napkin. This might have caused a risk for infections, especially during summer (Serning 1950: 74-75).

Table 10. Cox regression of sex, parity, seasonality, and birth period for Sami in Jukkasjärvi 1750-1899

	B	SE	Wald	df	Sig.	Exp(B)
Male	,219	,075	8,500	1	,004	1,245
Birth order			20,634	2	,000	
2-4	-,281	,102	7,545	1	,006	,755
5+	,103	,098	1,107	1	,293	1,109
Season			4,827	3	,185	
April-June	-,044	,101	,195	1	,659	,956
July-Sep	-,238	,111	4,598	1	,032	,788
Oct-Dec	-,043	,098	,192	1	,661	,958
Birth period			59,575	2	,000	
1800-1849	,069	,133	,269	1	,604	1,071
1850-1899	-,544	,138	15,559	1	,000	,581

Reference categories: female, parity 1, born January-March, and birth period 1749-1799. N=3844

The most distinct character of Sami infant mortality was, despite the fact that ethnicity had the greatest impact of all variables, a substantially decreased IMR risk after 1850 (in Jokkmokk also from 1800). Other features were lower risk from July to September, lower risk for parity 2-4, and higher for male infants.

The non-Sami were settlers, mostly from other parts of Sweden, but sometimes from Finland or Norway. Colonization was promoted by the state from the late-seventeenth century, but the great explosion of in-migration occurred in the second half of the nineteenth century, when mining, railroads and improved agricultural techniques offered new opportunities. The non-Sami had an initially low IMR but did not follow the general decrease in Sweden after 1860.

Table 11. Cox regression of sex, parity, seasonality, and birth period for non-Sami in Föllinge1750-1899

	B	SE	Wald	df	Sig.	Exp(B)
Male	,027	,105	,064	1	,800	1,027
Birth order			11,314	2	,003	
2-4	-,289	,133	4,736	1	,030	,749
5+	,117	,133	,775	1	,379	1,124
Season			11,343	3	,010	
April-June	-,344	,140	6,060	1	,014	,709
July-Sep	-,459	,150	9,309	1	,002	,632
Oct-Dec	-,240	,143	2,821	1	,093	,787
Birth period			3,170	2	,205	
1800-1849	-,302	,194	2,433	1	,119	,739
1850-1899	-,112	,173	,416	1	,519	,894

Reference categories: female, parity 1, born January-March, and birth period 1749-1799. N=4799

Infants with birth orders between 2 and 4 had the lowest risk of infant mortality among non-Sami in all three parishes. Parity together with seasonality had the greatest impact in the regression analysis. Births in January to March had the highest risk while infants born during the summer months had the lowest. The non-Sami were not always accustomed to the cold climate, which might explain the high winter IMR. The months of February and March were connected to the winter market, an establish arena for the spread of infectious diseases, that stroke the non-Sami more severely than the Sami.

3. Discussion

The Sami had a high IMR between 1750 and 1900. If infant mortality is used as an indicator of a positive shift in the demographic and the epidemiologic transitions it can be concluded that such a process had not been initiated in the northern Sami villages Jukkasjärvi and Jokkmokk. Even if IMR differences to the non-Sami in the area decreased over time, the Sami did not follow the decreasing IMR in Sweden from the 1820s. Instead they preserved a high level of infant mortality, and we can state that the indigenous people of northern Sweden experienced a delayed process. Other indigenous peoples of the Arctic still have much higher mortality rates, and IMR below 100 was achieved only after 1950 in most countries (Bogoyavlenskiy and Siggner 2004: 34-35; Bjerregaard et

al. 2004). Between 1910 and 1939 the native people in Canada had IMR between 120 and 205 (Moffat and Herring 1999: 1825-27). Serning reported remaining ethnic IMR differences in Jukkasjärvi and Jokkmokk for the period 1930-1948, but they were rapidly decreasing (Serning 1950: 100-101). And from the 1960s there are no significant mortality differences between Sami and non-Sami in the area (Hassler 2005). Therefore the first half of the twentieth century is crucial for our understanding of the IMR transition in Sápmi.

Brändström (1990) asked if there were reasons to believe that the Sami practiced birth control. Contemporary observers claimed that Sami women gave birth to few children, rarely more than five or six (Grape 1804: 1), even if they married at early ages (Nordin 2009). By doing so they might have balanced the increased risk with many births, and by concentrating births to the seasons with lower risk they might have improved their possibilities. Parity and seasonality were important factors for Sami infant mortality. Also cultural responses to infectious diseases and the use of a so-called komse, a small wooden boat-box where infants were kept almost constantly for one of even two years (Wargentin 1755, Arnell 1778) helped in the care of the newborn children.

