The Sociological Study of Fertility and Mortality in Ipswich 1872-1881.

Introduction

The main aim of the pilot project was to establish the feasibility of linking data on marriages, births and deaths to analyse nuptiality, fertility and mortality in Ipswich during 1872-1881. This is seen as a prelude to a long-term study for the period 1872-1930, clarifying some of the major demographic and sociological trends during one of the classical fertility and mortality transition periods. The research created a family database from information contained in four major sources: 1. Vaccination registers based on civil birth registers. 2. copies of the civil death register made for the local medical officer of health. 3. Anglican marriage registers. 4. the computerised 1881 census of England & Wales.

In addition to the above demographic data, sociological information was collected on individual families as follows: i. father's occupation from the birth and marriage registers; and from the 1881 census ii. rateable values of birth addresses from local rates registers; iii. details of family economic activities as detailed in the census; iv. employment of domestic servants returned in the census; v. information on the use of private or public doctors in the vaccination registers. A social class classification was generated by using information on private / public doctors evaluated through information on rateable values and the employment of domestic servants.

The compilation of detailed information on individual families is seen as a way of enhancing our knowledge of major demographic and sociological historical trends. The research carries forward family reconstitution techniques into the nineteenth century, not usually considered possible because of growing secularisation/ non-conformity, and there is the additional bonus of having detailed census information for the period covered. Most current knowledge of demographic trends is based on aggregative data allowing only general statistical analysis, with large areas of uncertainty about the specific interactions between major variables such as fertility and mortality. Detailed data at the individual family level will allow a much greater understanding of the role of particular sociological and demographic factors. Although this pilot project is necessarily limited in scope, its detailed research methodology and provisional findings should point the way to a much more ambitious and long-term study, which will greatly enhance our understanding of the fertility and mortality transitions which took place at the end of the nineteenth and beginning of the twentieth century.

The methodology of the linking process

The initial aim of the linking process was to establish the fate, at the time of the census in 1881, of children listed in the vaccination birth register for the period April 1871 - April 1881. These children could have (i) died; (ii) survived in Ipswich to be reported in the 1881 census, or (iii) have moved away from Ipswich. Those who migrated and survived in England & Wales to census night in 1881 should be found in the census index with their place of birth given as Ipswich. Those who migrated and died outside the parish would be lost from observation to this study.

Anglican marriages taking place in Ipswich during the ten years were linked to children born to those marriages. The linkage techniques used were based on those developed for family reconstitution and census-to-census linking. Individuals were identified by nominal data, addresses, occupations and ages, and by any known relationships to others. While male individuals usually keep the same names, the names of women and some children must be allowed to change over time, and the same is true of information on addresses and occupations. The shorter the interval between any two events (whether marriages, births or deaths), the more hope there is of matching extra fields of information. Problems in recognising that two descriptions refer to the same person mostly arise in common surname sets, but some are a result of mistakes in the original reporting of the data or the subsequent transcription and processing. The principle was to make the strongest and most certain links first and thus remove those records from the pool of possible links. A strong link has the maximum amount of matching information and has no competition from other links to the records involved – known as a 1:1 link.

The data fields used for identification in the various data sets were:

1. Vaccination Record: child's date of birth, gender, forename, address, a parent's (usually the father's) forename, surname and occupation, child's date of death where the child died before vaccination.
2. Census (Ipswich): child's forename, surname, gender, age address and relationship to head of household.
3. Census (other): child's forename, surname, gender, parish, estimated year of birth from age statements.

4. Deaths: child's forename, surname, gender, address, age at death.

The string fields were standardised to combine alternative spellings and eliminate errors introduced on input. The addresses were difficult to standardise as there was a great variation in the extent of the detail that was given. Some were given with house number or name, court, lane and main street, whereas others might consist of just any one of these descriptors. As most of the children aged under 10 were living with their parents in the census, it was possible to infer their parents' names and occupations and attach these to the children's records. Many were also living with siblings that could be used for further identification.

The birth records were grouped into possible families by using the father's names. Families containing children with differing addresses or father's occupations were checked for impossible intergenesic spacing or alternating addresses and occupations which were considered as signs of an intermingling of several families. These were split into more probable groupings. By establishing sibling groups, stronger links could be made to the families in the census, even in those cases where the father was absent from the census household.

At each stage the initial run was made requiring matches in all possible fields, and then several re-runs were made dropping the requirement of a match for various fields in turn. Only links which had no competition from others were accepted and established so that the records were removed from further stages. Mismatches in names were only allowed after careful consideration. The margin of error allowed in age matches was roughly proportional to the age involved. Ages given in weeks or days were required to be within 2 days, whereas for ages over 5 years, matches were considered possible if the error was +- 2years.

The accuracy of the data collected and the linking process.

