

## 7 The quality of event sampling and linkage within the Longitudinal Study

Three different types of event are collected for the Longitudinal Study (LS). The first type are events causing the entry of new members to the study: births on LS dates and immigration of persons born on LS dates. The second, are events causing exits from the study: deaths of LS members and emigrations of LS members from England and Wales. The third, are those occurring to LS members while alive and active in the study, such as the birth of children, cancer registrations or widow(er)hoods.

Event data quality within the LS has two components. First, the quality of the original event data collected for the England and Wales population; and second, the quality of the sampling of those events and of their linkage into the LS.

The quality of event data varies according to both the type of event and to the method(s) used for collecting it, whether for England and Wales or for the LS (see Chapter 6 for further details of the collection and linkage of events into the LS).

By definition entry events cannot be linked to existing LS members, so an entry rate is used to measure quality rather than a linkage rate. If all possible entries to the LS in a year are captured the entry rate will be 100 per cent. The quality of sampling for LS entry events is very high for new births of LS members into the study, with entry rates around 100 per cent. However, the quality is low for new LS members entering through immigration. Oversampling is particularly evident between 1971 and 1981, resulting in entry rates of well over 100 per cent.

The sampling and linkage of exit events from the study is of high quality for deaths. Ninety-eight per cent of deaths were captured in the first decade, but there was some oversampling of deaths among elderly LS members in the second decade resulting in a linkage rate of 109 per cent. Exits through emigration (embarkation) from the LS are of low quality. Only 64 per cent of emigrations were linked to LS members in the first decade, dropping to 36 per cent linkage in the second.

The linkage of events occurring to LS members is also of variable quality depending on the type of event being linked. The linkage of births occurring to women in the sample (sample mothers) is of good quality in both the first and second decades (92 per cent linkage in the first decade rising to 94 per cent in the second). At 86 per cent, the linkage rate is not so good for births occurring to sample fathers (only collected until 1978). Cancer registration linkage for LS members is also of good quality overall (over 98 per cent linkage) but highly variable at younger ages. Linkage for widow(er)hoods of LS members is of

lower quality than some other events, with a linkage rate of 77 per cent in the first decade rising to 84 per cent in the second.

Infant mortality, collected since 1976, suffers from the small numbers of infant deaths occurring in England and Wales. As a result the quality of linkage in the first decade was not particularly good at 86 per cent, however it rose to 91 per cent in the second.

The following events, though available for LS members, are not examined for quality as the England and Wales data are not easily available. These are enlistments to the armed forces, entries to long-stay psychiatric hospitals and re-entrants to the LS from previous embarkations, enlistments or periods in psychiatric hospital. Internal migration is also omitted as only four years' data (1971 to 1974) were collected for the LS. Counts for the number of these events occurring in the LS are given in section 7.3.6.

The quality of annual event data was examined for the two decades up to the 1991 Census. The first decade is defined as Census day 1971 to the day prior to Census day 1981, and the second decade as Census day 1981 to the day prior to Census day 1991. In 1971 the part year was 251 days, 1981 had 95 days in the first decade and 270 days in the second decade, and in 1991 there were 110 days prior to census day.

The data were examined in two ways. First by calculating the proportion of the population sampled in the LS for each event (the sampling fraction), and second, by examining the linkage rate (or in the case of entries, the entry rate) of each event to the sample. Because the LS is an approximate 1 per cent sample of the population of England and Wales, it would be expected that approximately 1 per cent of all events collected for the England and Wales population would occur to members of the LS sample (exact population sampling fractions are shown in Chapter 9). Both sampling fractions and linkage rates (or entry rates if appropriate) are used to examine this hypothesis.

The sampling fraction is calculated as:

$$\frac{\text{Events occurring to LS members in year } n}{\text{Events occurring to England \& Wales population in year } n} \times 100$$

The linkage rate for events is calculated as:

$$\frac{\text{Actual events occurring to the LS population in year } n}{\text{Events expected to occur to the LS population in year } n} \times 100$$

The entry rate for events is calculated as:

$$\frac{\text{Actual new members entering the LS in year } n}{\text{Expected number of new entries to the LS in year } n} \times 100$$

The expected number of events has been calculated in different ways depending on the type of event and the probability of that event occurring in the LS population. Each method of calculating expected events is given in the relevant sections of this chapter.

The LS population data were examined yearly, as well as over each decade, for the occurrence of each type of event. Analysis was also done, where possible, by age and sex.

## 7.1 THE QUALITY OF ENTRY EVENT DATA

Between censuses entries to the LS are either by birth in England and Wales on an LS date (new births), or by immigration into England and Wales where the immigrant was born on an LS date. New births are collected and entered into the study from birth registration data and 100 per cent of these new LS members should be captured. Immigrants only enter between censuses when they register with a general practitioner (GP) and are subsequently included in the index held at the National Health Service Central Register (NHSCR).

### 7.1.1 New births into the LS

Over the period from Census day 1971 to the day prior to Census day 1991, 144,893 new members entered the LS by virtue of being born on LS dates in England and Wales. Of these births, 71,888 occurred in the first decade.

The quality of new birth event data in the LS is extremely good and 100 per cent of all births occurring on LS dates enter the study. There is more variability in the entry rate in the first decade due to the capture of a small number of new births from the 1981 Census rather than from registration data (see Chapter 5, Table 5.1). Sampling fractions are higher than expected for most years but the LS still maintains an approximate 1 per cent sample of all births in England and Wales.

The quality of births data for the whole of England and Wales (used as the denominator for calculating sampling fractions for new births) is known to be extremely high. All births must be registered within six weeks of occurrence by law, and coverage is around 100 per cent.

#### 7.1.1.1 By sex and year of birth

New births occurring in the first decade are shown in Table 7.1a together with sampling fractions and entry rates.

The sampling fractions for LS new births are the proportions of all live births in England and Wales collected as new

entries to the study by virtue of being born on LS dates. Because births are not equally distributed either by day of the week,<sup>1</sup> or throughout the year, a selection effect producing a certain amount of variation must be expected in both the sampling fractions and the entry rates. The inclusion of a small number of new births entering via the 1981 Census (see below) rather than through birth registration, adds to the variation.

The overall sampling fraction for this decade was 1.12, 0.07 per cent above the sampling fraction of 1.05 expected in the LS. Sampling fractions ranged from a high of 1.23 to a low of 0.80 for males, and 1.21 to 0.80 for females.

The entry rate for the decade was only 1 per cent over the expected 100 per cent, but yearly rates fluctuated from 95 per cent (for the pre-census period of 1981) to just over 102 per cent in 1975. From 1974 to 1980, and from 1982 to 1991, the expected births on LS dates are taken from the England and Wales statistics for births that actually took place on those dates. In 1981 the Registrars of Births and Deaths in England and Wales took industrial action and as a result the daily birth figures are only available as a 10 per cent sample. When grossed up these figures are lower than would be expected compared with other years. A formula has therefore been used to calculate expected LS births for 1981 as well as for the period 1971 to 1973. The formula that was applied used the number of possible LS birth dates in a year. For 1971 the formula was:

$$3/365 \times \text{total births for the year in England and Wales}$$

as only three possible LS birth dates were available from census day onwards. The following year, 1972, was a leap year, therefore the fraction of births was 4/366, the fraction for 1973 was 4/365, and for 1981 pre-census the fraction was 1/365 and post-census 3/365. A correction factor was also applied for these three years to cope with the fact that births are not evenly distributed across days of the week.<sup>1</sup>

The births given as actual LS new births are those recorded in the LS. The differences seen in Table 7.1a between actual and expected numbers of new births are due to a gain of approximately 100 births per year from entries in the 1981 Census where an LS date of birth occurring after the 1971 Census was stated (see Chapter 5, Table 5.1). The percentage of female LS members entered as new births via the 1981 Census was slightly higher than the percentage of males. Subsequent examination of the birth records for these entries showed dates other than LS dates on their birth registration documents. Exclusion of these births (1095 in all) lowers the overall entry rate to 99.34 per cent. It is possible to use tracing history indicators to extract those new birth entries who entered at the 1981 Census but not before (see Appendix XIII). All tables in this section referring to first decade new births include these extra entries.

The second decade new births data analysed in this section do not include additional entries collected at the 1991 Census. The 'expected' LS new births are the actual births

(with the exception of the post-Census period of 1981 mentioned previously) occurring in England and Wales on LS dates in each year. It should be noted that the statistics on daily numbers of births occurring in England and Wales do include a very small number of births to women who are not residents of the country. All new birth entrants to the LS must be resident in England and Wales. The slightly higher numbers of births shown as expected LS births in the second decade are due to births to non-resident women.

The births for England and Wales have been apportioned for both 1981 and 1991 as these were part years. In 1981 the proportion of the year from census day onwards was

270/365, and for 1991, 110/365 for the period prior to census day.

Table 7.1b shows second decade new births by sex and year of birth. The overall sampling fraction is still higher than the 1.09 expected but is slightly lower than that observed in the first decade. Likewise, the entry rates are lower than those in the first decade, and with the exception of 1981, show yearly entry rates for all new births of 100 per cent. Male and female new births examined separately show slight variation, but there does not seem to be any systematic under- or over-sampling over the decade.

**Table 7.1a First decade new births by sex and year of birth**

Year of birth	Males					Females					Total				
	LS births	E & W births	S.F.	Exp. in LS	Entry rate	LS births	E & W births	S.F.	Exp. in LS	Entry rate	LS births	E & W births	S.F.	Exp. in LS	Entry rate
Part 1971	3,016	277,285	1.09	3,126	96.47	2,886	261,268	1.10	2,946	97.97	5,902	538,553	1.10	6,072	97.20
1972	4,142	373,982	1.11	4,169	99.35	3,972	351,458	1.13	3,918	101.38	8,114	725,440	1.12	8,087	100.34
1973	4,155	348,678	1.19	4,079	101.86	3,828	327,275	1.17	3,829	99.98	7,983	675,953	1.18	7,908	100.95
1974	3,953	329,459	1.20	3,929	100.60	3,770	310,426	1.21	3,701	101.88	7,723	639,885	1.21	7,630	101.22
1975	3,375	310,751	1.09	3,362	100.37	3,286	292,694	1.12	3,167	103.77	6,661	603,445	1.10	6,529	102.02
1976	2,923	300,313	0.97	2,842	102.86	2,691	283,957	0.95	2,676	100.55	5,614	584,270	0.96	5,518	101.74
1977	3,079	292,957	1.05	3,067	100.38	2,977	276,302	1.08	2,889	103.06	6,056	569,259	1.06	5,956	101.68
1978	3,594	307,088	1.17	3,591	100.10	3,501	289,330	1.21	3,381	103.54	7,095	596,418	1.19	6,972	101.76
1979	4,024	328,308	1.23	3,946	101.98	3,745	309,720	1.21	3,716	100.78	7,769	638,028	1.22	7,662	101.40
1980	3,960	335,954	1.18	3,882	102.01	3,683	320,280	1.15	3,656	100.74	7,643	656,234	1.16	7,538	101.39
Part 1981	682	84,774	0.80	717	95.12	646	80,368	0.80	674	95.85	1,328	165,142	0.80	1,391	95.47
Total	36,903	3,289,549	1.12	36,710	99.48	34,985	3,103,078	1.13	34,552	98.76	71,888	6,392,627	1.12	71,263	100.88

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.1b Second decade new births by sex and year of birth**

Year of birth	Males					Females					Total				
	LS births	E & W births	S.F.	Exp. in LS	Entry rate	LS births	E & W births	S.F.	Exp. in LS	Entry rate	LS births	E & W births	S.F.	Exp. in LS	Entry rate
Part 1981	2,591	240,937	1.08	2,531	102.37	2,392	228,413	1.05	2,336	102.40	4,983	469,350	1.06	4,867	102.38
1982	3,207	321,352	1.00	3,244	98.87	3,099	304,579	1.02	3,074	100.80	6,306	625,931	1.01	6,318	99.81
1983	3,517	323,192	1.09	3,427	102.61	3,149	305,942	1.03	3,245	97.06	6,666	629,134	1.06	6,672	99.91
1984	3,732	326,039	1.14	3,847	97.01	3,769	310,779	1.21	3,667	102.78	7,501	636,818	1.18	7,514	99.83
1985	4,045	336,835	1.20	3,993	101.31	3,733	319,582	1.17	3,788	98.54	7,778	656,417	1.18	7,781	99.96
1986	3,789	338,852	1.12	3,754	100.93	3,529	322,166	1.10	3,569	98.88	7,318	661,018	1.11	7,323	99.93
1987	3,422	349,624	0.98	3,495	97.92	3,387	331,887	1.02	3,317	102.10	6,809	681,511	1.00	6,812	99.96
1988	3,782	354,954	1.07	3,773	100.23	3,582	338,623	1.06	3,600	99.51	7,364	693,577	1.06	7,373	99.88
1989	4,034	352,381	1.14	4,078	98.92	3,923	335,344	1.17	3,881	101.08	7,957	687,725	1.16	7,959	99.97
1990	4,176	361,412	1.16	4,237	98.55	4,094	344,728	1.19	4,042	101.29	8,270	706,140	1.17	8,279	99.89
Part 1991	1,031	108,013	0.95	1,055	97.69	1,022	102,710	1.00	1,004	101.83	2,053	210,723	0.97	2,059	99.71
Total	37,326	3,413,591	1.09	37,435	99.71	35,679	3,244,753	1.10	35,522	100.44	73,005	6,658,344	1.10	72,957	100.07

S.F. = Sampling fraction.

Exp. = Expected.

### 7.1.1.2 By mother's age at registration

Table 7.2a shows new births by mother's age at registration in the first decade. England and Wales daily birth figures are not available by age of mother, therefore the 'expected' LS new births for each age group of mothers have been distributed proportionately using the formula:

$$\sum \text{LS Expected in year } n \times \frac{\text{E \& W births for age grp } x \text{ in year } n}{\sum \text{E \& W births in year } n}$$

The majority of new births in the first decade occurred to mothers aged 25-29 (36 per cent of all LS new births). Sampling fractions for each age group are higher than the

expected 1.05, varying from 1.11 to 1.16 for the whole decade.

The overall entry rates are highest for new births to mothers aged between 25 and 39. This suggests that 'new birth' entries coming from the 1981 Census rather than from registration data are more common for mothers in this age group than among those older or younger.

New births by mother's age at registration for the second decade (Table 7.2b) show reductions in the overall sampling fractions for each age group, but there is still a noticeable variability from year to year. Entry rates on the whole are nearer to 100 per cent than in the first decade but not

**Table 7.2a First decade new births by year of birth and mother's age at registration**

Year of new birth	Mother's age at registration														
	Under 20					20-24					25-29				
	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate
Part 1971	652	56,830	1.15	641	101.76	2,137	196,470	1.09	2,215	96.47	1,867	170,019	1.10	1,917	97.40
1972	950	79,087	1.20	882	107.76	2,734	249,109	1.10	2,777	98.45	2,708	247,676	1.09	2,761	98.08
1973	818	73,270	1.12	857	95.43	2,665	223,675	1.19	2,617	101.85	2,906	243,753	1.19	2,852	101.91
1974	781	68,724	1.14	819	95.31	2,512	208,084	1.21	2,481	101.24	2,890	235,593	1.23	2,809	102.88
1975	704	63,507	1.11	687	102.46	2,065	190,198	1.09	2,058	100.35	2,486	225,990	1.10	2,445	101.67
1976	602	57,943	1.04	547	110.01	1,744	182,210	0.96	1,721	101.35	2,116	220,712	0.96	2,084	101.51
1977	590	54,477	1.08	570	103.51	1,778	174,544	1.02	1,826	97.36	2,264	207,916	1.09	2,175	104.07
1978	617	55,984	1.10	654	94.28	2,130	182,580	1.17	2,134	99.80	2,557	210,598	1.21	2,462	103.87
1979	710	59,143	1.20	710	99.97	2,282	193,209	1.18	2,320	98.35	2,720	222,102	1.22	2,667	101.98
1980	686	60,754	1.13	698	98.30	2,297	201,541	1.14	2,315	99.22	2,625	223,438	1.17	2,567	102.28
Part 1981	139	14,724	0.94	125	111.20	402	50,623	0.79	431	93.27	446	56,157	0.79	473	94.29
Total	7,249	644,443	1.12	7,191	100.81	22,746	2,052,243	1.11	22,895	99.35	25,585	2,263,954	1.13	25,212	101.48
Year of new birth	30-34					35-39					40 and over				
	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate
	Part 1971	788	75,380	1.05	850	92.72	355	31,099	1.14	351	101.25	103	8,755	1.18	99
1972	1,138	98,739	1.15	1,101	103.39	455	39,821	1.14	444	102.50	129	11,008	1.17	123	105.12
1973	1,116	91,800	1.22	1,074	103.92	387	34,178	1.13	400	96.79	91	9,277	0.98	109	83.85
1974	1,081	89,132	1.21	1,063	101.71	355	30,308	1.17	361	98.23	104	8,044	1.29	96	108.43
1975	1,030	88,379	1.17	956	107.72	303	28,147	1.08	305	99.50	73	7,224	1.01	78	93.40
1976	849	90,791	0.94	857	99.01	255	26,117	0.98	247	103.38	48	6,497	0.74	61	78.23
1977	1,062	100,807	1.05	1,055	100.69	286	25,527	1.12	267	107.08	76	5,988	1.27	63	121.31
1978	1,353	113,077	1.20	1,322	102.36	370	27,937	1.32	327	113.30	68	6,242	1.09	73	93.19
1979	1,551	125,664	1.23	1,509	102.78	428	31,394	1.36	377	113.53	78	6,516	1.20	78	99.68
1980	1,540	129,908	1.19	1,492	103.20	416	33,893	1.23	389	106.85	79	6,700	1.18	77	102.65
Part 1981	244	32,948	0.74	278	87.77	76	8,904	0.85	70	108.57	21	1,785	1.18	14	150.00
Total	11,752	1,036,625	1.13	11,557	101.69	3,686	317,325	1.16	3,537	104.21	870	78,037	1.11	870	99.97

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.2b Second decade new births by year of birth and mother's age at registration**

Year of new birth	Mother's age at registration														
	Under 20					20-24					25-29				
	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate
Part 1981	428	41,846	1.02	438	97.72	1,536	143,877	1.07	1,509	101.79	1,703	159,603	1.07	1,655	102.90
1982	577	55,435	1.04	560	103.12	1,979	192,322	1.03	1,941	101.94	2,079	211,905	0.98	2,139	97.20
1983	599	54,059	1.11	573	104.48	2,039	191,852	1.06	2,035	100.22	2,265	214,078	1.06	2,270	99.77
1984	608	54,058	1.12	638	95.32	2,298	191,455	1.20	2,259	101.72	2,585	218,031	1.19	2,573	100.48
1985	630	56,929	1.11	675	93.36	2,306	193,958	1.19	2,299	100.30	2,684	227,486	1.18	2,697	99.53
1986	623	57,406	1.09	636	97.96	2,118	192,064	1.10	2,128	99.54	2,557	229,035	1.12	2,537	100.78
1987	563	57,545	0.98	575	97.88	1,956	193,232	1.01	1,931	101.27	2,405	238,929	1.01	2,388	100.70
1988	690	58,741	1.17	624	110.50	2,103	193,726	1.09	2,059	102.12	2,584	243,460	1.06	2,588	99.84
1989	620	55,543	1.12	643	96.45	2,109	185,239	1.14	2,144	98.38	2,804	242,822	1.15	2,810	99.78
1990	632	55,541	1.14	651	97.05	2,076	180,136	1.15	2,112	98.30	3,010	252,577	1.19	2,961	101.64
Part 1991	164	15,791	1.04	154	106.29	504	52,244	0.96	510	98.73	723	74,959	0.96	732	98.71
Total	6,134	562,894	1.09	6,167	99.46	21,024	1,910,105	1.10	20,928	100.46	25,399	2,312,885	1.10	25,351	100.19
Year of new birth	30-34					35-39					40 and over				
	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate
	Part 1981	1,002	93,642	1.07	973	102.98	260	25,306	1.03	243	107.00	54	5,076	1.06	49
1982	1,248	120,758	1.03	1,219	102.39	371	38,992	0.95	394	94.26	52	6,519	0.80	66	79.03
1983	1,289	120,996	1.07	1,283	100.45	413	41,277	1.00	438	94.35	61	6,872	0.89	73	83.70
1984	1,423	122,774	1.16	1,449	98.23	508	42,921	1.18	506	100.31	79	7,579	1.04	89	88.34
1985	1,502	126,185	1.19	1,496	100.42	571	44,393	1.29	526	108.51	85	7,466	1.14	89	96.05
1986	1,450	129,487	1.12	1,435	101.08	492	45,465	1.08	504	97.68	78	7,561	1.03	84	93.12
1987	1,368	136,558	1.00	1,365	100.22	438	46,604	0.94	466	94.03	79	8,643	0.91	86	91.45
1988	1,430	140,974	1.01	1,499	95.42	464	47,649	0.97	507	91.60	93	9,027	1.03	96	96.91
1989	1,719	145,320	1.18	1,682	102.21	587	49,465	1.19	572	102.54	118	9,336	1.26	108	109.21
1990	1,838	156,264	1.18	1,832	100.32	613	51,905	1.18	609	100.73	101	9,717	1.04	114	88.65
Part 1991	458	48,599	0.94	475	96.45	160	16,167	0.99	158	101.29	44	2,964	1.48	29	151.93
Total	14,727	1,341,557	1.10	14,706	100.14	4,877	450,144	1.08	4,922	99.09	844	80,760	1.05	883	95.62

S.F. = Sampling fraction.

