SOCIOECONOMIC VARIATIONS IN BREAST CANCER INCIDENCE, SURVIVAL AND THE UPTAKE OF SCREENING: A CASE STUDY IN MERSEYSIDE

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor in Philosophy

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SOCIOECONOMIC VARIATIONS IN BREAST CANCER INCIDENCE, SURVIVAL AND THE UPTAKE OF SCREENING: A CASE STUDY IN MERSEYSIDE

Julie Kidd

ABSTRACT

Breast cancer is a major cause of ill health and mortality world-wide. Rates of the disease in the UK are amongst the highest in the world, but survival from it has been relatively unfavourable in comparison with other European countries. In view of the potential benefits of breast screening by mammography, the UK National Health Service Breast Screening Programme was initiated, and commenced screening nationally during 1989 and 1990.

Socioeconomic status (SES) is one of the factors known to influence health and health behaviour in many settings. The literature on the association of SES with breast cancer incidence, survival and screening uptake is reviewed. The reviews also highlight the dearth of such information in Merseyside, the area chosen for study.

The socioeconomic dimension of breast cancer incidence and survival in the Wirral, Liverpool and Sefton districts of Merseyside is assessed. Also examined are socioeconomic variations in uptake of first and second round screening invitations issued by three of the screening units in the county. These units serve the same three districts, and in addition, Knowsley district to the east of Liverpool. The socioeconomic indicators used are the 1991-based Super Profiles typologies, a geodemographic system developed at the University of Liverpool. This PhD work sought to examine both local socioeconomic variation in breast cancer incidence, survival and the uptake of screening, and to assess the suitability of Super Profiles in this application.

SES has a direct, significant association with breast cancer incidence, survival and the uptake of screening in this part of Merseyside, i.e. women of higher SES had higher rates of the disease, but better survival, and greater response to screening invitation. All these findings are, to a degree, interlinked.

A wealth of new, detailed local information on these issues has been provided as a result of the analyses reported within. Elements of this information could be utilised, for example, in local targeting of populations to try and improve screening uptake, with the overall aim of increasing survival in women unfortunate enough to be diagnosed with breast cancer. The Super Profiles geodemographic classification has emerged as a practical and useful measure of SES in this research.

CHAPTER 1

INTRODUCTION

INTRODUCTION

1.1 RATIONALE BEHIND THE WORK

Breast cancer is a major cause of death and distress in women, particularly in developed nations. Many women's lives are touched by the disease, directly or indirectly, as current risks indicate that around one in 12 will develop breast cancer before the age of 75. Few of the major established risk factors for breast cancer are amenable to modification. Thus, emphasis is placed on secondary prevention in the form of early detection and treatment, to improve survival amongst those diagnosed with the disease. Breast screening by mammography has been identified as one potential means of reducing mortality, through its detection of early stage tumours, which are more amenable to successful treatment (chapter 2).

As part of the efforts to reduce ill health and mortality due to breast cancer, the UK government instituted the National Breast Screening Programme, which became fully operational in the early 1990s. This systematically calls and recalls 50-64 year old women, and will also screen those aged 65 and over on request. A 70% acceptance rate of screening invitations was deemed necessary to achieve the target for reduction of breast cancer mortality, as set out in the Department of Health's White Paper, "The Health of the Nation" (DoH 1992). Whilst recent years have seen a fall in mortality, through improvements in survival, the full impact of the National Breast Screening Programme cannot yet be assessed (chapter 2). In the interim, other indicators must be monitored, including rates of uptake (DoH 1995a).

Nationally, response to invitation for screening by mammography has exceeded 70%. However, this masks variation at regional and, more particularly, local level (chapter 2). The key challenges in moving the breast screening programme forward that have been identified by the Department of Health include increasing uptake of invitations and ensuring that compliance remains high amongst women invited for the second and subsequent time. Areas and groups in which response to invitation still falls short of 70% need to be identified and targeted in efforts to ensure that potential benefit is as widespread (geographically and socially) as possible. Merseyside, whilst reaching the uptake target overall, has not yet seen uptake rates above 70% in all of the areas covered by its screening units, including two investigated here (chapter 11).

It has long been recognised that variations in health occur according to socioeconomic status (SES) of individuals and populations. The body of literature on the general subject is vast. However, a key work in the UK was the Black Report (DHSS 1980), which extensively reviewed the relationship between ill health and social class. The idea of socioeconomic differences in health behaviour is also widespread. Economic and lifestyle factors can greatly influence expected health, lifespan and experience of medical care (Foster 1992). None of the individual factors that come under the collective heading of socioeconomic status, such as income and education, could have an immediate influence on health. Instead, they are considered to be proxies for other variables that are directly linked. Nonetheless, SES provides a powerful indication of likely health experiences (Angell 1993), albeit with complex causal pathways. Educational elements of SES can, however, have a more direct influence on health-related behaviours.

In most previous research examining breast cancer and mammography specifically, women of higher socioeconomic status (SES) have, more often than not, had higher incidence of the disease, but survived for longer (chapters 3 and 4). High SES tends also to be associated with a greater usage of screening by mammography (chapter 5). However, relatively little of the work on SES and breast cancer incidence and survival (the two separate components of mortality) has been carried out in the UK. Of that which has, the few investigations including recent data have not looked at the picture on Merseyside (chapters 3 and 4). Several well documented papers examined social factors in relation to screening by mammography. However, most report on work carried out prior to the introduction of the National Breast Screening Programme. The more recent, population-based British studies utilised data for the first round of screening only. None of these covered Merseyside, or included data for repeat rounds of screening in relation to social factors.

Selected for examination in this PhD research is an area covered by three of Merseyside's breast screening units, in and close to the city of Liverpool. Data for the first and second screening rounds are analysed. Breast cancer data cover a comparable area. Figure 1.1 shows the location of Merseyside within England and Wales, and figure 2.2 illustrates the relative locations of the districts within it. (Merseyside, until 1994, constituted its own Regional Health Authority. Since then, it has been incorporated within the newer, larger North West RHA.) A subset of information from the analyses will be of interest to regional cancer agencies. Another will be passed on to the local Breast Screening Quality Assurance Reference Centre, through which the screening data were provided.

Figure 1.1
LOCATION OF MERSEYSIDE
WITHIN ENGLAND & WALES

Figure 1.2
LOCAL AUTHORITY DISTRICTS OF MERSEYSIDE

Individual-level socioeconomic data are not usually available for ad hoc research in the UK. They may be collected for the purposes of special studies, but are not available routinely to most investigators. Therefore, it is customary to make use of the wealth of small area based information from the decennial Census. Geodemographic systems, multivariate socioeconomic classifications of small areas which take much of their information from the census, have been used in a wide range of applications. Over the last ten years, and in particular since the 1991 census, increasing interest has been shown in the use of geodemographics in health related studies (chapter 6). An example premise would be that if the socioeconomic profile of a group that it is desirous to highlight or target is known, then census-based information can be used to identify small areas where such people live (Jones and Moon 1987).

There is no single criterion for assessing the performance of any given geodemographic discriminator, other than its usefulness in practice. This research sought to examine the utility of one such series of typologies, Super Profiles, in analysing socioeconomic patterns of screening uptake and breast cancer incidence and survival. Other applications of these typologies, which were developed in Liverpool, have found them to be a useful means of identifying socioeconomic variations in health and health issues (chapter 6). It was hoped that in this exploratory analysis of the socioeconomic dimension of breast cancer incidence, survival and screening uptake in part of Merseyside, the Super Profiles classification would also emerge as a valuable measure of SES.

Another emphasis of this research is the potential for repeatability, whether in other areas of the country, or in this part of Merseyside, in the future. Data equivalent to those employed here are available for all other regions of the UK, and are collected on a routine basis. The coding and quality of information may change (the latter hopefully improving in progressively more recently collected data), but closely comparable studies could be carried out.

1.2 SUMMARY OF MAIN OBJECTIVES

- To investigate the recent socioeconomic dimension of breast cancer incidence and survival in part of Merseyside, and to set the results in the context of what is already known from previous studies in other regions and countries. Of the three issues researched here, the association of SES with breast cancer incidence is best known. Therefore, this section also serves as a 'validation' of the Super Profile classifications in health research. It is hoped that information provided as a result of this original research will contribute towards efforts to decrease the local impact of breast cancer.

- To investigate geodemographic variations in breast cancer screening uptake of first and second round invitations in the same area, again examining the contribution of results to what is known from research elsewhere.

- To explore the utility of Super Profiles as a tool for distinguishing between groups with more favourable and, in particular, less favourable breast cancer experience and/or screening behaviour.

1.3 SUMMARY OF THESIS STRUCTURE

Chapter 2 discusses in more detail the background facts and figures relating to breast cancer and the UK's breast screening programme. Reviewed in chapters 3, 4 and 5 is the body of published literature relating to the socioeconomic analysis of breast cancer incidence, survival and screening uptake, respectively. Each indicates the extent of agreement found between the studies in the variation in each issue and SES. Also evident is the relative absence of any such information in Merseyside.

Chapter 6 introduces the concept of geodemographics, and describes the development and structure of the Super Profiles classification. In chapter 7, the Super Profile Lifestyle characteristics of the districts studied are presented and discussed.

Data and methods used in this research are documented in chapter 8, with additional detail available for reference in appendix A. Chapters 9, 10 and 11 present and discuss, in turn, the results of the geodemographic analysis of breast cancer incidence, survival and uptake of invitations for screening in western Merseyside. Finally, chapter 12 brings these findings together in summary. It also discusses their implications and utility for action, and suggests potential for further research.

CHAPTER 2

BACKGROUND FACTS AND FIGURES ON BREAST CANCER AND BREAST SCREENING

BACKGROUND FACTS AND FIGURES ON BREAST CANCER AND BREAST SCREENING

Outlined first in this chapter are the recent patterns and trends in breast cancer incidence and survival, at international, national and local scale, where appropriate. The process of cancer registration is then introduced, as is the rationale behind the development of the NHS National Breast Screening Programme, and its basic structure. Given the vastness of the literature on cancer, and the frequency of the disease, it is surprisingly difficult to compile a picture of incidence or survival for comparable time periods over a range of geographical scales. Data collection, analysis and/or publication each vary from country to country and region to region. Nonetheless, a fairly extensive picture of the rates and patterns can be given. The introductions to the processes of cancer registration, breast screening, and the UK screening programme, are not exhaustive critiques. An evaluation of each could be the focus of an entire thesis and that is not the purpose of this one. The main issues in each are presented in sufficient detail to provide some of the backdrop for the research report that follows in later chapters.

2.1 THE OVERALL CANCER BURDEN

Cancer is a major source of ill health and death across world populations. Currently, the lifetime risk in England and Wales of developing any cancer is around one third, with roughly one in every four deaths being due to some form of the disease (Office for National Statistics 1997). Approximately 270,000 new cases and 145,000 cancer deaths are registered each year (Office for National Statistics 1997). Cancer is also a major economic burden; an estimated 6% of NHS hospital expenditure, or over £1 billion annually, goes on cancer care (DoH and Welsh Office 1995).

2.2 BREAST CANCER - THE DISEASE

Approximately one woman in 12 in the UK will develop breast cancer before the age of 75 years (Merseyside and Cheshire Cancer Registry 1994). The course of the disease is unpredictable, with the risk of metastatic cancers (i.e. the spread of cancerous cells to distant parts of the body) continuing for perhaps more than 20 years (OPCS 1994). Tumour behaviour and prognosis vary, depending, amongst other factors, upon clinical type of the disease (some forms are more aggressive than others) and stage at presentation. Average prognosis is moderately good, but highly variable according to the individual case. For example, OPCS (1994) note that, for 1975-1980 registrations, the all ages 5 year relative survival rate was 84% in women with stage I (early) breast cancer, but only 18% in women with stage IV (advanced) disease.

Amongst cancers of different sites, there is great variation in knowledge and potential for prevention and/or cure. At present, no primary prevention measure for breast cancer is known. Thus the focus is on secondary prevention in the form of early detection through screening, combined with treatment.

2.3 RISK FACTORS FOR BREAST CANCER

A number of risk factors for breast cancer have been identified. Listed below are the major established ones, with indication of the features associated with higher or lower risk of developing the disease. The degree of lifelong exposure to ovarian hormones plays a substantial part in the aetiology of breast cancer, hence reproductive factors are very influential on risk. Age is the most important demographic risk factor. A much fuller discussion of the risk factors for breast cancer is provided by Henderson et al (1996).

1. Demographic risk factors for breast cancer

- Age (risk increases with advancing age)
- Race (most common in Caucasian, westernised societies)
- Socioeconomic status (more common in high status women)

2. Reproductive factors

- Parity (increased risk in women who have never had children, even more so in those with a late first full term pregnancy)
- Early menarche (risk is higher when onset of menstruation is at a young age)
- Late menopause
- Length of menstrual cycle (shorter cycles increase risk)
- Lactation (has a protective effect)

3. Other factors

- Family History (increased risk, particularly of premenopausal breast cancer, in women with a first degree relative who had the disease)
- Genetic factors (involved in many family history issues. Certain specific genes for breast cancer susceptibility are now recognised)
- Previous breast disease (increases risk)
- Obesity (confers a higher risk, of postmenopausal cancers in particular)
- Fat consumption (greater consumption increases risk)
- Alcohol consumption (more than a couple of drinks daily increases risk)
- Ionising radiation (high doses to the chest increase risk)
- Activity levels (exercise is thought to have a protective effect in younger women)

2.4 BREAST CANCER INCIDENCE

2.4.1 The Global picture

World-wide, there are over half a million new cases of breast cancer each year (OPCS 1994). This disease accounts for almost a fifth of all carcinomas in women, making it the most common female cancer overall (OPCS, 1994)., Its relative frequency is greater in developed nations, with available data for the mid to late 1980s, documented in Volume VI of the "Cancer Incidence in Five Continents" series (Parkin et al 1992), illustrating the between-country variation in its significance. In westernised countries, the greatest single proportion of female cancer registrations was for ICD-9 174 (ICD =

International Classification of Diseases), the site coding for female breast. For UK regions breast cancer represented between 20 and 25 per cent of registrations, lower proportions than in Canada, the USA, the Netherlands, France and some parts of Switzerland, but still high nonetheless (Parkin et al 1992).

Meanwhile, in less developed parts of the world, other carcinomas were often more frequent than breast, for example, cervical cancer in parts of South America and India and stomach cancer in Japan. In China and Hong Kong, breast cancer can rank below that of the lung, stomach, liver, or a combination thereof (Parkin et al 1992). In some countries or regions where the relative frequency of lung cancer or others of generally poor prognosis are high, death rates from these can exceed those for breast cancer (Coleman et al 1993).

Rates of the disease (age-specific, age-standardised, etc.) are therefore predictably highest in western countries. The risk for breast cancer incidence may be several-fold greater in some developed nations than in many African or Asian locations. There is also notable variation in Europe, with eastern and some southern countries generally having lower rates than the northern and western nations, with the highest rates almost twice those of the lowest. The Age standardised rate (ASR) for England and Wales during 1983-87 was similar to rates given for Scotland, Italy, France and Australia, and lower than many for the USA, Canada, Denmark, Switzerland, Iceland, The Netherlands and Israeli Jews (Parkin et al 1992). However, OPCS (1994) noted that Great Britain topped the global league table in terms of overall breast cancer mortality rates (for years not stated).

2.4.2 Global trends in incidence

Since the 1960s, when incidence data became more widely available (Muir et al 1994), upward trends in the occurrence of breast cancer have been noted in most countries. Real increases in disease rates, transient increases in earlier diagnoses (for example, following the introduction of screening programmes), and improving accuracy of cancer registration will all, to greater or lesser degree, be factors in this. Amongst countries providing cancer registration data, the fastest rates of increase in breast cancer incidence between c.1970 and c.1985 were noted in Singapore and Japan (Coleman et al 1993, Ursin et al 1994). Other Asian countries and parts of South America and southern/eastern Europe experienced moderate increases. In the 'leading', westernised countries, such as the USA, England and Wales, the upward trend, although continuing, was possibly decelerating in some areas, including England (Coleman et al 1993). In certain nations including the USA, England and Wales, Norway and Switzerland, the increase in breast cancer incidence appeared to be minimal within the youngest birth cohorts (Coleman et al 1993, Ursin et al 1994).

2.4.3 Incidence in the UK

1. Overall registrations and mortality

Breast cancer is the single most commonly occurring cancer in UK women. Recently published data indicated that almost 3 in every ten female cancer registrations were for this site (Office for National Statistics, 1997). Figure 2.1 illustrates, in pie-chart form, the proportions of all 1990 female registrations relating to cancer of the breast, the next two common sites, colorectal and lung, and the others targeted in The Health of the Nation White Paper (DoH 1992), cervix and malignant melanoma of the skin. Currently, there around 14,500 deaths in the UK each year from breast cancer (Imperial Cancer Research Fund 1996). Whilst lung cancer now accounts for the greatest number of female carcinoma deaths in Scotland (Imperial Cancer Research Fund 1996), breast cancer remains the leading cause of such deaths in England, for women aged 35 and over (DoH 1995a, North West Regional Health Authority 1996).

2. Age-specific incidence rates

Figure 2.2 shows the age-specific breast cancer incidence rates per 100,000 women in England and Wales, for the years 1989 and 1990. The actual rates for 1990 are shown in table 2.1. From minimal numbers of cases in the under 30s, breast cancer incidence rises rapidly with age until the menopause (45-50). After this, rates for 1989 increased less rapidly, even slightly declining for about 10 years after the age of 60, before increasing more rapidly again in the oldest women (OPCS 1994). Meanwhile, the curve for 1990 illustrates the increase since 1989 in breast cancers diagnosed in 50-64 year olds. This is precisely the group targeted by the National Breast Screening Programme; an increase in registration rates as a result of such a programme's initiation is to be expected. After all, screening detects cancers at an earlier time than they might otherwise manifest themselves. On another note, Figure 2.2 also shows that breast cancer rates in younger and older women than the group targeted for screening were slightly lower in 1990 than in 1989.

Table 2.1
Age-specific rates per 100,000 of newly diagnosed breast cancers, 1990, England and Wales (29,145 registrations in total)

All ages	age <1	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39
112.1	0.3	0	0	0	0.1	1.4	7.5	23.0	55.3

40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
98.9	158.7	207.8	249.8	303.1	261.6	253.9	269.5	279.5	344.9

cases registered by December 1996
Data from Office for National Statistics 1997

2.4.4 UK Trends

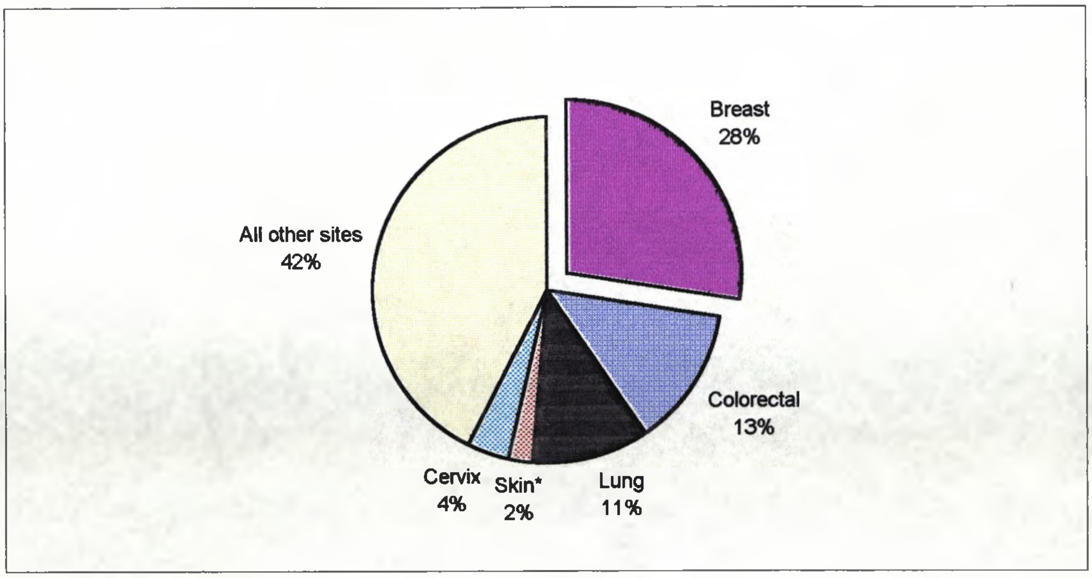
As mentioned above, incidence has been rising in Britain (as well as in other countries), although in recent years the increase may have decelerated. Table 2.2 illustrates the change in England and Wales for breast cancer rates in the 1980s. Provisional data indicate a continuing increase in breast cancer registrations between 1989 and 1990 of 2.8%, compared to 0.2% in female malignant neoplasms overall (OPCS 1995).

Table 2.2 Standardised Registration Ratios by year, 1980-89*, for breast cancer in England and Wales (base year 1979=100)

1980	1981	1982	1983	1984	1985	1986	1987	1988	1989#
103	102	105	102	102	111	110	114	122	126

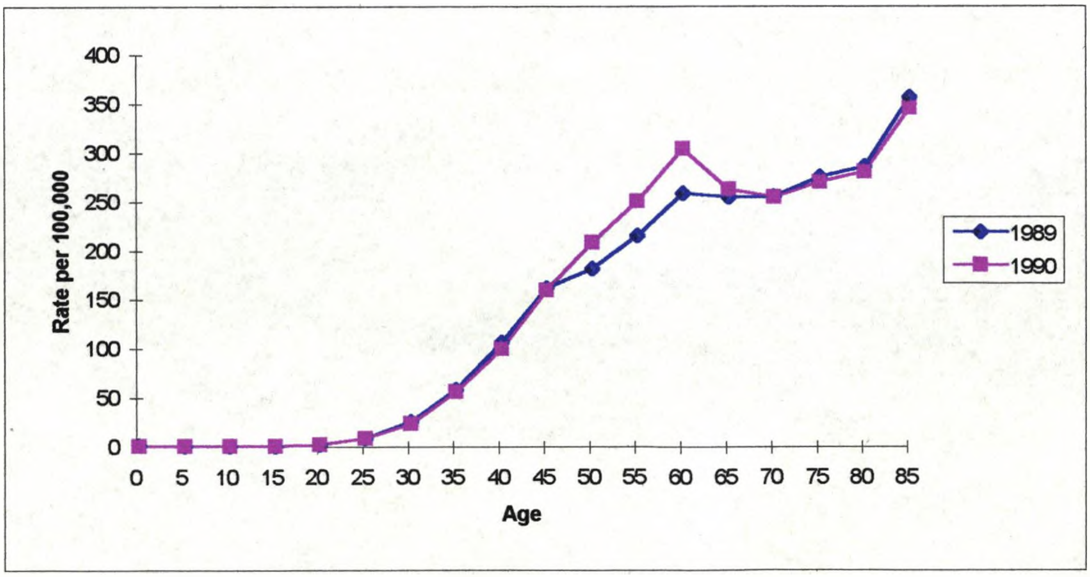
*SRRs calculated from the revised mid year estimates of population based on the 1981 Census. For 1980-84 SRRs are for persons aged under 75
#registered by December 1993
Data from OPCS 1994

Figure 2.1
The proportions of female cancer registrations, 1990, England and Wales, relating to cancer of the breast, and other common and "Health of the Nation" targeted sites



*malignant melanoma only
Data from Office for National Statistics (ONS), 1997

Figure 2.2 Age-specific rates of breast cancer in England and Wales, 1989 and 1990



1989 data from OPCS 1994
1990 data from ONS 1997

2.4.5 Breast Cancer Incidence in Merseyside

Within the whole Northwest Region (South Cumbria, Lancashire, Merseyside, Greater Manchester and Cheshire) there are around 3,400 new cases of primary breast cancer diagnosed, and approximately 1,700 deaths from it every year (North West Regional Health Authority 1996). Incidence and mortality are close to the national average, as are trends of slightly increasing incidence (partly as a consequence of screening) but slightly decreasing mortality (North West Regional Health Authority 1996).

For Merseyside and Cheshire, during 1986-1990, breast cancer accounted for 20.8% of new female cancers (Merseyside and Cheshire Cancer Registry 1994). It was previously reported that Mersey Region had a significantly high SRR in relation to England and Wales (Youngson et al 1992, OPCS 1994, Merseyside and Cheshire Cancer Registry 1994). More recently, breast cancer rates in Merseyside and Cheshire have been at or slightly below the average for England and Wales (Merseyside and Cheshire Cancer Registry, personal communication 1997). Table 2.3 lists the age-standardised incidence rates (ASRs) for 1989, and standardised registration ratios for 1989, by Regional Health Authority, and alongside them, the SRRs for 1990 (the 1997 ONS publication does not provide ASRs for 1990). From this it can be seen that the SRR for Mersey was higher than for England and Wales as a whole for 1989 registrations, but lower in 1990.

