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Doctors and the causes of neonatal death in Scotland in the second half of the nineteenth century

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Abstract

This paper examines causes of neonatal death in two contrasting Scottish communities in the second half of the nineteenth century. Individual death certificates allow comparison of the causes as recorded by different doctors and by lay informants. The paper finds that doctors almost always offer a medical-sounding cause of death, but that causes offered by individual doctors varied according to the nature of their practice, developments in medical terminology, and individual preference. Lay people were much more likely to offer no cause at all, or to suggest a non-medical term. Large percentages of deaths in the not-known category can therefore indicate poor medical provision, and are more likely to be found in remote rural areas and may be accompanied by an under-registration of very early neonatal infant deaths and their corresponding births, and by ‘disguise’ of certain causes of death. The paper examines the unusual age pattern of neonatal deaths on Skye and concludes that, although there is no mention of neonatal tetanus in the death registers, there is a substantial probability that the disease was present on the island. Comparisons of cause-of-death statistics between places and over time should therefore be made with extreme caution.

Introduction

Between 1881 and 1890, one fifth of the deaths occurring in Scotland were to infants under the age of one year, and one tenth were to infants under three months (GROS, 1890, 2-3). Scotland did not begin to publish deaths by younger units of age until 1911, but when, in 1905, the Registrar General for England and Wales began to publish such data consistently, one third of infant deaths occurred in the first month suggesting that in Scotland around one in every fifteen deaths would have been neonatal, that is involving an infant not more than four weeks old (GRO, 1905, cxix). Over the late nineteenth and early twentieth centuries, infant mortality was increasingly recognised as a largely avoidable problem, the solution for which would greatly enhance the overall health and prosperity of the nation (Newman, 1906, Lewis 1980, Dwork 1987), however deaths in the very earliest period of life were not considered to be as preventable as deaths in later infancy and childhood, and there was even a suggestion that it would be wrong to interfere with the natural order to try to save such ‘hardly viable’ infants (Armstrong, 1986, 219). Gradually more causes of infant death were recognised as being subject to intervention; by 1928 indirect control of ‘atrophy and debility’ was considered to be possible, but ‘premature birth’ was still regarded as

‘uncontrollable’ (McKinlay, 1928, 436). Thus the importance of the first month of life was slow to gain official recognition, indeed the Registrar General of England and Wales did not actually use the term ‘neonatal mortality’ until 1938 (Armstrong, 1986, 215). When infant mortality did start to fall, improvements were concentrated at later ages, and neonatal mortality had to wait until well into the twentieth century before any significant declines could be observed.

Historical comparisons of causes of death over both time and space are confounded by changing conceptions of disease, diagnostic nomenclature, recording practices and nosologies (Anderton and Hautaniemi Leonard, 2004; Alter and Carmichael, 1997, 1999; Lee, 1991, 61; Risse, 1997). During the nineteenth century changes in the disease environment altered the relative prevalence of diseases. At the same time awareness of the causal agents and mechanisms involved in the spread of particular diseases was growing, and this was reflected in changes in definitions and terminology used by those reporting deaths such that symptomatic causes (such as ‘consumption’) were superseded by more precise definitions (such as ‘pulmonary tuberculosis’), together with a move to greater precision in diagnosis (Anderton and Hautaniemi Leonard, 2004, 115). Increasing interaction between doctors and the families of deceased patients may have influenced the causes of death which were recorded on death certificates, sometimes obscuring the true causes (Hardy, 1994, 479), and a further layer of obfuscation could be created by the coding system which allocated doctors’ descriptions to published causal groups. A study in 1958, comparing cause of death category among neonatal deaths with the causes on the original death certificates attributed a high rate of inaccuracy to a combination of the coding system and particularly the quality of the statement made by the doctor on the death certificate (Fedrick and Butler, 1972, 105).

Cause of death among infants was particularly subject to uncertainty, with a much larger proportion of deaths relegated to the ‘undefined’ category than was true at other, older ages (Williams, 1996, 68). Deaths in the first month were predominantly attributed to causes associated with ‘immaturity’, defined as a combination of causes related to prematurity and congenital conditions, and including infants who did not seem strong enough to live (Woods, 2006, 37): the definitions of such causes were vague and their diagnoses difficult. It was recognised that the majority of deaths in the first 28 days, or 4 weeks, of life had an ‘ante-natal’ origin, but in an era when post-mortem examination of new-borns was very rare, relatively little was known about the precise causes of death and therefore the information recorded on death certificates was predominantly symptomatic. Armstrong (1986, 222) suggests that the non-pathological nature of the terms used to describe infant death in the nineteenth century reflected more on the status of the child than on medical ignorance or uncertainty. The view of infants as biological rather than medical or social objects meant that their deaths were seen as natural processes, about which little could, or even should, be done. The trajectory of the terminology used to describe causes of death as the century advanced, from ‘atrophy’ and ‘debility’, through ‘prematurity’, to ‘asphyxia’ and ‘atelectasis’, may thus be seen to reflect an increasing focus by doctors on infants as *patients*.

This paper considers the causes of death as recorded on death certificates in Scotland during the late nineteenth century by doctors and other informants, and reflects on the influences of medical provision, medical knowledge and fashion, and disease profiles in creating differences between places and over time in the recording of neonatal mortality. It allows comment on the diffusion of medical ideas across space and time from a 'bottom-up' perspective of 'local physicians insinuate[ing] their knowledge in humdrum settings' (Alter and Carmichael, 1999, 130) as well as insight into the causes of mortality in the first few weeks of life.

The data

Unlike Scandinavian and some other European countries, the British Isles are not lucky enough to have a system of continuous registration which follows individuals throughout their lives. Instead the constituent countries which make up the British Isles have held decennial, cross-sectional censuses since the early nineteenth century and have had three parallel civil registration systems for recording births, deaths and marriages as isolated events since 1837 in England and Wales, 1855 in Scotland and 1864 in Ireland. These sources are useful on their own, but can be made to yield even richer data by linking individuals and families from one source to the others, and this paper uses a detailed longitudinal database constructed in this way.¹ The paper concentrates primarily on deaths, and the information on the death certificates is enriched by linkage, allowing such details as a precise of age at death to be calculated.²

In Scotland each certificate of death included the name, qualifications and address of the doctor who certified the death, and these have been linked to other sources to provide information such as the doctor's age, graduation cohort and place of training which allow assessment of the roles of improving medical knowledge and fashion. Doctors have been identified using the London and Provincial Medical Directory, which covers the whole of the British Isles, including Scotland, and which provides self reported information about doctors on an annual basis, including name and address, qualifications with dates and places, official positions held (such as 'medical officer of health', 'poor law medical officer', 'surgeon to hospital', 'police surgeon' or 'surgeon for assurance company'), and any publications the doctor may have produced.³ The medical 'qualification cohort' of the doctor can be ascertained from the date of his earliest medical qualification, and his interests and specialities can be discerned from his positions and publications.

The databases cover the Isle of Skye, on Scotland's north-west coast, and the town of Kilmarnock, situated in the country's central Lowlands. One of the Inner Hebrides, Skye is a large island of just under 430,000 acres covering seven parishes, and with a population which declined over the second half of the nineteenth century from around 20,000 in 1861 to approximately 14,000 in 1901. Mainly dependent on crofting, a form of near-subsistence farming based on 'crofts' or small-holdings, and fishing, the population was thinly spread,

¹See also Reid et al 2006a, Reid et al 2006b, Garrett 2006.

²The civil registers of death in Scotland for 1855 were extraordinarily rich in detail (Sinclair, 2000, 40), but the amount of information requested was considerably reduced from 1856.

³See also Crowther and Dupree, 1996, for information about the activities of general practitioners.

mainly around the edges of this mountainous island, with poor and time-consuming transport links. A sense of the hardships of a crofter's life can be gleaned from Cameron (1986) who quotes one Skye resident's account of his accommodation in the 1880s:

'As our crofts do not produce enough straw for fodder for the cattle as well as for the thatch... our houses in rainy weather are most deplorable. Above our beds comes pattering down the rain... and so the inmates of the beds have to look for shelter on the lee side of the house. Of the twenty houses (in my village) there are only two in which the cattle are not under the same roof as the family' (Cameron, 1986, 14).

