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# Religious Differences in Rates of Infant and Child Mortality: Evidence from Alsace, 1750-1870

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**Religious Differences in Rates of  
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by  
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The results of the Princeton studies of the decline of fertility in Europe led to a renewed interest in the influence of cultural factors on fertility (Coale and Watkins, 1986). More recently, demographers have extended this concern to include the question of infant and child mortality. A number of studies, both historical and contemporary, have identified significant differences in levels and trends of mortality among cultural groups sharing similar physical and social environments (Van de Walle, 1986; Zunschke, 1984; Goldstein et al., 1994; Caldwell et al., 1990). These findings have provoked considerable speculation about the ways in which cultural practices may influence both susceptibility to disease and the treatment of illness (Landers, 1992). The present paper contributes to this discussion by examining the infant and child mortality patterns of two religious groups, Lutherans and Catholics, that lived side-by-side in the French region of Alsace. The similarity in their physical environment, as well as in the broader social and economic setting in which they lived, makes these groups good candidates for an assessment of the effect of religion on mortality.

### **Culture and Demographic Difference**

While demographic research has identified significant differences in behaviour among cultural groups, accounting for these differences has proven to be a major challenge. Often a particular cultural attribute - religion, ethnicity or language - can be shown to be associated with a distinctive demographic pattern, but how this attribute might influence the demographic behaviour in question is unclear. In some cases, the trait appears to be only a marker of group identity and not a determinant of behaviour (Hammel, 1990). The demographic pattern, lower mortality for example, may actually be a function of other features of the group, such as the higher socioeconomic status of its members. In these instances, the specific cultural trait that identifies the group has no direct effect on demographic behaviour.

In other cases, however, controlling for social and environmental differences between cultural groups does not account for all of the observed differences in demographic behaviour. This has led analysts to consider the ways in which culture may directly shape the demographic behaviour of group members. Such explanations have usually centered on the issue of values. Values can be seen as providing individuals with evaluations of different forms of social behaviour while also offering them a script to follow as they confront the decisions of everyday life (Swidler, 1986; Hammel, 1990).

The role of values appears particularly important when examining demographic differences among religious groups. Many religious denominations attempt to codify their teachings regarding

such issues as marriage, childbearing and childrearing. The Catholic proscription against artificial contraception was frequently cited in past as contributing to higher levels of marital fertility in devoutly Catholic populations. Seldom, however, is there an easy fit between the formal teachings of churches and the behaviour of their members. Goldscheider (1971) cautioned against what he termed a "particularized theology" explanation which links specific religious teachings to the behaviour of the group members. He argued instead for a broader perspective which views religious groups as subcultural communities marked by a coherent set of values, customs and institutions. This approach is especially apposite in the case of infant and childhood mortality since religious groups rarely have specific teachings that would directly affect the survival prospects of their members. Religious differentials in mortality are more likely to result from variations in religiously based values that promote or discourage patterns of behaviour that have implications for health. The effect may be fairly direct as in the case of prohibitions on the use of alcohol or tobacco that may in turn lead to a lower incidence of diseases such as cirrhosis of the liver or lung cancer. More often, however, it is likely to be indirect. Religious values that promote a fatalistic view of life may discourage effective use of medical treatment, while religions that hold egalitarian views of gender roles may encourage higher levels of literacy and educational attainment among women and, ultimately, lower levels of juvenile mortality. Uncovering the religious basis of mortality differentials demands a close analysis of the values and practices of specific social groups, a task that is not easy in an historical setting. Before addressing this issue, however, I will first describe the data used in this analysis and then trace the mortality patterns of the two religious communities of Alsace.

## **Data and Methods**

The data used in this paper are drawn from the parish and civil registers of a series of villages in the départements of the Bas-Rhin and Haut-Rhin, which together make up the old French province of Alsace. Most of the analysis is based on a family reconstitution study of five villages in the region. These results have been supplemented by analysis of aggregate data for a group of twenty-three Alsatian villages. In this section, I will first briefly describe the characteristics of the communities studied. I will also note the shortcomings in the primary sources of the data. Finally, I will describe the method followed in the analysis of the data from the reconstitution sample.

The primary focus of this work is to examine the effect of religious affiliation on patterns of infant and child mortality. The Alsatian countryside was divided from the time of the Reformation into communities of Lutherans and Catholics.

Elsewhere, I have shown that the Lutheran communities were characterized by higher levels of nuptiality and lower marital fertility (McQuillan, 1989; 1994). There is also evidence to suggest that the transition to lower levels of marital fertility occurred earlier among the Lutheran population. To examine religious differences in infant and child mortality, I have selected five villages for study, two of which were overwhelmingly Lutheran, the other three being uniformly Catholic.

In addition to the religious factor, however, I have tried to take account of the extraordinary economic diversity that marked the Alsatian countryside. Of the five villages included, two were almost exclusively devoted to agriculture (one Catholic, the other Lutheran), two others combined agriculture with the household production of specialized textiles (again, one Catholic, the other Lutheran), while the fifth village was the site of what grew through the nineteenth century to be a major textile factory (Schmitt, 1980). The aggregate sample was constructed along the same lines. The twenty-three villages included were chosen to reflect the diversity of the region on both economic and religious dimensions.

