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Religion and Child Death in Ireland's Industrial Capital: Belfast 1911

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Abstract
Ireland is often seen as an outlier within the western world in terms of demographic behavior. As a society it has also been noted for its religious fervor, including religious division, at least until fairly recently. Might there be connections historically between these two spheres? One intriguing area of enquiry relates to possible links between religious denomination and child mortality. We explore this possibility using individual-level data from the household schedules of the Irish Census of 1911. The study area is Belfast, Ireland's leading industrial city, which allows for a wide range of occupational and social class differences. Combining regression techniques and the mortality index proposed by Preston and Haines (1991), we seek to tease out the relationship between child mortality and religious affiliation while controlling for a range of other explanatory variables. We show that religious identity is clearly associated with different infant and child mortality outcomes. Of the three major religious denominations, Catholics suffered the most from high infant mortality, Church of Ireland (Anglican) families were only a little better off, while the largest Protestant denomination, the Presbyterians, had the best infant mortality outcomes. These differences were related, in the main, to the varying socioeconomic composition of the three major religious denominations but religious affiliation also mattered in its own right.

Introduction

The death of infants and very young children is among the historical nightmares that haunted families and societies in the not-too-distant past. At the beginning of the last century in most west European societies the death of children under one year of age exceeded 10% of all live births (Mitchell 1978). These tragic outcomes were even more prevalent in southern and eastern Europe, and in less economically advanced societies elsewhere. Perhaps surprisingly, Ireland is located at the better end of the child mortality range. While the scale of child mortality is well known, there is less agreement on the determinants of that mortality, and variations in these rates as between countries and time periods. This paper is a contribution to the historiography of child mortality in an urban, industrial setting.

Our study area is the city of Belfast at the time of the 1911 census. The Belfast region at that time, and for long afterwards, was the industrial heartland of Ireland. It specialized in the production of linen textiles and heavy engineering, including shipbuilding. Viewed in gender terms the textile industry was overwhelmingly an employer of female labor, including married women, while heavy industry was characterized by male-dominated occupations. In many respects Belfast had much in common with industrial cities in northern Britain such as Manchester, Leeds, Bradford, and Glasgow. It was different, however, in that it was a relatively new city, with most of its growth compressed into the second half of the nineteenth century, thereby making it one of the fastest-growing towns in the whole of the UK in that period. Rapid expansion spawned its own problems in the form of crowded housing, inadequate water supplies, and other public health hazards (Purdue 2013).

In the eyes of some commentators, Belfast was both a British and an Irish city (Lynch 2013). It was also varied in terms of religious affiliation. Most numerous were the Protestant denominations, which included members of the Church of Ireland (Anglicans), the Presbyterian church, the Methodist church, and some smaller sects. There was also a sizeable Roman Catholic minority making up roughly a quarter of the population. A small Jewish community added to the religious mix. Protestants dominated the social and economic life of the city, as well as its politics. These various and varied features of the industrial city make it especially attractive as a site for testing propositions relating to the social consequences of urban, industrial life, including the incidence and the determinants of infant and child mortality.

The city skyline was dominated not just by mill buildings, factory chimneys and shipyard gantries but also by a profusion of churches and steeples. Edwardian Belfast hosted two cathedrals, various churches, chapels, convents, seminaries, mission halls, and religious meeting houses. A divisive religious spirit along Catholic-Protestant lines marked its educational and cultural institutions, its municipal politics, and the residential patterns of the city (Purdue 2013; Kennedy and Ollerenshaw 2013: Kennedy et al. 2010). Might these religious cultures have implications also for the domestic sphere, shaping for instance, the life expectancy of children along denominational lines? Socioeconomic differences and neighborhood effects might well be relevant as well.

To explore these and related issues, we use the household schedules of the Irish census of 1911. This dataset offers individual-level information on occupation, religion, literacy, district of residence, primary demographic characteristics such as age, sex and civil status, number of surviving children as well as the number of children ever born according to marriage duration. Using this rich data source, we apply indirect methods to calculate an index of child mortality, which is then related to religious affiliation, socioeconomic status, and place of residence (UN 1983). Strictly speaking, religion in this context is best understood as religious culture, that is, the whole body of understandings and practices associated with a particular religious denomination as it related to fertility, pregnancy, childbirth, hygiene, and the care of young children. Thus, our objective is to establish if there were differences in the incidence of child mortality as between different religious groups or denominations that operated independently of the socioeconomic composition of these denominations.

The structure of the article is as follows. In the first section, we review briefly studies of infant and child mortality in Ireland and lay out some possible links with religious affiliation. This is followed by an account of the method for estimating child mortality. The source materials used in this case study are also discussed. In the third section, we present descriptive statistics relating to child mortality and religious affiliation, and the penultimate section lays out our regression findings on the links between child mortality, religion, socioeconomic variables, gender, and contextual factors. The conclusion rounds off the discussion and sketches the wider significance of the study.

Infant and child mortality in Ireland

Effects of religion affiliation on infant and child survivorship

Studies of child mortality based on the household schedules of the 1901 and 1911 censuses of Ireland are relatively rare and have tended to focus on rural Ireland and the city of Dublin. Of particular relevance to the present study, Reid et al. (2016) have analyzed the relationship between child mortality and mobility in the city of Belfast across the decade 1901–1911 by using individual-level data from the Irish censuses of population. Our study is different in the sense that the focus is on religious affiliation, and its possible implications for child survival. It is based, not on a sample but on the full population of the city.

A relationship between religion and child mortality is well-established in the international literature and has been documented for populations before, during, and after the demographic transition. Much less is known about the reasons for these differentials (Van Poppel et al. 2002). Differences in socioeconomic characteristics and lifestyle have been mentioned as possible explanations, but some studies (see for instance McQuillan 1999) have shown that religious differentials may persist even after controlling for socioeconomic and demographic characteristics.

For the Irish case, most of the evidence comes from the research of Cormac Ó Gráda (2004, 2006, 2008). The first of these studies focused on the township of Pembroke, which formed part of the Dublin registration district (and became part of the city of Dublin in 1930). This suburban township was characterized by a significant presence of non-Catholics, mostly members of the Church of Ireland but including also some Presbyterians and a sprinkling of smaller Protestant sects. Ó Gráda found that in 1911 "all faiths other than Catholicism were associated with lower mortality, with the infants and children of Presbyterians and other non-conformists being least at risk" (Ó Gráda 2004: 101). In his later book-length study of the Irish Jewish community, he also found evidence of lower mortality among Jewish children in Dublin city as well as in their smaller communities in Cork and Belfast. This was for the census year of 1911. Finally, in a study of the textile town of Lurgan, County Armagh, just over 20 miles from the city of Belfast, Ó Gráda (2008) found an association between infant and child mortality and religious affiliation. However, religious affiliation was also associated with living standards and socioeconomic advantage and these appear to have been the primary determinants.

We intend to explore here whether this explanatory sketch stands up for the larger, more economically diversified city of Belfast.

