Chains of Evidence: The 1780s Smallpox Epidemic in the Hudson Bay Region

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Introduction

Conjectures, assumptions and assertions surround the debate on the size of Native American populations just prior to European contact. Current estimates for North America north of the urban civilizations of central Mexico range from lows of 1,041,480 argued by Kroeber and 1,893,350 by Ubelaker to Dobyns’ estimate of 18,022,006 (Ramenofsky 1987: 7; Ubelaker 1992:170). A consensus view would put the population estimate in the range of six to twelve million. Critical to the wide variation are the estimates of the timing and impact on native peoples of the diseases brought by the first Europeans. There is little dispute about the native population in the nineteenth century, when direct counts were made. The issue is whether the seemingly low numbers in these counts are a consequence of a very much larger pre-contact population that was decimated by disease, or whether native population densities, even in the pre-contact period, were low. Pandemics with mortality rates of 90 percent as has been suggested by Doybns (1983), have far different implications than disease outbreaks that were more limited and less severe. As Shepard Kretch points out: “to decide on a sensible number, does not mean trivializing the extent of disease nor the extent of biological change introduced by Europeans. But to agree with the highest estimates assumes that diseases arrived early, spread widely and were invariably fatal ... and that diseases can actually be identified” (Kretch 1999: 85).

Native populations prior to 1500 and during first three centuries of European contact are hard to determine largely because we have so little information. Prior to contact, the main source is the archeological evidence. This evidence, drawn from excavations of particular sites, has been used to help describe many aspects of native life including, recently, their health (Steckel 2010); but, given the necessarily small samples, this sort of evidence is of limited use in determining, by extrapolation, the size of the overall population. For the
immediate post-contact period there are estimates of aboriginal populations based on the reports of European travellers and traders, who observed native settlements. There is, as well, a literature that has tried to infer native populations from the nature of their agricultural and hunting activities, and the types of flora and fauna that were available (Dobyns 1983; Ramenofsky 1987). But it is only in the last century and a half that we have direct census counts. Whatever the initial native population, it seems clear that nearly all the declines were due to disease rather than war, as Owsley’s (1992) study of archeological sites and skeletal remains has shown for the Northern Plains Indians.

In this paper we explore the impact of perhaps the earliest epidemic to hit natives living in the Hudson Bay drainage basin: the smallpox epidemic of 1780-82. Although the Hudson’s Bay Company erected its first trading posts on the bay coast in 1670s, nowhere in the written record of the next hundred is there any indication of smallpox. Indeed, the traders and the natives own oral history refer to the 1780s as the first time smallpox reached their region. This first outbreak provides an opportunity to examine the impact of smallpox on a native population who had never been exposed to the pathogen.

We begin by reviewing contemporary descriptions of the epidemic and the way Europeans and natives reported how smallpox affected the region. We then study the epidemic using three quite different approaches. First, we summarize the mortality experience associated with other smallpox outbreaks, focusing on the mortality among “virgin soil” populations, namely those with no previous exposure to smallpox. Second, we place the epidemic in the context of the region’s fur trade. Natives in the Hudson’s Bay Company’s hinterland were the sole trappers of beaver and other furs; and so any serious decline in the native population would certainly have been reflected in the company’s fur returns. Finally, we infer the extent of the population decline by making backward
projections of the native population from the early nineteenth century to the 1780s. The resulting estimates are compared to the likely pre-epidemic population, which we base on the carrying capacity of the region, namely the population that could have been sustained by the large game and other resources. Our three approaches to the epidemic all point in the same direction. We conclude that, although mortality was much higher during the smallpox outbreak, smallpox had an impact that was perhaps one-half to two-thirds lower that has previously been asserted. Although these findings are for one relatively small episode, our results may have broad implications for the interpretation of pre-contact aboriginal population and the impact of European-borne disease.

The Smallpox Epidemic of 1780-82

The first major epidemic to affect natives trading in the Hudson Bay region appears to have been transmitted by the Sioux, who spread the disease, in 1780 and 1781, through the trading villages along the upper Missouri River. This was really the tail end of a much larger series of smallpox outbreaks that began five years earlier, during the American Revolution.1 By the fall of 1781 the disease vector had reached the Assiniboin, who were trading at Hudson House and Cumberland House, two interior collection points that the Hudson’s Bay Company had established in the late 1770s along the Saskatchewan River to help compete with the mainly French traders from the east (see Figure 1). Both these collection centres traded for furs which they then sent to York Factory, the company’s largest trading post.