Given the complexity of the linkage process and the lack of full information on parents - in particular the absence of the mother's name in the vaccination birth register - it is important to evaluate the accuracy of the data collected and the linking of individual children to particular families. The computerisation of the 1881 census enables a check to be made on both the quality of the data on births and deaths, and the effectiveness of the linkage process. If the census, birth and death records are perfectly accurate and a correct allocation of individual children to particular families had taken place, there would be a perfect match between census and birth/death linkage schedules. This is subject to the caveat that is sometimes difficult to link illegitimate children to families formed by the subsequent marriage of mothers, as well as marriages being broken by death and re-formed by remarriage, and that this information is not always available using records of marriages, births and deaths in a particular town. However, the census often lists the original surnames of illegitimate children and stepchildren and this additional information invariably clarifies any anomalies in the linked marriage/birth/death records.

It was possible to establish the fate of the majority of children born in Ipswich: of 12670 births that were included in the birth registers between 06/04/1872 and 05/04/1880, 2681 of them (21.2%) were traced in the Ipswich death records, 7507 (59.3%) were located in the 1881 Ipswich census, 1209 (9.5%) were found in the census in areas outside of Ipswich, and 1273 (10.0%)were unaccounted for. We believe that the high proportion of children accounted for - 90 per cent of all births - represents a major achievement in the linking process. Of the children listed in the birth register and located in the 1881 census, 13.9 per cent (1309 out of 8716) were migrants living outside of Ipswich, a similar figure to the proportion of children enumerated in the census as born in Ipswich but living elsewhere - 16.9% (2077 of 12291). These figures suggest that 'stayers' - who form the basis of linked families - formed a large majority of all children born in the town.

Census information also allows any deficiencies in family linkage to be corrected, and adds an additional dimension to the effectiveness of the linkage process. Where the family was still resident in Ipswich, it is possible to assess the accuracy of the data and linking process by comparing families identified from birth and death records, with families enumerated in the census. An overall analysis of all families included in the research, suggests that the match between linked families and the enumeration of these families in the census was very high.

To further check the comparison of birth/ death family linkages with data on the same families in the census, a special study was carried out on a selected sample of all families with surnames beginning with the letter 'A' taken from the birth register. The linkages were established independently of the census and then compared to census entries traced in the 1881 census.. A total of 146 letter 'A' families linked and selected from the birth and death registers were located in the 1881 census of

Ipswich, of which there was a match of the number of expected children between linkage and census schedules in 134 families - 91.8 per cent of the total. There were minor variations in first names and surnames in these 134 cases, usually due to spelling errors, and there were some minor inaccuracies in age and birth dates, but overall the consistency of the data was of a very high order. Of the 12 'unmatched' cases, 9 were due to more children listed in the census than in the linkage schedules, and 3 due to more children in the birth register than in the census. In nearly all cases this was the result of one missing child in either the census or the linkage schedules. We were able to locate 7 missing births in the unmatched families through additional information in the census, and most of these appeared to have been illegitimate children or changed their names through the remarriage of their parents. Given the multiple reasons for possible mismatches - inaccuracies in the census, defects in the birth and death registers, problems in allocating individuals to the correct families - the high proportion of matches - nearly 92 per cent - is reassuring.

One of the reasons for the correct allocation of individual children to particular families, in spite of the absence of mother's name, is the relative stability of fathers' occupations and the addresses of families. 78% of fathers in letter A families had the same occupation listed in all birth records of their children, as against 47 % of repeated birth addresses. This relative stability allowed easier identification of family members, which along with the high accuracy of birth and death records, lays a secure basis for future research.

One additional way of checking the accuracy of the quality of our data is to analyse the pattern of same-naming amongst children. Families frequently gave the same name of a dead child to the next child of the same sex, and this enables us to analyse the accuracy of the registration of the death of the first child. Of 125 same-name children in the linkage schedules, the death of the first child was recorded in the death register in 120 cases - 96.0%. This percentage not only reflects the very high quality of the death registers, but the accuracy of the allocating children to particular families, providing a list of same-name children with the first child registered in the death register.

The social class classification of father's occupation.

One of the major variables relevant to the current project is social class. All social scientific work using socio-economic and social class categories faces the problem of how to construct a system of classification. Most historians have either used the method of classification created by Armstrong in his work on nineteenth century York, or have utilised the scheme devised by the Registrar-General at the beginning of the twentieth century for analysing fertility and mortality.

The problems of classification are well-known: local and historical variations might make any general scheme of classification inappropriate, and the difficulty of interpreting the meaning of ambiguous occupational descriptions. For example, in the vaccination birth registers two fathers were listed as builders, but one was returned in the census as a builder employing 112 men and 75 boys as well as two domestic servants, the other as a foreman builder without any employees. There is also the problem that the conventional Social Class 3 category normally includes over 50 per cent of all occupations, with only a small minority in Social Class 1 and 2, making statistical analysis difficult.