In a recent article, Connor (2017) employs an approach incorporating geographic information systems, and spatially derived predictors with multilevel models. He has been able to demonstrate a close link between segregation and health inequality, and to show a more complex picture for the city of Dublin in 1911. The higher Catholic mortality appears to have been driven mainly by poverty and the conditions engendered by residential segregation. However, it remains difficult to explain the lower Jewish child mortality by recourse to socioeconomic explanations or geographic location.

In other studies, mirroring the case of the Dublin Jews, socioeconomic considerations seem not to carry much explanatory weight. Derosas (2003) has concluded that cultural and behavioral differences account for most of the religious differentials as between Jews and other denominations. Thus, in the United States at the time of the 1910 census, Jewish immigrants experienced remarkably lower child mortality as compared to the native whites (mostly Protestants), whereas French Canadian (Roman Catholics) children suffered much more precarious survival conditions. The Jewish advantage in child survivorship was put down to unmeasured behaviors, mostly related to feeding practices and better hygiene standards (Condran and Preston 1994; Preston et al. 1994). Other explanations for lower mortality among Jewish children included austere habits, community welfare institutions and social cohesion, higher educational level, and fertility control (Derosas 2003). On a darker note, a recent Irish study uncovered a higher incidence of mortality among children raised by interreligious couples in early twentieth-century Ireland, even after controlling for socioeconomic characteristics. This finding suggests a possible lack of family and social support due to the general public disapproval of couples who married across the religious divide (Fernihough et al. 2014).

Causes of infant death

The appropriately named *Report on the Health of The County Borough of Belfast by the Medical Superintendent Officer of Health for the City* is an authoritative source on the causes of death in the city (Bailie 1912). These annual reports provide figures on infant mortality, infant mortality rates (see Table 1), and causes of death. In addition, there are useful comments and suggestions on the socioeconomic causes of infant mortality and the means for improving the health of the population[1]. According to a comprehensive listing in the report for 1911, infant deaths were due to "debility, prematurity of birth, diarrhea, measles, whooping cough, convulsions, accidents, bronchitis, and pneumonia". Among these causes of death, diarrhea was

[1]These Health Reports are rich in commentary and factual information. But even more valuable would be the notes recorded by Health Visitors who attended the mothers after childbirth. These notes included personalised information on various characteristics of the babies born, many of them visited until the age of 5. Unfortunately, as far as we know, these have not come to light so far for Belfast, though they have survived for other parts of the UK (Reid 2001, 2002, 2003). We have reclassified our dataset according to the Dispensary District in order to be able to compare our estimates of child mortality with the official ones collected in the Health Reports.

Table 1. Number of residents at the time of the census, Infant Mortality Rates, Diversity Index and Proportion of female Spinners and Weavers within the female population aged 15–64 years, by Dispensary District in Belfast in 1911

Dispensary	Number of Individuals	IMR ‰ in 1911	Diversity Index	Proportion of Spinners and Weavers in female pop. 15–64
Dock	15879	149.4	0.709	0.283
Duncairn	49500	128.6	0.740	0.165
Shankill	50032	132.6	0.699	0.224
Workhouse	32637	134.5	0.676	0.168
Millfield	16112	153.7	0.724	0.336
College	37293	88.8	0.744	0.032
Greencastle	2681	50.0	0.718	0.296
Ligoniel	5964	108.1	0.700	0.471
Falls	24427	130.5	0.522	0.275
Woodvale	28958	130.5	0.730	0.458
Ravenhill	39311	94.4	0.748	0.065
Newtownards	38076	132.2	0.732	0.184
Ballyhackamore	23233	85.5	0.709	0.063
Ballymaghan	175	0.0	0.712	0.000
Central	22669	202.7	0.348	0.378
Total	386947	128.3	0.690	0.208

Source: Report on the Health of County Borough of Belfast for IMR 1911, and our calculations on IPUMS (Ruggles et al. 2015) for Number of Individuals, Diversity Index, Proportion of Spinners and Weavers in female population 15–64.

the most frequent and lethal cause of death. It was mainly spread among the poorer classes, the Report argued, that tended to feed their neonates artificially. It was clear that breastfeeding played a central role in infant survivorship. As the Report noted, urban districts registered higher infant mortality rates than the rural districts in which breastfeeding was widely practised[2]:

> "The baneful effects of artificial feeding under certain circumstances are clearly demonstrated by a comparison of the death rate among infants in rural and urban districts. In the rural districts, as a rule, we find that the infantile death rate is much lower than in urban districts, and that the methods of feeding differ in this respect, while in purely rural districts artificial feeding is rare and the death rate low; amongst the working-class population in urban districts artificial feeding is common and the death rate generally high. This is largely borne out by the high rate of mortality which we find in certain districts of the city, and which are principally inhabited by the working classes [. . .]".

[2]*Report on the Health of County Borough of Belfast for 1911*, page 87.

Child mortality and female working conditions

The Health Report for 1913 highlighted the fact that many working mothers were accustomed to remaining in the mills and factories up to a few days before giving birth. In addition, they also returned to work soon after the birth of the child, thereby interrupting lactation prematurely. Consequently, their children generally experienced a higher mortality risk in the pre-natal and post-neonatal periods. In the words of the Report (page 54) "in a large number of cases in which there were children prematurely born the mothers were employed in the various mills and factories throughout the city and were in almost every case engaged at their daily work during pregnancy. The majority of the infants were breast-fed for periods from 1 till 3 months, but as the mothers had to return to work in order to supplement the incomes of the homes, artificial feeding was resorted to [. . .]". Indeed, one of the worst aspects in the linen industry during the early twentieth century in Belfast concerns the disruption of attachments between mother and child. In order to come back quickly to work after confinement, mothers used to leave their children to "the care of 'old women' that fed the infants with tea and whiskey and gave them various 'soothing syrups', the principal of which was opium" (Armstrong 1951).

These circumstances had been noted farther back in time. Purdon (1877) collected several reports from the doctors in charge of the various dispensary districts regarding living conditions and the health of mill workers. A Doctor Spedding, for instance, reported that some old women fed the infants on "[. . .] bad milk out of imperfectly cleansed feeding bottles, which turns the food sour". The old women also gave to the children "laudanum to keep them quiet". According to another medical practitioner, Doctor Newitt, the children of female workers did not have the same chance for life or health as children of non-working mothers whose care was more carefully attended to. In addition, "those who grow up cannot be expected to have strong constitutions. They suffer considerably from diarrhea, tubercular peritonitis and strumous diseases". These conditions made the infant death rate for the mill workers higher than that of other social classes in Belfast. Purdon's grim conclusion (1877) was that the mother's return to the mill was practically a sentence of death on the newly born.

Couples and households generally had to decide as to who would work and when, in the light of their material circumstances. Nevertheless, the social norms which regulated gender roles in the late Victorian period also influenced family decisions regarding work. For example, in the textile village of Tullylish (County Down), as more generally in Ireland, many women would not continue to work after childbirth because of prevailing family norms, that is, if household earnings permitted this. (In rural Ireland, however, the line between working and not working was often a blurred one for the wives of farmers and agricultural workers.) In the linen industry, the low wages of this sector obliged a considerable number of mothers from the poorer household to work full-time. Indeed, a married woman's decision to work outside the home usually reflected poverty, aggravating the burden of domestic duties she also bore (Cohen 1992; Tilly 1989: 311).

