BIRTH SPACING AND INFANT MORTALITY ON THE ISLE OF SKYE, SCOTLAND, IN THE 1880S: A COMPARISON WITH THE TOWN OF IPSWICH, ENGLAND

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In 1999 a paper by Chris Galley and Robert Woods appeared in the French journal *Population*.[1] Entitled 'On the distribution of deaths during the first year of life' the paper concludes that 'there are some clear patterns and regularities in the relationship between neo-natal, post-neonatal and infant mortality to the extent that the percentages of deaths under one and under three months do vary in a regular and predictable fashion with the infant mortality rates…'.[2] Galley and Woods use the age at death patterns for England and Wales over the nineteenth and twentieth centuries to propose that, in a population with an infant mortality rate (hereafter IMR) of 200 deaths per 1,000 births approximately 30 per cent (60 deaths for every 1,000 births) will take place in the first month of life.[3] Approximately 50 per cent of all infant deaths (100 per 1,000 births) in such populations would take place before the infants were three months old. When environmental conditions improved, older infants benefited most as the risk of death from 'exogenous' causes diminished. Fewer deaths amongst those aged 3–12 months meant that the percentage of deaths amongst infants in the first weeks of life rose. Thus in populations with a IMR of 100 roughly 35 per cent of deaths would occur within a month of birth, and 55 per cent within three months. By the time the IMR had fallen to 50 deaths per 1,000 births these figures would have risen to about 55 and 70 per cent respectively. Galley and Woods went on to suggest that these percentages could be used as a benchmark against which other demographic data might be set in order to detect irregularities in registration. If a population under study reported a much smaller percentage of its infant deaths as occurring in the first three months of life than the benchmark, then this could be taken to indicate the serious under-recording of the deaths of young children. If the percentage reported was much higher than the 'standard', then it was likely that either stillbirths were being reported as live births, or that childbirth was particularly risky for some reason. If a community practised infanticide this too would push the percentage of very early death upwards from the norm.[4] The reasons underlying such elevated percentages should not only be of interest to scholars of mortality. If stillborn children were being reported as though they had been born alive, then this could have implications for the calculation of fertility rates.

For their study of England and Wales Galley and Woods relied on the Registrar Generals' statistics, as access to the material contained in the civil registers of births, marriages and deaths does not readily permit the construction of large numbers of complete family histories for selected localities. This has greatly hampered attempts to pinpoint where inconsistencies in the way the data were reported or collected may have been affecting demographic rates calculated at the local or regional level. The study of infant mortality is especially affected, because such work requires the accurate registration of both births and deaths in order to produce robust, comparative measures. When comparing mortality rates over time or across space questions concerning comparability have tended to rest on whether the geographic, or administrative, units for which the data were published had altered over time, or whether the nosology used to report cause of death had been redefined, or was understood differently, from one location to another.[5] The impact of variations in the practice of local registrars, or of differing interpretations among the populace of the rules regulating the registration of vital events, or indeed of subtle variations in the wording of the laws themselves, have not gone unrecognised, but are all very hard to gauge for the late nineteenth century without recourse to individual level statistics.

This paper is based on two studies which have managed to circumvent the problems of access to civil registration data for late-nineteenth century Britain. The two communities under scrutiny were not initially chosen to form the basis of a comparison but as longitudinal data, seldom available to historians of nineteenth century Britain, could be constructed for both, the opportunity was taken to conduct a comparative study of their infant mortality in order to tease out some of the issues touched upon in Galley and Woods' paper.

The focus of the first study is the Isle of Skye. This relatively large island lies off Scotland's North West coast, and in the late nineteenth century the great majority of its population lived an almost peasant-like existence, relying on crofting and fishing for their livelihood and renting their land and homes from the estates of the local landowners or 'lairds'.[6] Settlements were predominantly small and widely dispersed across the island. By the 1880s Skye's population, having been depleted for several decades by out-migration, amounted to just under 16,400 persons. Access to the civil registers of births, marriages and deaths between 1881 and 1891 was granted by the General Register Office for Scotland and details of the events recorded have been linked to the local census enumerators' books (hereafter CEBs) for both the 1881 and 1891 censuses, allowing decade-long, partial family-building histories of couples living on the island to be constructed.

The second study relies upon information contained in the 1870s vaccination registers for Ipswich, Suffolk, England. The 1881 census enumerated approximately 51,200 residents of the town. As well as iron founding, clothing and a military encampment, the local economy also included port activities based on the River Orwell, on which the town stands. The vaccination registers were established in 1872, following the Vaccination Act of 1867 which required all infants in England and Wales to be vaccinated against smallpox by the age of three months. The birth registers were effectively extracts from the local civil birth registers, supplied to the vaccination officer by the local registrar. It was the duty of the vaccination officer to notify the parents of each child that vaccination should take place. Note then had to be made that vaccination had been carried out, or that the child had died before being vaccinated, or that the officer had been unsuccessful in carrying out the vaccination, stating the reasons for this.[7] Ipswich was unusual because, the 'vaccination death register' was a transcription of all deaths, both juvenile and adult, reported to have occurred in the town. Elsewhere it was more usual for such registers just to note the deaths of those infants who had died before vaccination, or to list only the deaths of infants dying before their first birthday. Observations in the current paper are based on work linking the births and the deaths of children under the age of five appearing in the Ipswich registers to the 1881 CEBs. The children's births were also linked to marriages recorded during the 1870s in the town's Anglican parish registers, about one-third of the total number of marriages taking place in the town at that time.[8]

The paper thus compares two contrasting communities. Skye, where the population lived almost exclusively in rural surroundings in widely dispersed settlements with Gaelic as their mother tongue, had little in common with the urban centre of Ipswich. However, by comparing the demographic experience of two such places from the seldom available, longitudinal perspective it was hoped that new insights might be gleaned into demographic behaviour. Following Galley and Woods' article it was of interest to see if reporting of Scottish data differed in any way from a community in England, and if the latter would differ significantly from the standard profile of the distribution of deaths in the first year of life. If such differences were discerned what wider implications were there for the understanding of British nineteenth century demography?

Conventionally the IMR is calculated by dividing the number of infant deaths occurring in a particular period by the number of births occurring in the same period: the deaths are not necessarily those of children observed being born. The longitudinal family building histories obtained by record linkage require a different sort of analysis. In order to ensure robust comparison of rates, analysis has to be precise about the amount of time for which each child remains 'in observation', and at risk of death, within the communities being studied. Care has to be taken that all children used in calculation of the rates either remained in their community for the first year of their life, or if the child died before reaching its first birthday, that members of its family were still resident in the community a year after its birth.[9] Children who were born but whose families could not be traced a year later had to be omitted because if all births were included in the mortality rate calculations, and families in population A were more mobile than in population B, the death rate in A would be underestimated as the infant deaths taking place outside the study community could not be accurately counted. In contrast, if a child's death, and not some other event, was taken as an indicator of 'continued residence' then the mortality rate would contain too many deaths relative to the number of births. This is because those children who were resident in the community for a similar length of time as the dead child, but lived to move away, will not be included in either the count of births or that of deaths. The 'selection' effect of including some births only because they subsequently died inflates the mortality rates calculated. It would appear that families in urban Ipswich were more likely to migrate than those in Skye, and as a result a lower proportion of the children registered in Ipswich could be included in the analyses.[10]

Only legitimate children were included in the calculations because illegitimate children were much more susceptible to the biases outlined above. The family building histories of unmarried women tended to be unconventional and their situation appears to have encouraged mobility, making single mothers and their offspring more difficult to trace. As a result, the period that illegitimate children were 'in observation' is very often far from certain. On Skye 229 of the birth certificates, 5.8 per cent of the total number considered, registered only the name of the mother, which has been taken to signify children born out of wedlock. Under the same assumption 4.9 per cent of Ipswich children were illegitimate.