The most direct knowledge we have of the epidemic in this area comes from the journals maintained by the chief trader at each of these houses. The Hudson’s Bay Company required that a daily journal of activities be maintained. Typically, it was the normal routine that was described, as in the following two entries from late November of 1781:
November 26th Monday Wind and Weather as Yesterday two Men still lame, sent five
Men to the Nets, also fitted out Mr Longmoore and George Hudson and sent them
away to trap Martins. 30 Sturgeon and 3 Pike yesterday

November Friday 30th Wind E.S. E a stiff Gale, with Cloudy weather till noon... one
man net Making two Hewing timber for the saw, sent others to overhaul the Nets 10
Sturgeon to day (HBC, *Cumberland House Journals*, p.221).

Cumberland House received first news of the epidemic in December. The entry, for Tuesday,
December 11, reads in part:

Wind Westerly, a fresh Breeze Weather for the most part cloudy, with a low Drift... In
the Evening three men and four women arrived from the southward with Furs to Trade
also one family came across the lake from the Westward, the former has brought the
Disagreeable news of many Indians dying, and the latter complain much for want of
food. Indeed one of those that came from the southward does not to me to live long as
she is troubled with violent pain in her back and much inclined to Vomitting, these
inform me of seeing several Tents without anybody alive in them and some of the
Dead not Buried (HBC, *Cumberland House Journals*, pp.223-4).2

After being absent from the post journals, reports of smallpox and its effects began to
dominate the reports. In a letter dated December 4th, William Walker, clerk at Hudson
House, wrote: “small pox is rageing all round us with great violence, sparing very few that
take it, we have received the News of above 9 tents of Indians within here all dead, ... as for
the Stone Indians there are very few if any left alive...”. Mr. Walker went on to say that the
post would have problems getting in provisions “when the Indians is dying daily and them
that has not taken the small pox is frightened to look after any thing for fear of falling with
others that is bad” (HBC, *Cumberland House Journals*, pp. 225-26). From the Cumberland
and Hudson House journals it is possible to roughly track, as has Ray (1974), the course of the disease (see Figure 2). It is noted that as of January 2nd, 1782, four Indians from Le Pas, which was west of the disease vector, “had not heard of the disorder;” but by the 25th of the month “many sick Indians [were] arriving” from there. On February 19th, Cumberland House was told that in some tents near Le Pas, all the Indians were dead and that one-third of the Piegan Indians had died. There was a report on March 23rd that all in a group of ten tents in the Swampy River area (to the south) were dead.³

Based on the journal entries, it appears that the epidemic had largely run its course by the spring of 1782. Thus the outbreak in this area appears to have lasted five or six months, from November 1781 to March or April 1782. As of that time, smallpox did not appear to have spread further towards York Factory. On March 1st, five men and three women arriving at Cumberland House from further north had heard nothing of the disease. But in following years, natives who had apparently recovered or were recovering from smallpox were reported in the vicinity of York Factory.⁴

The smallpox epidemic of 1780-82 clearly devastated and dislocated some native settlements. But what was the impact on the overall population of the region, and particularly on the groups living in the path of the disease vectors. Hudson’s Bay Company personnel did not merely describe the event, they also tried to assess its overall impact, which they reported to the directors in London. Samuel Hearne, who had been at York Factory during the outbreak and later became chief trader at Fort Churchill, reported that 90 percent of the Indians in the Northern Barrens, the area to the east and north of the post, had died (Tyrell 1934: lx). This assessment was based on what native traders told him when they came to trade. York Factory’s journal entry of July 2nd 1782 reported devastation among several tribes in the region: “not one in fifty of those tribes are still living” (HBC, Post Journals: 6)
York Factory: B87/a/5-9). David Thompson, who provides one of the first travel narratives, crossed the interior from York Factory to the Rocky Mountains four years after the epidemic. Based on conversations with natives, and from discussions with company employees who had been at Cumberland or Hudson House during the epidemic, he concluded that “far more than one half had died, and from the number of tents remaining, it appeared that about three fifths had perished.” Thompson goes on to assert that “more men died than women and children.”

The virtue of the contemporary reports is that they are based on first-hand accounts of the outbreak as experienced by those living in the region. In fact it is primarily from these accounts that researchers have concluded that mortality from smallpox ranged from 60 to 90 percent. In his work on the Northern Athapaskan social organization, Shepard Kretch, citing Hearne, writes: “there is no evidence that any epidemic disease reached the Kutchin in the eighteenth century. In 1781, smallpox ravaged the Cree and Chipewyan, with losses among some Chipewyan groups estimated up to 90 percent” (Kretch 1978: 712). In Indians and the Fur Trade, Ray writes that “lacking any immunity ... the Indians suffered terrible losses” (Ray 1974: 105). While not being specific about actual mortality, Ray tends to agree with David Thomson’s claim that mortality was one-half to three-fifth of the population. In his introduction to the Saskatchewan Journals, Glover wrote that “among the natives the scourge swept as murderously as the Black Death through medieval England” (Tyrell 1934: lviii).