Exp. = Expected.

markedly so. The variability in sampling fractions is probably due to day-of-the-week effect.

As in the first decade, the majority of LS new births occurred to mothers' aged between 25 and 29 (35 per cent), but the percentage of births observed for older mothers (aged 30 and over) rose from 22 per cent in the first decade to 28 per cent in the second decade. This closely reflects the pattern among the England and Wales population from which the sample is drawn.<sup>2</sup>

### 7.1.1.3 By marital status of mother

Table 7.3a shows new births in the first decade by marital status of mother. Sampling fractions for marital births show

similar variability to those for non-marital births. More variation is shown for entry rates between marital and non-marital new births. Part of this variation may be due to the small numbers of non-marital new births (approximately 10 per cent of all new births entries to the LS in the first decade).

Table 7.3b shows second decade new births by marital status. The percentage of births occurring outside marriage doubled over the two decades, from 10 per cent in the first decade to 21 per cent in the second. Entry rates in the second decade are slightly lower for non-marital births than for marital births (98.62 and 100.93 per cent respectively).

**Table 7.3a First decade new births by year of birth and marital status of mother**

Year of birth	Births within marriage					Births outside marriage					All new births				
	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate
Part 1971	5,364	493,388	1.09	5,563	96.43	538	45,165	1.19	509	105.65	5,902	538,553	1.10	6,072	97.20
1972	7,369	662,928	1.11	7,390	99.72	745	62,512	1.19	697	106.91	8,114	725,440	1.12	8,087	100.34
1973	7,274	617,856	1.18	7,228	100.64	709	58,097	1.22	680	104.32	7,983	675,953	1.18	7,908	100.95
1974	7,049	583,399	1.21	6,959	101.29	674	56,486	1.19	671	100.45	7,723	639,885	1.21	7,630	101.22
1975	6,065	548,554	1.11	5,935	102.19	596	54,891	1.09	594	100.35	6,661	603,445	1.10	6,529	102.02
1976	5,072	530,504	0.96	5,010	101.24	542	53,766	1.01	508	106.74	5,614	584,270	0.96	5,518	101.74
1977	5,448	513,880	1.06	5,378	101.30	608	55,379	1.10	578	105.19	6,056	569,259	1.06	5,956	101.68
1978	6,409	535,781	1.20	6,261	102.36	686	60,637	1.13	711	96.48	7,095	596,418	1.19	6,972	101.76
1979	6,979	568,561	1.23	6,827	102.23	790	69,467	1.14	835	94.61	7,769	638,028	1.22	7,662	101.40
1980	6,734	578,862	1.16	6,648	101.29	909	77,372	1.17	890	102.13	7,643	656,234	1.16	7,538	101.39
Part 1981	1,147	144,064	0.80	1,210	94.79	181	21,078	0.86	181	100.00	1,328	165,142	0.80	1,391	95.47
Total	64,910	5,777,778	1.12	64,409	100.78	6,978	614,849	1.13	6,854	101.81	71,888	639,267	1.12	71,263	100.88

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.3b Second decade new births by year of birth and marital status of mother**

Year of birth	Births within marriage					Births outside marriage					All new births				
	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate
Part 1981	4,350	409,445	1.06	4,234	102.74	633	59,905	1.06	633	100.00	4,983	469,350	1.06	4,867	102.38
1982	5,437	536,074	1.01	5,411	100.48	869	89,857	0.97	907	95.81	6,306	625,931	1.01	6,318	99.81
1983	5,597	529,923	1.06	5,620	99.59	1,069	99,211	1.08	1,052	101.60	6,666	629,134	1.06	6,672	99.91
1984	6,204	526,353	1.18	6,211	99.89	1,297	110,465	1.17	1,303	99.51	7,501	636,818	1.18	7,514	99.83
1985	6,372	530,167	1.20	6,284	101.39	1,406	126,250	1.11	1,497	93.95	7,778	656,417	1.18	7,781	99.96
1986	5,712	519,673	1.10	5,757	99.22	1,606	141,345	1.14	1,566	102.56	7,318	661,018	1.11	7,323	99.93
1987	5,260	523,080	1.01	5,228	100.60	1,549	158,431	0.98	1,584	97.82	6,809	681,511	1.00	6,812	99.96
1988	5,470	516,225	1.06	5,488	99.68	1,894	177,352	1.07	1,885	100.46	7,364	693,577	1.06	7,373	99.88
1989	5,826	501,921	1.16	5,809	100.30	2,131	185,804	1.15	2,150	99.10	7,957	687,725	1.16	7,959	99.97
1990	6,018	506,141	1.19	5,934	101.41	2,252	199,999	1.13	2,345	96.04	8,270	706,140	1.17	8,279	99.89
Part 1991	1,430	147,045	0.97	1,437	99.53	623	63,678	0.98	622	100.13	2,053	210,723	0.97	2,059	99.71
Total	57,676	5,246,047	1.10	57,143	100.93	15,329	1,412,297	1.09	15,544	98.62	73,005	6,658,344	1.10	72,957	100.07

S.F. = Sampling fraction.

Exp. = Expected.

**7.1.1.4 By mother's parity at registration**

Parity is defined here as the number of previous liveborn children a woman has had within marriage by her present or any former husband. A birth shown as occurring at parity 0 is a first birth within marriage. A birth at parity 1 is a second birth within marriage, etc. It should be noted that the previous marital births question on the birth registration document is only asked of women who are married to the current child's father at the time of

registration. Table 7.4a shows new births in the first decade by parity.

Information about previous non-marital births is not collected by the registrar. Therefore, only marital births are used in this table due to the lack of data for England and Wales non-marital parity. Sampling fractions tend to be over 1.05 for all parities and all years except parity 4+. Parity 4+ shows a low sampling fraction in 1977. Entry

**Table 7.4a First decade new births by year of birth and mother's parity at registration\***

Year of new birth	Parity 0					Parity 1					Parity 2				
	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate
Part 1971	2,139	195,034	1.10	2,199	97.28	1,812	165,580	1.09	1,867	97.06	848	76,779	1.10	866	97.96
1972	2,981	265,924	1.12	2,964	100.56	2,584	229,701	1.12	2,561	100.91	1,063	98,816	1.08	1,102	96.50
1973	2,979	253,814	1.17	2,969	100.33	2,584	222,483	1.16	2,603	99.28	1,022	86,118	1.19	1,007	101.44
1974	2,858	242,826	1.18	2,897	98.67	2,607	215,826	1.21	2,574	101.26	960	77,882	1.23	929	103.34
1975	2,505	226,944	1.10	2,455	102.02	2,277	206,155	1.10	2,230	102.09	814	73,312	1.11	793	102.62
1976	2,113	217,211	0.97	2,051	103.01	1,923	203,576	0.94	1,923	100.02	672	70,967	0.95	670	100.27
1977	2,259	214,573	1.05	2,246	100.60	2,108	195,035	1.08	2,041	103.28	714	68,796	1.04	720	99.17
1978	2,654	226,586	1.17	2,648	100.23	2,391	198,088	1.21	2,315	103.29	924	74,173	1.25	867	106.60
1979	2,824	238,890	1.18	2,868	98.45	2,601	206,667	1.26	2,482	104.81	1,050	82,742	1.27	994	105.68
1980	2,773	240,975	1.15	2,768	100.20	2,374	209,164	1.13	2,402	98.83	1,068	86,336	1.24	992	107.71
Part 1981	480	58,377	0.82	484	97.28	401	53,536	0.75	448	89.51	176	21,447	0.82	182	96.70
Total	26,565	2,381,154	1.12	26,549	100.33	23,662	2,105,811	1.12	23,445	100.92	9,311	817,368	1.14	9,121	102.08
Year of new birth	Parity 3					Parity 4 +									
	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate					
Part 1971	326	31,536	1.03	356	91.57	239	24,459	0.98	276	86.67					
1972	431	39,462	1.09	440	97.95	310	29,025	1.07	324	95.81					
1973	415	32,692	1.27	382	108.64	274	22,749	1.20	266	102.96					
1974	379	27,889	1.36	333	113.81	245	18,976	1.29	226	108.24					
1975	290	25,410	1.14	275	105.45	179	16,733	1.07	181	98.87					
1976	201	23,569	0.85	223	90.13	163	15,181	1.07	143	113.69					
1977	241	21,935	1.10	230	104.78	126	13,541	0.93	142	88.91					
1978	256	23,358	1.10	273	93.77	184	13,576	1.36	159	115.98					
1979	316	25,963	1.22	312	101.28	188	14,299	1.31	172	109.50					
1980	356	27,537	1.29	316	112.66	163	14,850	1.10	171	95.58					
Part 1981	56	6,809	0.82	60	93.33	34	3,899	0.87	36	94.44					
Total	3,267	286,160	1.14	3,200	102.09	2,105	187,288	1.12	2,095	100.49					

\* Marital births only.

S.F. = Sampling fraction.

Exp. = Expected.

rates are again variable, more so for births at higher parities where the numbers of LS new births are low.

Second decade new births by mother's parity are shown in Table 7.4b. Both yearly sampling fractions and entry rates are highly variable at each parity, but variability is greater at higher parities where the numbers of LS births are low. The overall entry rates for each parity show less variation than in the first decade.

### 7.1.2 Immigrants into the LS

Immigrants into the LS join the study when they register for the first time with a GP. The issue of an NHS number

and the subsequent notification to NHSCR generates the entry of those immigrants born on LS dates into the sample. It should be noted that not all immigrants will register with a GP, and among those who register, many do so long after they have arrived in England and Wales.

The total number of immigrants entering the LS between Census day 1971 and the day prior to Census day 1991 was 54,851, with 31,224 immigrants recorded as entering the LS in the first decade. Among these, 3,681 immigrants were not identified until the 1981 Census-LS link exercise when they were found to have stated an LS date of birth on the census form. When these entrants were checked against the records at NHSCR they were found to possess an NHS number of the type issued to immigrants. They

**Table 7.4b Second decade new births by year of birth and mother's parity at registration\***

Year of birth	Parity 0					Parity 1					Parity 2				
	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate
Part 1981	1,823	165,913	1.10	1,694	107.62	1,553	152,154	1.02	1,567	99.11	641	60,953	1.05	635	100.94
1982	2,139	211,862	1.01	2,138	100.02	2,004	200,681	1.00	2,026	98.93	884	81,431	1.09	822	107.55
1983	2,191	211,753	1.03	2,246	97.56	2,157	195,630	1.10	2,075	103.97	841	80,728	1.04	856	98.23
1984	2,450	210,421	1.16	2,483	98.67	2,302	193,093	1.19	2,279	101.03	943	80,643	1.17	952	99.10
1985	2,540	212,017	1.20	2,513	101.07	2,305	193,058	1.19	2,288	100.73	986	82,403	1.20	977	100.95
1986	2,258	206,942	1.09	2,293	98.49	2,039	189,186	1.08	2,096	97.29	931	80,842	1.15	896	103.96
1987	2,156	209,971	1.03	2,099	102.74	1,887	189,370	1.00	1,893	99.70	768	81,180	0.95	811	94.66
1988	2,236	209,291	1.07	2,225	100.50	1,985	185,553	1.07	1,973	100.63	813	79,411	1.02	844	96.30
1989	2,329	200,970	1.16	2,326	100.13	2,139	182,765	1.17	2,115	101.12	903	77,518	1.16	897	100.65
1990	2,390	200,394	1.19	2,349	101.73	2,212	185,334	1.19	2,173	101.80	927	79,040	1.17	927	100.04
Part 1991	542	58,365	0.93	570	95.03	522	53,739	0.97	525	99.40	241	22,948	1.05	224	107.46
Total	23,054	2,097,899	1.10	22,936	100.51	21,105	1,920,564	1.10	21,009	100.46	8,878	807,098	1.10	8,841	100.42
Year of birth	Parity 3					Parity 4 +									
	LS new births	E & W births	S.F.	Exp. in LS	Entry rate	LS new births	E & W births	S.F.	Exp. in LS	Entry rate					
Part 1981	211	19,351	1.09	212	99.53	122	11,081	1.10	127	96.06					
1982	271	27,123	1.00	274	98.99	139	14,977	0.93	151	91.95					
1983	252	26,646	0.95	283	89.18	156	15,166	1.03	161	96.99					
1984	311	26,860	1.16	317	98.12	198	15,336	1.29	181	109.41					
1985	363	26,865	1.35	318	114.00	178	15,824	1.12	188	94.90					
1986	299	26,920	1.11	298	100.26	185	15,783	1.17	175	105.81					
1987	286	26,593	1.08	266	107.60	163	15,966	1.02	160	102.15					
1988	274	26,379	1.04	280	97.71	162	15,591	1.04	166	97.74					
1989	291	25,807	1.13	299	97.43	164	14,861	1.10	172	95.35					
1990	306	25,984	1.18	305	100.45	183	15,389	1.19	180	101.43					
Part 1991	77	7,559	1.02	74	104.24	48	4,434	1.08	43	110.77					
Total	2,941	266,087	1.11	2,925	100.53	1,698	154,408	1.10	1,703	99.68					

\* Marital births only.

S.F. = Sampling fraction.

Exp. = Expected.

had not entered the study at the time of their original registration due to a non-LS date of birth on their NHS record. Like the group of new births into the LS who were found at the 1981 Census, this group of immigrants can be identified for analysis using tracing history indicators (see Appendix XIII).

Of the total 31,224 first decade immigrants only 15,342 traced immigrants were identified as such at the 1981 Census.<sup>3</sup> A further 12,201 persons were identified as immigrants after the 1981 Census though they had entered England and Wales in the first decade. Once identified they were added to the first decade LS immigrant file by date of entry.

During the second decade, 23,627 immigrants entered the LS as the result of registration with a GP. Any new immigrants identified from the 1991 Census who registered with the NHS prior to the census, have yet to be added to the second decade figures.

It should be noted that immigrants to the LS include persons entering England and Wales from Scotland, Northern Ireland, the Isle of Man and the Channel Islands, as well as those entering from abroad. A small number of immigrants are known as re-entrants to the NHS. Although born in England and Wales, these persons were not enumerated at the 1971 Census when the original LS sample was drawn. They subsequently returned to the country after



1971 and registered (or re-registered) with a GP retaining their original NHS number.

The capture of immigrants in the LS using information generated at NHSCR is known to be unreliable. This reflects the quality of migration data as a whole. Immigration figures for England and Wales are gathered from a number of different sources all of which are prone to error.<sup>4</sup> Migration data for the United Kingdom and its constituent parts should only be seen as an indicator of the true situation, due to the way in which the data is collected.

The main source of data on international migration is that collected by the International Passenger Survey (IPS) which samples travellers at ports and airports throughout the UK. Because only international arrivals and departures are sampled, anyone arriving on domestic flights (which include those from Southern Ireland) or via ferry routes across the Irish Sea is not included. The IPS surveys between 1971 and 1980 had standard errors for their yearly inflow estimates ranging from  $\pm 3$  per cent to  $\pm 4$  per cent. In the second decade the standard errors ranged from  $\pm 4$  per cent to  $\pm 5$  per cent.

Data on migration from Southern Ireland is estimated using inflow data from the British Labour Force Survey (LFS) and inflow and outflow data from the Irish LFS. The British LFS is a small survey with an accordingly large sampling error and tends to underestimate the inflow from Southern Ireland. The Irish LFS is a larger population sample and has smaller error estimates. However, the wording of the migration question in the Irish LFS tended to produce underestimates of the outflow until 1988, when the question was clarified to ensure that living abroad for long periods of time was considered to be emigration.<sup>4</sup>

Immigration into England and Wales from Northern Ireland, Scotland, the Isle of Man and the Channel Islands is recorded by NHSCR.

Both the numerators used for the number of immigrants entering the LS in each year and the denominators (all immigrants entering England and Wales in each year) are not only derived from different sources but are also known to be inaccurate. This must be taken into account particularly when examining the sampling fractions and linkage rates in the tables that follow.

### 7.1.2.1 By sex and year of entry

Table 7.5a shows the first decade immigrants and re-entrants to the LS by sex and year of entry to the LS. The sampling fractions and linkage rates are far higher than would be expected (with sampling fractions of over 2 per cent in some cases). The overall sampling fraction for the first decade was 1.78 per cent.

The first decade figures include the 3,681 immigrants found during the 1981 Census-LS link exercise to have an NHS immigrant number but a discrepant date of birth. However, exclusion of these extra persons only reduced the overall sampling fraction to 1.57 per cent and the linkage rate from 161.68 per cent to 142.62 per cent.

It is clear that there are problems with the capture of immigrants, especially in the first decade. It is probable that much of the bias in sampling fractions and linkage rates is due to the denominators used being too low. The England and Wales immigration figures used in calculating LS sampling fractions and expected entry rates are grossed up from the sample surveys discussed above.<sup>5</sup>

**Table 7.5a First decade immigrants and re-entrants by sex and year of entry**

Year of entry	Males					Females					Total				
	LS immi-grants	E & W immi-grants	S.F.	Exp. in LS	Entry rate	LS immi-grants	E & W immi-grants	S.F.	Exp. in LS	Entry rate	LS immi-grants	E & W immi-grants	S.F.	Exp. in LS	Entry rate
Part 1971	1,049	67,048	1.56	801	130.90	1,078	61,959	1.74	741	145.57	2,127	129,007	1.65	1,542	137.95
1972	1,816	108,300	1.68	1,184	153.43	1,851	100,800	1.84	1,102	168.02	3,667	209,100	1.75	2,285	160.46
1973	1,754	97,800	1.79	1,072	163.65	1,774	84,700	2.09	928	191.12	3,528	182,500	1.93	2,000	176.40
1974	1,537	94,300	1.63	1,033	148.73	1,652	71,900	2.30	788	209.66	3,189	166,200	1.92	1,821	175.09
1975	1,530	94,100	1.63	1,031	148.37	1,871	87,000	2.15	953	196.24	3,401	181,100	1.88	1,985	171.36
1976	1,637	93,000	1.76	1,016	161.06	1,712	85,700	2.00	937	182.79	3,349	178,700	1.87	1,953	171.48
1977	1,325	80,400	1.65	881	150.38	1,673	69,100	2.42	757	220.93	2,998	149,500	2.01	1,638	182.99
1978	1,443	89,700	1.61	983	146.79	1,600	86,300	1.85	946	169.18	3,043	176,000	1.73	1,929	157.77
1979	1,382	96,700	1.43	1,060	130.41	1,429	85,300	1.68	935	152.87	2,811	181,000	1.55	1,984	141.71
1980	1,225	86,400	1.42	944	129.73	1,321	77,200	1.71	844	156.57	2,546	163,600	1.56	1,788	142.40
Part 1981	273	19,755	1.38	208	131.28	292	16,996	1.72	179	163.22	565	36,751	1.54	387	146.05
Total	14,971	927,503	1.61	10,214	146.58	16,253	826,955	1.97	9,109	178.43	31,224	1,753,458	1.78	19,312	161.68

S.F. = Sampling fraction.