Registration of vital events in the villages studied was generally excellent. However, in the case of infant mortality, there are several problems that need to be noted. First, for two of the Catholic villages, data for the period 1750-1785 were either missing or seriously deficient. Thus for the earliest part of the period studied in this paper, the analysis of Catholic patterns rests heavily on just the rural industrial village of Mussig. For the years after 1785, however, there appear to be no significant problems with under-registration in the Catholic villages. For the Lutheran villages the data are of high quality throughout the entire period.

A second problem concerns the distinction between stillbirths and early infant deaths. This is always a serious problem in studying infant mortality, even in modern societies with efficient systems of registration. Analysis of the Alsatian registers suggests substantial variation among local communities in the registration of stillbirths. For example, a comparison of two neighbouring Catholic villages showed that in one village stillbirths accounted for almost one-third of early infant deaths (stillbirths plus deaths to infants recorded as less than one month of age at the time of death), while in the other village only a handful of stillbirths were recorded. However, when stillbirths were treated as neonatal deaths, the proportion of all infant deaths that were neonatal was very similar in the two villages. To deal with this inconsistency, I have treated all stillbirths as being infant deaths.

Finally, a comment is required on the infants and children included in the analysis. Family reconstitution studies are handicapped by the fact that individuals born in the villages

studied frequently leave the villages at some point in their lives, and thus no record of their death is available. Various strategies have been suggested to insure that the individuals included in the analysis of mortality are continuously in observation. In this paper, I have followed the lead of Knodel (1988) and limited the analysis to children born to parents who married in the village being studied and remained there until their deaths. This approach gives us a high degree of confidence that the children included in the analysis remained in observation until at least the age of ten. It should be noted, though, that this "conservative" strategy limits the focus to children born to the most stable families in the village, a group that may have been more privileged in a number of ways. In particular, this strategy excludes illegitimate children (unless their parents married and remained in the village), a group known to suffer higher rates of infant mortality. It is reasonable to conclude that the rates shown here underestimate somewhat the true level of infant and child mortality in the villages.

## Results

The results presented in Tables 1 and 2 for the reconstituted villages, and in Figure 1 for the aggregate sample, provide basic estimates of infant and child mortality rates. They point to a pattern of high infant mortality and show no clear evidence of a decline over time. As was noted above, data for the period 1750-89 are flawed for the Catholic population, and even for the Lutheran communities may slightly underestimate the risk of dying in infancy<sup>1</sup>. Even allowing for this, infant death rates in the decades preceding the Franco-Prussian War were no lower than in any of the previous time periods. This conclusion is confirmed by the data for the larger sample of twenty-three villages. For both the Lutheran and Catholic communities, the infant mortality rate moved up and down over the course of the nineteenth century, showing no evidence of progress towards lower mortality. The proportion of infant deaths that occurred in the first month of life (neo-natal deaths) was higher in the Lutheran villages, as we would expect in the light of their lower overall rate; yet there is no clear upward trend in either religious community that would indicate the kind of decline in the post-neonatal death rate that normally accompanies declining infant mortality.

Central to the concern of this paper is the religious differential in mortality rates. The results suggest that rates of infant mortality were generally lower in the Lutheran communities.

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<sup>1</sup> There is some evidence of underregistration in the village of Baldenheim in the period 1750-1789, though the extent of it was limited.

Using data from the larger sample, the infant mortality rate averaged about forty points higher in the Catholic communities. The data from the five reconstituted villages generally support this conclusion, though the picture is more complicated. On the basis of these five communities, the religious differential appears smaller, particularly in the period before 1815, though a precise comparison is difficult given the problem of underregistration. It does seem that more than the religious factor was involved in shaping the experience of infant mortality, however. The data for the individual communities show that the rank-order of villages with respect to the risk of infant death does not fit neatly with a simple Catholic/Lutheran dichotomy. Taken together, the two villages close to the Rhine, Baldenheim and Mussig<sup>2</sup>, did better than the two agricultural villages of the interior, Avolsheim and Goxwiller. These findings hint at the possibility of a regional effect as well as a religious influence. Environmental factors may have created a natural setting within which the religious variable operated. Nevertheless, in each of these two geographic pairings (which also shared important economic characteristics), the risk of dying in infancy was significantly lower in the Lutheran community than in the Catholic village.

The industrial commune of Husseren provides further evidence of a regional effect, perhaps linked to geographic factors. In the period from 1790-1835, Husseren had the second lowest infant mortality rate, higher only than the rate for Baldenheim. Imperfect registration might have depressed the rate slightly, but the true figure was likely close to the calculated rate and certainly below the level of mortality in the villages of the Plain. The mountainous setting of the village may have contributed to this relatively favourable experience, offsetting whatever negative effects early industrialization produced (Dobson, 1992; Viazzo, 1994). An abundant fresh water supply from the Vosges may have created a healthier environment than in the other four villages. This speculation is supported by the fact that two of the villages in the aggregate sample, also located in mountainous regions, had relatively low mortality rates despite the fact that the canton in which they were located was generally thought to be among the poorest in Alsace.