To reduce the infant death rate, the health authorities recommended support for pregnant and parturient mothers. Purdon (1873, 1877) advised that mothers should not be allowed to return to work immediately after confinement and that public

crèches open to inspection by the state should be established. No action, unfortunately, was taken to implement Purdon's recommendation until the turn of the century. In any case, mothers were afraid of losing their jobs if they stayed out for any extended length of time (Armstrong 1951).

In other countries, for example in France, pro-natalist efforts made motherhood and work more compatible by introducing on-site factory crèches and wet-nursing schemes. No comparable improvements were effected in Ireland and Britain. The owner of one of Belfast's largest mills, Mulholland's, is cited as saying "Married or breeding women are not employed or retained in this mill" (Purdue 2019: 229). Such a rigid ruling was far from universal, however. There is no doubt maternity and pregnancy created dilemmas for a working woman in Belfast. Far from being supported, maternity sometimes meant the end of a woman's employment in the industry. The rights of pregnant workers would not be adequately protected by law in the United Kingdom until the late 1990s when the Employment Rights Act was introduced (Purdue 2019: 228–229).

Expected effects

Here we briefly preview the main hypotheses and anticipated results.

Religion

In the light of previous studies, we would expect Belfast Catholics to have experienced higher child mortality than other religious groups, in large part because of their low socioeconomic status. Moreover, if socioeconomic conditions were the primary determinants of infant mortality, then from what we know of the average conditions of life of members of the various denominations we would expect Presbyterians and Methodists to be especially advantaged. By contrast, we would expect Church of Ireland parents to have the poorest record for child mortality among the major Protestant denominations. Moving outside of Christian denominations, we might well expect Jews in Belfast, as elsewhere in the world, to have considerably lower child mortality in view of their distinctive cultural norms, including more effective hygiene practices. In relation to the small but intriguing subset of inter-religious marriages, we might expect higher mortality among children from families of mixed marriages. The argument here might be that such couples suffered from a potential lack of support from relatives and neighbors because of the lower social acceptability of these types of weddings.

Literacy and socioeconomic conditions

One might well expect the children of illiterate women to suffer higher mortality from their mothers' lack of knowledge about good hygiene and child-rearing practices. A gradient relating to socioeconomic status is also expected, showing higher mortality among the children of the poorer laborers. Mothers involved in the textile sector might be expected to experience elevated child mortality as some continued working during late pregnancy and the neonatal period, thereby endangering the life of the child. By comparison, better-off families, where the mother did not need to go out to work, would be advantaged, or so one might assume.

Neighborhoods and contextual factors

Differences in mortality between Belfast neighborhoods might also be expected as environmental conditions, including the quality of housing, bathing facilities, and proximity to livestock markets, varied across the city. This study uses the dispensary districts as the most relevant spatial unit of analysis, given that health services were organized at this level.[3] Conveniently also, the official statistics on infant mortality were reported by dispensary district. Table 1 presents the number of individuals enumerated in 1911 and the proportion of female spinners in the female population in the age category 15 to 64 years of age.

In Table 1, we also present a Diversity index for each dispensary district. The Diversity Index (D_i) is a measure of the diversity or heterogeneity of a population in terms of its different characteristics, such as religion, race, ethnicity, or cultural background (see Alesina et al. 2003; Simpson 1949). In the case of religious affiliation, the D_i can be calculated using the formula:

$$D_i = 1 - \sum_{j=1}^{k} p_{ij}^2$$

where p_{ij} is the probability that an individual randomly selected from district i and another individual randomly selected from the same district are both affiliated with religion j. To calculate p_{ij}, divide the number of individuals affiliated with religion j in district i by the total number of individuals in that unit. The index can be used to express the diversity of religious affiliations within a geographical unit and to make comparisons between different units. If there is a high concentration of a particular religion in a unit, the D_i will be lower, indicating a lower level of diversity. On the other hand, if the different religious affiliations are well represented then the D_i will be higher, indicating a higher level of diversity. The Diversity Index (D_i) can range from 0 to 1. A value of 0 indicates complete homogeneity, meaning that all individuals belong to the same religious denomination within a specific geographical unit. On the other hand, a value of 1 indicates complete diversity. In the Belfast case, the diversity index is high for all dispensary districts. A high score on religious diversity might be expected to produce high infant and child mortality because of an assumed lower social cohesion and mutual support. Conversely, the mortality risk is expected to be lower among children living in districts with larger groups of affiliates of the same religion.

Decline in religion effect after controlling for socioeconomic factors

As the religious groups tended to vary in terms of their socioeconomic and related characteristics (such as literacy and female labor force participation), the expectation must be that controlling for these variables will serve to reduce the

[3]The Irish Poor Law system, administered by local authorities, originated in 1838 and was designed to deal with destitution and later the provision of medical care. The country was divided into administrative units called poor law unions. There were 163 such units in 1911. The poor law unions were subdivided in turn into approximately 800 dispensary districts, and these more fine-grained units were used for the administration of rudimentary health services locally. Belfast in 1911 was divided into fifteen Registrar or Dispensary Districts.

explanatory power of religion in shaping inter-group differences in mortality. If this turns out not to be the case, then the religious differences in mortality must arise from factors independent of socioeconomic circumstances.

Data

This study uses data from the 1911 census of Ireland which provides information relating to 4,381,018 individuals in Ireland and 388,279 in Belfast. The census date was April 2, 1911. The micro census data, digitised by the National Archives of Ireland, were downloaded from the Integrated Public Use Microdata Series (IPUMS) database[4] (Ruggles et al. 2015). All registered individuals are grouped by household. In this way, each individual record reports the household index number and the person index within the household. The IPUMS archive offers individual-level information on occupation, religion, literacy, electoral district of residence, household structure, primary demographic characteristics such as age, sex and civil status, number of surviving children (CSURV), and children ever born (CEB) per woman. Using the information related to CSURV and CEB, it is possible to indirectly estimate child mortality measures (UN 1983, Preston and Haines 1991) by religion, socioeconomic status, place of residence, and socioeconomic status.

As our main interest is in the effect of religion on infant and child mortality, we classified individuals according to religious affiliation. The categories used were: Presbyterian, Church of Ireland, Methodist, Other Protestant, Catholic, Jewish, and Other Religion that also includes the small numbers of agnostics, atheists, and those of unknown affiliation.

Following a long tradition in social stratification research, we chose occupational categories as the core information to identify socioeconomic status (henceforth SES) (Van Leeuwen and Maas 2011). We used the 5-digit HISCO classification to construct a proxy for the husband's socioeconomic status (SES) based on the HISCLASS classification scheme (Van Leeuwen et al. 2002; Van Leeuven and Maas 2011)[5]. In the analysis, we use an eight-category classification based on HISCLASS: (I) Manager and professionals (grouping HISCLASS from 1 to 4); (II) Clerical and sales (5); (III) Skilled workers (6 and 7); (IV) Farmers (8); (V) Farm workers (10 and 12); (VI) Lower-skilled workers (9); (VII) Unskilled workers (11); (VIII) No occupation.