Table 2.3
England and Wales: Directly age-standardised rates (1989) and Standardised Registration Ratios (1989 & 1990) of newly diagnosed breast cancer cases, by Regional Health Authority

RHA	ASR (1989) per 100,000 (World Standard)	SRR for 1989 (England and Wales = 100)	SRR for 1990
Northern	62.5	87	88
Yorkshire	65.3	96	94
Trent	58.6	86	93
East Anglian	70.8	101	110
North West Thames	68.6	101	107
North East Thames	69.5	105	111
South East Thames	66.0	98	98
South West Thames	68.4	102	100
Wessex	80.3	119	119
Oxford	63.4	92	116
South Western	70.0	102	100
West Midlands	72.0	104	96
Mersey*	**72.2**	**103**	**98**
North Western	63.8	93	90
Wales	76.8	119	95
(ENGLAND AND WALES)	68.2		

1989 data from OPCS 1994, for cases registered by December 1993
1990 data from Office for National Statistics 1997, for cases registered by December 1996
*This refers to Mersey Region prior to its merging with the new North West Region

Considerable variation in breast cancer rates occur within Merseyside and Cheshire. Table 2.4 shows the Standardised Registration Ratios (SRRs) for each district during 1990-94, referenced to England and Wales as a whole. The old district of Southport and Formby had the highest SRR. This and Wirral's were significantly higher than the average registration rates for England and Wales. Meanwhile, Macclesfield and the old South Sefton district had significantly low SRRs. Liverpool's SRR was also lower than the national average, although not significantly so.

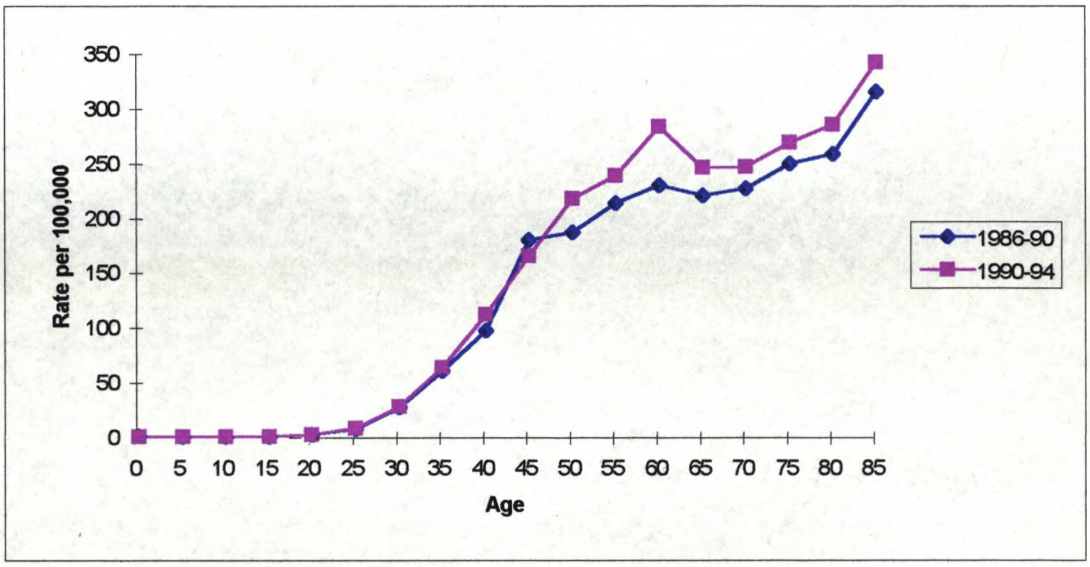
Table 2.4 Standardised Registration Ratios for breast cancer in Merseyside and Cheshire, 1990-1994, by district

District	SRR	95% Confidence Interval
Chester	99.9	91.3 to 108.5
Crewe	102.4	95.1 to 109.7
Halton	102.4	92.1 to 112.7
Macclesfield	91.4	83.5 to 99.4
Warrington	104.4	95.5 to 113.3
Liverpool	95.2	90.0 to 100.5
St. Helens	94.8	88.5 to 101.1
Southport & Formby	118.4	108.1 to 128.7
South Sefton	89.8	81.8 to 97.9
Wirral	106.7	100.5 to 112.7
Merseyside and Cheshire	99.8	97.5 to 102.1

Source: Merseyside and Cheshire Cancer Registry 1997 (unpublished)
Referenced to England and Wales registrations for 1990 (Office for National Statistics 1997)

Age-specific rates for Merseyside and Cheshire follow a similar general pattern to the national one, although data for 1987-91 showed 45-65 year olds had higher incidence rates and those over 65 lower ones than in England and Wales as a whole (Merseyside and Cheshire Cancer Registry 1994). Incidence in the older age groups has been increasing since 1977 however, bringing them more into line with the overall pattern. The introduction of the National Health Service Breast Screening Programme will have only made a small contribution to the figures given in that report. Meanwhile, Figure 2.3 illustrates the changes in age-specific rates in Merseyside and Cheshire between 1986-90 and 1990-94. The general increase in incidence in women aged 50 and over is clear.

Figure 2.3
Age-specific rates of breast cancer over the whole of Merseyside and Cheshire for the periods 1986-90 and 1990-94



Data source for 1986-90: Youngson et al 1992

Data source for 1990-94: Merseyside and Cheshire Cancer Registry 1997 (unpublished)

2.5 BREAST CANCER SURVIVAL

Breast cancer has a moderately good prognosis in comparison with other malignant neoplasms. For instance, sites including lung, oesophagus, pancreas and stomach tend to have the poorest survival (Coebergh 1995, Kogevinas et al 1991). Meanwhile, the prognosis for malignant melanoma and other skin cancers is often the best (Kogevinas et al 1991).

2.5.1 Geographical variations

International data on survival are less available than for incidence or mortality. However, the EUROCARE study and related work have examined cancer survival in 12 European countries (Berrino et al 1995, Sant et al, forthcoming). Table 2.5 shows the one and five year relative survival rates from breast cancer in each of these countries, for cases registered between 1978 and 1985.

Mean one year age-standardised (to the overall age distribution of the study population) relative survival was 90% and the five year rate was 67% (Coebergh 1995). Switzerland, Finland, France and Italy had the most favourable 5-year rates, all exceeding 70%, whilst England's was the third poorest, at 62.5% (Coebergh 1995); see table 2.5. For 1983-85, the latter three years of the study period, England's relative ranking was better, with a rate of 64% (Sant et al, forthcoming). However, survival rates in this country are still much lower than those for the richer nations in Europe.

Diagnosis at a generally later stage has been postulated as a major possible reason for poorer survival in England, Poland and Estonia, the other lowest ranking countries (Coebergh 1995) which, if this is the case, should partly be addressed by the introduction of the National Screening Programme.

Table 2.5 Age standardised one and five year relative survival amongst breast cancer cases diagnosed during 1978-85 in 12 European countries

Country	No. of cases	One-year survival % (95% CI)		Five-year survival % (95% CI)	
England	**60,390**	**86.9**	**(86.3 - 87.5)**	**62.5**	**(61.5 - 63.5)**
Denmark	17,498	91.2	(90.2 - 92.1)	68.1	(66.2 - 69.9)
Estonia	2,387	87.6	(83.8 - 90.5)	58.8	(53.1 - 64.3)
Finland	11,123	94.0	(92.7 - 95.0)	73.5	(71.2 - 75.7)
France	2,498	94.0	(91.2 - 96.0)	71.4	(66.1 - 76.1)
Germany	3,359	90.4	(87.6 - 92.5)	68.4	(63.9 - 72.7)
Italy	3,595	93.7	(91.5 - 95.4)	70.8	(66.6 - 74.6)
Netherlands	2,653	93.8	(91.0 - 95.7)	69.9	(64.5 - 74.8)
Poland	1,089	77.5	(71.0 - 82.9)	43.9	(36.3 - 51.8)
Scotland	11,261	86.9	(85.4 - 88.3)	61.8	(59.3 - 64.2)
Spain	1,043	90.8	(85.7 - 94.2)	62.5	(54.3 - 69.9)
Switzerland	2,243	95.4	(92.8 - 97.1)	75.7	(70.5 - 80.3)
EUROPE		90.4	(88.0 - 92.3)	66.5	(62.4 - 70.4)

Data from the EUROCARE study (Berrino et al 1995) CI = Confidence Interval

Survival generally declines with age at diagnosis. For instance, OPCS (1994) note 5 year relative survival in women aged 35-44 (1981 registrations) to be 70%, compared with 55% in the 75-84 year group (they do not provide further figures for tabulation). However, in women under 40, a reverse trend, i.e. of poorer survival in *younger* women, has been noted (Sant et al, forthcoming), possibly due to more aggressive forms of the disease in younger women.

2.5.2 European trends in breast cancer survival

Table 2.6 illustrates the direction of changes in breast cancer survival rates within 11 European countries between 1978-80 and 1983-85. In Switzerland, the one year rate fell slightly, this being the only country to experience worsening of any sort with respect to breast cancer. In England and Finland, 5 year rates improved slightly. Meanwhile, in the Netherlands, Estonia, France, Italy and Poland, one and five year rates all improved. There was no particular change in Denmark, Germany or Scotland (Coebergh 1995). The situation also improved in Spain (Sant et al, forthcoming).

Table 2.6 Changes in breast cancer survival rates between 1978-80 and 1983-85* in 11 European countries

	1-year	5-year
Denmark	=	=
Holland	+	+
England	=	+
Estonia	+	++
Finland	=	+
France	+	+
Germany	=	=
Italy	++	+
Poland	++	++
Scotland	=	=
Switzerland	-	=

data from Coebergh (1995) in the EUROCARE study
= change less than 2%
+ or - minimum 2% absolute change
++ minimum 5% absolute change
*1978-80 and 1981-82 for Scotland

Measuring survival changes over a wider time period would probably produce clearer results throughout Europe, illustrating improvement across the board. For example, whilst no significant change was noted in Scotland over the period of the EUROCARE study, Black et al (1993) note an increase in 5 year relative survival from c.56% to c.64% between 1968-72 cases and those diagnosed during 1983-87. Changes in cancer management and, more lately, earlier detection of disease, are thought to account for the generally continuing improvement in survival.

2.5.3 Survival in the UK and Merseyside

As stated above, England's survival rates have been generally poor in comparison with other European nations. However, the all-ages and age-specific rates have all been improving since 1978 (Coebergh 1995). This is also true for Merseyside and Cheshire cases since the mid 1970s (Merseyside and Cheshire Cancer Registry 1994). For 1985-89 registrations, overall 5 year relative survival in the registry's area was 62.6%, similar to that for England (Merseyside and Cheshire Cancer Registry, personal communication 1997). Table 2.7 shows the improvements in 1 and 5 year relative survival rates in Merseyside and Cheshire amongst women diagnosed between 1975 and 1989, split into three quinquennia. Survival rates all increased, with the exception of the under 40s, for whom better short and intermediate term survival was observed for 1980-84 registrations than for 1985-89 cases (Merseyside and Cheshire Cancer Registry 1996, unpublished data). Overall, survival patterns are broadly similar between individual districts (Merseyside and Cheshire Cancer Registry 1994).

Table 2.7 Changes in 1, 2 and 5 year relative survival in Merseyside and Cheshire, by 5 year age group, 1975-89

Age group	Period	Number of women	Relative Survival (%)		
			1 year	2 year	5 year
< 40	1975-79	310	90.9	78.2	58.6
	1980-84	359	93.1	83.8	64.8
	1985-89	383	92.1	80.5	62.3
40-49	1975-79	911	91.1	82.0	64.9
	1980-84	901	93.7	82.6	66.5
	1985-89	1012	94.6	87.3	68.9
50-59	1975-79	1125	82.9	73.1	51.9
	1980-84	1173	87.5	77.3	55.5
	1985-89	1265	92.1	83.3	67.3
60-69	1975-79	1318	81.2	73.2	56.4
	1980-84	1361	82.8	75.4	57.6
	1985-89	1416	87.6	80.7	62.9
70+	1975-79	1564	66.6	59.0	42.3
	1980-84	1759	74.5	66.6	49.3
	1985-89	1839	76.3	69.7	55.0
All ages	1975-79	5228	79.8	71.2	53.5
	1980-84	5553	83.8	75.0	56.8
	1985-89	5915	86.7	79.2	62.6

Source: Merseyside and Cheshire Cancer Registry 1996 (unpublished)

2.6 TRENDS IN MORTALITY

Mortality from breast cancer continues to increase in many nations. However, in some countries including England and Wales, the USA and Norway, mortality rates changed little between c.1970 and c.1985 (Ursin et al 1994). Since then annual rates have remained fairly constant in Norway and the USA, but appear to have taken a downturn in the UK (Beral et al 1995, Hermon and Beral 1996). Here and elsewhere much of this seems to be due to decreasing mortality from breast cancer in more recent birth cohorts (Hermon and Beral 1996).

The Department of Health, monitoring progress towards their target for breast cancer mortality reduction (section 2.9), note that mortality amongst 50-59 year olds in England has fallen by about 2% per year since 1989 (DoH 1995a). In 1993, OPCS made changes to the coding of cause of death, with the result that for some conditions, pre-1993 and post-1993 rates are not directly comparable. However, there was little or no effect with respect to cancer mortality rates (Rooney and Devis 1996).

Mortality rates in Merseyside and Cheshire were similar to those for England and Wales during 1977 to 1992 (approximately 50 per 100,000), and whilst in all ages combined there was a continual increase over that period, for 50-69 year olds a slight drop was noted in the early 1990s. Women in this age may still have been dying as frequently from breast cancer, but doing so after a longer survival period, i.e. dying at or after the age of 70. For older and younger women increases in mortality were slight (Merseyside and Cheshire Cancer Registry 1994).

Overall, it would appear that between-country differences are showing a trend towards convergence. Incidence and mortality rates are both increasing where they have historically been lowest, e.g. Asian countries, and remaining stable or declining in countries where experience of this disease has been most significant. In the UK, the national screening programme may contribute to a drop in mortality that appears to have begun in the mid 1980s. Note, however, that all the figures and trends discussed in this chapter relate to locations where suitable data are available and thus can be included for analysis in such studies.

2.7 CANCER REGISTRATION IN ENGLAND AND WALES

"Cancer registration is the process of maintaining a systematic collection of data on the occurrence and characteristics of malignant neoplasms and certain non-malignant tumours." (Davies and Williams 1994, OPCS 1994)

England is one of a relatively small number of countries in which there is full population-based registration. When radium treatment was introduced in the 1920s, it was recognised that information on patient treatment and outcomes was essential for the planning and operating of cancer services. In 1945, the Radium Commission was designated as the central statistical bureau responsible for collating results. Two years later this duty was passed to the General Register Office and then, until 1993, to its successor, the Office of Population Censuses and Surveys (OPCS) (Davies and Williams 1994, OPCS 1994). The successor to the OPCS, the Office for National Statistics (ONS) has now taken over its functions, including the collating of cancer registration data.

Complete national coverage of cancer registration was achieved in 1962 and is spread between 12 independent registries. That for the Mersey region was founded in 1944, with data for 1951 onwards held in computerised form. Each registry periodically submits a standard dataset for centralised analysis and publication, previously carried out by the OPCS, now by the ONS.

Information is gathered from a number of sources, primarily medical records and pathology departments of local hospitals, death certificates on which cancer is mentioned, and also from others such as GPs and the Family Health Services Authorities (FHSAs). The minimum data set contains information on the patient (location, age, sex etc.), their diagnosis (e.g. date, site, histology), treatment indicators and details of death if it has occurred. When a cancer is registered the corresponding patient's record in the National Health Service Central Register (NHSCR) is flagged. The relevant registry will be informed when a flagged case is known to have died; this is passive follow-up of registration. Additionally follow-up may be active, in that the registry seeks out information on the patient's status from the hospital or GP concerned. The Merseyside and Cheshire Cancer Registry uses a combination of both approaches.

Cancer registration can never be entirely exhaustive but only a very small percentage of the cases in this country will fail to be documented somewhere.

2.8 SCREENING FOR BREAST CANCER

2.8.1 The concept of screening

The aim of screening is to detect a condition at an early stage. Additionally, it is only a logical procedure if treatment is more effective when implemented before the disease is clinically manifested. Screening is not itself diagnostic; rather disease-free individuals are separated from asymptomatic persons who have an abnormality that requires further investigation. However, since patients with abnormalities should then be carefully followed-up with regard to diagnosis and treatment, it is a rightful assumption that volunteers for screening will benefit (Leinster 1989). The practicability of screening for a given condition depends on many factors, which are outlined below.

2.8.2 Principles of screening and their applicability to breast cancer

Wilson and Jungner (1968), for the World Health Organisation, published a set of logical criteria for screening, which were considered and augmented by the Forrest committee (introduced further in section 2.9.1) when assessing the potential for the national breast screening programme (DHSS 1986). The main points associated with each criterion are introduced briefly below:

1. The condition should be an important health problem

It must be the cause of significant morbidity or mortality in the population, and it must be sufficiently common to make any screening programme cost-effective in terms of the number of cases detected per unit cost of screening. As detailed in the early sections of this chapter, breast cancer is indeed a major cause of death and distress amongst women, being a major contributor to loss of life and working years in women aged under 65 (DoH 1995b). A National Audit Office report notes that a death from the disease occurs an average of every forty minutes in England (National Audit Office 1992).

2. The natural history of the disease should be adequately understood

It is known that breast cancer initially develops in the milk-producing cells and in the cells lining the small milk ducts. During the early, pre-invasive stage malignant cells are confined within the ductal system. In the subsequent, invasive phase, the cancer invades the surrounding tissues and from then will potentially spread to local lymph nodes and beyond. Common metastatic sites include the bones, liver and brain. The length of time from early to late stage disease is very variable, since some types of breast cancer are more aggressive than others.

3. There should be a recognisable early stage

Invasive cancers, if detected sufficiently early, have a good chance of being locally confined, not yet having metastasised to regional/distant sites. For breast cancer, non-invasive and small invasive tumours under 1 centimetre in diameter are generally regarded as constituting an early stage of the disease (DHSS 1986).

4. Early treatment should be of more benefit than that implemented at a later stage

The value of early treatment for breast cancer is believed to be high, even when allowing for certain recognised sources of bias in survival calculations. Firstly, early diagnosis inevitably lengthens the time interval between diagnosis and death, irrespective of factors such as treatment; this is known as lead time bias. Secondly, length time bias relates to the fact that screening programmes will pick up a higher proportion of slow growing tumours, with inherently better survival, than will be the case for clinical-only diagnoses. This increases the apparent survival advantage in screening-detected women. Thirdly, there is Selection bias; Respondents to screening may be more health conscious than non-attenders, and/or have better access to quality health care. Thus they may have a generally better prognosis anyway than those who choose not to attend.

As the Forrest report notes (DHSS 1986), the effect of these biases can only be overcome by comparing a case (i.e. screening offered) with a control (screening not offered) population. The screening trials conducted in New York and Sweden that used this type of method, and demonstrated significantly increased survival in screened populations (Shapiro 1977, Tabár et al 1985), were key pieces of evidence contributing to the Government's decision to implement the National Breast Screening Programme. The favourable results of studies in Utrecht (Collette et al 1984) and Nijmegen (Verbeek et al 1984), Holland, also backed up this decision.

A few years after the Forrest report, early reports on mortality effects in UK trials were published. The UK trial of early detection of breast cancer group (1988) noted no apparent difference in mortality between screened and unscreened women in the first five years after the trial, but that between 5 and 7 years, a gap began to appear. Later, Roberts et al (1990a) reported that mortality had indeed been reduced by screening, if not by a significant margin. However, more time is needed to be able to examine the effects of the UK programme (DoH 1995a). More emphatic confirmation of the mortality reduction achievable (at least in women aged over 50 or 55) came from work relating to screening programmes that have been in existence for longer, in Italy (Palli et al 1986) and Sweden (Tabár et al 1989, Larsson et al 1996). Very recently, Hakama et al's (1997) case-control study in Finland concluded that, although breast cancer mortality was reduced by mass screening, the reduction was relatively small in relation to the cost of the programme, and that considerations other than absolute levels of mortality reductions should be included when assessing the likely benefit of screening programmes. All of these findings will contribute to continuing assessments of the existing breast screening programme in the UK.

<u>5. There should be a suitable test or examination</u>

The test used must give sufficiently valid, i.e. accurate results. Persons with pre-clinical disease should emerge as test positive and those without pre-clinical disease as test negative. Sensitivity and specificity are two inversely related measures in assessing this. Sensitivity is the probability of testing positive if the condition is present, whilst specificity is the probability of testing negative when the condition is absent. False positive results in persons without the disease are undesirable, not least since they result in unnecessary distress. Minimising false negatives is even more crucial, in that persons with the condition should be diagnosed and treated, rather than being erroneously reassured. Various options are available for detecting breast cancer, including Breast self-examination (BSE), Ultrasonography, and Mammography. This latter technique is the one implemented in the National Breast Screening Programme. The Forrest report viewed mammography in a positive light with regard to its potential sensitivity (DHSS 1986).

6. The screening programme should be acceptable to the population

The opportunity to attend for screening should be presented to as many of the eligible population as possible (coverage), and from that, a sufficiently high number of people must choose to present for the test (uptake). Overall, breast screening programmes usually achieve reasonable response rates, although in certain subgroups (social, cultural, age) real or perceived barriers to attendance would appear to operate.

7. There should be adequate facilities for the diagnosis and treatment of screen-detected abnormalities

Assessment diagnostics include expert clinical examination, mammography, fine needle aspiration (which discriminates between solid and cystic lesions) and fine needle aspiration cytology (defines the nature of solid lesions). If cancer is still suspected after one or more of these tests, biopsy and histological assessment are necessary. For non-palpable abnormalities, particular radiological, surgical and pathological skills are required to ensure correct diagnosis.

Surgery, radiotherapy, chemotherapy, hormone therapy or a combination thereof may be used to treat the disease, the choice of method(s) being largely stage-dependent. Earlier-stage disease is usually treated surgically, with or without another form of therapy, whilst metastatic disease is treated somewhat differently, or indeed palliative care (aimed at symptom relief) may be more appropriate.

8. For a disease of insidious onset, screening should be repeated at intervals appropriate to its natural history

The current interval for repeat screens is three years, not least for economic reasons (Das 1990). The optimum interval is not known, however, although further research into interval cancers (those diagnosed between screening appointments) may elucidate the picture.

9. The chance of physical or psychological harm to those screened should be less than the chance of benefit

The possibility of physical harm to women undergoing screening by mammography relates to the ionising radiation used in the procedure. Whilst it is true that radiation might itself induce subsequent cancers, the risk arising from a limited series of screens in women across a specific age range was thought to be tiny in comparison with the potential benefits of early detection across the population (DHSS 1986).

Potential psychological costs relate both to the appointment and the possibility of false test results. The actual appointment may be uncomfortable or embarrassing for some women, but more worrying are the possibilities of stress due to false positive results or the diagnosis and treatment of lesions which might not have ever entered a clinically invasive phase. The conclusion of the Forrest Report was that the potential for individual women to take this pro-active stance against such a major disease would result in the overall psychological benefit being more pronounced than the potential for stress.

10. The cost of the screening programme should be balanced against the resulting benefits

The actual monetary cost of providing a screening service should be outweighed by the number of life years gained. It is extremely difficult to assess health benefits of screening in monetary terms. However, the cost of providing a national breast screening service was analysed prior to the setting up of units countrywide, and deemed to be manageable (DHSS 1986).

An additional point to be made in the discussion of screening principles is that there should be an agreed policy on whom to target for the procedure. In this country, women between the ages of 50 and 64, around which a peak in breast cancer incidence rates occur, are automatically eligible for screening. Older women, in whom the risk of breast cancer is higher, are free to self-refer. Whether a wider age group should be targeted for screening has been the subject of debate. For example, it is doubtful whether screening women aged under 50 has a beneficial effect on mortality (Palli et al 1986, Andersson et al 1988, Larsson et al 1996). Tabár et al (1995), in a further Swedish study, concluded that women of 40-49 would have to be screened at intervals of less than 2 years for a significant mortality reduction to be achieved. This finding was related to the larger subgroup of more rapidly growing tumours in younger women. In contrast, the beneficial effect of screening in women of 65 and over has also been re-iterated by Swedish findings (Chen et al 1995). However, attendance does tend to decline with age, as confirmed in later chapters.