The small size of the crofts, the small scale of the fishing industry and the lack of alternative employment even on 'public works' (state sponsored employment schemes), meant that many of the inhabitants of Skye had little option but to leave the island in summer to try to find work (Cameron, 1986, 18).

In contrast, Kilmarnock was a thriving town, serviced by train and tram links, which lay within easy reach of Glasgow. Its population growth was aided by in-migrants who came to work in the flourishing textile concerns (including carpet and bonnet making) and railway and engineering works. The records for study were drawn from the Registration District formed by the Parish of Kilmarnock, which covered not only the town, but also the surrounding rural, 'landward' districts of the town's hinterland, containing both agricultural land and coal mines. In total, however, the Registration District covered barely 9,500 acres, and the population, which grew from about 20,000 to 30,000 people between 1861 and 1901 was concentrated in the town itself.⁴ Death rates have been calculated using the roughly 17,700 births for Skye and 38,000 births for Kilmarnock, and neonatal deaths are taken as those dying under one month of age, where age is calculated using the interval between the date of birth and the date of death, and 'one month' is taken to be four weeks or twenty eight days.⁵

The medical certification of death in Scotland

When considering mortality in the context of nineteenth century Scotland, it is useful to bear in mind that over the period three Registrars General oversaw civil registration in Britain, there being separate systems for England and Wales, Ireland and Scotland. Researchers comparing cause of death statistics across the British Isles should therefore be wary of taking the available data at face value. Putting Irish statistics to one side, by the late nineteenth century it was a legal requirement in both Scotland and England and Wales that all deaths be notified to the local registrar, together with a certificate of cause of death furnished by the medical man who attended the deceased during his or her last illness (Select Committee on Death Certification, 1893, iii). However, if no such medical man was available, the registrar was instructed to fill up the cause with information provided by

⁴The release of individual level census data for 1911 to the research community via the ICeM project is eagerly awaited as the data collected in the course of this census, including fertility and length of marriage, should enable a more finely nuanced understanding of the relative living conditions of rural Skye and urban Kilmarnock than is possible to glean even from the parish level data provided in the published census reports for Scotland.

⁵The interval between date of birth and date of death is a more accurate measure of age than taking the age of death reported on the death certificate, as there is considerable evidence of heaping of age at death on one, two and three weeks.

surviving friends, or if the death was violent or suspicious by the Coroner if in England and Wales or the Procurator Fiscal if in Scotland.

The implications of variations in the procedures for registering deaths and their causes for our understanding of mortality can be illustrated by considering important differences in death registration between England and Wales and Scotland. In England and Wales the medical practitioner was required to hand a death certificate to a relative of the deceased or other informant who would then take the certificate to the local registrar when they registered the death. Doctors were reliant on the good will and trust of their patients to maintain their practice, and therefore there was an incentive not to certify causes of death which might reflect badly on themselves or their patients. In Scotland, however, the procedure was different. A relative (or other informant) had to register the death, but an attending doctor was supposed to independently send a cause of death certificate directly to the registrar, although Davis (2007, 2) suggests that it was also often handed to the relative who would then deliver it to the registrar. If the doctor failed to submit a certificate within a certain time, the registrar was entitled to chase him up with the threat of fines, but in practice it appears that penalties were rarely exacted (Crowther, 2006, 4). In Scotland, therefore, the relatives of the deceased did not necessarily see the death certificates and there was less reason for doctors to have prevaricated as to the cause of death. In small communities, however, where the registrar might have known many or all of the inhabitants, it is plausible that doctors and families of deceased persons may have colluded to disguise an unpalatable cause of death. While this might have been more a cause for concern amongst older patients, families may have preferred that it were not broadcast that their infants had perished from particular causes, congenital syphilis for example. Although there was a legal requirement to obtain a medical certification of death where a doctor had been in attendance on the deceased, in practice doctors were not always available. Firstly they may not have been called; secondly, they may have already been committed to attendance on another patient; thirdly they may have been unable to make what might have been a long or difficult journey in time; or fourth, they may have chosen not to set out in the first place. Dr. Grant, writing at the very end of the nineteenth century pointed out that:

‘the large districts which medical men had to cover (in remote parts of rural Scotland), and the small remuneration which they received, were very real problems. The great bulk of the people, while not paupers, were so poor that they could not pay for medical attendance, and a medical man could not be expected to undertake long, arduous and even dangerous journeys, in the certain knowledge that he would not be paid.’ (quoted in Ferguson, 1958, 448)

In any case where a doctor did not attend a dying patient the cause of death recorded would have been suggested by the informant, usually a relative of the deceased. Such cases are generally flagged on individual death certificates as ‘not medically certified’ or ‘no medical attendant’.

The Select Committee on Death Certification (hereafter SCDC) was appointed to ‘inquire into the sufficiency of the existing Law as to the Disposal of the Dead, for securing an accurate record of the Causes of Death in all cases, and especially for detecting them where death may have been due to poison, violence, or criminal neglect’ (SCDC, 1893, ii). The

Select Committee met on 21 occasions in 1893, heard evidence from 32 witnesses across the British Isles and published its conclusions and recommendations in the form of a second report, with the addition of the proceedings of the committee, minutes of evidence, and appendices (SCDC, 1893).⁶

The SCDC drew attention to the varying levels of medical certification of death in different places. All lines but the last line on Table 1 have been derived from data presented in tables in the appendices to the SCDC's reports, revealing large differences by place in the percentages of deaths with the cause not certified by a doctor in the 1880s.⁷ Just over three per cent of deaths in England and Wales were not medically certified, but this disguises a fair amount of variation between places, with London and even the worst-performing town, Halifax, having a higher proportion of deaths medically certified than rural north Wales. Although almost all deaths in London were medically certified, in Scotland not all cities and towns fared so well, and the general level of non-certification was higher at 5.8 per cent in 1890 (SCDC, 1893, vii). Crowther (2006, 4) suggests that rural areas and the outlying areas of growing towns, where administration did not keep up with population, had above average levels of non-certification. Against this backdrop, our sample town of Kilmarnock does very well, having the lowest percentage of non-certified deaths in the list of major Scottish towns and cities; nearly as low as that of London. The situation was very different on the Isle of Skye, where fewer than half of deaths occurring in the 1880s were medically certified. As a whole Inverness-shire, the county in which Skye lay, was no better with only 42 per cent of deaths certified in 1890 (SCDC, 1893, vii). The SCDC did not mull for long over what forces might contribute to these differences in certification, but the implication was made that it was a matter of administration and efficiency: 'the maximum figure [of uncertified deaths] must be taken as indicating the state of things which may occur under the existing system, while the minimum shows what can be achieved by judicious administration combined with the intelligent co-operation of the different authorities and officials concerned' (SCDC, 1893, vii).

Some aspects of the high level of non-certification in Scotland, such as the rate in Edinburgh, may be due to the practice of accepting certifications by fourth (final) year medical students, who were more knowledgeable than the lay population, but whose presence during a patient's last illness was recorded as 'no qualified medical attendant' (SCDC, 1893, 141, 155).⁸ In Glasgow non-certification was found to be highest in districts which also had the highest mortality, and this was attributed to the poverty of the areas, and to 'the moral deterioration that attends want of health and prevalence of disease; people get careless and callous, and death seems of little importance to them' (SCDC, 1893, 173). This correlation between non-certification and poverty was particularly strong for infant deaths: of those districts in Glasgow where the infant mortality rate was 108 per thousand, only six per cent of the infant deaths were uncertified, but where it was 230 per thousand, 37 per cent were uncertified (SCDC, 1893, 173-174). The committee received evidence that non-

⁶The publication refers to both the first and second reports of the SCDC, but the first report is restricted to an agreement to report conclusions to the House of Commons (SCDC, 1893, iii).

⁷Figures in Appendix 5 of the SCDC's report showed that during 1890-92 in Dublin, Ireland 10.3 per cent of deaths were not medically certified. This figure was not included in Table 1 as it fell outside the 1880s (SCDC, 1893, 263).

