

ESRC Report: The Sociological Study Of Fertility And Mortality In Ipswich, 1872-1910 (Ref: R000239761).

BACKGROUND

It was not until the first years of the twentieth century that nationally infant mortality began a sustained decline, and while the role of the hot summers of the 1890s in maintaining high rates is now well documented, social and spatial variations at the local level, and their contribution to the lateness of the overall decline remain under-researched.[1] In recent work, on a selection of 53 census enumeration districts from the 1911 census of England and Wales, by Reid and Garrett *et al* it was demonstrated that 'environment'; the physical and social characteristics of a neighbourhood or district, had a greater impact on children's survival chances than did their social class, as defined by their father's occupation.

A second recent perspective on the underlying causes of morbidity and mortality has focused on the relationship between infant disease and subsequent adult mortality. Rose presented evidence in 1964 showing that the siblings of children dying in infancy suffered from higher rates of heart disease mortality in later life.[2] Subsequent work by Forsdahl, Buck & Simpson, Barker & Osmond, Leon & Davey Smith and others found an historical relationship between infant mortality rates and subsequent adult mortality rates from a number of diseases, including coronary heart disease, stroke, stomach cancer and diabetes.[3]

It has been widely assumed by the epidemiologists carrying out these studies that poverty and malnutrition were mainly responsible for the historical infant mortality rates quoted in their work. For example, Dorling and colleagues have recently found that the spatio-geographical distribution of poverty in London in 1896 correlates more strongly with adult disease mortality in London in 1991 than does the distribution of poverty in 1991.[4] Yet research at the Open University has indicated that there was little or no association between Booth's poverty map of the 1880s, and the incidence of infant mortality during that period.[5]

The latter finding is reflected in other research at the Open University on social class and infant mortality in the 1870s and 1880s, showing little or no correlation between class and mortality.[6] The pilot project carried out by the present applicants also demonstrated a minimal social class gradient in infant mortality in Ipswich in the 1870s.[7] There is evidence from a special study carried out at the Open University on infant mortality that the occupational gradient in infant mortality sharpened significantly during the 1880s onwards. The relationship between the social class infant mortality gradient and fertility changes is unknown, and these are central areas to be explored by the present research.

Unable to chart demographic events occurring to individual couples and their children, scholars studying the demography of the late nineteenth early twentieth century have relied for the most part on aggregate statistics published by the Registrar-General, on the published reports of the 1911 'Fertility Census' or on the demographic manipulation of 'point in time' census data. Although informative, each of these sources has major methodological drawbacks which means they provide an incomplete picture of events and do not allow the complex interplay of period and cohort variables to be fully explored.

OBJECTIVES

The project had five major objectives:

1. To create a detailed sociological and demographic database on individual families for the period 1871-1910 for the town of Ipswich by linking information from marriage, birth and death registers, and the 1871, 1881, 1891 and 1901 censuses.
2. To clarify the relationship between socio-economic status and fertility & mortality.
3. To illuminate the nature of the long-term transition in fertility and mortality that took place in Ipswich and in England between 1871 and 1910.
4. To analyse the relationship and interaction between fertility and mortality variables and how they changed over time.
5. To clarify the influence of local environment and geography on the structure of mortality, and to study patterns of geographical migration in the period between 1871 and 1910.

The first objective has largely been fulfilled, and the project has created a database which will provide a significant body of high-quality data of value to researchers for a number of years. The other four objectives have only been partly met, largely as a result of transcription problems in the first year of the project which delayed the collection of data and its eventual analysis. However, it was possible to carry out sufficient analysis to suggest certain provisional findings, which if confirmed, will significantly advance our understanding of the fertility and mortality transitions that took place in the period under consideration.

METHODS

The primary method employed in the research was nominal record linkage, linking data for individuals from census, birth and death records. Births are derived from vaccination registers which are copies of the civil birth registers, but they normally exclude information on mother's name, and include data on the names of vaccinating doctors and other additional details. The death registers were copies of the civil death register made for the local Medical Officer of Health, but again both excluding and adding information to the original civil register. Both sets of registers have been deposited in the Ipswich Record Office.

Each person enumerated in a census had been given a personal identifier (Pid) which is unique within that census and a household identifier (Sch) which is shared with others in the same household in that census. The initial digit of the Sch indicates the census to which it belongs (e.g. 7 for 1871). Linking was done by simple queries using matches between standardised fields and employing age consistency checks. The process used was similar in part to that being employed in a project using Scottish census and civil registration data and described in a forthcoming article,[8] although the more restricted content of the Ipswich birth and death registers made the linking more problematic and potentially less robust.

All nominative record linkage is vulnerable to the ever present competing risk of migration and in order to minimise this, the preliminary links are made between records close together in time.

Birth to infant death is the first type of link to be made. The vaccination register records the date of death for those children who were known to have died before being called in for vaccination, which makes linking these records a very simple first pass. Further links were found by requiring matches on the child's forename, surname and age at death and 'address' could be used for further discrimination where needed. After 1885 the death register records a child's parent, predominantly the father, so the links for deaths after that date could be based on the matching of two individuals in combination.

Child Deaths To The Preceding Census. Where possible, children in the census were assigned a 'mother's name' and a 'father's name'. The linking criteria were the same as above.

Other Deaths To The Preceding Census. After 1885 husbands are recorded for married women which allows links based on information for two individuals in combination.

Births To The Following Census. The births were grouped into families using the information given for the father. After 1881 details of the mother could often be extracted from the 'given to' data field (showing to whom the Notice of Vaccination had been given) and used in the family definition. These families are a construct that allows births with matching data, possibly a sequence of identical addresses, to be kept together even though that address might not match the one given in the later census. The survivors within the family units provide a signature age structure and name sequence that can be searched for in the subsequent censuses.

Census To Census. Similarly the information given in a census provides not just the basic fields used for identifying individuals such as names, age and birthplace, but also supplements this with extra information such as relatives' names, ages and occupations presenting a profile of the family structure that can be used to identify them in another context. Exploiting the additional information allows more confidence to be placed in the links made between the family sets and households in consecutive censuses. For example, an individual with a very common name combination who, when considered in isolation, is likely to have a plethora of possible links. Such an individual can be identified by means of a more unusual aspect of the family profile: one William Smith can be distinguished from all the others as the one whose younger brother is called Octavius or whose father was born in the United States.