The contemporary accounts of natives are direct evidence of the epidemic. Still, Europeans in the region would have had only a partial picture of the epidemic. They did hear about and witness native deaths, but given the small area where they lived and worked, they could obtain no more than a rough idea of the broader impact.
Smallpox or variola is an infectious disease. Variola major is the more severe class and would have been the form that afflicted America in the eighteenth century. Yet even in the case of variola major there could be larger differences in mortality depending on the progress of the disease, whether haemorrhagic, flat, ordinary, or modified. Modified refers to those who have had previous exposure and so is not relevant to this discussion.

Haemorrhagic and flat are both extremely severe and nearly always fatal. As its name suggests, haemorrhagic refers to visible bleeding into the skin and flat refers to pustules that are not raised on the skin. None of the company officials describe these forms. Ordinary variola major is probably what was contracted. For example, the journal entry for December 27th notes “This morning could observe the small pox coming out very thick upon sick lads heads and thighs.” This is the classic location for smallpox.

The nature of the rash itself also affects mortality. The number of lesions touching one another within a defined area is called confluence. The greater the degree of confluence the more dangerous the disease. A twentieth-century study of an unvaccinated population in rural India found case fatality rates of 62 percent for confluent ordinary-type smallpox, 37 percent for semi-confluent ordinary-type smallpox, and 9 percent for discrete ordinary-type smallpox (Fenner et al. 1988: 22). That same study found the incidence of these three types to be 22.8, 23.9 and 42.9 percent, respectively, of the total cases. Thus the weighted case fatality rate over the three types of smallpox was 30 percent. Another study of smallpox in six states of India during the 1970s found a case fatality of 26 percent among unvaccinated subjects with significant variation by age (Fenner et al. 1988: 176). Rates were highest in the 0-4 group at 46 percent, and 30 percent for those aged 40 or more. Among the age group from whom the fur trappers were drawn, 15-39, the fatality rate was 21 percent. These are the rates
for those who contracted smallpox. To the extent that some escaped the disease, mortality rates among the overall population would be lower. The rates reported for India, especially among adults under the age of 40, are much lower than the Native American experience as described in the post journals, especially considering that the correspondence reports that it was the adult males who were hardest hit.

We do not know which sub-type comprised the smallpox epidemic of the eighteenth century. Given the wide variation in later smallpox fatality rates, the strain of smallpox that afflicted North America in the late eighteenth century could have had important implications for the mortality of the native (and European) populations. As noted earlier the descriptions do suggest the ordinary type rather than the much more fatal haemorrhagic or flat. In the 1721 outbreak in Boston the death rate was 15 percent among those who contracted smallpox naturally, indicating perhaps that the sub-types of smallpox that characterized the epidemics were not the most virulent, but we do not know how many might have had prior contact with the disease (Fenn 2001: 33). At the same it might be inappropriate to infer too much given that we are dealing with a “virgin soil” epidemic, which typically led to higher mortality than epidemics among previously exposed populations. Still, among isolated European populations that had never been exposed to smallpox, mortality rates from the first outbreaks appear to have been no more than 30 percent and more likely under twenty percent.6

Given the comparatively low mortality among European and other populations outside the Americas, there is speculation that, because of the thousands of years of isolation, there was less diversity in the Native Americans’ immune system antigens which rendered them less able to survive smallpox and other new infections (Fenn 2001: 26). Fenn points out, however, this lack of diversity was more likely an issue in resisting measles rather than smallpox; while Crosby is sceptical of a genetic explanation (Crosby 1976: 291-92). We
should, nevertheless, heed Ramenofsky’s warning that it is inappropriate to take mortality rates in the recent past from smallpox and simply apply them to the early experience of Native Americans (Ramonofsky 1987: 160-62).

No doubt, smallpox had an effect, and its virulence may have been exacerbated by concurrent diseases and other factors, such the way the disease was treated. Observers noted that the practice of the sweat lodge would have increased the fever associated with the early stage of the disease when mortality was greatest. On the other hand it has been noted by others that natives responded to their fever by jumping into cold streams which, according to one fur trader, caused “instant death;” but, in fact, cold water may have been an effective way of reducing fever. In any case, and as Fenn points out, it is not at all clear that the treatment Europeans typically received, such as bloodletting, was better than the practices of Natives Americans.