⁸A nineteenth-century medical degree was generally four years long (Bradley et al, 1996, 6).

certification was concentrated into the youngest and oldest age-groups, and particularly among those under one month and over 95 years: in Glasgow between 1886 and 1890, 24 per cent of those dying under one month were uncertified, 7.5 per cent of those dying between one month and a year, and 28 per cent of those over 95 years (SCDC, 1893, 174). The Select Committee also worried that uncertified newborns might have been too easily passed off as stillborn infants.⁹

The Select Committee's summary and recommendations were relatively silent about the high level of non-certification in the Highlands, besides lamenting the rate for Inverness-shire. Closer inspection, however, shows that they pressed one of their witnesses, Mr Murray, who was both an MP and former Solicitor General for Scotland, hard on the question of the high rate of non-certification in Inverness-shire. Mr Murray maintained that it was simply a question of medical attendance: doctors were few and far between in a place such as Skye, and implied that this problem would not improve until medical provision improved, as it was illegal for a doctor to sign the death certificate if he had only seen the deceased after death (SCDC, 1893, 241-2). 'The real difficulty,' as Ferguson (1958, 447) notes, 'was not so much that the total number of doctors in (Scotland) was inadequate as that such doctors as were in practice were very unevenly distributed.' Powell (2005) has shown there were still significant geographical variations in medical provision in England and Wales in the 1930s, with doctors more likely to settle in wealthy towns and seaside resorts, and to have eschewed practices in the north, in poorer places and in mining areas. Although Powell found that rural areas in England did not necessarily have fewer doctors per capita than urban areas, it is worth remembering that the logistics of travel and transport mean that the same number of doctors per capita would have translated into significantly worse provision in a sparsely populated rural area. Loudon (2001, 204-205) comments that the effect of terrain and road quality on doctors' transport options restricted the working capacity of the medical service in the Highlands and Islands well into the early twentieth century.

Crowther (2006, 3-4) and Davis (2007) report that in neither England and Wales nor Scotland was the certifying doctor required to have attended the deathbed or even to have viewed the body, but Mr Murray, in his evidence to the Select Committee on death certification (SCDC, 1893, 241-2) clearly believed that a doctor medically certifying a death had to have seen the deceased in their final illness, and that it was illegal to sign a death certificate otherwise, and had prosecuted doctors for so doing. The SCDC (1893, lii) recommended that every death be medically certified, after attendance or personal inspection by a medical practitioner, or verification by two other people, and that a medical practitioner should be appointed as public medical certifier of the cause of death in cases in which a medical practitioner was not forthcoming. However these recommendations were not popular among doctors and the first attempts to include them in legislation did not

⁹Stillborns were not registered as either births or deaths until 1927 in England and Wales and 1939 in Scotland. However in England and Wales a certificate of stillbirth was required before the body could be buried under the 1874 Births and Deaths Registration Act (37 & 38 Victoria, c.88) (Woods, 2009, 69-70), while in Scotland an 'order of burial' had to be issued by the registrar before burial could take place. [Thank you to Yvonne Ravizza of the GROS, for details of the registration requirements for stillbirths in Scotland.] The issue was whether, in the absence of a medical man at the birth, any 'qualified' person present at the birth could inform the registrar of whether a child was born alive - a mother was deemed so qualified.

emerge until after the turn of the century.¹⁰ Thus the status quo remained and significant improvements in levels of certification on Skye may have been an unrealistic goal until medical provision improved.

The proportion of deaths where the cause of death was medically certified improved over the 1880s in both Scotland and England and Wales, and the doctors providing evidence for the SCDC believed that the Friendly Societies Act of 1882 was at least partly responsible for this, as under that Act claims against life insurance needed a death certificate before payment would be rendered, and it was suggested that the culture of obtaining a certificate was also taken up by people without insurance policies (SCDC, 1893, 185).

Figure 1 shows the percentages of deaths certified by a doctor for each year in Skye and Kilmarnock across the study period, with the gradual increases demonstrating the improving levels of certification common in most parts of Scotland over this period. Nearly 90 per cent of all deaths were already medically certified in the accessible lowland town of Kilmarnock in 1861, rising to virtually all by the end of the century. The situation was very different on the Isle of Skye, where fewer than 20 per cent of deaths were medically certified in the 1860s. Although this increased in the ensuing forty years, in 1901 it still did not exceed 60 per cent.

The discussion above suggests that the candidates for explaining low levels of certification on Skye were poverty, medical provision (in terms of the scarcity of doctors, the cost of their services and the distances involved in both seeking and providing medical help), or poor administration. Little is known about the precise administration of the registration machinery on Skye, but registrars (of which Skye had eight in 1861, one for each of the seven parishes and an additional one for the island of Raasay, part of the parish of Portree) usually held other jobs and might not have felt their energy was best devoted to encouraging better certification of death: where a doctor had not visited the deceased in their final illness there was no point in pursuing a certificate. The patterns of medical certification in neither Skye nor Kilmarnock suggest that the Friendly Society Act of 1883 played much of role in improving certification in these places, as levels stagnated in the immediate aftermath of the Act. It is plausible that the population of Skye was too poor to have taken out insurance or routinely seek medical attention, even for those at high risk of death. The crofters and their neighbours were certainly very poor, and improving certification over the period is unlikely to have been due to rising incomes, as the agricultural depression of the last quarter of the nineteenth century is more likely to have reduced than increased incomes.

The availability of medical provision, however, is likely to have played a role in the differences in levels of certification. In 1861 and 1871 Kilmarnock had around four doctors per 10,000 inhabitants, but Skye had only two per 10,000. Deficiencies in medical provision can produce spatial differences in certification at the local level and this can be seen to be the case in both the study districts. Figure 2 shows five year moving averages of the percentages of deaths which were medically certified in the Skye parish of Kilmuir, together with the same percentages for the whole of the island for comparison. Kilmuir is arguably

¹⁰See British Medical Journal (1900) for examples of the recommendations unpopularity among doctors.

the most remote of all Skye's parishes, located at the top of the Trotternish peninsula (in the North-East of Skye), whose central part is mountainous and virtually impassable, so that virtually all the settlements are located around the coast. Medical directories show that the parish had no resident doctor until 1877, suggesting very strongly that the almost complete lack of medical certification of deaths prior to that date is linked to the absence of a doctor available to attend a patient in their final illness. By the 1890s both Skye and Kilmarnock had about five doctors per 10,000 people, but there were still enormous discrepancies in medical certification of death. Terrain, the logistics of travel, and the poverty of the population are likely to have meant that each doctor will have been able to effectively serve a smaller number of people on Skye, and it has been suggested that it was not until the Highlands and Islands Medical Service was established in 1913 that medical provision improved enough to make a big difference in these remote areas (Davis, 2007, 2).

Even including its rural, 'landward' districts, Kilmarnock covered a much smaller area and doctors were more easily accessible, but there were still geographical differences in levels of medical certification. Whereas 96.5 per cent of deaths in Kilmarnock as a whole were medically certified, the figure was lower, at 94.7 per cent of deaths in the landward area (excluding the village of Crookedholm where there was a resident doctor). It is possible to detect the probable impact of poverty here too, with levels of medical certification in the densely populated areas in the middle of the town where the poorest sections of the population lived also relatively low for Kilmarnock at 94 per cent.