Exp. = Expected.

The second decade immigrants and re-entrants are shown in Table 7.5b. Both sampling fractions and linkage rates are much improved over those seen in the first decade (1.14 and 106.09 per cent respectively). It is not clear why there was such a noticeable improvement in the quality of data in the second decade.

## 7.2 THE QUALITY OF EXIT EVENT DATA

Between censuses exits from the LS occur by two means, death or emigration. Given the methods used to collect and link death information for LS members (see Chapter 6), the coverage of deaths to LS members should be in the region of 100 per cent. Emigration from the LS occurs when an LS member leaves England and Wales permanently. Information on emigrations is obtained from NHSCR.

### 7.2.1 Deaths of LS members

There were 125,919 deaths of LS members during the period from Census day 1971 to the day prior to Census 1991. Of these, 61,029 occurred in the first decade.

The quality of death data in the LS is good, with a linkage rate of 98.35 per cent for the first decade rising to 109.09 per cent in the second decade. The expected numbers of deaths to the LS population needed to calculate the linkage rates were generated by applying the England and Wales age-specific (and sex-specific) death rates for each year to the LS population. The LS population was aged by single years of age, adding immigrants and new births to the sample, and subtracting emigrants and deaths. Each decade

was dealt with separately using the 1971 and 1981 Census–LS samples as starting points.

The quality of death data for England and Wales is, like births data, extremely high. Death certificates are required by law before burial or cremation of a body, and as a result, virtually all deaths occurring in England and Wales are registered. Some delays in certification can occur if an inquest is required or a person has died while abroad. The number of deaths registered as occurring to LS members abroad is small; between 1971 and the Census in 1981 only 116 deaths of LS members were notified as occurring outside England and Wales. Deaths will only be missed where no body has been found as a result of disappearance either because of successful crime or misadventure.

#### 7.2.1.1 First decade deaths

Table 7.6a shows deaths by sex and age at death for the first decade. Overall the sampling fraction was 1.05 and the linkage rate 98.35 per cent. Some variation can be seen, particularly in the younger age groups, but much of this is likely to be due to the small numbers of deaths prior to reaching the age of 45. The majority of deaths occurred to those aged 65 and over (75 per cent in the first decade). A small number of deaths may have been missed because they occurred overseas after an LS member emigrated and were never notified to NHSCR. The deaths of the very elderly (85 and over) appear to be oversampled with linkage rates of over 100 per cent. This may be due to an over-estimation of age among the elderly, particularly those living in institutions. It should be noted that when a death is registered the deceased's date of birth is taken from the informant. No documentary evidence of that date is legally required.

**Table 7.5b Second decade immigrants and re-entrants by sex and year of entry**

Year of entry	Males					Females					Total				
	LS immi-grants	E & W immi-grants	S.F.	Exp. in LS	Entry rate	LS immi-grants	E & W immi-grants	S.F.	Exp. in LS	Entry rate	LS immi-grants	E & W immi-grants	S.F.	Exp. in LS	Entry rate
Part 1981	690	56,145	1.23	461	149.52	800	48,304	1.66	397	201.50	1,490	104,449	1.43	858	173.56
1982	782	96,200	0.81	1,054	74.18	889	93,900	0.95	1,029	86.39	1,671	190,100	0.88	2,083	80.21
1983	851	97,700	0.87	1,071	79.48	998	88,300	1.13	968	103.13	1,849	186,000	0.99	2,038	90.71
1984	917	93,400	0.98	1,021	89.83	1,066	93,500	1.14	1,022	104.32	1,983	186,900	1.06	2,043	97.08
1985	979	92,100	1.06	1,009	97.00	1,191	124,500	0.96	1,364	87.29	2,170	216,600	1.00	2,374	91.42
1986	1,215	113,500	1.07	1,244	97.68	1,399	118,300	1.18	1,296	107.91	2,614	231,800	1.13	2,540	102.90
1987	1,174	97,200	1.21	1,065	110.21	1,364	103,100	1.32	1,130	120.72	2,538	200,300	1.27	2,195	115.62
1988	1,195	101,700	1.18	1,111	107.51	1,357	100,400	1.35	1,097	123.67	2,552	202,100	1.26	2,209	115.54
1989	1,235	101,200	1.22	1,109	111.36	1,352	129,300	1.05	1,417	95.41	2,587	230,500	1.12	2,526	102.41
1990	1,326	124,500	1.07	1,364	97.19	1,619	125,700	1.29	1,378	117.53	2,945	250,200	1.18	2,742	107.41
Part 1991	595	32,819	1.81	298	199.43	633	39,932	1.59	363	174.37	1,228	72,751	1.69	661	185.68
Total	10,959	1,006,464	1.09	10,809	101.39	12,668	1,065,236	1.19	11,461	110.53	23,627	2,071,700	1.14	22,270	106.09

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.6a First decade deaths by sex and age at death**

Age at death	Males					Females					Total				
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
0-4	702	64,267	1.09	701	100.14	548	47,383	1.16	544	100.74	1,250	111,650	1.12	1,245	100.40
5-14	134	13,207	1.01	136	98.53	71	8,415	0.84	91	78.02	205	21,622	0.95	227	90.31
15-24	320	33,064	0.97	359	89.14	138	13,467	1.02	148	93.24	458	46,531	0.98	507	90.34
25-34	313	32,301	0.97	346	90.46	219	18,733	1.17	208	105.29	532	51,073	1.04	554	96.03
35-44	611	60,163	1.02	649	94.14	356	41,000	0.87	448	79.46	967	101,163	0.96	1,097	88.15
45-54	2,073	202,009	1.03	2,170	95.53	1,321	125,116	1.06	1,377	95.93	3,394	327,126	1.04	3,547	95.69
55-64	5,431	513,164	1.06	5,568	97.54	3,212	291,621	1.10	3,248	98.89	8,643	804,785	1.07	8,816	98.04
65-74	10,156	954,623	1.06	10,115	100.41	6,823	654,678	1.04	7,063	96.60	16,979	1,609,301	1.06	17,178	98.84
75-84	8,272	785,880	1.05	8,418	98.27	10,418	1,006,725	1.03	10,883	95.73	18,690	1,792,606	1.04	19,301	96.83
85 +	2,915	276,334	1.05	2,736	106.54	6,996	680,558	1.03	6,844	102.22	9,911	956,892	1.04	9,580	103.46
Total	30,927	2,935,012	1.05	31,198	99.13	30,102	2,887,736	1.04	30,854	97.56	61,029	5,822,748	1.05	62,052	98.35

\* Expected deaths based on England and Wales age-specific death rates applied to the LS population.

S.F. = Sampling fraction.

Exp. = Expected.

Table 7.6b shows first decade deaths by sex, age and year of death. Large age groupings (0–14, 15–44, 45–64, 65–74 and 75+) are used because of the small numbers of deaths in younger age groups.

Among LS members aged 0 to 14, sampling fractions and linkage rates for deaths were very variable. This was mainly due to the small numbers of deaths in this age group (comprising only 2.7 per cent of all male deaths and 2.1 per cent of all female deaths in the first decade). Most deaths for this group occurred among those aged 0 to 4.

There were low numbers of deaths in the 15–44 age group. The small numbers again caused wide variation in both yearly sampling fractions and linkage rates for both males and females. Although the overall sampling fractions for the decade were 0.99 for males in this group and 0.97 for females, they ranged from a low of 0.87 to a high of 1.14 for males and a low of 0.70 to a high of 1.16 for females. Linkage rates showed the same patterns.

The greater number of deaths among the 45–64 age group gave a greater consistency in linkage rates and sampling fractions. The overall sampling fraction was 1.05 for males and 1.09 for females, and the overall linkage rates stood at 96.98 per cent for males and 101.18 per cent for females. Variability between the individual years was far less than for younger age groups. The number of male deaths over the decade was 60 per cent greater than the number of female deaths.

As the number of deaths increase among the older age groups, the variability decreases. Among the 65–74 age group the overall sampling fraction for males was 1.06 (a range of 0.97 to 1.11 over the decade) and for females 1.04 (with a range of 0.98 to 1.13). Linkage rates were

slightly more variable among males than females but the overall rates for both sexes were around 100 per cent.

The final age group, those aged 75 and over, had the most deaths and, as might be expected, there was a higher number of female deaths. There was little variability in either sampling fractions or linkage rates. The overall rates for sampling fractions were 1.05 for males and 1.03 for females. Overall linkage rates were 100.30 per cent and 100.97 per cent respectively.

### 7.2.1.2 Second decade deaths

Table 7.7a shows deaths by sex and age at death for the second decade. Sampling fractions and linkage rates are generally higher than in the first decade. The overall sampling fraction was 1.12 and the linkage rate was 109.09 per cent compared with 1.05 and 98.35 respectively in the first decade. Approximately 500 extra deaths were linked to the LS in this period due to the data cleaning at NHSCR following the computerisation of the index. This was an artefact of computerisation and these deaths would have been found during the data cleaning associated with the 1991 Census-LS link. Deaths to LS members which had been previously missed were linked back into the LS. Even allowing for the replacement of these missing deaths, there still appears to be undersampling of deaths for the under 14s and for LS members aged between 25 and 54 years of age. A small amount of oversampling is seen among those aged 15 to 24 and a much larger amount among those over 65. The population of LS members sampled at the 1981 Census was slightly larger than 1.05 per cent of the population of England and Wales (at 1.09 per cent; see Chapter 9) and this should be taken into account. The effect of this slightly larger sample is to allow more deaths to be included from the 1981 Census onwards. However,

**Table 7.6b First decade deaths by sex, age and year of death**

This table continues on the next page

**a) Males**

Year of death	Age at death														
	0-14					15-44					45-64				
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
Part 1971	64	7,342	0.86	77	83.12	82	8,966	0.91	94	87.23	517	52,775	0.98	565	91.50
1972	120	9,985	1.20	87	137.93	112	12,853	0.87	139	80.58	846	78,039	1.08	843	100.36
1973	92	9,296	0.99	106	86.79	115	13,137	0.88	138	83.33	779	75,899	1.03	817	95.35
1974	99	8,601	1.15	105	94.29	121	12,711	0.95	139	87.05	791	74,271	1.07	804	98.38
1975	78	7,782	1.00	91	85.71	110	12,445	0.88	134	82.09	725	72,425	1.00	781	92.83
1976	69	7,070	0.98	78	88.46	131	12,496	1.05	135	97.04	782	72,497	1.08	784	99.74
1977	67	6,521	1.03	66	101.52	139	12,184	1.14	129	107.75	748	69,455	1.08	752	99.47
1978	76	6,499	1.17	67	113.43	130	12,711	1.02	136	95.59	721	69,281	1.04	754	95.62
1979	90	6,579	1.37	69	130.43	140	12,624	1.11	140	100.00	731	68,193	1.07	745	98.12
1980	72	6,202	1.16	72	100.00	130	12,271	1.06	134	97.01	653	65,746	0.99	714	91.46
Part 1981	9	1,507	0.60	18	50.00	34	3,130	1.09	34	100.00	211	16,592	1.27	179	117.88
Total	836	77,474	1.08	836	100.00	1,244	125,528	0.99	1,352	92.01	7,504	715,173	1.05	7,738	96.98

  

Year of death	Age at death										Total				
	65-74					75+									
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
Part 1971	597	61,754	0.97	642	92.99	665	67,368	0.99	692	96.10	1,925	198,296	0.97	2,070	93.00
1972	1,060	96,329	1.10	1,019	104.02	1,102	103,183	1.07	1,118	98.57	3,240	300,389	1.08	3,206	101.06
1973	994	95,605	1.04	1,006	98.81	1,092	102,609	1.06	1,106	98.73	3,072	296,546	1.04	3,173	96.82
1974	988	97,331	1.02	1,027	96.20	1,039	102,401	1.01	1,092	95.15	3,038	295,315	1.03	3,167	95.93
1975	1,069	96,934	1.10	1,028	103.99	1,066	104,588	1.02	1,101	96.82	3,048	294,174	1.04	3,135	97.22
1976	1,046	98,654	1.06	1,056	99.05	1,153	109,341	1.05	1,148	100.44	3,181	300,058	1.06	3,201	99.38
1977	1,048	95,873	1.09	1,024	102.34	1,137	105,740	1.08	1,106	102.80	3,139	289,773	1.08	3,077	102.01
1978	1,016	97,196	1.05	1,027	98.93	1,156	109,818	1.05	1,154	100.17	3,099	295,505	1.05	3,138	98.76
1979	1,054	96,764	1.09	1,023	103.03	1,205	113,702	1.06	1,195	100.84	3,220	297,862	1.08	3,172	101.51
1980	1,042	94,188	1.11	1,003	103.89	1,188	113,462	1.05	1,145	103.76	3,085	291,869	1.06	3,068	100.55
Part 1981	242	23,994	1.01	260	93.08	384	30,002	1.28	297	129.29	880	75,225	1.17	788	111.68
Total	10,156	954,623	1.06	10,115	100.41	11,187	1,062,214	1.05	11,154	100.30	30,927	2,935,012	1.05	31,195	99.14

\* Expected deaths based on England and Wales age-specific death rates applied to the LS population.

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.6b- continued**

**b) Females**

Year of death	Age at death														
	0-14					15-44					45-64				
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
Part 1971	58	5,301	1.09	53	109.43	49	5,351	0.92	55	89.09	333	30,281	1.10	320	104.06
1972	81	7,307	1.11	64	126.56	78	7,757	1.01	80	97.50	501	45,016	1.11	480	104.38
1973	79	6,607	1.20	78	101.28	89	7,659	1.16	81	109.88	459	43,483	1.06	467	98.29
1974	82	6,096	1.35	72	113.89	73	7,394	0.99	76	96.05	504	43,299	1.16	464	108.62
1975	63	5,591	1.13	68	92.65	86	7,444	1.16	80	107.50	445	42,245	1.05	454	98.02
1976	40	4,196	0.81	55	72.73	72	7,274	0.99	81	88.89	442	42,411	1.04	454	97.36
1977	43	4,703	0.91	48	89.58	75	7,071	1.06	73	102.74	444	40,757	1.09	440	100.91
1978	51	4,813	1.06	51	100.00	52	7,447	0.70	80	65.00	461	40,518	1.06	440	104.77
1979	56	4,728	1.18	53	105.66	65	7,063	0.92	80	81.25	431	40,295	1.07	437	98.63
1980	55	4,668	1.18	55	100.00	58	6,995	0.83	74	78.38	432	38,614	1.12	418	103.35
Part 1981	11	1,067	1.03	12	91.67	16	1,784	0.90	20	80.00	111	9,819	1.13	106	104.72
Total	619	55,798	1.11	609	101.64	713	73,240	0.97	780	91.41	4,533	416,737	1.09	4,480	101.18
Year of death	Age at death										Total				
	65-74					75+									
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
Part 1971	456	44,023	1.04	459	99.35	994	106,837	0.93	1,053	94.40	1,890	191,794	0.99	1,940	97.42
1972	701	67,215	1.04	704	99.57	1,662	164,205	1.01	1,696	98.00	3,023	291,500	1.04	3,024	99.97
1973	739	67,137	1.10	700	105.57	1,728	166,046	1.04	1,720	100.47	3,094	290,932	1.06	3,046	101.58
1974	756	66,992	1.13	698	108.31	1,669	166,196	1.00	1,717	97.20	3,084	289,977	1.06	3,027	101.88
1975	645	65,822	0.98	686	94.02	1,688	167,565	1.01	1,722	98.03	2,927	288,667	1.01	3,010	97.24
1976	676	67,107	1.01	704	96.02	1,820	176,750	1.03	1,830	99.45	3,050	298,458	1.02	3,124	97.63
1977	692	64,903	1.07	680	101.76	1,798	168,721	1.07	1,723	104.35	3,052	286,155	1.07	2,964	102.97
1978	666	65,411	1.02	682	97.65	1,803	172,207	1.05	1,748	103.15	3,003	290,396	1.03	3,001	100.07
1979	686	65,646	1.04	687	99.85	1,843	177,425	1.04	1,800	102.39	3,081	295,157	1.04	3,057	100.79
1980	637	64,087	0.99	680	93.68	1,867	175,152	1.07	1,770	105.48	3,049	289,516	1.05	2,997	101.74
Part 1981	169	16,335	1.03	175	96.57	542	46,179	1.17	468	115.81	849	75,185	1.13	781	108.71
Total	6,823	654,678	1.04	6,855	99.53	17,414	1,687,284	1.03	17,247	100.97	30,102	2,887,736	1.04	29,971	100.44

\* Expected deaths based on England and Wales age-specific death rates applied to the LS population.

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.7a Second decade deaths by sex and age at death**

Age at death	Males					Females					Total				
	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate
0-4	428	42,136	1.02	438	97.72	297	31,095	0.96	323	91.95	725	73,231	0.99	761	95.27
5-14	78	8,059	0.97	88	88.73	51	5,344	0.95	65	78.46	129	13,403	0.96	153	84.36
15-24	355	31,966	1.11	340	104.41	141	12,006	1.17	127	111.02	496	43,972	1.13	467	106.21
25-34	343	32,416	1.06	366	93.72	203	17,003	1.19	196	103.57	546	49,419	1.10	562	97.15
35-44	611	57,798	1.06	641	95.32	386	38,317	1.01	420	91.90	997	96,115	1.04	1,061	93.97
45-54	1,533	146,711	1.04	1,630	94.05	979	91,255	1.07	997	98.19	2,512	237,966	1.06	2,627	95.62
55-64	4,794	430,479	1.11	4,708	101.83	2,819	258,296	1.09	2,830	99.61	7,613	688,775	1.11	7,538	100.99
65-74	9,695	844,537	1.15	9,195	105.44	6,676	583,467	1.14	6,368	104.84	16,371	1,428,004	1.15	15,563	105.19
75-84	10,452	941,044	1.11	9,684	107.93	12,016	1,051,079	1.14	11,016	109.08	22,468	1,992,123	1.13	20,700	108.54
85+	3,674	323,081	1.14	2,324	158.09	9,359	832,995	1.12	7,727	121.12	13,033	1,156,076	1.13	10,051	129.67
Total	31,963	2,858,227	1.12	29,414	108.67	32,927	2,920,855	1.13	30,069	109.50	64,890	5,779,082	1.12	59,483	109.09

\* Expected deaths based on England and Wales age-specific death rates applied to the LS population.

S.F. = Sampling fraction.

Exp. = Expected.

the application of age-specific death rates to the aged-on LS population should have taken this into account. It is probable that much of the variation seen is due to the effect of sampling variation and in the case of the 15–24 age group, small numbers of deaths.

Table 7.7b shows second decade deaths by sex, age and year of death. The numbers of deaths occurring to the 0–14 age group in this period are very small, averaging 50 per year for males and 35 per year for females. As a result both sampling fractions and linkage rates show high variability with overall sampling fractions of 1.01 for males and 0.96 for females. The overall linkage rates are low at 96.40 per cent for males and 89.80 per cent for females.

Low numbers of deaths are also seen in the 15–44 age group for both males and females. Males had an average of 130 deaths per year, nearly twice as many as the females in this age group with an average of 73 deaths per year. Again there was high variability in both sampling fractions and linkage rates. Sampling fractions ranged from 0.88 to 1.20 for males with an overall sampling fraction of 1.07. For females the sampling fractions ranged from 0.85 to 1.40 with an overall sampling fraction of 1.08 for the decade. The overall linkage rates were 97.40 per cent for males and 98.49 per cent for females.