The linking process is iterative and the first run will establish uncontested links where all data and relationships match perfectly. In the cases where there is a multiple set of possible links for a record, the occupations and addresses of those involved may be used to prefer one link over another. Much more time consuming are the following iterations. In these possible links are created where the data matches in all but one field. For example ages given in the two records are allowed to be inconsistent as this item of data is known to be error prone both in its reporting and transcription. Not only can surnames and forenames also be mis-spelled and mis-transcribed, but it has also become clear that individuals can use different combinations of their set of given forenames each time they appear in the records. By allowing for these inconsistencies

many more potential links can be found, but the latter have to be carefully monitored before they can be confirmed as true links. In this way the child that failed to link along with his siblings can be allowed to link despite a wildly incorrect age or even a name change from Charles E to Edward because of his relative position in the household. Similarly, women who have remarried may be recognised by the sets of children from their first marriages provided their children have kept their original surnames. With more time such links could be flagged to show any mismatch of information which had been deemed acceptable.

Once a link has been confirmed the Pid and Sch of an individual in the later census are inserted into the record of the same individual in the earlier census and vice versa. Similarly birth and death records have unique identifiers that are used to indicate links between these files and the appropriate census records. These are the keys to be used when joining the tables in the linked data bases.

The three elements of Table 1 below show that good rates of linkage have been achieved between demographic events and census entries.

Table 1: Rates Of Linkage Between Demographic Events And Census Entries.

A: Births.

<i>Births</i>	<i>Number Of Records</i>	<i>Linked To Death Before Next Census</i>	<i>Linked To Next Census</i>	<i>Percentage Accounted For</i>
2/4/1871 – 3/4/1881	15,294	3,075	9,290	80.8%
3/4/1881 – 5/4/1891	17,098	3,163	9,355	73.2%
5/4/1891 – 31/3/1901	17,764	3,488	11,094	82.1%
Total 2/4/1871– 31/3/1901	51,677	9,726	29,739	76.4%

B: Deaths.

<i>Period</i>	<i>Number Of Records</i>	<i>Deaths Linked To Births</i>	<i>Deaths Linked To Previous Census</i>	<i>Percentage Of All Deaths Accounted For</i>	<i>Number Of Deaths Under 1 Year</i>	<i>Number Of Deaths Under 1 Linked To Birth</i>	<i>Percentage Of Deaths Under 1 Linked To Birth</i>
2/4/1871– 3/4/1881	10,188	3,077	4,668	76.0%	2,375	2,084	87.7%
3/4/1881– 5/4/1891	10,354	3,229	4,704	76.6%	2,328	2,158	92.7%
5/4/1891– 31/3/1901	11,559	3,439	4,631	70.0%	2,789	2,567	92.0%
All 2/4/1871– 31/3/1901	32,101	9,745	14,003	74.0%	7,492	6,909	90.9%

C: Census Population.

<i>Period</i>	<i>Number Of Records</i>	<i>Number Linked To Next Census</i>	<i>Number Dead Before Next Census</i>	<i>Percentage Accounted For</i>
2/4/1871	42,711	21,174	4,683	60.5%
3/4/1881	50,341	21,459	4,704	52.0%
5/4/1891	56,974	27,283	4,631	56.0%
31/3/1901	66,638	-	-	-

Overall more than 75% of births have been linked to the subsequent census, or to a death occurring before that census (reasons for the relatively low rate of linkage from 1880s births to the 1891 census are being investigated). Linkage rates of deaths to the preceding census, or to a birth occurring since the census date are only slightly lower at 74% overall. As Table 1b shows, however, certain age groups are more easily traced than others; over 90% of all infant deaths can be matched to the corresponding birth.

When linking a census entry to a subsequent census, or to a death occurring in the intervening decade, the linkage rates in Table 1c indicate that further links may well be possible. Again, certain age groups and persons in particular life-cycle stages are more difficult to identify with confidence, especially in the absence of marriage information. Single young people living outside their family home can be difficult to trace between censuses, and the tendency for elderly people to exaggerate their age as they get older can result in multiple links which are time consuming to resolve, particularly if the person reporting a death is not certain of the age of the deceased.

The crosschecking required at each iteration of the linkage becomes increasingly time consuming and the returns on effort begin to diminish. Although solitary individuals are linked the linkage process does tend to favour 'well connected' individuals who experience demographic events; a widower living alone who reports his forename and age differently in consecutive censuses is much less likely to be recognised and linked than a widower with three children remaining at home who does the same. While this bias is unproblematic for many research questions it should be borne in mind when undertaking certain analyses.

The Evaluation Of The Quality Of The Database.

In order to evaluate the quality of the database, a special study has been carried out on a sample of cases selected both for this purpose, and to provide data for an early analysis of the results of the research. The first five hundred families were selected from both the 1871 and 1891 censuses, designated hereafter as the 1871 Ipswich Sample and the 1891 Ipswich Sample. The samples were selected using the following criteria: 1. Both husband and wife were alive at the date of the census. 2. At least one of the couple was alive in the following census. 3. That families either employed a domestic servant or were headed by a husband listed in the census as a labourer. The latter criteria were adopted in order to explore the impact of differences in socio-economic status. These samples are not necessarily representative of the total population, as they were probably drawn from different districts of the town in 1871 and 1891.

The first stage of data evaluation was to compare statements of birth in the 1901 census with the register of births compiled for the period 1891-1901. Of 557 sample births that took place in Ipswich according to the 1901 census between 1891 and 1901, 546 – 98.0% – were traced in the birth register. The very high proportion of matches between census and birth registers suggests a high level of reliability of both types of data.