We have devised a scheme of classification for the present research which uses data included in the original source material. The vaccination birth register includes information on whether individual children were vaccinated by the public vaccinator, or were vaccinated by private family doctors. Private vaccination cost something of the order of five shillings per vaccination (this is a topic requiring further research), a significant sum for most people in the 1870s. The basis of the system of classification of occupations is to measure the number of private or public vaccinators used by particular occupational groups for the vaccination of their children, assuming that the ability to pay for private vaccination is a reflection of socio-economic status.

Father's occupations were classified into five categories: 1. Occupations where 0-20% of children's vaccinations were public. 2. 21-40% of public vaccinations. 3. 41-60%. 4. 61-80%. 5. 81-100%. This classification of occupations requires at least five individual birth entries and yields a similar result to that found in conventional social class classifications; for example professional occupations fall into social class 1, skilled manual occupations such as carpenters fall into social class 3, and unskilled occupations such as labourers and porters fall into social class 5.

The main occupations in each category are as follows: Social Class 1: accountant, clerk, commercial traveller, draper, grocer, innkeeper, merchant and professional occupations including clergymen, solicitors, doctors architects, surveyors and naval officers. Social Class 2: baker, cabinet maker, chemist, coach builder, printer, confectioner, engine fitter, grocer's assistant, hair dresser, market gardener, master mariner, engineer, plumber, pork butcher, schoolmaster, upholsterer and

watchmaker. Social Class 3: bookbinder, bootmaker, butcher, coachman, engine driver, gardener, carpenter, machinist, miller, ostler, police constable, army private, shoe clicker, stonemason, tailor, wheelwright and whitesmith. Social Class 4: blacksmith, bricklayer, boilermaker, coal carter, currier, groom, iron moulder, malster, mariner, painter, shipwright, shoemaker and shoe finisher. Social Class 5: brickmaker, cab driver, labourer, porter, farm labourer, hawker, and journeyman shoemaker.

There are a number of potential anomalies in the above classification: clerks and commercial travellers in social class 1 rather than 2, and some traders in social class 1 - drapers, grocers and innkeepers - and others in social classes 2 and 3 - bakers, butchers, chemists and confectioners. The advantage of the dataset on individual families is that it allows detailed exploration of these potential anomalies. Information was collected on the presence of domestic servants in social class 1 families enumerated in the 1881 census, as well as available rateable value data of birth addresses. Although the numbers are small, the following table gives some indication of the relative prosperity of the most important occupational groups in social class 1, as measured by their ability to employ domestic servants:

Table 1: Social class 1 occupations and domestic servants employed as enumerated in the 1881 census

Occupation	*Percentage of families with domestic servants*	*Number of families*
Professionals (Clergymen, doctors, solicitors, architects, surveyors and navy officers)	94.7%	38
Merchants and bankers	89.7%	29
Accountants	69.6%	23
Drapers	68.6%	32
Clerks	58.2%	91
Grocers	52.0%	50
Innkeepers/publicans	45.7%	35
Commercial travellers	25.8%	31

The high percentage of professional and merchant families employing domestic servants is not surprising , but the high proportion amongst drapers, clerks and grocers is less expected. Many clerks were described in the vaccination registers and census schedules as accountants, perhaps in part explaining their relatively high socio-economic status.

Ideally we would want to explore the relationship between all occupations and employment of domestic servants, particularly in social class 2, but limited time does not make this possible at this stage. However, it is possible to compare social class 1 families with other families in the letter A group. Of 404 social class 1 families found in the census, 224 - 55.4% - had domestic servants, compared to 2.4% - 3 out of 125 - in the non-social class 1 letter A families. A special study was also carried out on the families of bakers and butchers who might be expected to have had a measure of prosperity, but the percentage of bakers' families employing servants was only 18.6% - 11 out of 59 - and butchers 17.7% - 8 of 45. The difference in the employment of domestic servants by commercial travellers in social class 1 (25.8%) and bakers in social class 2 (18.6%) and butchers in social class 3 (17.7%) was therefore very marginal, but to some extent this is what we would expect with some occupational groups on the margins of the social class classification.

The following table summarises the data on social class and rateable value.

Table 2: Social class and rateable value of birth addresses, Ipswich 1872-1881.

Social Class	*Mean Rateable Value (£)*	*Number*
1	22.2	141
2	14.0	172
3	9.0	255
4	6.7	223
5	5.9	140

There is a linear trend of decreasing rateable values by social class, reducing from £22.2 in social class 1 to £5.9 in social class 5, confirming the general validity of the class classification. The mean rateable value of houses lived in by social class 1 families employing domestic servants was £30.6, compared to £14.1 for social class 1 families not employing servants, suggesting that a further sub-division of the social class gradient is valid.

There is a similar linear gradient between rateable value and the percentage of private doctors used by families: 16.2% of £2.75-£3.75 rateable value families used private doctors, compared to 86.6% of those living at addresses with rateable values in the £40-£175 band, and the percentages of private doctors ran evenly between these two extremes as rateable values increased.