2.9 THE DEVELOPMENT OF THE SCREENING PROGRAMME IN THE UK

2.9.1 Initial development and targets

1. Overview

The United Kingdom was the first member of the European Community to introduce a national breast screening programme. In view of notable mortality rates from breast cancer, the government appointed a working group in July 1985 to examine the case for the introduction of a national breast screening programme. Chair of this group was Sir Patrick Forrest, then Professor of Clinical Surgery at the University of Edinburgh. The Forrest Report, as it is widely known, was published in 1986 and concluded that a national breast screening programme would probably significantly assist in reducing the death rate. The report's conclusions were accepted and in February 1987 the Secretary of State for Health announced the government's decision to institute a national programme. It was intended that this be fully operational by the end of March 1990 (National Audit Office 1992).

Each Regional Health Authority was responsible for the setting up of screening units within its constituent districts. The service was required to operate on a three yearly call and recall basis for all women 50 to 64 years of age and on request for women of 65 and over. Also established by the Department of Health was a co-ordinating network, the National Health Service Breast Screening Programme (NHSBSP). This was set up to assist the RHAs in implementing the service, covering aspects such as professional training requirements, information systems and quality assurance. £55 million was allocated for service establishment and cost contribution, although now all running costs are met under general regional budgets (National Audit Office 1992). Most of the planned centres opened by the target date, with Mersey Region one of the first nationally to have all its units in operation.

2. Target for mortality reduction

A specific target had been set in the Health of the Nation White Paper -to reduce cancer deaths in the population invited for screening by 25% by the year 2000 compared to 1990, from 92.4 per 100,000 to no more than 69 per 100,000 (DoH 1992). The Department of Health identified certain requirements in order that a reduction in breast cancer mortality be achieved via maximum detection of early disease (National Audit Office 1992):

a) rapid commencement of the service, with target date as above

b) work to improve the accuracy of the Family Health Services Authority registers to identify as many women in the target age group as possible and to ensure that invitations reach them

c) effective health education to inform women about the screening programme and its potential benefits, to maximise take up of invitations

d) the use of high quality mammography equipment and highly trained staff to minimise false results (in either direction) and the recall of women for technical reasons

e) an adequate level of assessment and treatment services, staffed with experienced multidisciplinary breast teams to ensure prompt follow-up and treatment

3. Target for uptake of invitations for screening

A target acceptance rate of 70 per cent was established as this was considered necessary to achieve the hoped for 25 per cent reduction in mortality from breast cancer by the year 2000. Breast Screening Programme information for 1990-91 (the first or second year of screening depending on the unit) indicated that nationally this target was being exceeded. However there was notable regional (not to mention local) variation. Uptake was lowest for the North East Thames region, at 60.2%, whilst for Oxford the figure was 81.7%. Overall, Merseyside's uptake was satisfactory, at 73% (National Audit Office 1992). However, as highlighted in chapter 11, there has been considerable local variation in rates of response to screening invitations.

2.9.2 Promotion of the service

It was considered that this new service should be enthusiastically publicised and promoted in order to encourage attendance. General health education was combined with specific local initiatives at the discretion of each RHA. These included presentations to groups, promotional work with GPs, and the location of mobile units in convenient places. For attenders, the aim was to encourage re-attendance by providing a relaxing, informative environment within the screening unit. Attenders' opinions were often sought by questionnaire. After completion of the initial screening round, it would again be up to the Regions to consider the need for further promotion. For example, whether or not to target specific groups of non-attending women should be considered.

2.10 THE UK BREAST SCREENING SERVICE

2.10.1 National arrangements

The basic procedure for invitation and screening throughout the UK is outlined below.

1. Location of screening clinics

Static clinics are situated within community health clinics or hospitals. Mobile clinics may operate in a variety of locations, although clinics, health centres, and other familiar public locations (e.g. supermarkets) are common choices.

2. Invitation of women

Women aged between 50 and 64 are eligible for routine screening, carried out approximately every three years. Women aged over 65 years of age are not routinely invited for screening but are free to self-refer. Meanwhile women aged under 50 can sometimes attend subject to their GP assessing them as a possible high risk individual.

In England and Wales the list of women eligible women for screening is identified from GP registers held by what were the Family Practitioner Committees, now the Family Health Services Authorities (FHSAs). These registers must be as complete and accurate as possible if the screening programme is to be effective. At the time of the Forrest report, it was known that up to 20% of the addresses were inaccurate. However, efforts made and continuing since then have improved register accuracy, even although it cannot be known exactly how many people are not being reached (National Audit Office 1992).

Each FHSA will send a list of eligible women to the relevant GP surgery at regular intervals. It is up to the GP to delete the names of those women in whom screening is contraindicated (e.g. because of illness) and return the list to the FHSA. A computerised invitation letter will be sent, normally bearing the GP's name.

3. Basic screening stage

Clinical responsibility for each woman being screened is taken by a doctor experienced in the clinical aspects of breast cancer screening, who may be a consultant radiologist. This person is not however required to be present during the actual screening appointment. The x-ray films are usually read in batches separately from the clinic session. Reading of these is ultimately the responsibility of the consultant radiologist although films can be read by radiologists, other doctors (e.g. clinical medical officers) or other suitably qualified health professionals (such as radiographers).

Basic screening does not lead straight to diagnosis; rather it separates women who need further investigation from those who clearly do not. The reading of the initial mammogram separates women into 3 groups:

a) Women to be recalled routinely

b) Women who need assessment

c) Women who will be recalled to the unit for further mammograms e.g. to clarify doubtful shadows.

The doctor who is clinically responsible for the patient will also be responsible for notifying the woman and her GP of the result.

4. Referral

If an abnormality is detected by mammography the woman is either referred

a) to her GP, and from thence for further referral as considered appropriate

b) with prior consent of her GP, directly to a specialist assessment team

5. Assessment

For definitive diagnosis of breast cancer, a biopsy specimen of a suspected lesion must be histologically examined. It is not appropriate or desirable to perform biopsies on all cases; keeping the number down to an acceptable level requires expert assessment of abnormalities by a multidisciplinary team. Various techniques are available for assessment, including ultrasonography, fine needle aspiration, and x-ray localisation. A medical member of this team (usually the clinician) must be responsible for

a) co-ordinating the results of further investigations

b) reaching a decision on the need for biopsy

c) notifying the women, GP and screening office

Assessment may either be carried out in a hospital or community clinic.

6. Treatment

Treatment will be administered as appropriate to the particular case. Since screen-detected cancers are frequently in-situ or small invasive tumours, conservative surgery with or without other forms of therapy is more likely.

2.10.2 Breast screening on Merseyside

1. Coverage by screening units

Breast screening has been instituted in Merseyside since January 1989 (although some trial appointments were conducted at the Liverpool unit in late 1988). There are seven screening centres in Merseyside and Cheshire. Five are static clinics, these being Chester, Crewe, Liverpool, Macclesfield and Wirral. The other two are mobile services, the first covering Southport, Formby, South Sefton and Knowsley, the second serving Warrington, Halton and St Helens. Uptake in three of these units (Wirral, Liverpool, Sefton & Knowsley) is considered in this thesis, with each briefly introduced below.

2. The Wirral unit

The Wirral unit is situated in St Catherine's hospital, Birkenhead. Part of the rationale behind locating it there was that this is in the less affluent part of the district and therefore likely to pose fewest barriers to physical accessibility. The first round commenced on 8th May 1990, and was complete within three years.

3. The Liverpool unit

Initially located at the Women's hospital near the city centre, screening is now conducted at the new Women's hospital a short distance away. This was the first unit to commence screening; round 1 proper began on 1st January 1989 and took nearly four years to complete. Since then the unit has caught up and is back on schedule, now in its third round.

4. The South Sefton & Knowsley unit

Administered by the Liverpool unit, this mobile moves between 11 sites, which were chosen for ease of parking and/or for nearby backup medical facilities. Screening officially commenced on 15th January 1990, and the first round took just over three years to complete.

Table 2.8 Dates of the first and second rounds of screening at the Wirral, Liverpool and Sefton & Knowsley units

	Wirral	Liverpool	Sefton & Knowsley
First Round	8/5/90 to 30/4/93	3/1/89 to 14/10/92	15/1/90 to 7/7/93
Second Round	1/5/93 onwards (beyond data download time)	14/10/92 to 29/10/95	8/7/93 to 6/3/96

CHAPTER 3

THE ASSOCIATION OF SOCIOECONOMIC STATUS WITH BREAST CANCER INCIDENCE:

A REVIEW OF THE LITERATURE

THE ASSOCIATION OF SOCIOECONOMIC STATUS WITH BREAST CANCER INCIDENCE: A REVIEW OF THE LITERATURE

This and the following two chapters examine the direction, consistency and size of socioeconomic differences in breast cancer experience and use of screening found in previous research. Thus, they provide the background against which this research is set, as well as highlighting the niche for work based on recent data in Merseyside.

3.1 SELECTION OF LITERATURE FOR REVIEW IN CHAPTERS 3, 4 AND 5

The initial material was identified via the Medline index on CD-ROM covering the period 1990-1996, using general searches of the following:

1) "(socioeconomic or social or economic) with breast with (incidence or survival) with cancer"

2) "(socioeconomic or social or economic) with breast with screening"

Thus, specific keywords were included, but in the broadest possible range of combinations. References from these papers were then followed up if they appeared to be relevant. Additionally, 1996 copies of the following cancer and public health journals were scanned: British Journal of Cancer, European Journal of Cancer, International Journal of Cancer, Cancer, Journal of the National Cancer Institute, American Journal of Public Health, International Journal of Epidemiology, and British Medical Journal.

Only articles published in English were included for review. However, in Scandinavia and Italy, from which several of the studies come, both original and English language versions have commonly been published. For chapters 3 and 4, articles which included breast cancer data, but did not present results for this site individually, were excluded from review.

It is recognised that the findings of each review may suffer from publication bias. For instance, researchers with inconclusive results might be less inclined to submit their work for publication than those with findings in one direction or the other. The extent of any bias due to the inclusion only of published work cannot be known here.

Research included for review often provided additional information, firstly on other factors relating to breast cancer and screening, and secondly, on possibly reasons for observed socioeconomic differences in incidence, survival or mammography uptake. Other articles encountered during the literature searching process, which had some overlap in their focus with those in the main parts of the reviews, added to the information available for discussion. However, it is stressed that the body of literature used in sections discussing other factors relating to incidence, survival and screening is by no means exhaustive, and was never intended to be. The research used simply provides a flavour of what has been found.

3.2 RESEARCH INTO SOCIOECONOMIC STATUS AND BREAST CANCER INCIDENCE

Differential cancer experience by social class was noted by Heron as early as 1907, with a recognition that lifestyle factors play a part in the aetiology of the disease. Later the Registrar General's Decennial Supplement on occupational mortality for 1930-32, published in 1938, featured analysis of breast cancer by social class. Married women were classified according to their husband's social class and single women by their own occupation, using a familiar I to V listing, with a further category for unoccupied persons. A striking positive social class gradient (i.e. higher class, higher mortality) was noted in married women, less so amongst the single (Registrar General 1938). Stocks (1955) examined the picture twenty years later and found a similar direct association between class and breast cancer mortality. However, none of these reports analysed incidence or survival separately.

3.2.1 Number and locations of studies

An early study of incidence came in 1951 (Clemmesen and Nielsen); this and 18 others, published up to and including 1996, are reviewed in the following section. Table 3.1 summarises the studies in chronological order of publication.

Table 3.1 Summary notes on 19 published studies examining socioeconomic variations in breast cancer incidence

Author(s)	Location (H = Hospital-based study)	No. of cases	SES measure(s) & (no. of categories)	Years of diagnosis	Age range of subjects	Incidence Measure
Clemmesen and Nielsen (1951)	Copenhagen, Denmark	1,633	Area- house rent by subdistrict (5)	1943-47	25+	Ratio of observed to expected incidence
Cohart (1955)	New Haven, Connecticut, USA	807	Area- "ecological districts" (3 and 7)	1935-49	all	Ratio of observed to expected incidence
Graham et al (1961)	Buffalo, New York, USA	931*	Area- median rental (4)	1948-52	all	Age-standardised rates (1950 Buffalo standard population)
Devesa and Diamond (1980)	various, USA	20,914	Area- income and education 5 categories each for whites, 3 each for blacks	1969-71	>15	"Average annual adjusted rates"
Cuello et al (1982)	Cali, Colombia	not stated	Area- index for census tract, based primarily on income (3)	1971-75	all	Age-adjusted rates (Cali 1973 census population as standard)
Talamini et al (1984)	Pordenone, Italy (H)	368	Individual- occupation (4), education (2)	1980-83	27-79	Relative Risk
Vågerö and Persson (1986)	Sweden	>17,477*	Individual- occupational status (5)	1961-79	20-64	Standardised Morbidity Ratios
Rimpelä and Pukkala (1987)	Finland	4,597*	Individual- occupation (7), education (4)	1971-75	30-69	Standardised Incidence Ratios
Ewertz (1988)	Denmark	1,486[1]	Individual- education (3), employment status (4), job type (4 and 5), social class (5) occupation (9 and 10)	1983-84	<70	Relative Risk

*for Graham et al 1961, from adding counts by social class category

*for Vågerö and Persson 1986, from adding counts by occupational status (2 categories omitted)

*for Rimpelä and Pukkala 1987, from adding counts in educational categories

[1]For whom social factors known

Table 3.1 continued

Author(s)	Location (H = Hospital-based study)	No. of cases	SES measure(s) & (no. of categories)	Years of diagnosis	Age range of subjects	Incidence Measure
Leon (1988)	England and Wales	1,249*	Individual- education (3), housing tenure (4), access to cars (3) and household amenities (3), social class (8)	1971-75	15+	Standardised Registration Ratios
Carter et al (1989)	USA	122	Individual- education (4), income (4)	1971-75 & 1981-84	25-74	Relative Risk
Krieger (1990)	San Fransisco, USA	4,664	Area- percent working class (2)	1979-81	all	Odds Ratios and Age-adjusted rates (1970 US standard population)
Baquet et al (1991)	Atlanta, Detroit and San Francisco-Oakland, USA	not stated	Area- income (4), education (4), population density (3)	1978-82	25+	Age-adjusted rates (1970 USA Standard population)
Williams et al (1991)	Melbourne, Australia	not stated	Area- index from census variables (10)	1982-83	40-74	Age-standardised rates (World standard population)
La Vecchia et al (1992)	Greater Milan, Italy (H)	2,860	Individual- education (3)	1983-90	<75	Relative Risk
Ewertz (1993)	Denmark	1,486[1]	Individual- education (3), job type (4 and 5), social class (5)	1983-84	<70	Relative Risk
Faggiano et al (1994)	Turin, Italy	1,110	Individual- education (4), housing tenure (2), occupational status (6)	1981-89	20-69	Odds Ratios
Van Loon et al (1994)	Holland	471	Individual- education (5), occupation (4 and 6)	1986-89	55-69	"Rate Ratios"
Gorey and Vena (1995)	Upstate New York, USA	10,247	Area- "poverty status" (2)	1979-86	25+	Age-standardised rate ratios
Barbone et al (1996)	six regions of Italy (H)	2,569	Individual- education (5), occupation (8)	1991-94	<=75	Odds Ratios

*for Leon 1988, from adding counts by social class category

[1]For whom social factors known. Note that Ewertz (1993) is a later publication on the same study as Ewertz (1988)

- Seven studies dealt with incidence in parts of the USA (Cohart 1955, Graham et al 1961, Devesa and Diamond 1980, Carter et al 1989, Krieger 1990, Baquet et al 1991, Gorey and Vena 1995)
- Ten are European (Clemmesen and Nielsen 1951, Talamini et al 1984, Vågerö and Persson 1986, Rimpelä and Pukkala 1987, Leon 1988, La Vecchia et al 1992, Ewertz 1988 & 1993, Faggiano et al 1994, Van Loon et al 1994, Barbone et al 1996)
- One reports on research in Australia (Williams et al 1991)
- Only a single publication relates to analysis for a developing country (Cuello et al 1982)

Of the European papers, the Longitudinal Study on social distribution of cancer presents a picture for England and Wales (Leon 1988). The incidence data cover a wide timespan, from 1935 (Cohart 1955) to February 1994 (Barbone et al 1996).

3.2.2 Measures of socioeconomic status used

In terms of the subjects' social status:-

- Nine reports employed *ecological* (area) measures (Clemmesen and Nielsen 1951, Cohart 1955, Graham et al 1961, Devesa and Diamond 1980, Cuello et al 1982, Krieger 1990, Baquet et al 1991, Williams et al 1991, Gorey and Vena 1995)
- The other ten assigned SES at an *individual* level (Talamini et al 1984, Vågerö and Persson 1986, Rimpelä and Pukkala 1987, Ewertz 1988 & 1993, Leon 1988, Carter et al 1989, La Vecchia et al 1992, Faggiano et al 1994, Van Loon et al 1994, Barbone et al 1996)

There was great variety in the socioeconomic variables chosen:-

- Eleven used *education* (Devesa and Diamond 1980, Talamini et al 1984, Rimpelä and Pukkala 1987, Leon 1988, Carter et al 1989, Baquet et al 1991, La Vecchia et al 1992, Ewertz 1988 & 1993, Faggiano et al 1994, Van Loon et al 1994, Barbone et al 1996)
- Six looked at *occupation* (Talamini et al 1984, Vågerö and Persson 1986, Rimpelä and Pukkala 1987, Faggiano et al 1994, Van Loon et al 1994, Barbone et al 1996)
- Three used measures of *income* (Devesa and Diamond 1980, Carter et al 1989, Baquet et al 1991)
- Another three employed *home rental value* in their analysis (Clemmesen and Nielsen 1951, Ewertz 1993, Graham et al 1961)
- Three used *multivariate index* measures of SES (Cohart 1955, Cuello et al 1982, Williams et al 1991)
- Other measures of socioeconomic status employed were *social class* (Ewertz 1988 & 1993), *housing tenure* (Leon 1988, Faggiano et al 1994), and *other area measures* (Baquet et al 1991, Gorey and Vena 1995)

Home rental value was applied as an ecological variable, whilst occupation can only be employed when social class is individually assigned. Housing tenure was also utilised as an individual-specific variable. Income and education were used in both area and individual-based measures of SES.

3.3 THE RELATIONSHIP OF SOCIOECONOMIC STATUS WITH BREAST CANCER INCIDENCE

A summary of the findings from published research is given in table 3.2. Of 44 socioeconomic variables employed:-

- 37 had a direct relationship with incidence, i.e. higher incidence in higher SES women (in 20 this was statistically significant)
- 2 were found to have an inverse relationship with incidence, i.e. lower incidence in higher SES women (significant in 1)
- 5 showed no trend in either direction

Nine studies found all their measures of SES to have a significant direct association with breast cancer incidence, i.e. higher incidence occurring in higher SES groups (Cohart 1955, Devesa and Diamond 1980, Cuello et al 1982, Vågerö and Persson 1986, Rimpelä and Pukkala 1987, Carter et al 1989, Williams et al 1991, La Vecchia et al 1992, Barbone et al 1996). In addition, four others had some significant results; for Faggiano et al (1994) it was their education indicator, Talamini et al (1984) found occupation to be significantly related to incidence, Baquet et al (1991) found a significant relationship for all variables in white women, plus population density in blacks, and Krieger (1990) notes a similar pattern for women aged 40 or over. Two of the earliest studies showing a general trend of increasing SES having higher breast cancer risk employed no significance test (Clemmesen and Nielsen 1951, Graham et al 1961). In addition Ewertz (1988) noted a significant increased risk in office workers, though occupational type as utilised in that study is not readily ranked into a socioeconomic gradient as such.

Table 3.2 Direction of association between SES variables and breast cancer incidence, and significance of findings, for each study reviewed

	Association between social variable and incidence		
Author(s)	**Direct**	**No trend**	**Inverse**
Clemmesen and Nielsen 1951	house rent[1]		
Cohart 1955	ecological district*		
Graham et al 1961	median house rent[1]		
Devesa and Diamond 1980	income* education*		
Cuello et al 1982	area index*		
Talamini et al 1984	education occupation*		
Vågerö and Persson 1986	occupational status*		
Rimpelä and Pukkala 1987	education* occupation*		
Leon 1988	household amenities own social class[2] husband's class[2] education	housing tenure access to cars	
Carter et al 1989	education* income*		
Krieger 1990[3]	blacks under 40* whites under 40* blacks over 40		whites under 40
Baquet et al 1991	blacks- education blacks- income whites- education* whites- income* population density*		
Williams et al 1991	area index*		
La Vecchia et al 1992	education*		
Ewertz 1993&Ewertz 1993	education job type social class husband's job type	employment status	
Faggiano et al 1994	education* housing tenure occupational status		
Van Loon et al 1994	occupational sector	education occupational status	
Gorey and Vena 1995			poverty status*
Barbone et al 1996	education* occupation*		

*denotes an association that is statistically significant at least to $p<0.05$

[1]trend not tested for significance

[2]trends only partial

[3]all refer to percent of the census block that is working class

Other variables were positively but not significantly associated with incidence (Talamini et al 1984, Leon 1988, Krieger 1990, Baquet et al 1991, Ewertz 1988 & Ewertz 1993, Faggiano et al 1994, Van Loon et al 1994). Note, however, that in the study by Ewertz (1988), whilst a weak direct relationship appeared with three categories of education when considered by single years, those with the longest education had the lowest point estimates of risk, albeit with wide confidence intervals.

With some of the indicators chosen there was no particular trend evident in either direction (Leon 1988, Ewertz 1988, & 1993, Van Loon et al 1994). Findings of an inverse relationship were much less common. Krieger (1990) noted a trend (not significant) for declining incidence with increasing social class amongst white women aged under 40; only Gorey and Vena (1995) found a statistically significant negative relationship (between incidence and "near poverty status") and they themselves admit that their results are in conflict with the general pattern of previous analyses.

In terms of the magnitude of the differential between social groups, incidence in the highest social group compared with the lowest ranged from a few percent (e.g. Leon 1988) to more than three times greater (Barbone et al 1996) in studies where a direct relationship or no relationship was found. In the two opposing results cases assigned to higher SES groups had incidence rates a few percent (Krieger 1990) or 30-40 per cent lower (Gorey and Vena 1995) than those in the lowest social groups.

Thus, a fairly consistent positive association between breast cancer incidence and SES has been found, though it has often been observed to be quite weak.

3.4 REASONS FOR SOCIOECONOMIC DIFFERENCES IN INCIDENCE

For many cancers, exposure to particular carcinogenic agents is responsible for initial onset. Persons of lower SES often reside in more polluted zones or work in occupations involving exposure to hazardous substances. Cigarette smoking is of course a major cause of certain cancers. However, these concerns are not particularly relevant to breast cancer specifically (Harris 1989). Socioeconomic differences in incidence are believed to be attributable to indirect effects on the individual due to their lifestyle and behaviour, i.e. SES can be used as a marker for some of these factors.

Harris (1989) distinguishes between early and late influences on cancer. Factors involved in early carcinogenesis that have a socioeconomic dimension include age at menarche, and more particularly, parity and age at first pregnancy. Women of lower SES on average have their first child at a much earlier age than women of higher social status, a factor which is quantitatively significant in terms of lifetime risk of breast cancer (Harris 1989). During the potentially lengthy early carcinogenesis period, individuals may well experience altered social circumstances or migrate to areas with different prevailing social climates. In addition, prior to any change of socioeconomic circumstances, certain major primary risk factors for breast cancer (e.g. age at first full term pregnancy, age at menarche) may already be in place. Current social situation may or may not be similar to past ones, which probably goes some way to explaining the oft-found weakness of the SES association with incidence.

Late influences on cancer primarily include detection and treatment, and whilst to some degree higher detection rates of early or slow growing cancers among high SES women may elevate apparent incidence figures, these factors are more specifically relevant to prognosis and therefore SES differences in survival, discussed in chapter 4.

3.5 QUALITY OF THE STUDIES

All the research reviewed is valuable since it contributes to the overall picture being built regarding SES and breast cancer incidence. One might choose to focus on the analyses of more recent data or indeed studies using specifically individual or area based measures of SES. However that was deliberately avoided here, so as to include a wide body of research.

It should be recognised that cancer incidence and survival studies have been necessarily biased towards those regions where there are established cancer registration systems, especially the USA, Scandinavia, the UK and also Italy where much work, both hospital and population based, has been conducted. Therefore the pattern of findings may only be valid for Western countries; for the purpose of this thesis this is not problematic though, since the emphasis is on cancer experience and secondary prevention in part of Merseyside, England.