Equally intriguing is the apparent increase in the infant death rate in Husseren in the years after 1836. There is some evidence of rising mortality generally; the rate increased after

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<sup>2</sup> Baldenheim and Goxwiller were predominantly Lutheran; Mussig and Avolsheim as well as the industrial village of Husseren were almost entirely Catholic.

1836 in four of the five villages<sup>3</sup>. The situation in Husseren may have been further aggravated by difficult times for the textile factory. Wholesale layoffs were frequent during this period as the factory suffered through the ups and downs of the international textile trade (Schmitt, 1980). The curé of the local parish wrote to the bishop of Strasbourg in 1854, pleading for assistance to the many poor thrown out of work at the factory. There is also evidence of substantial emigration in these years, with a number of families listed as leaving for America (Schrader-Muggenthaler, 1989). The deteriorating conditions combined with greater mechanization (and perhaps environmental damage) may have overcome some of the natural advantages that the community initially held.

The data from the five reconstituted villages also allow us to examine trends in child mortality. Here, the religious differential appears fairly clear. Among Lutheran families, the probability of death in early childhood (between ages one and five) declined from .165 in the prerevolutionary era to .075 in the years leading up to the Franco-Prussian War. Similarly, for children between the ages of five and ten ( ${}_5q_5$ ), the likelihood of death fell sharply during the nineteenth century. As a result, though there was no progress made against infant mortality, the chances of a child born in a Lutheran community surviving to age ten improved significantly, if not dramatically, between the beginning and end of the period studied here. Prior to 1789, approximately 35% of children died before their tenth birthday; the corresponding figure for the years 1836-1870 was 26%.

Trends in the Catholic population are more difficult to chart, though overall there seems little evidence of significant improvement. The data for the years 1750-89 are, as noted above, flawed, and in any case refer only to the village of Mussig. The figures in Tables 1 and 2 show no indication of a decline in the risk of childhood mortality. If we assume the figures for the early years underestimate the mortality level in Mussig prior to the Revolution, it is possible that some improvement in survival prospects did occur in the period following the Revolution. If so, the progress was slight and did not continue into the nineteenth century. Taking the three Catholic villages together, the probability of dying between ages one and five remained stable in the period from 1790 to 1870. There was a slight decline in the risk of death in the later childhood ages, but it was too small to have any significant impact on the overall probability of dying by age ten, which actually reached its high point in the last time period examined. Again, even assuming that figures for the early

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<sup>3</sup> An increase in the years 1850-1870 has been noted for many parts of Europe by a number of observers. See, for example, Vallin (1991). For the whole sample,  ${}_1q_0$  for the period 1850-1870 was .203 and for the Catholic population it was .221.

years underestimate infant and childhood mortality risks, it is hard to see how any significant improvement in the survival rates of Catholic children could have occurred prior to 1870.

### **Endogenous and Exogenous Sources of Infant Mortality**

It is unfortunate that neither the parish registers nor the civil registers of deaths recorded information on cause of death. There are occasional notations made beside particular entries and other sources provide some information about the outbreak of particular epidemics, but no analysis of cause of death structure can be undertaken with these data. It is possible, however, to distinguish between early infant deaths, generally due to congenital or other prenatal factors or trauma connected to the birth itself, and those that take place later in infancy and are the usually the result of environmental factors affecting the health of the child after birth. Table 3 provides neonatal and post-neonatal death rates for the Lutheran and Catholic populations for the years from 1785-1870, that is, the period when I believe registration to have been virtually complete. The data indicate that almost all the difference in infant mortality between the two religious groups was attributable to differences in the risk of dying after the first month of life. The neonatal death rate for Catholic infants was only 3.2% higher than for Lutheran children, while the post-neonatal rate in the Catholic communities was more than 25% higher. This points to an important role for environmental factors in producing the higher infant mortality in the Catholic population.

A somewhat more sophisticated way to approach this problem is to use the "biometric" technique developed by the French demographer Jean Bourgeois-Pichat (1952). He suggested using a graphic technique to distinguish between infant deaths due to endogenous and exogenous sources. His method consisted of cumulating infant deaths from one month of age to one year and plotting the result against a logarithmic transformation of age measured in days. The resulting line indicating the cumulative number of deaths at given ages should be close to a straight line. By extending the line back to the origin, Bourgeois-Pichat argued that we would arrive at an estimate of the rate of endogenous mortality. I have followed his technique here, though a regression equation was used to estimate the point at which the graph would meet the intercept. The method works remarkably well for both the Lutheran and Catholic populations. In both cases, the plots result in almost perfect straight lines ( $R^2$  equals .996 for Catholics, .997 for Lutherans) and produce an estimated endogenous mortality rate of 71 per 1 000 for the Lutheran population and 77 per 1 000 for the Catholic group.