Additionally, nominal record research of the sort involved in the Ipswich project, assumes that for families resident in Ipswich between censuses that all demographic events will take place during the intervening decade inside the town. In order to test this assumption, the birthplaces of children aged nine and under were analysed for the 1891 Ipswich sample. According to the 1901 census, there were 5 children born outside of Ipswich in families enumerated in Ipswich in both 1891 and 1901 – representing 0.9% of the 551 total number of births. This very low proportion of external births indicates that it is not a major problem for constructing data using nominal record linkage methodology amongst those moving out and then back into the town, although this figure would not include children born and dying outside of Ipswich.

In order to evaluate the reliability of adult death registration, a search was made for the deaths of husbands and wives who were listed either in the 1871 or 1891 census, but whose partners had subsequently become widows or widowers.

Table 2: Analysis Of Traced And Untraced Adult Deaths As Indicated By Widower/Widow Status In Subsequent Censuses, 1871 And 1891 Ipswich Samples.[9]

	<i>Traced Deaths</i>	<i>Untraced Deaths</i>	<i>Total Deaths</i>	<i>% Untraced</i>
1871 Sample Total	108	8	116	7.4%
1891 Sample Total	93	14	107	13.1%

The proportion of untraced deaths rose from 7.4% in the 1870s to 13.1% in the 1890s. At this stage it is not clear what the reasons are for the higher proportion of untraced cases in the later decade. It is not critical for the research, partly because of the relatively low proportions of untraced cases, but also because it is possible to allow for death under-registration by including the known number of widower/widow deaths in calculations of mortality.

One reason for untraced cases is the difficulty of accurately capturing information on names in census and registration documents, due to inaccuracies in recording and transcribing information. Handwriting in nineteenth century documents can sometimes be very difficult to decipher. These difficulties are illustrated by an analysis of changes in surname spelling in families linked in the 1871 and 1881 censuses. In the 1871 Ipswich sample there were 63 families with different surname spellings in the two censuses, as against 334 with the same spelling. These 63 cases represent a total of 15.9% of the total – 63 out of 397. The majority of the spelling variations were minor, and did not pose a major problem for the linkage of data. However, more difficult to evaluate at this stage, is the number of links which weren't made because the rendition of the surnames in different sources were so different that they were not recognised as the same name.

It is possible to trace these variations because of the large amount of contextual information on surname, names of children, address, age and occupation. It

is this information which has provided the basis of many of the successful links, in spite of variations in information on particular items.

This can be illustrated with reference to age variations. A comparison of the returned ages in the 1891 and 1901 censuses in the 1891 Ipswich sample yields the following result. Of a total of 881 cases examined, there was an exact match in 465 (52.8%), a difference of plus or minus one year in 230 (26.1%), and a variation in plus or minus two years or more in 186 (21.1%). Thus 79 per cent were accurate to within plus or minus one year, a reasonable proportion for data of this kind. However, some of the age variations within the plus or minus two year or more category were very large, and for future analysis an attempt will be made to estimate correct age from the multiple sources available.

Finally, an assessment was made of the accuracy of death registration by examining the registration of deaths for same-name cases. The same name of a dead child in the late nineteenth century was often given to a subsequent child of the same sex, allowing the measurement of the reliability of death registration through analysing the proportion of first same-name children traced in the death registers. Two of seventeen same-name children could not be located in the death register in the 1870s, and the equivalent figure for the 1890s was one out of twelve cases. The total for both samples was three out of twenty-nine same name cases not traced in the death register – 10 per cent of the total. This is perhaps not dissimilar to the proportion of missing adult deaths found in Table 2, but larger samples will be required before confident conclusions can be reached about the quality of death registration.

RESULTS

Classification Of Socio-Economic Status.

In order to illustrate the analytical possibilities of the dataset, a detailed analysis was carried out on the two samples drawn from the 1871 and 1891 censuses. These samples were chosen so as to allow an examination of the role of socio-economic status, although any findings must be subject to the caveat that the samples are not necessarily representative of the total population. In our earlier report on the pilot project covering the years 1871-81, we found little evidence of an influence of social class on fertility and infant mortality, but a measurable impact on child mortality.[10]

However, the measures of social class in the pilot project were not entirely satisfactory, due mainly to the ambiguous and difficult nature of classifying class on the basis of occupation. This difficulty has been well recognized, illustrated by the Registrar-General's allocation of clerks to the Social Class 1 category in the first attempt to classify occupational social class in the 1911 Census, subsequently relegated to Social Class 2 and Social Class 3 in later censuses. There is also the problem that about half of all occupations were allocated to Social Class 3, which precluded a precise and focused analysis of socio-economic differences.

In the pilot project report we attempted to deal with this problem by using external and objective measures – rateable value of addresses and the proportion of public/private doctors used for vaccination – but this still left a range of uncertainty and ambiguity. In the present report, information on the employment of domestic servants was available for individual families – a measure of socio-economic status used by contemporaries such as Seebohm Rowntree [11] – and we have used this data to establish socio-economic categories. We have contrasted families employing

domestic servants – which we have termed elite families – with those headed by labourers, a well-defined group known to have been one of the poorest and least educated in late nineteenth century England.[12]

We classified the elite group into two categories: 1. Families with two or more resident domestic servants (SEG1). 2. Families with only one domestic servant (SEG2). To give some idea of the nature of these categories, we list below the main occupations followed by the elite male heads of household enumerated in the two censuses combined.

Table 3: Occupations Of Head Of Households In SEG1 And SEG2 Families, 1871 and 1891 Ipswich Samples.

<i>SEG1 Occupations</i>	<i>Number Of Cases</i>
Attorney & Solicitor	10
Doctors & Surgeons	13
Hotel/ Innkeepers	13
Manufacturers	8
Merchants	23
Others	62
Total	132
<i>SEG2 Occupations</i>	<i>Number Of Cases</i>
Attorney & Solicitor	5
Baker & Confectioner	8
Builders	6
Butchers	16
Clerks	31
Commercial Travellers	19
Drapers & Tailors	19
Grocers	10
Independent/ Property Owners	6
Manufacturers	17
Merchants	16
Musicians/Piano Tuners	5
Printers	6
Others	180
Total	344

Socio-Economic Group 1 (SEG1) was mainly made up of professionals and business occupations, whereas although Group 2 (SEG2) included some of these occupations, it was mainly made up of clerks, commercial travellers, artisans and tradesmen. SEG1 appears to have been significantly more stable in its status characteristics than SEG2, as revealed in the following table.