It therefore appears that there is an interlocking relationship between rateable value, the use of private/ public doctors, the employment of domestic servants, and occupational group, providing the basis for a comprehensive system of classification of socio-economic status.

The data collected.

The following summarises the data collected in the pilot project:
Births: 15331 births from 3 sub-registration districts running from March 1871 to 6th April 1881. These were grouped into 7022 families: 3220 with 1 child only observed, 1448 with 2 children, 1049 with 3 children, 713 with 4 children, 390 with 5 children, 146 with 6 children, 40 with 7 children, 7 with 8 children, 3 with 9 children. The births for the period March 1871 to April 1872 were dropped from the research because of the incompleteness of births in one registration district.
Marriages: 1707 marriages from Anglican registers from 27-12-69 to 25-12-83.
Deaths: 10243 deaths from 01-01-1871 to 06-04-1881. These were deaths to persons of all ages; 2375 were of children aged less than 1 year, 1374 were of children aged 1-4 years and 310 were of children aged 5-9 years.

The research also had access to the 1881Census, which included the 1881 census of Ipswich, one copy of the data supplied by ESRC data archive and one copy as part of the Mormon data set, as well as the 1881 census of England and Wales as supplied by the Mormons. A lot more could be done with these data sets if time and computing space permitted – e.g.: mapping causes of death, social areas or 'neighbourhoods', looking at the households containing Ipswich born children elsewhere in the country.

For analysis of mortality we created a file which included all 12671 occurring births between 06-04-72 and 06-04-80, allowing us to follow 8 birth cohorts to at least their first birthday. This file contained data drawn from the other files, including a standardised cause of death for those children observed to die before 06-04-81 and the father's occupation at the birth of the first child classified by social class.

The analysis of infant and child mortality, and fertility change.

The vaccination birth registration data from Ipswich offer a rare insight into demographic events for nineteenth century England and Wales; access to the civil registers of births being strictly circumscribed at present. The copies of the civil death registers made for the local medical officer of health add greatly to the data from the vaccination registers of the same period, as they list all deaths occurring in the town, not just those of infants, or indeed of those infants dying before vaccination.

The ability to combine this 'flow' data with the 'stock' of population listed in the 1881 census adds extra richness to the data as the census date gives an 'end of observation' date which often lies well beyond the vaccination date, and is also independent of any demographic event. The ability to use the 'Mormon' CDs to locate children born in Ipswich in the relevant period, but no longer resident there on census night, adds further potential information on both the level and destination of flows of out-migration.

Numbers of children.

The 1881 census shows 49,464 individuals resident in Ipswich in 1881. (305 of these were resident in 'Shire Hall Yard' in central Ipswich but not noted in the 'Mormon census' as belonging to the town). The census also identifies the parishes of Ipswich as those of Saints: Margaret, Nicholas, Peter, Mathew, Mary at Elms, Mary Key or Quay, Mary Stoke, Mary at Tower, Clement, Helen, Stephen, Lawrence and again Shire Hall Yard. Using the street names listed in the census returns these have been mapped, but as the deaths and births were returned from sub-registration districts rather than parishes it has not yet been possible to map demography by parish although with a little more work on street indexes this should prove possible. When rateable values and occupational characteristics of the population are fully integrated into the database and combination with the address information we will be able to say a great deal about the interaction between the social geography and demography of the town.

Searching the 'Mormon' CDs for the 1881 census for all children born in 'IPSWICH' or its parishes in the period 1876 plus or minus 5 years, we find that: there were 10214 children born in Ipswich between 1871 and 1881 still resident in the town on census night 1881. There were also 1367 children of the same age living in Ipswich on census night who had not been born there. In addition there were 2077 children born in the parishes of Ipswich who were living elsewhere on census night 1881. (There may well have been more, we cannot be certain that all possible renditions of Ipswich as a birthplace were correctly identified). The 2077 children belonged to 1529 'households', either as single individuals or as members of a 'sibling group' identified as persons of the same surname resident in the same location listed in subsequent order. Of these 2077 'migrant children', 571 (37%) lived elsewhere in Suffolk, 244 (16%) lived in Essex, 174 (11%) lived in London, 108 (7%) lived in Surrey, and 84 (5%) lived in Kent. Surprisingly perhaps only 81 or 5% of the 'migrant households' from Ipswich were residing in neighbouring Norfolk, but this rural county was an area of population loss in the later nineteenth century and no doubt looked less attractive to migrants. The vast majority of migrant children were living with relatives: 1656 (80%) were children of the head of household and 146 (7%) as grandchildren.

According to the census returns of England and Wales at least 17% of the children born in Ipswich in the decade before the 1881 census were still alive, but living elsewhere on census night. This rose to virtually 25% amongst those born in the town in the early 1870s and fell to less than 10% in those born in the year before, as one might expect; there having been less time for the latter to move. The data suggests that Ipswich was a focus of in-migration over the decade: almost 600 more children moved into the town than moved out.