The number of deaths rose in the 45–65 age group. Males had double the number of deaths of females in the decade, and with the higher number of deaths the variability of sampling fractions and linkage rates lessened. The overall sampling fraction for males was 1.10 and for females 1.09. Given that the overall sampling fraction at the 1981 Census for the LS population was 1.09, these figures indicate that the deaths in this age group are probably being sampled correctly. The overall linkage rates of 99.81 per cent for males and 99.28 per cent for females tend to reinforce this.

The 65–74 age group is slightly oversampled. The overall

sampling fractions are 1.15 for males and 1.14 for females with linkage rates of 105.41 per cent and 104.84 per cent respectively. It is not clear why this group should be oversampled. The 75 and over age group also shows oversampling, with sampling fractions of 1.12 for males and 1.13 for females for the whole decade. Linkage rates however, are somewhat higher than expected at 117.65 per cent for males and 114.04 per cent for females.

## 7.2.2 Emigrants out of the LS

Two sources of emigration data are used to update the index at NHSCR. One source is Family Health Service Authority (FHSA) (previously FPC) data on persons leaving the NHS system, and the other is data acquired from the Department of Social Security (DSS). NHSCR is notified of embarkations from England and Wales if the persons emigrating return their NHS registration cards to their FHSAs. The notification that a person has left the NHS system is then passed to NHSCR by the FHSAs (see Chapter 6). However, most people do not bother to return their cards, or to inform their GPs that they are leaving the country permanently.

Additional data on emigration is available from the DSS. However, this data applies to specific groups of individuals claiming allowances or benefits rather than the whole population. The groups covered are mothers who can no longer claim child benefit if leaving the country, and pensioners who need to alter the method of claiming their statutory retirement pension if resident in another country. The DSS figures do not include those persons leaving England and Wales for countries in the rest of the UK – the benefit systems are the same in Northern Ireland and Scotland and are centrally administered. Both FHSA and DSS data are used by NHSCR in generating information on LS emigrations, but because of the gaps in coverage noted above a great number of emigrations are missed.

**Table 7.7b Second decade deaths by sex, age and year of death**

This table continues on the next page

**a) Males**

Year of death	Age at death														
	0-14					15-44					45-64				
	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate
Part 1981	49	4,283	1.14	46	106.52	107	8,896	1.20	95	112.63	485	47,155	1.03	509	95.28
1982	61	5,503	1.11	49	124.49	117	11,985	0.98	131	89.31	678	62,665	1.08	684	99.12
1983	53	5,163	1.03	53	100.00	123	11,867	1.04	127	96.85	732	62,947	1.16	687	106.55
1984	51	4,902	1.04	51	100.00	114	11,757	0.97	129	88.37	675	61,987	1.09	678	99.56
1985	42	4,979	0.84	56	75.00	134	11,831	1.13	127	105.51	659	60,542	1.09	666	98.95
1986	45	5,002	0.90	57	78.95	134	12,046	1.11	133	100.75	623	58,007	1.07	638	97.65
1987	51	4,928	1.03	52	98.08	140	12,241	1.14	137	102.19	590	55,045	1.07	609	96.88
1988	52	5,012	1.04	48	108.33	117	12,303	0.95	138	84.78	599	53,492	1.12	590	101.53
1989	50	4,682	1.07	50	100.00	136	12,434	1.09	139	97.84	582	51,087	1.14	564	103.19
1990	40	4,471	0.89	49	81.63	153	12,958	1.18	144	106.25	546	49,747	1.10	552	98.91
Part 1991	12	1,270	0.94	14	86.20	34	3,862	0.88	44	77.27	158	14,517	1.09	162	97.53
Total	506	50,195	1.01	525	96.40	1,309	122,180	1.07	1,344	97.40	6,327	577,191	1.10	6,339	99.81

  

Year of death	Age at death										Total				
	65-74					75+									
	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate
Part 1981	754	68,195	1.11	730	103.29	987	85,268	1.16	881	112.03	2,382	213,797	1.11	2,262	105.31
1982	990	91,079	1.09	995	99.50	1,305	118,934	1.10	1,249	104.48	3,151	290,166	1.09	3,109	101.35
1983	1,020	88,622	1.15	965	105.70	1,337	120,820	1.11	1,185	112.83	3,265	289,419	1.13	3,017	108.22
1984	936	83,728	1.12	912	102.63	1,364	119,983	1.14	1,162	117.38	3,140	282,357	1.11	2,932	107.09
1985	975	85,695	1.14	923	105.63	1,467	128,270	1.14	1,232	119.07	3,277	291,317	1.12	3,004	109.09
1986	1,009	84,437	1.19	914	110.39	1,349	128,402	1.05	1,211	111.40	3,160	287,894	1.10	2,953	107.01
1987	950	82,021	1.16	948	100.21	1,357	125,942	1.08	1,167	116.28	3,088	280,177	1.10	2,913	106.01
1988	921	80,870	1.14	874	105.38	1,444	129,254	1.12	1,178	122.58	3,133	280,931	1.12	2,829	110.75
1989	954	79,012	1.21	852	111.97	1,506	134,075	1.12	1,202	125.29	3,228	281,290	1.15	2,807	115.00
1990	896	77,604	1.15	833	107.56	1,477	132,516	1.11	1,176	125.60	3,112	277,296	1.12	2,754	113.00
Part 1991	290	23,274	1.25	251	115.54	533	40,661	1.31	364	146.43	1,027	83,583	1.23	834	123.14
Total	9,695	844,536	1.15	9,197	105.41	14,126	1,264,125	1.12	12,007	117.65	31,963	2,858,228	1.12	29,414	108.67

\* Expected deaths based on England and Wales age-specific death rates applied to the LS population.

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.7b- continued**

**b) Females**

Year of death	Age at death														
	0-14					15-44					45-64				
	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate
Part 1981	19	3,034	0.63	31	61.29	69	5,071	1.36	56	124.17	311	27,905	1.11	303	102.64
1982	30	3,952	0.76	34	88.24	70	6,749	1.04	74	94.64	401	37,741	1.06	412	97.33
1983	34	3,817	0.89	40	85.00	72	6,589	1.09	73	98.63	465	37,578	1.24	412	112.92
1984	31	3,610	0.86	37	83.78	72	6,530	1.10	71	100.89	372	37,147	1.00	404	92.08
1985	43	3,696	1.16	42	102.38	64	6,596	0.97	72	88.54	394	36,775	1.07	403	97.77
1986	40	3,600	1.11	41	97.56	94	6,716	1.40	73	128.77	385	34,546	1.11	377	102.12
1987	38	3,607	1.05	40	95.00	65	6,769	0.96	75	86.67	359	33,774	1.06	368	97.55
1988	38	3,569	1.06	39	97.44	71	6,887	1.03	78	91.03	344	32,552	1.06	357	96.43
1989	35	3,379	1.04	37	94.52	58	6,784	0.85	75	77.33	348	31,742	1.10	350	99.43
1990	32	3,241	0.99	36	90.10	75	6,665	1.13	71	105.63	323	30,848	1.05	341	94.72
Part 1991	8	935	0.86	11	72.73	20	1,970	1.02	23	86.96	96	8,942	1.07	99	96.97
Total	348	36,439	0.96	388	89.80	730	67,326	1.08	741	98.49	3,798	349,551	1.09	3,826	99.28

  

Year of death	Age at death										Total				
	65-74					75+									
	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS*	Linkage rate
Part 1981	487	46,427	1.05	498	97.79	1,524	131,247	1.16	1,351	112.81	2,410	213,683	1.13	2,240	107.59
1982	718	62,221	1.15	678	105.90	2,046	181,032	1.13	1,897	107.85	3,265	291,695	1.12	3,095	105.49
1983	684	59,913	1.14	652	104.91	2,036	182,292	1.12	1,881	108.24	3,291	290,189	1.13	3,059	107.58
1984	640	57,812	1.11	632	101.29	2,016	179,424	1.12	1,832	110.04	3,131	284,524	1.10	2,976	105.21
1985	695	59,285	1.17	643	108.09	2,069	192,091	1.08	1,930	107.20	3,265	298,443	1.09	3,090	105.66
1986	720	58,360	1.23	633	113.74	2,166	190,087	1.14	1,909	113.46	3,405	293,309	1.16	3,034	112.23
1987	670	56,858	1.18	624	107.37	2,114	185,809	1.14	1,823	115.96	3,246	286,817	1.13	2,930	110.78
1988	616	56,567	1.09	622	99.04	2,184	190,902	1.14	1,846	118.31	3,253	290,477	1.12	2,942	110.57
1989	663	55,932	1.19	618	107.28	2,256	197,745	1.14	1,875	120.32	3,360	295,582	1.14	2,956	113.67
1990	608	53,770	1.13	590	103.05	2,209	193,986	1.14	1,826	120.97	3,247	288,510	1.13	2,865	113.33
Part 1991	175	16,321	1.07	178	98.31	755	59,458	1.27	574	131.53	1,054	87,627	1.20	884	119.23
Total	6,676	583,467	1.14	6,368	104.84	21,375	1,884,073	1.13	18,744	114.04	32,927	2,920,856	1.13	30,071	109.50

\* Expected deaths based on England and Wales age-specific death rates applied to the LS population.

S.F. = Sampling fraction.

Exp. = Expected.



As with immigrations there is a numerator/denominator mismatch. NHSCR LS migration data (though known to be inadequate) is used for the numerator when calculating sampling fractions and linkage rates. The denominator is the emigration data for England and Wales taken from the published migration figures.<sup>5</sup> It should be noted that emigration data for the total population of England and Wales are based on the same sources as those used for estimating immigration<sup>4</sup> and are subject to the same caveats (see section 7.1.2).

### 7.2.2.1 First decade emigration

First decade emigrations by sex and year of emigration are shown in Table 7.8a. The number of known emigrants from the LS in the first decade is small both in terms of sampling fractions and linkage rates. An overall sampling fraction of 0.71 probably indicates that there is undersampling in the LS but, given the caveats on the England and Wales emigration figures, it cannot be seen as an accurate measure of the quality of the data.

### 7.2.2.2 Second decade emigration

The quality of the LS emigration data for the second decade is far worse than in the first decade as Table 7.8b shows. The overall sampling fraction dropped from 0.71 in the first decade to 0.39 in the second decade and the linkage rate from 64.49 per cent to 35.80 per cent. This latter figure will rise over the decade as many emigrations are notified belatedly. After the 1981 Census data had been linked to the sample only 5,625 LS members were known to have emigrated in the first decade.<sup>3</sup> By the end of 1993 the number of first decade emigrations had increased to

14,123 due to a combination of data cleaning and late reporting of first decade emigrants. Similarly, late reports of second decade emigrants will still be coming into NHSCR for some time to come and sampling fractions and linkage rates will rise.

## 7.3 THE QUALITY OF OTHER EVENT DATA

As well as entry and exit events occurring to members of the LS, data on a number of other events are collected. These fall into two types – those for which quality can be measured and those for which it cannot.

The events for which quality can be measured are births occurring to women in the LS sample (and to men in the LS sample between 1971 and 1978), widow(er)hoods, cancer registrations and infant mortality of children of female LS members.

The quality of event data cannot be assessed for enlistments into the armed services, entries into long-stay psychiatric hospitals (collected from 1971 to 1983), inter-FPC moves (between 1971 and 1974), and re-entries to the NHS of LS members returning from the armed services, psychiatric hospitals and previous emigrations. All these events were collected and recorded at NHSCR, but before the introduction of the computerised database in 1991 all processing was manual. No annual figures for England and Wales are available. These data are shown as tables in section 7.3.6, giving the number of events occurring to LS members by sex and year of occurrence.

**Table 7.8a First decade emigrations (embarkations) by sex and year of emigration**

Year of emigration	Males					Females					Total				
	Emig-rants from LS	Emig-rants from E & W	S.F.	Exp. in LS	Linkage rate	Emig-rants from LS	Emig-rants from E & W	S.F.	Exp. in LS	Linkage rate	Emig-rants from LS	Emig-rants from E & W	S.F.	Exp. in LS	Linkage rate
Part 1971	560	75,438	0.74	827	67.74	485	71,930	0.67	788	61.53	1,045	147,368	0.71	1,615	64.71
1972	954	109,800	0.87	1,200	79.50	799	96,400	0.83	1,054	75.84	1,753	206,200	0.85	2,254	77.79
1973	980	110,100	0.89	1,207	81.22	897	109,100	0.82	1,196	75.02	1,877	219,200	0.86	2,402	78.14
1974	1,058	124,900	0.85	1,369	77.30	897	111,200	0.81	1,219	73.61	1,955	236,100	0.83	2,587	75.56
1975	750	112,200	0.67	1,230	61.00	669	99,400	0.67	1,089	61.41	1,419	211,600	0.67	2,319	61.19
1976	562	105,000	0.54	1,148	48.97	590	82,600	0.71	903	65.36	1,152	187,600	0.61	2,050	56.19
1977	651	105,600	0.62	1,157	56.25	604	80,300	0.75	880	68.64	1,255	186,000	0.67	2,038	61.57
1978	622	94,300	0.66	1,033	60.19	562	75,600	0.74	828	67.83	1,184	169,900	0.70	1,862	63.59
1979	533	96,000	0.56	1,052	50.66	573	75,300	0.76	825	69.44	1,106	171,200	0.65	1,876	58.95
1980	522	120,300	0.43	1,315	39.70	524	80,100	0.65	875	59.86	1,046	200,400	0.52	2,190	47.76
Part 1981	178	31,181	0.57	342	52.09	153	22,696	0.67	249	61.51	331	53,877	0.61	590	56.06
Total	7,370	1,084,818	0.68	11,941	61.72	6,753	904,626	0.75	9,957	67.82	14,123	1,989,445	0.71	21,898	64.49

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.8b Second decade emigrations (embarkations) by sex and year of emigration**

Year of emigration	Males					Females					Total				
	Emig-rants from LS	Emig-rants from E & W	S.F.	Exp. in LS	Linkage rate	Emig-rants from LS	Emig-rants from E & W	S.F.	Exp. in LS	Linkage rate	Emig-rants from LS	Emig-rants from E & W	S.F.	Exp. in LS	Linkage rate
Part 1981	510	119,800	0.43	971	52.51	482	87,200	0.55	707	68.19	992	207,000	0.48	1,678	59.12
1982	634	117,500	0.54	1,288	49.24	577	112,200	0.51	1,230	46.93	1,211	229,700	0.53	2,517	48.11
1983	416	80,500	0.52	882	47.16	452	80,900	0.56	887	50.98	868	161,400	0.54	1,769	49.07
1984	358	73,200	0.49	800	44.75	363	77,800	0.47	850	42.69	721	151,000	0.48	1,650	43.69
1985	302	78,800	0.38	864	34.97	272	76,100	0.36	834	32.61	574	154,900	0.37	1,698	33.81
1986	281	96,300	0.29	1,055	26.63	251	92,000	0.27	1,008	24.90	532	188,300	0.28	2,064	25.78
1987	280	96,200	0.29	1,054	26.56	270	92,900	0.29	1,018	26.52	550	189,100	0.29	2,072	26.54
1988	340	110,400	0.31	1,207	28.18	368	102,600	0.36	1,121	32.82	708	213,000	0.33	2,328	30.41
1989	267	97,000	0.28	1,063	25.12	387	91,400	0.42	1,002	38.64	654	188,400	0.35	2,065	31.68
1990	332	99,300	0.33	1,088	30.51	446	103,700	0.43	1,136	39.25	778	203,000	0.38	2,225	34.97
Part 1991	11	32,699	0.03	358	3.07	17	3,158	0.05	346	4.91	28	64,282	0.04	704	3.97
Total	3,731	1,001,699	0.37	10,927	34.15	3,885	916,800	0.42	10,001	38.85	7,616	1,950,082	0.39	21,272	35.80

S.F. = Sampling fraction.

Exp. = Expected.

In the following sections (7.3.1 to 7.3.5) events are examined for the quality of sampling and linkage. The population base against which each event is measured varies according to the type of event being studied. Births to women in the LS sample (sample mothers) are measured against all births (live and still) occurring in England and Wales, except when examining parity (defined here as the number of previous marital liveborn children – see section 7.1.1.4) and births by mother's place of birth. Only live birth data is available for parity and for births in England and Wales by mother's place of birth. Births to men in the LS sample (sample fathers) are measured against marital and non-marital jointly registered live births in England and Wales. LS live birth data (rather than all birth data) are therefore used when examining parity, births by birthplace of mother and births to sample fathers. LS widow(er)hoods are measured against all widow(er)hoods occurring in England and Wales and collected at death registration by OPCS. Cancer registrations for LS members are compared with cancer registrations recorded for the population of England and Wales by the cancer registries and sent to NHSCR. LS infant mortality is measured against infant mortality occurring to children born to women in England and Wales for the years in question.

### 7.3.1 Births to women in the LS sample

Both live and stillbirths occurring to LS women have been collected since Census day 1971 and include both marital and non-marital births. Up to Census day 1991 there were 133,304 births to mothers in the sample. Less than 1 per cent (895) of these births were stillbirths. The quality of linkage of these births to sample mothers is good overall (92 per cent linkage in the first decade rising to 93 per cent

in the second) but the capture rate is not as high as that for new birth entries into the LS. Unlike new births, which enter the sample if the infant's birthdate is on an LS date, births occurring to LS women are linked to the sample using the mother's birthdate. If there is a discrepancy between the mother's birthdate given at census or at immigration and that given when registering her child's birth, then no linkage between the mother and child can be made. It is likely that most of the births that have not been linked have been missed because of a discrepancy in the mother's birthdate as given at birth registration.

After the 1981 Census an exercise was undertaken to try and improve the linkage of births to sample mothers. Checks were made of the number of children present in the household of an LS mother at the 1981 Census and the number reported for her in the LS. If the census showed a higher number of children than the LS then the birth files were searched to identify any missing births. The draft birth entry forms were examined to check whether the mother was an LS member and if so, the birth was added into the LS. A total of 4,394 births occurring to traced LS women between 1971 and Census day 1981 were added to the sample by this exercise and are included in the tables (see also Chapter 6, section 6.2.1).

The method used for calculating expected births to sample mothers assumes that approximately 1.1 per cent (4/365) of all births occurring in England and Wales would be to women in the LS and that those births would be spread equally throughout the year. Apart from fractional years (1971, 1981 and 1991) the proportion of births occurring to sample mothers would be 4/365 (or 4/366 if the year was a leap year). This was based on two assumptions.

First, that of all births in a year, four out of every 365 would be to a woman with an LS date of birth, and second, that the age distribution of women in the LS sample is the same as that of the population of England and Wales. The expected number of births in fractional years was calculated differently, but the probability of a birth occurring in the fraction of the year was assumed, as in non-fractional years, to be equally spread across the fraction of the year. In 1971 there were 251 days from census day to the end of the year; in 1981, 95 days before the census and 270 from census day on; and in 1991 the pre-census period was 110 days. The expected number of births for these fractional

years was calculated as follows:

$$\Sigma \text{ of all births in E \& W for year } x \text{ (fraction of year)} \times (4/365)$$

### 7.3.1.1 By sex and year of birth

Table 7.9a shows first decade births to sample mothers by sex and year of birth. Sampling fractions are lower than would be expected at 0.99 over the decade for male births and 1.01 for female births.