Table 4: Continuities In The Employment Of Servants In Families, Ipswich 1871 And 1891 Samples.

<i>SEG 1 Families 1871</i>				<i>SEG 2 Families 1871</i>			
No Servants In 1881	1 Servant In 1881	2+ Servants In 1881	Total	No Servants In 1881	1 Servant In 1881	2+ Servants In 1881	Total
5 (6.7%)	13 (17.3%)	57 (76.0%)	75	73 (42.4%)	80 (46.5%)	19 (11.0%)	172
<i>SEG 1 Families In 1891</i>				<i>SEG 2 Families In 1891</i>			
No Servants In 1901	1 Servant In 1901	2+ Servants In 1901	Total	No Servants In 1901	1 Servant In 1901	2+ Servants In 1901	Total
6 (10.5%)	16 (28.0%)	35 (61.4%)	57	96 (55.8%)	61 (35.5%)	15 (8.7%)	172

Only between 6.7 and 10.5 per cent of SEG1 families had no servants ten years after they were initially enumerated, whereas the equivalent figure for SEG2 families was 42.4 to 55.8 per cent. Many of the SEG2 families without servants in subsequent censuses appear to have been artisans and tradesmen rather than professional or business people, suggesting that a more refined classification of socio-economic status will be possible in future by combining information on servants at different stages in the life cycle.

Although there were differences in the continuity of employment of servants between SEG1 and SEG2, they appear to have shared rather than differed in other socio-economic characteristics. We showed in the pilot project report that employment of public/ private vaccinators was linked to social class, as well as other measures such as rateable value. (The names of doctors used in vaccination are listed in the vaccination register, including that of the public vaccinator). The following table analyses the use of public/private vaccinators in elite compared to labourers' families in the 1871 sample, with the latter divided between non-agricultural labourers (SEG3) and agricultural labourers (SEG4).

Table 5: Private/ Public Vaccinators Used By Families 1871-81, Ipswich 1871 Sample Analysed By Socio-Economic Group

Socio-Economic Group	All Vaccinations Private	Mixed Private/ Public Vaccinations	All Vaccinations Public	Total Number Of Families
1	21 (78%)	2 (7%)	4(15%)	27
2	58 (78%)	8 (11%)	8 (11%)	74
3	6 (8%)	9 (12%)	62 (81%)	77
4	1 (6%)	1 (6%)	14 (88%)	16
1 & 2	79 (78%)	10 (10%)	12 (12%)	103
3 & 4	7 (8%)	10 (11%)	76 (85%)	89

Although the numbers are small, the table indicates that SEG1 and SEG2 both employed the same number of private doctors for the vaccination of their children – 78 per cent – compared to the 8 to 6 per cent used by SEG 3 and SEG4.

Finally, a fragment of evidence on living in the local workhouse ten years after first census enumeration, illustrates the poverty of labourers' families compared to those employing domestic servants: none of the latter group finished up as paupers, whereas six husbands and wives of labourers from the 1871 sample suffered that fate, and four from the 1891 sample experienced a similar fall into absolute poverty.

The Relationship Between Socio-Economic Status And Patterns Of Residence, Fertility And Mortality.

A study was carried out of the residential stability of elite and labourers' families contained in the complete database, preparatory to an analysis of their fertility and mortality patterns in the specially selected samples.[13]

Table 6: Disappearance Of Families In Ipswich Between 1871 And 1881.

<i>Elite Families</i>			<i>Labourers Families</i>		
Numbers Resident In 1871	Both Husbands & Wives Absent In 1881	Proportion Disappearing	Numbers Resident In 1871	Both Husbands & Wives Absent In 1881	Proportion Disappearing
1158	218	18.8%	648	112	17.3%

Slightly more elite than labourers' families – 18.8 per cent as against 17.3 per cent – disappeared from Ipswich between 1871 and 1881, suggesting that socio-economic status did not significantly influence patterns of external migration at least in these two groups. Other groups may have been more mobile, and this can only be established through further research on the database. The linking of data in the project was mainly carried out on non-migrant families, and the relatively low amount of movement out of Ipswich, and the absence of an association between socio-economic status and migration, suggests that migration does not pose a major problem for nominal record linkage for individual decades, although cumulative migration could constitute a much more serious problem. An analysis was also carried out on stability of street residence, in order to clarify identifying patterns of address and variations in disease environment.

Table 7: Changes In Street Residence Between 1871 and 1881, Ipswich 1871 Sample By Socio-Economic Group (Numbers With Percentages In Brackets)

<i>Socio-Economic Category</i>	<i>Same Street Address</i>	<i>Different Street Address</i>	<i>Total Number Of Families</i>
1	39 (53%)	34 (47%)	73
2	74 (43%)	99 (57%)	173
3	77 (38%)	126 (62%)	203
4	12 (32%)	25 (68%)	37

Table 7 indicates that the higher the socio-economic status, the greater degree of residential stability. Elite families moved less frequently than labourers' families, and were exposed to fewer residential disease environments in the 1870s.

This difference of disease environment appears to have had little influence on patterns of mortality during this period. There was little socio-economic variation in adult mortality in the sample selected from the 1871 census, but this appears to have changed in the sample derived from the 1891 census.[14]

Table 8: Adult Mortality In 1871 And 1891 Ipswich Sample Families (Husband & Wife), 1871-81 and 1891-1901.

Period	Age Group	Elite Husbands & Wives			Labourers Husbands & Wives		
		Number At Risk	Number Of Deaths	% Mortality	Number At Risk	Number Of Deaths	% Mortality
1871-1881	20-44	297	19	6.4%	302	24	7.9%
	45-69	195	34	17.4%	184	31	16.8%
	Total	492	53	10.8%	486	55	11.3%
1891-1901	20-44	284	17	6.0%	356	30	8.4%
	45-69	169	20	11.8%	175	31	17.7%
	Total	453	37	8.2%	536	61	11.4%

Table 8 was compiled by tracking husbands and wives between censuses, and was restricted to couples where at least one of them was still present and alive in Ipswich ten years later. The figures are not therefore 'true' mortality rates as they exclude husbands and wives who had both died between censuses. Also, the age groups are very broad as a result of the relatively small sample sizes, and the growth of a socio-economic gradient in adult mortality at the end of the nineteenth century will have to be assessed in detail through further research on the database.