Data from the vaccination registers indicates that 41% of the children born were vaccinated when between 3 and 4 months old and 75% had had the procedure before they were 5 months old, but some children reached their first birthday without having been vaccinated. In all 9% of the children born died before they could be vaccinated. Of those dying in their first year 35%, on average, did so after vaccination, although the percentage fluctuated from cohort to cohort. Altering age at vaccination can provide headaches when attempting analysis on vaccination registers alone, where no further observation point is available. The current study linked the births to the census for places both inside and outside Ipswich, and thus could observe children surviving to 06.04.81, the date of the 1881 census.

For those children for whom we know no more details than provided by the vaccination register we have to say that they 'left observation' on the day of vaccination. For children who have younger siblings born in Ipswich we can say that the family are still resident there, and assume that the older is still present and therefore at risk of dying - the older child thus leaves observation on the date we last observe the youngest child in the family group.

To calculate mortality rates the date of birth was subtracted from the 'last date of observation', the resultant number of days was then divided by thirty and the integer taken to represent 'months in view'. A figure of 3 meant that a child was in observation when it was 90 days old, but had left it by the time it was 120 days (or 4 months) old. Those children for whom deaths were recorded had their date of birth subtracted from their date of death and the resultant figure altered to reflect 'month of death', in the same way. The number of deaths in month 3 could then be divided by the number of children alive at 90 days to calculate a mortality rate for children aged 3<4 months. (The number of children per 1000 alive at 90 days who had died before they reached 120 days) [This measurement could be refined e.g. by calculating it for days or weeks, or by dividing the number of deaths by the average of 'number in observation at 90 days by the number in observation at 120 days, but as an assessment exercise the method adopted should suffice.]

Mortality measures were calculated for birth parity - first, second and third birth - and each of the father's social classes, for illegitimate children, and for the three sub-registration districts (St. Cuthbert's, St. Margaret's and St Mathew's) from which data on births and deaths was gathered.

There is some evidence that historically parity influenced infant mortality levels, important for a longer-run study of the interaction of fertility and mortality. The following table summarises the relationship between parity and mortality within the first year of life:

Table 3: The relationship between parity and mortality within the first year of life

	1st Birth	2nd Birth	3rd Birth
Number Born	575	359	192
Sums Of Age Specific Mortality Rates			
Under 2 Months	52.7	39.3	31.4

2<9 Months	57.7	51.4	61.7
9<12 Months	19.3	22.4	41.7

The early months mortality shows the expected gradient with parity, with the first child suffering from greater mortality. The higher mortality for parity 3 children in the period after two months may be a function of small numbers or the result of shorter birth intervals (we are more likely to see three children born to a family if they had shorter birth intervals). It is also possible that higher mortality in parity three children, particularly between 9 to 12 months, was due to greater risk of infection from siblings. There is clearly a great deal more scope for investigation on parity and mortality, particularly if a longer time run of years was investigated covering the period of fertility transition.

A table was drawn up for mortality rates observed to model populations during the first five years of life and the data analysed by social class summarised as follows:

Table 4: Social class and infant & child mortality rates (per 1000) in Ipswich 1872-1880.

	Social Class					
Infant mortality Rate	1	2	3	4	5	Illegitimate
in 1st Year of life	119	145	151	146	137	280
Child mortality rate						
1< 5 years	65	95	129	126	122	170

[Numbers of births: class 1 = 1293; class 2 = 2062; class 3 = 2755; class 4 = 3145; class 5 = 2850; illegitimate = 411; total = 12670. Numbers at 1st birthday: class 1 = 875; class 2 = 1427; class 3 = 1866; class 4 = 2245; class 5 = 2128; illegitimate = 163; total = 8787.]

The most obvious feature of Table 4 is the extraordinarily high mortality experienced by illegitimate children. But the other interesting feature of the table is the uneven and relatively small social class gradient in the first year of life, which increases significantly for the subsequent age group 1 to 4 years. Another way of illustrating this is to express sums of age specific mortality rates in social class 1 as a proportion of social class 5

Table 5: Sums of age-specific mortality rates: social class 1 as a proportion of social class 5

Age Group	*Ratios Of Mortality Levels*
<2 Months	95.5%
2<9 Months	82.7%
9<12 Months	81.5%
12-18 Months	63.3%
18-24 Months	46.4%
24-36 Months	36.7%
36-48 Months	33.3%
48-60 Months	92.3%

In the fifth year, the social gradient is uneven, but the numbers are very small perhaps accounting for some of the fluctuation in that year. The gradient between social class 1 and social class 5 becomes particularly sharp after twelve months of life, and it is instructive to examine the causes of death by social class for the second year of life.