With the linked, longitudinal data for Skye and Ipswich it is possible to follow individual children over their first year of life. Between 1 April 1881 and 31 March 1890, 3,967 births took place on Skye where the child could be followed over the first year of its life.[11] Within this period 410 of the children died before their first birthday, giving an infant mortality rate of 103 per 1,000 births. In Ipswich, vaccination birth registers running from 6 April 1872 to 5 April 1880 were consulted; 12,670 births could be traced across their first year of life.[12] Of these infants 1,787 were registered as dying before reaching their first birthday—an IMR of 139 per 1,000 births.

While both figures are pretty respectable for the late nineteenth century, when IMRs of over 200 were not uncommon, Skye's IMR was almost half again as lethal as England's most salubrious rural districts where only 70 infant deaths were occurring per 1,000 births in the 1880s.[13] In addition, when the mortality figures were broken down by age, it emerged that while mortality in the first month of life was 37 deaths per 1,000 births in Ipswich, on Skye it was over 60 deaths, a far higher rate than expected for a population with an IMR of around 100, according to Galley and Woods' model.

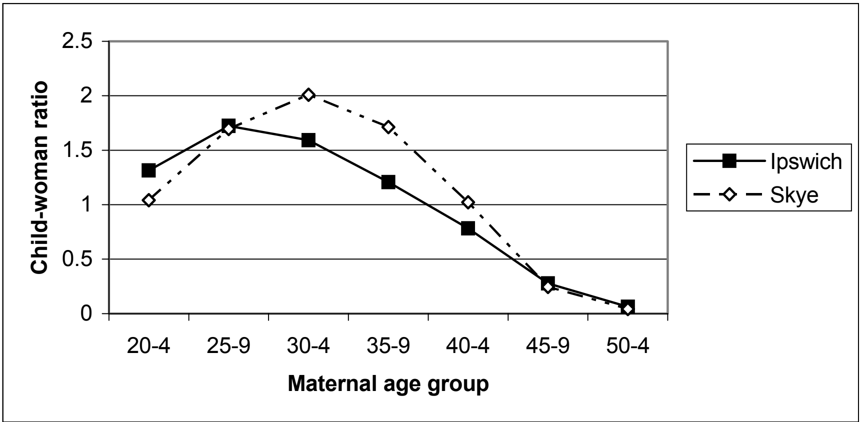
What might account for Skye's relatively poor performance? Was fertility particularly high amongst the married couples of Skye, leading to short average birth intervals and high numbers of weak or sickly infants who were at particular risk of dying?[14] Mothers having births in quick succession might be slow to recover their health, making them more prone to miscarriage, stillbirth or to producing sick or weakly infants who die within a short time of birth, contributing to the 'endogenous' mortality rate.[15] Weak infants surviving the trauma of birth and the first few weeks of life might well be at greater risk of death from 'exogenous', environmentally related, causes, particularly if the infant becomes too weak to suckle or the mother has little milk and the child has to be artificially fed. This risk may be compounded if a further rapid pregnancy follows and the mother weans the older infant in order to suckle its younger sibling. The cycle of cause and effect is, however, complex, given that it may be because the mother weaned her first child relatively early that she quickly fell pregnant again. Alternatively, did the environment of Skye hold particular hazards for very young children? Were local practices associated with childbirth more dangerous than those seen elsewhere? Or were Skye people recording, as Galley and Woods suggested, stillbirths as live births and elevating the mortality rate amongst newborn infants in comparison to populations who did not record the advent of a stillborn child? Comparison between Ipswich and Skye allows us to examine each of these possibilities in turn.

Previous studies of nineteenth century Britain suggest fertility might be expected to be higher, and infant mortality lower, on rural Skye than in urban Ipswich.[16] Earlier work on the Skye data indicated that, although *overall* fertility levels were relatively low, as a result of both sexes experiencing late average ages at marriage and high proportions remaining unmarried, *marital* fertility levels were very high, almost on a par with those found among the famously fertile Irish.[17] Using the common point of the 1881 CEBs to estimate child-woman ratios, fertility levels in Ipswich and Skye can be compared. For each locality the number of co-resident married couples where the wife is aged between 20 and 54 was noted, along with the number of children aged less than five returned as 'son' or 'daughter' of the couple, grouped by the mother's age. Only children surviving to be enumerated can be observed in the census returns, so allowance has to be made for those children 'lost' to observation via mortality. The number of children was therefore inflated to reflect the mortality experience of children under the age of five as observed in the register entries from each community.[18] The ratio of children per married woman was then calculated for each five-year maternal age group.[19]

Figure 1 shows that Skye women in their 30s and early 40s had, in the five years prior to the 1881 census, borne more children than their counterparts in Ipswich.

If it is assumed that levels of infertility and sub-fecundity were probably similar in the two populations, Figure 1 could be interpreted as indicating that birth intervals on Skye were, on average, considerably shorter than in Ipswich.[20] Brides marrying for the first time on Skye in the 1880s did so, on average, when aged around 26.5 years, a full three years older than spinsters marrying in the Anglican churches of Ipswich. It would also appear than Ipswich brides were more likely to be pregnant on marriage than those on Skye. It is difficult to gauge the exact magnitude of this difference, as many couples observed marrying in both locations would make their home and rear their family elsewhere, rendering their fertility histories difficult to follow. However, of the 170 couples on Skye observed to have had a child within one year of their marriage, 26 per cent had had a baby within seven months of

Figure 1 **The child-woman ratio (adjusted for mortality) for married women, co-resident with their husbands on census night, 1881: Skye and Ipswich.**



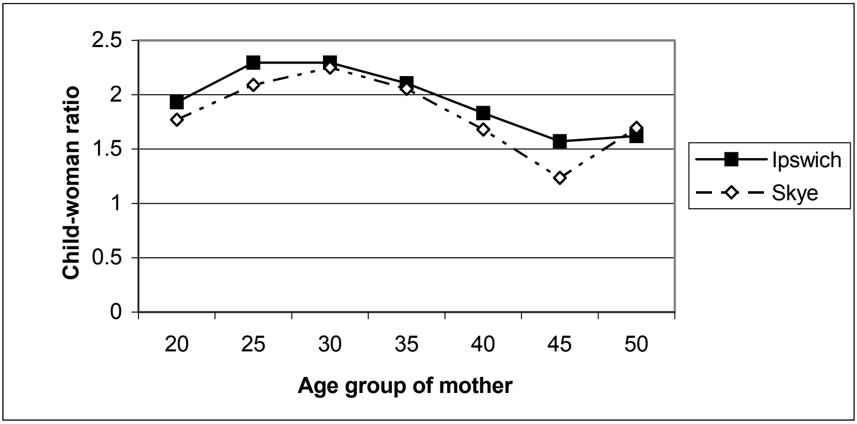
Source: 1881 census enumerators' books.