Three reports (Cuello et al 1982, Baquet et al 1991, Williams et al 1991) did not state the number of breast cancer cases being examined, though given the geographical and time coverage, numbers are not likely to be small. The findings of Carter et al (1989) rely on a very small number of women, but individual-level socioeconomic information was available. The direction and magnitude of their SES-incidence association was in agreement with the majority, however. The reports noting an inverse trend or a lack of any apparent association with incidence made use of completely different SES measures, so an immediate explanation for that is not available. Interestingly, both variables found to have an inverse association with incidence were ecological (Krieger 1990, Gorey and Vena 1995) whilst the group showing no particular trend were assigned on an individual level (Leon 1988, Ewertz 1993, Van Loon et al 1994).

That the data cover a wide time period and utilise various social indicators yet, come out with moderately consistent results, is a positive feature. However, a difficulty in collating and summarising the results has been the fact that the body of existing research in this area is very disparate in terms of methodology, especially presentation of incidence rates and choice of standard population where used. Therefore only general rather than specific comparisons between studies have been made.

3.6 SUMMARY

The literature reviewed here provides evidence that socioeconomic status has a direct, though sometimes fairly weak, association with breast cancer incidence. It would appear that no one indicator of SES is more closely linked to incidence than any other, something that Ewertz (1988, 1993) terms “an unspecific effect of social status”.

Only one of the studies reviewed was carried out in this country, and that concerned national data now over twenty years old (Leon 1988). Leon's findings were also much less conclusive than many of the others. Thus there is a dearth of knowledge on the more recent picture of class-specific incidence in the UK and more particularly within regions, which provides added justification for the Merseyside-based analysis in this thesis.

CHAPTER 4

SOCIOECONOMIC STATUS AND SURVIVAL FROM BREAST CANCER:

A REVIEW OF THE LITERATURE

SOCIOECONOMIC STATUS AND SURVIVAL FROM BREAST CANCER: A REVIEW OF THE LITERATURE

4.1 RESEARCH INTO SOCIOECONOMIC STATUS AND SURVIVAL FROM BREAST CANCER

4.1.1 Number and locations of studies

The potential link between socioeconomic status and breast cancer survival was first examined a number of years after the early analyses of social factors and incidence. Twenty studies dating from 1965 to 1995 are reviewed in the following section, and in table 4.1 are summarised in chronological order of publication.

All the analyses were based in developed nations:-

- Twelve studies utilised American data (Haenszel and Chiazze 1965, Linden 1969, Lipworth et al 1970, Morrison et al 1972, Berg et al 1977, Dayal et al 1982, Keirn and Metter 1985, Vernon et al 1985, Bassett et al 1986, Gordon et al 1992, Ansell et al 1993, Ayanian et al 1993)
- Eight examined information from various European sources (Morrison et al 1972, Vågerö and Persson 1987, Karjalainen and Pukkala 1990, Kogevinas 1990 & Kogevinas et al 1991, Boffetta et al 1993, Ewertz 1993, Schrijvers et al 1995a & 1995b, Schrijvers et al 1995c & 1995d)
- Of these 8, three employed British data (Morrison et al 1972, Kogevinas 1990 & Kogevinas et al 1991, Schrijvers et al 1995a & 1995b)

- One study was Australian (Bonett et al 1984), and a single report, based on three datasets from different countries, included Japanese survival data (Morrison et al 1972)

Dates of diagnosis for the women involved vary within the period 1940 (Berg et al 1977) to 1989 (Schrijvers et al 1995a & 1995b, Schrijvers et al 1995c & 1995d), with years of follow-up ranging between three (Lipworth et al 1970, Morrison et al 1972) and 34 (Berg et al 1977). Generally the statistics employed were less variable and more clearly stated than those in the incidence studies.

4.1.2 Measures of socioeconomic status used

There was a roughly half and half split between the attachment of area based and individual socioeconomic indicators:-

Nine employed *area-based* measures (Haenszel and Chiazze 1965, Lipworth et al 1970, Dayal et al 1982, Bonett et al 1984, Bassett et al 1986, Gordon et al 1992, Ansell et al 1993, Schrijvers et al 1995a & 1995b, Schrijvers et al 1995c & 1995d)

- Eleven assigned SES at an *individual* level (Linden 1969, Morrison et al 1972, Berg et al 1977, Keirn and Metter 1985, Vernon et al 1985, Vågerö and Persson 1987, Karjalainen and Pukkala 1990, Kogevinas 1990 & Kogevinas et al 1991, Ayanian et al 1993, Boffetta et al 1993, Ewertz 1993). As with the papers on breast cancer incidence, quite a wide variety of socioeconomic indicators were used:

Table 4.1 Summary notes on 20 published studies examining socioeconomic variations in breast cancer survival

Author(s)	Location (H = Hospital based study)	No. of cases	SES measure(s) & (no. of categories)	Years of diagnosis	Age range of subjects	Maximum Years of follow-up	Survival Measure (s)
Haenszel and Chiazze 1965	USA	*2229	Area- income (2)	1947-48 & 1950	all	>=5	Life Tables, relative rate
Linden 1969	California, USA (H)	1662	Individual- type of hospital (2)	1942-62	55-64	>=20	Life Tables, relative rate, "competing risks" method
Lipworth et al 1970	Massachusetts, USA (H)	272	Area- median family income (2)	1957-63 for Boston	all	3	relative rate
Morrison et al 1972	Boston, USA; Glamorgan, Wales; Tokyo, Japan (H for Tokyo)	732 701 829	Individual- education (4)	not stated, but 1960s	all	3	relative rate
Berg et al 1977	Iowa, USA (H)	2170	Individual- health insurance status (3)	1940-69	30+	34	crude and adjusted rates
Dayal et al 1982	Virginia, USA (H)	323	Area- census tract score (3)	1968-77	all	10	Cox regression
Bonett et al 1984	South Australia	2676	Area- median male income (2)	1977-82	all	6.5	Life Tables, Cox regression
Keirn and Metter 1985	California, USA (H)	430	Individual- insurance status (2)	1976-81	all	6.5	Cox regression
Vernon et al 1985	Texas, USA (H)	1983	Individual- ability to pay for treatment (3)	1949-68	all	10	Cox regression
Bassett et al 1986	Washington State, USA	1114	Area- occupation (2)	1973-83	all	11	Cox regression
Vågerö and Persson 1987	Sweden	11,531	Individual- occupation (2)	1961-79	20-64	18	relative rate, cumulative relative survival probability
Karjalainen and Pukkala 1990	Finland	10,181	Individual- occupation (4)	1971-80	25-69	11	corrected and relative rates, Cox regression

*minimum obtained by adding 3 Cities and Iowa figures given

Table 4.1 continued

Author(s)	Location (H = Hospital based study)	No. of cases	SES measure(s) & (no. of categories)	Years of diagnosis	Age range of subjects	Maximum Years of follow-up	Survival Measure (s)
Kogevinas 1990 & Kogevinas et al 1991	UK	2050	Individual- housing tenure (2), social class (4) (latter reported in Kogevinas 1990 only)	1971-81	all	12	Standardised Case-Fatality Ratios
Gordon et al 1992	Ohio, NY State, Pennsylvania, USA (H)	1392	Area- income, education Both continuous not categorical variables	1974-79 & 1980-85	<76	16	Cox regression
Ansell et al 1993	Illinois, USA (H)	1152	Area- income (2)	1973-85	all	13	Kaplan-Meier, Cox regression
Ayanian et al 1993	New Jersey, USA	4675	Individual- insurance status (3)	1985-87	35-64	7.5	Kaplan-Meier, Cox regression
Boffetta et al 1993	Piedmont, Italy	4764	Individual- education (2), occupation (8)	1979-81	all	8	Kaplan-Meier, crude and relative rates, Cox regression
Ewertz 1993	Denmark	2445	Individual- education (not stated; 2 or 3)	1983-84	<70	7	Cox regression
Schrijvers et al 1995a & 1995b	South Thames RHA, UK	29,676	Area- Carstairs Index (5)	1980-89	30-99	13	relative rate, Cox-related model
Schrijvers et al 1995c &1995d	Southeastern Netherlands	3928	Area- education (5)	1980-89	all	12	relative rate, Cox-related model

- Five used *income* (Haenszel and Chiazze 1965, Lipworth et al 1970, Bonett et al 1984, Gordon et al 1992, Ansell et al 1993) as an indicator of socioeconomic status
- Five used *education* (Morrison et al 1972, Gordon et al 1992, Boffetta et al 1993, Ewertz 1993, Schrijvers et al 1995c & 1995d)
- Four had information on *occupation* (Bassett et al 1986, Vågerö and Persson 1987, Karjalainen and Pukkala 1990, Boffetta et al 1993)
- Three used income-related measures of *insurance status* in their analysis (Berg et al 1977, Keirn and Metter 1985, Boffetta et al 1993)
- Other SES indicators were *social class* (Kogevinas 1990), *ability to pay for treatment* (Vernon et al 1985), *housing tenure* (Kogevinas 1990 & Kogevinas et al 1991), *type of hospital* (Linden 1969), the *Carstairs Index* (Schrijvers et al 1995a & 1995b) and *another composite score* (Dayal et al 1982)

4.2 RELATIONSHIP OF SOCIOECONOMIC STATUS WITH SURVIVAL

Findings from published research are summarised in Table 4.2. Of 26 socioeconomic variables employed:-

- 21 had a direct relationship with survival, i.e. survival was higher in women of high SES (for 14 this was statistically significant)
- 2 were found to have an inverse relationship with survival, i.e. survival was lower in women of high SES
- 3 showed no trend in either direction

Nine studies noted a direct relationship between survival from breast cancer and SES that was statistically significant (Lipworth et al 1970, Dayal et al 1982, Bonett et al 1984, Bassett et al 1986, Karjalainen and Pukkala 1990, Gordon et al 1992, Ansell et al 1993, Ayanian et al 1993, Schrijvers et al 1995a & 1995b). Other reports found significant trends towards higher survival in higher SES women for certain geographical locations or SES indicators (Morrison et al 1972, Kogevinas 1990). Similarly, Linden (1969) conducted separate analyses for two age bands and found a significant direct relationship between SES and survival for 55-64 year olds but a smaller, nonsignificant relationship in those aged 65-74. Meanwhile in Vernon et al's (1985) study, women in the lowest SES group certainly had significantly worse survival rates than any of the others, though women in the middle group had more favourable rates than those in the highest category. In three reports a positive relationship was apparent but significance was either not tested or not stated (Haenszel and Chiazze 1965, Berg et al 1977, Vågerö and Persson 1987). Five noted a slight direct relationship for all or part of their analyses (Morrison et al 1972, Kogevinas 1990 & Kogevinas et al 1991, Ansell et al 1993, Boffetta et al 1993, Schrijvers et al 1995c & 1995d).

The majority of the findings were thus generally towards increased SES giving increased survival chances. There were four exceptions to this. Keirn and Metter (1985) stated no particular effect of SES upon survival, and Boffetta et al (1993) found no trend between occupation and survival. Kogevinas (1990) and Ewertz (1993) found small, not significant inverse relationships with housing tenure and education respectively. Both these latter authors recognised that their findings were contrary to most. Kogevinas (1990) briefly suggests possible lead-time bias reasons for the

Table 4.2 Direction of association between SES variables and breast cancer survival, and significance of findings, for each study reviewed

	Association between social variable and survival		
Author(s)	Direct	No trend	Inverse
Haenszel and Chiazze 1965	income		
Linden 1969	hospital type a) age 55-64* b) age 65-74		
Lipworth et al 1970	income*		
Morrison et al 1972	education (Glamorgan)* (Boston)	education (Tokyo)	
Berg et al 1977	insurance status		
Dayal et al 1982	census tract score*		
Bonett et al 1984	income*		
Keirn and Metter 1985		insurance status	
Vernon et al 1985	ability to pay for treatment*[1]		
Bassett et al 1986	occupation*		
Vågerö and Persson 1987	occupation		
Karjalainen and Pukkala 1990	occupation*		
Kogevinas 1990, Kogevinas et al 1991	social class*		housing tenure
Gordon et al 1992	income* education*		
Ansell et al 1993	income*		
Ayanian et al 1993	insurance status*		
Boffetta et al 1993	education	occupation	
Ewertz 1993			education
Schrijvers et al 1995a & 1995b	Carstairs Index*		
Schrijvers et al 1995c & 1995d	education		

*denotes an association that is statistically significant at least to p<0.05

[1]low SES women had significantly lowest survival; however middle SES women had the highest rates, with high SES women the intermediate values

observed patterns in the British study, although nothing is conclusive. Ewertz (1993) offers no explanation for her findings with regard to SES, although the socioeconomic dimension of survival was a relatively small consideration in that paper.

Where a direct relationship between social factors and survival was found, anything from about 2% difference between the highest and lowest social groups (Kogevinas 1990) to rates more than twice as high in the most affluent group (Gordon et al 1992) were noted. However this second figure was exceptional and figures indicating 40-50% better survival amongst the highest as opposed to lowest SES groups were much more common (e.g. Berg et al 1977, Bassett et al 1986, Gordon et al 1992, Ansell et al 1993, Ayanian et al 1993).

Additionally there was some evidence that socioeconomic status might have greater influence on survival likelihood in the first few years after diagnosis. Linden (1969) noted the greatest difference between the social groups during the first five years, and Karjalainen and Pukkala (1990) state that SES as well as age cease to be important prognostic factors after the same period of time.

4.3 REASONS FOR SOCIOECONOMIC DIFFERENCES IN SURVIVAL

A number of 'risk factors' for survival are known or thought to play a part in explaining the socioeconomic gradient in outcomes. As Schrijvers et al (1995d) note, these can be divided into two broad categories: firstly those that potentially confound the association between SES and survival, and secondly, those that may be intermediary in the association.

Risk factors for breast cancer survival include:

- Age
- Period of diagnosis
- Stage at diagnosis
- Delay in seeking treatment
- Treatment
- Host susceptibility/response

4.3.1 Confounding factors

1) Age distribution of cases

Age is usually the main potential confounder to researchers examining social status and survival from cancer (incidence studies always adjust for age). As a single prognostic factor its effect has not yet been completely elucidated. Vernon et al (1985) and Gordon et al (1992) found age to have only a very weak association with survival. Bonett et al (1984), Ewertz (1993) and before them, Mueller et al (1978) noted an inverse relationship (i.e. younger age, longer survival), the latter two to a significant degree. Dayal et al (1982) stated an inverse association between age and long-term (beyond seven years) survival "which may be a reflection of other competing risks which increase with age" (p677). For short and intermediate term survival their picture was more complex, with youngest women having the worst prognosis, middle aged women the best and older women intermediate chances. Boffetta et al (1993) also noted a variable effect of age, with women aged 40-49 having the best prognosis, younger and older groups lower chances, and women over 80 the worst potential survival. These findings are probably reflective of the differences in premenopausal and postmenopausal breast cancer (the former often being more aggressive) coupled with higher overall mortality rates amongst the elderly. Another possible, though weaker explanation is that age might be associated with stage and/or delay. Hackett et al (1973) found no relationship between age and delay, and Mandelblatt et al (1991) found postmenopausal women tended towards later stage cancers. Conversely, Richardson et al (1992) noted that older women presented with significantly earlier stage disease.

Both Karjalainen and Pukkala (1990) and Schrijvers et al (1995a) found SES gradients in survival were steeper for older than younger women, there being hardly any social differentials among premenopausal women in the Finnish study (Karjalainen and Pukkala 1990). In the latter study the decline in survival with age was more pronounced in lower SES groups. Thus the outcome of both these related trends was the calculated survival rates were worst in the oldest, poorest women. For Berg et al in an earlier study (1977), it was the youngest women in the lower SES group who appeared to come off worst, with women of higher status having better rates up to the age of 69. At 70 and above there was no difference between the groups.

Certain of the studies reviewed here found age to be a confounding factor in their results. Berg et al estimated the contributions made by various factors to the observed

SES differentials in survival; 25 percent of the disadvantage in lower groups was thought to be due to age at diagnosis. In the much more recent study by Schrijvers et al (1995c & 1995d), the distribution of age varied significantly with socioeconomic status, and after adjusting for age in a Cox regression model, the predicted differences between the SES groups were reduced substantially.

2) Deaths from causes other than cancer

Deaths due to causes other than the cancer itself lower the observed (i.e. crude) survival rates. Older patients are more likely to die from other causes than younger ones; similarly all-cause mortality is higher in very deprived groups than the most affluent. Berg et al (1977) estimated that 28 percent of the excess mortality among their lower socioeconomic group related to other causes of death.

Seven of the studies reviewed here adjusted for non-cancer deaths, treating them as censored observations (Linden 1969, Berg et al 1977, Dayal et al 1982, Bonett et al 1984, Karjalainen and Pukkala 1990, Gordon et al 1992, Boffetta et al 1993). In the past, the calculation of relative survival rates did not allow for differential life expectancy between groups other than age bands; however Linden (1969) and Gordon et al (1992) found that calculating adjusted rates changed their findings only fractionally. However, it should be noted that, in cancer studies, there are often problems in ascribing the exact cause of death of each person, so adjustments for 'non-cancer' deaths will sometimes be approximate.

3) Period of diagnosis

If the recruitment period of a study covers quite a large time span, women diagnosed in earlier years may have generally had a less favourable prognosis than more recent cases, simply due to ongoing advances in detection and treatment. Schrijvers et al (1995c & 1995d) were amongst the authors making allowances for period of diagnosis in their analyses. However, time of diagnosis would only influence any SES-survival association if a clearly larger proportion of patients from the lower categories were diagnosed during the earlier years of the study.

4.3.2 Intermediary factors

1) Stage at diagnosis

This is one of the single most important prognostic factors, having a significant inverse relationship with survival (e.g. Keirn and Metter 1985, Vernon et al 1985, Schrijvers et al 1995d). Stage has also usually been found to be inversely related to socioeconomic status, with high SES women having a higher percentage of early stage cancers and a lower percentage of metastatic disease than low SES women (Linden 1969, Keirn and Metter 1985, Karjalainen and Pukkala 1990, Ayanian et al 1993, Schrijvers et al 1995d, Wells and Horm 1992, Farley and Flannery 1989, Richardson et al 1992, Mandelblatt et al 1995, Roberts et al 1990b). However, some authors found only a very small or no association (Lipworth et al 1970, Berg et al 1977, Ewertz 1993, Carnon et al 1994), the analyses by Ewertz (1993) and Carnon et al (1994) examining SES and two stage-related variables of tumour size and number of positive lymph nodes. Meanwhile Schrijvers et al (1995a) only noted the effect in women aged over 65.

Therefore, the role that stage plays in accounting for the observed pattern of survival by SES has not quite been agreed upon. In their work Lipworth et al (1970) found that adjusting for stage reduced survival differences between the SES groups by a negligible degree only. Similarly, in studies by Berg et al (1977), Dayal et al (1982), Karjalainen and Pukkala (1990) and Schrijvers et al (1995a, 1995b), a definite socioeconomic gradient remained after accounting for stage. Gordon et al (1992) did not use a single stage variable, though SES was still significantly associated with survival after adjustment for tumour size and number of positive lymph nodes. However, Keirn and Metter (1985) and Schrijvers et al (1995c & 1995d) found stage at diagnosis to be the primary explanation for SES differences in survival, with little or no difference remaining between groups when stratified by stage. In Keirn and Metter's study, high SES women survived much better from local and regional disease but actually fared worse for metastatic cancers. A similar picture emerged for Ayanian et al (1993), who noted 54 to 89 month survival to be worse in poorer women when examining local and regional disease; for distant disease there was minimal difference between the social groups. For Berg et al (1977) survival differentials were not really present in very early or very advanced disease; rather it was regional cancers that showed a gradient by socioeconomic status.

2) Delay in seeking treatment

Stage at presentation may be partly dependent on patient delay if a fairly lengthy period of time has elapsed between the patient's discovery of a lump or the onset of symptoms and her first approaching a health professional. Delay, for whatever reason, has been found to have a significant association with SES, in that patients of higher status are much more likely to seek prompt medical attention (Richardson et al 1992, Hackett et al 1973). Hackett et al's work relates to a number of cancer sites considered collectively, including breast. However there is no reason to suppose that breast cancer patients should show significantly different delay patterns from this overall finding when examined separately.

Karjalainen and Pukkala (1990), Kogevinas (1990) and Schrijvers et al (1995d) all considered that the effects of delay would contribute at least in small part to socioeconomic survival differentials. Gordon et al (1992) disagreed, arguing that having adjusted for stage, delay could not remain as a factor in explaining survival patterns. This would only be true, however, if recording of stage at time of diagnosis was perfect. It is likely that delay in seeking medical attention will affect the eventual prognosis in some groups of women. Hackett et al (1973) concluded that delay "appears to be a conscious and deliberate act performed by many patients with full awareness" (p19). They found that patients of a higher social class were more likely to have a reasonable level of knowledge about their condition whilst those of a lower SES showed a greater tendency to have health worries which were not assuaged by information from health professionals during treatment. They cite differences in communication styles employed by doctors when treating patients of varying social classes as a contributing factor in this. Patients who delay longer (therefore often those of low SES) are probably more likely to deny the existence of symptoms (Karjalainen and Pukkala 1990), to have more doubts about the curability of cancer (Karjalainen and Pukkala 1990, Richardson et al 1992), or perhaps to have a lower availability of social support (Ayanian et al 1993).

Richardson et al (1992) examined the temporal trend in their data and noted that in the more recent years, whilst women overall were being diagnosed at an earlier stage and at a shorter time from symptom onset, the improvement did not occur amongst women of low SES.

3) Lead time bias

Whilst time of diagnosis can genuinely affect prognosis, it is also possible in some cases that early detection of asymptomatic disease (especially through screening) does not actually alter the natural history of the disease (Kogevinas et al 1991); therefore prognosis is not improved and apparently better survival is merely statistical artefact (Vågerö and Persson 1987). If indeed higher SES women tend to have their cancers diagnosed earlier, a certain amount of lead time bias in their favour must be considered. Vågerö and Persson (1987) and Schrijvers et al (1995b) both examined this possibility, the former by assuming their higher SES women had been diagnosed a year later than they actually were, the latter by examining the magnitude of difference in survival over different follow-up periods. Both studies found that the survival gradient by SES persisted after allowing for lead time and therefore concluded that the effect of this upon eventual survival was a minor one.

4) Length time bias

Since the introduction of mass screening programmes, the possibility of length-time bias in survival calculations has been considered. Early detection through screening could lead to the detection of more slow-growing cancers which would take much longer to become symptomatic. In groups where uptake is higher (e.g. high SES women) the numbers of these types of cancers could be higher and therefore influence apparent survival outcomes. However, many of the studies reviewed here utilised data gathered before the introduction of mass screening programmes, and in those that did use more recent data, length time bias is probably going to be a relatively minor contributor towards survival differentials.

5) Treatment

It has been suggested that differential access to treatment facilities or provision of treatment of quality varying according to economic means could be a reason for the SES gradient in survival (Lipworth et al 1970, Karjalainen and Pukkala 1990, Kogevinas 1990, Gordon et al 1992, Ayanian et al 1993). This may apply during the primary care stage (surgery, radiotherapy, etc.) and/or in the follow-up of patients and their care following a complication or relapse (Karjalainen and Pukkala 1990). However, Lipworth et al (1970) found lower SES patients did not have quantitatively worse levels of treatment, Keirn and Metter (1985) selected a study location where care was theoretically uniformly provided regardless of status, and Gordon et al (1992) assumed that access to care was probably equal amongst groups. Nor did Berg et al (1977) consider quality of care a factor likely to be influential in survival differences. Additionally, in Scandinavian countries where access to health services is generally relatively easy for the whole population, treatment was not thought to be a hugely influential factor (Vågerö and Persson 1987, Karjalainen and Pukkala 1990, Ewertz 1993, Schrijvers et al 1995c & 1995d). For instance, Schrijvers et al (1995c) note that after adjustment for stage there was no substantial influence of treatment on the socioeconomic gradient in survival. In the USA, UK and other European countries however, experience of care must surely differ both qualitatively and quantitatively by socioeconomic status.