Table 6: Social class and mortality rates from selected causes in the second year of life

	Social Class						
	1	2	3	4	5	Illegitimate	Total
Bronchitis	5.7	8.4	13.4	16.9	11.7	6.1	12.2
Pneumonia	6.9	2.1	7.5	6.2	11.3	12.3	7.2
Infection*	4.6	19.6	31.1	23.6	12.0	27.3	18.4
Diarrhoea	0.0	5.6	7.5	5.8	10.8	12.3	6.9
Convulsions	14.9	14.0	15.0	19.6	9.9	24.5	15.1
Marasmus	3.4	3.5	7.0	6.7	10.3	36.8	7.5

[*Infection includes chickenpox, smallpox, roseola, measles, scarlet fever, diptheria and whooping cough.]

The causes of death have been standardised, and where multiple causes were given, the first cause listed has been used. Social Class 1 children were at much less risk of dying from bronchitis, infection, than other groups. They were one third as likely to die from marasmus as children of Social Class 5 father's and only one tenth as likely as illegitimate children to die from this cause for which the social gradient is unmistakable. Illegitimate children surprisingly did not suffer so much from bronchitis or infection as some of the other groups, but they were more prone to diarrhoea and convulsions. They seemed particularly susceptible to developmental and 'wasting diseases' suggesting poor, or unsatisfactory care as much as exposure to infective hazards.

Some of the relative rates arouse the suspicion that certain groups preferred to report a death as being due to one cause rather than another - could this explain the greater number of pneumonia, relative to bronchitis deaths, amongst class 1? Or could this be attributed to different medical diagnosis, or a different culture as to when the doctor ought to be called. [On Scottish medical certificates it is noted whether a doctor attended the death, if not we must assume the cause of death registered was as described by lay people either to a doctor or to the registrar. If this also went on in England there is great scope for differential reporting of cause of death amongst the classes.]

The lower mortality in social class 1 appears to be mainly due to an absence of deaths from diarrhoea and infection, particularly the latter. (The absence of deaths from diarrhoea might be due to the classification of diarrhoea under convulsions). Although speculative, it is possible that social class 1 had lower child mortality because of the ability to avoid infection, having the wealth to send their children away during periods of infection, as well as less overcrowding due to better housing. It also possible that better nutrition protected social class 1 children from the effects of infection, but this topic is beyond the scope of the present report.

There is little to choose between the three registration sub-districts, St Margaret's being marginally less likely to lose children between the ages of 2 and 9 months. The spatial aspect of mortality is one that might well reward further exploration as the 3 sub-districts divide Ipswich into a 3 wedge shaped sections, meeting in the town centre. In a town concentric social 'zones' (the poorest in the centre and the better off at the fringes) such division might result in a more equal social mix in each of the sub-districts. Small localities may show higher rates when these can be mapped. For example Fitzroy Street saw 107 births and 34 deaths (318 per 1000), in Woodhouse Street there were 192 births and 40 infant deaths (208 per 1000), and Curriers Lane had 133 births and 28 infant deaths (210 per 1000). The Union (Work)House had an infant mortality rate of 266 (124 births and 33 infant deaths). If we could group together streets of similar social mix/rateable value to obtain sufficient births to calculate reliable mortality rates it might be possible to discern 'hot spots' of particularly high mortality risk. St Cuthbert remains a very unhealthy place for two year olds, but for 4 year olds is exceptionally risk free. St Margaret has now overtaken St. Mathew as the 'healthiest' of the four sub-districts.

The records do allow a detailed examination of mortality, but any further study would benefit from a more detailed geographic breakdown, possibly a more detailed social classification plus a longer run of data to allow more cohorts to be followed to their 5th birthday and beyond. There is also considerable scope to examine adult mortality, an aspect which has not been pursued here.

The relative lack of a social class gradient in infant mortality during the first year of life is perhaps one of the most interesting findings of the present pilot research. There is evidence from the Open University's project on infant mortality that there was little or no social class gradient before the 1880s in any of the areas studied, but in Ipswich the gradient increased sharply between 1887 and 1911. Future research on the Ipswich records will allow clarification of this major historical shift in infant mortality, perhaps along with the decline in fertility one of the defining demographic transitions during the late nineteenth and early twentieth century.

Marriage

In order to consider a detailed study of fertility, including details of the interval between marriage and first birth, details of the parents' marriage, such as the date and the age of the parties are required. The marriages supplied came from the Anglican parishes of Ipswich, as Civil, Non-conformist and Catholic marriage registers were not available. According to the Registrar-General's figures, 46.2 per cent of all marriages in Ipswich during the period 1871-1881 were Anglican. In future work it will be necessary to purchase the non-Anglican marriage certificates in order to obtain full information on all marriages that took place in Ipswich.