As found by the Select Committee on death certification, the likelihood of a death being medically certified differed according to age, with particular deficiencies in certification occurring among the very young and very old. This paper concentrates on the very young, and Figure 1 also shows that although, compared to deaths at older ages, a higher percentage of infant deaths in both study areas were not medically certified, the discrepancy was particularly large in Skye, where over 90 per cent of infant deaths went uncertified in the 1860s, and nearly three-quarters were uncertified in the 1890s. Among these, deaths in the first month were particularly unlikely to have been medically certified: 94 per cent in the 1860s failing to be certified by a doctor and 86 per cent in the 1890s. In Kilmarnock, in contrast, 13 per cent of infant deaths were uncertified in the 1860s falling to 2 per cent in the 1890s, and among neonatal deaths 18 per cent were uncertified in the 1860s, falling to 6 per cent in the 1890s. It has been suggested that the low levels of certification for infant deaths reflect views about the inevitability of infant death and low value of infant life (Armstrong, 1986), but they could also be a function of low medical attendance during childbirth. Although not much is known about how often, or under what circumstances, childbirth was overseen by a medical practitioner in either Kilmarnock or Skye, the records show that only about half the deaths of women who died of causes associated with childbirth on Skye were medically certified. Given that a doctor was most often called in cases of complicated childbirth where the mother's life seemed in danger, the figure probably overestimates the proportion of births attended by a doctor.¹¹ It is likely that most women on Skye were delivered by a midwife or relative, and that for many a doctor was not summoned or available even when complications occurred.¹² Therefore if a baby failed to thrive, suffered a birth injury, an acute illness or a life threatening condition, there may have been simply not enough time to summon a doctor before the child expired. The death certificates also

give the length of the last illness, and in three-fifths of those first day deaths where this information is shown, the duration of the last illness was one hour or less. In contrast those dying in the later neonatal period generally suffered an illness of several days duration, and deaths among older infants, children and adults were also frequently preceded by longer durations of illness, so the relatively sudden nature of very early neonatal deaths in the absence of a doctor at childbirth might explain low levels of certification of early infant deaths on Skye.

Medical certification and causes of neonatal deaths

Contemporary observers assumed that deaths certified by doctors were more likely to have accurate causes attributed, but in the absence of a medical man during the deceased's last illness relatives were also at liberty to suggest a cause, which could then be recorded by the registrar. The balance of recorded causes of neonatal mortality is therefore likely to reflect levels of medical certification, particularly if the causes put forward by relatives differed from those reported by doctors. However doctors themselves may also have varied in the terms they used to describe the cause of death, which may in turn have been influenced by their training and graduation cohort, and how well they had known the patient before death. Kunitz (1999, 233) shows that even well-known conditions with recognizable symptoms were likely to have been misdiagnosed in the nineteenth century if the patient had not been observed by the doctor over a period of time, and doctors in nineteenth-century Bavaria lamented that they 'had to rely upon people's gossip in order to find the cause of the illness in the case of death at hand' (Stolberg, 1999, 221). The following discussion will compare the causes of neonatal death recorded on Skye and Kilmarnock, examine the causes reported by both doctors and lay informants, and comment on the role of medical provision in increasing the difficulty of comparison between the two places, but first it is useful to compare rates of infant mortality in our two communities.

As explained above, deaths under 3 months were not broken down into younger age groups in the Registrars' General reports until the early twentieth century. However, as Galley and Woods (1999, 38) report, William Ogle did draw up detailed tables of cause of and age at

¹¹The measurement of maternal mortality is fraught with difficulty, as it has to incorporate not only deaths as a direct consequence of childbirth but also those to which childbirth may have contributed, hastening a death from tuberculosis, for example. The latter are often referred to as 'indirect' or 'associated' maternal deaths. In the late nineteenth century official statistics in England and Wales did not include such 'associated' deaths when tabulating maternal mortality, but in Scotland they were counted, making international comparison problematic. 'Hidden' maternal deaths also took place where a woman died during, or shortly after, childbirth, but the cause recorded did not reflect this. For example 'peritonitis' in a woman of childbearing age is very often the result of complications of labour or puerperal infection. The comparison of maternal mortality on Skye and in Kilmarnock is the subject of a paper currently under preparation for publication. In essence it concludes, amongst other points, that if the causes of death on death certificates are taken at 'face value' then maternal mortality 1861-1901 on Skye looked, at approximately 75 maternal deaths per 10,000 births, appreciably higher than that in Kilmarnock at the same time, when around 48 women died per 10,000 births. However, when the data were examined more rigorously, and both hidden and associated deaths were accounted for, the Skye rate was found to be 110 maternal deaths per 10,000 births, while in Kilmarnock it was 118 per 10,000 births, the larger increase in Kilmarnock being mainly attributable to higher background mortality and associated maternal deaths. Given the relatively small numbers involved it would appear that women in both communities ran a very similar risk of death in childbirth.

¹²Practices surrounding childbirth in nineteenth-century Scotland, particularly the more remote regions, are not well documented as 'few communities enjoyed the services of a trained nurse or midwife' (Steel, 1994, 153) and the local 'knee-woman' would be left to her own devices. Only 49 out of 38,430 births registered in Kilmarnock between 1861 and 1901 were recorded as having taken place in hospital, maternity hospital or poorhouse, but more were almost certainly delivered by general practitioners in the patient's own home. Several of the doctors practicing in Kilmarnock at this time published papers on obstetrical topics, including a treatise on the dangers of untrained midwives.

death for three high-mortality towns and three low-mortality rural districts in England for the years 1889-91.¹³ Ogle's figures suggest that his urban areas, where the overall infant mortality rate was just under 220 deaths under 1 year per 1,000 live births, had a neonatal death rate of just under 50 deaths in the first month (which he took as the first 30 days) per 1,000 live births. His 'healthy' rural areas had a combined infant mortality rate of just over 97 deaths per 1,000 live births and a neonatal rate of just under 35 deaths per 1,000 live births (Galley and Woods, 1999, Table 1, 40-1; Woods and Shelton, 1997, Table 5, 54). In the 1860s neonatal mortality rates in Kilmarnock, as calculated direct from the civil registers ran at 43 per 1,000 live births.¹⁴ This rate fell slightly to 41 per 1,000 live births in the 1870s, 40 per 1,000 in the 1880s and 41 per 1,000 in the 1890s; figures which are in line with Ogle's urban figures, given that his three towns were chosen to represent conditions particularly pernicious to infant health. Much more surprising are the figures for Skye. The neonatal mortality rate for the island in the 1860s was 52 deaths amongst infants aged less than 28 days per 1,000 live births, and actually rose to 59 such deaths in the 1870s and 1880s before falling to 49 deaths per 1,000 live births in the 1890s. This isolated rural environment appeared to be even more dangerous for newborn infants than Ogle's most unhealthy towns. This finding was particularly unexpected as Skye's decadal Infant Mortality Rates over the four decades between 1860 and 1900 lay between 90 and 110 deaths per 1,000 births, yet those in Kilmarnock lay between 130 and 149 deaths per 1,000 births.

Trying to identify the cause, or causes, of Skye's unexpectedly high neonatal mortality rates in the later nineteenth century, we turned to the information available from the death certificates generated by the two communities. Comparisons between countries such as England and Wales and Scotland using published data are often compromised by the different nosologies used to classify causes of death (Davis, 2007). Comparisons over time are also hampered by changing nosologies (Woods and Shelton, 1997, 23) but such issues were not a concern for the present study because the data used were drawn from original registration certificates, allowing us to bypass the conventions imposed on the causes by the registrars and the Registrar General and see precisely the descriptions and assignments used by the doctors themselves, including those descriptions which might not have appeared at all in published tables having been grouped with other causes. Here a broad cause of death classification has been used, developed with reference to contemporary classifications but with additional categories to draw out the mix of ascribed causes visible in the registers of each of the two study communities. The main causal groupings of neonatal death are used; 'prematurity', 'congenital debility', 'congenital malformations', 'convulsions', 'bronchitis and pneumonia', and 'gastritis and diarrhoea' as well as other individual causes which appear to figure highly in our study communities.

Figure 3 shows the percentages of neonatal deaths attributed to different causes in Kilmarnock in the 40 year period between 1861 and 1901. There was an average of 40

¹³Ogle was Statistical Superintendent at the General Register Office for England and Wales. His study was published in the Registrar General's annual report for 1891 (See Galley and Woods, 1999, 28).

¹⁴The decadal neonatal figures for Kilmarnock and Skye were calculated using deaths under 4 weeks (that is under 28 days) rather than under a month (under 30 days), as used by Ogle. See Garrett 2006, 141.

neonatal deaths in Kilmarnock per year, and five point moving averages are shown to smooth out the worst fluctuations due to small numbers. There are few consistent trends discernable in causes of neonatal death, except for a decline in the percentage of very young deaths attributed to 'debility', which would be expected given a change in terminology from 'debility' to 'prematurity'. Even though 10 to 20 per cent of these deaths did not fit into one of the six main groups, almost all deaths were ascribed a cause of some sort; there were very few deaths where the cause of death is given as 'unknown'.