We constructed a simpler variable to take account of female employment status (work as spinner, work in other occupation, no occupation). We isolated the spinners because many health reports at the time showed that their children experienced the highest mortality. The variable 'spinners and weavers' encompasses a somewhat wider range of textile workers, including weavers, knitters, dyers, and related workers.

[4]It is possible to find information, complete documentation and data on the IPUMS website at: https://international.ipums.org/international/index.shtml

[5]On the website of the History of Work Information System, it is possible to find documentation, bibliography and information on the Historical International Classification of Occupations (HISCO) and on the social class scheme HISCLASS: http://historyofwork.iisg.nl/index.php.

Unfortunately, many of the variables measured by the census were time-dependent. SES and female work participation variables in 1911 do not fully represent the entire life course, as both the husbands' and the wives' occupations could change in the years before the census date, so there is inevitably a degree of approximation. We might also note that the occupations of homeworkers, almost all of whom were in the textile sector, were not recorded in the Census because they worked from home. The Health Report for 1911 (page 142) commented:

> "a large proportion of the homeworkers are married women, the thrifty, careful wives of laborers who do this work in order to supplement the income; in addition, they have their homes and families to look after, and in some instances the houses are not as clean nor the children as well looked after as would be desirable in the interests of all concerned. Speaking generally, however, the houses in which outworkers reside compare most favorably with those occupied by persons of the same station in life who do not carryon homework"[6].

Women's place of birth is also considered, distinguishing among those born in Belfast, those in an adjacent county (Antrim or Down), or those born farther afield. Inevitably, the census does not provide any information regarding the timing of migration as it is a snapshot in time. Place of residence at the most disaggregated level refers to street and electoral division at the time of enumeration, which also could vary across the life course of the woman in question. The IPUMS data offer two pieces of information relating to the street and electoral division of residence. We use this information to identify each woman with the dispensary district in which she found herself in May 1911. To identify the dispensary district in which women were located we consulted the enumerators' returns for the 1911 Census (available online) which show the street in which each of the women resided[7]. In some instances, it was necessary to supplement this approach by consulting the records for civil birth registration which are also available online.

Analytical sample

Having downloaded the IPUMS dataset relating to the entire Irish census of 1911, we then selected the residents in the Belfast city wards of Clifton, Court, Cromac, Dock, Duncairn, Falls, Ormeau, Smithfield, Shankill, St. Anne, St. George, Windsor, Woodvale, Pottinger, Victoria. Among the residents in Belfast, we further selected 43,181 married women whose marriage duration was less than or equal to 35 years, reporting the number of children ever born that appeared valid and was greater than zero. As in some cases, the reported woman's age was suspiciously low, we eliminated all the married women whose age was less than 15 years at the time of the census.

[6]Health Report, 1911, p. 140. According to the official lists of homeworkers sent to the Medical Officer, which are probably under-estimates, there were 10,213 outworkers. Of these, 1,979 were contractors and 8,234 were homeworkers, with no distinction by gender, though a large percentage were married women.

[7]http://www.census.nationalarchives.ie/

Indirect estimation of infant and child mortality by religion

This section presents indirect estimates of infant and child mortality using the aggregate counts of surviving children (CSURV) and children ever born (CEB) per woman by 5-year marriage duration. We summarize the method briefly and compare the indirect estimates and the corresponding measures from the official data. We also apply the indirect method to estimate the infant and child mortality levels by religious affiliation so as to provide a preliminary sketch at the aggregate level.

In a method first proposed by Brass (1968), the probability of dying q(a) between birth and a given age "a" can be estimated as a product of the proportion of children dead to women in age group (x to x+4) and an age-specific multiplier which depends on the age pattern of the average number of surviving children (CSURV) and children ever born (CEB). Thus, q(a) values for ages 1, 2, 3, 5, 10, 15, and 20 are derived from the proportion of children dead in each mother's age group 15–19, 20–24, . . . , 45–49. Following the same procedure, q(a) for ages 2, 3, 5, 10, 15, 20, and 25 are calculated using the proportion of children dead at different marriage durations from 0–4 to 30–34 (Sullivan 1972). By means of simulation, regression equations were developed to estimate the age-specific multiplier and the time references to which the q(a)s refer (United Nations 1983). A specific set of regressions for the Coale and Demeny models was developed by Trussell (1975). Through further regression equations, it is also possible to approximate the infant mortality rate q(0), the probability of dying between ages 0 and 5 q(0–5), and the life expectancy at birth e(0) corresponding to the q(a) values within each model life table pattern (United Nations 2013).

Using the software MORTPAK 4.3 (UN 2013) and referring to the West model, we applied Sullivan's procedure based on the proportion of dead children by marriage duration (UN 1983). We estimated infant and child mortality rates (per 1,000 live births), and the life expectancy at birth by different religious groups in Belfast. The estimates refer to several points on the time axis from 1892 to 1909. Because the number of cases for some religious groupings is small, Table 2 presents the average values from 1892 to 1909. While Catholics registered the highest values for all three mortality measures, Jews, by contrast, experienced the lowest incidence of child mortality. Interestingly, some differences emerged between the major protestant denominations. Adherents of the Church of Ireland suffered higher infant and child mortality as compared to their Presbyterian counterparts. Of course, these results do not control for the possibly confounding effects of socio-economic difference.

Mortality index and modelling strategy

We first calculated a child mortality index for each individual woman, dividing the actual number of dead children by the expected number according to a life table chosen as a standard (Preston and Haines 1991). This index can be easily interpreted. When children born to the woman (or a group of women) experienced child mortality rates above those expected by the standard life table, the mortality index will be above 1.0. A value of 1.1 indicates that child mortality was 10 percent

Table 2. Indirect estimation of infant and childhood mortality by religion in Belfast (average estimates from 1892 to 1909)

	Infant mortality rate ‰	Under five mortality ‰	Life expectancy at birth	N.
Religion				
Presbyterian	119.6	175.6	50.3	14,414
Church of Ireland	133.4	197.1	48.0	12,687
Methodist	121.7	178.7	49.9	2,722
Other Protestant	117.3	171.6	50.8	2,963
Catholic	160.9	239.4	43.5	9,650
Jewish	88.6	127.6	57.1	145
Other Religion	120.7	177.0	50.3	600
Total	133.0	196.6	48.0	43,181

Source: IPUMS (Ruggles et al. 2015).

above the level represented by the standard. On the other hand, when the children experienced mortality rates below the standard, the index will be below 1.0.

As Preston and Haines explained (1991: 226–228), this index represents a summary of child mortality and can be incorporated into multiple regression models. The child mortality index enters in the regression models as the dependent variable: it is assumed to vary as a function of religion, literacy, socioeconomic status, and place of residence. Adopting the West mortality model (Coale and Demeny 1966), Table 3 shows that the index calculated for the level 13.5 provides a mean value equal to 1. The level 13.5 values were obtained by interpolating the values between levels 13 and 14 in the West mortality models, registering an infant mortality rate and a life expectancy at birth of about 122 per thousand and 50, respectively.