their wedding day, suggesting prenuptial pregnancy, compared to 40 per cent in Ipswich

Given their higher rate of prenuptial pregnancy and earlier age at marriage, women in Ipswich would have spent a considerably longer portion of their twenties 'at risk of childbearing within marriage' than their peers on Skye. Thus, in order for Skye women in their 20s to have child women ratios as close to those of Ipswich as shown in Figure 1, it would seem that women on Skye must have been bearing children more rapidly, leaving shorter gaps between births. The rapid tempo of child-bearing, continuing into women's 30s and early 40s, would serve to push the child-woman ratios amongst Skye women in these age groups well above those of similar women in Ipswich, before the increasing proportions of women affected by the menopause curtailed fertility in both populations.

Having data for only one decade in each locality—the 1870s for Ipswich and the 1880s for Skye—meant that it was not possible to trace full child-bearing histories for each couple. Only a small proportion of the couples in the censuses closing the observation period could be linked to a marriage in the preceding years. Where marriage data was not available, the parity of births could not be ascertained. In an attempt to circumvent this problem, all families who were observed to have had a particular number of children by the relevant census were identified. For obvious reasons, couples observed to bear large numbers of children within a given period appear to have had shorter birth intervals. A woman who has a child on the day after a period of observation began will have one more child recorded than a woman who has a child the day before the start date, *ceteris paribus*. In order to minimise the effect of this 'censoring', the gap in days between the first observed birth and the second was calculated, as was the

Figure 2 The child-woman ratio (adjusted for mortality) for fecund, married women, co-resident with their husband on census night 1881: Skye and Ipswich.

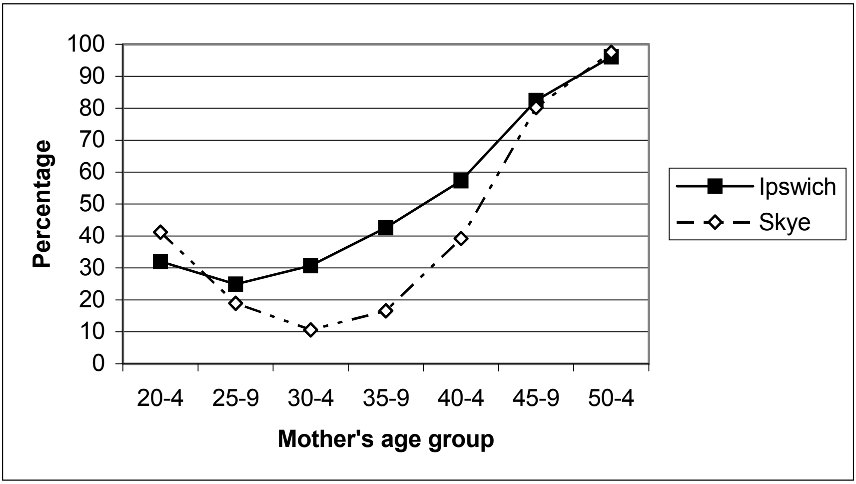


Source: 1881 census enumerators' books.

length of the gap between the second and third births, but only for those couples who could be traced in the census closing the period of observation. In both Skye and Ipswich the average length of the gaps between the first and second and second and third observed births was virtually the same, so the two sets of birth intervals were added together and the average calculated. The average gap between these observed births was 25.3 months in Ipswich and 25.5 months in Skye. Thus where they could be measured birth intervals on Skye were, in fact, fractionally longer than they were in Ipswich.

Figure 2 shows the child-woman ratio among 'fecund' married women in the 1881 census, that is those women who had at least one child of their own registered with them and their husband on census night. When the figures are adjusted to allow for those children who had died before the census, the level in Ipswich appears a little higher. By applying the same mortality inflation factors to create Figure 2 as was used to create Figure 1 the difference between the 'fecund fertility' levels shown in Figure 2 may be exaggerated, as it is likely that rates of infant and child mortality would have been higher among those women with no children living with them on census night. It may therefore be concluded that there is very little difference between the two communities: married women who were bearing children were bearing them at approximately the same rate in both Ipswich and Skye. The registers concur on this point: of the 1,538 families traced in Skye to the 1891 census who had registered at least one birth in the previous 10 years, 66 per cent had had a second by 1891, 45 per cent a third and 23 per cent a fourth. For the 3,824 families traced in Ipswich to the 1881 census where at least one child was born during the 1870s, 70 per cent had had a second birth, 43 per cent had had a third and 21 per cent had had a fourth.

Figure 3 **The percentage of wives with husbands present, who have no own children aged under 5 years resident with them on census night 1881: Skye and Ipswich.**



Source: 1881 census enumerators' books.

Figure 3, however, shows the percentage of co-resident married couples in the 1881 census who had no children of their own aged less than five registered with them. Married women in Ipswich in their 30s and early 40s were much less likely to have a child of their own aged under five in the home than were their peers on Skye. Without additional information it is difficult to estimate how many of these apparently childless women had in fact borne children, but seen them die before they could be recorded in the census. Unfortunately, without information from the 1871 census, couples who did not bear children during the 1870s are 'invisible' to the longitudinal analyses.[21] While Ipswich's higher mortality no doubt plays a part in creating the disparities observed in Figure 3, it would appear that the assumption of similar rates of infertility and sub-fecundity, made when interpreting Figure 1, may well have been in error. The longitudinal data and the census data, when viewed in tandem, suggest that the women of Skye were highly fertile not because they were having children more quickly, but because more women were having children. A proportion of married women in each community could not contribute to the birth interval analysis because they failed to give birth to sufficient children within the study period to allow them to contribute to the calculations; this proportion seems to have been much larger in Ipswich.[22]

Table 1 indicates that for the children of fecund married couples, both on Skye and in Ipswich, the risk of infant mortality did significantly lessen as birth interval lengthened.[23] Among singleton children born less than a year after their siblings in Ipswich the risk of infant death was greater than one in four. Children born 12 to 23 months after their elder siblings had only half this risk

Table 1 **The mortality of legitimate children closing birth intervals of specified length: Skye 1880s, Ipswich 1870s.**

		Ipswich				Skye			
Length of birth interval	Length of birth interval (days)	No. of children	IMR[a]	IMR[a] at < 31days	C as % of B	No. of children	IMR[a]	IMR[a] at < 31days	C as % of B
		A	B	C		A	B	C	
twins	0	168	428	202	47	92	272	174	64
9 months–1 year	270–365	119	260	109	42	31	161	97	60
1 year–2 years	366–730	2,889	129	29	22	949	84	51	61
2 years–3 years	731–1,095	1,762	106	18	17	823	61	33	54
3 years–4 years	1,096–1,460	333	93	24	26	160	82	51	62
up to 4 years	0–1,460	5,271	130	32	25	2,055	84	50	59

Source: Skye: record linkage of 1881 and 1891 censuses and 1880s civil registers, Ipswich: vaccination registers and 1881 census.