The picture is very different on Skye: the cause of well over half of all neonatal deaths was said to be 'unknown' – virtually unheard of in Kilmarnock, and the percentage of deaths ascribed to an unknown cause does not appear to decrease with increasing medical certification towards the end of the century. If anything, the popularity of 'debility' as a cause increased over time, while that of 'prematurity' fluctuated. Pleurisy, a relatively prominent cause of neonatal death in the 1860s had declined markedly by the mid 1890s. An average of only 25 neonatal deaths per year were reported on Skye in the study period, so random fluctuations may play a larger part in the patterns seen here than in Kilmarnock. Even among those deaths assigned a cause, the balance of causes and particular terms was very different on Skye from that in Kilmarnock: the term 'weakness' was much more likely to have been used than 'debility' on Skye (here the two are both grouped under 'debility'), and almost no neonates appear to have died from causes which could be grouped under 'bronchitis and pneumonia' or 'gastritis and diarrhoea'¹⁵. Instead very small infants on Skye were reported to have died from 'pleurisy' and 'croup': causes which did not figure in Kilmarnock. To what extent do these differences truly reflect underlying causes of death, or do they simply document different ways of describing deaths? If the latter, to what extent are differences in recording a function of the high proportion of certificates where the cause of death was reported by a lay informant? We can start to answer these questions by using the certificates of deaths registered on Skye to compare the causes of death assigned by doctors with those provided by lay informants.

Figure 1, above, showed that infant deaths were particularly likely to have gone uncertified by a doctor. Amongst infant deaths, non-medical certification was further concentrated among the very youngest: those dying in the first month of life. On Skye more than half (59 per cent) of the non-medically-certified deaths in the first year of life occurred amongst neonates. In contrast only 35 per cent of infant deaths certified by doctors occurred in the neonatal period.

Figure 5 shows the distribution of causes of neonatal deaths on Skye for those certified by doctors and for those not medically certified, with the same distributions for all neonatal deaths in Kilmarnock and for those in Scotland as a whole. The figures for Scotland are for 1911, the first year in which neonatal deaths were reported in the Registrar-General's reports, and differences could be due to urban-rural differences in the causes of death, to declines in certain causes of death over time or to changes in definitions used. Infant

¹⁵It is of interest that most of the population of Skye were Gaelic speakers. In Gaelic the word 'laigse' can be translated as either 'weakness' or 'debility' (Watson, 2005). The issue may therefore not be the word used to report the cause of death by a Gaelic-speaking informant, but the word chosen by the registrar when translating the term into English for inclusion on the death certificate.

mortality as a whole began to fall from around the turn in the century throughout Britain, but this was restricted to exogenous causes, and diarrhoea in particular (Woods et al, 1988, 351). Although exogenous causes had most effect *after* the first month, they also affected some younger infants, and the lower percentage of diarrhoeal deaths in Scotland in 1911 compared to Kilmarnock between 1861 and 1901 may be at least partly a product of improving diarrheal mortality.¹⁶ However urban areas typically had higher mortality from this group of causes, and the higher rate in Kilmarnock could also reflect the urban conditions in which the majority of its population lived. Convulsions also figured more prominently in Kilmarnock than in Scotland as a whole. Convulsions could indicate problems of the nervous system, or a child with a very high temperature, but they could also occur if an infant was dehydrated from diarrhoea so deaths from convulsions and diarrhoea may be linked. However for convulsions there is also a possibility that the lower percentage for Scotland as a whole at the later date reflects a move away from the use of signs and symptoms as causes of death to more precise pathological definitions.

Nevertheless Kilmarnock, where the majority of neonatal deaths were medically certified, appears to reflect the general Scottish experience fairly well, but it is clear that the distribution of causes of death reported by doctors on Skye was rather different, in particular with a smaller than expected percentage of deaths from 'prematurity'. At face value this might indicate that mortality from causes related to 'immaturity' (covering both 'prematurity' and 'debility'), which would probably be concentrated in the very first days after birth, was lower on Skye than in Kilmarnock. However this is perhaps unlikely, as although rural infant mortality was generally lower than urban, urban-rural differences were much smaller for the very youngest ages, and mortality was frequently higher in rural areas on the first day of life (Newman, 1906). Thus a higher percentage of neonatal deaths due to 'immaturity' would be expected on Skye.

A more plausible explanation is an under-registration of very early infant deaths and their corresponding births on Skye. Where women were not routinely attended by a doctor during the birth, as suggested above, there would be no doctor to attest to the cause of death of an infant dying very soon after, and a much higher level of uncertified first day deaths would be expected, compared to later neonatal deaths. Table 2 shows that this pattern is discernable in Kilmarnock, where lower percentages of first day and first week deaths were medically certified. On Skye, however, where it appears doctors were less likely to have either attended births or been called to a weak infant, first day deaths in fact appear more likely to have been medically certified than those in the following two or three weeks. This could be a real pattern, or it could be produced by a deficit in non-certified deaths due to under-registration, with some parents who did not bother to register either the birth or death of an infant who died very soon after death, treating it instead as a stillbirth for which registration was not necessary but burial was still possible. The plausibility of this scenario is further bolstered by the fact that only 30 per cent of maternal deaths on Skye were associated with a live birth, compared to 75 per cent of those in Kilmarnock, and similar figures elsewhere.¹⁷

¹⁶1911 was a hot year, with a peak in diarrhoea deaths in England and Wales, but this does not appear to have been so severe in Scotland, where the distribution of causes of neonatal deaths for 1911 is typical of those in the 1911-1919 period (Annual Reports of the Registrar General for Scotland).

Even where a mother's death was registered, therefore, the infant's may have been treated as a stillbirth and gone not only un-medically-certified but also un-registered. The disguising of early neonatal deaths as stillbirths was a concern to the SCDC and was associated with poverty and a desire to avoid the higher burial costs of live-born infants (Davis, 2009, 633), but on Skye there is also the possibility that distance to the registrar was a disincentive to registration and infants may have been buried privately or illegally. A doctor present at the birth of a child who died very young, however, will have written a death certificate stating or implying the child was live-born, which provided an incentive for parents to register both the birth and death. Therefore the majority of missing (unregistered) early neonatal deaths will have been among those who, had they been registered, would have been not medically certified. This increases the ratio of medically certified to not medically certified deaths on the first day or days, creating a possibly spurious impression that first day deaths were more likely to have been registered by a doctor.¹⁸ A deficit in first day deaths will have reduced the percentages of infants dying from causes associated with 'immaturity' among non-certified deaths, and the lack of medical attention at birth will have reduced the numbers of early neonatal deaths able to be certified by doctors and thus causes due to 'prematurity' among doctors. If the age profile of deaths certified by doctors was more representative of neonatal deaths on Skye, it is plausible that the profile of causes would look more like those certified by doctors in Kilmarnock and Scotland as a whole, with the exception of a smaller percentage of deaths due to 'congenital malformations' and 'gastritis and diarrhoea'. It is unclear why 'congenital malformations' would either show urban-rural differences or be underreported, but it is possible that diarrhoea was less common on the island, as it was a predominantly urban affliction at this time, affected by poor sanitation and high population density.

Returning to Figure 5, it is clear that lay informants on Skye offered a very different balance of causes of neonatal death from that reported by doctors. As in Kilmarnock, medical men were reluctant to confess ignorance of a cause of neonatal death, and would almost always suggest a cause, even if quite vague, but either lay people had no such qualms or registrars were less likely to record a cause offered by a lay informant. Fully two-thirds of not-medically-certified neonatal deaths were not given a cause or were recorded as of 'unknown cause'. When lay men or women did offer a cause, however, they offered a different range of causes to those reported by doctors.¹⁹ The final bar on Figure 5 (Skye not certified 2) represents all neonatal deaths where a specific cause of death was reported by a lay person, so none of the deaths of 'unknown cause' are included. The subdivisions show the percentages of 'known' causes assigned to major causal groups. Lay informants were much less likely than doctors to attribute a death to 'prematurity', and the under-registration of very early infant deaths is likely to at least partially explain this (as above), but where they

¹⁷70 per cent of maternal deaths were associated with a live birth in New York State, 1936-1938 (calculated from Loudon, 1992, 484, Table 28.1).