Native lifeways may have led to increased mortality from smallpox. The Cree and Assiniboin were migratory hunters, who came together in large bands in the spring and summer but then broke up in the fall and winter, when they moved to separate winter hunting grounds. Thus at certain times of the year, native peoples were part of large agglomerations, while at other times, they were relatively isolated. Smallpox is a serious, contagious disease but measles, influenza and whooping cough are each more contagious than smallpox. Generally, according to the U.S. Center for Disease Control: “direct and fairly prolonged face-to-face contact is required to spread the disease from one person to another,” where face-to-face means within about 6-7 feet and for a fairly prolonged period of at least a few hours. The disease does not normally spread as a result of casual or brief encounters. The incubation period for the disease is normally 12 to 14 days but can range from 7 to 17 days. If the disease came in contact with native groups during their annual rendezvous then the
contagion could be very great. If, however, the epidemic entered the territory after they had dispersed to their winter grounds, then the level of contact outside of the immediate family would be low, although once brought into a tent it would almost certainly have spread to all the occupants. The disease was first reported in the late autumn which would explain high incidence within given tents, but the time of year may also account for the reports that natives not far from the disease vectors were unscathed.  

The isolation of native groups during the winter limited the spread of smallpox, but the impact on those who contracted the disease may have been greater due to the effect on the natives’ ability to obtain food. A long period of forced inactivity or reduced activity opened up the greater chance of starvation, and increased their susceptibility to other illnesses. There are accounts of Indians, in the vicinity of the trading posts, hungry because they had contracted smallpox, but these were the survivors. Overwhelmingly the reports imply that it was during the course of the disease that victims died, reports that are consistent with the pathology. Death most likely would have occurred between the tenth and sixteenth day of onset; and, although the scabs left by the pox on the soles of feet might have continued to affect mobility, much of the disease’s impact on productivity would have largely dissipated after a month. Of course even a month of inactivity could have serious consequences for the hunters and their families.

Mortality from the 1780-82 Smallpox Epidemic and the Trade Records

Given the nature of smallpox and the more recent evidence on how it has affected diverse populations, one might be sceptical of mortality rates of 60 percent and higher, as reported in the contemporary accounts from Hudson Bay. As an alternative to the reports of mortality in the region, we approach the epidemic and its impact by focussing on the trade
statistics. In the mid-1770s the Hudson’s Bay Company set up two trading houses designed to serve York Factory and help the company compete with the Montreal traders who were an increasing presence in the region. Cumberland House and Hudson House, located in the interior several hundred kilometers from York Factory (see Figure 1), generated a trade comparable to what York Factory was receiving from the rest of its hinterland. The trade at these two posts are especially pertinent to our discussion of mortality since they were in the direct path of the epidemic (see Figure 2). One would expect, then, that any decline in the native population would be reflected in the trade returns, especially since it was the adult males who were said to be most affected.

Neither Cumberland House nor Hudson House kept separate accounts. We do have their journals, but these provide no more than a rough indication of the extent of their trade. Better are the accounts of the main trading post, York Factory. Its records include all the furs received by the post; but, more importantly in terms of assessing the trade at its collection points, the accounts give a detailed list of the trade goods sent to Cumberland House (and Hudson House) each year both before and after the smallpox outbreak. As shown in Figure 3, the volume of trade goods sent in 1777 was relatively modest at 6,060 made beaver (mb), not surprising given that the two sites had just been established. But activity increased dramatically, peaking at 11,770 mb in 1781, the year before the epidemic struck. Of course central in terms of inferring the impact of smallpox on the aboriginal population is what happened after 1781.

There is no question that the epidemic year itself was devastating to the fur trade. Hardly any natives arrived at the posts, and those who did come brought few furs. The house journals comment on the virtual disappearance of the trade and the York Factory accounts are
consistent with the traders’ descriptions. Realizing that little additional inventory was needed, York Factory sent just 800 mb in trade goods that year. There was very little trade the following year as well, although in this case the reason may have been political as much as environmental. The region had entirely escaped conflict during the Seven Years’ War of 1756 to 1763, but the involvement of the French in the American Revolution spilled over into the Hudson Bay region (Rich II 1960: 84). In 1782, Comte de Lapérouse set out with a 74-gun ship and two frigates to capture the main English posts. On August 8th he took Fort Churchill and two weeks later York Factory. There was no resistance from the English in either case, but both posts were severely damaged, although not completely destroyed. Still, it was nearly a year before the company could re-establish trade at York Factory and Fort Churchill.

Despite the temporary loss of York Factory, the inland houses continued to trade from their inventory. The Cumberland House journal entry of June 20, 1783 reports that 115 bundles of furs in ten canoes were sent to York Factory. At roughly 50 mb per bundle, the total trade would have been close to 6,000 mb, an indication the trade was already beginning to recover. But much more revealing is what happened after York Factory became operational and resumed sending trade goods to its inland collection points. In 1784 deliveries totalled more than 6,850 mb, and in 1785 the value of trade goods, 9,400 mb, was more than in any year other than the peak of 1781. Following 1785 the trade continued to increase, and in 1787 it surpassed any previous year. Even recognizing that some of the trade goods sent after 1783 were needed to replenish inventories and there may have been some change in the price of furs, it seems inescapable that the natives were bringing greater numbers of furs to the post, and this was after an epidemic that was claimed to have decimated the population, and even more so the segment of the population, adult males, who
were the main participants in the fur trade.