As was the case with the neonatal and post-neonatal rates, these findings suggest that the experience of the two religious groups differed most with respect to environmental influences on

the life chances of their children. In the circumstances, this is not surprising. Endogenous sources of mortality were largely beyond the control of mothers and midwives, and we might expect to find important differences between two populations in the same setting only if there were substantial variation in such demographic factors as the distribution of mothers by age. This is not the case here, though more Catholic women did continue childbearing into their forties, and this may have contributed to the slightly higher level of endogenous mortality.

### **Multivariate Analysis**

The results presented thus far point to lower infant and child mortality rates among the Lutheran population in Alsace. Mortality patterns among infants and children can be influenced by a wide variety of demographic and social variables, however, and a fuller understanding of the problem requires a more complex multivariate analysis. To do this, I have employed a proportional hazards model, the results of which are presented in Tables 4 and 5. Like the more familiar life table approach used in demography, the proportional hazards method examines the risk of death for a group of individuals. However, the technique also permits us to see how characteristics of the individuals increase or decrease the risk of infant or child death. In that sense, it operates much like a standard regression technique.

Table 4 presents two models dealing with the risk of death during the first year of life. Both models contain a variety of demographic variables that past research has shown to influence the risk of infant mortality. Including these variables in the analysis should provide a better assessment of the influence of the social factors, particularly religion, on the risk of infant death. The results in the first column of the table are based on an analysis that includes all infants in our sample; the figures in the second column result from a reanalysis that excluded first-born children. This was done to include a measure of the time interval between births as well as an indicator of the survival status of the previous child.

The results shown in column 1 of Table 4 point to a significant role for several of the demographic variables. Male children, as expected, faced a significantly higher risk of early death. Interestingly, birth order also influenced survival prospects. Using first-born children as the reference group, the coefficients are negative and statistically significant for birth orders two through seven but not for infants of birth order eight or higher. These results point to a curvilinear relationship between birth order and the risk of infant death with first-borns and those of the highest birth orders experiencing greater risk of death. The effect of sibsize appears to have been important only in the case of very large families. With families of size five

through eight chosen to be the reference category, the coefficient for smaller families is not significant. For children from families with more than eight births, however, the risk of infant death was some 14% higher. Having controlled for such related factors as sibsize and birth order, age of mother has no significant effect on the risk of infant death.

Most important for purposes of this paper, however, are the results for the sociological variables included in the analysis. The religious factor continues to play an important role even when holding constant all other factors. For Catholic infants, the relative risk of early death was 25% higher than that faced by infants in Lutheran families. Risks differed also among the geographic regions. The two agricultural villages located in the wine-producing central region were chosen as the reference category. As the results show, infants in the other two regions, whether from the villages along the Rhine or from the mountainous industrial centre of Husseren, faced a significantly lower risk of premature death. For children in Husseren, the risk was about 1/3 lower than in the agricultural villages.

Occupational differentials in the risk of infant mortality appear to have been modest. The children of workers and servants, arguably the most disadvantaged groups, did experience a significantly higher risk of death. This was the only occupational group for whom the level of risk differed significantly from that of the artisan group that was used as the reference category. There is no evidence of any significant change over time in the risk of infant death. Using the cohort born between 1800 and 1849 as the reference group, the relative risk of death for those from the earlier and later cohorts was not significantly different. This supports the earlier finding that no significant progress against infant mortality was made during this 120 year period.

The analysis presented in the second column of the table includes the variables dealing with a previous birth (and thereby excludes first-born children). The results for the previously included variables do not change dramatically, but the newly added variables play an important role. The length of time between births now emerges as an important factor. An interval between births of less than eighteen months increased the risk of infant death for the index child by almost 35%. Longer intervals (of thirty months or more) were also associated with a higher risk of early death, although the increase was not as pronounced as was true for short intervals. It is important to note that a number of these longer intervals may have been a function of pregnancies during the interval that resulted in miscarriages or still births that went unrecorded. If so, women with unusually long intervals might have been at a generally higher risk of suffering infant deaths. The other additional variable tries to tap this issue. The negative coefficient for the variable indicating whether the earlier born child survived until the birth of the index child

suggests a tendency for infant death to run in families. While we might have expected that the continued presence of the earlier born child in the household would have increased the demands on the mother, it appears that after controlling for other factors, especially the length of the birth interval, the survival of the previous child increases the survival prospects of the index child. The most plausible interpretation of this finding is that some families, for reasons that are hard to identify, provided an environment more conducive to good health among infants.

Adding these demographic variables had no significant effect on the part played by the sociological factors. Especially important is the continued role of religion. Although Catholic women experienced, on average, shorter birth intervals, controlling for length of interval and survival status of the previous child does not eliminate the effect of religion. After holding constant the effects of both demographic and sociological factors, Catholic infants still faced a significantly higher risk of death. As well, the region variable continues to exert an important effect, most likely pointing to the significance of geographic and environmental factors that cannot be directly measured.