¹⁸If we were to assume that all first day deaths delivered by doctors were medically certified, and inflate the number of non-certified first day deaths so that about nine percent of all first day deaths were certified (perhaps a conservative increase), we can calculate a plausible number of missing first day deaths. Adding these back in raises the first day mortality rate for Skye from 6 to 9 per thousand (an increase of nearly 60 per cent), the neonatal mortality rate from 54 to 58 (an increase of 6 per cent), and the infant mortality rate from 101 to 104 (an increase of 3 per cent).

¹⁹See also Duffin, 1997 and Leidinger et al, 1997, for comparative examples of major differences in the causes of death offered by doctors and lay informants.

did offer a cause which could be classed in the 'debility' group it was almost always 'weakly from birth', rather than the more medical-sounding 'debility' usually offered by doctors. Unqualified informants also resorted to two causes almost never used by doctors: 'croup' and 'pleurisy'. In contrast, 'bronchitis' and 'pneumonia' were offered predominantly by doctors. In this era, croup was usually classed with diphtheria (Duffin, 1997, 200; Leidinger, 1997, 223), but it was an acute respiratory condition, as was pleurisy, which the medical dictionary (Wingate and Wingate, 1988) defines as 'inflammation of the pleura (the double layer of thin membrane surrounding the lungs)' and which was characterised by respiratory distress. Therefore it is possible that both 'croup' and 'pleurisy' may indicate conditions which might have been attributed by doctors to 'bronchitis' and 'pneumonia'. A much lower percentage of bronchitis and pneumonia on Skye overall may therefore not indicate that small infants did not suffer from it, but that it was being recorded using different terms.

With doctors more likely to ascribe a cause to a death, increasing medical certification of these events over the second half of the nineteenth century on Skye might be expected to have been accompanied by a parallel increase in the proportions of deaths ascribed a cause, but in fact, as we saw earlier in Figure 4, this was not the case. Instead it appears that either relatives became more reticent about offering causes, or registrars became less likely to accept a cause as given by a relative. Perhaps registrars and the registration system were increasing in efficiency, although the percentage of deaths which were medically certified was still constrained by the availability of doctors.

No doctor on Skye certified more than eight neonatal deaths in the period under observation, but Kilmarnock was not only a more populous place and growing over the second half of the nineteenth century, but it also had higher rates of both infant mortality and medical certification, so doctors in Kilmarnock certified a great many neonatal deaths, allowing investigation into individual doctors' certification patterns. Although there were 127 doctors who certified at least one death in the town between 1861 and 1901, some were resident in the town for only a very short time or lived in a neighbouring town so did not undertake many certifications, and in what follows only those doctors, 13 in all, who certified at least 20 neonatal deaths are considered. Most doctors in Kilmarnock appear to have been dependant for their income on private practice, although some also held official posts such as 'Medical Officer of Health', 'hospital physician' or 'surgeon', or 'medical referee' for a friendly society. Any doctor attending a terminally ill patient would be required to certify their death, so the nature of a doctor's practice, or official position, might be expected to influence the profile of the deaths he certified, (if, as some have feared, the insurance of infant lives led to higher infant mortality, then friendly society officials might be expected to certify more infant deaths) but this does not appear to have necessarily been the case in Kilmarnock: the two doctors for whom infant deaths formed the highest and lowest percentages of their overall deaths were both medical referees for friendly societies.

For each doctor under consideration, the percentage of neonatal deaths they certified, grouped into main causal categories are displayed in Figure 6. In this figure the doctors are arranged from left to right in order of their date of first qualification. Causes of neonatal death (as a percentage of that doctor's neonatal deaths) varied considerably between doctors,

but there is little evidence of any systematic qualification cohort effect. Some of the differences between doctors may be due to the different ages of infants certified, which are themselves likely to be a function of the prominence of obstetric work in the different doctors' practices. There is a strong relationship between the percentage of deaths due to the 'prematurity' and 'debility' groups of causes and the average age at death of each doctor's neonatal death certifications. Doctors who attributed around 70 per cent of neonatal deaths to the 'prematurity' or 'debility' groups were certifying infants with an average age of 6 days, whereas those only attributing 40 per cent of deaths to these groups of causes were certifying infants with an average age of 10 days. Thus to a considerable degree, the different cause of death patterns between individual doctors are likely to have been due to their clientele and the age profile of the deaths they were asked to certify, with the possibility that those with a large obstetric element to their practice would certify more very early neonatal deaths and thus deaths broadly speaking due to 'immaturity'.

The changes over time in the approach to weak and premature infants has been described above, with a move over the latter half of the nineteenth century from descriptions such as 'atrophy' and 'debility', through 'prematurity', to specific causes such as 'atelectasis', an imperfect expansion of the lungs at birth (Payne, 1885, 7), and 'asphyxia'. In keeping with this change some of the earlier-qualifying doctors were more likely to have used 'debility' than 'prematurity', yet two of the earliest-qualifying, John Thomson and Donald Macleod restricted themselves entirely to 'prematurity' and did not use 'debility' at all. Others however demonstrate a change over time: James McAlister, for example certified 21 deaths as debility and 2 as premature in the 1860s, 3 as debility and 17 as premature in the 1870s, and none as debility and 8 as premature in the 1880s. The few deaths attributed to atelectasis all occurred in the last decade of the study. Interestingly, however they were not confined to the youngest cohorts of doctors, but were used by doctors who had trained 20 years previously as well as to newly qualified recruits: it seems that some doctors were keeping abreast of new developments in diagnosis and terminology, while others remained wedded to their old ways. Interestingly, 'weakness' was very rarely used as a cause in Kilmarnock – even uncertified deaths were attributed to 'debility'. It is likely that the registrars, as well as the doctors, were more attuned to medical phraseology.

Age patterns of neonatal death

Another way of examining causes of neonatal death where information on causes is poor is to look at the age patterns of deaths in the first month of life. Figure 7 shows the mortality rates per 1,000 live births in five age periods: the first day, the rest of the second week, the third week and the fourth week. The figure indicates that Skye reported rather lower death rates on the first day of life than Kilmarnock, and as suggested above, it is plausible that first day deaths on Skye were not being as fully reported as they were in the town. However this does not appear to have been particularly concentrated in those places with the worst medical provision: in Kilmuir first day mortality was 9 per 1,000 before the parish had a doctor, and 11 per 1,000 after a doctor had arrived, but the difference is not statistically significant, and both figures are in line with those on the rest of the island. The likelihood of registering an early neonatal death might also have been connected to the proximity to a registrar as much as to the availability of medical services.²⁰

Perhaps even more surprising, is the high mortality rate on Skye for the rest of the first week of life, and for the second and third weeks, but particularly the second. One possibility for these high mortality rates is that the children on Skye suffered from a cause of death which was notorious in the history of the island of St. Kilda: a very remote group of islands on the very margins of the Scottish Hebrides. Despite its remoteness St. Kilda had close ties to Skye, as its inhabitants were tenants of one of Skye's main landlords, Lord MacLeod. The St Kildan church and civil registers attest to the fact that a horrendous proportion of the island's infants succumbed to 'eight day sickness', 'lockjaw' or tetanus.²¹ The civil registers of St Kilda show that between 1871 and 1891 almost half the 51 children born on the island died in the first month of life, and all but three of these died between the 6th and 14th days, the majority being ascribed by the lay informants (there was no doctor on St Kilda) to 'lockjaw'.