Because infant and child mortality rates were declining in early-twentieth-century Ireland, the mortality index could be biased by differences in the timing of children's deaths among women of different ages and parities. To correct this bias, the model also includes the mortality reference date (MRD), which is the midpoint of the period to which the mortality estimates refer for each woman (see detailed description in United Nations 1983; see also Haines and Preston 1997; Dribe et al. 2020). The mortality reference date expresses the number of years before the 1911 census.

Following Preston and Haines (1991) and Garrett et al. (2001), we estimate an OLS regression, taking the mortality index as the dependent variable. Even though the unit of analysis is currently married women, the regressions are weighted by the number of children born to reflect the population of children at risk of mortality (e.g. Preston et al. 1994; Dribe et al. 2020).

Table 3. Number and percentage of women and children; mean and standard deviation of child mortality in Belfast, 1911

	Women		Children		Child Mortality Index	
Variable	N	%	N	%	Mean	SD
Religion						
Presbyterian	14,414	33.4	62,525	32.8	0.898	1.344
Church of Ireland	12,687	29.4	55,964	29.3	1.008	1.429
Methodist	2,722	6.3	11,860	6.2	0.921	1.396
Other Protestant	2,963	6.9	12,228	6.4	0.859	1.358
Catholic	9,650	22.3	44,955	23.6	1.256	1.556
Jewish	145	0.3	662	0.3	0.531	1.209
Other Religion	600	1.4	2,634	1.4	0.894	1.352
Religion of Spouse						
Different Religion	6,835	15.8	27,222	14.3	1.145	1.647
Same Religion as Spouse	36,346	84.2	163,606	85.7	0.982	1.384
Literacy						
Illiterate	3,338	7.7	17,849	9.4	1.437	1.507
Literate	39,587	91.7	171,766	90.0	0.971	1.417
Unknown	256	0.6	1,213	0.6	1.008	1.395
Marriage Duration						
0–4	6,687	15.5	10,204	5.3	0.768	1.987
5–9	9,024	20.9	26,540	13.9	0.892	1.483
10–14	8,271	19.2	35,709	18.7	1.025	1.363
15–14	6,802	15.8	36,913	19.3	1.122	1.269
20–24	5,598	13.0	34,767	18.2	1.168	1.189
25–29	3,891	9.0	26,050	13.7	1.140	1.048
30–34	2,908	6.7	20,645	10.8	1.117	0.959
Migration						
Born in Belfast	13,749	31.8	59,541	31.2	1.061	1.488
Born in Antrim or Down	15,655	36.3	71,749	37.6	1.004	1.398
Born in other places	13,777	31.9	59,538	31.2	0.959	1.404
Female Occupation						
No occupation	34,809	80.6	155,796	81.6	0.932	1.339
Spinners and Weavers	3,530	8.2	13,352	7.0	1.521	1.874
Other occupation	4,842	11.2	21,680	11.4	1.175	1.587

(*Continued*)

Table 3. (*Continued*)

Variable	Women		Children		Child Mortality Index	
	N	%	N	%	Mean	SD
Socio-Economic Status						
Managers and professionals	610	1.4	2,401	1.3	0.692	1.262
Clerical and sales	14,418	33.4	62,152	32.6	0.854	1.305
Skilled Workers	5,219	12.1	24,212	12.7	0.935	1.319
Farmers	154	0.4	754	0.4	0.769	1.192
Farm Workers	309	0.7	1,358	0.7	0.879	1.282
Lower Skilled Workers	4,645	10.8	20,490	10.7	1.000	1.418
Unskilled Workers	10,943	25.3	51,461	27.0	1.212	1.500
Not Available	6,883	15.9	28,000	14.7	1.104	1.617
Dispensary Districts						
Missing	1,343	3.1	5,758	3.0	0.976	1.467
Dock	1,586	3.7	7,487	3.9	1.237	1.549
Duncairn	5,499	12.7	24,142	12.7	0.938	1.363
Shankill	5,995	13.9	26,639	14.0	1.047	1.447
Workhouse	3,594	8.3	15,606	8.2	0.993	1.462
Millfield	2,001	4.6	9,049	4.7	1.273	1.57
College	3,590	8.3	14,793	7.8	0.82	1.316
Greencastle	189	0.4	788	0.4	0.686	1.177
Ligoniel	560	1.3	2476	1.3	1.002	1.43
Falls	2,285	5.3	10,426	5.5	0.991	1.357
Woodvale	3,302	7.6	15,481	8.1	1.071	1.443
Ravenhill	3,691	8.5	15,274	8.0	0.88	1.371
Newtownards	4,399	10.2	20,452	10.7	1.055	1.42
Ballyhackamore	2,647	6.1	11,135	5.8	0.704	1.17
Ballymaghan	18	0.0	66	0.0	0.421	0.736
Central	2,482	5.7	11,256	5.9	1.409	1.670
Total	43,181	100.0	190,828	100.0	1.008	1.430

Source: IPUMS (Ruggles et al. 2015).

We assess the effect of religion on the mortality index controlling for demographic factors and socioeconomic conditions at the individual and contextual levels. We construct five models:

1) A first "Basic" model assesses the effect of religion on child mortality controlling for the demographic determinants (age, squared age, children ever born, and MRD).
2) As the impact of religion on child mortality could be due to the concomitant effects of socioeconomic factors, we estimate a second "Individual" model including a set of individual controls such as female literacy, migration status, female occupational condition, and SES based on the husband's HISCLASS group. We also consider the spouse's religion, including a dummy variable for women with the same religion as the spouse.
3) In the third "Contextual" model, we control for the previous determinants in the "Individual" model but add a set of aggregate variables at the dispensary level:
   - the proportion of women working as spinners among the female population aged 15 to 64;
   - the relative size of a particular religious grouping within the dispensary district's population;
   - the diversity index measuring the degree of religious diversity ranging from 0 (no diversity) to 1 (complete diversity);
   - the mean of the Mortality Index by Preston and Haines (1991), to capture the general background mortality environment.
4) In a fourth "Fixed effects" model, we add to the Individual Model a further 15-category covariate referring to Dispensary Districts of residence.
5) The religious effects on child mortality could vary, depending not only on the mother's religion but that of her husband as well. He might or might not belong to the same religious denomination. So, we further estimate an "Interaction" model, referring to the husband's religion by adding an interaction term between the wife's religion and the husband's religion in the "Fixed Effects" model.

Descriptive results

Table 3 presents the number of married women and the mean value of the child mortality index by religion, husband's religion, literacy, migration, female occupation, socioeconomic status, and dispensary district. The table also shows the distribution of the children. These descriptive findings show:

- Protestants accounted for the majority of the mothers (76%), mirroring their share of the overall population of Belfast (74.2%). The proportion of Catholic women was 22.3%. The distribution of the children almost mirrors the mothers' percentages. On average, Catholics suffered higher child mortality compared to the other religious groups. Strikingly, the Jewish mortality index is almost 50% lower than the mean value of the entire sample. The Jewish group includes only 145 women, however. Looking at the mean of the child mortality index, the Church of Ireland registers the same value as the total population (1.008). Interestingly, Presbyterians, Methodists, and other

Protestants experienced lower child mortality levels as compared to Church of Ireland women.