To highlight the change in trade before and after the epidemic, we compare the trade goods sent from York Factory to Cumberland House in 1781 and 1785 (see Table 1). In 1785, just three years after the epidemic had swept through the region and less than three years after the York Factory post had been sacked by the French, trade in the region was already recovering. There is a lot of variation by commodity but two in particular likely give a good perspective on the volume of the trade, since it is unlikely these goods would be been stored for long periods. In 1785, 448 gallons of brandy were sent to Cumberland House as compared to 675 gallons in 1781, a decline of one-third. Meanwhile the shipment of tobacco, another important trade good fell by 15 percent, from 2,348 lbs to 2,007 lbs. Overall trade declined by a roughly corresponding amount. At the official \textit{made beaver} prices of the trade goods, the total value of shipments declined by 20 percent, between 1781 and 1785, from 11,769 \textit{mb} to 9,401 \textit{mb}. Such a reduction in trade seems totally out of line with claims that the population of native hunters during this period had fallen by 60 percent or more. And even the 20 percent reduction in the volume of trade goods may have been due as much to the disruption caused by the French as the change in the native population. Just three years later, in 1788, York Factory sent 13,856 \textit{mb} in trade goods to Cumberland House, or nearly 20 percent \textit{more} than the value of goods sent in 1781. We do not mean to suggest that the number of native traders was unaffected by the smallpox epidemic; rather that the pattern of trade in an area that was in the path of the epidemic is inconsistent with extreme mortality.\textsuperscript{11}

\textit{The Smallpox Epidemic and Population Estimates}

The volume of trade after 1782 at Cumberland House and Hudson House appears to belie the contemporary reports that sixty percent or more (possibly nine-tenths) of the native
population in the region were carried off by smallpox. Given that such factors as a changing fur resource base, the degree of competition from the French traders, the size of the hinterland served by the houses, and population shifts could also affect the trade, it is important and perhaps ultimately more useful to deal directly with the issue of mortality by focussing directly on the size of native population.

Our approach follows initially along the lines of Ray (1974: 94-116). Some European travellers to the region described the native settlements they visited and often included a commentary on the number of tents. These reports include the years preceding and following the smallpox outbreak. For the early nineteenth century we have Alexander Henry the Younger’s breakdown for the Assiniboin groups, many of whom had been in the direct path of the disease. In 1808, twenty-six years after the epidemic, Alexander Henry put the total for eleven different groups of Plains Assiniboin at 850 tents (Coues II 1897: 522-23). Assuming nine persons per tent gives a population of 7,650. At eleven per tent, the number Peter Fidler assumed in the early nineteenth century and reported by Demollie and Miller (1981: 590), the population was 9,350. We do not unfortunately have similar detail for earlier years, including those prior to 1782. In 1776, Alexander Henry the Elder reported 300 tents for the Plains Assiniboin, or just 35 percent of his nephew’s later estimate. Even had there been no epidemic this number would be implausible. It seems clear that Alexander Henry the Elder’s count was incomplete. In fact elsewhere he wrote: “The Osinipoilles [Assiniboin] have many villages composed of from one to two hundred tents each” (Henry 1969: 303). This statement suggests that the Assiniboin population in the region may have been closer to, or even above, the more detailed estimate of thirty-two years later.

Given that the eighteenth-century reports on native settlements are incomplete and
vague, we approach the question of native population and the impact of the smallpox
epidemic in a way that relies on information that is more firmly based. We begin by taking
the nineteenth-century population estimate of Henry the Younger and project it backwards to
just after the epidemic. We then compare that projected value to an estimate of the pre-
epidemic population, which we base on the carrying capacity of the region, namely the native
population that could have been supported by the local food supply. During the subarctic
winter adult males required 4,500 to 5,000 calories per day; and, although fewer calories were
needed at other times, the average daily requirement was at least four pounds of flesh food
(Rogers and Smith 1981:141). Moreover, because a high fat content was necessary, the
requirement had to be met mainly from the meat of large game. The native population was
therefore limited by the population of large ungulates.