6) Host susceptibility/response

Various authors have postulated that socioeconomic position may have an association with various host characteristics that affect the course of the disease, such as a weak immune system and poor nutrition (Lipworth et al 1970, Berg et al 1977, Kogevinas et al 1991). Kogevinas et al (1991) state that the influences of such characteristics on the progression of cancers are well known, though they do not support the statement by referencing specific studies. They do recognise that the "degree to which such characteristics influence socioeconomic differences in survival is still questionable" (p218). In addition, Vågerö and Persson (1987) note that in their study it was not possible to separate potential diagnosis or treatment benefits from those relating to host factors, and this has also been the case for the other studies reviewed here.

4.4 QUALITY OF THE STUDIES

The quality issues mentioned in the previous chapter (section 3.5) also apply here. In addition, the findings of Lipworth et al (1970), Dayal et al (1982) and Keirn and Metter (1985) should probably be interpreted with caution due to the relatively small number of cases. Additionally, the work by Lipworth et al and Morrison et al (1972) suffer from only studying survival in the first three years; all the others considered survival for at least five years.

4.5 SUMMARY

Socioeconomic status appears to have a direct relationship with survival, rates being most favourable in more educated or affluent women. When analysing survival, allowance must be made for age, other causes of death, and period of diagnosis, which are all potential confounding factors in any association with SES. Any available information on the intermediary variables should also be utilised.

All the reports noting an inverse association between SES and survival, or lack thereof, actually used individual level socioeconomic data so misclassification of individuals, as happens in ecological studies, was much less likely to be a factor in this. These findings, in disagreement with the majority of others, were based on a range of SES indicators, not just one particular type. Thus, whilst it might be suggested that different elements of socioeconomic status have a differential effect on survival, that does not seem to be emerging in this context.

Three of the studies reviewed utilised British data (Morrison et al 1972, Kogevinas 1990 & Kogevinas et al 1991, Schrijvers et al 1995a & 1995b). Morrison et al included a small Welsh dataset, now around 30 years old. Meanwhile the national study, though having the advantage of individual-level social data, concerns cases now 15-25 years old (Kogevinas 1990 & Kogevinas et al 1991). Whilst their findings are still relevant today, advances in treatment and the introduction of screening since the Longitudinal Study means that a more up to date investigation of SES variations in survival in this country is warranted. Additionally, a gradient in survival by SES was not consistently observed as it was in many of the other studies reviewed. The partial finding of an inverse relationship with housing tenure might be a peculiarity arising from a possible imprecise representation of social class by this indicator.

Schrijvers et al (1995a, 1995b) have examined more recent British data (their results being published when this research was well under way) and showed a clear social gradient in survival within the South Thames area. A study specific to Merseyside, utilising Super Profiles as a social indicator, will provide a local picture of survival in recent cases and should also complement the work undertaken in South East England. In the South Thames study, age was a notable confounding factor, and account was taken of stage (or an approximation thereof) which is not available as a data item here.

CHAPTER 5

THE ASSOCIATION OF SOCIOECONOMIC STATUS WITH UPTAKE OF SCREENING:

A REVIEW OF THE LITERATURE

SOCIOECONOMIC STATUS AND UPTAKE OF SCREENING: A REVIEW OF THE LITERATURE

5.1 RESEARCH INTO SOCIOECONOMIC STATUS AND UPTAKE OF BREAST SCREENING

5.1.1 Number and locations of studies

Breast screening by mammography has been technologically possible for a number of decades, but only during the last ten years or so has it come into widespread use. Table 5.1 summarises 25 studies which focus on, or include an examination of, socioeconomic status and (non) attendance for breast screening, dating from 1968 to 1996, in chronological order of publication. Note that much of this body of research was conducted at times or in locations when screening was not offered as part of a population-based programme. Additionally, while all the studies are obviously located in specific socio-spatial settings, that by Ross et al (1994) is the only one explicitly concerned with geographical variations in uptake within their region of interest.

In terms of country of origin, the range of locations for the study of screening uptake has been more limited than for work on either breast cancer incidence or survival. This is partially explained by the fact that relatively few countries in the world have had screening programmes (either population based or for certain groups such as health insurance plan members) to examine.

- Twelve were based in the USA (Fink et al 1968, Fink et al 1972, Kruse and Phillips 1987, Hayward et al 1988, Rutledge et al 1988, Rimer et al 1989, Zapka et al 1989, Fulton et al 1991, Rimer et al 1992, Calle et al 1993, Breen and Kessler 1994, Moody Thomas and Fick 1995)
- One compared Canadian and American data (Katz and Hofer 1994)
- Two of the most recent studies were entirely Canadian (Ross et al 1994, Beaulieu et al 1996)
- Three of the published reports are Italian (Donato et al 1991, Gordon et al 1991, Ciatto et al 1992)
- The remaining seven concern British research (Hobbs et al 1980, French et al 1982, Maclean et al 1984, Calnan et al 1985, Haiart et al 1990, Vaile et al 1993, Sutton et al 1994)

Some of the American work has a slightly different context to the British situation in that analyses have often concerned uptake of screening within a specific health insurance setting (Fink et al 1968, Fink et al 1972, Rimer et al 1989, Taplin et al 1989) or workplace (Rutledge et al 1988). Therefore, the social range of these groups would have been truncated in contrast with the general area population, and their findings would be unlikely to apply throughout the wider geographical areas in which their studies were set.

The earliest three British reports, those of Hobbs et al (1980), French et al (1982) and Maclean et al (1984) were all General Practice/Clinic based and, together with Calnan et al's 1985 publication, were based on data collected several years before the introduction of the National Breast Screening Programme. Haiart et al's (1990) work was conducted when the programme was being developed. Only the research reported by Vaile et al (1993) and Sutton et al (1994) concerns data actually relating to the current, national system of breast screening. Both these studies examined first round screening only, in the South Thames region of the UK. Whilst population-based, only a subset of all eligible women were studied to allow for individual attachment of socioeconomic data. Marshall (1994) studied factors in relation to second round attendance in Nottingham but she did not include socioeconomic data in her analysis.

Fink et al (1968, 1972) examined uptake during 1963-4, and the three early British studies included data from the late 1970s (Hobbs et al 1980, French et al 1982, Maclean et al 1984). However, most of the work refers to adherence to screening opportunities or recommendations during the 1980s and early 1990s. The statistics employed for analysis and/or summarisation of the results were fairly uniform, commonly involving chi-squared calculations or logistic regression.

Table 5.1 Summary notes on 25 published studies examining socioeconomic variations in uptake of breast screening by mammography

Author(s)	Location	No. of cases	SES measure(s) & (no. of categories)	Years under study	Age range of subjects	Hospital (H), Population (P) or Insurance plan (I) based	Population-based screening programme in existence?
Fink et al 1968	Greater New York, USA	1758	Individual- education (3)	1963-4	40-64	I	No
Fink et al 1972	Greater New York, USA	3232	Individual- education (3), income (4), occupation (5)	1963-4	40-64	I	No
Hobbs et al 1980	Manchester, UK	250	Individual- social class (3)	c.1979[1]	50-79	General Practice	No
French et al 1982	Edinburgh, UK	115	Individual- social class (4)	c.1979-80[1]	45-64	Clinic	No
Maclean et al 1984	Edinburgh, UK	146	Area and Individual- social class (4)	late 1970s-early 1980s	45-64	Clinic	No
Calnan et al 1985	Canterbury, Kent, UK	610	Individual- social class (ns), school leaving age (ns)	early 1980s[1]	45-64	P	No
Kruse and Phillips 1987	Illinois, USA	735	Area and Individual- education (3), income (3)	1985	35+	H	No
Hayward et al 1988	USA	c.2000	Individual- insurance status (2), education (3), income (2)	1986	50+	P	No
Rutledge et al 1988	Tennesee and California, USA	1495	Individual- education (continuous), occupation (ns)	1986	40-70	H	No
Rimer et al 1989	Pennsylvania & New Jersey, USA	484	Individual- education (3), occupation (5)	later 1980s[1]	50+	I	No
Zapka et al 1989	Eastern Massachusetts, USA	1184	Individual- education (4), income (4)	1987	45-75	P	No

ns = not stated

[1]date not stated explicitly

Table 5.1 continued

Author(s)	Location	No. of cases	SES measure(s) & (no. of categories)	Years under study	Age range of subjects	Hospital (H), Population (P) or Insurance plan (I) based	Population-based screening programme in existence?
Haiart et al 1990	Edinburgh area, UK	5853[2]	Area and Individual- employment status (2), housing tenure (2), car availability (2)	1986	40-64	P	Under development
Donato et al 1991	Brescia, Italy	1644	Individual- education (4), social class (5)	1987	50-60	P	Yes
Gordon et al 1991*	Florence, Italy	143	Individual- education (2)	1990	50-70	P	Yes
Fulton et al 1991	Rhode Island, USA	786	Individual- education (3), income (4)	1987	40+	P	No
Ciatto et al 1992	Florence, Italy	334	Individual- education (3), employment (3)	1989	40-70	P	Yes
Rimer et al 1992	Philadelphia, USA	412	Individual- education (4)	late 1980s/ early 1990s[1]	65+	P**	No
Calle et al 1993	USA	6353	Individual- education (3), income (4)	1987	40+	P	No
Vaile et al 1993*	South-East Thames RHA, UK	2060	Individual- education (2), social class (2)	early 1990s[1]	50-64	P	Yes
Sutton et al 1994	Inner South East London, UK	1301	Individual- education (ns), occupation (ns), social class (ns), housing tenure (2)	1990	50-64	P	Yes

ns = not stated

[1]date not stated explicitly

[2]attenders; these are compared with the general population

* prospective study examining intention to participate in screening

**within selected retirement communities (prospective study)

Table 5.1 continued

Author(s)	Location	No. of cases	SES measure(s) & (no. of categories)	Years under study	Age range of subjects	Hospital (H), Population (P) or Insurance plan (I) based	Population-based screening programme in existence?
Katz and Hofer 1994	Ontario, Canada; USA	47,453	Individual- education (4), income (6)	1990	50+	P	No USA, Yes Canada
Breen and Kessler 1994	USA	19,590	Individual- education (3), income (2)	1987 & 1990	40+	P	No
Ross et al 1994	Ontario, Canada	2810 (Area) 137 (Indiv)	Area (ns) and Individual (4)- income	1992	50-69	P	Yes
Moody Thomas and Fick 1995	New Orleans, USA	184	Individual- income (3)	early 1990s[1]	40-65	P	No
Beaulieu et al 1996	Montreal, Canada	149	Individual- education (3), economic status (2)	1991-92	50-69	Clinic	No

ns = not stated

[1]date not stated explicitly

5.1.2 Measures of socioeconomic status used

Socioeconomic status was considered almost exclusively at an individual level. Maclean et al (1984), Kruse and Phillips (1987), Haiart et al (1990) and Ross et al (1994) included areal social data, though this was in conjunction with a smaller number of individually assigned cases. Most of the research used measures of education, with income and social class the next most frequent choices:-

- 19 Studies used *education* (Fink et al 1968, Fink et al 1972, Calnan et al 1985, Kruse and Phillips 1987, Hayward et al 1988, Rutledge et al 1988, Rimer et al 1989, Zapka et al 1989, Donato et al 1991, Gordon et al 1991, Fulton et al 1991, Ciatto et al 1992, Rimer et al 1992, Calle et al 1993, Vaile et al 1993, Sutton et al 1994, Katz and Hofer 1994, Breen and Kessler 1994, Beaulieu et al 1996)
- Ten included *income* (Fink et al 1972, Kruse and Phillips 1987, Hayward et al 1988, Zapka et al 1989, Fulton et al 1991, Calle et al 1993, Katz and Hofer 1994, Breen and Kessler 1994, Ross et al 1994, Moody Thomas and Fick 1995)
- Seven used definitions of *social class* (Hobbs et al 1980, French et al 1982, Maclean et al 1984, Calnan et al 1985, Donato et al 1991, Vaile et al 1993, Sutton et al 1994)
- Other SES variables used were *health insurance status* (Hayward et al 1988), *occupation* (Fink et al 1972, Rutledge et al 1988, Rimer et al 1989, Sutton et al 1994), *employment status* (Haiart et al 1990, Ciatto et al 1992), *economic status* (Beaulieu et al 1996), *housing tenure* (Haiart et al 1990, Sutton et al 1994) and *car availability* (Haiart et al 1990)

5.2 RELATIONSHIP OF SOCIOECONOMIC STATUS WITH UPTAKE

The findings of the reviewed research are summarised in Table 5.2. Of 48 socioeconomic variables employed:-

- 31 had a direct relationship with uptake, i.e. uptake was higher in women of higher SES (for 23 this was statistically significant)
- 3 were found to have an inverse relationship with uptake, i.e. it tended to be lower in women of higher SES (significant for 1)
- 14 showed no trend in either direction

Eleven studies noted a direct, statistically significant relationship between SES and attendance (French et al 1982, Kruse and Phillips 1987, Rutledge et al 1988, Zapka et al 1989, Haiart et al 1990, Gordon et al 1991, Rimer et al 1992, Calle et al 1993, Katz and Hofer 1994, Breen and Kessler 1994, Moody Thomas and Fick 1995). Others noted significant findings for certain of their indicators: Hayward et al (1988) for education and insurance status, Sutton et al (1994) for housing tenure and Ross et al (1994) for income measured at an ecological level. Fink et al (1972) examined repeat participation; the social differences in this were sometimes statistically significant, sometimes not. Hobbs et al (1980) noted a direct but not significant relationship between social class and attendance; Fulton et al's (1991) results were similar for income and education. Fink et al (1968) and Ross et al (1994) did not test or state the significance of their findings with regard to education or individual income respectively.

Several studies, either entirely or in part, found no particular association between their SES variable(s) and attendance for screening by mammography (Maclean et al 1984, Calnan et al 1985, Hayward et al 1988, Rimer et al 1989, Donato et al 1991, Ciatto et al 1992, Sutton et al 1994, Beaulieu et al 1996). Two noted an inverse relationship, i.e. higher social classes showing reduced attendance. Firstly, Vaile et al (1993) found this with respect to education and social class, though figures were not statistically significant. Secondly, an earlier study by Donato et al (1991) noted an inverse relationship with education that was statistically significant. However, they offer a possible explanation for this finding, that use of private health services is relatively common in Italy, particularly amongst higher class women, and this seemed to be true for their study sample with regard to self-initiated mammography.

The majority of these findings support the general acceptance that higher SES women are more likely to attend for breast screening. However, the findings are not consistently strong either by geography or individual socioeconomic descriptor.

Table 5.2 Direction of association between SES variables and uptake of breast screening, and significance of findings, for each study reviewed

	Association between social variable and attendance		
Author(s)	Direct	No trend	Inverse
Fink et al 1968	education[1]		
Fink et al 1972	education[2] income[2] occupation[2]		
Hobbs et al 1980	social class[3]		
French et al 1982	social class*		
Maclean et al 1984		social class	
Calnan et al 1985		social class education	
Kruse and Phillips 1987	income* education*		
Hayward et al 1988	education* insurance status*	income	
Rutledge et al 1988	education* job classification*		
Rimer et al 1989		education occupation	
Zapka et al 1989	income* education*		
Haiart et al 1990	housing tenure* car availability* employment status*		
Donato et al 1991		social class	education*
Gordon et al 1991	education*		
Fulton et al 1991	income education		
Ciatto et al 1992		education employment	
Rimer et al 1992	education*		
Calle et al 1993	income* education*		
Sutton et al 1994	housing tenure*	education social class occupation	
Katz and Hofer 1994	income* education*		
Breen and Kessler 1994	income* education*		
Ross et al 1994	area income* individual income[1]		
Moody Thomas and Fick 1995	income*		
Beaulieu et al 1996		education economic status	
Vaile et al 1993			education social class

*denotes an association that is statistically significant at least to $p<0.05$
[1]significance not tested/stated
[2]some nonsignificant, some significant findings; SES related to number of mammograms
[3]not significant between attenders and nonattenders though self-referred women were of a significantly higher social makeup

5.3 OTHER FACTORS ASSOCIATED WITH UPTAKE

Many dimensions, not mutually exclusive, act together to influence an individual's decision to adopt preventive behaviour. System-individual interactions (such as media publicity and invites), within-individual factors and individual-social environment interactions are all involved. Individual factors include perceived personal susceptibility to the disease, perceived seriousness of the disease, general health motivation and current or recent health status. These individual perceptions are modified by intermediary variables such as sociodemographic characteristics, contact with the medical profession, and history of health problems in the woman or people close to her. Cues to action (i.e. attending for a mammogram) include the invite itself, perceived benefits of attending, normative pressure, and the presence or absence of logistical (e.g. transport, time) or attitudinal (e.g. fear) barriers.

"Risk factors" for use of mammography, discussed shortly, include:

- Age
- Marital Status, religion and race
- Accessibility of the service
- Family/personal history of breast disease
- Social support
- Knowledge of and perceived vulnerability to breast cancer
- Use of other medical services
- Previous mammography use, and attitudes to it

5.3.1 Age

Age, a major risk factor for breast cancer incidence and survival, is also of particular relevance to screening mammography. A tendency for participants in screening programmes to be at the younger end of the studied age group and nonparticipants to be older has frequently been found (Fink et al 1968, Fink et al 1972, Hobbs et al 1980, Calnan et al 1985, Hayward et al 1988, Haiart et al 1990, Donato et al 1991, Gordon et al 1991, Ciatto et al 1992, Calle et al 1993, Costanza et al 1992). Others have noted a rise in attendance rates with age in younger women, a peak at around 50-55 years and a decline thereafter (Katz and Hofer 1994, Breen and Kessler 1994, Hobbs et al 1980, Vaile et al 1993).

Additionally, motivation to participate is probably age related, for example, the early observation by Hobbs et al (1980), before the introduction of the National Breast Screening Programme, that self-referred women tended to be younger than invited women. However, a lack of an apparent age-attendance association has been found by some researchers (French et al 1982, Rutledge et al 1988, Rimer et al 1989, Sutton et al 1994, Beaulieu et al 1996). Others uncovered a more complex picture. For example, Zapka et al (1989) and Lerman et al (1990) noted a decline with age in the likelihood of ever having had a mammogram. However, Zapka et al found that the older women in their study were significantly more likely to have been screened within the last year, whilst no significant influence on recent or repeated screening behaviour was found in the more recent study. In Taplin et al's (1989) research, the overall finding was for higher attendance in *older* women but here attendance was examined in relation to the personal risk category assigned to the individual, and of which they were informed. Broken down by category, older women who were told that they were at moderate risk of developing breast cancer were more likely to attend than their younger counterparts, whereas the more commonly observed inverse association between attendance and age was noted in the subgroup informed that they were at 'high risk'. It is likely that many women are not aware of age as a risk factor for breast cancer. For instance Rimer et al (1992) noted that an initial 94% of women did not realise that greater age meant greater risk.

5.3.2 Marital status

Where this factor has been examined, married women have usually recorded better attendance than single women (Fink et al 1968, French et al 1982, Calnan et al 1985, Rimer et al 1989, Haiart et al 1990, Donato et al 1991, Ciatto et al 1992, Lerman et al 1990) with variable findings for widowed, separated or divorced women (Donato et al 1991, Ciatto et al 1992). Vaile et al's (1993) overall figures also indicated a higher attendance by married women, although amongst inner city residents 'nonmarrieds' showed better attendance (not significantly so). Meanwhile, Lerman et al (1990) found that whilst married women were significantly more likely to have ever had a mammogram or done so recently, their status was not a predictor of attendance for repeat screening. Fink et al (1972), Rutledge et al (1988), Calle et al (1993) and Beaulieu et al (1996) found no significant differences in attendance according to whether the women were single or not.

5.3.3 Religion

The possible influence of religious beliefs and practices upon attendance has only received limited attention. Fink et al (1968, 1972) and Zapka et al (1989) found Jewish women presented much more readily for screening than either Catholics or Protestants (Protestants not included in Fink et al 1968).

5.3.4 Race

In some studies white women have been more likely to report mammography or have attended a specific programme than blacks (Kruse and Phillips 1987, Rimer et al 1989, Lerman et al 1990) and/or other ethnic minorities (Atri et al 1996). In another, however, there was no apparent ethnic difference in attendance records (Fink et al 1972). The gap between white and black was reported to have narrowed in the USA between 1987 and 1990 (Breen and Kessler 1994). Additionally, in a reverse of the usual finding, Sutton et al (1994) observed higher than average attendance amongst blacks in a postal sample of women in South East London.

5.3.5 Urban/Rural residence

Urban residence has previously been found to be related to a better record for mammographic screening (Hayward et al 1988, Calle et al 1993, Katz and Hofer 1994, Breen and Kessler 1994, Mah and Bryant 1992, Gram and Slenker 1992). For Hayward et al (1988) and Breen and Kessler (1994), it remained a main predictor in multivariate models. Ross et al (1994) found city centre rates of attendance to be lower than either rural or suburban areas though this study had involved specific health promotion activities and overall figures were not presented. Vaile et al's (1993) British study, in contrast to the findings in America and Canada, noted highest attendance rates in rural areas and lowest in the inner city women. However, the rural areas considered were identified as being relatively wealthy and this will have a bearing on screening behaviour. Additionally, the definitions of 'urban' versus 'rural' are not absolutely equivalent between the USA/Canada and the UK.

5.3.6 Social Support/Subjective norm

Women with a close, confiding relationship were more likely to attend according to the findings of Calnan et al (1985). Similarly, Gordon et al's (1991) results showed women living alone to be less likely to present for screening. Zapka et al (1989) found that attenders were much more likely to have discussed mammography with a friend or been encouraged by them. Indeed, subjective norms are likely to be influential in screening behaviour; women who thought that people important to them would want them to attend (family, friends, doctor) were more likely to attend (Vaile et al 1993, Sutton et al 1994).

5.3.7 Family History

Women with a first degree relative (e.g. mother, sister) who had had the disease were more likely to attend according to the findings of Fink et al (1972), Taplin et al (1989), Zapka et al (1989), Lerman et al (1990), Donato et al (1991), Gordon et al (1991), Costanza et al (1992) and Rimer et al (1992).

5.3 8 Having known someone with breast cancer

Having known someone else who had had breast cancer has usually been found to have a positive effect on attendance (French et al 1982, Calnan et al 1985, Sutton et al 1994, Lerman et al 1990).

5.3.9 Past/current breast symptoms

More attenders had had previous breast symptoms than nonattenders in studies by Fink et al (1968, 1972), Calnan et al (1985) and Gordon et al (1991), though in the latter case numbers were small. More of Taplin et al's (1989) and Rimer et al's (1992) attending group had undergone a biopsy in the past. Other researchers have found acceptors and rejectors of screening opportunities to be similar with regard to personal experience of the disease (Hobbs et al 1980) though women who self-refer, a different 'type' of attender, might have a greater personal history of breast cancer.

5.3.10 Risk factors for the disease

When certain risk factors for breast cancer other than age and family history have been examined, those of late age at first pregnancy, nulliparity, early menarche or late menopause, little or no difference between screened and unscreened women has been found (Donato et al 1991, Sutton et al 1994, Beaulieu et al 1996, Gram and Slenker 1992, Taplin et al 1989). As mentioned earlier, in Taplin et al's (1989) study, higher risk women were more likely to participate in screening, but they had previously been informed of their individual risk category and this would have been influential upon their behaviour.

5.3.11 Logistical barriers

Receipt of invitation, availability of time for the appointment and transport arrangements all influence likely attendance. Not receiving an invite for a mammogram in the first place affects screening in a non-decisional sense. For instance, Ciatto et al (1992) noted that significantly more attenders than nonattenders had actually received their invitation. Similarly, McEwen et al (1989) noted that a high proportion of non response in a study in Camberwell, South East London, was due to errors in address records.

One would expect that women with greater demands on their time would be less able to fit in a screening appointment, which was indeed the case in Marshall's (1994) and

Beaulieu et al's (1996) research. French et al's earlier (1982) study noted the opposite, that more attenders were working, often for longer hours, and had extra calls on their time, such as elderly relatives. However, their appointment times were more likely to have been arranged outside of working hours, and these women were perhaps making a more determined effort to fit in a screening examination despite having busy lives.

Few studies explicitly considered travelling distance to the screening appointment as an influential factor. Fink et al (1972), Haiart et al (1990) and Ross et al (1994) noted uptake declined with distance, whilst for Donato et al's (1991) study population this was not the case, with highest baseline screening rates being amongst women living an intermediate distance from the centre.