There is only limited data currently available on socio-economic status and fertility, but the evidence suggests that again significant changes took place in the last three decades of the nineteenth century. The following table summarizes data on the fertility of sample mothers listed in the 1871 and 1891 censuses, and enumerated in the following decadal census.

Table 9: Mean Number Of Children Born Between Censuses By Enumerated Age And Socio-Economic Group, 1871 And 1891 Ipswich Samples (Number Of Mothers In Brackets).[15]

<i>Period</i>	<i>Age Group</i>	<i>SEG 1</i>	<i>SEG 2</i>	<i>SEG 1 & 2</i>	<i>SEG 3</i>	<i>SEG 4</i>	<i>SEG 3 & 4</i>
<i>1871-1881</i>	20-24	5.5 (4)	5.1 (8)	5.3 (12)	3.9 (15)	3.3 (3)	3.8 (18)
	25-29	4.8 (9)	3.1 (27)	3.6 (36)	2.9 (25)	3.7 (3)	2.9 (28)
	30-34	3.5 (8)	2.7 (23)	2.9 (31)	1.7 (29)	2.3 (3)	1.8 (32)
	35-39	1.4 (11)	1.2 (26)	1.2 (37)	1.3 (24)	0.8 (12)	1.2 (36)
	40-44	0 (10)	0.2 (19)	0.1 (29)	0.3 (22)	0.5 (2)	0.3 (24)
	Total	2.6 (42)	2.1 (103)	2.3 (145)	1.9 (115)	1.7 (23)	1.9 (138)
<i>1891-1901</i>	20-24	2.8 (5)	2.6 (7)	2.7 (12)	3.7 (12)	4.0 (1)	3.7 (13)
	25-29	2.0 (5)	2.5 (15)	2.4 (20)	2.9 (38)	5.7 (3)	3.1 (41)
	30-34	2.0 (13)	1.5 (32)	1.6 (45)	2.4 (37)	2.0 (3)	2.3 (40)
	35-39	0.7 (6)	1.0 (23)	0.9 (29)	1.8 (34)	3.0 (2)	1.8 (36)
	40-44	0.2 (12)	0.2 (17)	0.2 (29)	0.4 (27)	1.0 (2)	0.4 (29)
	Total	1.4 (41)	1.4 (94)	1.4 (135)	2.1 (148)	3.2 (11)	2.2 (159)

Although the sample sizes are small, Table 9 indicates that fertility was higher amongst elite than labourers' families in the 1870s, a difference that had reversed by the 1890s. In the period 1871-81 the mean number of children born to elite families (SEG1 and SEG2) was 2.3 children, an average that had fallen to 1.4 by 1891-1901. The equivalent figures for labourers' families (SEG3 and SEG 4) were 1.9 children in 1871-81, increasing slightly to 2.1 by 1891-1901. This evidence reveals previously unexplored patterns of fertility – for example, that labourers were having children far more slowly than the elite in 1871-81, but not in 1891-1901. However, these patterns will have to be examined in much greater detail through an analysis of the whole database, where information is available on much larger samples.[16]

The pattern of association between socio-economic status and child mortality appears to have been similar to that of adult mortality in Ipswich at the end of the nineteenth century. The following table summarizes evidence based on the tracking of births in the two decades under observation, and is based on families present in both censuses at the beginning and end of the decade.

Table 10: Cohort Infant And Child Mortality In The 1871 And 1891 Ipswich Samples, 1871-1881 & 1891-1901.[17]

<i>Period</i>	<i>Age (Years)</i>	<i>Elite Families</i>			<i>Labourers Families</i>		
		<i>Number At Risk</i>	<i>Number Dying</i>	<i>Proportion Dying</i>	<i>Number At Risk</i>	<i>Number Dying</i>	<i>Proportion Dying</i>
<i>1871-1881</i>							
	0	343	48	14.0%	267	30	11.2%
	1-4	206	13	6.3%	159	15	9.4%
<i>1891-1901</i>							
	0	193	19	9.8%	349	40	11.5%
	1-4	157	4	2.5%	262	23	8.8%

There was little variation in overall mortality in children aged 0-4 between the different socio-economic groups in the 1870s, but a strong gradient had emerged by the end of century. Infant mortality was higher in the elite than the labourers group in 1871-81, perhaps compensated by slightly lower child mortality in the 1-4 age category, although cumulative mortality between birth and aged four was very similar in the two groups. There was subsequently a significant fall in both infant and child mortality in elite families, but virtually no change in these forms of mortality amongst labourers in the period between the 1870s and 1890s.

We found in our pilot research little association between social class and infant mortality in the period 1871-81, but a significant class gradient in child mortality for the age group 1-4 years. This discrepancy in findings may be partly a function of using socio-economic status in our current analysis and social class in the earlier research, as well as differences in sample sizes.

Information on cause of death helps clarify the patterns of mortality amongst elite and labourers' families, although the classification of cause of death is subject to ambiguity and uncertainty.

Table 11: Cause Of Infant Death In Elite And Labourers Families,1871 And 1891 Ipswich Samples.