To explore the implications of this food requirement, we consider a population reliant
on caribou. In the twentieth century, G.R. Parker studied the Kaminuriak barren-ground
caribou, whose total range, roughly 109,000 square miles, includes part of the hinterland that
was served by Fort Churchill, although the area is generally north of what was the Hudson
Bay Company’s main fur trading hinterland (Parker 1972:13). Historical reports of the entire
barren-ground caribou population are as high as 3.5 million (p. 17); but in Parker’s study area,
the greatest number of caribou reported is 149,000. Parker argues that this figure, which was
for 1955, is well below earlier levels. In fact the implied density of 1.4 caribou per square
mile is much below the maximum density of five per square mile that has been suggested for
productive land (Parker 1972: 88-89). Taking the higher figure as representing the biological
optimum, it follows that, in the Kaminuriak area, a caribou population of 550,000 would have
supplied the most meat on a sustained basis. Given fertility rates of caribou and mortality
from other causes, the sustainable kill could be no more than 5 percent of biomass (Carlos and
Lewis 2004: 340), implying a potential harvest of 27,500 caribou each year. There are a range of estimates of human requirements, but Parker sees 150 caribou as reasonable for a family relying exclusively on caribou. Parker’s estimate includes feed for dogs, and excludes other food sources. If we take, instead, an allowance (per male adult) of 3 pounds of caribou meat per day, then an annual requirement of 50 caribou per family seems more reasonable. The implied maximum human population that the region could support is 550 families, or 2,750 individuals, giving a human population density of one person per 40 square miles. This population density is at the top of the range given by Rogers and Smith (1981:141) for the entire subarctic region. Our estimate seems reasonable given that much of the subarctic was less productive than the Kaminuriak area.

The York Factory hinterland, which is the focus of our study, would be expected to have a maximum population density at least as high as the area studied by Parker. Until the 1770s the post served a hinterland of about one million square kilometers (386,000 sq. miles); so at one person per 40 square miles the region could have had a pre-epidemic population of 9,650. The area serviced by the two interior posts was undoubtedly smaller than this, although by 1780 the trade had extended to the foothills of the Rockies and also further south. As noted above, estimates for 1808 by Alexander Henry the Younger imply an Assiniboin population of 7,650 to 9,350, who occupied a territory in the early nineteenth century of about 160,000 square miles (Ray 1974: 101). The implied population density is one person per 21 to 17 square miles, or about twice the high end (one person per 40 square miles) of the estimated carrying capacity of the subarctic region. It should be noted, though, that population densities would certainly have been higher in the areas occupied by the Assiniboin.

Population densities in the plains areas may have been greater than the range of one
person per 21-17 square miles, but in the more northerly boreal forest region, it is unlikely that densities could have been much greater than this. In fact, given the region’s carrying capacity of large game, the Assiniboin could hardly have numbered much more than 8,000 prior to the smallpox outbreak of 1781-82. We do not know how fast the native population was growing following the epidemic; but increases in population with life expectancies typical of the time would not have been greater than one percent per year. Assuming this rate, and applying Alexander Henry’s 1808 estimate of 850 tents, or a population of 7,650 to 9,350, the Assiniboin population immediately following the smallpox epidemic was likely between 5,900 to 7,200. The implied mortality suffered by a pre-epidemic population of 8,000 is therefore 10 to 26 percent. These estimates are in keeping with the experience of other “virgin soil” smallpox epidemics.

_Interpreting the Epidemic_

Our conclusion that the smallpox epidemic of 1780-82 led to mortality of between 10 and 26 percent is contrary to nearly all that has been written, both by contemporary observers and historians. Given that we have no reliable population counts for the pre-epidemic period, such an iconoclastic result should be viewed with scepticism, and requires further analysis especially of the food supply available to natives in the region. At the same time, it is important to recognize that the alternative narrative is based on evidence that is less than firm. Statements by the English about mortality were in fact their interpretation of what the Assiniboine, Ojibwa, and other groups were telling them. For example, Samuel Hearne the chief trader at Fort Churchill thought that nine-tenths of the Indians in the hinterland of the post had died. Given how far removed Fort Churchill was from the path of the epidemic, this impression could only have come from the statements of the natives who came to the post,
many of whom may not even have been living in the main areas hit by the disease. The entry in the York Factory journal for July 2, 1782 includes the claim that among natives who had been in the La Pas area “not one in fifty of those tribes is still living.” Again this statement is based on the Governor’s impression of what those Indians coming from the interior were saying.

Mortality rates of 90 or 95 percent for the overall region have generally been discounted, but other more modest estimates by contemporaries suffer from the same problem in that they are based either on incomplete death counts or on vague comparisons of pre- and post-epidemic native populations. David Thompson, who traveled widely in the region, but only after the smallpox outbreak, gives 60 percent as the possible mortality. This estimate comes in part from Mitchell Omam, one of the Company’s interior traders, who accompanied Thompson in 1786. From what the natives told Omam and what he observed about the number of tents that remained he told Thompson that “it appeared about three-fifths had perished” (Glover 1962: 236). Thompson also talked about seeing tents in the vicinity in which the natives “were all dead.” Clearly these eye-witness accounts are testimony to a disease that killed many. Still, the lack of anything approaching firm numbers calls for skepticism about the direct evidence as well.