Notes: Only families remaining in view in succeeding census included.
[a] IMR measured per 1,000 births.

of dying in their first year. There was a further diminution in risk for those born after a two to three year gap. Where siblings were born three to four years apart in Ipswich the younger child had less than a 1 in 10 chance of dying within its first year. These measurements exclude twins. In Ipswich 428 individual twins in every 1,000 born (that is, in every 500 twin births) would die before the age of one, but this is hardly an appropriate comparison with singleton births.[24]

On Skye the pattern was broadly similar, although the risk of death was much lower at all lengths of birth interval. The small number of singleton children born less than a year after their previous sibling were much more likely to survive than were their peers in Ipswich, having an IMR of 'only 161' per 1,000 births. This, however, was almost twice the 84 per 1,000 births mortality rate of children born 12–23 months after their elder sibling. Among children born after a two-three year gap mortality was only 61 per 1,000 births, and among those born at the end of a three–four year gap 82 per 1,000 births. Why the rate among the latter group was higher is unclear, although it is probable that in a proportion of such cases the long gap between births hid a pregnancy which had terminated in a miscarriage or stillbirth, and thus went unrecorded in the registers, distorting the apparent interval since last pregnancy. Generally, however, there is a decreasing risk of infant death with increased period since previous birth in both communities. Table 1 again suggests that, where birth intervals could be measured, they were on average a little shorter in Ipswich than on Skye: 57 per cent of the single births shown in Ipswich took place less than 730 days after the previous birth, whereas on Skye only 48 per cent of the single births shown did so. The fractionally longer birth intervals on Skye may have afforded the children additional protection against mortality, but their chances of survival were much higher than those of children in Ipswich anyway.

Table 1 raises some interesting questions. The lower mortality on Skye might suggest that breast-feeding was more widespread and of longer duration on the island than in Ipswich, providing more effective protection against pathogens present in the local environment.[25] However, it is likely that sparsely populated Skye would provide infants with a much less lethal environment than that to be encountered in a bustling, crowded town and therefore the protection offered by breast-milk may not have been of great importance. If breast-feeding was practised to a greater extent, however, lower levels of fertility might be expected, as birth intervals would be lengthened, *ceteris paribus*. As we have seen above, however, amongst fecund women birth intervals do not appear to have been very different in the two communities suggesting that breast-feeding practices were probably similar, at least amongst this group of women.

If a mother has births in quick succession, her physical reserves may be drained as she has little time to recover between pregnancies. Such 'maternal depletion' may lead to a less viable neonate—a baby born very underweight, malformed or otherwise in poor health—or to a more difficult birth with an elevated risk of mortality for both mother and child. In either case the infant's chance of surviving the first few days is much reduced. Among women with short birth intervals, therefore, the rates of infant mortality within the first month of life might be expected to be higher in relation to mortality in the following 11 months than would be true among women with longer birth intervals. In the two study populations, the number of singleton births observed to occur less than a year after that of an older sibling is relatively small. Table 1 indicates, however, that their risk of mortality in the first 30 days of life is over 100 per 1,000 births both in Ipswich and on Skye, much higher than the equivalent risk run by children born after longer intervals. Among singleton births preceded by a birth interval of less than a year in Ipswich, 40 per cent of total infant mortality occurred in the first month of life, a percentage not far short of that seen among twins. Amongst births closing longer birth intervals, deaths in the first month of life contributed 26 per cent or less of all infant mortality. Here, perhaps, is evidence that in this community very short birth intervals did produce infants who were more likely to succumb to very early deaths.

The Skye figures suggest a different story. Amongst twins and children born after a birth interval of less than a year, 60 per cent of all infant mortality occurs in the month after birth, a substantially higher percentage than in Ipswich. Of course, in a community where environmental hazards were fewer and older infants therefore ran a reduced risk of contracting a fatal illness, first month deaths might be expected to form a higher proportion of all deaths in the first year of life. However, Table 1 indicates that, although overall IMRs

Table 2 Mortality in the first year of life: a comparison between Ipswich, Skye London and Rural Counties in England and Wales for selected dates.

	Ipswich	Skye	London[a]	Blackburn Leicester & Preston[b]	Rural Counties[a]	Dorset, Herts. &. Wilts.[b]	Norway[c]	28 towns in England and Wales[d]
Date:	6.4.1872 – 5.4.1880	1.4.1881 – 31.3.1890	1902	1889 – 1891	1902	1889 – 1891	1876 – 1880	1907 – 1910
No. of births	12,671	3,973	130,478		107,622			
No. of deaths by age at death								
< 1 hour	14	25						
< 1 day	87	48						
< 1 week	272	128	3,138		2,788			
< 1 month	473	243	5,438		4,461			
< 1 year	1,759	408	18,307		12,470			
Cumulative deaths per 1,000 births occurring at given ages:								
< 1 hour	1	6						
< 1 day	7	12				8		
< 1week	21	32	24	26	26	22	17	17–31
< 1 month	37	61	42	49	42	35	35	31–48
Deaths per 1,000 births occurring at given ages:								
1 month < 1 year	101[e]	41[e]	99	169	74	62		51–117
< 1 year	139	103	140	218	116	97		81–162

Notes: a) Figures for London and the ‘Rural Counties’. The latter include, in England: Buckinghamshire, Cambridgeshire, Cornwall, Hertfordshire, Huntingdonshire, Lincolnshire, Norfolk, Oxfordshire, Rutland, Shropshire, Somerset, Suffolk, Westmorland and Wiltshire, and in Wales: all counties excluding Glamorgan. Figures for 1902 are taken from *Report of the Inter-departmental Committee on Physical Deterioration* BPP. 1904 [Cd 2175] Vol.1, Appendix 5.

b) Figures taken from R. Woods and N. Shelton, *An Atlas of Victorian Mortality*, (Liverpool, 1997), Table 5, 54.

c) Figures for Norway are taken from E.A. Wrigley, 'Explaining the rise in marital fertility in England in the 'long' eighteenth century. *Economic History Review*, 1998, **LI***,* 3, 435-464, Table 3, p. 444. Note that figures for less than 1 month relate to mortality in days 0-27 in the case of Norway.

d) Figures shown are the maxima and minima given in R. Millward and F. Bell 'Infant mortality in Victorian Britain: the mother as medium' *Economic History Review* **LIV**, 4 (2001), Table 3, 708. They were originally drawn from A. Newsholme 'Second report on infant and child mortality' Appendix II, Tables 1 and 3, B.P.P. 1913 XXXII, *Annual report of the Local Government Board, 1912-13, Supplement*.

e) Note that the rates for Ipswich and Skye are rather higher than the rates reported in Table 1 where families had to remain in view until the succeeding census.

were lower on Skye for all lengths of birth interval, mortality rates for the first month of life were not far short of those seen in Ipswich amongst children following very short birth intervals and, indeed, for children born after an interval of more than one year, the rates of first month mortality were almost twice as high on Skye as they were in Ipswich. In addition the percentage of infant deaths taking place within a month of birth saw little diminution with increasing birth interval. Skye appears to have been a very dangerous place for newborn infants, and the risks were not diminished by increasing the interval between births, which suggests that the hazards were due to the surroundings into which a baby emerged, rather than to its own health or that of its mother.