The traditional nomadic life style is important for our understanding of Sami infant mortality (Hellstenius 1884). But there is no reason to believe that hard working conditions caused the Sami women to stop breast-feeding their infants, as was often the result in other contexts (Brändström 1988). This is also strengthened by the fact that Sami had o lower risk for neonatal mortality during the warm summer months. Reindeer herding was an extreme form of living, and the social organization did not offer any assistance. Sami women joined the continued travel with the reindeer only a couple of days after birth giving (Grape 1804: 11-12) or were left alone with the child in a hut (Serning 1950: 60). This ought to have increased the risk for the infants to die.

Sami IMR was considerably high compared to the non-Sami in the area. Even if extensive breast-feeding prevented from infectious diseases and nutritional defeat Sami experienced increased risks for infant mortality. We can note cultural differences within Sápmi, where the South Sami joined the low IMR of the district of Jämtland while the northern parishes remained at high levels. There are no arguments that any intervention by medical expertise played any significant role in preventing infant mortality, the Sami rarely had any contact with the district physicians, and mid-wives were not contracted in the northern parishes until the late nineteenth century.

Demographic changes certainly occurred in Sápmi during the process of colonization. Kertzer and Fricke (1997) discuss the cultural approach to demographic behaviour, explaining that the critique from anthropologists says that the concept of agency must be more closely involved. They suggest

that a cultural sphere that is interwoven with, both shaping and being shaped by, political and economic institutions, as well as by kinship and other social organizational structures is investigated. The Sami population has slowly increased since the eighteenth century and onwards. The previously general opinion that the Sami was a dying race was not correct. Therefore, it is the Sami culture, and not the Sami race, that is under threat today (Manker 1947: 67). But the way to this point has been long and winding, including great improvements in life-expectancy. Infant mortality was a difficult obstacle to over win, and the final break-through did not appear until the twentieth century.

REFERENCES

Annual report 1851. District phycisian of Jämtland. National Archives. Stockholm.

Arnell, Carl (1778). 'Om förekommande af späda barns förquäfwande'. *Hushållnings Journal för December 1778*, 3-8.

Bjerregaard, Peter, Young, T. Kue, Dewally, Eric and Ebbesson, Sven O. E. (2004). 'Indigenous health in the Arctic: an overwiev of the circumpolar Inuit population'. *Scandinavian Journal of Public Health*, 32: 390-96.

Bogoyavlenskiy, Dmitry and Siggner, Andy (2004). 'Arctic demography'. *Arctic Human Development Report*. Akureiry: Stefeansson Arctic Institute, 27-41.

Brändström, Anders (1988). 'The impact of female labour conditions on infant mortality: a case study of the parishes of Nedertorneå and Jokkmokk, 1800-96'. *Social History of Medicine*, 1(3): 329-58.

Brändström, Anders (1990). 'Från förebild till motbild. Spädbarnsvård och spädbarnsdödlighet i Jokkmokk'. *Älvdal i norr. Människor och resurser i Luledalen 1300-1800* (eds. Sune Åkerman and Kjell Lundholm). Stockholm: Almqvist & Wiksell, 307-51.

Brändström, Anders, Edvinsson, Sören and Rogers, John (2000). ' Infant mortality in Sweden. Creating regions from nineteenth-century parish data'. *Historical Methods*, 33(2): 105-13.

Caldwell, John C. (2001). 'Population health in transition'. *Bulletin of the World Health Organization*, 79(2).

von Düben, Gustaf (1873). *Om Lappland och lapparne, företrädesvis de svenske*. Stockholm: Nordstedts.

Edvinsson, Sören, Gardarsdottir, Olöf and Thorvaldsen, Gunnar (2008). Infant mortality in the Nordic countries, 1780-1930'. *Continuity and Change* 23(3): 457-85.

Grape, Erik. (1804). 'Fortsättning af Utkast til Beskrifning öfver Enontekis Sokn i Torneå Lappmark'. *Kongl. Vetenskaps Academiens Nya Handlingar*, vol. 25, 1-44.

Gracey, Michael and King, Malcolm (2009). 'Indigenous health part 1: determinants and disease patterns'. *The Lancet* 374: 65-75.

Hacker, David J. and Haines, Michael R. (2005). 'American Indian mortality in the late nineteenth century: the impact of federal assimilation policies on a vulnerable population'. *Annales de Démographie Historique*, 2: 17-45.

Hassler, Sven (2005). *The Health Condition in the Sami Population of Sweden 1961-2002*. Umeå: Umeå University.

Heaton, Tim B., England, J. Lynne, Bencomo, Myrna Garcia and López, Gerardo Lopez (2007). 'The child mortality disadvantage among indigenous people in Mexico'. *Population Review*, 46(1): 1-11.

Hellstenius, J. (1884). 'Barnadödligheten i Vesternorrlands och Jemtlands län'. *Statistisk Tidskrift* 1884: 153-68.

Kertzer, David I. and Fricke, Tom (1997). 'Towards an anthropological demography'. *Anthropological Demography. Towards a New Synthesis* (eds. David I. Kertzer and Tom Fricke). Chicago: University of Chicago Press, 1-35.