The accounts relating to Cumberland and Hudson Houses have the advantage of providing clear measures of the pattern of trade over a period that includes the smallpox outbreak. We can use this circumstantial evidence to make inferences about the impact of the epidemic. Assuming a standard harvest function:

\[ H = H(E, X), \]  

where \( H \) is the harvest, \( X \) is the population of fur-bearing animals (mainly beaver), and \( E \) is
harvesting effort, observations on the size of the harvest can shed light on the extent of harvesting effort and, by extension, the number of people involved in the trade. We have derived elsewhere an effort elasticity for beaver of 2/3.\textsuperscript{16} For this elasticity, a sixty percent decline in effort, reflecting the reported decline in the native population, would have reduced the harvest for a given animal stock by more than 45 percent. Allowing for some growth in the animal population due to the temporarily lower harvest gives a somewhat smaller decline of 40 percent.\textsuperscript{17} Prior to the smallpox epidemic, the value of trade goods sent from York Factory to Cumberland House peaked in 1781 at 11,770 mb. A reduction in the harvest of 40 percent would have been expected to reduce the trade to about 7,000 mb. This in fact approximated the value of goods sent in 1784. But in 1786 11,000 mb in trade goods were sent, and the value of trade goods sent in 1788 was nearly 14,000mb, roughly double what might have been expected if the reports of mortality had been even approximately true.

Implications and Conclusions

Despite the claims of contemporaries and the interpretation of historians of the smallpox epidemic of 1780-82 in the Hudson Bay region, the three approaches to smallpox mortality used in this paper lead to broadly similar conclusions that are in sharp contrast to the generally accepted view. There is a long history of variola in its various forms, some more virulent than others, but in no case where numbers are reliable did case fatality rates begin to approach the sorts of mortality claims made about the 1780-82 epidemic, and this includes rates for “virgin soil” populations. In areas of rural India, where the population had no previous exposure to smallpox, case fatality rates for the adult population under age 40 were found to be on the order of 20 percent, and the experience of other populations where data are reliable has been similar. If these rates are at all reflective of what Native Americans might
have experienced, then the overall mortality of a population as dispersed as the one in the subarctic and far northern plains could very well have been on the order of 25 percent or less.

Our second approach to mortality is to examine the trade at the Cumberland and Hudson outposts, which were in the direct path of the epidemic. The volume of furs brought to these sites was entirely dependent on the natives. It seems inconceivable that a large decline in that population would not have been reflected in the trade returns. In 1782, the year smallpox passed through the region, the trade at these posts did indeed collapse, but apparently not because of native mortality. Rather it appears that fearing the effects of the disease, natives redirected their effort away from obtaining the luxuries associated with the fur trade, and instead concentrated on ensuring their survival. Had a decline in native population been the reason for the loss in the trade, the effects would have been long-lasting. What we find is that the volume of trade, as reflected in the goods sent by York Factory, exceeded within six years the peak of the trade prior to the epidemic.

Finally we infer mortality on the basis of a backward population projection and the carrying capacity of the land in the region. We have for the Assiniboin what appears to be a careful population estimate for 1808. By assuming a relatively high annual growth rate of 1 percent, we derive estimates of the human population in 1782, just after the epidemic passed through the region, of 5,900 to 7,200. Next we derive what is arguably an upward biased estimate of the population just prior to the smallpox epidemic. Appealing to the carrying capacity of the land in terms of large game, we suggest a plausible maximum human population. At a density of one person per 20 square miles and an area of 160,000 square miles, the population of Assiniboin prior to the smallpox outbreak would have been, 8,000. This figure is not very much above, perhaps 10 to 26 percent above, the native population
shortly after the disease struck the area.

Undoubtedly some natives in the region died of smallpox; the contemporary accounts on this score are indisputable. What is in question is how widespread was smallpox in terms of the numbers contracting the disease, and how lethal was the disease to those affected. Our finding is that the smallpox epidemic of 1780-82 in the subarctic and far northern plains had a modest impact on the native population. It may be premature to be drawing broader implications from this finding about mortality from smallpox in other parts of North America. Indeed the finding for the Hudson Bay region is preliminary. Nevertheless, our result suggests that claims of widespread devastation from this disease outbreak deserve a second look. More broadly, the indication that few natives died as a result of this smallpox outbreak has implications for the size of native populations prior to the coming of Europeans and how contact affected those populations and native society.
References


Glover, Richard. David Thompson’s Narrative: 1784-1812. Toronto: Champlain Society,
1962.