Table 5 shows the results of the analysis of child mortality. The focus here is on the probability of dying between exact ages one and five for children who have celebrated their first birthday. The analysis proceeds in the same way, looking first at all children who survived infancy, and then narrowing the focus by excluding first-born children. In contrast to the case of infant mortality, demographic variables are of little help in explaining variation in the risk of early childhood mortality. Interestingly, there was no significant difference in the risk of childhood death for male and female children. The only statistically significant coefficients among the demographic variables are for large family size, indicating that the risk of death in childhood was greater among children from families with more than eight children, and somewhat anomalously, for children of birth order five through seven. However, even the effect of these variables becomes non-significant when first-born children are excluded and an indicator of the status of the previous-born sibling is included. The higher risk of death that some families faced had its impact largely through an elevated risk of infant rather than childhood mortality.

Adding the social factors into the model, however, strengthens the findings noticeably. The statistically significant coefficient for the variable indicating that the child was born in the period 1750-1800 makes clear the improvement in the risk of childhood mortality that occurred over time. Children born before 1800 faced a markedly higher risk of early childhood death. Once again, there is evidence of a clear regional effect. Children who lived in the centrally located villages of Avolsheim and Goxwiller not only faced higher risks in infancy, but even those who survived the first year of life continued to run a greater risk of death during

the early years of childhood. Again of central concern is the role of religion. Its effect here is weaker than was true for infant mortality. The relative risk of death for Catholic children was about 16% higher than for Lutheran children, though the coefficient was statistically significant only at the .10 level. Nevertheless, while it would appear that the effect of religion on survival prospects was greatest in infancy, it appears to have exerted a continuing effect through early childhood as well.

### **Summary and Conclusions**

Throughout the years from 1750-1870, Alsace experienced relatively high rates of infant and child mortality and saw little evidence of improvement. Overall, approximately one in five infants died in their first year of life and between 1/4 and 1/3 of children died before their tenth birthday. As was often the case, the region's experience placed it between the relatively low rates that prevailed in France throughout much of the nineteenth century and the very high rates that characterized southern Germany at that time (Poulain and Tabutin, 1980). Despite the uncertainty created by the underregistration of deaths in some villages, especially during the latter half of the eighteenth century, it appears certain that little or no progress was made against infant mortality in the period covered by this study. This was not entirely true in the case of childhood mortality, however. There is fairly clear evidence of decline among the Lutheran population of Alsace. In the Catholic community, on the other hand, little if any progress was achieved. When the treaty of Frankfurt was signed in 1871 and the region passed under the control of Germany, the Catholic community continued to experience high levels of both infant and child mortality.

Reports from public health officials, which date from the early nineteenth century, make the high level of infant and child mortality in the region appear unsurprising. The doctors appointed to these positions filed regular reports on the health and living conditions of the population, as well as special reports when epidemics occurred.<sup>4</sup> Their reports make clear that while the great crises of mortality that had decimated the population in the seventeenth and early eighteenth centuries had disappeared by the period of our study, periodic outbreaks of infectious disease continued to strike both rural and urban populations in the region. The province was regularly ravaged by typhus, smallpox, and dysentery, as well as malarial infections in the marshy regions near the Rhine. In the nineteenth century, cholera appeared as a new threat to the populace. The spread of disease was aided by the very poor quality of nutrition, contaminated sources of water, and

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<sup>4</sup> Their reports are contained in the series 5M in the Archives Départementales du Bas-Rhin.

a general lack of hygiene at both the individual and community level. The average rural family ate meat rarely and survived on a diet that relied heavily on potatoes and bread. A number of officials noted that during times of near famine, impoverished families would dig up the potatoes before they had ripened, a habit they associated with outbreaks of diarrhoea among both children and adults. Water drawn from stagnant pools or shallow wells was frequently cited as a source of disease, and some doctors applauded the increasing reliance on wine as the main beverage even among children. Housing was of poor quality, and families often lived in desperately crowded conditions. One doctor reported visiting a household stricken by an outbreak of typhoid fever in which six family members, all sick with the disease, were gathered in one room, two to a bed. Perhaps the most regular complaint of these officials concerned the lack of attention to cleanliness in the public spaces of the villages. Piles of garbage and human waste left to fester, streets with no drainage, and pools of stagnant water were most commonly cited as threats to public health. Despite their advice to local officials to take action on these problems, little seems to have been done. Reports from the 1850s echo the same complaints recorded in the first decades of the century.

Medical care apparently had little impact on the health of the rural population, though doctors felt they could have made a difference if only villagers would have heeded their advice. An aggressive campaign of vaccination against smallpox was begun in the beginning of the nineteenth century. As late as the 1850s, however, doctors still complained that parents attempted to avoid having their children vaccinated, and in this they were abetted by local officials. When epidemics broke out, some doctors complained, people would not call on their services, or when they did so would not follow their advice. Popular remedies - inducing vomiting or ingesting schnapps - were likely to aggravate the patient's condition rather than alleviate it. It is not clear how useful the treatments prescribed by physicians would have been in the face of bacterial and viral infections, though at least some of their advice - particularly to limit contact between the infected persons and others - would have helped limit the spread of the diseases. One physician complained that masters would send servants who fell ill back to their families in neighbouring villages spreading the disease in the process.