- A mother that married a spouse from her own religious group (84.2%) registered a lower child mortality index.
- Illiterate mothers had the highest mortality index.
- Women born in Belfast suffered higher child mortality than females born elsewhere.
- Even if most married females did not work (80.6%), 19.4% had an occupation and constituted 8.2% of the total workforce in the textile sector. Looking at mothers' occupations, spinners registered the highest mortality index, whereas other mothers with no occupation had the lowest mortality level.
- We also used the HISCLASS classification for the husband's occupation. The table shows a clear social gradient in child mortality. At one end of the spectrum, professional and administrative workers registered the lowest index; at the other end, laborers had the highest mortality scores. A small number of women were married to agricultural labourers or farmers, living presumably on the edge of the city. These experienced one of the lowest incidences of child mortality, coming after Managers and Professionals in the ranking. Again, the mother's and the children's distributions slightly differ due to socioeconomic differences in reproductive behavior.
- With the exception of the dispensary district of Ballymaghan, which may be discounted as it held only 18 mothers fitting our criteria, child mortality varied widely between the dispensary districts. The index ranges from the minimum value in Greencastle (0.686) to a maximum in Central (1.409). This strongly suggests spatial inequalities along socioeconomic lines.

We further include in this analysis some continuous variables at the individual and the dispensary levels. As Table 4 shows, the average age of mothers in the sample was 37.6 years while the mean number of children ever born was 4.4. The mean reference date reveals that the mortality index refers on average to 7.7 years before the census year of 1911. The average values for the contextual covariates are as shown in the table.

Regression results

Here we briefly summarize the model results.

Table 5 shows the regression results from Basic, Individual, Contextual, and Fixed Effects models including religion as the main variable and progressively adding demographic, socioeconomic, and contextual variables. All these models confirm significant differences in child mortality between religious groups. While the significance levels remain almost the same, the size of the coefficients reduce slightly as we include further individual and contextual variables.

In the regression models, we take Presbyterians as the reference category. Focusing first on the Basic model, we find significantly higher child mortality among the members of the Church of Ireland compared to Presbyterians. This underlines the point that Protestants were not a homogenous social category. The

Table 4. Mean of individual and contextual variables in Belfast, 1911

	Mean
Individual variables	
Children Ever Born	4.42
Age	37.55
Mean Reference Date	7.72
Contextual variables	
Spinners and Weavers Proportion	0.208
Diversity Index	0.690
Relative group size	0.312

Source: IPUMS (Ruggles et al. 2015).

children of the Methodists register a slightly higher mortality than the reference category. Once again, the Jewish group is shown to have experienced a noticeably lower child mortality while Catholics experienced significantly higher mortality.

Comparing the Basic model with the Individual model, we can note that the correlation of child mortality with religion decreases when the individual control variables are included. It is clear that at least part of the mortality variation between religious groups arises from differences in literacy and socioeconomic status. The inclusion of dispensary district contextual variables further reduces the correlation with religion, revealing that some more limited role is also played by neighborhood features such as the proportion of female workers in the textile sectors, the relative group size, and the diversity index regarding the religious groups. We find similar results when using fixed effects at the dispensary level (see also Figure 1).

As expected from the Fixed effects model in Table 5 and Figure 2, Catholics, illiterate and working women, and spouses of labourers experienced significantly higher child mortality than the reference categories. Children born to mothers who were textile workers also suffered higher mortality than the reference group and significant differences between the dispensary districts are also confirmed (see also Figure 2).

The correlation between migration and child mortality was statistically significant in all the models presented in Table 5, as the children of the mothers born in Belfast experienced higher mortality, probably because a more rural environment was more conducive to health as compared to crowded city lanes and slums.

Looking at the Contextual model in Table 5, the proportion of spinners and weavers has a significant negative coefficient for child mortality. This is quite unexpected in view of the pronouncements of health authorities and medical practitioners. Though the adverse effects noted in individual cases are no doubt true, the prospects for infant survival may be benefiting from a higher standard of living due to higher family income. More religiously mixed communities (captured by the diversity index) are associated with higher child mortality. Conversely, the coefficient for the relative size of a religious group has a negative sign and is

Table 5. Weighted OLS regression of mortality index: Comparing basic, individual, contextual, and fixed effects models

	Basic		Individual		Contextual		Fixed effects	
	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t
Religion								
Presbyterian	Ref		Ref		Ref		Ref	
Church of Ireland	0.123	0.000	0.079	0.000	0.064	0.000	0.068	0.000
Methodist	0.034	0.005	0.045	0.000	0.023	0.092	0.044	0.000
Other Protestant	−0.017	0.145	−0.011	0.328	−0.026	0.056	−0.006	0.583
Catholic	0.319	0.000	0.209	0.000	0.182	0.000	0.199	0.000
Jewish	−0.410	0.000	−0.393	0.000	−0.446	0.000	−0.446	0.000
Other Religion	0.014	0.543	−0.061	0.012	−0.077	0.003	−0.050	0.037
Religion of Spouse								
Different Religion			Ref		Ref		Ref	
Same Religion as Spouse			−0.109	0.000	−0.109	0.000	−0.110	0.000
Literacy								
Illiterate			0.247	0.000	0.226	0.000	0.225	0.000
Literate			Ref		Ref		Ref	
Unknown			−0.001	0.974	−0.018	0.596	−0.014	0.677
Migration								
Born in other places			Ref		Ref		Ref	
Born in Antrim or Down			0.006	0.346	0.004	0.505	0.004	0.583
Born in Belfast			0.052	0.000	0.034	0.000	0.032	0.000
Female Occupation								
No occupation			Ref		Ref		Ref	
Other occupation			0.131	0.000	0.123	0.000	0.120	0.000
Spinners and Weavers			0.514	0.000	0.498	0.000	0.491	0.000
Husband's Occupation								
Managers and professionals			Ref		Ref		Ref	
Clerical and sales personnel			0.116	0.000	0.085	0.001	0.089	0.000
Skilled Workers			0.161	0.000	0.124	0.000	0.128	0.000
Farmers			−0.055	0.260	−0.058	0.233	−0.054	0.270
Farm workers			0.118	0.003	0.127	0.001	0.133	0.001
Lower Skilled Workers			0.211	0.000	0.165	0.000	0.170	0.000
Unskilled Workers			0.332	0.000	0.288	0.000	0.293	0.000
Not Available			0.169	0.000	0.134	0.000	0.141	0.000

(*Continued*)

Table 5. (*Continued*)

	Basic		Individual		Contextual		Fixed effects	
	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t
Variable at Dispensary Level								
Spinners and Weavers Proportion					−0,380	0.000		
Diversity Index					0.231	0.000		
Relative group size					−0.073	0.004		
Mortality Index					0.814	0.000		
Dispensary								
Missing							−0.084	0.000
Dock							0.036	0.019
Duncairn							−0.131	0.000
Shankill							Ref	
Workhouse							−0.083	0.000
Millfield							0.120	0.000
College							−0.160	0.000
Greencastle							−0.310	0.000
Ligoniel							−0.196	0.000
Falls							−0.208	0.000
Woodvale							−0.105	0.000
Ravenhill							−0.084	0.000
Newtownards							−0.035	0.001
Ballyhackamore							−0.243	0.000
Ballymaghan							−0.456	0.002
Central							0.086	0.000
Constant	1.406	0.000	1.041	0.000	0.167	0.021	1.114	0.000
Number of Cases	190,828		190,828		190,828		190,828	
R-Square	0.062		0.089		0.094		0.094	
Adj. R-Square	0.062		0.089		0.094		0.094	

Source: IPUMS (Ruggles et al. 2015).
Note: The models also include controls for age, squared age, mortality reference date, children ever born.

statistically significant. In other words, families and children embedded in a large body of coreligionists experienced lower mortality.