Cause Of Death In Infants Dying Under One Year	Elite Families		Labourers Families	
	Number Of Deaths (Deaths As A Proportion Of Total Births In Brackets)		Number Of Deaths (Deaths As A Proportion Of Total Births In Brackets)	
	Period	Period	Period	Period
	1871-81	1891-1901	1871-81	1891-1901
Asthenia	2 (1.4%)	0 (0%)	3 (2.2%)	0 (0%)
Atrophy	2 (1.4%)	0 (0%)	1 (0.7%)	0 (0%)
Bronchitis	2 (1.4%)	1 (0.7%)	1 (0.7%)	7 (4.4%)
Convulsions	2 (1.4%)	1 (0.7%)	1 (0.7%)	6 (3.8%)
Debility	14 (9.7%)	2 (1.5%)	2 (1.5%)	0 (0%)
Diarrhoea	6 (4.1%)	6 (4.4%)	3 (2.2%)	8 (5.0%)
Marasmus	1 (0.7%)	0 (0%)	3 (2.2%)	7 (4.4%)
Measles	1 (0.7%)	0 (0%)	1 (0.7%)	0 (0%)
Mouth And Throat	3 (2.1%)	0 (0%)	0 (0%)	0 (0%)
Pneumonia	3 (2.1%)	3 (2.2%)	5 (3.6%)	3 (1.9%)
Premature Birth	2 (1.4%)	2 (1.5%)	5 (3.6%)	2 (1.3%)
Respiratory	3 (2.1%)	0 (0%)	1 (0.7%)	0 (0%)
Syphilis	0 (0%)	0 (0%)	1 (0.7%)	1 (0.6%)
Tuberculosis	0 (0%)	1 (0.7%)	0 (0%)	2 (1.3%)
Whooping Cough	3 (2.1%)	2 (1.5%)	0 (0%)	3 (1.9%)
All Others	4 (2.8%)	1 (0.7%)	3 (2.2%)	2 (1.3%)
Total Births	145	135	138	159

A large part of the decline in infant mortality amongst elite families appears to have been linked to a reduction in deaths due to debility, much which occurred during the neonatal period. This may have possibly been associated with a decline in fertility and an increase in breastfeeding in middle class families. However, diarrhoea continued to be an important cause of death amongst elite families in the 1890s. Labourers' families appear to have suffered from an increase in the incidence of bronchitis, convulsions (probably related to diarrhoea), diarrhoea, marasmus and whooping cough.

Mortality amongst servant-keeping families probably also declined amongst children aged 1-4 as well as amongst adults, and fragments of evidence suggest that much of the latter decline was due to a reduction in deaths from respiratory diseases, tuberculosis, pneumonia and bronchitis. However, only much larger samples will allow confident conclusions about changing disease patterns among the different socio-economic groups.

ACTIVITIES

The early findings from the research have been incorporated into two forthcoming articles: 1. "The hazards of wealth: adult mortality in England before the twentieth century", *Social History of Medicine* (By Peter Razzell and Christine Spence, Forthcoming 2006). 2. "Population, Poverty and Wealth: The History of Mortality and

Fertility in England, 1550-1900.”, in Peter Razzell, *Essays in English Historical Demography* (Forthcoming 2006). There are also a number of articles planned on socio-economic status, geographical environment, fertility and mortality to be published in 2007, as well as a book to be published in 2008.

Some of the early findings were presented at the following conferences and seminars: 1. European Social Science History Conference held in Amsterdam on the 24th March 2006. 2. Local Population Studies Society annual conference in St. Albans on the 8th April 2006. 3. Bedfordshire Family History Society seminar on the 5th May 2006. 4. The London School of Hygiene’s Population Unit’s seminar on the 23rd May 2006. Further findings will be presented to the International Conference of Family Historians to be held in Northampton in September 2006, as well as other conferences in 2007 and 2008.

OUPUTS

The major output to date is the dataset, which has three elements. The first comprises files containing the transcripts of the original data from the census enumerators’ books of the Registration District of Ipswich 1871-1901 and from the Ipswich vaccination birth and death registers 1871-1910.

The second element of the database contains Excel data-files created from the transcripts, and the third, an Access relational database where links are shown between individuals and households in the various data-files. Regrettably, the project experienced considerable slippage in the delivery of the data to the staff contracted to undertake the record linkage (See Table 12).

Table 12: Delivery Of Data For Ipswich Project.

<i>Period And Data Type</i>	<i>Delivery Date Expected</i>	<i>Delivery Date Bulk Received</i>	<i>Omissions Received</i>
1871 Census	March 2003	March 2003	December 2004
1881-91 Births	March 2003	March 2003	November 2004
1881-91 Deaths	March 2003	August 2004	November 2004
1891 Census	March 2003	August 2004	October 2004
1891-1901 Births	January 2004	June 2005	
1901 Census	January 2004	June 2005	
1901-10 Births		November 2005	
1901-10 Deaths		November 2005	

There were also problems with the quality of some data in the early stages of the research. This was due to difficulties with recruiting qualified transcribers in the first few months of the project, as well as the absence of a data editor working in Ipswich. These difficulties were resolved in the second year of the research by establishing a team of high quality transcribers – mainly recruited from the local record office – and appointing one of the transcribers (Mr David Feakes) to supervise both the day-to-day gathering of data, and the resolution of problems in the identification and capture of missing data.

Summary Of Cleaning And Coding.

- * Files were merged and columns harmonised.
- * Individuals and households had unique identifiers assigned, which meant that household schedule numbers and their enumeration district of origin had to be established, checked and verified.
- * Columns containing multiple data items (for example, the forename column and the 'Given to' column) had to be deconstructed and the individual items extracted, which was a particularly time consuming task.
- * The following fields were standardised:

Age. The 'key' files show the system used to standardise names.

Surnames and forenames. Preliminary work showed that coding with Double Metaphone program alone was inadequate for our purposes as it tended to over-group the names, erroneously amalgamating some large name sets, such as Bell and Bailey and Reid and Wright. The codes were therefore used to create a manual but more discerning name dictionary.

Cause of death. The causes of death in the death file have been standardised very roughly. In the time available it was impossible to streamline the spelling and pull out the individual causes of death listed. Consequently the MO's classification entered on the later death files from the 1890s has been used as the basis of a classification system which should be viewed very much as a starting point for further work. Certain causes of death were placed in special categories separate from this classification as they had particular relevance to the themes of fertility and infant mortality (e.g. deaths which were noted as in some way related to childbirth were placed in a 'parturition' category). Again the categories devised may be discerned by cross-tabulating the 'original' data column against the 'standardised' column.

Birth Places. In some census files these have been disaggregated into the parish and county of birth, and then these elements standardised.