While St Kilda was a very small community, no doubt with one 'handy-woman' or 'knee-woman' who attended all births on the island, Skye was a much bigger island, with a plethora of small communities scattered around its coastal fringes. No doubt particular villages, or townships, at certain times had untrained midwives whose methods were neither hygienic nor safe for the mother, or dwellings which might be more prone to tetanus infection than others. Certainly there were townships on Skye where rates of infant mortality in the second and third weeks of life, at 40 deaths or more per 1,000 births, were much higher than in other hamlets where the rates were almost negligible (Garrett, 2006, 145). Nowhere on the island were rates as high as those experienced on St Kilda. Nevertheless further evidence that tetanus was prevalent in the vicinity of Skye is provided by a 1926 article in the *Caledonian Medical Journal* discussing 'The tragedy of St. Kilda' (Gibson, 1926). The author indicated that he had searched death registers from Iceland, the Faroes, the Orkneys, Shetland, Fair Isle and the Isle of Lewis, which lies between St Kilda and Skye, looking for cases of neonatal tetanus. He had had very varying rates of success. Having studied the registers of two parishes on Lewis, he notes that the recording of '*tetanus neonatorum*' appears to have varied as the registrar changed. He concludes: '...too much reliance cannot be placed in these non-medical diagnoses. But it is also seen that *tetanus neonatorum* occurred frequently, but how often is difficult to say...' (Gibson, 1926, 55). On a happier note he was able to report that since 1891 no children had died of tetanus on St Kilda after the island's minister, frustrated at the lack of success nurses from off-island had had in reducing deaths from tetanus, took a course in midwifery himself and was able to advise members of the community, who had always turned to the Church for guidance, how births and the after-care of mother and child ought to be conducted.²²

A similar picture is described for Vestmannaeyjar, a small island off the coast of Iceland, by Ólöf Gar arsdóttir (2002, 116-21), who ascribes the high tetanus rates to a combination of mud floors, a proliferation of sea-birds, and archaic midwifery. These causes are confirmed by the Cambridge Historical Dictionary of Disease, which states that neonatal tetanus is associated with filth and rural conditions, depending on soil conditions, type of agriculture,

²⁰See also Finlay (1980) for other evidence of under-registration of early infant deaths with distance from point of registration.

²¹For discussion of the effects of the ravages of tetanus on the island's population see for example: Steel (1994) MacLean (1992).

²²A story repeated by Steel (1994).

poverty and health services, particularly midwifery (McMillen, 2003, 326-28). The disease is caused by neurotoxins created by tetanus bacteria when spores enter a wound, frequently the unhealed end of the umbilical cord, and encounter anaerobic conditions. The symptoms appear between three and ten days after birth, and include a stiffening of the jaw (hence the name 'lockjaw') which prevents suckling, a flexing of the limbs, stifled cry, respiratory complications and gastroenteritis. Death was almost inevitable for those who became infected: 'no disease of infancy was more fatal, and few parents saw any reason to call a doctor' (McMillen, 2003, 326-28).

Could the relatively high neonatal mortality on Skye be a result of neonatal tetanus? Neither the term '*tetanus neonatorum*' nor 'lockjaw' appear in relation to infants in the island's death registers during the period of study (Garrett, 2006, 144)²³. However, the timing of the deaths seems to fit the pattern characteristic of tetanus. The list of symptoms given in the extract above included 'respiratory complications' and it is possible that when lay people reported an infant death from 'pleurisy' that they were reporting apparent symptoms of tetanus rather than of 'bronchitis' or 'pneumonia'. In addition the population of Skye lived in conditions which today we might consider filthy; their animals, whose droppings could carry the tetanus spores, were often housed in a byre which formed part of the family home, and where the tetanus spores might lie dormant for many years if not exposed to sunlight. Health services, were, as we have seen difficult to access and obstetrical care was largely in the hands of local 'handy women' or 'knee women' rather than trained midwives. Doctors do not appear to have attended births, except in some cases where the mother's life was threatened. If the outcome of a case of tetanus really was a foregone conclusion, as suggested in the quote above, then it is perhaps little wonder that very few of the deaths in the 7-21 days age group were medically certified – parents saw little point in going to the trouble and expense of calling a doctor if he was going to be unable to relieve their child's sufferings.

While it seems likely that tetanus was present on Skye it is perhaps worth noting that other causes of death could offer similar peaks of death in the second and third week of life. One of these is 'tetany', thought to be caused by calcium deficiency and evincing symptoms 'nearly' identical to the symptoms of 'neonatal tetanus' according to Kiple (2003, 329). It is possible that the population of the Western Highlands could become calcium deficient as their water supplies would not encounter calciferous rocks, and their crops would be grown on mostly acidic soils. In addition many of the mothers would be 'multi-parous'. However there is no evidence at present that the condition was widespread.

Perhaps, given the housing conditions previously described and poor obstetrical care, the risk of septic infection was a greater danger to infant life, although again the written record says very little about cases of neonatal sepsis, which would have a mortality peak similar to that of neonatal tetanus (Boerma and Stroh, 1993). Oral history records, however, suggest that local midwives were not really aware of the need for stringent hygiene. One Orkney midwife, who practised in the early 20th century (it is not stated to what degree she had been trained), when asked about cutting the umbilical cord and whether she had to 'boil up' the

²³Garrett (2006, 144) reports that three per cent of infant deaths in Kilmarnock were ascribed to 'tetanus'.

scissors replied, 'I suppose we nivver (never) paid attention, just the kitchen scissors and that was all' (Bennett, 2004). These practices, however, do not appear to have translated into high levels of puerperal fever or sepsis among newly delivered mothers, which was no higher on Skye than in Kilmarnock, at least according to the death certificates.

To explore and compare the possibility of neonatal tetanus, we have adopted a method suggested by Boerma and Stroh (1993). These authors, in trying to gauge the success of tetanus immunization programmes in countries and regions of today's developing world, propose that looking at infant mortality rates not by weeks of life, but by three periods within the first 28 days gives a good indication of the presence of tetanus.²⁴

Boerma and Stroh divide the first 28 days into the first four completed days lived (days 0-3) then days 4-14 and days 15-27. While they suggest that the percentage of neonatal deaths which occur during days 4-14 can be a useful indicator of the presence of neonatal tetanus, deficiencies in the reporting of deaths in the first few days of life can distort the usefulness of this measure. Given that Skye may have been underreporting very early deaths it was decided instead to use the ratio between NMR at days 4-14 and NMR and days 15-27 as an indicator of the presence of elevated mortality in the 4-14 day period. Boerma and Stroh were of the opinion that, in the absence of neonatal tetanus in a community, IMR in both these periods should be roughly equal; or in other words the ratio between them should be about 1.

Table 3 shows the figures which Boerma and Stroh calculated, from 1980s DHS survey results, for 7 countries where they believed neonatal tetanus remained a major challenge for prevention programmes. As can be seen mortality in the 4-14 day age range in these countries lies between 16 and 22 deaths per 1000 births. In the 15-27 day age range, mortality is much lower, lying mostly about 3 or 4 deaths per 1000 births, except in Pakistan where it rises to 7. Thus mortality in the 4-14 day range is 4-5 times higher than that in the following 2 weeks of life, except in Pakistan where the ratio is 2.3:1.

The table also shows Kilmarnock, Skye, and three other small Scottish rural communities; Jura, Rothiemay and Torthorwald²⁵. When we compare these Scottish communities with those of Boerma and Stroh it is clear that levels of 4-14 day mortality in both Skye and Torthorwald are higher than those of the any of the modern day countries listed. However mortality at days 15-27 is also higher, a feature Boerma and Stroh (1993, 473) argue occurs when 'diarrhoea and pneumonia are common', thus the ratio between the two figures is only 3.1:1 for Skye and 2.2:1 for Torthorwald. Jura, on the other hand, also has a 4-14 day NIMR which is well within the range of the African figures, but a 15-27 day mortality of only 2 deaths per 1000 births, so the ratio is very high at 9:1. It thus seems highly probable that neonatal tetanus (or some other condition resulting from poor birth or after-care practices) was depressing the survival chances of newborn infants in these three communities, although the disease is only fleetingly glimpsed in the civil death registers. Skye recorded no

²⁴This method has also been adopted by Vasey (1997) in his study of neonatal tetanus mortality in Iceland.

²⁵The Isle of Jura, like Skye lay off Scotland's west coast. Rothiemay was an agricultural parish in the county of Banff in the north-east of Scotland and Torthorwald lay in Dumfries-shire in Scotland's south-western peninsula. All three communities had populations of no more than one or two thousand in the late nineteenth century, and were therefore much smaller than either Skye or Kilmarnock.

infant deaths from tetanus. Torthorwald listed only one – that of a 10 day old child in 1867, and Jura also listed only one case – of a ‘2 week’ old child in 1856 – so at least there is some recorded evidence of the presence of the disease in these communities.