King, Malcolm, Smith, Alexandra and Gracey, Michael (2009). 'Indigenous health part 2: the underlying causes of the health gap'. *The Lancet* 374: 76-85.

Kunitz, Stephen J. (1990). 'Public policy and mortality among indigenous populations of Northern America and Australia'. *Population and Development Review*, 16(4): 647-72.

Kunitz, Stephen (1994). *Disease and social diversity. European impact on the health of non-Europeans*. New York and Oxford: Oxford University Press.

Kvist, Roger. (1989). *Rennomadismens dilemma. Det rennomadiska samhällets förändring i Tuorpon och Sirkas 1760-1860*. Umeå: Umeå University.

Kvist, Roger (1992). 'Nomadic Saami and alcohol: Jokkmokk parish, 1760-1910'. *Canadian Journal of Native Studies* 12: 185-201.

Manker, Ernst (1947). *De svenska fjällapparna*. Stockholm: Svenska Turistföreningens Förlag.

Marelius, Nils (1772) 'Slutet om land- och fjällryggarne, samt gränsen imellan Sverige och Norrige'. *Kungliga Vetenskaps Academiens Handlingar För År 1772*. Vol. 33; 3-16.

Moffat, Tina and Herring, Ann (1999). 'The historical roots of high rates of infant death in Aboriginal communities in Canada in the early twentieth century: the case of Fisher River, Manitoba'. *Social Science and Medicine*, 48: 1821-1832.

Morris, Kelly (2009). 'Loss of land could threaten health of Sámi people'. *The Lancet* 374: 15-16.

Nordin, Gabriella (2009). *Äktenskap i Sápmi. Giftermålsmönster och etnisk komplexitet I kolonisationens tidevarv*, 1722-1895. Umeå: Umeå University.

Omran, A. R. (1971). 'The epidemiologic transition. A theory of the epidemiology of population change'. *Millbank Memorial Fund Quarterly*, 49(4):509-538.

Rydving, Håkan (1993). *The End of Drum-Time. Religious Change among the Lule Saami, 1670s-1740s*. Uppsala: Uppsala University.

Serning, Inga (1950). 'Lappbarnen, deras vård och uppfostran i spädbarnsåldern och lekåldern'. *Norrbotten*. Norrbottens Läns Hembygdsförenings Årsbok 1949. Luleå: Luleå Boktryckeri, 55-109.

Sköld, Peter och Kvist, Roger (1988). 'Alkoholen och de nomadiserande samerna. Jokkmokks socken 1860-1910'. *Alkoholpolitik. Tidskrift för nordisk alkoholforskning* 5 (4): 249-254.

Sköld, Peter (1992). *Samisk bosättning i Gällivare 1550-1750*. Center för Arktisk Kulturforskning. Umeå universitet. Rapport nr 22. Umeå: Umeå University.

Sköld, Peter (1997). 'Escape from Catastrophe: The Saami's Experience with Smallpox in Eighteenth- and Early- Nineteenth-Century Sweden'. *Social Science History*, 21(1): 1-25.

Sköld, P. (2001). *Kunskap och kontroll – Den svenska befolkningsstatistikens historia*. Umeå; Almqvist & Wiksell International.

Sköld, P. (2004). 'Liv och död i Lappmarken. Aspekter på den demografiska utvecklingen i Arjeplog under 1700- och 1800-talen'. Lantto, P. and Sköld, P. (red.). *Befolkning och bosättning i norr. Etnicitet, identitet och gränser i historiens sken*. Skrifter från Centrum för samisk forskning 1. Umeå: Umeå University: 85-105.

Sköld, Peter and Axelsson, Per (2008). 'The Northern Population Development. Colonization, and mortality in Swedish Sápmi 1786-1895'. *International Journal of Circumpolar Health* 67:1: 29-44.

Stephens, Carolyn, Porter, John, Nettleton, Clive and Willis, Ruth (2006). 'Disappearing, displaced, and undervalued: a call to action for indigenous health worldwide'. *The Lancet* 367: 2019-2028.

Taylor, John (2009). 'Indigenous demography and public policy in Australia: population or peoples?'. *Journal of Population Research*, 26: 115-30.

Trovato, Frank (2001). 'Aboriginal mortality in Canada, the United States and New Zealand'. *Journal of Biosocial Science*, 33: 67-86.

Wahlund, Sten (1932*). Demographic Studies in the Nomadic and the Settled Population of Northern Lapland*. Uppsala.

Waldram, James, B., Herring, Ann and Young, T. Kue (2006). *Aboriginal health in Canada: Historical, cultural and epidemiological perspectives*. 2nd edition. Toronto: Toronto University Press.

Wargentin, Per (1755). 'Anmärkningar Om nyttan af årliga Förtekningar på födda och döda i et land. Sjette stycket'. *Kongl. Vetenskaps Academiens Handlingar för år 1755*. Vol. XVI. Stockholm: Lars Salvius, 241-253.