Addresses. In several files these have been disaggregated into their separate elements, but only in the death file have street names been fully standardised.

The approximately 200 'transcription' files delivered have been placed on the data CD in folders; one for each census, one for births and one for deaths. From these 7 'data files' were created: 1871 census, 1891 census, 1901 census East, 1901 census West, and 2 Birth files and a Death file. (Where two files exist this is because in combination they exceeded Excel's limit of 65,000 lines.) An eighth data file was derived from the 1881 census file compiled by the Church of the Latter Day Saints and enhanced by staff at the UK Data Archive, University of Essex where it is held (Ref. Number: SN 4177).

As far as possible, the data-files contain consistent columns. In each of the data-files several fields have been standardised. In some cases this was problematic as the form or content of the fields changed over time. There are 2 'key' files supplied on the data CD explaining the content of the data fields, and indicating which fields are available in each file. Some of the data (e.g. dates) have been provided in a variety of forms so that they can be used in different ways depending on the questions one is

asking. Many of the columns have also been standardised (e.g. age has been made fully numeric), but all original fields have been retained so that the mapping of the standardisation is transparent.

Each record in a file contains unique key identifiers which allows it to be matched to the linked files, and the information is given to allow every record to be located in the original 'transcription' files so that the 'data file' version can be checked against the transcription received.

The great variety of ways in which address information was given, both in the original sources and in the transcription files meant that there was insufficient time to standardise the street information across all files. Only on the death file are street names available in standardised form. The record of each individual in all the census files has had the parish in which that individual was enumerated entered on it. Parishes can make useful units for geographical analysis, although it should be noted that some streets run through more than one parish, and more than one parish contains a 'Church Lane' so some demographic events cannot be reliably assigned to a parish.

Had time permitted occupations would have been cleaned, standardised and then classified into social classes, or occupational groups, as has been done at the Data Archive for the 1881 census material.

The data-files presented on the accompanying CD were used as the basis for linkage, although not all the data fields were used. Linkage was restricted to census records and those births and deaths occurring between census day 1871 and census day 1901. The total number of records transcribed and the number of records available to the linkage exercise are listed in Table 13 below.

Table 13: Number Of Records Transcribed And Used In Linkage Of Data, 1871-1901.

	<i>Period</i>	<i>Number Of Records Used In Linkage</i>	<i>Total Number Of Records Transcribed</i>
Births	2/4/1871 – 3/4/1881	15,294	
	3/4/1881-5/4/1891	17,098	
	5/4/1881- 31/3/1901	17,764	
	Total 2/4/1871 – 31/3/1901	51,677	68,318
Deaths	2/4/1871 – 3/4/1881	10,188	
	3/4/1881- - 5/4/1891	10,354	
	5/4/1881 – 31/3/1901	11,559	
	Total 2/4/1871 – 31/3/1901	32,101	43,020
Census	2/4/1871	42,711	
	3/4/1881	50,341	
	5/4/1891	56,974	
	31/3/1901	66,638	
	Total 1871, 1891, 1901	216,664	166,323

IMPACTS

With the closure of the civil registers to academic research, the post civil registration era (1837 onwards) understanding of the mortality and fertility developments of the late nineteenth and early twentieth century has been severely hampered. One major impact of the research will be to show that a major sociological and demographic study of a large urban area over a period of four decades is possible by using copies of the birth and death registers made for vaccination and other purposes. The findings on the role of local environments in shaping mortality patterns, and the cohort analysis of infant, child and adult mortality, will add to an understanding of the determinants of mortality, of interest to all professionals working in the field of preventative social health policy. Also the research will add to our understanding of the fertility and mortality transitions that took place at the end of the nineteenth and beginning of the twentieth century, opening a whole new field of scholarship, and illuminating the process of demographic transition in many developing countries which is currently being re-assessed.

The project has produced three versions of a large and complex dataset which individually or collectively may be used both as a research tool and a teaching resource for those with interests in economic and social history, demography, geography or health studies as well as scholars of Ipswich's local history.

With the data preparation and linkage now largely completed there are many research questions which may be addressed. Amongst these are some raised in the course of the data linkage exercise. For example, the finding concerning the interchangeability of forenames would merit further attention as this has profound implications for any future linkage research and also has commercial implications for those supplying the increasing number of online genealogical sources most of which are indexed on one forename only.

CONCLUSIONS AND FUTURE RESEARCH PRIORITIES

The project has transcribed a total of 85,611 births and 53,748 deaths registered for the period 1871-1910. Additionally, census entries were transcribed for 166,323 individuals enumerated in the 1871, 1891 and 1901 censuses, along with 1,707 Anglican marriages for 1871-1881.

Of the 51,677 births recorded in 1871-1901, 76.4 per cent were linked to either a death record before the next census or to the census itself. Of the 32,101 deaths that took place in 1871-1901, 74.0% were accounted for either by a link to births or to the previous census, and it was possible to link 90.9% of deaths under the age of one to a previous birth record. Of the 150,026 individuals enumerated in the 1871, 1881 and 1891 censuses, 83,934 – 55.9% – were accounted for either through linkage to the next census or to a death record before that census.

The transcription and linkage of data on this scale is a major achievement, and an evaluation of the quality of the nominal record linkage data through a series of internal checks indicates that it was of a very high quality.

An analysis of the selected samples was used for classifying socio-economic status, as well as examining the relationship between socio-economic status and patterns of residence, mortality and fertility. A number of findings emerged from this provisional analysis: 1. The proportion of families leaving Ipswich between 1871 and 1881 was similar amongst elite and labourers' families – approximately 19 and 17 per

cent. 2. Labourers were more likely to change street address than families with domestic servants. 3. There were no significant socio-economic differences in adult mortality in the 1870s, but this was replaced by an emerging gradient in the 1890s, associated with a fall in mortality amongst elite families. 4. There were minimal differences in infant and child mortality in the 1870s, but a strong association between socio-economic status and early mortality in the 1890s, again linked to a reduction in mortality amongst families with domestic servants. 5. Fertility was slightly higher amongst the elite group than in labourer's families in the 1870s, but this pattern was reversed in the 1890s, with a slight increase in fertility amongst labourers but a significant fall in servant-keeping families.