Table 6 reports two further models, including an interaction between woman's religion and husband's religion. Interestingly, the first interaction turns out to be significant. Thus, when a Catholic woman married a non-Catholic, child mortality

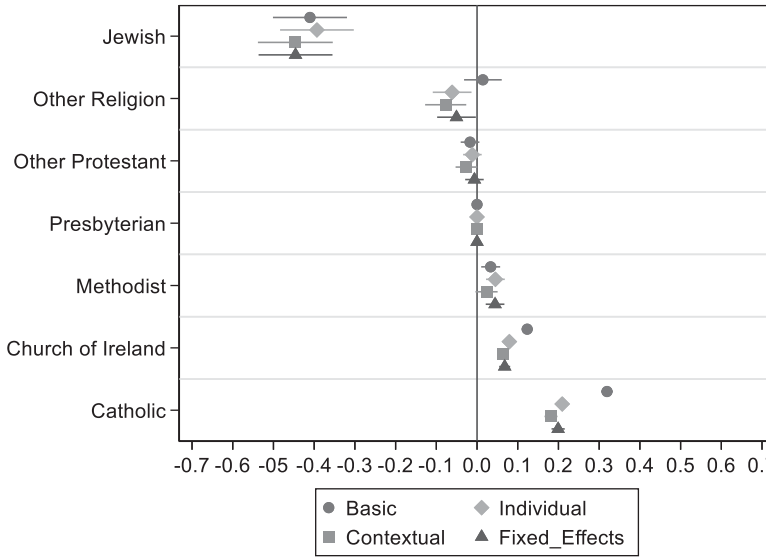

Figure 1. Estimated Effects of Religion on Child Mortality Index from Basic, Individual, Contextual and Fixed Effects Models (coefficients with 95% confidence interval).
Source: IPUMS (Ruggles et al. 2015).
Note: The Basic Model includes religion as a control variable and controls for age, squared age, mortality reference date, and children ever born. The Individual Model includes additional control variables such as religion of spouse, literacy, migration, female occupation, and husband's profession. The Contextual Model also controls for variables at the dispensary level, such as Spinners and Weavers Proportion, Diversity Index, Relative group size, and Mortality Index. Finally, the Fixed Effects Model also includes a control for dispensary districts (Table 5).

was higher. Other significant interactions in this model were found for the Church of Ireland. However, based on the same interaction coefficients, we can calculate the net effects to better interpret these results.

Table 7 shows the net effects calculated in the model that includes the interaction between the wife's and husband's religion in Table 6. Again, it is possible to see that the Catholic disadvantage was reduced when the Catholic mother married a spouse from within her own religious group. Women from a Church of Ireland background marrying men from another denomination risked a 0.011 mortality index increase with respect to the base category (Presbyterian mothers married to men with a different religious affiliation). As was the case for Catholics marrying a coreligionist, a reduction in the mortality index is shown where a Church of Ireland mother marries within her own denomination.

Conclusion

This study shows that religious affiliation is strongly associated with variations in infant and child mortality in Belfast around the turn of the twentieth century. This conclusion, which is in line with our expectations, rests on indirect estimation of mortality using an aggregate approach (Haines and Preston 1997), the descriptive findings, and the results of regression analysis. Catholics are confirmed (Ó Gráda 2004) as the most disadvantaged of the larger religious denominations. However,

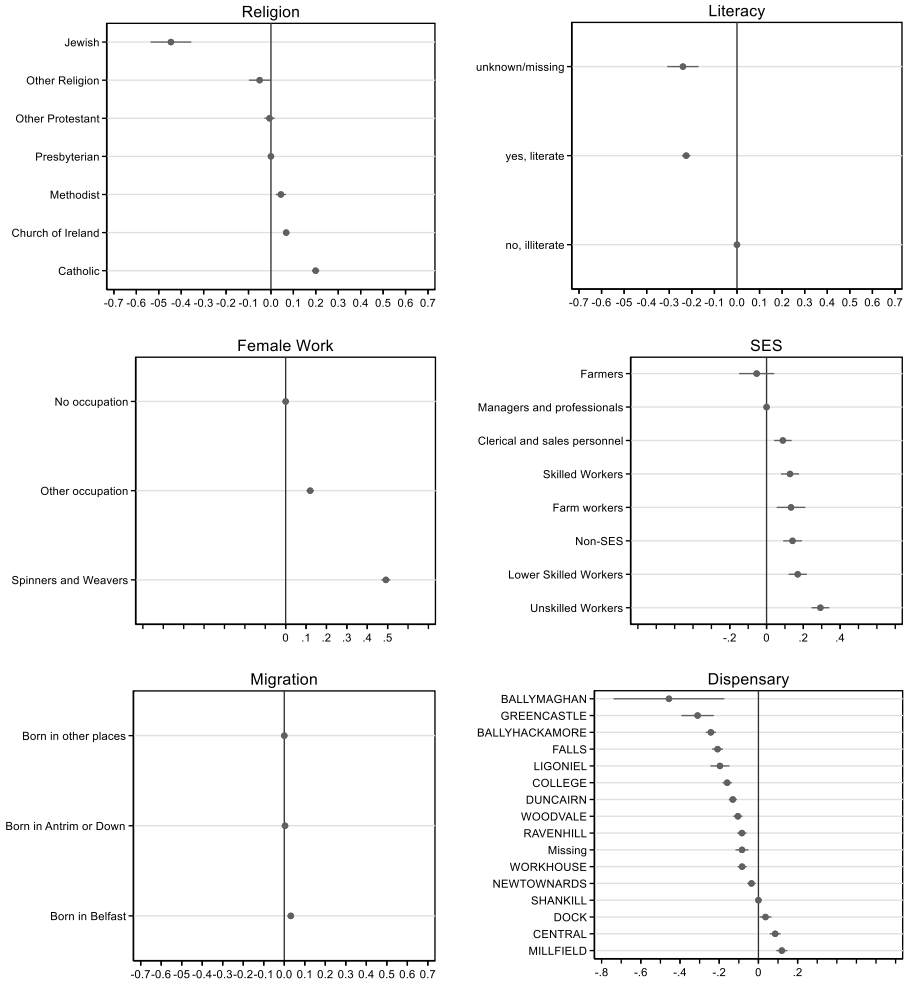

Figure 2. Estimated Effects of a set of covariates on Child Mortality Index from Fixed Effects Model (coefficients with 95% confidence interval).