It is not surprising, then, that survival prospects, particularly for infants and children, remained poor throughout much of the nineteenth century. Our primary interest, though, is in the variability in mortality rates among groups in the population. The multivariate analysis pointed to significant regional and religious differences even after taking into account the effects of a wide range of demographic factors. The regional factor is especially surprising in that lower rates of mortality

were found in the industrial village of Husseren and in the two villages located near the Rhine. One plausible reason for the better performance of Husseren involves the presence of a cleaner and abundant source of water from the Vosges mountains. As well, the rise in mortality that appears to have occurred in the village during the nineteenth century could reflect a deterioration in the water supply associated with greater population density and greater mechanization in the textile industry.

The lower mortality rates in the villages near the Rhine relative to those in the agricultural villages of the Plain are more puzzling. The canton of Marckolsheim in which they are located was generally viewed as one of the poorer areas of Alsace. Before large-scale drainage efforts were undertaken in the nineteenth century, the land was marshy and experienced periodic outbreaks of malaria. If environmental factors were a critical determinant of juvenile mortality patterns, one might have expected this region to have been at a significant disadvantage. Population density was lower in this area than in the more heavily populated region of the interior, though it is hard to say whether this would have made a great difference (Dobson, 1992). The region was not on the main roads of the region and appears to have experienced very little in the way of immigration. The two villages studied here had fewer servants who originated outside the villages than was true for the wine-producing villages of the interior. Of course, it must also be noted that the industrial village of Husseren had, by far, the greatest amount of population turnover.

Most intriguing given the major interest of this paper is the significant difference between Catholics and Lutherans, a difference that is not erased by controlling for a range of demographic variables. The religious cleavage of the Alsatian population was deep and enduring, and there is little doubt that religious affiliation was a fundamental aspect of personal identity. As a result, sectarian conflict was a more or less constant feature of life in the region throughout the eighteenth and nineteenth centuries (Chatellier, 1981; Muller, 1986). The Catholic Church in Alsace was resolutely traditionalist and in a position to exert a strong influence over the Catholic community. Lutherans, by contrast, showed a far greater openness to change and, in particular, to the secular philosophies associated with the Enlightenment. The sharp contrast between the two groups was clearly exemplified in their different responses to the reforms introduced by the French Revolution (Vogler, 1994). Lutherans, on the whole, welcomed the changes while the Catholic community adopted a posture of almost complete rejection. Their reaction to the Revolution shaped the evolution of the two communities throughout the nineteenth century. The Lutheran community was marked by evidence of increasing secularization, while in the Catholic community religious devotion may well have increased and Church authorities remained solidly committed to traditional

teaching.

Of course, even if we accept the argument that the Lutheran community was more secular and open to innovation, the link between religion and mortality is not easy to explain. Nevertheless, several specific factors, some of which can be linked to the more "secular" orientation of the Lutheran community, can be advanced to account for the religious differential. First, the longer intervals between births in the Lutheran population likely reflected greater reliance on breastfeeding and later weaning. This may have conferred a qualitative advantage on infants, the effect of which is not fully captured by holding constant the length of time between births. Secondly, the Lutheran population was more affluent (Dreyfus, 1979; Wahl, 1980) and perhaps, as a result, better nourished. The proportion of the population that was indigent was significantly lower among Lutherans (Muckensturm, 1988). And data on recruits into the army for the canton of Marckolsheim show that young men from the predominantly Lutheran villages were on average some two centimetres taller and a smaller proportion were rejected for health reasons (Selig, 1988).

There are two other possible sources of the advantage enjoyed by infants and children in the Lutheran villages, though the evidence to support them is more speculative. One concerns the greater level of hygiene in the Protestant communities. It is a factor noted in passing by scholars in the region even though hard evidence to prove it is all but impossible to obtain. Juillard and Kessler (1952) drew attention to it in their comparative analysis of Lutheran and Catholic villages in the fertile Kochersberg region, west of Strasbourg. Despite the obvious similarities between the two communities, they noted in their ethnographic study conducted in the 1940s the greater concern with cleanliness among Lutherans: "Saturday evenings each Protestant family sweeps the street and cleans the gutter in front of their house; among Catholics, there is less unanimity and the Protestant village, it is generally agreed, is cleaner." (1952:50) This observation was made several generations after the end of our study period, of course, and it is risky to assume that such differences prevailed a century or more earlier. Yet even the cantonal doctor of Marckolsheim, commenting on the generally deplorable state of hygiene in the region, identified the Catholic village of Mussig as "holding the honour of being the most unhygienic in the whole canton... so that a disease that presents little danger in another village, becomes in Mussig ... serious and dangerous."