Both Rothiemay and Kilmarnock have a 4-14/15-27 day ratio approximating 1, suggesting that tetanus was not a major killer of infants. Kilmarnock did experience cases of neonatal tetanus: 26 cases were recorded between 1861 and 1900, 16 of them aged 4-14 days, but they formed only a tiny fraction of all neonatal deaths. One of the doctors, Donald Macleod, even published a paper in the Glasgow Medical Journal in 1859 describing a case of idiopathic tetanus. The presence of the disease is therefore confirmed, but urban conditions, probably coupled with better medical knowledge and care, kept it at bay. It is perhaps surprising, however, that if the disease was present on Skye, that not one doctor came across it, and that it was not even acknowledged by one of its lay terms, unless the term ‘pleurisy’ confuses the picture by ‘disguising’ the true cause of death.

Conclusions

It is not possible to examine causes of neonatal death for the British Isles in the nineteenth century using published data as the smallest age unit given is one year, nor is it possible to compare the causes suggested by lay people and doctors. This investigation of individual death certificates therefore provides a rare opportunity to examine the cause of death among the very young and comment on the factors influencing both the individual reported causes and the resulting official statistics.

One of the largest influences on reported cause of death in the nineteenth century appears to have been the number of doctors and their level of attendance on the population. It is likely that Skye, and the Highlands and Islands of Scotland, represent an extreme case in the British Isles: although medical provision in terms of the numbers of doctors per 10,000 people was comparable to other parts of Scotland in the last decades of the nineteenth century, difficult terrain and sparse population density meant that doctors could not serve as many people and effective medical provision was much lower. Levels of medical certification were much higher in most other places, but differences in Kilmarnock indicate that even where transport and distance was not such a problem, rural areas and poorer places and people were likely to have been less well served by medical men, a situation which would have been reflected in the cause of death statistics. The short period between birth and death for very early neonatal deaths means that any place where doctors did not routinely attend births is likely to have had higher levels of non-medical certification among the very young, and thus poorer information on cause of death in this age group. They may also have significant under-registration of very early neonatal deaths and their corresponding births. In childhood and adulthood, when illnesses took longer to develop, there was more time to summon a doctor, and deaths are more likely to have been more reliably medically certified.

Because doctors were reluctant to admit ignorance of cause of death, it is plausible to assume that ‘not known’ causes were not medically certified, and a significant number of ‘not known’ deaths should be taken as an indication of low levels of medical certification

and effective medical provision, and thus that recorded causes may have been skewed by the balance of lay and medical certification at different ages and by a different range of causes of death suggested by doctors and lay people. Some of the causes offered by lay informants can be equated with causes suggested by medical men, such as 'weakness' with 'debility', but these were not necessarily placed in the same categories by the registrar general's coding schemes. Other possible equivalent causes must remain more speculative, such as 'pleurisy' and 'tetanus' although age patterns of death can indicate where they might be the same pathological cause.

Causes offered by individual doctors also varied in ways which reflected the doctors' practices: those with well established obstetrical practices certifying more first day deaths and thus more with 'immaturity' as a cause. They also varied in ways which showed doctors following medical developments and learning to use new terminology, such as those who followed recommendations by moving from classifying newborn deaths as 'debility' to 'prematurity'. Other doctors, however, appear to have been less open to new ideas. The balance of doctors in a community, therefore, will have a bearing on the causes presented, which might have as much to do with individual doctors' whims and preferences than with any particular pathological causes of death.

The Select Committee for Death Certification, reporting in 1893, was concerned about high levels of non medical certification of death among certain sections of the British population, and worried particularly about the potential for false certification, homicide, premature burial, and the registration of infant deaths as stillbirths. This paper has shown that they were right to have worried about the under-registration of very early infant death in rural areas, and about the possible under-reporting of some causes, such as, we suspect, tetanus on Skye. However they should perhaps have been more concerned about the influence of effective levels of medical provision on recorded causes than about disguised homicide and deliberate falsification.

Anne Hardy (1994, 472) wrote that 'registered causes of death bear only an approximation of the truth', and this is true: comparisons can be misleading if attention is not paid to the context behind them and should be undertaken extremely cautiously.

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Figure 1.

The annual percentage of infant deaths and all deaths which were medically certified, Skye and Kilmarnock 1861-1890.

Sources: Civil registers of death, Skye and Kilmarnock, GROS.

An earlier version of this graph appeared in Garrett, 2006, 127.

Figure 2.

Percentage of deaths certified over time, Skye and the parish of Kilmuir

Source: Civil registers of death, Skye, GROS.

Note: 5 year moving averages are shown.

Figure 3.

Causes of neonatal death in Kilmarnock, 1861-1901.

Source: Civil registers of death for Kilmarnock, 1861-1901.

Note: 5-year moving averages are shown.

Figure 4.
 Causes of neonatal death on Skye, 1861-1901.
 Source: Civil registers of death for Skye, 1861-1901.
 Note: 5-year moving averages are shown.

Figure 5.

Causes of neonatal death: Scotland 1911, Kilmarnock 1861-1901, and Skye 1861-1901, by source of certification.

Sources: Annual Report of the Registrar General for Scotland, 1911, lxxxiii; Civil registers of death, Skye and Kilmarnock, 1861-1901.

Figure 6.

Causes of neonatal death in Kilmarnock

Source: Civil registers of death, Kilmarnock, 1861-1901.

Figure 7.

Mortality rates for age periods over the first month of life, Skye and Kilmarnock

Source: Civil registers of death for Skye and Kilmarnock, 1861-1901.

Table 1

Percentage of deaths not medically certified in various places, 1880s

		% of deaths not certified
England & Wales	1882-1892	3.3
London	1882-1892	1.3
Halifax	1882-1892	6.5
North Wales	1882-1892	8.5
Glasgow	1881-1890	5.6
Edinburgh	1881-1890	10.2
Dundee	1881-1890	3.7
Aberdeen	1881-1890	1.8
Greenock	1881-1890	7.0
Leith	1881-1890	6.7
Paisley	1881-1890	5.3
Perth	1881-1890	4.5
Kilmarnock	1881-1890	1.4
Skye	1881-1890	58.7

Sources: Calculated from Appendix to the first and second reports from the Select Committee on Death Certification, 1893, p. 288, 298-300. Skye figure calculated from individual death registers.

Table 2

Percentages of neonatal deaths where cause of death is medically certified, Skye and Kilmarnock, 1861-1901, by age.

	Kilmarnock	Skye
<1 day	81.67	14.29
1-6 days	82.59	8.90
7-13 days	85.81	7.23
14-20 days	94.35	10.71
21-28 days	89.58	15.19

Source: Civil registers of death for Skye and Kilmarnock, 1861-1901.

Table 3
The ratio of NMR at 15-27 days to NMR at 4-14 days, C20th sample populations with estimated rates of neonatal tetanus of 4-15 per 1000 live births and 19th century Scottish populations

<i>In the absence of neonatal tetanus the ratio would be expected to be about 1</i>						
		NMR 4-14 days	NMR 15-27 days	Ratio 4-14/15-27days	NMR Total	N of births
Late C20th Africa	LIBERIA	22	4	5.5	67	4991
	SENEGAL	22	4	5.5	45	4180
	MALI	21	4	5.3	50	3313
	EGYPT	17	4	4.3	38	8470
	SUDAN	16	3	5.3	43	6375
	BURUNDI	15	3	5.0	35	3764
Asia	PAKISTAN	16	7	2.3	47	6245
Late C19th Scotland	SKYE	31	10	3.1	55	17714
	TORTHORWALD	28	13	2.2	65	1120
	JURA	18	2	9.0	58	600
	KILMARNOCK	12	9	1.3	41	38158
	ROTHIEMAY	9	10	0.9	27	1646
	ST KILDA	471	59	8.0	529	51 **

20th Century Figures from Boerma & Stroh (1993), based on DHS data. (Have been rounded to whole numbers).