Ray, Arthur J. and Donald Freeman. ‘Give Us Good Measure’: *An Economic Analysis of*


1. The epidemic likely originated in the Boston in the spring of 1775, spread south along the eastern seaboard to the Gulf of Mexico, and then northward through the central plains, reaching the southern part of the Hudson Bay Company’s fur-trading hinterland (current-day southern Alberta) in the summer of 1781. This same epidemic continued to the Columbia River basin and Puget Sound (Fenn 2001: 7).

2. The tone set in this entry is similar to that found in other entries. William Walker does not mention smallpox here but does subsequently. The women mentioned died two days later and were buried by the company men because the natives would not touch her body.

3. Arthur Ray has used these reports to map the progress of the smallpox epidemic as shown in Figure 2. See Indians and the Fur Trade chapter 5.

4. In 1786, David Thompson saw a group of Indians sitting on a beach about 150 miles up river from York Factory: “to our surprise they had marks of the small pox, were weak and just recovering ” (Glover 1962: 235-36).

5. This observation was based on information from Mitchell Omen who had been at the posts during 1781/2. See Glover (1952: 236).

6. In 1241 the first smallpox epidemic in Iceland is estimated to have killed about 30 percent of the population (Fenn 2001: 229). Another outbreak in Iceland in 1707 is estimated to have had similar mortality (Ramenofsky 1987: 161).


8. Smallpox also can be spread through direct contact with infected bodily fluids or contaminated objects such as bedding or clothing. Rarely has smallpox been spread in enclosed settings such as buildings, buses, and trains. Humans are the only natural hosts of variola. Smallpox is not transmitted by insects or animals. Ibid.

9. A tent or teepee, typically about 100 square feet , was home to 8-10 people

10. The made beaver (mb) was the unit of account used by the Hudson’s Bay Company at all its trading posts. A prime beaver pelt had a price of 1mb and all other fur and trade goods were assigned prices relative to that standard. A gallon of brandy for example had a price of 4mb.

11. Native traders may have been coming to Cumberland and Hudson House from greater distances. We need to explore this possibility; although, given the increasing presence of traders from the east, it seem unlikely that native traders were coming from further afield. The trade might also have been maintained if native groups less affected by the epidemic had moved into the region.

12. The implied population growth rate is nearly 5 percent per year.
13. Given other sources of food a requirement of 3 lbs. per day seems more reasonable than the 4 lbs. or more implied by the caloric needs. Weighting women at .75 of a man and children at .5, consumption of a 5-person household would have totaled 3,560 lbs. In the 1960s, caribou in this region yielded about 70 lbs. of meat on average (Parker 1972: 78), implying that a family would have needed roughly 50 caribou each year.

14. Shepard Krech (1978: 718), however, has argued for densities more than twice the previous consensus, concluding that the subarctic environment could support densities as high as one person per 20 square miles.

15. Life expectancy at birth of these populations would certainly have been under 35 years. The required gross reproduction rate (GRR) that would have allowed an annual population growth of 1 percent was between 2.75 and 3.00 (Wrigley and Schofield 1989: 243). A GRR in this range (roughly 5.5 to 6 births per woman) is close to the upper end of what would have been possible.

16. The harvest function for beaver has been derived as: \( H = K \cdot E^{\frac{1}{2}} \cdot X^{\frac{1}{3}} \) (Carlos and Lewis 1993: 492).

17. A 60 percent decline in effort combined with a 30 percent increase in the beaver population gives this result (see note 16).
Table 1
Trade Goods Sent from York Factory to Cumberland House, 1781 and 1785

<table>
<thead>
<tr>
<th>Trade Good</th>
<th>1781</th>
<th>1785</th>
<th>1781</th>
<th>1785</th>
</tr>
</thead>
<tbody>
<tr>
<td>awl blades</td>
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<td>26</td>
<td>52</td>
<td>61</td>
</tr>
<tr>
<td>baize (yds)</td>
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<td>1,818</td>
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<td>bayonets</td>
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<td>180</td>
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<td>40</td>
<td>48</td>
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<td>388</td>
<td>504</td>
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<tr>
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<td></td>
<td>10</td>
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<tr>
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<td>761</td>
<td>1,308</td>
<td>934</td>
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<td>combs</td>
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<td>100</td>
<td>7</td>
<td>9</td>
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<tr>
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<td>24</td>
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<td>ice chissels</td>
<td>202</td>
<td>80</td>
<td>14</td>
<td>10</td>
</tr>
</tbody>
</table>

Total - *made beaver* 11,769 9,401

Figure 1. Fur Trading Posts in the York Factory Trading Region
Figure 2. The Path of the Smallpox Epidemic in the Hudson Bay Region
Table 1
The Value of Trade Goods Sent from York Factory to Cumberland House, 1777-1789
(made beaver)