Finally, it is interesting to speculate on whether the generally higher level of literacy among Lutheran parents was associated with a higher standard of childcare. Research on currently developing societies has identified literacy and/or the educational level of mothers as an important correlate of infant and child mortality (Hobcraft, 1993). The link is a complex one and there is some evidence that the effect of literacy may have

been smaller in earlier times (Preston and Haines, 1991). Yet, some researchers have argued that literacy may be associated with better quality childcare within the home. It is not impossible that a similar pattern existed in nineteenth century Alsace, and that the children of Lutheran families benefited indirectly from a culture that placed great value on literacy for both men and women.

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Table 1 Summary Measures of Infant and Child Mortality By Religion and Period of Birth.

Measure	Catholics				Lutherans			
	1750-89	1790-1815	1816-1835	1836-1870	1750-1789	1790-1815	1816-1835	1836-1870
${}_1q_0$	.191	.185	.190	.212	.157	.187	.155	.178
${}_4q_1$	.118	.125	.118	.125	.165	.117	.103	.075
${}_5q_0$	.287	.287	.285	.310	.297	.282	.242	.240
${}_5q_5$	.037	.052	.050	.039	.074	.048	.039	.028
${}_{10}q_0$	.313	.324	.321	.337	.349	.317	.272	.261
% Neonatal	62.5	58.4	48.1	44.1	49.5	53.2	52.4	53.5
N	418	963	1260	1862	1178	1006	677	1051

Note: Includes stillbirths.

Table 2 Infant Mortality and Child Mortality Rates by Village and Period of Birth.

Village	1750-1789	1790-1815	1816-1835	1836-1870
	${}_1q_0$			
Avolsheim	---	.250	.202	.221
Husseren	---	.154	.160	.189
Mussig	.196	.146	.201	.220
Baldenheim	.132	.159	.138	.179
Goxwiller	.188	.224	.190	.177
	${}_4q_1$			
Avolsheim	---	.169	.141	.162
Husseren	---	.091	.075	.134
Mussig	.117	.114	.132	.089
Baldenheim	.154	.106	.125	.056
Goxwiller	.180	.137	.073	.104

Table 3. Infant and Child Mortality Rates, Neonatal Mortality Rates and Post-Neonatal Mortality Rate, By Religion, Period of Complete Death Registration.

<b>Mortality Measure</b>	<b>Catholics</b>	<b>Lutherans</b>
Neonatal	.096	.093
Post-neonatal	.113	.090
% Neonatal	48.6	53.2
Endogenous	.077	.071
N	4178	2882

Table 4 Hazards Regression Results for Models of Infant Mortality.