Of the 1707 Anglican marriages transcribed for the project, 192 took place before the end of 1871. The listing of births in 1871 was not complete and therefore we could not be certain of locating the first birth to these marriages. In addition 444 took place after the end of 1878. In stopping at that date we allowed couples at least 2 years before the census to produce a child. Thus 1071 Anglican marriages took place between 01.01.72 and 31.12.78. Of these 1071, just 505 could be linked to the birth of one or more children occurring before 31.12.80. (An additional 196 marriages linked to families were identified but fell outside the 01.01.72 –31.12.78 period.) That fewer than half the marriages could be linked is not unusual in our experience as, of course some couples will never have children, some will have them but not until after 1881, and in many cases the couple will have moved away. Some indeed will have returned expressly to Ipswich just for the marriage. Brides in particular, finding husbands from elsewhere, seem more likely to return home to their parents parish for the marriage ceremony, before leaving Ipswich.

Of the 1072 Anglican marriages registered between 01.01.72 and 12.31.78, 201 (19%) involved widowed persons; in 94 cases (9%) a widower remarried, taking a spinster bride, in 47 cases (4%) a widow married a bachelor and in 60 cases (6%) both bride and groom had been previously married. Of the 405 marriages which were linked to 'families' only 12% involved widowed persons; 11 (2%) involved bachelors marrying widows and the same number involved widows and widowers intermarrying. 38 marriages where a widower married a spinster (7%) were subsequently observed to have children.

There were interesting social class differences in the first marriage ages of spinsters, as summarised in the following table.

Table 7: Social class and age at first marriage of spinsters in Ipswich,1872-1881

Social Class	*Mean Age At marriage*	*Number*
1	26.8	173
2	25.0	272
3	24.4	275
4	23.9	348
5	23.9	195

There was a difference of about three years in the average age at first marriage between women marrying men of social classes 1 and 5, which is what would be expected from known national patterns. There was a U-Shaped social class distribution of mean male first age at marriage: social class one 27.4 years, class two 26.2 years, class three 25.0 years, class four 26.2 years and class five 26.8 years. Only larger samples and more data would enable confirmation and further analysis of these patterns.

Fertility

The measurement of fertility is not easy from the data collected given the relatively short number of years for which data was gathered, but in particular because precise date of marriage data could only be collected for Anglican marriages. This resulted in fewer than one third of the transcribed marriages being used in analysis. It is likely that about three times as many marriages could have been included had non-conformist and Catholic marriage data been available, and linked to the data for births.

Of the 505 linked families, one was observed to have 6 children between the marriage date and 31.21.80 (2 years after the last marriage), 8 had 5 children in observation, 33 had 4 children, 63 had 3 children, 138 had 2 children and 171 had just 1 child in observation. The distribution of father's occupation at the birth of his first child (this point of classification has been adopted because the first observed birth of a child was the only common event to each of the 'families' identified) was as follows: Class 1: 41 cases; Class 2: 89, Class 3: 112, Class 4: 109; and Class 5: 66. (In one case the father's occupation could not be classified.)

Ideally we should observe all couples who are 'in observation' for, say, two years from their marriage and count how quickly a child was produced within that time. In practice the links mean that we observe only couples where children are produced. Thus the measures used can only be suggestive. We identified all marriages in our linked sample which produced a child in less than 240 days (8 months) after marriage, those which had a child before their first wedding anniversary and those which produced a child before their second wedding anniversary. All family groups where the mother only was given on any of the children's birth certificate, or where a child had been apparently born before

the parents' marriage were discounted. Table 8 shows the proportion of couples observed achieving their first birth at the relevant points within 2 years of marriage.

Table 8: Marriage to the first birth intervals amongst families with marriage and birth linked: Anglican marriages 1872-78

	Father's social class at birth of first child				
	1	2`	3	4	5
Cumulative percentage within					
%<240 days	13.0	32.3	37.8	34.7	37.5
%366 days	58.7	67.7	68.9	53.2	56.3
%<731 days	84.8	89.9	90.8	71.8	82.8
Average marriage - 1st birth interval (days)	507	360	376	504	625

It is plain that very few women who married class 1 men were pregnant on marriage. Roughly one third, or just over, of the brides observed in other classes were pregnant on marriage, and therefore had their baby within 240 days after the wedding. By their first wedding anniversary however almost 70 percent of the couples in classes 2 and 3 had had their first baby, but just under 60 percent of class I couples and fewer than 55% of classes 4 and 5 had done so. The slower pace of childbearing amongst class 1 is perhaps not surprising, but the fact that, despite similar levels of pre-nuptial pregnancy, Classes 4 and 5 had not been as fertile as Classes 2 and 3, gives pause for thought. Possibly brides in these two classes were more likely to suffer miscarriages or still births, or perhaps those who married before falling pregnant found it more difficult to conceive, or being less well off felt it prudent to wait awhile before conceiving.