Linkage rates are slightly better for female births than for

**Table 7.9a First decade births to sample mothers by sex and year of birth**

Year of birth	Males					Females					Total				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1971	2,467	280,748	0.88	3,077	80.18	2,521	264,612	0.95	2,900	86.93	5,168	545,360	0.95	5,977	86.46
1972	3,743	378,395	0.99	4,135	90.51	3,674	355,844	1.03	3,889	94.47	7,417	734,239	1.01	8,024	92.43
1973	3,540	352,714	1.00	3,865	91.58	3,389	331,175	1.02	3,629	93.38	6,929	683,889	1.01	7,495	92.45
1974	3,387	333,038	1.02	3,650	92.80	3,079	314,022	0.98	3,441	89.47	6,466	647,060	1.00	7,091	91.19
1975	3,043	313,866	0.97	3,440	88.47	2,984	295,874	1.01	3,242	92.03	6,027	609,740	0.99	6,682	90.20
1976	3,045	303,263	1.00	3,314	91.87	2,932	286,716	1.02	3,134	93.57	5,977	589,979	1.01	6,448	92.70
1977	3,062	295,770	1.04	3,241	94.47	2,892	278,894	1.04	3,056	94.62	5,954	574,664	1.04	6,298	94.54
1978	3,193	309,722	1.03	3,394	94.07	3,003	291,804	1.03	3,198	93.91	6,196	601,526	1.03	6,592	93.99
1979	3,356	330,964	1.01	3,627	92.53	3,136	312,189	1.00	3,421	91.66	6,492	643,153	1.01	7,048	92.11
1980	3,329	338,437	0.98	3,699	90.00	3,193	322,570	0.99	3,525	90.57	6,522	661,007	0.99	7,224	90.28
Part 1981	839	85,343	0.98	935	89.73	883	80,894	1.09	887	99.55	1,722	166,237	1.04	1,822	94.51
Total	33,004	3,322,260	0.99	36,378	90.73	31,686	3,134,594	1.01	34,323	92.32	64,870	6,456,854	1.00	70,701	91.75

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.9b Second decade births to sample mothers by sex and year of birth**

Year of birth	Males					Females					Total				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1981	2,472	242,554	1.02	2,658	93.00	2,325	229,908	1.01	2,520	92.28	4,797	472,462	1.02	5,178	92.65
1982	3,388	323,444	1.05	3,545	95.58	3,037	306,426	0.99	3,358	90.44	6,425	629,870	1.02	6,903	93.08
1983	3,416	325,152	1.05	3,563	95.87	3,204	307,613	1.04	3,371	95.04	6,620	632,765	1.05	6,934	95.47
1984	3,533	328,006	1.08	3,585	98.56	3,233	312,455	1.03	3,415	94.68	6,766	640,461	1.06	7,000	96.66
1985	3,438	338,818	1.01	3,713	92.59	3,363	321,244	1.05	3,520	95.53	6,801	660,062	1.03	7,234	94.02
1986	3,464	340,756	1.02	3,734	92.76	3,262	323,811	1.01	3,549	91.92	6,726	664,567	1.01	7,283	92.35
1987	3,491	351,493	0.99	3,852	90.63	3,349	333,441	1.00	3,654	91.65	6,840	684,934	1.00	7,506	91.13
1988	3,718	356,765	1.04	3,899	95.36	3,320	340,194	0.98	3,718	89.30	7,038	696,959	1.01	7,617	92.40
1989	3,684	354,143	1.04	3,881	94.92	3,396	336,818	1.01	3,691	92.00	7,080	690,961	1.02	7,572	93.50
1990	3,677	363,165	1.01	3,980	92.39	3,539	346,231	1.02	3,794	93.27	7,216	709,396	1.02	7,774	92.82
Part 1991	1,139	108,533	1.05	1,189	95.76	986	103,171	0.96	1,131	87.21	2,125	211,704	1.00	2,320	91.59
Total	35,420	3,432,829	1.03	37,600	94.20	33,014	3,261,312	1.01	35,721	92.42	68,434	6,694,141	1.02	73,320	93.34

S.F. = Sampling fraction.

Exp. = Expected.

male births. The addition of the 4,394 missing births to the first decade sample after the 1981 Census improved the overall linkage rate by 6.21 per cent from 85.54 to the 91.75 per cent shown in the table, and the sampling fraction rose from 0.95 to 1.

In the second decade, despite the lack of an exercise to improve linkage retrospectively, there was a slight improvement in both sampling fractions and linkage rates, with male births showing better rates than female births. Overall the sampling fraction rose to 1.02 and the linkage rate to 93.34 per cent.

Much of this improvement in linkage over the second decade is due to the higher tracing rates of the LS population after 1981. At the 1971 Census women either already in the fertile period (aged 15–44 at census), or entering it by the next census (aged 5–14 in 1971) had ‘no trace’ rates that averaged over 5 per cent for women aged 20–39. The lowest no trace rates were found among those aged 5–14 (around 2 per cent). At the 1981 Census the ‘no trace’ rates for women aged between 5 and 44 at census had dropped to between 0.1 and 1.7 per cent (see Chapter 8 for further details of tracing rates).

### 7.3.1.2 By marital status of the mother

First decade births by marital status of the mother (Table 7.10a) show a consistently higher rate of linkage for marital births than for non-marital births. The proportion of non-marital births among births to sample mothers in the first decade was 8.8 per cent compared with 9.6 per cent of all births in England and Wales. The linkage rates for marital births ranged between 87.57 and 95.65 per cent over the decade compared with rates which did not rise over 86.38 per cent for non-marital births.

By the second decade (Table 7.10b), non-marital births were increasing as a proportion of all births (21 per cent of all births to sample mothers were outside marriage between the 1981 and 1991 Censuses). Births outside marriage had become more socially acceptable and the improvements in linkage rates for this group may be a reflection of this. On the whole the quality of linkage for both marital and non-marital birth data improved. However, the improvement was more marked for non-marital births where the overall sampling fraction increased from 0.91 in the first decade to 0.99 in the second decade, and the overall linkage rate rose from 83.31 per cent to 90.70. Neither the sampling fractions nor the linkage rates were as high as those for second decade marital births overall which stood at 1.03 and 94.05 per cent respectively.

### 7.3.1.3 By mother’s age at registration

Table 7.11a shows first decade births to sample mothers by year of birth and mother’s age at the registration of the birth. The linkage of births was most complete among the mothers aged 20–24 where the overall sampling fraction was 1.02 and the linkage rate 93.32 per cent for the whole

decade. The largest number of births actually occurred among the 25–29 year age group, and though both the sampling fractions and linkage rates were lower than those found among the 20–24 year age group, the variability was less. Variability in sampling fractions and linkage rates was high at both ends of the age distribution. Some of this variability was probably due to the small numbers of births occurring among women aged over 35, accounting for only 6 per cent of all births to sample mothers in the first decade.

During the second decade (Table 7.11b) linkage of births to sample mothers improved greatly for all age groups, but particularly for those aged under 20, where the overall linkage rate for the decade was 94.24 per cent. Variability in sampling fractions and linkage rates was still high at either end of the age distribution but low variability was now found for two age groups, 20–24 and 25–29. Overall sampling fractions ranged from 1 to 1.03 compared with a range of 0.92 to 1.02 in the first decade.

### 7.3.1.4 By mother’s place of birth

Only live births by mother’s place of birth are available for England and Wales. The LS births shown in Tables 7.12a and 7.12b are live births only.

Eighty-eight per cent of all live births to sample mothers, in both the first and second decades, occurred to women whose place of birth was the UK. In the first decade 1.7 per cent of sample births were to women born in the Irish Republic but this dropped to 0.8 per cent in the second decade. The proportion of births occurring to women born in the New Commonwealth and Pakistan rose from 7.9 per cent in the first decade to 9 per cent in the second.

The quality of data was good for births occurring to mothers born in the UK but unreliable for other groups. Births occurring to women born in the New Commonwealth and Pakistan were oversampled in both decades, with the oversampling increasing in the second decade. Large numbers of women in this group entered the UK in the 1970s and 80s to join husbands who were already resident. Many, especially those coming from agricultural areas of the Indian subcontinent, were illiterate and either did not know their dates of birth or could not translate from one dating system to another.

First decade births to sample mothers by mother’s place of birth are shown in Table 7.12a. The quality of the data for births to sample mothers whose birthplace was the UK was high, and variability of both sampling fractions and linkage rates was low, with an overall sampling fraction of 1.01 and linkage rate of 91.92 per cent.

Where the mother’s place of birth was given as the Irish Republic the quality of the data was low and the variability was extremely high. Linkage rates ranged between 55.16 and 88.12 per cent but much of this was probably due to the low numbers of births. The overall sampling fraction was 0.82 and the overall linkage rate 74.72 per cent.

**Table 7.10a First decade births to sample mothers by year of birth and marital status of mother**

Year of birth	Marital births					Non-marital births					All births				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1971	4,793	499,458	0.96	5,474	87.57	375	45,902	0.82	503	74.55	5,168	545,360	0.95	5,977	86.47
1972	6,828	670,777	1.02	7,331	93.14	589	63,462	0.93	694	84.92	7,417	734,239	1.01	8,024	92.43
1973	6,371	624,913	1.02	6,848	93.03	558	58,976	0.95	646	86.34	6,929	683,889	1.01	7,495	92.45
1974	5,942	589,740	1.01	6,463	91.94	524	57,320	0.91	628	83.42	6,466	647,060	1.00	7,091	91.19
1975	5,534	554,133	1.00	6,073	91.13	493	55,607	0.89	609	80.90	6,027	609,740	0.99	6,682	90.20
1976	5,475	535,526	1.02	5,853	93.55	502	54,453	0.92	595	84.35	5,977	589,979	1.01	6,448	92.70
1977	5,436	518,586	1.05	5,683	95.65	518	56,078	0.92	615	84.29	5,954	574,664	1.04	6,298	94.54
1978	5,623	540,190	1.04	5,920	94.98	573	61,336	0.93	672	85.25	6,196	601,526	1.03	6,592	93.99
1979	5,871	572,971	1.02	6,279	93.50	621	70,182	0.88	769	80.74	6,492	643,153	1.01	7,048	92.11
1980	5,785	582,939	0.99	6,371	90.80	737	78,068	0.94	853	86.38	6,522	661,007	0.99	7,224	90.28
Part 1981	1,532	144,978	1.06	1,589	96.43	190	21,259	0.89	233	81.55	1,722	166,237	1.04	1,822	94.52
Total	59,190	5,834,211	1.01	63,883	92.65	5,680	622,643	0.91	6,818	83.31	64,870	6,456,854	1.00	70,701	91.75

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.10b Second decade births to sample mothers by year of birth and marital status of mother**

Year of birth	Marital births					Non-marital births					All births				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1981	4,202	412,041	1.02	4,516	93.06	595	60,421	0.98	662	89.86	4,797	472,462	1.02	5,178	92.65
1982	5,501	539,356	1.02	5,911	93.07	924	90,514	1.02	992	93.15	6,425	629,870	1.02	6,903	93.08
1983	5,599	532,836	1.05	5,839	95.88	1,021	99,929	1.02	1,095	93.23	6,620	632,765	1.05	6,934	95.47
1984	5,636	529,178	1.07	5,783	97.45	1,130	111,283	1.02	1,216	92.91	6,766	640,461	1.06	7,000	96.66
1985	5,540	532,940	1.04	5,840	94.86	1,261	127,122	0.99	1,393	90.52	6,801	660,062	1.03	7,234	94.02
1986	5,312	522,273	1.02	5,724	92.81	1,414	142,294	0.99	1,559	90.68	6,726	664,567	1.01	7,283	92.35
1987	5,311	525,484	1.01	5,759	92.23	1,529	159,450	0.96	1,747	87.50	6,840	684,934	1.00	7,506	91.13
1988	5,332	518,547	1.03	5,667	94.09	1,706	178,412	0.96	1,950	87.49	7,038	696,959	1.01	7,617	92.40
1989	5,254	504,090	1.04	5,524	95.11	1,826	186,871	0.98	2,048	89.16	7,080	690,961	1.02	7,572	93.50
1990	5,154	508,317	1.01	5,571	92.52	2,062	201,079	1.03	2,204	93.57	7,216	709,396	1.02	7,774	92.82
Part 1991	1,472	147,678	1.00	1,618	90.95	653	64,025	1.02	702	93.07	2,125	211,704	1.00	2,320	91.59
Total	54,313	5,272,741	1.03	57,752	94.05	14,121	1,421,400	0.99	15,568	90.70	68,434	6,694,141	1.02	73,320	93.34

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.11a First decade births to sample mothers by year of birth and age of mother at registration**

Year of birth	Mother's age at registration														
	Under 20					20-24					25-29				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1971	500	57,566	0.87	631	79.26	1,864	198,646	0.94	2,177	85.62	1,720	171,951	1.00	1,884	91.28
1972	776	80,015	0.97	874	88.74	2,635	251,824	1.05	2,752	95.74	2,532	250,356	1.01	2,736	92.54
1973	700	74,170	0.94	813	86.12	2,281	226,006	1.01	2,477	92.10	2,524	246,339	1.02	2,700	93.50
1974	695	69,579	1.00	763	91.15	2,113	210,259	1.00	2,304	91.70	2,379	237,844	1.00	2,607	91.27
1975	646	64,198	1.01	704	91.82	1,944	192,023	1.01	2,104	92.38	2,196	228,151	0.96	2,500	87.83
1976	629	58,585	1.07	640	98.24	1,832	183,836	1.00	2,009	91.18	2,230	222,637	1.00	2,433	91.65
1977	588	55,112	1.07	604	97.36	1,842	176,149	1.05	1,930	95.42	2,152	209,647	1.03	2,298	93.67
1978	595	56,599	1.05	620	95.93	1,922	184,064	1.04	2,017	95.28	2,174	212,197	1.02	2,325	93.49
1979	579	59,722	0.97	654	88.47	2,075	194,729	1.07	2,134	97.23	2,230	223,695	1.00	2,451	90.97
1980	593	61,262	0.97	670	88.57	2,106	202,928	1.04	2,218	94.96	2,236	224,898	0.99	2,458	90.97
Part 1981	154	14,842	1.04	163	94.68	552	50,944	1.08	558	98.87	599	56,489	1.06	619	96.76
Total	6,455	651,651	0.99	7,135	90.46	21,166	2,071,408	1.02	22,681	93.32	22,972	2,284,204	1.01	25,011	91.85
Year of birth	30-34					35-39					40 and over				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
	Part 1971	691	76,400	0.90	837	82.53	319	31,759	1.00	348	91.66	74	9,039	0.82	99
1972	981	100,029	0.98	1,093	89.74	400	40,661	0.98	444	90.01	93	11,354	0.82	124	74.95
1973	963	92,971	1.04	1,019	94.52	361	34,841	1.04	382	94.55	100	9,562	1.05	105	95.43
1974	897	90,169	0.99	988	90.78	292	30,934	0.94	339	86.13	90	8,275	1.09	91	99.24
1975	880	89,318	0.99	979	89.90	294	28,632	1.03	314	93.70	67	7,418	0.90	81	82.42
1976	966	91,722	1.05	1,002	96.37	264	26,530	1.00	290	91.05	56	6,669	0.84	73	76.83
1977	1,073	101,732	1.05	1,115	96.24	241	25,915	0.93	284	84.86	58	6,109	0.95	67	86.63
1978	1,175	113,988	1.03	1,249	94.06	270	28,307	0.95	310	87.04	60	6,371	0.94	70	85.94
1979	1,241	126,622	0.98	1,388	89.43	301	31,733	0.95	348	86.55	66	6,652	0.99	73	90.54
1980	1,220	130,861	0.93	1,430	85.30	310	34,236	0.91	374	82.85	57	6,822	0.84	75	76.45
Part 1981	318	33,163	0.96	363	87.50	80	8,986	0.89	98	81.23	19	1,812	1.05	20	95.71
Total	10,405	1,046,975	0.99	11,464	90.76	3,132	322,534	0.97	3,532	88.69	740	80,082	0.92	877	84.39

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.11b Second decade births to sample mothers by year of birth and age of mother at registration**

Year of birth	Mother's age at registration														
	Under 20					20-24					25-29				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1981	398	42,184	0.94	462	86.09	1,503	144,787	1.04	1,587	94.72	1,631	160,548	1.02	1,759	92.70
1982	574	55,832	1.03	612	93.81	1,981	193,508	1.02	2,121	93.42	2,156	213,052	1.01	2,335	92.34
1983	553	54,456	1.02	597	92.66	2,021	192,892	1.05	2,114	95.61	2,265	215,184	1.05	2,358	96.05
1984	585	54,453	1.07	595	98.30	1,955	192,554	1.02	2,104	92.90	2,392	219,144	1.09	2,395	99.87
1985	642	57,290	1.12	628	102.26	2,029	194,997	1.04	2,137	94.95	2,332	228,594	1.02	2,505	93.09
1986	611	57,773	1.06	633	96.50	1,890	193,081	0.98	2,116	89.32	2,345	230,133	1.02	2,522	92.98
1987	588	57,865	1.02	634	92.72	1,924	194,190	0.99	2,128	90.41	2,436	240,008	1.01	2,630	92.62
1988	586	59,077	0.99	646	90.76	1,977	194,620	1.02	2,127	92.95	2,444	244,507	1.00	2,672	91.46
1989	542	55,868	0.97	612	88.53	1,878	186,075	1.01	2,039	92.10	2,539	243,832	1.04	2,672	95.02
1990	596	55,873	1.07	612	97.34	1,922	180,941	1.06	1,983	96.93	2,551	253,619	1.01	2,779	91.78
Part 1991	173	15,874	1.09	174	99.44	516	52,492	0.98	575	89.70	765	75,271	1.02	825	92.74
Total	5,848	566,545	1.03	6,205	94.24	19,596	1,920,138	1.02	21,031	93.18	23,843	2,323,892	1.03	25,453	93.67
Year of birth	30-34					35-39					40 and over				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
	Part 1981	973	94,253	1.03	1,033	94.20	243	25,541	0.95	280	86.82	49	5,148	0.95	56
1982	1,267	121,524	1.04	1,332	95.14	389	39,326	0.99	431	90.26	58	6,628	0.88	73	79.85
1983	1,265	121,685	1.04	1,334	94.86	434	41,595	1.04	456	95.21	82	6,953	1.18	76	107.62
1984	1,305	123,406	1.06	1,349	96.76	462	43,242	1.07	473	97.76	67	7,212	0.93	79	85.00
1985	1,269	126,930	1.00	1,391	91.23	438	44,697	0.98	490	89.42	91	7,554	1.20	83	109.93
1986	1,341	130,167	1.03	1,426	94.01	463	45,780	1.01	502	92.29	76	7,633	1.00	84	90.86
1987	1,306	137,219	0.95	1,504	86.85	505	46,919	1.08	514	98.21	94	8,733	1.08	96	98.22
1988	1,473	141,680	1.04	1,548	95.13	474	47,961	0.99	524	90.43	84	9,114	0.92	100	84.33
1989	1,508	146,002	1.03	1,600	94.25	528	49,774	1.06	545	96.80	85	9,410	0.90	103	82.43
1990	1,575	156,933	1.00	1,720	91.58	480	52,219	0.92	572	83.88	92	9,811	0.94	108	85.57
Part 1991	495	48,811	1.01	535	92.54	145	16,264	0.89	178	81.35	31	2,991	1.04	33	94.56
Total	13,777	1,348,610	1.02	14,771	93.27	4,561	453,317	1.01	4,965	91.86	809	81,188	1.00	889	90.98

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.12a First decade live births to sample mothers by year and mother's place of birth**

Year of birth	Mother's place of birth														
	United Kingdom					Irish Republic*					New Commonwealth and Pakistan				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1971	4,529	474,285	0.95	5,198	87.13	123	14,842	0.83	163	75.62	310	31,057	1.00	340	91.18
1972	6,514	640,010	1.02	6,995	93.12	158	18,911	0.84	207	76.45	479	43,003	1.11	470	101.91
1973	6,053	596,893	1.01	6,541	92.54	120	16,383	0.73	180	66.84	489	40,968	1.19	449	108.91
1974	5,638	564,191	1.00	6,183	91.19	141	14,601	0.97	160	88.12	463	39,982	1.16	438	105.71
1975	5,329	530,481	1.00	5,813	91.67	79	12,823	0.62	141	56.22	402	39,965	1.01	438	91.78
1976	5,208	511,212	1.02	5,587	93.22	99	11,387	0.87	124	79.55	442	41,953	1.05	459	96.30
1977	5,158	494,470	1.04	5,419	95.18	86	10,373	0.83	114	75.65	493	44,349	1.11	486	101.44
1978	5,302	517,795	1.02	5,674	93.44	81	9,767	0.83	107	75.68	568	47,964	1.18	526	107.98
1979	5,541	554,212	1.00	6,074	91.22	91	9,658	0.94	106	85.98	643	52,181	1.23	572	112.41
1980	5,575	569,069	0.98	6,219	89.64	73	9,154	0.80	100	72.97	629	55,478	1.13	606	103.80
Part 1981	1,488	143,523	1.04	1,573	94.60	13	2,150	0.60	24	55.16	164	13,837	1.19	152	107.89
Total	56,335	5,596,141	1.01	61,276	91.94	1,064	130,049	0.82	1,424	74.72	5,082	450,737	1.13	4,936	102.96
Year of birth	Old Commonwealth					Other (includes not stated)					Total				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
	Part 1971	7	1,680	0.42	18	38.89	154	16,689	0.92	183	84.15	5,123	538,553	0.95	5,902
1972	17	2,410	0.71	26	65.38	192	21,106	0.91	231	83.12	7,360	725,440	1.01	7,928	92.84
1973	23	2,435	0.94	27	85.19	181	19,274	0.94	211	85.78	6,866	675,953	1.02	7,408	92.68
1974	14	2,333	0.60	26	53.85	155	18,778	0.83	206	75.24	6,411	639,885	1.00	7,012	91.43
1975	19	2,172	0.87	24	79.17	154	18,004	0.86	197	78.17	5,980	603,445	0.99	6,613	90.43
1976	14	2,105	0.67	23	60.87	170	17,613	0.97	192	88.54	5,933	584,270	1.02	6,385	92.92
1977	17	2,170	0.78	24	70.83	149	17,897	0.83	196	76.02	5,902	569,259	1.04	6,238	94.61
1978	32	2,212	1.45	24	133.33	149	18,680	0.80	205	72.68	6,135	596,418	1.03	6,536	93.86
1979	16	2,488	0.64	27	59.26	160	19,489	0.82	214	74.77	6,452	638,028	1.01	6,992	92.28
1980	33	2,497	1.32	27	122.22	164	20,036	0.82	219	74.89	6,474	656,234	0.99	7,172	90.27
Part 1981	7	602	1.16	7	100.00	36	5,028	0.72	55	65.45	1,708	165,142	1.03	1,810	94.36
Total	199	23,104	0.86	253	78.66	1,664	192,594	0.86	2,109	78.90	64,340	6,392,627	1.01	69,996	91.92

\* Includes Ireland part not stated.