Table 2 compares mortality rates in the first year of life in Ipswich and on Skye with those in other late-nineteenth and early-twentieth century populations. As both the civil and the vaccination registers provide information on age at death it is possible to break this down for the populations of Skye and Ipswich to show rates for the first hour and the first day of life.[26] Beyond this we can compare death rates within the first week, and first month and the next eleven months with rates for the populations shown. The table confirms that, although survival chances were relatively good amongst Skye infants, and indeed older infants on Skye were impressively healthy, mortality in the first month of life was abnormally high, exceeding even that of newborns in the notoriously unhealthy towns of Blackburn, Leicester and Preston. With an IMR of approximately 100, yet neo-natal mortality rate of 60 deaths per 1000 births, Skye therefore appears to fit Galley and Woods' description of a population where there were 'imperfections or hidden irregularities' in the registration of births or infant deaths.

Were stillbirths being recorded as live births on Skye?. It must be remembered that the systems for civil registration established in England in 1837 and Scotland in 1855 were set up under two separate legal systems. It is thought that in England and Wales from 1837 there was some under-registration of births and deaths until after the 1874 Births and Deaths Registration Act. This Act made the notification of death the responsibility of the nearest relative of the deceased, rather than of the registrar, and the latter was also no longer responsible for the registration of births, this having passed to the parents of the child.[27] The Act further required that the death certificate be accompanied by a statement of the cause of death signed by the doctor attending the final illness. In Scotland, despite a few initial hiccups there were 'good grounds for believing the returns from civil registration…to be very accurate'.[28] Although civil registration started later, legal compulsion on parents to register a birth was introduced from the start, as was the requirement for the cause of death to be certified by a doctor. It is to be noted, however, that the Scottish legislation, probably in recognition of the far flung settlement patterns, allowed, in the absence of a doctor, for the cause of death to be certified by a 'relative of the deceased'.[29]

In Scotland death registration in the 1880s was still covered by the provisions of the Registration of Births, Deaths and Marriages (Scotland) Act 1854. A child was held to be stillborn, although the heart might beat a little, where no respiration occurred, the lungs failing to inflate. The recording of stillbirths did not begin in Scotland until 1939, but an 'order of burial' had to be issued by the registrar before a stillbirth could be buried, just as a death certificate was required before a live-born child could be buried. Thus the birth of a child, whether live or stillborn, would be brought to the attention of the registrar. In an era and an area where medical attendance at a birth was by no means the norm, and indeed there was provision for 'no medical attendant' to be entered on the death certificate, parents reporting the birth and subsequent death of their child to the registrar may well have chosen to state that their child had taken one or two breaths before it died. Or, indeed, the registrars on Skye may have believed that lay persons were unable to distinguish between a stillbirth and a very early death, and chosen to assume the birth was a live one.[30] In either of these cases both a birth and death certificate would have been issued. Perhaps in other registration districts the opposite assumption was made and certificates of burial were issued and stillborn children interred without contributing to the Registrar General for Scotland's annual statistics.[31] In England, until the compulsory registration of stillbirths began in 1927, the burials of stillbirths could proceed with either 'a doctor's certificate, a coroner's order…, or with the declaration of a 'qualified informant'.[32] This last provision meant that a note from the mother or father of a child could be sufficient for an undertaker, or even a gravedigger, to inter the dead infant with no official record being kept of either its birth or death. Mooney provides evidence that differences in the price of burials for live and stillborn children may well have induced poor parents to treat liveborn children as stillborn.

There is some evidence for the close connection between death and the registration of birth in vaccination registers studied for other localities. Under the Vaccination Acts notification of the need to have a child vaccinated was handed out to the person notifying the registrar of the child's birth. Thus by subtracting the date of birth from the 'date of notification', where this is provided in the registers, it is possible to gauge when parents got round to registering the birth of their child.[33] In Higham Ferrars, Northamptonshire in the mid-1880s, data indicate that some 93 per cent of births had been registered, and notification of vaccination given, by the end of the eighth week of life.[34] The vast majority of births (57 per cent) were registered during the infant's sixth or seventh week of life. One hundred and thirty five births (13 per cent) were, however, registered before the child was 28 days old. Of these, 24 infants (18 per cent) had died before their birth was registered; but of the 16 children whose existence was registered within a week of birth, 11 (69 per cent) had died before registration. An infant death in the first few days of life in Higham Ferrars appears to have led to the child's birth being registered earlier than it would have been under happier circumstances

If births on Skye were 'over-registered', this should show up in high levels of infant mortality in the first hours of life. Conversely if early deaths, and the

Table 3 **Deaths from specific causes in the first month of life per 1,000 births: Skye 1880s, Ipswich 1870s.**

SKYE				IPSWICH	
Cause	Mortality rate per 1,000 births	Medical Certification		Cause	Mortality rate per 1,000 births
		% cert.	% not cert.		
Unknown	24	0	100	Debility	12
Pleurisy	6	0	100	Prematurity	7
Prematurity	5	38	62	Convulsions	2
Weakness	2	0	100	Diarrhoea	1
Debility	2	43	57	Asthenia	1
Croup	1	0	100	Atrophy	1
Other	6	5	95	Other	4
Total	47	10	90	Total	27

Notes: Legitimate children from families seen in succeeding census only. Also rates of medical certification of cause of death on Skye.

Source: Ipswich: vaccination registers, Skye: civil death registers.

associated births, went 'under-registered' in Ipswich, mortality rates in the first day of life would appear relatively low. Table 2 shows that Skye-born infants were six times more likely to die in their first hour of life than those born in Ipswich, strongly suggesting that stillbirths were being registered as live ones. However, the rates of death among Skye infants were also over 50 per cent higher than among newborns in Ipswich in the first day, week and month of life. Mortality within the first week on Skye was also higher than that experienced by any of the other populations shown in Table 2. The cumulative figures in Table 2 can be broken down to show that, for every 1,000 children born, in Ipswich one died in the hour after birth while on Skye it was 6, yet in the following 23 hours 6 further children died in both communities. Fourteen more newborns had died by the end of the first week in Ipswich, but on Skye 40 had succumbed. In the next 3 weeks, per 1,000 born, a further 18 would die in Ipswich, a further 29 on Skye. If the reporting of stillbirths as live births followed immediately by death was occurring, this would account for Skye's elevated death rate within an hour of birth, but would not explain the higher risks run by older neonates. Was a local practice on Skye proving lethal solely to newborn infants? Did, for example, birth attendants seal the umbilical scar with earth as is reported to have induced high rates of fatal infant tetanus on the island of St Kilda, which, after all, had close links with Skye?[35]

In both the civil death registers for Skye and the vaccination death registers for Ipswich the cause of death is given. Tables 3 and 4 consider causes of death among those legitimate children where the families can be identified in the 1881 census of Ipswich and the 1891 census of Skye. The mortality rates shown

Table 4 **Deaths from specific causes amongst ages 1 month - 1 year: Skye 1880s, Ipswich 1870s.**

SKYE				IPSWICH	
Cause	Mortality rate per 1,000 births	Medical Certification		Cause	Mortality rate per 1,000 births
		% cert.	% not cert.		
Unknown	7	0	100	Diarrhoea	15
Whooping cough	5	28	72	Convulsions	12
Bronchitis	5	56	44	Bronchitis	10
Pleurisy	4	0	100	Marasmus	9
Measles	2	20	80	Debility	7
Teething	2	20	80	Whooping cough	6
Other	7			Pneumonia	5
				Other	14
Total	31	25	75	Total	80

Notes: Legitimate children from families seen in succeeding census only.
Also rates of medical certification of cause of death on Skye.