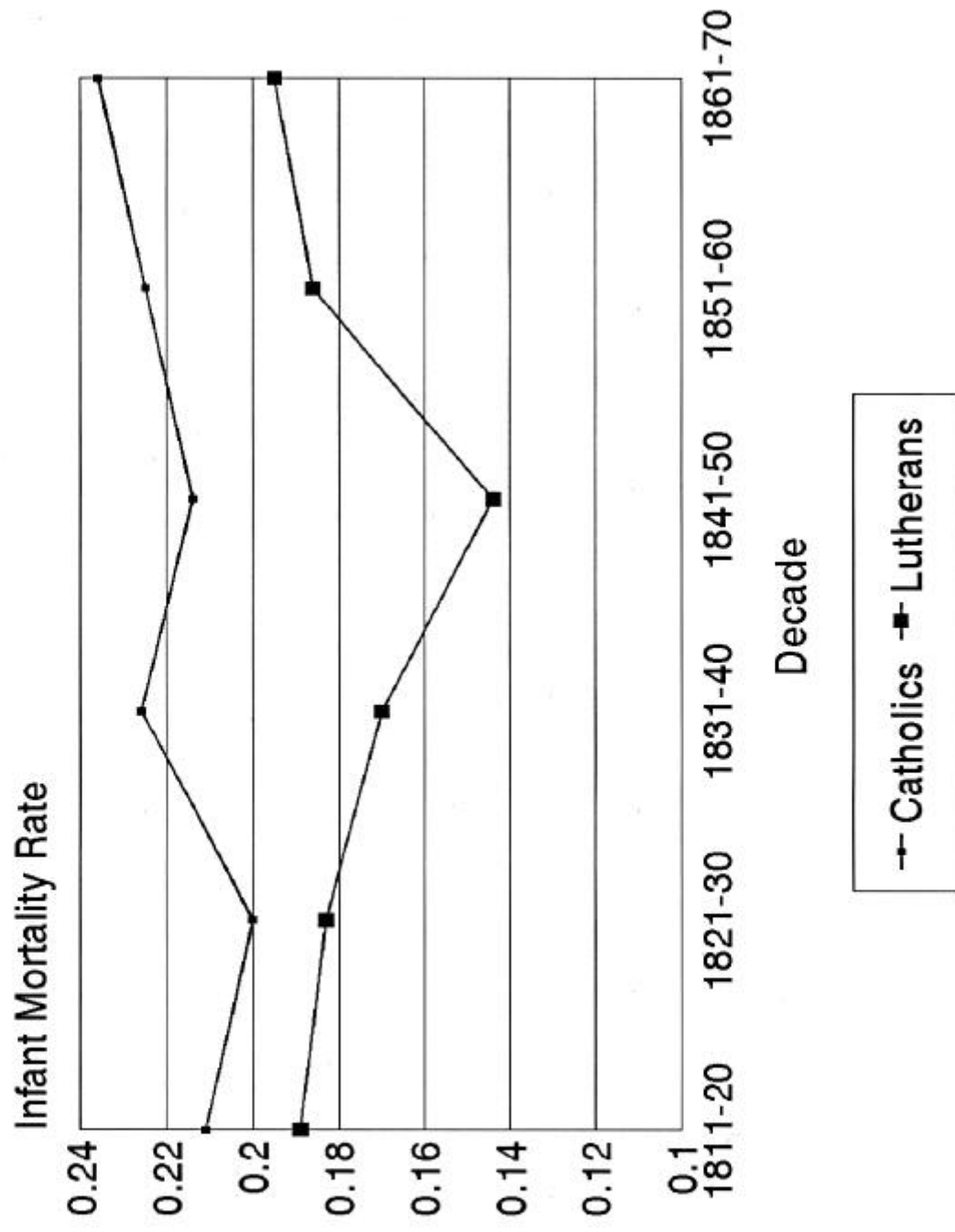
Variable	All Infants		First-Born Excluded	
	Coefficient	Risk Ratio	Coefficient	Risk Ratio
<b>Sex of Child</b>				
Female	-.301***	0.740	-.350***	0.705
<b>Birth Order</b>				
2-4	-.310***	0.734	-	-
5-7	-.309**	0.734	+.015	1.015
8+	-.052	0.949	+.250**	1.284
<b>Family Size</b>				
1-4 Children	+.130	1.139	+.127	1.135
9+ Children	+.134*	1.144	+.118	1.126
<b>Marriage Order</b>				
2nd Marriage	+.071	1.074	+.160	1.173
<b>Age of Mother</b>				
Mother < 22	+.015	1.015	+.131	1.140
Mother 30-39	+.063	1.065	+.073	1.075
Mother 40+	+.180	1.198	+.189	1.208
<b>Status of Previous Child</b>				
Survived	-	-	-.334***	0.716
<b>Interval Between Births</b>				
< 18 months	-	-	+.277**	1.320
> 29 months	-	-	+.200**	1.221
<b>Cohort</b>				
1750-1799	-.113	0.893	-.135	0.873
1850-1870	-.065	0.937	-.036	0.965
<b>Religion</b>				
Catholic	+.224***	1.250	+.184***	1.202
<b>Region</b>				
Baldenheim/Mussig	-.293***	0.746	-.233***	0.792
Husseren	-.398***	0.672	-.407***	0.666
<b>Occupation</b>				
Farmer	+.222	1.249	+.201	1.223
Worker	+.224*	1.252	+.270*	1.310
Unknown	-.085	0.919	-.207	0.813
Log Likelihood	-12864.8***		-9138.2***	
N	8351		6545	

\* p < .10    \*\* p < .05    \*\*\* p < .01

Table 5 Hazards Regression Results for Models of Early Childhood Mortality.

Variable	All Children		First-Born Excluded	
	Coefficient	Risk Ratio	Coefficient	Risk Ratio
<b>Sex of Child</b>				
Female	+.083	1.087	+.059	1.060
<b>Birth Order</b>				
2-4	+.150	1.162	-	-
5-7	+.229*	1.257	+.091	1.095
8+	+.225	1.253	+.120	1.128
<b>Family Size</b>				
1-4 Children	-.074	0.929	-.100	0.904
9+ Children	+.187*	1.207	+.126	1.134
<b>Marriage Order</b>				
2nd Marriage	+.147	1.158	+.049	1.050
<b>Age of Mother</b>				
Mother < 22	+.196	1.216	+.204	1.227
Mother 30-39	+.109	0.896	-.127	0.881
Mother 40+	+.040	0.961	-.031	0.970
<b>Status of Previous Child</b>				
Survived	-	-	+.102	1.107
<b>Interval Between Births</b>				
< 18 months	-	-	+.130	1.139
> 29 months	-	-	-.060	0.942
<b>Cohort</b>				
1750-1799	+.424***	1.529	+.362**	1.436
1850+	+.026	1.026	+.075	1.078
<b>Religion</b>				
Catholic	+.144*	1.155	+.154*	1.166
<b>Region</b>				
Baldenheim/Mussig	-.396***	0.673	-.439***	0.645
Husseren	-.463***	0.629	-.479***	0.620
<b>Occupation</b>				
Farmer	-.196	0.822	-.098	0.907
Worker	+.050	1.051	+.142	1.152
Unknown	-.109	0.896	-.174	0.840
Log Likelihood	-7355.0		-5793.3	
N	6912		5495	
* p < .10	** p < .05		*** p < .01	

Figure 1: Infant Mortality Rates by Dominant Religion of Village  
1811-1870



Sample of 23 villages