S.F. = Sampling fraction.

Exp. = Expected.



**Table 7.12b Second decade live births to sample mothers by year and mother's place of birth**

Year of birth	Mother's place of birth															
	United Kingdom					Irish Republic*					New Commonwealth and Pakistan					
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	
Part	1981	4,115	407,909	1.01	4,470	92.05	58	6,112	0.95	67	86.60	437	39,328	1.11	431	101.40
	1982	5,494	544,407	1.01	5,966	92.09	55	7,302	0.75	80	68.73	647	53,186	1.22	583	111.00
	1983	5,649	549,435	1.03	6,021	93.82	66	6,711	0.98	74	89.74	667	52,010	1.28	570	117.02
	1984	5,842	556,518	1.05	6,082	96.05	52	6,428	0.81	70	74.02	638	52,445	1.22	573	111.31
	1985	5,904	575,220	1.03	6,304	93.66	49	6,311	0.78	69	70.85	630	52,733	1.19	578	109.02
	1986	5,788	579,322	1.00	6,349	91.17	59	6,188	0.95	68	87.00	618	52,705	1.17	578	107.00
	1987	5,993	600,734	1.00	6,583	91.03	48	6,000	0.80	66	73.00	583	51,574	1.13	565	103.15
	1988	6,180	612,530	1.01	6,694	92.32	41	6,483	0.63	71	57.87	576	50,570	1.14	553	104.22
	1989	6,199	607,228	1.02	6,655	93.15	50	6,561	0.76	72	69.54	609	49,532	1.23	543	112.19
	1990	6,325	624,160	1.01	6,840	92.47	59	6,424	0.92	70	83.81	586	49,790	1.18	546	107.40
Part	1991	1,901	186,049	1.02	2,039	93.24	17	1,819	0.93	20	85.29	143	14,857	0.96	163	87.83
Total		59,390	5,843,511	1.02	64,003	92.79	554	66,338	0.84	727	76.24	6,134	518,729	1.18	5,682	107.96
Year of birth	Old Commonwealth					Other (includes not stated)					Total					
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	
	Part	1981	22	1,711	1.29	19	117.33	126	14,292	0.88	157	80.45	4,758	469,350	1.01	5,144
	1982	23	2,187	1.05	24	95.96	171	18,849	0.91	207	82.78	6,390	625,931	1.02	6,860	93.16
	1983	31	2,246	1.38	25	125.95	174	18,732	0.93	205	84.76	6,582	629,134	1.05	6,895	95.47
	1984	28	2,321	1.21	25	110.38	173	19,106	0.91	209	82.85	6,733	636,818	1.06	6,960	96.74
	1985	30	2,361	1.27	26	115.95	157	19,792	0.79	217	72.38	6,770	656,417	1.03	7,194	94.11
	1986	31	2,470	1.26	27	114.52	184	20,333	0.90	223	82.58	6,680	661,018	1.01	7,244	92.21
	1987	27	2,498	1.08	27	98.63	157	20,705	0.76	227	69.19	6,808	681,511	1.00	7,469	91.15
	1988	21	2,653	0.79	29	72.43	191	21,341	0.89	233	81.89	7,009	693,577	1.01	7,580	92.47
	1989	24	2,772	0.87	30	79.00	170	21,632	0.79	237	71.71	7,052	687,725	1.03	7,537	93.57
	1990	37	2,998	1.23	33	112.62	178	22,768	0.78	250	71.34	7,185	706,140	1.02	7,739	92.85
Part	1991	5	934	0.54	10	48.85	49	7,070	0.69	77	63.24	2,115	210,723	1.00	2,309	91.59
Total		279	25,151	1.11	275	101.28	1,730	204,619	0.85	2,241	77.19	68,082	6,658,344	1.02	72,928	93.35

\* Includes Ireland part not stated.

S.F. = Sampling fraction.

Exp. = Expected.

Births to women born in the New Commonwealth and Pakistan were, as stated above, oversampled in most years. There was high variability in the linkage rates, which ranged from 91.18 to 112.41 per cent. The overall linkage rate was 102.96 per cent and the overall sampling fraction 1.13. The population originating from the New Commonwealth and Pakistan is known to have been oversampled and undertraced at the 1971 Census.<sup>6</sup> Many women in this group will only have registered with the NHS when they became pregnant. This is borne out by the fact that the percentage of 'no trace' women from the New Commonwealth and Pakistan at the 1971 Census was 17 per cent and had fallen to 6 per cent at the 1981 Census. It should be noted that name-based tracing at NHSCR is made more difficult by the structure of many Asian women's names.

Births to sample mothers originating from the Old Commonwealth and from 'other' (the rest of the world plus 'not stated') areas showed high variability and poor quality of data. This was partially due to sampling variation because of small numbers, but was also related to very high 'no trace' rates for the women in these groups.

Because births to sample mothers born in the UK made up the majority of births in the first decade, the lower quality of birth data for the other groups had very little effect on either linkage rates or sampling fractions for total births. Six births are known to have been missed due to miscoding of the mother's place of birth.

Table 7.12b shows second decade births to sample mothers by mother's place of birth. The quality of data for births to sample mothers whose birthplace was in the UK was slightly better than in the first decade. The overall sampling fraction had risen to 1.02, and the linkage rate for the decade to 93.35 per cent. The variability of the data over the second decade was slightly less than in the first decade.

Births to mothers born in the Irish Republic were fewer than in the first decade and there was a slight improvement in linkage rates and sampling fractions. Variability was still high but less than in the first decade. The overall sampling fraction was 0.84 with an overall linkage rate of 76.24 per cent.

Births to sample mothers born in the New Commonwealth and Pakistan in the second decade show higher linkage rates and sampling fractions than in the first decade. Oversampling of women born in this area occurred at the 1981 Census with a sampling fraction of 1.22 compared with a sampling fraction at the 1971 Census of 1.12. This tends to reflect the fact that only traced persons are used to calculate the sampling fractions. By 1981 the tracing rate for these women had increased from 83.3 to 93.8 per cent. Consequently more births could be linked to an already oversampled population. Linkage rates ranged from 87.83 per cent for 1991 (a part year) to 117.02 per cent for 1983. The low rate for 1991 pulled down the overall linkage rate to 107.96 per cent for the whole decade, but this was still 5 per cent higher than in the first decade. The overall sampling fraction for the second decade births was 1.18.

Births to sample mothers born in the Old Commonwealth and also from the rest of the world were small in number, and as in the first decade, showed great variability in both sampling fractions and linkage rates.

The effect of the births that occurred to sample mothers born in the UK (87 per cent of all second decade sample mothers) was again noticeable in the second decade total births. The lower quality of data on births to mothers born outside the UK had very little effect on either the overall sampling fractions or linkage rates. Twenty births are missing from Table 7.12b due to the miscoding of the mother's place of birth.

#### **7.3.1.5 Live births to sample mothers by mother's parity**

Parity data is only collected for marital live births in England and Wales, therefore only marital live births, not all births, to sample mothers are examined in this section. The term parity is defined here as the number of previous liveborn children a woman has had inside marriage. Births occurring at parity 0 are therefore first births within marriage, births at parity 1 are second births within marriage, etc. (see section 7.1.1.4).

The quality of this data is slightly better in the second decade than in the first, but both decades show high rates of linkage. In the first decade 92 per cent of marital live births to the sample occurred within parity 0, 1 or 2, with the majority occurring at parity 0. Only 8 per cent occurred at parities of 3 or over. In the second decade a slight change of pattern was seen with 91 per cent of births occurring within parities 0, 1 or 2 and a rise to 9 per cent for marital births at higher parities.

First decade live births to sample mothers by mother's parity at registration are shown in Table 7.13a. The overall sampling fraction for all marital births was 0.99 and the overall linkage rate for the decade was 90.41 per cent. These overall rates were affected by the lower linkage rates and sampling fractions found at higher parities.

Births at parity 0 showed very little variation over the decade with an overall linkage rate of 92.65 per cent and a sampling fraction of 1.01. Variation in linkage rates began to increase as the parities increased, with overall linkage rates slightly worse for parity 1, at 91.10 per cent, and parity 2, at 91.21 per cent. The overall sampling fraction at parity 1 was 1.02 and 1.03 at parity 2. Variation in linkage rates at parities 3 and 4+ was high, but numbers of births at these parities were small. The overall linkage rates at these parities were 87.03 and 85.97 per cent respectively. Sampling fractions were less than 1.00, at 0.95 for parity 3 and 0.94 for parity 4+.

Second decade live marital births by mother's parity at registration are shown in Table 7.13b. There was a general improvement in linkage rates and sampling fractions in the second decade when compared with the first decade. The rise in linkage rates and sampling fractions was particularly noticeable for births to sample mothers at parities 1, 2 and 3.

**Table 7.13a First decade live births to sample mothers by mother's parity at registration\***

Year of birth	Parity 0					Parity 1					Parity 2				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1971	1,910	195,034	0.98	2,137	89.36	1,582	165,580	0.96	1,815	87.18	746	76,779	0.97	841	88.66
1972	2,646	265,924	1.00	2,906	91.04	2,416	229,701	1.05	2,510	96.24	1,030	98,816	1.04	1,080	95.37
1973	2,601	253,814	1.02	2,782	93.51	2,245	222,483	1.01	2,438	92.08	936	86,118	1.09	944	99.18
1974	2,479	242,826	1.02	2,661	93.16	2,144	215,826	0.99	2,365	90.65	803	77,882	1.03	854	94.08
1975	2,254	226,944	0.99	2,487	90.63	2,165	206,155	1.05	2,259	95.83	704	73,312	0.96	803	87.63
1976	2,239	217,211	1.03	2,374	94.32	2,062	203,576	1.01	2,225	92.68	756	70,967	1.07	776	97.47
1977	2,239	214,573	1.04	2,351	95.22	2,077	195,035	1.06	2,137	97.18	721	68,796	1.05	754	95.63
1978	2,350	226,586	1.04	2,483	94.64	2,092	198,088	1.06	2,171	96.37	756	74,173	1.02	813	93.01
1979	2,428	238,890	1.02	2,618	92.74	2,129	206,667	1.03	2,265	94.00	873	82,742	1.06	907	96.28
1980	2,402	240,975	1.00	2,634	91.21	2,098	209,164	1.00	2,286	91.78	838	86,336	0.97	944	88.81
Part 1981	610	58,377	1.04	640	95.35	568	53,536	1.06	587	96.81	219	21,447	1.02	235	93.18
Total	24,158	2,381,154	1.01	26,073	92.65	21,006	2,052,275	1.02	23,058	91.10	8,163	795,921	1.03	8,950	91.21
Year of birth	Parity 3					Parity 4 +					Total				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1971	288	31,536	0.91	346	83.33	228	24,459	0.93	268	85.06	4,754	493,388	0.96	5,407	87.92
1972	394	39,462	1.00	431	91.36	292	29,025	1.01	317	92.05	6,778	662,928	1.02	7,245	93.55
1973	307	32,692	0.94	358	85.69	228	22,749	1.00	249	91.45	6,317	617,856	1.02	6,771	93.29
1974	275	27,889	0.99	306	89.98	196	18,976	1.03	208	94.25	5,897	583,399	1.01	6,393	92.24
1975	224	25,410	0.88	278	80.44	148	16,733	0.88	183	80.71	5,495	548,554	1.00	6,012	91.41
1976	234	23,569	0.99	258	90.84	145	15,181	0.96	166	87.40	5,436	530,504	1.02	5,798	93.76
1977	228	21,935	1.04	240	94.85	125	13,541	0.92	148	84.23	5,390	513,880	1.05	5,632	95.71
1978	246	23,358	1.05	256	96.10	123	13,576	0.91	149	82.67	5,567	535,781	1.04	5,872	94.81
1979	261	25,963	1.01	285	91.73	145	14,299	1.01	157	92.53	5,836	568,561	1.03	6,231	93.66
1980	270	27,537	0.98	301	89.72	133	14,850	0.90	162	81.95	5,741	578,862	0.99	6,326	90.75
Part 1981	77	6,809	1.13	75	103.19	46	3,899	1.18	43	107.66	1,520	144,067	1.06	1,579	96.27
Total	2,727	286,160	0.95	3,133	87.03	1,763	187,288	0.94	2,051	85.97	57,199	5,777,780	0.99	63,265	90.41

\* Marital births only.

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.13b Second decade live births to sample mothers by mother's parity at registration\***

Year of birth	Parity 0					Parity 1					Parity 2				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1981	1,673	165,913	1.01	1,818	92.01	1,532	152,154	1.01	1,667	91.88	655	60,953	1.07	668	98.06
1982	2,158	211,862	1.02	2,322	92.95	2,040	200,681	1.02	2,199	92.76	822	81,431	1.01	892	92.11
1983	2,183	211,753	1.03	2,321	94.07	2,064	195,630	1.06	2,144	96.27	830	80,728	1.03	885	93.82
1984	2,158	210,421	1.03	2,300	93.84	2,113	193,093	1.09	2,110	100.13	871	80,643	1.08	881	98.83
1985	2,166	212,017	1.02	2,323	93.22	2,014	193,058	1.04	2,116	95.19	843	82,403	1.02	903	93.35
1986	2,027	206,942	0.98	2,268	89.38	1,965	189,186	1.04	2,073	94.78	811	80,842	1.00	886	91.54
1987	2,073	209,971	0.99	2,301	90.09	1,856	189,370	0.98	2,075	89.43	882	81,180	1.09	890	99.14
1988	2,168	209,291	1.04	2,287	94.78	1,866	185,553	1.01	2,028	92.02	805	79,411	1.01	868	92.75
1989	2,018	200,970	1.00	2,202	91.63	1,913	182,765	1.05	2,003	95.51	806	77,518	1.04	850	94.88
1990	2,006	200,394	1.00	2,196	91.34	1,898	185,334	1.02	2,031	93.45	820	79,040	1.04	866	94.67
Part 1991	548	58,365	0.94	640	85.68	563	53,739	1.05	589	95.60	237	22,948	1.03	251	94.24
Total	21,178	2,097,899	1.01	22,978	92.17	19,824	1,920,564	1.03	21,036	94.24	8,382	807,098	1.04	8,840	94.82
Year of birth	Parity 3					Parity 4 +					Total				
	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1981	206	19,351	1.06	212	97.14	100	11,081	0.90	121	82.35	4,166	409,453	1.02	4,487	92.84
1982	281	27,123	1.04	297	94.54	174	14,977	1.16	164	106.01	5,475	536,074	1.02	5,875	93.19
1983	318	26,646	1.19	292	108.90	171	15,166	1.13	166	102.89	5,566	529,923	1.05	5,807	95.84
1984	290	26,860	1.08	294	98.79	179	15,336	1.17	168	106.80	5,611	526,353	1.07	5,752	97.54
1985	299	26,865	1.11	294	101.56	193	15,824	1.22	173	111.29	5,515	530,167	1.04	5,810	94.92
1986	267	26,920	0.99	295	90.50	211	15,783	1.34	173	121.99	5,281	519,673	1.02	5,695	92.73
1987	281	26,593	1.06	291	96.42	203	15,966	1.27	175	116.02	5,295	523,080	1.01	5,732	92.37
1988	279	26,379	1.06	288	96.78	197	15,591	1.26	170	115.61	5,315	516,225	1.03	5,642	94.21
1989	311	25,807	1.21	283	109.97	190	14,861	1.28	163	116.66	5,238	501,921	1.04	5,501	95.23
1990	236	25,984	0.91	285	82.88	174	15,389	1.13	169	103.17	5,134	506,141	1.01	5,547	92.56
Part 1991	66	7,559	0.87	83	79.67	52	4,434	1.17	49	107.01	1,466	147,045	1.00	1,611	90.97
Total	2,834	266,087	1.07	2,914	97.24	1,844	154,408	1.19	1,691	109.03	54,062	5,246,055	1.03	57,460	94.09

\* Marital births only.

S.F. = Sampling fraction.

Exp. = Expected.

Variability in rates was lowest at parity 2. Parity 3 births showed high variation in linkage rates from 79.67 per cent in 1991 (a part year) to 109.97 per cent in 1989. Much of this variation is probably due to the low numbers of marital live births occurring at this parity. Births at parity 4+ appear to have been oversampled with a sampling fraction of 1.19 for the whole decade. However, this parity suffers from the effects of small numbers of births and subsequently from a lot of variation or random noise. Overall, for all marital births to sample mothers, there was a rise of over 4 per cent in the linkage rate from 90.41 per cent in the first decade to 94.09 in the second.

### 7.3.2 Live births to men in the LS sample

Live births to sample fathers were collected between 1971 and 1978 (see Table 7.14). These births were collected from birth registrations where the father quoted an LS date of birth. As a result only births which gave details of the father at registration are included. The father's details are only normally given if the birth occurs either within marriage or, if occurring outside marriage, is jointly registered. No data on the sex of the child is published for births to fathers in England and Wales.

**Table 7.14 First decade live births to sample fathers by year of birth\***

Year of birth	LS births	E & W births	S.F.	Exp. in LS	Linkage rate
Part 1971	4,796	513,937	0.93	5,632	85.15
1972	6,837	691,768	0.99	7,560	90.43
1973	6,069	644,785	0.94	7,066	85.89
1974	5,805	610,487	0.95	6,690	86.77
1975	5,283	575,459	0.92	6,306	83.77
1976	5,227	557,911	0.94	6,097	85.73
1977	5,146	543,195	0.95	5,953	86.45
1978	5,127	568,583	0.90	6,231	82.28
Total	44,290	4,706,125	0.94	51,537	85.94

\* Births to sample fathers not available for 1979 onwards.

S.F. = Sampling fraction.

Exp. = Expected.

The quality of the data is not particularly good with linkage rates ranging from 82.28 to 90.43 per cent. The overall sampling fraction for the period was 0.94 and the overall linkage rate 85.94 per cent. It should be noted that the exercise to find missing births to sample mothers after the 1981 Census was not attempted for births to sample fathers. The linkage rate for births to sample fathers is comparable to the 85.54 per cent linkage rate for first decade births to sample mothers before the enhancement exercise.