5.3.12 Knowledge and views of cancer

Where examined, knowledge of cancer generally, or that of the breast specifically, has been more evident in screened women. Gordon et al (1991) found that those who did not intend to go for a mammogram were less familiar with cancer/prevention terminology and facts. Nonattenders were also more likely to subscribe to the view that pain was necessarily a symptom of cancer. In some respects the subgroups of women were similar. For instance, the fairly early study by French et al (1982) found no difference between the proportions of attenders and nonattenders who know that any breast lumps had a good chance of being benign. Gordon et al's work led them to believe that, overall, much of nonattenders' lack of medical knowledge was "not necessarily due to lack of opportunity and that many are interested in maintaining their distance from the illness" (p916).

5.3.13 Perceived vulnerability to breast cancer

Screened women perceived themselves as more vulnerable to the disease than did nonattending women according to the findings of Fink et al (1968, 1972), Calnan et al (1985), Lerman et al (1990), Gordon et al (1991) and Vaile et al (1993). Higher perceived susceptibility also significantly influenced attendance in Rimer et al's (1992) findings. Lerman et al's findings were consistent with regard to ever having been screened and for repeat mammography. Rutledge et al's (1988) women were divided into three groups; recently screened women had a significantly greater perceived vulnerability to the disease than did the never-attenders, with mammography participants not mentioned specifically in this context. Rimer et al (1992) noted that attendance increased with perceived susceptibility up to a point, after which women who saw themselves as high risk attended less; this was perhaps due to a fear of what might be found. Meanwhile, in a fairly recent Nottingham study, Marshall (1994) found no difference in perceived personal risk between women who attended and those who did not.

5.3.14 Perceived personal health status

Attending women were more likely to currently/recently be in good health according to Fink et al's (1972), Calnan et al's (1985) and Vaile et al's (1993) findings. Similarly, nonattenders reported more recent bad health (Gordon et al 1991), though in opposition to this Hayward et al (1988) had a greater proportion of nonattenders proclaiming themselves to be in good health. Certain influences could be at work here. For instance, apparently healthy women might see no need to go for screening; others might wish to 'reinforce' their healthy status by attending. In terms of ill health, women with current or recent problems might wish to have a mammogram in the hope of controlling future potential breast problems, or they might avoid an appointment out of a desire to avoiding having to deal with anything else that arose. Gordon et al (1991) noted that personal health was rated as of equally high importance by all their study group.

5.3.15 Use of medical services and other health behaviours

The amount of contact that a woman has had and maintains with medical practitioners has an important bearing on her likelihood of attending for mammography. In a general sense, this refers to the use of doctors and other health services; more specifically important may be her previous uptake of preventive health measures, including mammography.

Women undergoing mammography have been found to have a better history of cervical smear test uptake (Hobbs et al 1980, French et al 1982, Maclean et al 1984, Calnan et al 1985, Gordon et al 1991, Sutton et al 1994, Beaulieu et al 1996, Atri et al 1996, Vaile et al 1993, Wilcox and Mosher 1993) and regular dental checks (Hobbs et al 1980, French et al 1982, Maclean et al 1984, Calnan et al 1985, Sutton et al 1994). Holding a higher opinion of breast self-examination (Maclean et al 1984), knowing how to perform it (Rimer et al 1989), practising it (Gram and Slenker 1992) or having been given a recent breast exam (Rutledge et al 1988) have all been linked to greater likelihood of attending for a mammogram. Screened women have also been reported as being more likely to make regular visits to their doctor (Zapka et al 1989, Gordon et al 1991, Fulton et al 1991, Ciatto et al 1992, Fink et al 1972), have a particular source of gynaecological care (Gordon et al 1991, Ciatto et al 1992, Beaulieu et al 1996, Burg et al 1990) have attended hospital recently (Maclean et al 1984), or have seen any doctor recently (Fulton et al 1991, Beaulieu et al 1996, Burg et al 1990). Some nonattenders reported avoiding going to a doctor even when they had a problem (Gordon et al 1991).

Fink et al (1972) noted that more attenders than nonattenders had had a polio vaccination, and other researchers have found a greater use of other health-conscious behaviours on the part of screening programme participants, such as regular use of car seat belts (Maclean et al 1984) or being less likely to smoke (Rimer et al 1989, Beaulieu et al 1996). Conversely, more nonattenders have been noted to have medical or dental check-ups only in the event of problems (Fink et al 1968, Maclean et al 1984, Fink et al 1972) and be ignorant of the existence or purpose of well woman clinics (Maclean et al 1984). Overall, as noted by Gordon et al (1991), women refusing the opportunity to be screened are generally those who are more distant from the medical system. Attendance is less likely from an individual who is less familiar with her local doctor and/or other health services. Mammographic screening is part of a continuity of preventive care and might be considered a step up from, say, cervical screening and breast self-examination as women reach an eligible age for X-ray breast examinations.

5.3.16 Having had a previous mammogram

Previous experience of mammography made subsequent attendance, or intention to attend, more likely in studies by Gordon et al (1991), Rimer et al (1989,1992) and Beaulieu et al (1996). Conversely Calnan et al (1985), Vaile et al (1993) and Sutton et al (1994) noted that previously screened women were more likely to be nonattenders during their studies. In the latter study this effect was reportedly entirely due to those women having been screened within the past year and therefore not yet requiring another x-ray examination. This was very probably also the case for Vaile et al (1993). Potentially of more concern are instances where a negative experience of mammography reduced the likelihood of subsequent uptake.

5.3.17 Recommendation by a doctor

In non-British settings, recommendation by the woman's own doctor that she have a mammogram has positively affected attendance (Gordon et al 1991, Rimer et al 1992, Lerman et al 1990). Many of Zapka et al's (1989) nonattending subjects stated that if their doctor had recommended the procedure they would have had the examination. Similarly, women in the lower SES groups would have responded favourably to a personal encouragement, according to Kruse and Phillips' (1987) research. Beaulieu et al (1996) did not find this in their Canadian study, noncompliant women expressing more frequently than attenders that recommendation by their doctor was unlikely to make them have a mammogram. In the context of the British National Breast Screening Programme, although the emphasising of screening invitations as being specifically recommended by the GP is a potential approach to improving uptake, invites are in fact already issued in groups according to the practice with which a woman is registered.

5.3.18 Attitudes to mammography

Calnan et al (1985) describe this element of beliefs as "the probability that compliant behaviour will reduce the threat". This encompassed ideas both about personal control over cancer and the perceived efficacy of screening procedures in optimising personal health. They and Vaile et al (1993) noted that their attenders were significantly more likely to have some feeling of control over cancer than women who chose not to be screened. Unscreened women have been found to be more negative about primary or secondary prevention (Hobbs et al 1980, Gordon et al 1991), with attenders being more likely to believe in the value of early diagnosis and treatment (Hobbs et al 1980, French et al 1982; though in both these studies a high proportion of all women believed this). In a related vein, nonattenders were more likely to endorse the view of mammography being unnecessary in the absence of symptoms in the findings of two studies by Rimer and colleagues (1989,1992). "One shouldn't go looking for trouble" or "the less I know the better I am" can be the general feeling in this group of women (Fink et al 1972, French et al 1982, Maclean et al 1984, Gordon et al 1991). The possibility of intentional (blissful?) ignorance continued through Gordon et al's (1991) findings that significantly fewer women not intending to be screened expressed interest in receiving more information on breast cancer or its prevention. In terms of the actual screening procedure, Calnan et al (1985), Rutledge et al (1988), Zapka et al (1989), Fulton et al (1991) and Sutton et al (1994) noted that attenders tended to regard potential benefits as outweighing any personal risks. Mah and Bryant (1992) found that it was older women in particular who tended to hold negative beliefs about mammography itself.

Fear of the exam (French et al 1982, Lerman et al 1990, Beaulieu et al 1994) or worry about potentially finding cancer (French et al 1982) additionally act as barriers to attendance, though in terms of modesty or embarrassment screened and unscreened women may be similar (French et al 1982, Rimer et al 1989). Perhaps attending women make more of an effort to put aside feelings of self-consciousness for an examination that they feel to be beneficial.

5.4 POSSIBLE REASONS FOR SOCIOECONOMIC DIFFERENCES IN UPTAKE

The mechanisms by which SES has appeared as an intermediary variable in matters of screening attendance have been examined in some of the studies reported on here.

Higher status women have more general contact with the health system and specific experience of preventive health measures. However, Katz and Hofer (1994) found the effect of this association to be fairly small; excluding women who had had no recent physician contact did not alter the overall associations between SES and attendance.

Socioeconomic differences in health attitudes and beliefs are probably more important in explaining uptake variations. Women in higher socioeconomic groups may feel more vulnerable to breast cancer yet have a greater belief in the benefit of early diagnosis; the same study found that the lower income subjects apparently placed a high value on health but had a greater belief in the influence of uncontrollable external factors on their own health status (Moody Thomas and Fick 1995). Lower income women may be less likely to feel that screening is necessary or that they personally were eligible for one (Roetzheim et al 1993).

Lower SES groups have more often cited fear, worry or anxiety as reasons for nonattendance (Maclean et al 1984, Kruse and Phillips 1987, Roetzheim et al 1993, Harper 1993), fear including that about the cancer itself, the X-ray procedure and the possibility of losing a breast (Roetzheim et al 1993).

Direct encouragement from the woman's own doctor to attend may be influential. In Kruse and Phillips' research (1987) less educated and lower income women were more likely to identify physician encouragement as a reason for attendance; in studies set in the USA, lower income women more often stated the lack of doctor's recommendation as a reason for nonattendance (Moody Thomas and Fick 1995, Harper 1993). Media publicity, particularly published material, appeared have more influence on women in higher SES groups (Kruse and Phillips 1987).

In terms of logistical barriers to attendance a mixed picture emerges. Less educated or lower income women experience greater problems obtaining transport to clinics (Moody Thomas and Fick 1995, Roetzheim et al 1993). In Moody Thomas and Fick's (1995) study group, lower income women were more likely to lose pay if they took time off work to seek medical care. The time involved in going for a screening examination was also a cause of concern for nonattending poor women in Harper et al's (1993) research. Elsewhere, time off work or away from home seemed to be more of a problem for higher socioeconomic groups in studies by Maclean et al (1984) and Roetzheim et al (1993).

5.5 THE MOST INFLUENTIAL PREDICTORS OF UPTAKE?

Given that the body of research reviewed here utilised a wide variety of possible independent variables, and even when using broadly similar ones often defined them differently, it is not entirely surprising that little consistency emerges as to the strongest predictors of screening attendance. Where specifically mentioned, a variety of influences upon uptake of mammography emerged as dominant. Calnan et al's (1985) main explanatory factors were previous use of screening, perception of vulnerability to breast cancer and beliefs in the benefits of screening, though these accounted for only a modest proportion of the difference between groups. In Hayward et al's (1988) regression analysis age entered the model first, followed by education, health status then health insurance status. Around 65% of the variance in attendance rates by census enumeration district was accounted for by five variables in Haiart et al's (1990) British study, these being town of residence, distance to appointment, car ownership, full time employment and marital status. Gordon et al (1991) found that doctor's recommendation was the single most influential factor in predicting screening status. Vaile et al's (1993) findings were different again, in that personal perceptions of vulnerability yet control over the disease and a positive subjective norm were strong predictors. A multiplicity of reasons exist as to why women choose or are enabled to attend.

The issue of nonattendance might be even more complex. Rimer et al (1989) noted that they were able to predict compliance more accurately than noncompliance, suggesting a need to further investigate the characteristics of nonattenders. Hunt et al (1988) before them identified different subcategories of nonattenders- active refusers, those who accept the invite but don't appear, and those who do not respond. The latter group of course would include women who never actually received their invitation due to addressing problems. Those who refuse the opportunity to be screened may feel that screening is unnecessary or of no potential benefit to them, or they may feel overly anxious about the procedure. Those who don't attend after accepting might be experiencing more logistical barriers, or simply forget. The diversity and varying strength of reasons given for choosing to attend or not is very apparent when reviewing this body of work and highlights the complexity of the subject.

5.6 QUALITY OF THE STUDIES

Some points should be made about the methods in some of the previous research, or the relevance of the findings to the current setting. Within this area of concern, some of the American findings may not be directly applicable to the British situation. In the USA, frequently the women have borne at least some of the financial cost of mammogram (Kruse and Phillips 1987, Hayward et al 1988, Zapka et al 1989, Rimer et al 1992), which is not the case here. The analysis of women within a particular insurance-plan group may possibly reduce relevance to this country, though Katz and Hofer (1994), in a secondary analysis eliminating U.S. uninsured women, found that socioeconomic differences in screening history remained. The external applicability of results should also be considered when very specific populations have been studied, such as those of Rutledge et al (1988) and Rimer et al (1992), both set in America. The former research examined response among the employees of a particular university and medical centre (Rutledge et al 1988), the latter looked at women from a distinct group of retirement communities (Rimer et al 1992).

Though individual-level assignation of socioeconomic data is advantageous in some respects, problems in terms of representativeness of sample with questionnaire (Vaile et al 1993, Sutton et al 1994) or telephone (Fink et al 1968, Hayward et al 1988, Rimer et al 1989, Fulton et al 1991, Ciatto et al 1992, Rimer et al 1992, Moody Thomas and Fick 1995) surveys remain. Real socioeconomic (and other) differences might have been understated or masked due to factors such as the omission of people without a phone (who are likely to be at the lower end of the socioeconomic scale), those not reached due to their address being incorrect (Donato et al 1991, Ciatto et al 1992, Vaile et al 1993, Sutton et al 1994) and those who refuse to participate in any enquiries (Hobbs et al 1980, French et al 1982, Donato et al 1991, Ciatto et al 1992, Vaile et al 1993, Rimer et al 1992, Sutton et al 1994).

The fact that fairly small numbers were involved in some studies should be noted. The earliest British reports (Hobbs et al 1980, French et al 1982, Maclean et al 1984) all considered 250 women or less, albeit in some detail, as did three more recent pieces of research in Italy (Gordon et al 1991), the USA (Moody Thomas and Fick 1995) and Canada (Beaulieu et al 1996). Maclean et al's work considered a very small number of screening participants (21) though admittedly their original intention was to study only nonattenders. Both their work and that of Haiart et al (1990) compared socioeconomic status measured at the individual level (their samples) with that at the ecological level (their overall local populations). Haiart et al were also vague in explaining their dataset, with regard to precise location and number of cases. Date was not explicitly mentioned in a number of reports and had to be estimated.

5.7 SUMMARY

The literature indicates that a multiplicity of variables appear to have an influence on the uptake of breast screening. In terms of socioeconomic characteristics, evidence most commonly suggests that attendance is better in women of higher status, although a mixed picture has emerged from previous studies within the UK. Different subgroups of attenders, and more particularly, nonattenders may well exist, each with their own likely range of reasons for being screened or not. SES variables are not necessarily dominant in explaining attendance, rather their role is an intermediary one, drawing together several elements and/or being routes via which many 'single' characteristics are expressed. Social status here acts like a common thread through sections of the population's screening behaviour.

Since the implementation of the NHSBSP, elements of uptake patterns have been studied in South Thames Region (Vaile et al 1993, Sutton et al 1994) and a district in Nottingham (Marshall 1994). Only the former two considered socioeconomic status, only the latter included second round data, and none were particularly concerned with finer spatial detail in variations in attendance within their areas. The partial examinations of these issues reinforce the case for conducting a wider ranging study on Merseyside, in which geodemographic and geographic variation, amongst a very large number of recent screening invitees, are given due consideration.

CHAPTER 6

INTRODUCTORY GEODEMOGRAPHICS AND THE DEVELOPMENT OF SUPER PROFILES

INTRODUCTORY GEODEMOGRAPHICS AND THE DEVELOPMENT OF SUPER PROFILES

6.1 THE NATURE AND DEVELOPMENT OF GEODEMOGRAPHICS

Geodemographics, broadly, is the application of multivariate social classifications to small geographical areas. In the UK, variables used in the creation of geodemographic systems most usually come from the decennial Census, but may also include information from other sources, such as market research or the Electoral Roll. The end result is that a small area, such as a Census Enumeration District or postcode sector, is classified as being predominantly one 'type' out of a number of possibilities. People living in a given area are assigned to this type though one can not necessarily assume that they possess the area's dominant characteristics at an individual level. However, such systems have proved to be extremely effective when used in certain applications, since important differences between geographical localities can be identified. Ideally, for comparative purposes, any given classification should be national in its coverage.

Systems similar to today's geodemographic classifications first appeared in the late 1960s, but came more strongly into being during the 1980s as computer processing power improved (Brown, 1991). Generally, they take into account a broad range of social, economic, demographic, and other variables. The Jarman Score (Jarman, 1983) for the identification of underprivileged areas, might be considered to be a halfway house towards a full geodemographic system, through its construction of index values based on a small number of variables.

Such classifications were originally developed and extensively and successfully used for marketing purposes, and are also commonly employed in addressing more traditional planning concerns such as store location, site development, and the optimisation of store ranging and merchandising. Uses in the public sector include the siting and management of health and community facilities (Brown, 1991). More recently, their application for other uses including health studies has been explored. Preventive medicine campaigning is one example. There is no single criterion of typology performance, other than its usefulness in practice.

All geodemographic systems are hierarchical in that a large number of social clusters are aggregated once or twice to provide a progressively cruder, but simpler and more manageable summary of the variation in any given population. Usually a postcode is required for attaching geodemographic codes to other data.

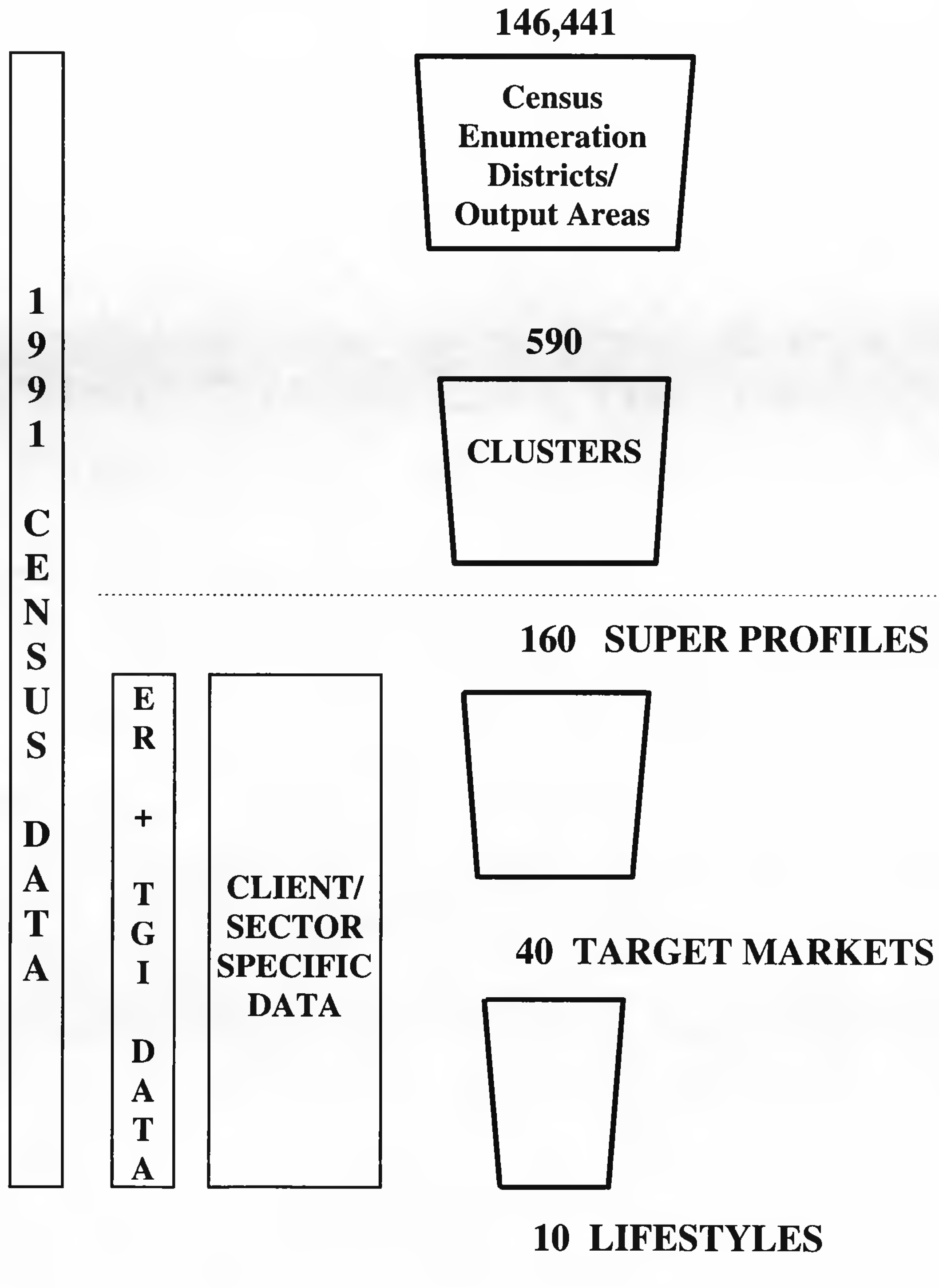
6.2 THE CONSTRUCTION OF THE SUPER PROFILES TYPOLOGIES

The Super Profiles geodemographic classification system was initially developed at the Universities of Newcastle and Liverpool using Small Area Statistics from the 1981 Census. The typologies used in this research relate to the refined version, constructed using variables from the 1991 Census for the basic clustering and classification plus Electoral Roll and market research data for additional descriptive power. Super Profiles are used in both academic and commercial fields of application, in the latter case being promoted by Credit and Data Marketing Services (CDMS) Limited, part of the Littlewoods organisation.

The development of the current classification used 72 census variables and five from the Electoral Roll and Littlewoods trading data in a cluster analysis for social characterisation of small areas. These were Census Enumeration Districts (EDs) for England and Wales, and output areas in Scotland. At the finest level available to the user an ED (usually containing around 150-200 households) will be characterised as belonging to one of one of 160 types (Super Profiles clusters). At a more general (and useful) level the clusters are aggregated so that the ED will 'belong' to one of 40 Target Market types, or more generally still to one of 10 Lifestyles (with an extra category at each level for areas unclassified due to their having very small resident populations or being otherwise poorly classified). The classification is thus a hierarchical one. A further 203 variables from various sources were used to assist in describing the dominant characteristics of and social conditions amongst those resident in each ED. Figure 6.1 summarises the process of creating the Super Profile hierarchy from the initial set of national EDs (or output areas) and their associated social and economic characteristics. Note again that the characteristics of a group, however small, cannot be assumed with certainty to apply to any individual within it. The variables used in the development of Super Profiles are fully described in Brown and Batey (1994b).

Tabulations of standardised index values compare the Lifestyle mean of each variable with the national mean. These provide a basis for deriving "pen pictures" or short verbal descriptions of the characteristics of each lifestyle. These values are presented in Brown and Batey (1994c). Note that in the interpretation of these values it should be remembered that a high index value merely indicates a high value of that variable in relation to the national mean and should not be taken to imply that that attribute is associated with the majority of the population.

Figure 6.1 Schematic diagram of the Super Profiles hierarchy



ER: Electoral Roll TGI: Target Group Index data

Adapted from Brown and Batey (1994a)

Super Profile data may be linked to other data by unit postcode, i.e. the postcode is referenced to the ED within which it lies (or predominantly lies) and thus the Super Profile Lifestyle or Target Market assigned to that ED. This is potentially extremely useful for very detailed area studies, whilst at the same, time since individual level data are not linked to other individual level data, cross-referencing of precise records and thus pinpointing of specific individuals is avoided. Analytical detail and anonymity are both retained.

6.3 SUPER PROFILE LIFESTYLE PEN PICTURES

A short description of each Lifestyle provides some idea of the likely characteristics of these geodemographic groups. The pen pictures for Lifestyles A to J are taken from Brown and Batey (1994a).

Lifestyle A: Affluent Professionals

High income families, living predominantly in detached houses. The Affluent Professional typically lives in the stockbroker belts of the major cities, and is likely to own two or more cars, which are top of the range recent purchases and much relied on for the pursuit of an active social and family life. This type of person has sophisticated tastes. They eat out regularly, go to the theatre and opera and take an active interest in sports (e.g. cricket, rugby union and golf). In addition they can afford several expensive holidays every year.

Financially aware, with a high disposable income, Affluent Professionals often invest in company shares and/or specialised accounts. They use credit and charge cards frequently, and are likely to have private health insurance. Investments are followed closely in broadsheets such as the Financial Times, The Times and the Telegraph. Other magazines bought may include Hello, Harpers & Queen, and Vogue.