Source: Ipswich: vaccination registers, Skye: civil death vaccination registers.

are rather lower than those reported in Table 2, however the general pattern—of higher mortality in the first month of life on Skye, but higher mortality in the following 11 months in Ipswich—is repeated.[36] Table 3 indicates that of the 47 children per 1,000 born on Skye in the 1880s dying in the first month of life, six were reported to have died from 'pleurisy', five from 'prematurity', two from 'weakness' and two from 'debility'.[37] In every 1,000 births, 'croup' would kill one child before it was a month old and assorted 'other causes' would carry off a further six. In by far the majority of cases, however, accounting for 24 deaths for every 1,000 births, the cause of death of very young infants was 'unknown'.

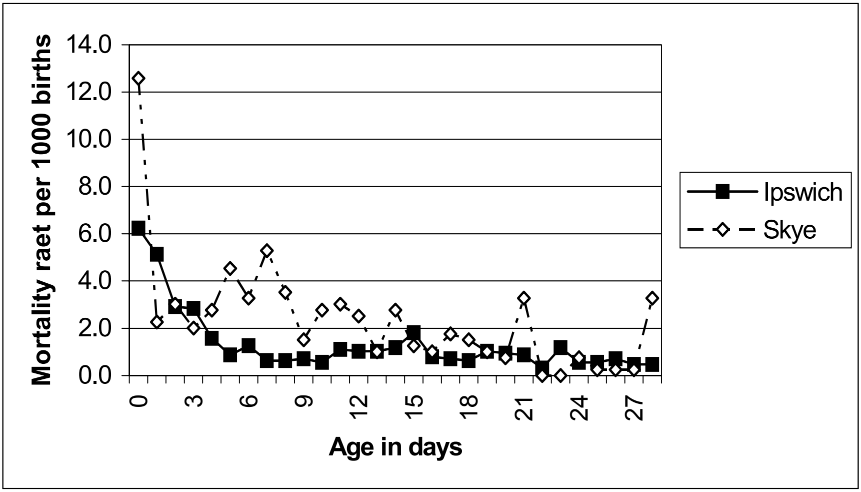
As noted above, the Scottish registration system allowed close relatives to *report* the cause of a death being registered without this necessarily being *certified* by a medical practitioner. A space was provided on death certificates to record whether the death had been 'medically certified' or not. Sometimes the certificate noted that the deceased had had 'no medical attendant' during their last illness, hence partially explaining why doctors might feel ill-qualified to pronounce on the cause of death. The population of Skye's remote hamlets could not always expect to have a doctor present either during an illness, particularly a short-lived one, or at a birth. Thus only 10 per cent of infants dying on Skye before they were a month old had their cause of death medically certified, and as Table 4 indicates the figure rose to only 25 per cent among those dying in the next 11 months. For a considerable proportion of these older infants the cause of death was also reported as 'unknown'. The causes of death which were reported included ’whooping cough’ and ’measles’, ’pleurisy’ and ’bronchitis’, as well as ’teething’ (a medically certified cause in some cases) and a mix of ’other causes’.

In all only 19 per cent of children on Skye dying before their first birthday had their cause of death medically certified. The degree of certification does not, however, seem to have been related to the medical provision available. In the 1881 census there were six doctors returned as resident on the island, and there was another visiting from Glasgow.[38] In addition three midwives were listed, along with a fourth who was visiting from the neighbouring island of Raasay. Of the six local doctors four were resident in the northern parish of Duirinish, yet only 4 per cent of infant deaths in that parish were medically certified. In the southern parish of Sleat there were no doctors recorded in the 1881 census and yet 56 per cent of infant deaths occurring in the parish in the ensuing decade had their causes medically certified. The census figures can, of course, give little information on the social and spatial restrictions on *access* to medical care. Perhaps the doctors in Duirinish were primarily there to attend the needs of the local laird and his household; perhaps a doctor would cross from the nearby mainland to attend patients in Sleat.

The vaccination death register data for Ipswich did not include a note of whether a doctor had certified the cause of death. However, the 1874 the Births and Deaths Registration Act in England and Wales required medical certification of cause of death, and the fact that there were no ’unknown’ causes of death listed for Ipswich in Tables 3 and 4 certainly suggests the presence of professionals who did not wish to be seen ’not to know’ what had carried off an infant.[39] The very high rates, at least compared to those of Skye, of ’debility’ in Ipswich may indicate that this was a catch-all category used when the cause of death was uncertain. The reasons for higher death rates between the start of the second month and the end of the first year of life in Ipswich become clear in Table 4. ’Diarrhoea’ carried off 15 children in this age group for every 1,000 born, yet does not appear among the major killers of older infants on Skye. ’Wasting’ diseases such as ’marasmus’ and ’debility’ killed 16 older infants out of every 1,000 born in Ipswich, yet apparently Skye infants did not succumb to such conditions after the first month of life. Convulsions did not kill Skye infants, yet 12 older Ipswich infants in every 1,000 born died after a convulsive fit. Pneumonia and bronchitis between them carried off 15 Ipswich infants, yet ’bronchitis’ and ’pleurisy’ together accounted for only 9 later infant deaths per 1,000 births on Skye.

As the cause of death information was not particularly helpful in resolving the reason for Skye’s high level of neonatal mortality, Figure 4 was constructed, to show the distribution of deaths over the first 28 days of life on Skye and in Ipswich. While the peak in Skye’s mortality in the first 24 hours is clear on the graph, the shapes of the two curves are thereafter rather different. In Ipswich the second 24-hour period appears to have been almost as lethal as the first. Possibly this was simply a function of the imprecision which might occur when age at death is being described as ’first day’ rather than precisely in minutes or hours. If this is true then perhaps Ipswich’s rates of deaths within

Figure 4 The IMRs by age in days for the first four weeks of life: Skye 1880s and Ipswich 1870s.



Source: Skye: civil registers, Ipswich: vaccination registers.

the first 24 hours of life did not fall as far short of those on Skye as previously suggested. Days 2 and 3 seem to have been equally lethal in both communities, but from day 5 until day 12 infants on Skye were subject to levels of mortality that were several times higher than those prevalent in Ipswich, even if we ignore the peaks which occur on days which are multiples of seven, these being caused by those reported to be '*x* weeks' old having to be counted with those who were (*x* x 7) days old.