### 7.3.3 Widow(er)hoods of LS members

Widow(er)hoods of LS members are generated from death registrations using the date of birth of the surviving spouse (if an LS date) as the selection criteria (see Chapter 6).

The quality of linkage for widow(er)hoods is not particularly high, 77 per cent linkage over the first decade rising to 84 per cent in the second. Although some of the failure to link can be attributed to date of birth discrepancies on the part of the LS member registering the death of his/her spouse, much of it arises from the idiosyncracies of death registration. If the date of birth of the surviving spouse given in the confidential particulars on the death draft is an LS date, then the registers at NHSCR are searched using the name of the spouse given on the draft. If the surviving spouse is female her name is only given on the death draft if she is the informant at registration. Although there are more widows than widowers recorded in the LS, the sampling fractions suggest that proportionately more widows are missed from the LS than widowers. If the surviving spouse is male his name is always given on the death draft whether or not he is the informant. It should also be remembered that if the marital status of the deceased is not given as married on the death draft, even though he or she was, no tracing of a surviving spouse can be attempted.

The England and Wales widow(er)hood data suffers from most of the problems mentioned above, but it is particularly unreliable for 1981. During 1981 the registrars in England and Wales took industrial action which caused over 80 per cent of deaths to be processed using 'quarterly copies' of death registrations. Unlike death draft entry forms, 'quarterly copies' contain no confidential particulars so the details that included the spouse's date of birth were not available. Recorded widow(er)hoods for England and Wales for the year are approximately half the number that would have been expected if the pattern of the surrounding years had been followed. The LS was less affected by the strike, as a manual search of the 1981 death drafts was undertaken to identify surviving spouses with LS dates of birth.

#### 7.3.3.1 Widow(er)hoods by sex of dead spouse and year of death registration

First decade widow(er)hoods by the sex of the dead spouse and year of death registration are shown in Table 7.15a. The linkage rates for widowerhoods are better at 80.10 per cent overall than for widowhoods at 75.49 per cent. It should be noted that the low England and Wales widow(er)hood figures for the pre-census part of 1981 grossly distort the expected LS widow(er)hood figures for that year resulting in high sampling fractions and linkage rates. However, the exclusion of widow(er)hoods for 1981 from total widow(er)hoods for the decade only lowers the overall sampling fractions from 0.85 to 0.83, and the overall linkage rates from 77.19 per cent to 75.84 per cent.

Second decade widow(er)hoods (see Table 7.15b) show generally higher sampling fractions and linkage rates than those seen in the first decade. There is no great variability between years for either males or females with the exception of the two partial years. The reasons for the high sampling fractions and linkage rates in 1981 have been discussed above. The linkage rates for widowerhoods are better than for widowhoods (88.69 per cent compared with 81.87 per cent for the decade), as are sampling fractions.

**Table 7.15a First decade widow(er)hoods by sex of dead spouse and year of death registration**

Year of death registration	Sex of dead spouse										Total				
	Male					Female									
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
Part 1971	1,007	125,263	0.80	1,373	73.36	439	56,359	0.78	618	71.08	1,446	181,623	0.80	1,990	72.65
1972	1,625	189,693	0.86	2,073	78.38	778	84,641	0.92	925	84.10	2,403	274,334	0.88	2,998	80.15
1973	1,519	187,042	0.81	2,050	74.11	724	83,898	0.86	919	78.74	2,243	270,940	0.83	2,969	75.54
1974	1,497	186,154	0.80	2,040	73.38	671	83,495	0.80	915	73.33	2,168	269,649	0.80	2,955	73.37
1975	1,512	186,072	0.81	2,039	74.15	719	82,687	0.87	906	79.35	2,231	268,759	0.83	2,945	75.75
1976	1,504	188,301	0.80	2,058	73.08	702	84,290	0.83	921	76.20	2,206	272,591	0.81	2,979	74.05
1977	1,540	183,328	0.84	2,009	76.65	707	81,662	0.87	895	79.00	2,247	264,990	0.85	2,904	77.38
1978	1,558	186,125	0.84	2,040	76.38	707	82,684	0.86	906	78.02	2,265	268,809	0.84	2,946	76.89
1979	1,493	186,296	0.80	2,042	73.13	706	82,907	0.85	909	77.70	2,199	269,203	0.82	2,950	74.54
1980	1,467	182,472	0.80	1,994	73.56	755	81,190	0.93	887	85.09	2,222	263,662	0.84	2,882	77.11
Part 1981	444	24,447	1.82	268	165.73	236	10,715	2.20	117	201.71	680	35,162	1.93	385	176.62
Total	15,166	1,825,193	0.83	20,090	75.49	7,144	814,528	0.88	8,918	80.10	22,310	2,639,722	0.85	28,904	77.19

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.15b Second decade widow(er)hoods by sex of dead spouse and year of death registration**

Year of death registration	Sex of dead spouse										Total				
	Male					Female									
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
Part 1981*	1,033	69,481	1.49	761	135.66	537	30,452	1.76	334	160.91	1,570	99,933	1.57	1,095	143.36
1982	1,467	179,668	0.82	1,969	74.51	772	80,216	0.96	879	87.82	2,239	259,884	0.86	2,848	78.62
1983	1,537	178,884	0.86	1,960	78.40	771	79,176	0.97	868	88.86	2,308	258,060	0.89	2,828	81.61
1984	1,516	174,502	0.87	1,907	79.49	739	77,591	0.95	848	87.15	2,255	252,093	0.89	2,755	81.85
1985	1,490	177,923	0.84	1,950	76.42	724	80,548	0.90	883	82.02	2,214	258,471	0.86	2,833	78.16
1986	1,595	175,123	0.91	1,919	83.11	712	78,280	0.91	858	83.00	2,307	253,403	0.91	2,777	83.07
1987	1,464	169,749	0.86	1,860	78.70	724	77,128	0.94	845	85.66	2,188	246,877	0.89	2,706	80.87
1988	1,489	167,990	0.89	1,836	81.10	715	76,875	0.93	840	85.10	2,204	244,865	0.90	2,676	82.36
1989	1,477	166,500	0.89	1,825	80.95	736	77,071	0.95	845	87.14	2,213	243,571	0.91	2,669	82.91
1990	1,415	163,574	0.87	1,793	78.94	682	75,458	0.90	827	82.47	2,097	239,032	0.88	2,620	80.05
Part 1991	512	48,840	1.05	535	95.70	227	22,693	1.00	249	91.16	739	71,533	1.03	783	94.38
Total	14,995	1,672,234	0.90	18,315	81.87	7,339	755,488	0.97	8,275	88.69	22,334	2,427,722	0.92	26,589	84.00

\* Note: 1981 figures for deaths distorted due to registrars' strike.

S.F. = Sampling fraction.

Exp. = Expected.

### 7.3.4 Cancer registrations

NHSCR flags all cancer registrations in the central NHS registers. If an LS member has a cancer registration and is traced they will be automatically flagged. Untraced LS members may also be flagged as a result of the date of birth search of the OPCS cancer statistical files (see Chapter 6). The England and Wales data used for the denominator, and as the basis of calculating expected numbers of cancer registrations for the LS, are all NHSCR flagged cancer registrations occurring in England and Wales in the years in question.

The national cancer registration scheme was started in 1945, initially under the aegis of the Radium Commission, and from 1947 under the General Register Office (later known as the Office of Population Censuses and Surveys). All regions have been covered since 1962. Data is collected by several independent regional registries which differ both in their methods of data collection and in the completeness of the data (see Chapter 6, section 6.2.3). In 1971 there were 13 regional registries, which reduced to 12 in 1985. The completeness and accuracy of the data that these registries collect are affected not only by the methods used but also by late registrations and duplication of data. Late registration of cancers was found to be particularly common in the over-75 age group and where survival was known to be long. Duplication of registrations generally occurs where a patient is resident in one region but treated in another. OPCS identifies duplicate data and deletes one record. Between 1971 and 1981 only 70,000 cancer registrations flagged at NHSCR (4 per cent of all England and Wales cancer registrations in the same period) were found to be duplicates. Of these, it was estimated that 60 per cent were genuine multiple primary cancers and 40 per cent were duplicate registrations.<sup>7</sup>

Cancer registration information is collected for all malignant neoplasms, reticuloses, carcinoma in situ, neoplasms of

uncertain behaviour, benign neoplasms and hydatidiform moles. Registration rates for benign neoplasms and uncertain and unspecified neoplasms are believed to be underestimates of the true incidence of these conditions in the population.<sup>8</sup>

Although the accuracy and completeness of data for the whole of England and Wales are known to be variable, ascertainment is improving over time and the flagging of those registrations that are received at NHSCR is known to be almost complete. It is estimated that approximately 96 per cent of cancer registrations received by OPCS in recent years have been successfully linked to a record in the NHSCR index.<sup>8</sup>

#### 7.3.4.1 Cancer registrations occurring to LS members

There were 30,910 cancer registrations linked to LS members between 1971 and 1985. The quality of cancer registration data in the LS is good (98.50 per cent overall linkage rate for the first decade, rising to 104.42 per cent for the 1981 to 1985 period). However, it must be remembered that the denominator is not all cancers occurring to the population of England and Wales, but all cancer registrations flagged at NHSCR. The LS reflects the population levels of cancer registrations well, but the caveats expressed in section 7.3.4 above concerning the quality of cancer registrations in England and Wales, should be taken into account.

#### 7.3.4.2 First decade cancer registrations

Table 7.16a shows the total cancer registrations by age and sex for the first decade. The variation in linkage rates and sampling fractions seen for both sexes in this table is partially explained by the low numbers of cancers registered for younger age groups. Only from age 50 do the linkage rates start to stabilise as the numbers of cancers increase. The overall sampling fractions at 1.08 for males and 1.09 for females are a reflection of the quality of the flagging

**Table 7.16a First decade cancer registrations by age and sex**

Age at diagnosis of cancer	Males					Females					Total				
	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate
0-9	49	4,724	1.04	52	94.24	34	3,517	0.97	39	87.82	83	8,241	1.01	91	91.50
10-19	46	4,572	0.97	52	87.94	33	3,924	0.84	43	76.40	79	8,677	0.91	96	82.72
20-29	96	9,699	0.99	107	89.92	214	13,551	1.58	149	143.48	309	23,250	1.33	256	120.75
30-39	192	16,789	1.14	185	103.89	459	33,972	1.35	374	122.75	651	50,761	1.28	559	116.51
40-49	526	47,021	1.12	518	101.63	880	80,653	1.09	888	99.13	1,406	127,674	1.10	1,405	100.05
50-59	1,644	150,063	1.10	1,652	99.53	1,754	156,068	1.12	1,718	102.10	3,398	306,131	1.11	3,370	100.84
60-69	3,347	303,505	1.10	3,341	100.19	2,461	229,239	1.07	2,523	97.53	5,808	532,744	1.09	5,864	99.05
70-79	3,000	287,689	1.04	3,167	94.74	2,624	238,405	1.07	2,624	96.83	5,541	526,094	1.05	5,791	95.69
80+	1,034	99,469	1.04	1,095	94.44	1,454	139,825	1.04	1,539	94.47	2,488	239,294	1.04	2,634	94.46
Total	9,934	923,712	1.08	10,167	97.70	9,830	899,154	1.09	9,897	99.32	19,764	1,822,866	1.08	20,065	98.50

S.F. = Sampling fraction.

Exp. = Expected.

of cancer registrations at NHSCR. The overall linkage rate was 98.50 per cent, again reflecting the good quality of flagging. It should be noted that female cancer registrations exceed male registrations by 2 to 1 for the 20–29 and 30–39 age groups, and by 1½ times for the 40–49 year age group. This pattern changes after age 50 and female registrations do not exceed male until age 80.

First decade cancers by sex, age and year of cancer occurrence are shown in Table 7.16b. The 10-year age groups used in Table 7.16a have been further grouped because of the small number of cancers diagnosed in a single year for all 10-year age groups.

Among males under 50 both sampling fractions and linkage rates were highly variable, but the number of cancers diagnosed each year was small. Because of the small numbers involved the sampling fractions and linkage rates for the pre-census period of 1981 (95 days) were particularly distorted. The quality of cancer registration linkage for LS males improved in the 50–69 and 70+ age groups with overall sampling fractions of 1.10 and 1.04, and linkage rates of 99.97 and 94.66 per cent respectively. Some variability was still present, but excluding the linkage rates for part years (1971 and 1981) the range of linkage rates for males aged 50–69 was 92.32 to 108.82 per cent, and for males aged 70 and over, 84.84 to 100.02 per cent.

**Table 7.16b First decade cancer registrations by sex, age and year of occurrence of cancer**

a) Males

This table continues on the next page

Year of diagnosis of cancer	Age at cancer occurrence														
	0-19					20-49					50-69				
	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate
Part 1971	10	637	1.57	5	208.16	51	5,148	0.99	39	131.46	328	29,846	1.10	225	145.83
1972	11	958	1.15	10	105.06	72	7,456	0.97	81	88.36	482	43,633	1.10	477	101.08
1973	13	887	1.47	10	133.74	84	7,351	1.14	81	104.27	531	44,527	1.19	488	108.82
1974	9	940	0.96	10	87.37	85	7,586	1.12	83	102.24	472	46,655	1.01	511	92.32
1975	10	989	1.01	11	92.26	100	7,390	1.35	81	123.48	512	45,604	1.12	500	102.45
1976	10	983	1.02	11	93.08	94	7,360	1.28	80	116.86	518	46,746	1.11	511	101.39
1977	8	946	0.85	10	77.17	77	7,330	1.05	80	95.86	515	46,976	1.10	515	100.04
1978	6	949	0.63	10	57.69	82	7,109	1.15	78	105.25	469	45,395	1.03	497	94.28
1979	8	995	0.80	11	73.37	61	7,438	0.82	82	74.84	533	46,310	1.15	508	105.02
1980	8	938	0.85	10	78.04	80	7,379	1.08	81	99.20	511	45,944	1.11	502	101.77
Part 1981	2	254	0.79	1	276.31	28	1,962	1.43	6	500.22	120	11,932	1.01	34	352.60
Total	95	9,476	1.00	104	91.08	814	73,509	1.11	809	100.60	4,991	453,568	1.10	4,992	99.97
Year of diagnosis of cancer	70+					Total									
	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate					
Part 1971	230	20,761	1.11	156	147.01	619	56,392	1.10	425	145.65					
1972	323	31,093	1.04	340	95.05	888	83,140	1.07	909	97.73					
1973	356	33,528	1.06	367	96.89	984	86,293	1.14	946	104.05					
1974	377	37,126	1.02	407	92.66	943	92,307	1.02	1,012	93.22					
1975	405	38,245	1.06	419	96.63	1,027	92,228	1.11	1,011	101.61					
1976	388	39,463	0.98	431	89.96	1,010	94,552	1.07	1,033	97.74					
1977	448	41,796	1.07	458	97.81	1,048	97,048	1.08	1,064	98.54					
1978	393	42,270	0.93	463	84.84	950	95,723	0.99	1,049	90.56					
1979	472	44,797	1.05	491	96.14	1,074	99,540	1.08	1,091	98.46					
1980	499	45,649	1.09	499	100.02	1,098	99,910	1.10	1,092	100.56					
Part 1981	143	12,430	1.15	35	403.32	293	26,578	1.10	76	386.49					
Total	4,034	387,158	1.04	4,262	94.66	9,934	923,712	1.08	10,167	97.70					

S.F. = Sampling fraction.

Exp. = Expected.



**Table 7.16b** - *continued*

**b) Females**

Year of diagnosis of cancer	Age at cancer occurrence														
	0-19					20-49					50-69				
	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate
Part 1971	4	487	0.82	4	109.02	112	8,062	1.39	61	184.35	283	24,077	1.18	181	155.97
1972	6	723	0.83	8	75.93	140	11,888	1.18	130	107.76	413	36,410	1.13	398	103.79
1973	10	689	1.45	8	132.44	150	11,669	1.29	128	117.30	448	37,236	1.20	408	109.79
1974	9	718	1.25	8	114.38	148	12,294	1.20	135	109.85	443	39,592	1.12	434	102.10
1975	2	720	0.28	8	25.35	132	11,808	1.12	129	102.01	399	38,614	1.03	423	94.29
1976	4	795	0.50	9	46.04	160	11,655	1.37	127	125.61	445	39,319	1.13	430	103.56
1977	9	774	1.16	8	106.10	157	11,690	1.34	128	122.55	432	39,847	1.08	437	98.93
1978	6	697	0.86	8	78.55	178	11,470	1.55	126	141.61	395	39,221	1.01	430	91.90
1979	7	804	0.87	9	79.45	161	16,293	0.99	179	90.17	411	40,133	1.02	440	93.45
1980	5	816	0.61	9	56.07	166	16,718	0.99	183	90.85	439	40,239	1.09	440	99.82
Part 1981	5	218	2.29	1	500.00	49	4,629	1.06	13	371.10	107	10,619	1.01	30	353.27
Total	67	7,441	0.90	82	81.80	1,553	128,176	1.21	1,411	110.08	4,215	385,307	1.09	4,241	99.38
Year of diagnosis of cancer	70+					Total									
	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate					
Part 1971	245	20,269	1.21	153	160.39	644	52,895	1.22	399	161.56					
1972	332	30,390	1.09	332	99.96	891	79,411	1.12	868	98.06					
1973	362	32,617	1.11	357	101.27	970	82,211	1.18	901	107.67					
1974	402	37,179	1.08	407	98.66	1,002	89,783	1.12	984	101.84					
1975	373	37,920	0.98	416	89.76	906	89,062	1.02	976	92.83					
1976	407	38,922	1.05	425	95.68	1,016	90,691	1.12	991	102.51					
1977	388	40,458	0.96	443	87.51	986	92,769	1.06	1,017	96.99					
1978	450	41,379	1.09	453	99.24	1,029	92,767	1.11	1,017	101.22					
1979	442	43,177	1.02	473	93.41	1,021	100,407	1.02	1,100	92.79					
1980	473	43,850	1.08	479	98.70	1,083	101,623	1.07	1,111	97.51					
Part 1981	121	12,069	1.00	34	351.50	282	27,535	1.02	79	359.05					
Total	3,995	378,230	1.06	4,163	95.96	9,830	899,154	1.09	9,897	99.32					

S.F. = Sampling fraction.

Exp. = Expected.

Female first decade cancer registrations showed slightly more variability than male cancer registrations, especially among the younger age groups. Sampling fractions and linkage rates were as good as those for males in the oldest age groups, with overall sampling fractions of 1.09 and 1.06, and overall linkage rates of 99.38 and 95.96 per cent respectively.

The quality of the linkage for females for single years was reasonably good, with the exception of the youngest age group where the highest numbers of cancers registered in a single year (1973) was 10 and the lowest two (in 1975).

### 7.3.4.3 Second decade cancer registrations

Second decade cancer registration data is not yet complete (see section 7.3.4). As a result, Table 7.17a showing second decade cancer registrations by age and sex, only contains data collected until 1985.

The cancer registration data for 1981 to 1985 did not show as much variability as those seen in the first decade. Both overall sampling fractions and linkage rates were slightly higher. However, the rise in linkage rates shown in the table is probably partially due to the data cleaning that was undertaken at NHSCR when the NHS registers were computerised. The distribution patterns for male and female cancers were the same as in the first decade.

Table 7.17b shows second decade cancers by sex, age and year of occurrence. Like Table 7.16b, the age groups have been aggregated to provide a reasonable number of cancers per year. Variability was particularly high among the younger age groups but much of this was due to small numbers which exacerbated the effect of sampling variation. Linkage rates were best among the older ages for both sexes, but it would appear that there was some

oversampling of cancer registration data particularly in 1983. The reason for this is unknown. Compared with the first decade, the numbers of cancers registered as occurring to those aged over 50 appear to have increased. However, this could be an artefact of improvements in the cancer registration system together with the improvements associated with the computerisation of the NHSCR registration system.

## 7.3.5 Infant mortality

Data on infant mortality to children born to LS mothers (and for three years to LS fathers) has been collected since 1976. Because data is only available between 1976 and 1978 for infant deaths to LS fathers they have not been included in this section. The numbers of infant deaths occurring in England and Wales are small and this affects the numbers collected for the LS.