Source: IPUMS (Ruggles et al. 2015).

Note: The Fixed Effects Model includes religion controlling for age, squared age, mortality reference date, and children ever born, literacy, migration, religion of spouse, female occupation, husband's profession, dispensary districts (see Table 5).

the Protestant population was not homogenous in terms of infant survivorship, and some interesting differences are confirmed (Ó Gráda 2004) between the various Protestant groupings. Members of the Church of Ireland suffered higher mortality than Presbyterians, for instance. These differences seem to be related to the different socioeconomic conditions of each religious group. We also show that other individual determinants, such as literacy and female occupational status, exerted an influence. The somewhat anomalous case is that of the Jews (Ó Gráda 2006), who were small in number and not particularly well off on average, yet their children experienced the lowest mortality.

Table 6. Weighted OLS regression of mortality index from interaction model

	Coef.	P>t
Religion		
Presbyterian	Ref.	
Church of Ireland	0.011	0.585
Methodist	0.090	0.009
Other Protestant	−0.059	0.053
Catholic	0.279	0.000
Jewish	−0.360	0.049
Other Religion	−0.119	0.001
Religion of Spouse		
Different Religion	Ref.	
Same Religion as Spouse	−0.110	0.000
Literacy		
Illiterate	0.223	0.000
Literate	Ref.	
Unknown	0.003	0.941
Migration		
Born in other places	Ref.	
Born in Antrim or Down	0.003	0.599
Born in Belfast	0.032	0.000
Female Occupation		
No occupation	Ref.	
Spinners and Weavers	0.488	0.000
Other occupation	0.120	0.000
Husband's Occupation		
Managers and professionals	Ref.	
Clerical and sales personnel	0.089	0.000
Skilled Workers	0.127	0.000
Farmers	−0.056	0.255
Farm workers	0.132	0.001
Lower Skilled Workers	0.169	0.000
Unskilled Workers	0.294	0.000
Not Available	0.134	0.000

(*Continued*)

Table 6. (*Continued*)

	Coef.	P>t
Dispensary		
Missing	−0.083	0.000
Dock	0.037	0.016
Duncairn	−0.129	0.000
Shankill	Ref.	
Workhouse	−0.083	0.000
Millfield	0.121	0.000
College	−0.158	0.000
Greencastle	−0.304	0.000
Ligoniel	−0.194	0.000
Falls	−0.202	0.000
Woodvale	−0.103	0.000
Ravenhill	−0.082	0.000
Newtownards	−0.034	0.002
Ballyhackamore	−0.243	0.000
Ballymaghan	−0.453	0.002
Central	0.093	0.000
Religion * Husband's Religion	0.066	0.002
Methodist*Same Religion	−0.051	0.163
Other Protestant*Same Religion	0.062	0.059
Catholic*Same Religion	−0.100	0.000
Jewish*Same Religion	−0.090	0.633
Other Religion*Same Religion	0.148	0.003
Constant	1.116	0.000
Number of Cases	190,828	
R-Square	0.095	
Adj. R-Square	0.094	

Source: IPUMS (Ruggles et al. 2015).
Note: The models also include controls for age, squared age, mortality reference date, children ever born.

In line with historical studies elsewhere, the findings for Belfast confirm that mothers in the textile sector suffered particularly badly (Cohen 1992; Tilly 1989). Their children experienced the highest mortality penalty. Because of their poverty (Armostrong 1951), many of these women were obliged to work until close to the end of pregnancy and again during the first weeks or months of the life of the newly born. Including the socioeconomic variables at the individual level decreases the

Table 7. Net effects from weighted OLS regression model with interaction between religion of women and religion of spouse

	Presbyterian	Church of Ireland	Methodist	Other Protestant	Catholic	Jewish	Other Religion
Religion of Spouse							
Different Religion	Ref.	0.011	0.090	−0.059	0.279	−0.360	−0.119
		(0.585)	(0.009)	(0.053)	(0.000)	(0.049)	(0.001)
Same Religion of Spouse	−0.110	−0.033	−0.071	−0.107	0.069	−0.560	−0.081
	(0.000)	(0.002)	(0.163)	(0.059)	(0.000)	(0.633)	(0.003)

Source: IPUMS (Ruggles et al. 2015).
Note: The interaction model includes an in interaction between religion of women and religion of spouse controlling for age, squared age, mortality reference date, children ever born, literacy, migration, female occupation, husband's occupation, and dispensary districts. P-values are reported in brackets.

strength of the relationship between religious affiliation and child mortality but does not eliminate it. It means that the observed socioeconomic characteristics only partially explain differences in child mortality. The district of residence also had a bearing on child mortality but, interestingly, did not reduce the religious impact. Having accounted for all kinds of confounding factors, it seems that religion, or perhaps religious culture, really did matter in its own right (e.g. Derosas 2003; McQuillan 1999; Ó Gráda 2008).

We were surprised to find that female in-migration was associated with lower child mortality by comparison with city-born women. As our cross-sectional data do not offer any information on the entire life migration experience (Garrett et al. 2010), we could only speculate that a possible explanation might be that many of these migrants, having grown up in the countryside, were healthier and sturdier than city-born women, especially compared to those brought up in slum areas of the city. Moreover, some of the older mothers may have married in a rural area and raised children there before moving to the urban-industrial setting of Belfast. For a more definitive conclusion on this issue, it would be necessary to link the current dataset to the Irish census for 1901. That would help to measure the neighborhood effect more precisely than our estimates based on the dispensary district of residence at the time of the census.

In future work, we intend to explore more fully the urban-industrial context of child mortality, though it is already clear that socioeconomic circumstances materially affected infant and child mortality. The temporal dimension is also important. For instance, there are limitations to the definition of the migrant as used in this cross-sectional view of life in the city. Linkages to the 1901 census would introduce a longitudinal dimension and help produce a more refined measure of the migrant experience.

We have also estimated the association between child mortality and other variables available at the district level, as gleaned from a variety of historical sources (e.g. Connor 2017). These contextual covariates included the proportion of women

who breastfed their children and the proportion of individuals living in a house with only one or two rooms. It turns out that variables of this kind had very little explanatory power and so, for the sake of brevity, these regression results are not shown here.

The implications of marriage across denominational lines are especially suggestive. Marrying a husband from the same religious group was associated with a lower mortality index compared to marriage with a spouse from a different religion. Mixed marriages gave rise to all kinds of tensions, something that is still the case in some circles in Northern Ireland (Fernihough et al. 2014), and could mean less support from the parents on one or other side of the marriage, or indeed both. The diminution or absence of family and kinfolk support could leave the mixed couple more vulnerable materially and psychologically. Thus, Catholic women with a husband of the same religion experienced lower child mortality as compared to those married to a non-Catholic husband. This result is also confirmed for the Church of Ireland. To conclude on a speculative note, it is also possible that Catholic and Church of Ireland women married downwards when they found a husband outside their own religious denomination, thereby entering on a lifetime of poorer social and economic conditions. This might be seen as a form of hypogamy. However, these are issues that need to be teased out more carefully through the medium of a linked sample of the 1901 and 1911 censuses.

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