Lifestyle B: Better Off Older People

Generally older than Affluent Professionals, possibly taking early retirement, the Better-Off Older People are also prosperous. Their detached or semi-detached homes have been completely paid for, and children have grown up and left home. Therefore they have money to spare for investments or spending, on items such as a superior car. They eat out regularly, take one or two holidays a year, and are likely to play golf and enjoy going to the theatre. This group also are financially aware and may invest in the stock exchange, and/or purchase health insurance. The Better Off Older People read the broadsheets as well as more traditional magazines, such as Woman's Realm and Woman and Home.

Lifestyle C: Settled Suburbans

Well-established families in generally semi-detached suburban homes. Settled Suburbans are employed in white collar and middle management positions, while in addition many wives work part-time. The lifestyle is fairly affluent, in that one or two package holidays a year may be taken, and the family can afford to purchase newer cars. They have taken advantage of government share offers in the past and often use credit cards. Many are mail order agents. Typical publications read include the Daily Mail, The Express, Ideal Home and Family Circle.

Lifestyle D: Better Off Young Families

'Thirtysomethings' who have recently started a family, the Better Off Young Families are middle management, white collar workers. Although there are often two incomes, the mortgage on the house consumes a large portion of the money. With young children and a relatively small amount of money for luxuries, this group rely on home-based entertainment, such as watching sport on television, or subscribing to satellite/cable TV. Socialising is usually done at home, while many also shop via catalogues. They may have more than one car, though frequently these are older, cheaper models. Tabloids, and in particular Today, are Lifestyle D's chosen papers. They also read Home PC and Mother & Baby in significantly high numbers.

Lifestyle E: Younger/mobile persons

This cosmopolitan, multiracial group reside in areas of major cities that are undergoing gentrification but retain a significant proportion of poorer quality housing. These young adults live in terraced houses or flats and have a high level of disposable income, which is spent on eating out, expensive holidays, keeping fit, going to pubs, clubs, concerts and the cinema. Close to busy areas, there is little need for a car, so forms of public transport (bus, train, and the tube) are preferred.

Younger/mobile groups read about their interests in magazines such as Time Out and Cosmopolitan and keep up to date with current affairs in the more liberal broadsheets, The Guardian and The Independent.

Lifestyle F: Rural Communities

This group lives, works and plays in the countryside. Many live on farms or in tied cottages, which are concentrated in East Anglia, Scotland, Wales and the South West. Given the relatively low numbers of retail outlets and the distances to them, car ownership and the utilisation of direct mail are both high. Popular reading includes the Field and Country Living magazines, and broadsheet newspaper The Telegraph. As might be expected, they like to relax outdoors, and one preferred leisure pursuit is watching horse racing.

Lifestyle G: Lower Income Elderly

An elderly group living in small, possibly sheltered accommodation. Many have moved into retirement areas and there are many 'little old ladies' -lone single female pensioners. The Lower Income Elderly will live within their means, however limited, with their key recreational activities being passive, such as the pub and television. They also prefer to shop at convenience stores in their own neighbourhood.

This group have always been financially aware and saving for a rainy day has been a way of life. Of all the lifestyle groups the Lower Income Elderly are the least likely to read newspapers and the popular magazines.

Lifestyle H: Blue Collar Families

These more affluent blue collar workers live in terraced or semi-detached housing. Many are middle aged or older and their children have left home. The Blue Collar Families work in traditional occupations and manufacturing industries, where unemployment has risen to a significant level. Most are well settled in their homes, which are either purchased or rented from the council. Leisure pursuits include going to the pub and betting on horse races. On TV, football and rugby league are the preferred sports. They do not spend money on cars and there is little planning for the future by way of financial investments. The Sun, The Mirror, and The News of the World are the most popular newspapers.

Lifestyle I: Lower Income Families

Living in council estates, in reasonably good accommodation, unemployment is a key issue for these families. Most work is found in unskilled manufacturing jobs, if available, or on Government schemes. The parochial nature of this group is emphasised by an unwillingness or inability to either move home or go on holiday. The most popular leisure activities are betting and going to pubs and clubs. On TV, sports such as football and rugby league are watched. Tabloids, particularly The Sun, The Mirror and The Daily Record are their chosen daily papers.

Taken from Brown and Batey 1994a

Lifestyle J: 'Have Nots' Households

Single parent families composed of young adults and large numbers of young children, living in cramped flats. These are the underprivileged who move frequently in search of a break. However, with two and a half times the national rate of unemployment, and with low qualifications, there seems little hope for the future.

Most are on Income Support, and those who can find work are in low paid, unskilled jobs. There are very few cars and little chance of getting away on holidays. Recreation comes mainly from the television and the take up of satellite and cable TV is high. Betting is also popular, particularly on greyhound racing. The Sun and The Mirror are the most popular newspapers.

Taken from Brown and Batey 1994a

Lifestyle K: unclassified EDs

During the tabulations and cross-tabulation of Census variables for later use, any or all of the counts for EDs with small resident populations may be suppressed. This is to avoid the possibility of persons in such localities becoming individually identifiable. Such EDs (occurring, for instance, in industrial areas) are, for the Super Profile typologies, assigned to Lifestyle K (and Target Market 41), the 'unclassified' category. The socioeconomic characteristics of this group are unknown, other than that they live in low population, often largely non-residential EDs. However, in the context of this research, the inclusion of an unclassified category serves to distinguish between people with a known location and those to whom Super Profile information cannot be attached, for reasons such as missing or inadequately recorded postcode.

6.4 SUPER PROFILE TARGET MARKETS IN THEIR LIFESTYLE GROUPINGS

Listed on the following page are brief descriptors of each of the 40 Target Markets. The prefix letter indicates which Lifestyle the Target Market aggregates to, whilst the number of the Target Market indicates its relative position when all are ranked by Median Income. Again, this information is taken from Brown and Batey (1994a).

The Super Profile Target Markets

A1	Very high income professionals in exclusive areas
A4	Mature families with large detached properties in 'stockbroker belts'
A6	Mature families in select suburban properties
B5	Highly qualified professionals in mixed housing
B7	Affluent ageing couples, many in purchased property
B12	Older professionals in retirement areas
B17	Comfortably well-off older owner occupiers
B18	Affluent ageing couples in rural areas
C11	White collar families in owner occupied suburban semis
C14	Mature white collar couples established in suburban semis
C16	White collar couples in mixed suburban housing
D2	Mortgaged commuting professionals, with children, in detached properties
D8	Double income young families in select properties
D9	Military families
D13	Young families in small semis and terraces
D15	Young white collar families in semis
D27	Young blue and white collar families in semis and terraces
D28	Young families in terraces- many council
E3	High income young professionals, many renting (mainly Greater London)
E10	Young professionals in multi-racial areas (mainly greater London)
E20	Young white collar couples buying properties
E21	Young families buying terraces in multi-racial areas
E29	Young families renting basic accomodation in multi-racial areas
E30	Young white collar singles sharing city centre accomodation
F19	Prosperous farming communities
F25	Smallholders and rural workers (mainly Scotland)
G22	Retired white collar workers in owner occupied flats
G23	Older residents and young transient singles, many in seaside resorts
G26	Old and young buying terraces and flats
G32	Retired blue collar workers in council flats (mainly Scotland)
H24	Older white collar owner-occupiers in semis
H33	Older workers established in terraces and semis
H36	Older and retired blue collar workers in small council properties
I34	Blue collar families in council properties
I35	Young blue collar families in council terraces
I37	Manufacturing workers in terraced housing
J31	Council tenants in multi-racial areas; high unemployment
J38	Blue collar families in council properties; high unemployment
J39	Young families, many single parents; high unemployment
J40	Young singles and pensioners in council flats; high unemployment
K41	Unclassified

6.5 THE USE OF SUPER PROFILES IN HEALTH-RELATED STUDIES

Super Profiles have been employed in a range of analyses investigating the socioeconomic distribution of certain health conditions or health-related activities, and also in the socioeconomic profiling of populations for the purpose of health resource allocation.

Research projects involving the 1981-based Super Profiles classification are reported by Hirschfield et al (1990), Fazey et al (1990), Todd et al (1993) and Todd et al (1994a). Hirschfield et al examined the incidence of campylobacter and salmonella-related food poisoning in the Blackpool, Wyre and Fylde Health Authority. Cases were particularly over-represented amongst lower middle class groups, whilst rural and semi-rural communities had a relatively low incidence of food poisoning. The work by Fazey et al (1990) looked into the pattern of attendance at the Liverpool Drug Dependency Clinic by drug abuse patients from Liverpool and South Sefton. A distinct bi-modal distribution of patients was noted, with the majority being from either the poorest sections of the community, or the more affluent, 'Young Professional' persons.

In a later study, Todd et al (1993) found that a disproportionately large number of angina patients treated at Arrowe Park hospital, Wirral, came from Super Profile groups characterised by high levels of council tenancy. However, the more affluent sectors of the district's population were better served by clinics, thus highlighting an imbalance between service provision and need. Todd et al (1993, 1994a) also report on the use of Super Profiles in providing socioeconomic profiles of various areas of the North West, to assist in oncology service planning.

By the time the 1991-based Super Profiles were developed, the Department of Health had recognised the potential utility of small area typologies, and purchased a license to use the classification from CDMS. As a result of this, the new Super Profiles are available for use by all health authorities in the UK (Mersey Regional Information Unit, 1993).

The 1991-based classifications have been used both in population profiling of regions (Yorkshire Regional Health Authority 1994, North West Regional Health Authority, 1994) and in recent research into specific issues. Todd et al (1994a), examining data for localities within Wirral district, found notable socioeconomic variations in cancer mortality. Death rates from lung and cervical cancer were much higher in more deprived areas, whilst those for breast cancer were greater in the affluent localities. Todd et al (1994b) and Bundred et al (1995b), in a continuation of earlier work on oncology service provision and expansion, found that a disproportionate number of patients undergoing specialist cancer treatment tended to be from affluent groups. However, Angus et al (1995) found that access to care for lung cancer was equitable by social group in the north west, and not apparently better for those of higher SES. Super Profiles have also been used to provide information for general health resource allocation in Wirral (Bundred et al 1995a).

Finally, the utility of Super Profiles in the planning of research has been less examined. In ongoing research, Brown, P.J.B. et al (personal communication) have been making use of the Lifestyle categories to assist in identifying suitable control and contrast areas for comparison with a sample group of patients receiving treatment for gastric cancer at Fazakerley hospital, Liverpool. Cases of this cancer were concentrated in four of the

Lifestyle groups. Controls were to be drawn from areas with similar socioeconomic characteristics, the contrast sample from an area with a different geodemographic make-up.

It is inevitable that since the new Super Profiles were developed and are provided by Liverpool-based organisations, much of their early use has been in Merseyside. The typologies have been found to have utility in a number of health related applications, and it was with this anticipation that they were used as the socioeconomic indicator in the this research into breast cancer and breast screening.

6.6 ERRORS AND UNCERTAINTIES ASSOCIATED WITH THE USE OF GEODEMOGRAPHIC SYSTEMS

It is recognised that certain errors and uncertainties are associated with the use of geodemographic systems in any application. The main points to be aware of are discussed briefly below.

6.6.1 The error associated with the postcode to ED link

Prior to the 1991 Census, matching of postcodes to Census Enumeration Districts was performed by a very imprecise method of grid referencing and proximity matching of postcode to ED centroid (see, for example, Gatrell 1989). Misallocation of postcodes, to the wrong EDs, was a common feature then. However, since the 1991 Census, this problem has been substantially reduced with the development of the postcode to ED directory, which references each unit postcode to the ED within which it is located. Where a given unit postcode is attached to a large number of individual addresses falling into more than one ED, the postcode is referenced to the ED within which it predominantly lies. Thus, there is scope for error in these instances, but in general the allocation of postcodes to EDs has become considerably more accurate.

6.6.2 The effects of assigning to individual people or households the characteristics of areas (inference errors arising from the effects of the ecological fallacy)

It has already been stated, early in this chapter, that when using area-based socioeconomic descriptors, it cannot be assumed that the predominant group characteristics apply to any given individual or household within it. Given that in the UK, socioeconomic data is not widely available at an individual level, most research necessarily utilises area-based information. In the use of typologies such as Super Profiles, one must always remember that when talking of “Affluent Professionals”, “Have Nots Households”, etc., the reference is to persons *resident* in such areas, who may or may not individually exhibit some of the associated characteristics.

6.6.3 Errors in ED classification

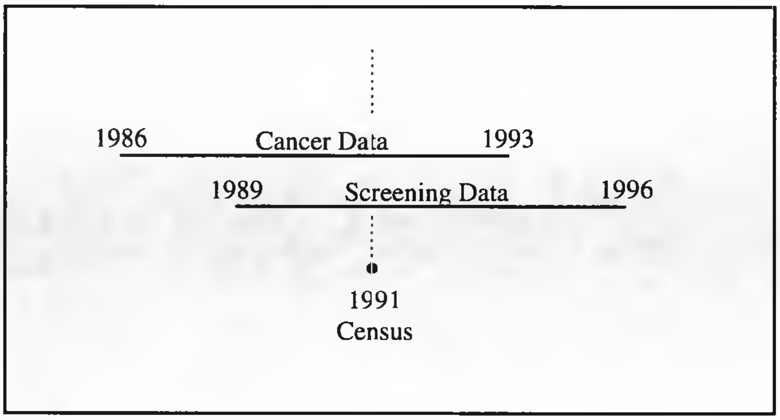
Classification error involves EDs being assigned to the wrong socioeconomic type, or being difficult to allocate due to their belonging to more than one type. Brown et al (1991) point out that the process of cluster analysis (used in the development of geodemographic systems) is a subjective one. The choice of variables for inclusion, clustering methods, number of clusters, etc., is up to the individual developer(s). Additionally, small areas and geodemographic clusters (e.g. Target Markets, Lifestyles) vary in their degree of internal consistency. Description and interpretation of cluster characteristics are based on the identification of features distinctive in those clusters, but often shared by only a small proportion of the population involved (Brown et al 1991).

6.6.4 The effects of post-census change, which varies widely from area to area

Whilst the Decennial Census provides the most comprehensive set of socioeconomic information on the population in the UK, the accuracy of its data can only decrease with time. Neighbourhoods may decline in affluence, or undergo redevelopment. Previously sparsely populated areas may become new housing estates. For instance, in Liverpool, recent redevelopment along the Mersey, south of the city centre, has introduced more high quality, expensive housing for professionals. The breast cancer and screening data used in this research collectively cover the ten years around the last Census, from 5 years before it (cancer data) to 5 years after it (screening data). See figure 6.2 for an illustration of this.

Therefore, it is hoped that post-census changes in population characteristics should not have had an unduly large influence on the findings of this research.

Figure 6.2 The timespan of the cancer and screening data used, in relation to the 1991 Census



In summary, despite the errors and uncertainties associated with geodemographic systems, their use can be of great assistance in examining various phenomena, including health and behavioural patterns, and from this be used to highlight where efforts/resources might be directed.

CHAPTER 7

THE GEODEMOGRAPHIC CHARACTERISTICS OF WIRRAL, LIVERPOOL, SEFTON AND KNOWSLEY DISTRICTS

THE GEODEMOGRAPHIC CHARACTERISTICS OF WIRRAL, LIVERPOOL SEFTON AND KNOWSLEY DISTRICTS

In this chapter the socioeconomic characteristics of the three Local Authority districts studied throughout this research, as defined by Super Profile Lifestyles, are discussed in turn. In addition, the characteristics of Knowsley, covered by one of the screening units providing data, are presented and discussed. The nature of the populations in each is somewhat different, as will be seen. Table 7.1 lists the national rankings for Wirral, Liverpool, Sefton and Knowsley with regard to the proportions of their populations assigned to each Super Profile Lifestyle, as well as the actual proportions. This information is discussed shortly. Meanwhile, table 7.2 shows the number of Census Enumeration Districts (EDs) assigned to the various Lifestyles in each district, complementing the maps shown in figures 7.1, 7.3, 7.5 and 7.7.

Table 7.1 National Ranking for the districts with respect to Super Profile Lifestyle Population (of 459 districts overall), and percentages of their populations assigned to each Lifestyle

	Wirral		Liverpool		Sefton		Knowsley	
	rank	%	rank	%	rank	%	rank	%
A: Affluent Professionals	124	13.7	336	4.4	137	12.6	427	1.4
B: Better Off Older People	214	11.6	365	4.7	208	12.4	416	2.2
C: Settled Suburbans	50	18.8	350	7.3	28	22.1	147	13.6
D: Better Off Young Families	225	15.4	275	12.9	277	12.9	230	15.1
E: Younger/mobile persons	383	0.4	122	5.3	389	0.3	452	0.1
F: Rural Communities	340	0.2	390	*0.0	363	0.1	338	0.2
G: Lower Income Elderly	151	7.0	286	4.2	85	10.0	432	1.5
H: Blue Collar Families	362	9.3	400	6.8	383	8.0	283	12.8
I: Lower Income Households	194	6.4	75	13.0	235	5.2	92	11.6
J: 'Have Nots' Households	41	17.1	8	41.4	42	16.4	7	41.6

Data from Brown and Batey (1994c) (ranks)
and Brown, P.J.B. (personal communication) (percents)
*0.0% of Liverpool's population assigned to Lifestyle F; yet the ranking is given as 390 due to other urban districts in the country similarly having no EDs designated as 'Rural Communities'

Table 7.2 Frequency of Super Profile Lifestyles by Census ED in each district

	Wirral		Liverpool		Sefton		Knowsley	
Lifestyle	**No.**	**Percent**	**No.**	**Percent**	**No.**	**Percent**	**No.**	**Percent**
A	85	12.0	34	3.4	66	11.4	4	1.3
B	84	11.8	43	4.4	70	12.1	8	2.7
C	121	17.1	64	6.5	126	21.7	38	12.7
D	103	14.5	115	11.6	70	12.1	40	13.4
E	4	0.6	74	7.5	3	0.5	1	0.3
F	2	0.3	0	0.0	1	0.1	1	0.3
G	59	8.3	57	5.8	74	12.8	8	2.7
H	70	9.9	64	6.5	48	8.3	42	14.0
I	47	6.6	122	12.3	28	4.8	33	11.0
J	130	18.3	403	40.8	92	15.9	121	40.5
K[1]	4	0.6	12	1.2	2	0.3	3	1.0
Totals	**709**	**100**	**988**	**100**	**580**	**100**	**299**	**99.9***

[1] unclassified EDs due to the small size of their populations
*due to rounding

7.1 THE GEODEMOGRAPHIC MAKE-UP OF WIRRAL DISTRICT

Wirral is a district of great socioeconomic contrasts. Within it are many areas of considerable affluence and many of notable deprivation. The Settled Suburban (C) and 'Have Nots' Households (J) Lifestyles are the two most frequently occurring in this district; Wirral ranks 50th and 41st respectively, in the national rankings with regard to the percentages of its population which fall into these categories (table 7.1). Also notable is that 6.84% of the 1991 population was classified as being of Target Market C14- "Mature white collar couples established in suburban semis"; with regard to this sector of the population Wirral district ranks 6th nationally (Brown and Batey 1994c). Figure 7.1 illustrates the geographical pattern of Super Profile Lifestyles across the district, whilst table 7.2 shows the information in count form. Meanwhile, figure 7.2

provides a basic illustration of the locations of the villages, towns and other small areas discussed in the text.

Very loosely, the more affluent parts of the district tend to be in the west and southwest, whilst its northern and north eastern areas show more deprived localities. EDs classified as Lifestyle A, Affluent Professionals, appear in distinct clusters around Hoylake and neighbouring Meols, Clady Hill and Newton (south and east of West Kirby), Heswall, Pensby, Thingwall, Bebington, Bidston Hill (between Birkenhead and Moreton) and New Brighton. Often Lifestyle B areas neighbour or intermingle with those of Lifestyle A. Lifestyle B (Better Off Older People) localities are to be found in West Kirby, Irby, Thurstaston (just west of Irby), eastern Heswall, New Brighton and the Oxton/Claughton area of Birkenhead, as well as in smaller occurrences elsewhere.

The population of Settled Suburbans is scattered throughout much of the Wirral, though not Deeside (the western coast), which is dominated by the two most affluent groups. The main clusters of Lifestyle C EDs are to be found in Eastham, Brookhurst (south of Bromborough), Higher Bebington, Prenton (between Bebington and Oxton/Claughton), Greasby, Wallasey and Moreton. Often neighbouring these are the Better Off Young Families (Lifestyle D), living, for example, in Liscard, Moreton, southwest Birkenhead, Poulton (north of Birkenhead centre), Eastham and Bromborough.

WIRRAL

LIFESTYLE GROUPS
by CENSUS ED

- A: Affluent Professionals
- B: Better Off Older People
- C: Settled Suburbans
- D: Better Off Young Families
- E: Younger/Mobile Persons
- F: Rural Communities
- G: Lower Income Elderly
- H: Blue Collar Families
- I: Lower Income Households
- J: Have Nots Households
- K: Unclassified

Figure 7.1

Figure 7.2 Town and village locations within Wirral for reference when discussed in the text

Lifestyle E has a low representation in Wirral, with just four scattered EDs classified as being dominated by 'Young/mobile persons'. All are near the Birkenhead-Hoylake railway line or the northern end of the M53. Similarly, only 2 EDs are described as Lifestyle F, Rural Communities. Both are around Thornton Hough at the southern end of the district.

Lifestyle G, the Lower Income Elderly, are generally located in more densely populated EDs. Example areas include central West Kirby, New Brighton, Egremont (east of Liscard), Rock Ferry, New Ferry and Port Sunlight (both east of Bebington), and the Oxton/Claughton area of Birkenhead. Meanwhile, areas represented as being Lifestyle H, Producers, include the Manor Road station area of Hoylake, Moreton, the Thingwall/Arrowe Park (just to the north of Thingwall) localities, Bromborough Pool (east of Bebington) and Eastham.

Most of the Lifestyle I and J EDs are concentrated in the densely populated north-eastern parts of Wirral nearer the River Mersey and Liverpool. Parts of Bidston and Bidston Moss (between Birkenhead and Moreton), Liscard and the Rock Ferry area are characterised as Lower Income Household (Lifestyle I) areas, whilst 'Have Nots' Households (Lifestyle J) appear in clusters around Leasowe (between Wallasey and Moreton), Bidston, Woodchurch (between Upton and Thingwall), Rock Ferry, Tranmere (between Birkenhead and Rock Ferry) and much of Central Birkenhead.

7.2 THE GEODEMOGRAPHIC MAKE-UP OF LIVERPOOL DISTRICT

Liverpool district is one of the most deprived in the country. It ranks eighth nationally with regard to the percentage of its population living in Lifestyle J ('Have Nots' Households) EDs; only five London Boroughs, one district in Strathclyde, and Liverpool's neighbouring district of Knowsley have greater proportions of these poorest people (Brown and Batey 1994c). At the Target Market level, Liverpool has the third highest representation in the country of Target Market J38- "Blue collar families in council properties", with 30.4% of its population classified as such in 1991. It also ranks 6th highest in Target Market J40 - "Young singles and pensioners in council flats-high unemployment", with 6.4% of the district population. Liverpool is also 75th of the 459 UK districts in Lifestyle I (Lower Income Households) representation (table 7.1).

Figure 7.3 illustrates the spatial distribution of the Super Profile Lifestyles by Census ED in Liverpool whilst table 7.2 tallies the frequencies. Figure 7.4 provides the locations of some of the inner city areas and suburbs, for the benefit of those who are not familiar with the district. Whilst this district is one of renowned deprivation, pockets of affluence do exist in the eastern and more especially south-eastern suburbs of the city. Affluent Professionals (Lifestyle A) areas are concentrated within Woolton, Childwall (between Broad Green and Belle Vale), Allerton and parts of Mossley Hill and Grassendale, with also some representation around Croxteth country park. Many Lifestyle B (Better Off Older People) areas neighbour these, with Lifestyle B EDs in Gateacre, Childwall, Woolton, Mossley Hill and Aigburth. A few Lifestyle B EDs also appear in parts of West Derby and outer Wavertree. Settled Suburban (Lifestyle C) areas border the Lifestyle A and B EDs in southeast Liverpool, and also extend through the eastern city outskirts. This group is mainly represented in Grassendale, Allerton, Mossley Hill, northern Childwall, Broad Green and West Derby.

The distribution of the Better Off Young Families (Lifestyle D) departs from this pattern, with these EDs generally scattered around the periphery of the city and in the north and north-eastern parts of the district. Lifestyle D zones include the area around Walton prison and towards Aintree railway station (at the northern edge of the district), Croxteth, parts of Kirkdale and Wavertree, and also St Michael's Hamlet.