The percentages in Table 8 can be rendered into 'average first birth interval' although it should be noted that these are all 'closed' birth intervals, and closed within 2 years. Class 2 had the shortest average birth interval at 360 days, followed closely by Class 3 at 376 days, Class 1 and Class 4 were very close at 507 days and 504 days (almost 17 months) while Class 5 was the longest at 625 days (virtually 21 months). These figures are tentative, and should be interpreted with considerable caution, but it is possible that the considerable differences in these birth intervals may be related to the relative lack of a social gradient in infant mortality. If Social Class 5 did indeed have longer birth intervals than Classes 2 and 3 then this may have offered some protection to the children at the bottom of the social ladder.

One further exercise was undertaken. All families having children in Ipswich from the 1872-1880 cohorts which could be traced to the census with the mother still alive, could be grouped by the mothers age at census (for simplicity they were allocated to 5 year age groups 20-54 - there were very small numbers of teenage married mothers), and then by father's social class. The number of children born to mothers was then summed and the result was divided by the numbers of mothers. The results are shown in Table 9.

Table 9: Relative fertility of mothers, by age group at 1881 census, and father's social class, Ipswich, children born to women

Mother's age at 1881 census	*Father's social class at birth of 1st child*				
	1	2	3	4	5
20	1.8	1.7	1.5	1.8	1.8
25	2.0	2.4	2.3	2.4	2.4
30	2.9	2.9	2.7	2.9	2.9
35	2.9	2.8	2.8	2.9	2.8
40	2.7	2.6	2.6	2.6	2.6
45	1.7	1.9	2.0	2.0	1.9
50	1.3	1.0	1.4	1.2	1.3

There are hardly any class differences in the number of children produced along any of the rows. The slightly lower fertility amongst Class 1 women in the late 20s may be a function of later age at marriage, or a slightly slower pace of child bearing after marriage, but in the other age groups this factor is unlikely to produce any differences and none can be discerned. It would appear that women of all classes were bearing children at roughly the same tempo - little sign of a fertility transition here.

Conclusion

Overall this pilot project has proven that it is possible to do successful record linkage of information on marriage, birth, death and census data on a town of 45000+ people. Data of high quality has been generated on mortality, nuptiality and fertility, enabling reliable conclusions to be reached on a number of topics covered by the pilot research. The cross-linking of information has enabled an evaluation of the quality of the data, as well as providing very detailed demographic and sociological information on individual families. Data was collected on 7022 families, with information on 15331 births, 10243 deaths and 1707 marriages.

The research has developed new methods of classifying occupations into social class categories, as well as generating a range of measures of socio-economic status using data on private/public doctors, rateable value and the employment of domestic servants. This extension of conventional social class analysis mirrors recent work by the Office of National Statistics, which has used a number of additional measures of socio-economic status such as house ownership in the analysis of contemporary mortality.

The length of the discussions of mortality, nuptiality and fertility are an indication of the relative strength of the register data available for Ipswich. The provisional conclusions to emerge from the pilot project are as follows: (1) There are strong associations between social class as defined by the use of private doctors, rateable value levels and the employment of domestic servants in individual families. (2) There was a relatively small social class gradient in infant mortality, particularly during the early months of life, but a more marked class gradient existed in the 1-4 year age group. (3) The social class/child mortality gradient appears to be related to specific causes of death, particularly patterns of infection possibly related to overcrowding and the ability to avoid infection. (4) There is some evidence that parity is related to infant mortality, particularly for the 9-12 months age group. (5) The research found a linear correlation between social class and first age at marriage of women, but a U-Shaped pattern between class and men's first age at marriage. (6) Nearly a third of Anglican marriages were associated with pre-marital conceptions amongst all social classes, except for social class 1 which had a significantly smaller percentage. (7) There appeared to be no association between social class and fertility levels within age groups, suggesting that the fertility transition had yet to take place in Ipswich in the 1870s.

If the 1870s could be joined to data for the next 50 years there would be considerable scope for following the fertility transition. We do however need to acknowledge the necessity of having census data also available over the intervening decades. Without such 'stock' data any of the analyses will be diminished as it is otherwise difficult to determine 'time in view'. The census also gives a basis for socio-spatial analysis which it is otherwise difficult to obtain. The above analysis has concentrated on child mortality. There is still considerable scope for the analysis of mortality patterns at older ages. but that for a truly successful analysis more years than were currently available would be advantageous.

Future research will not only be able to examine demographic variables, but will also enable the analysis of a range of sociological factors, including a number of measures of socio-economic status, religious affiliation (though marriage and cemetery registers), social mobility, patterns of geographical residence and the incidence and nature of family migration. The pilot research has shown that it is possible to generate data of very high quality and successfully link detailed demographic and sociological information at the individual family level. We believe that the outstanding quality of the research materials available and the success of the linking methodology used in the pilot project, have laid the foundations for a long-term study of nuptiality, fertility and mortality in Ipswich in the period 1872-1930. This will enable detailed analysis of the interactions of these variables at the individual family level, greatly enhancing our knowledge of the fertility and mortality transitions taking place at the end of the nineteenth and beginning of the twentieth centuries.