It is possible that infants on Skye were subject to infanticide but, as Sauer has shown, numbers of proven cases of infanticide in nineteenth-century Britain were very low compared to the numbers of births occurring, and there seems little reason to think Skye exceptional in this regard.[40] Where infanticide is an issue it is very often associated with excess deaths of one or other sex, but as the sex of 22 of the 53 Skye children dying on their first day of life could not be determined, no name being registered, this proposition could not be tested.

The timing of death among Skye's newborns strongly suggests that 'neo-natal' or 'infantile' tetanus may have been the culprit. This disease, still a major scourge at the end of the twentieth century in many developing countries, usually occurs 3–12 days after birth.[41] The infantile form results from a birth in insanitary conditions, particularly if the umbilical cord is cut with an unclean blade. Blades contaminated by soil from a farmyard setting would be a particular hazard. Infants in the crofting communities, where many houses were still wholly or partially earth floored at the end of the nineteenth century, and animals were sometimes housed alongside the human residents, may have been particularly at risk. The island of St Kilda, lying beyond the

Western Isles of Scotland, was notorious for the incidence of tetanus amongst it infants, the disease being the main reason why only half of the island's infants reached their first birthday. It was 'not until the last decade of the nineteenth century that the cause of the disease was recognised and prophylactic measures introduced' to the island.[42] Unfortunately 'tetanus' is not mentioned at all in the Skye death registers, although it appears twice in those of Ipswich, in one instance carrying off a 3-day old infant and in the other a 12-day old. We therefore cannot be totally certain that this disease was responsible for striking down Skye infants in their first month of life at a greater rate than those elsewhere, although it must be a strong contender. It is likely that in the very small population on St Kilda all births would have been subject to the same practices, for example treating the umbilical scar with earth mixed with fulmar oil, but on Skye the population was well dispersed and therefore variations in risk might be expected. It is therefore of interest that, although numbers are quite small and therefore only suggestive, mortality in the first four weeks of life accounted for more than 70 deaths per 1,000 births in Duirnish and Kilmuir, the two parishes furthest from the mainland, yet Sleat, nearest the mainland, lost only 35 of its infants in their first month. Local practices, differentially affected by the spread of knowledge, do therefore appear to have played an important role in accounting for variations in survival chances.

To return to Galley and Woods' observations on the distribution of deaths within the first year of life: the population of Skye in the 1880s undoubtedly reported a rate of infant mortality within four weeks of birth far in excess of that expected. It has been demonstrated that there is a strong probability that, although the reporting of some stillbirths as live births was contributing to the elevated rates, a more significant factor was deaths in the first to third weeks of life which resulted from infections contacted during childbirth.

Women on Skye who lost infants did so disproportionately in the first few weeks of life when compared to Ipswich and other nineteenth-century populations. This would result, *ceteris paribus*, in a more rapid restoration of ovulation and a shorter subsequent birth interval than would have occurred if the infant had survived a few more months. This may partly explain the high rate of 'fecundity' observed amongst the married women of Skye. Above we examined the effects of the length of birth interval on the 'closing' child; future research will examine the impact of the 'opening' child's demise on the length of the subsequent interval.

The two longitudinal studies considered here have demonstrated that while Galley and Woods' use of 'benchmark' distributions of infant deaths does pick out populations where the registration of demographic events is 'irregular', many questions and a great deal of work remain, as the authors themselves admit, before the circumstances underlying the 'irregularities' can be fully assessed and understood. It is unlikely that such questions will be answered, certainly for the British Isles, until access can be gained to a greater variety of sources showing the inter-relationship between demographic events and their entry into, or omission from, official records.

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NOTES

1. C. Galley and R. Woods, 'On the distribution of deaths during the first year of life', *Population: an English Selection*, **11** (1999), 35-60.
2. Galley and Woods, 'Distribution of deaths', 56-7.
3. These and the following figures are taken from Galley and Woods, 'Distribution of deaths', Figure 8; 50.
4. Galley and Woods, 'Distribution of deaths', 57.
5. See R. Woods, *The demography of Victorian England and Wales* (Cambridge, 2000), Chapter 2; R. Woods and N. Shelton, *An atlas of Victorian Mortality* (Liverpool, 1997), Chapter 2.
6. Crofting was a small-scale, family-based form of agriculture. The nature of livelihoods derived from such an economy is evident from the definition of a 'crofting parish' set by the Napier Commission in the late 1880s. Such a parish contained 'holdings consisting of arable land, held with a right of free pasture in common … the annual rent of which did not exceed £35'. See I.M. M. MacPhail, *The crofters' war* (Stornoway, 1989), 174.
7. Reasons could include, among others, the family moving out of the area for which the vaccination officer was responsible or the parents conscientiously objecting to vaccination. The vaccination registers are described in greater detail in M. Drake and P. Razzell, 'The decline of infant mortality in England and Wales, 1871-1948: a medical conundrum', unpublished interim report (1997) Open University.
8. It is hoped in future work to expand coverage of marriage records in Ipswich to include other denominations. For further details of the linkage procedure and the findings of the study see P. Razzell, E. Garrett, and R. Davies , 'Research Grant 200023842; end of grant report', lodged with the Economic and Social Research Council and available online at www.regard.ac.uk. N. Williams in 'Death in its season: class, environment and the mortality of infants in nineteenth century Sheffield', *Social History of Medicine*, **5** (1992), 71-94 used similar methodology, but she only had information on deaths available so could not address issues requiring knowledge of precise dates of birth.
9. Presence of the families was determined either by the presence of family members in the succeeding census, or by the birth of a younger sibling. It should be noted that by including the latter criterion families with more than one child and/or closely spaced births are more likely to be included in the calculations, which may serve to inflate mortality rates to some degree.
10. See Razzell *et al*., 'End of grant report'.
11. 31 March 1890 was taken as the cut off point, with 'cohort' analysis in mind, to allow observation of the first full year of the children's life before the census of 1891.
12. 5 April 1880 was taken as the cut off point, again with the 'cohort 'analysis in mind, as it allowed

observation of the first full year of the children's life before the census of 1881.