### 7.3.5.1 By sex and year of death

In the first decade (from 1976 to the day before Census day 1981) the small numbers of infant deaths collected for the LS showed variability in both sampling fractions and linkage rates. This was particularly noticeable among female infant deaths where the number of deaths recorded over the period was 30 per cent lower than male infant deaths. The overall sampling fraction for both sexes was 0.94 and the overall linkage rate was 86.11 per cent.

In the second decade the number of infant deaths occurring each year had dropped substantially (see Table 7.18b). However, due to the small numbers of deaths, both male and female sampling fractions and linkage rates were highly variable. Overall sampling fractions and linkage rates were higher than in the first decade and had risen to 1.00 and 91.27 per cent respectively.

**Table 7.17a Second decade cancer registrations by age and sex\***

Age at diagnosis of cancer	Males					Females					Total				
	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate
0-9	21	2,035	1.03	21	100.00	18	1,651	1.09	17	105.88	39	3,686	1.06	38	102.63
10-19	29	2,589	1.12	27	107.41	28	2,474	1.13	26	107.69	57	5,063	1.13	53	107.55
20-29	52	4,946	1.05	52	100.00	195	17,775	1.10	188	103.72	247	22,721	1.09	240	102.92
30-39	90	9,573	0.94	101	89.11	389	35,821	1.09	379	102.64	479	45,394	1.06	480	99.79
40-49	248	21,065	1.18	221	112.22	471	42,520	1.11	448	105.13	719	63,585	1.13	669	107.47
50-59	735	66,998	1.10	702	104.70	781	73,313	1.07	769	101.56	1,516	140,311	1.08	1,471	103.06
60-69	1,646	145,064	1.13	1,524	108.01	1,329	118,179	1.12	1,242	107.00	2,975	263,243	1.13	2,766	107.56
70-79	1,908	172,740	1.10	1,818	104.95	1,500	138,470	1.08	1,457	102.95	3,408	311,210	1.10	3,275	104.06
80+	722	67,842	1.06	716	100.84	984	91,569	1.07	965	101.97	1,706	159,411	1.07	1,681	101.49
Total	5,451	492,854	1.11	5,183	105.17	5,695	521,773	1.09	5,491	103.72	11,146	1,014,627	1.10	10,674	104.42

\* Only available for the LS until 1985.

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.17b Second decade cancer registrations by sex, age and year of occurrence of cancer\***

**a) Males**

Year of diagnosis of cancer	Age at cancer occurrence														
	0-19					20-49					50-69				
	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate
Part 1981	4	721	0.55	6	68.41	66	5,578	1.18	45	145.97	355	33,911	1.05	275	129.14
1982	11	977	1.13	11	102.74	68	7,340	0.93	80	84.54	512	45,427	1.13	498	102.85
1983	12	1,027	1.17	11	106.62	89	7,603	1.17	83	106.82	558	44,397	1.26	487	114.69
1984	14	987	1.42	11	129.79	80	7,494	1.07	82	97.68	492	44,659	1.10	488	100.80
1985	9	912	0.99	10	90.05	87	7,570	1.15	83	104.87	464	43,668	1.06	479	96.96
Total	50	4,624	1.08	49	102.04	390	35,585	1.10	373	104.56	2,381	212,062	1.12	2,227	106.92

  

Year of diagnosis of cancer	70+					Total				
	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate
Part 1981	391	35,329	1.11	286	136.53	816	75,539	1.08	612	133.25
1982	510	49,461	1.03	542	94.09	1,101	103,205	1.07	1,131	97.35
1983	599	50,639	1.18	555	107.94	1,258	103,666	1.21	1,136	110.73
1984	525	52,379	1.00	572	91.71	1,111	105,519	1.05	1,153	96.34
1985	605	52,775	1.15	578	104.61	1,165	104,925	1.11	1,150	101.32
Total	2,630	240,583	1.09	2,533	103.83	5,451	492,854	1.11	5,182	105.19

S.F. = Sampling fraction.

Exp. = Expected.

**b) Females**

Year of diagnosis of cancer	Age at cancer occurrence														
	0-19					20-49					50-69				
	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate
Part 1981	4	621	0.64	5	79.50	142	13,157	1.08	107	133.40	358	30,180	1.19	245	146.33
1982	6	809	0.74	9	67.68	192	18,237	1.05	200	96.07	450	40,800	1.10	447	100.64
1983	14	898	1.56	10	142.26	230	19,012	1.21	208	110.39	431	40,173	1.07	440	97.90
1984	12	896	1.34	10	122.54	231	21,028	1.10	230	100.52	434	40,394	1.07	441	98.31
1985	10	902	1.11	10	101.16	260	24,682	1.05	270	96.12	437	39,945	1.09	438	99.83
Total	46	4,126	1.11	44	104.55	1,055	96,116	1.10	1,015	103.94	2,110	191,492	1.10	2,011	104.92

  

Year of diagnosis of cancer	70+					Total				
	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate	LS cancers	E & W cancers	S.F.	Exp. in LS	Linkage rate
Part 1981	414	34,301	1.21	278	148.89	918	78,259	1.17	634	144.70
1982	478	47,137	1.01	517	92.53	1,126	106,983	1.05	1,172	96.04
1983	533	48,364	1.10	530	100.56	1,208	108,447	1.11	1,188	101.64
1984	542	49,945	1.09	546	99.30	1,219	112,263	1.09	1,227	99.35
1985	517	50,292	1.03	551	93.80	1,224	115,821	1.06	1,269	96.43
Total	2,484	230,039	1.08	2,422	102.56	5,695	521,773	1.09	5,490	103.73

\* Only available for the LS until 1985.

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.18a First decade infant mortality by sex and year of death**

Year of death	Males					Females					Total				
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
1976	47	4,787	0.98	52	90.38	28	3,393	0.83	37	75.51	75	8,180	0.92	89	83.89
1977	43	4,437	0.97	49	88.43	33	3,274	1.01	36	91.97	76	7,711	0.99	85	89.94
1978	40	4,432	0.90	49	82.36	29	3,298	0.88	36	80.24	69	7,730	0.89	85	81.45
1979	43	4,678	0.92	51	83.88	34	3,386	1.00	37	91.63	77	8,064	0.95	88	87.13
1980	47	4,408	1.07	48	97.56	24	3,382	0.71	37	64.93	71	7,790	0.91	85	83.40
Part 1981	10	1,052	0.95	12	86.72	11	740	1.49	8	135.70	21	1,792	1.17	20	106.93
Total	230	23,794	0.97	260	88.30	159	17,473	0.91	191	83.12	389	41,267	0.94	452	86.11

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.18b Second decade infant mortality by sex and year of death**

Year of death	Males					Females					Total				
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
Part 1981	19	2,991	0.64	33	57.97	20	2,102	0.95	23	86.81	39	5,093	0.77	56	69.88
1982	45	3,857	1.17	42	106.46	30	2,806	1.07	31	97.56	75	6,663	1.13	73	102.71
1983	46	3,603	1.28	39	116.50	20	2,681	0.75	29	68.07	66	6,284	1.05	69	95.84
1984	33	3,398	0.97	37	88.86	20	2,547	0.79	28	71.85	53	5,945	0.89	65	81.57
1985	40	3,448	1.16	38	105.86	23	2,579	0.89	28	81.38	63	6,027	1.05	66	95.38
1986	31	3,667	0.85	40	77.14	33	2,542	1.30	28	118.46	64	6,209	1.03	68	94.06
1987	33	3,575	0.92	39	84.23	27	2,580	1.05	28	95.49	60	6,155	0.97	67	88.95
1988	38	3,603	1.05	39	96.50	23	2,576	0.89	28	81.70	61	6,179	0.99	68	90.33
1989	33	3,323	0.99	36	90.62	19	2,378	0.80	26	72.91	52	5,701	0.91	62	83.23
1990	33	3,130	1.05	34	96.21	26	2,311	1.13	25	102.66	59	5,441	1.08	60	98.95
Part 1991	10	878	1.14	10	103.94	10	646	1.55	7	141.36	20	1,523	1.31	17	119.80
Total	361	35,473	1.02	389	92.91	251	25,748	0.97	282	89.00	612	61,220	1.00	671	91.27

S.F. = Sampling fraction.

Exp. = Expected.

### 7.3.5.2 By mother's age

Table 7.19a shows infant mortality by mother's age in the first decade. The highest numbers of infant deaths were found where the mothers were aged between 20 and 29. As a result less variability was seen among the sampling fractions and linkage rates for infant deaths to mothers in this age group than among those to mothers of younger or older ages. Overall sampling fractions varied from 0.80 to 1.12 and linkage rates from 76.03 to 102.30 per cent.

In the second decade (see Table 7.19b) the highest numbers of infant deaths were again found where the mothers were aged between 20 and 29. More variability was seen in sampling fractions and linkage rates than in the first decade as a result of the small number of infant deaths.

### 7.3.6 Events where quality cannot be assessed

A number of events collected at NHSCR for LS members cannot be checked for quality as population statistics for England and Wales are not available. The events in question are enlistments into the armed services, entries into long-stay psychiatric hospitals, inter-FPC moves and re-entries to the LS. A series of tables give the yearly occurrence figures of these events for LS members.

### 7.3.6.1 Enlistments into the armed forces

Enlistment figures have been collected for the LS since 1971. The annual number of events by decade is shown in Table 7.20. The numbers of yearly enlistments by LS members are small, and have halved over the second decade. In the first decade only 11 per cent of enlistments were women, rising to 15 per cent in the second decade.

### 7.3.6.2 Entries into long-stay psychiatric hospitals

Table 7.21 shows entries of LS members into long-stay psychiatric hospitals by sex and year of entry. This data was collected from 1971 to 1983. Although the numbers of entries per year are small, the data clearly show the much higher proportion of women than men entering these institutions.

### 7.3.6.3 Regional Family Practitioner Committee moves

Between 1971 and 1974 inter-regional FPC moves were recorded for LS members. These figures (shown in Table 7.22) give some estimate of internal migration in these years. Caution should always be used if quoting these figures for LS members as they will always be an underestimate of the situation. FPC figures have a time lag due both to delays in registration with GPs and delays in

**Table 7.19a First decade infant mortality by mother's age at birth and year of infant death**

Year of death	Mother's age at birth														
	Under 20					20-24					25-29				
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
1976	15	1,279	1.17	14	107.31	24	2,763	0.87	30	79.48	24	2,545	0.94	28	86.29
1977	10	1,153	0.87	13	79.14	23	2,577	0.89	28	81.44	26	2,426	1.07	27	97.79
1978	8	1,051	0.76	12	69.46	24	2,569	0.93	28	85.25	22	2,396	0.92	26	83.79
1979	9	1,219	0.74	13	67.37	19	2,643	0.72	29	65.60	34	2,346	1.45	26	132.25
1980	6	1,066	0.56	12	51.50	23	2,612	0.88	29	80.57	31	2,361	1.31	26	120.14
Part 1981	2	239	0.84	3	76.22	7	615	1.14	7	104.23	4	516	0.77	6	70.68
Total	50	6,007	0.83	66	76.03	120	13,779	0.87	151	79.57	141	12,590	1.12	138	102.30

  

Year of death	Mother's age at birth														
	30-34					35-39					40 and over				
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
1976	7	1,062	0.66	12	60.31	3	404	0.74	4	75.00	3	127	2.36	1	216.14
1977	12	1,105	1.09	12	99.10	4	331	1.21	4	100.00	3	119	2.52	1	230.04
1978	12	1,232	0.97	14	88.88	3	390	0.77	4	75.00	0	92	0.00	1	0.00
1979	12	1,332	0.90	15	82.21	3	410	0.73	4	75.00	0	114	0.00	1	0.00
1980	8	1,283	0.62	14	57.05	3	365	0.82	4	75.00	0	103	0.00	1	0.00
Part 1981	8	283	2.83	3	258.26	0	92	0.00	1	0.00	0	47	0.00	1	0.00
Total	59	6,297	0.94	69	85.59	16	1,992	0.80	21	76.17	6	602	1.00	7	91.03

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.19b Second decade infant mortality by mother's age at birth and year of infant death**

Year of death	Mother's age at birth														
	Under 20					20-24					25-29				
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
Part 1981	4	681	0.59	7	53.63	14	1,746	0.80	19	73.15	10	1,468	0.68	16	62.18
1982	11	890	1.24	10	112.78	24	2,244	1.07	25	97.59	21	1,976	1.06	22	96.98
1983	7	824	0.85	9	77.52	24	2,089	1.15	23	104.83	17	1,848	0.92	20	83.94
1984	13	777	1.67	8	153.09	15	1,975	0.76	22	69.49	17	1,761	0.97	19	88.33
1985	7	801	0.87	9	79.74	21	1,979	1.06	22	96.83	18	1,758	1.02	19	93.43
1986	6	847	0.71	9	64.64	22	1,968	1.12	22	102.01	16	1,888	0.85	21	77.33
1987	8	799	1.00	9	91.36	16	2,029	0.79	22	71.96	27	1,786	1.51	20	137.95
1988	5	844	0.59	9	54.21	21	1,942	1.08	21	98.94	20	1,843	1.09	20	99.29
1989	5	765	0.65	8	59.64	14	1,710	0.82	19	74.71	11	1,747	0.63	19	57.46
1990	9	655	1.37	7	125.38	21	1,672	1.26	18	114.61	18	1,609	1.12	18	102.08
Part 1991	1	188	0.53	2	48.52	8	428	1.87	5	170.58	7	480	1.46	5	133.05
Total	76	8,071	0.94	88	85.98	200	19,782	1.01	217	92.30	182	18,164	1.00	199	91.48
Year of death	30-34					35-39					40 and over				
	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate	LS deaths	E & W deaths	S.F.	Exp. in LS	Linkage rate
	Part 1981	5	803	0.62	9	56.79	4	261	1.53	3	139.78	2	134	1.49	1
1982	13	1,086	1.20	12	109.23	6	378	1.59	4	144.84	0	89	0.00	1	0.00
1983	13	1,022	1.27	11	116.07	5	399	1.25	4	114.35	0	102	0.00	1	0.00
1984	3	970	0.31	11	28.30	4	383	1.04	4	95.56	1	79	1.27	1	115.82
1985	13	1,000	1.30	11	118.63	4	404	0.99	4	90.35	0	85	0.00	1	0.00
1986	14	984	1.42	11	129.83	5	449	1.11	5	101.61	1	73	1.37	1	125.00
1987	6	1,053	0.57	12	51.99	2	405	0.49	4	45.06	1	83	1.20	1	109.94
1988	13	1,050	1.24	11	113.29	2	414	0.48	5	44.20	0	86	0.00	1	0.00
1989	17	988	1.72	11	157.01	5	397	1.26	4	114.92	0	94	0.00	1	0.00
1990	10	1,030	0.97	11	88.59	1	399	0.25	4	22.87	0	76	0.00	1	0.00
Part 1991	0	284	0.00	3	0.00	4	118	3.39	1	309.75	0	25	0.00	0	0.00
Total	107	10,271	1.04	112	95.12	42	4,007	1.05	44	95.70	5	926	0.54	10	49.28

S.F. = Sampling fraction.

Exp. = Expected.

**Table 7.20 Enlistments of LS members into the armed forces by sex and year of enlistment**

Year of enlistment	First decade			Year of enlistment	Second decade		
	Sex		Total		Sex		Total
	Males	Females			Males	Females	
Part 1971	267	35	302	Part 1981	80	12	92
1972	357	43	400	1982	84	13	97
1973	244	46	290	1983	163	31	194
1974	267	43	310	1984	173	31	204
1975	299	29	328	1985	165	25	190
1976	280	31	311	1986	171	34	205
1977	257	35	292	1987	188	24	212
1978	280	32	312	1988	165	31	196
1979	277	36	313	1989	191	34	225
1980	289	34	323	1990	191	43	234
Part 1981	34	6	40	Part 1991	31	3	34
Total	2,851	370	3,221	Total	1,602	281	1,883

**Table 7.21 Entry of LS members into long-stay psychiatric hospitals by sex and year of entry**

Year of entry	First decade			Year of entry	Second decade		
	Sex		Total		Sex		Total
	Males	Females			Males	Females	
Part 1971	21	29	50	Part 1981	12	18	30
1972	15	31	46	1982	22	24	46
1973	23	36	59	1983	5	16	21
1974	26	32	58	1984	N/A	N/A	N/A
1975	24	27	51	1985	N/A	N/A	N/A
1976	25	30	55	1986	N/A	N/A	N/A
1977	23	37	60	1987	N/A	N/A	N/A
1978	18	42	60	1988	N/A	N/A	N/A
1979	20	31	51	1989	N/A	N/A	N/A
1980	23	31	54	1990	N/A	N/A	N/A
Part 1981	4	10	14	Part 1991	N/A	N/A	N/A
Total	222	336	558	Total	39	58	97

passing that data on to NHSCR. The only people who register with a GP immediately upon moving are those with existing health problems, families with young children and pregnant women. The young and fit do not normally register until they become sick.

#### 7.6.3.4 LS re-entrants to the NHS

Re-entries to the LS by members who had previously left the study and the NHS by either emigrating, joining the armed services or being committed to long-stay psychiatric

hospital are shown in Table 7.23. These persons remained as members of the LS but very few events could be linked to them while they were outside the NHS. For those LS members in the armed forces or in long-stay psychiatric hospitals, deaths and cancer registrations would be caught as part of the normal NHSCR registration system. On re-entry to the LS, and to the NHS, events could again be linked to them. The majority of re-entrants are those returning either from overseas or from countries in the UK other than England and Wales.

**Table 7.22 Regional FPC moves by LS members from 1971 to 1974**

Standard region of previous FPC	1971			1972			1973			1974			Total		
	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total
Scotland	3	3	6	29	29	58	46	55	101	48	58	106	126	145	271
Northern Yorkshire and Humberside	200	233	433	308	382	690	367	366	733	303	362	665	1,178	1,343	2,521
North West	337	390	727	607	753	1,360	666	698	1,364	561	629	1,190	2,171	2,470	4,641
East Midlands	546	654	1,200	1,035	1,093	2,128	925	1,092	2,017	795	885	1,680	3,301	3,724	7,025
West Midlands	244	280	524	422	460	882	398	477	875	354	366	720	1,418	1,583	3,001
East Anglia	440	438	878	691	811	1,502	737	830	1,567	617	679	1,296	2,485	2,758	5,243
South East	130	159	289	230	266	496	231	290	521	217	245	462	808	960	1,768
South West	1,739	1,993	3,732	3,258	3,820	7,078	3,361	3,783	7,144	2,894	3,291	6,185	11,252	12,887	24,139
Wales	323	411	734	615	752	1,367	608	779	1,387	528	620	1,148	2,074	2,562	4,636
Total	164	173	337	268	341	609	263	344	607	256	316	572	951	1,174	2,125
Total	4,126	4,734	8,860	7,463	8,707	16,170	7,602	8,714	16,316	6,573	7,451	14,024	25,764	29,606	55,370

**Table 7.23 Re-entrants to the LS by re-entry type**

Year of re-entry	First decade				Year of re-entry	Second decade			
	Re-entrant type					Re-entrant type			
	From emigration	From enlistment	From LSP hospital	All types		From emigration	From enlistment	From LSP hospital	All types
Part 1971	21	12	0	33	Part 1981	238	75	4	317
1972	177	71	3	251	1982	331	105	4	440
1973	434	74	6	514	1983	391	92	3	486
1974	493	99	2	594	1984	416	73	9	498
1975	456	126	7	589	1985	406	50	6	462
1976	484	136	12	632	1986	352	75	3	430
1977	449	154	13	616	1987	393	59	1	453
1978	463	194	11	668	1988	432	69	1	502
1979	462	234	5	701	1989	463	67	2	532
1980	384	203	6	593	1990	523	67	3	593
Part 1981	80	29	2	111	Part 1991	96	48	1	145
Total	3,903	1,332	67	5,302	Total	4,041	780	37	4,858

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