The above findings will have to be evaluated by a detailed analysis of the full database, using a variety of measures of socio-economic status, as well as examining the role of geographical and other factors in shaping the changing pattern of demographic experience. This will include an analysis of the interaction of a number of variables, including socio-economic status, geographical residence, adult, infant, child mortality and fertility.

The late nineteenth century was a period of rapid cultural and social change, which included both an increased knowledge of disease causation and the role of hygiene in preventing mortality, as well as a growing acceptance of birth control, particularly amongst middle class families. It is possible that many of the late nineteenth demographic changes outlined in this report were primarily the result of life-style changes in middle class families, involving reductions in adult as well as infant/child mortality and fertility. The relationship and interaction of the variables involved in these processes will have to be examined in detail. Understanding these patterns of change has a relevance to the current debate among epidemiologists about the role of inequality and social class in shaping adult mortality in the twentieth and twenty-first centuries, as well as the understanding of the demographic transition in both historical and current populations. The success of the current research project will ensure that it makes a significant contribution to this major debate.

FOOTNOTES.

- 1 . On infant mortality see for example: R.I. Woods, P.A. Watterson & J.H. Woodward, 'The causes of rapid infant mortality decline in England and Wales, 1861-1921. Part I', *Population Studies*, 42 (1988) pp. 343-66, and 'Part II', *Population Studies*, 43 (1989) pp. 113-32; N. Williams & C. Galley 'Urban-rural differentials in infant mortality in Victorian England', *Population Studies*, 49 (1995) pp. 401-20; N. Williams & G. Mooney 'Infant mortality in "an age of great cities": London and English provincial cities compared, c. 1840-1910', *Continuity and Change*, 9 (1994) pp. 185-212; G. Mooney, 'Did London pass the sanitary test? Seasonal infant mortality in London, c. 1870-1914', *Journal of Historical Geography*, 20,2 (1994) pp.158-74. For the importance of social and spatial variation at the local level see: N. Williams 'Death in its season: class, environment and the mortality of infants in nineteenth century Sheffield', *Social History of Medicine*, 5 (1992) pp. 71-94; E.M. Garrett & A. Reid 'Thinking of England and taking care: family building strategies and infant mortality in England and Wales, 1891-1911', *International Journal of Population Geography*, 1, (1995) pp. 69-102.
2. S. Macintyre, S. MacIver, & A. Sooman, 'Area, class and health: should we be focusing on places or people?', *Journal of Social Policy*, 22:2 (1993) pp. 213-34.
3. A. Forsdahl, 'Are poor living conditions in childhood and adolescence an important risk factor for arteriosclerotic disease?', *British Journal Of Preventative And Social Medicine*, 31 (1977) pp. 91-95; C. Buck and H. Simpson, 'Infant diarrhoea and subsequent mortality from heart disease and cancer', *Journal Of Epidemiology And Community Health*, 36 (1982) pp. 27-30; D.J.P. Barker and C. Osmond, 'Infant mortality, childhood nutrition, and ischaemic heart disease in England & Wales', *The Lancet* (May 10 1986) pp. 1077-1081; D.A. Leon and G. Davey Smith, 'Infant mortality, stomach cancer, stroke, and coronary heart disease: ecological analysis', *British Medical Journal*, 320 (24 June 2000) pp. 1705-1706.
4. D. Dorling, R. Mitchell, M. Shaw, S. Orford and G. Davey Smith, 'The ghost of Christmas past: health effects of poverty in London in 1896 and 1991', *British Medical Journal*, 321 (23-30 December 2000) pp. 1547-1551.
5. This conclusion is based on births and infant deaths in the Fulham registration district for the years 1876, 1877, 1881, 1882, 1887 and 1888. We are grateful to Sue Smith for allowing us to cite findings from her post-graduate research at the Open University.
6. The registration districts covered by the project are Fulham, Ipswich, Bungay, Felixstowe, Loughborough and Hollingsbourne.
7. *Report On The Sociological Study Of Fertility And Mortality In Ipswich 1872-1881* submitted to the Economic And Social Research Council, 2000, p. 7.
8. A. Reid, R. Davies and E. Garrett, "Nineteenth century Scottish demography from linked censuses and civil registers: a 'sets of related individuals' approach", *History and Computing*, Vol. 14, forthcoming.

9. In 1871 four of the eight untraced deaths were husbands/wives of widows and widowers in 1881, and 4 were of spouses who had remarried. In 1891 eight of the untraced deaths were husbands and wives of widows and widowers in 1901, and six were of spouses who had remarried.
10. Report, 'The Sociological Study of Fertility and Mortality in Ipswich, 1872-1881' submitted to the ESRC 2001, Ref R000238429. No attempt was made in our pilot research to measure patterns of adult mortality in the 1870s.
11. B. Seebohm Rowntree, *Poverty: A Study Of Town Life*, (London, 1901) pp. 222-294.
12. For a discussion of the poverty of labourers at the end of the nineteenth century, see Rowntree, *op.cit.*, pp. 136, 137.
13. For this table, all elite families were selected from the 1871 census and were compared to those whose heads were described as labourers. Not all types of labourers' families were selected for this aspect of the research, but only those designated simply as labourers.
14. For other evidence of the absence of a socio-economic gradient in adult mortality before the late nineteenth century, see Peter Razzell and Christine Spence, 'The hazards of wealth: adult mortality in England before the twentieth century', *Social History of Medicine*, forthcoming.
15. Full vaccination birth registration did not start until the year 1872, and some missing births for 1871 were traced in the subsequent census. Some 1871 births resulting in infant or child death may have been under-counted, but this is not likely to have been a significant number or varied greatly between the different socio-economic groups.
16. The samples considered in this report are between a quarter and a fifth of the total number of families with domestic servants and those headed by labourers enumerated in the censuses. Also, in subsequent research, an analysis will be carried out on all families, classifying occupations into social class groups.
17. Numbers at risk in the 1-4 group were truncated by being in observation for at least four years before the date of the later census.