13. Woods and Shelton, *Atlas,* Map 7a, 49. Similar rates could also be found in earlier decades; Woods and Shelton, *Atlas,* Fig. 15, 56. The figure of 103 is, however, very close to the 97 per 1,000 births returned for the three rural counties of Dorset, Hertfordshire and Wiltshire: see Table 2 below.
14. See J. Knodel and E. van de Walle, 'Breast feeding, fertility and infant mortality: an analysis of some early German data', *Population Studies*, **21** (1967), 109-31.
15. For a definition and discussion of endogenous and exogenous causes of death see R. Finlay, 'Distance to church and registration experience', *Local Population Studies*, **24** (1980) 26-40.
16. The rural-urban dichotomy in demographic experience is highlighted in many works. See for example N. Williams and C. Galley, 'Urban-rural differentials in infant mortality in infant mortality in Victorian England', *Population Studies*, **49** (1995), 401-20; and E. Garrett, A. Reid, K. Schürer and S. Szreter, *Changing family size in England and Wales: place, class and demography, 1891-1911* (Cambridge, 2001).
17. R. Davies and E. Garrett, '"More Irish than the Irish": nuptiality and fertility patterns on the Isle of Skye, Scotland 1881-1891', in L. Kennedy and R.J. Morris eds., *Order and disorder: Ireland and Scotland, 1600-2001* (Edinburgh, forthcoming).
18. Due to the constraints of the 1881 census data rates of infant mortality had to be assumed to be same for all age groups of mothers in this calculation. This is, of course, unlikely to have been the case.
19. Child-woman ratios are a less sophisticated measure than true Age-Specific Marital Fertility Rates (ASMFRs) which adjust the rates to allow for mother's age at childbirth, rather than her age at census, but the ratios amply describe the difference between Skye and Ipswich. Although it is assumed when calculating ASMFRs that women cease childbearing aged 50, the age group 50-54 is included here because women having surviving children in their late 40s will have still have children under age 5 living with them when they themselves are in their early 50s. For a discussion of the methods used to calculate such measures see W.H. Grabill and L.J. Cho, 'Method for the measurement of current fertility from population data on young children', *Demography*, **2** (1965), 50-73 or D. Mills and K. Schürer, eds, *Local communities in the Victorian census enumerators' books* (Oxford, 1996), 78-9. To be truly accurate adjustments should also be made for those children alive but not resident with their parents on census night. This has not been done here as the proportion of such children is thought to have been very low. It should also be noted that in a few cases where a father has re-married shortly after his wife has died leaving a young baby, the census information may cause the child to be erroneously counted as that of the second wife. For further discussion of these issues see Garrett *et al., Changing family size*, 234-41.
20. It is usually assumed that 'voluntary childlessness' was absent in historical populations of Europe and that sterility has a 'similar (age) profile in most populations': see R. Pressat and C. Wilson eds., 'Sterility' in *The dictionary of demography* (Oxford, 198l). However, also see M. Anderson, 'Highly restricted fertility: very small families in the British fertility decline', *Population Studies*, **52** (1998), 177-99.
21. Mortality inflation factors cannot be applied when the number of children observed is '0'. Work is underway to collect census and other data which will allow 'apparently childless' couples to be distinguished from the 'definitely childless', thus allowing the relative contributions of infertility and infant mortality to Ipswich's lower child-woman ratio's to be assessed.
22. M. Anderson, 'Fertility decline in Scotland, England and Wales, and Ireland: comparisons from the 1911 census of fertility', *Population Studies*, **52** (1998), 1-20 and Anderson 'Highly restricted fertility', indicate that such families were by no means unusual. Whether family limitation was being practised in Ipswich in the 1870s is the subject of future research. It must also be borne in mind that the 'census snapshot' may well show up more women unencumbered with children in an urban setting where in-migration rates are higher. In rural communities experiencing out-migration women raising families are more likely to remain, those without children having greater freedom to move away.
23. Given the data available, it would be possible to consider the impact on children opening the birth interval, but it was felt that interpretation would be too complex to consider here.

24. Neither would it be appropriate to consider the twin birth as one birth event and calculate the interval from the previous birth, given the high intrinsic mortality risk of being a twin.
25. V. Fildes, 'Infant feeding practices and infant mortality in England', *Continuity and Change*, **13** (1998) 251-80 discusses differences in breast-feeding practices in various populations at the turn of the century. No evidence has yet been uncovered concerning the length or duration of breast-feeding on Skye.
26. Where birth and deaths have been linked it is possible to calculate age at death, but only in days. Where a child has died within a day of birth its registered age at death has to be used.
27. M. Nissel, *People count: a history of the General Register Office* (London, 1987), 26, 32, 144. The extent of under-registration of births in England and Wales is discussed in M. Teitelbaum, 'Birth under-registration in the constituent counties of England and Wales, 1841-1910', *Population Studies*, **28** (1974), 329-343.
28. M. Flinn *et al., Scottish population history, from the seventeenth century to the 1930s* (Cambridge, 1977), 90.
29. M. Flinn *et al., Scottish population history*, 89.
30. The fact that the informant's description of the state of the child was in many cases being translated from Gaelic into English by the Registrar may have clouded the details still further.
31. The help of Yvonne Ravizza of the General Register Office, Scotland, who supplied details of the registration requirements for stillbirths in Scotland current in the 1880s, is gratefully acknowledged.
32. G. Mooney, 'Still-births and the measurement of urban infant mortality rates c.1890-1930', *Local Population Studies* **53**, (1994), 42-52; 43.
33. Under the initial Registration Act of 1837 births had to be registered within six weeks; failure to do so would result in substantial fine. When the law changed in 1874 to compel parents to register the births of their children, a fine was introduced for 'non-compliance within 21 days'. Woods, *Victorian England and Wales,* 34. It would appear from James' data that this latter deadline was not adhered to.
34. The data for Higham Ferrars were collected by Tricia James and provided on CD-Rom by members of *The decline of Infant Mortality in England and Wales 1871-1948: a medical conundrum* project based at the Open University, Milton Keynes, under the directorship of Michael Drake and Peter Razzell. A similar phenomenon was also found by the current authors in the vaccination registers of Sheffield, held at Sheffield City Archives.
35. Flinn *et al.*, *Scottish population history*, 521, fn.19.
36. The figures in Table 2 include both legitimate and illegitimate children, increasing the infant mortality rate. It is also possible, however, that the linkage process is to some degree selective as it will be easier to confirm a link to the census where there are more children surviving. Families with fewer surviving children may also be more mobile and leave observation before the next census.
37. All these causes are suggestive of premature or underweight babies. The diagnosis of 'pleurisy' may arise from the lung problems very often suffered by premature infants: thanks to Tricia James for this observation.
38. The census enumerators' books in Scotland report on the number of individuals 'habitually resident' in a community who were absent on census night, very often noting the reason for this absence. They also note the number of individuals who are visiting, and would not normally be counted among the resident population.
39. The 1874 Births and Deaths Registration Act also transferred the obligation to register births 'from the registrar to the parents, or occupier of the house or persons having charge of the child': Nissel, *People count,* 26.
40. R. Sauer 'Infanticide and abortion in nineteenth-century Britain', *Population Studies*, **32** (1978), 81-93.
41. Details of the disease, its symptoms, causes and treatment can be found at: www.ecureme.com/emyhealth/Peadiatrics/tetanus.asp. Rates in contemporary developing nations may be found in a report by UNICEF at: www.unicef.org/pon00/immu8.htlm. In the developed nations a vaccine for tetanus has been available since the 1920s. When given to pregnant women this offers protection to infants for their initial weeks of life. See C.M. Smucker, G.B. Simmons, S.

Bernstein and B.D. Misra 'Neo-natal mortality in South Asia: the special role of tetanus', *Population Studies*, **34** (1980), 321-35.

42. E.J. Clegg, 'Population changes in St. Kilda during the nineteenth and twentieth centuries', *Journal of Biosocial Science,* **9** (1977), 293-307, 305. E.J. Clegg and J.F. Cross, 'Aspects of neonatal death in St. Kilda, 1830-1930', *Journal of Biosocial Science* **26** (1994), 97-106, 98 explain that it was not until the island's minister became a man-midwife in the early 1890s that antiseptic techniques in childbirth were accepted by St Kilda's population.