'Younger/mobile' persons are much more numerous in Liverpool than either Wirral or Sefton. The greatest concentrations of these, Lifestyle E, EDs are to be found within the city centre, the area around the Queens and Albert Docks (on the River Mersey, at and just south of the city centre), Edge Hill and the Princes Park area of Toxteth. Another cluster of such EDs occurs in Wavertree. Other smaller occurrences of this Lifestyle appear elsewhere in the district, excepting the extreme south east parts. Meanwhile, given the district's urban and suburban nature, rural groups (Lifestyle F) do not appear on the ED-level plot.

Lifestyle G EDs, the Lower Income Elderly, are fairly scattered, though mainly within the western and northern parts of the district. Representation occurs in various areas including parts of Tuebrook and Walton, and to the north of Sefton Park (between Toxteth and Mossley Hill). Lifestyle H (Blue Collar Families) EDs are also quite

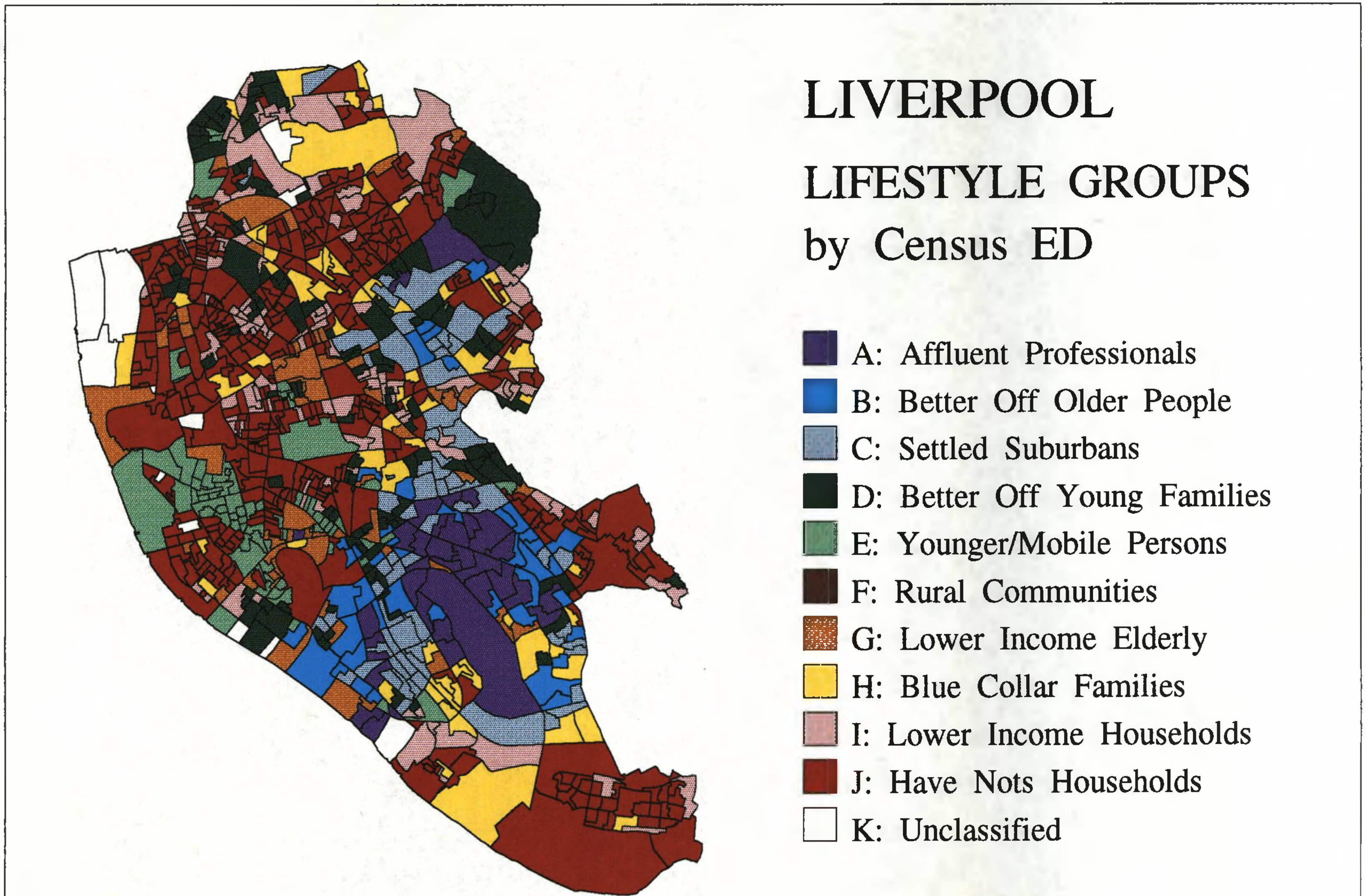

LIVERPOOL
LIFESTYLE GROUPS
by Census ED
A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/Mobile Persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: Have Nots Households
K: Unclassified

Figure 7.3

Figure 7.4 Inner city and suburb locations in Liverpool for reference when discussed in the text

scattered, with occurrences in parts of Fazakerley, Clubmoor (between Tuebrook and Norris Green), Old Swan, Hunts Cross (north west of Speke), Grassendale and Garston.

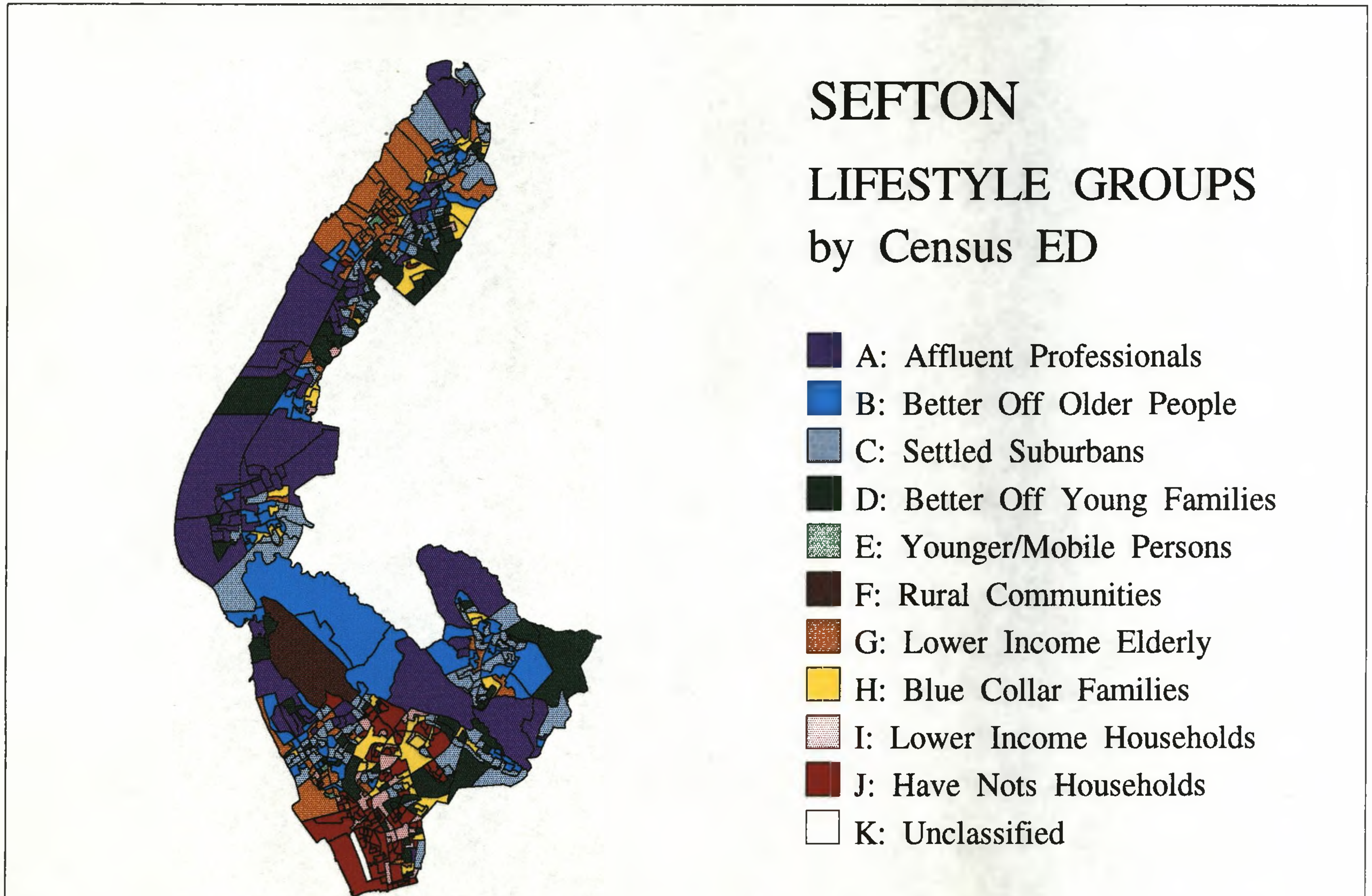
Areas characterised as Lower Income Household type (Lifestyle I), often bordering or close to Lifestyle J areas, occur more frequently in the northern half of the district. EDs in parts of Walton, Everton and Anfield, Stoney Croft (between Old Swan and Tuebrook), Old Swan, Dovecot, Belle Vale, Netherley, Garston and Speke have this Lifestyle type. Meanwhile Lifestyle J, the 'Have Nots' Households, share Lifestyle E's domination of inner city areas and appear in large swathes in various parts of the district. Dense clusters of the most deprived EDs occur around Toxteth, Sefton Park, Edge Hill and inner Wavertree, Everton, Kirkdale, Anfield, Walton, Norris Green, Belle Vale, Gateacre, Netherley, Garston and Speke. Have Nots are also represented in West Derby, the periphery of Sefton Park, and Croxteth. In total, 403 of Liverpool's 988 EDs are characterised as Lifestyle J (table 7.2). The most notable unclassified EDs (Lifestyle K) are around the northern docks and in industrial areas alongside the River Mersey.

7.3 THE GEODEMOGRAPHIC MAKE-UP OF SEFTON DISTRICT

Sefton district bears some similarities with Wirral as regards its socioeconomic mix. Areas of notable affluence, especially in the central and eastern parts of the district, contrast with distinctly deprived neighbourhoods at the southern fringes. The percentage representation of Lifestyle C (Settled Suburbans) is high. Sefton ranks 28th in the country for this Lifestyle overall, and in Target Market C14 (see section 7.1) it has the highest population proportion in the country, with nearly 10% of its residents assigned to that Target Market (Brown and Batey 1994c). At 42nd place nationally, with regard to the poorest Lifestyle, J, Sefton also has more than the average share of deprivation. In addition, the Lower Income Elderly Lifestyle (G) occurs relatively frequently, this district ranking 85th overall with regard to this group (table 7.1).

Figure 7.5 illustrates the distribution of Super Profile Lifestyles by Census ED, whilst table 7.2 contains their frequencies. Figure 7.6 illustrates the locations of the principle towns, villages and other areas in the district. Both Affluent Professionals (A) and Better Off Older People (B) are quite well represented in Sefton. Lifestyle A EDs occur in Ainsdale, Formby, Lydiate, Maghull, Waddicar, Crosby and Blundellsands, and also amongst the northern and eastern fringes of Southport. Lifestyle B localities are scattered throughout the district, in peripheral areas of Southport, in Woodvale, Hightown, Ince Blundell (2 kilometres east of Hightown) Maghull, Crosby, Great Crosby (north east of Crosby) and parts of Aintree.

126 of Sefton's 580 EDs are classified as Lifestyle C; this is the single most frequent Lifestyle when mapped in this fashion. Settled Suburbans are to be found in particular around Blowick (an eastern suburb of Southport), Churchtown, Little Altcar (an eastern area of Formby) and other areas around Formby, Maghull, Aintree, Waterloo Park (between Crosby and Litherland), Great Crosby and parts of Orrell. Lifestyle D (Better Off Young Families) EDs meanwhile, are located to the south-east of Southport town centre and in other peripheral areas such as Hillside, and also around Hightown, Moss


SEFTON
LIFESTYLE GROUPS
by Census ED
A: Affluent Professionals
B: Better Off Older People
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G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
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K: Unclassified

Figure 7.5

Figure 7.6 Town and village locations within Sefton for reference when discussed in the text

Side (south east of Lydiate), Aintree, Old Roan (north west of Aintree), and parts of Orrell and Litherland.

Lifestyles E and F both have low spatial representation in Sefton. One Lifestyle E (Younger/mobile groups) ED is to be found in Southport whilst two more occur around the Waterloo (docks) area near the main A565 road at the southern, more densely populated end of the district where it borders with Liverpool. Only one ED is characterised as Lifestyle F (Rural Communities), this being an area stretching around Moss Wood just south of Ince Blundell, between Crosby and Formby.

Much of the fairly high proportion of Sefton's population classified as Lower Income Elderly reside in central Southport, where these Lifestyle G EDs predominate. Smaller occurrences are seen in Maghull, Crosby and Blundellsands. Lifestyle H (Blue Collar Families) EDs are relatively infrequent in this district, with small clusters around Litherland and Great Crosby, and in areas such as High Park (skirting Southport), for example. Meanwhile the small number of Lifestyle I (Lower Income Household) areas are mainly located in the southern part of the district, within Bootle, Litherland and Orrell.

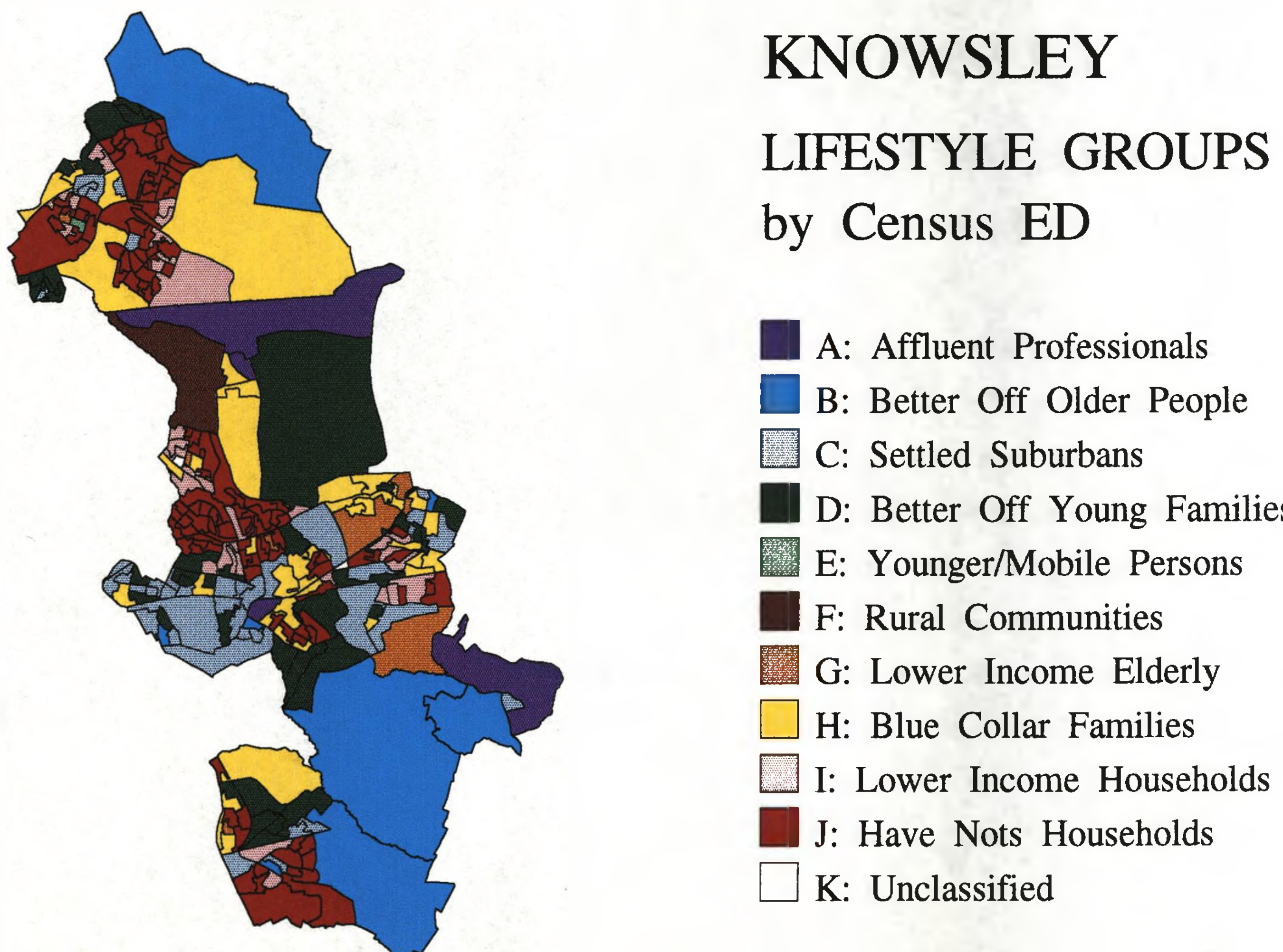
Lifestyle J EDs, the 'Have Nots' areas, are also predominantly to be found at the southern end of Sefton. Whilst three EDs in Southport are indicated to contain especially deprived conditions, the rest are heavily concentrated in Bootle and also Litherland and Thornton. Only two EDs are unclassified (Lifestyle K), one in Southport and one in the Dock Road area of Bootle.

7.4 THE GEODEMOGRAPHIC MAKE-UP OF KNOWSLEY DISTRICT

Knowsley district, which occupies a thin north-south strip immediately to the east of Liverpool, bears some similarities to its neighbour in terms of the high prevalence of the most deprived socioeconomic groups in its population. It ranks 7th in the country with respect to the proportion of its population living in EDs assigned to the poorest Lifestyle, J ('Have Nots' Households), one place higher than Liverpool. At the level of the Target Market, Knowsley ranks 2nd and 4th nationally in terms of its populations in groups J38- "Blue Collar Families in Council Properties- High Unemployment" and J39- "Young Families, Many Single Parents- High Unemployment". It also has lower proportions of its populations in the most affluent Lifestyles than the other three districts studied here (table 7.1).

Figure 7.7 illustrates the spatial distribution of the Super Profile Lifestyles by Census ED in Knowsley, whilst table 7.2, as before, tallies the frequencies. To assist those unfamiliar with the district, figure 7.8 indicates some of the suburb and village locations in the area.

The relatively low representation of Lifestyles A and B amongst Knowsley's 299 EDs is clear from table 7.2. The areas assigned to Lifestyle A, Affluent Achievers, are for the most part, in the proximity of Cronton village to the south east of the district, and in another strip of land around Knowsley village in the northern half of the district. Meanwhile, four of the eight Lifestyle B (Better Off Older People) EDs are to be found in the south east corner of the district.


KNOWSLEY
LIFESTYLE GROUPS
by Census ED
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G: Lower Income Elderly
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I: Lower Income Households
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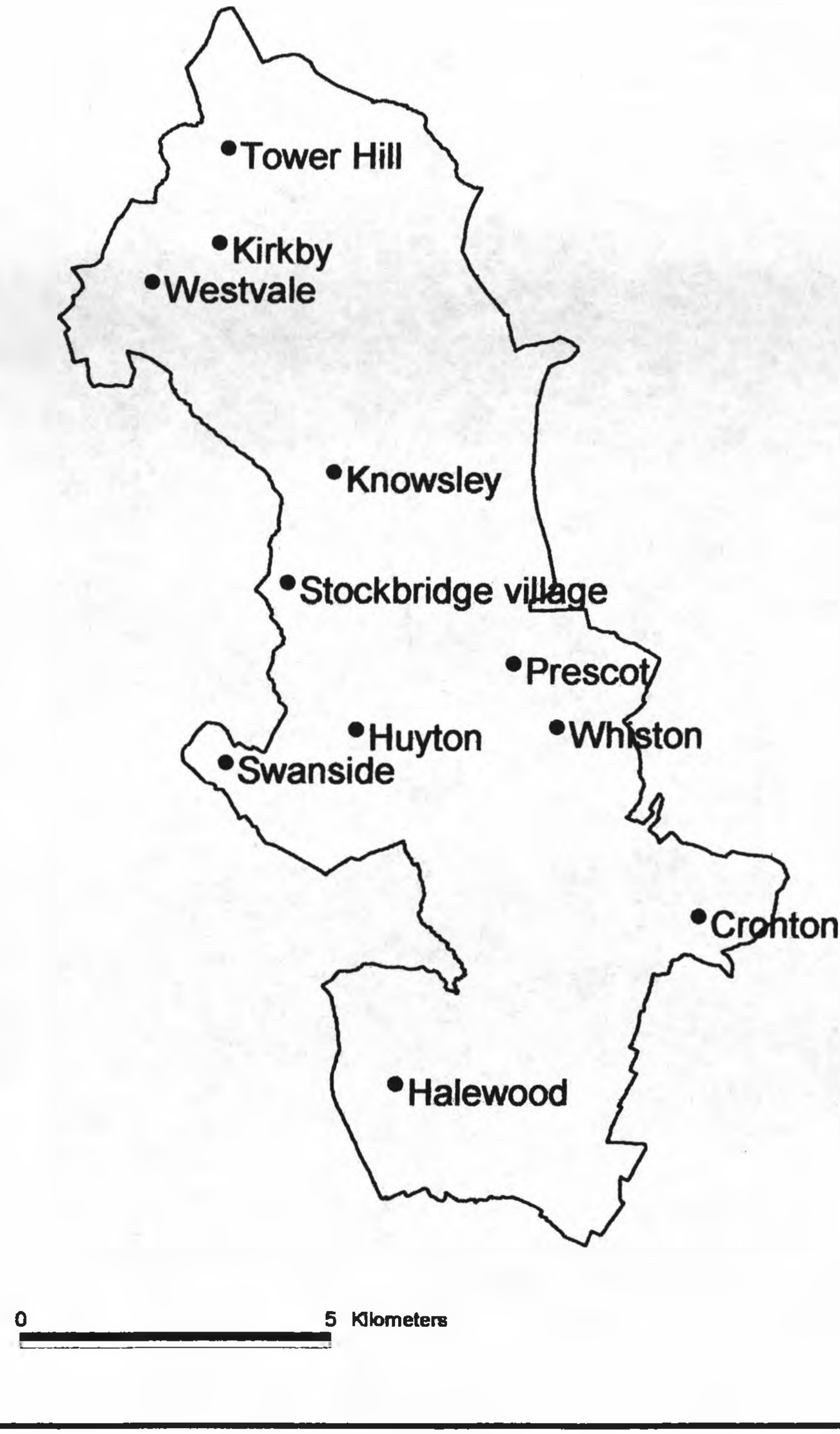
Figure 7.7

Figure 7.8 Suburb and village locations in Knowsley for reference when discussed in the text



Much of Knowsley's representation of Lifestyle C (Settled Suburbans) concerns the areas to either side of the M62 motorway and the nearby rail line heading east out of Liverpool. Areas such as Bowring Park, Huyton and Swanside are encompassed in this densely populated central section of the district. Other Lifestyle C ED are to be found in areas such as Westvale in the north of the district, and Halewood at the south west end.

The distribution of Lifestyle D areas (Better Off Young Families) overlaps with that of Lifestyle C. Many of the Lifestyle D areas occur in the same Huyton-Prescot-Whiston strip to either side of the M62 motorway. Other clusters of Lifestyle D EDs are seen in areas such as Tower Hill in the north west of the district, and Halewood in the south west.

Lifestyles E and F have only a single ED each in Knowsley district. The one 'Younger/mobile persons' ED is located in a densely populated part of Westvale, whilst the one ED assigned to 'Rural Communities' is located around and just west of Knowsley village, albeit near to the M57 motorway, which runs through western parts of the district.

The representation of Lifestyle G is also quite low, only 8 EDs being assigned to the 'Lower Income Elderly' Lifestyle. The main group of these EDs are to be found in the Prescot/Whiston area in the east side of the district; the others are scattered as single EDs within the western areas (the outer suburbs of Liverpool). Lifestyle H has a higher representation, with 42 EDs classified as 'Blue Collar Families' spread throughout the district, excepting its south east corner.

The 33 Lifestyle I (Lower Income Household) EDs mostly border areas assigned to J, the poorest Lifestyle, in the more densely populated areas of the district. Clusters of Lifestyle I EDs occur in areas such as Stockbridge village and Whiston. Meanwhile, figure 7.7 clearly shows the clustering of the 121 EDs assigned to Lifestyle J, the 'Have Nots' Households. These clusters mainly occur in 3 distinct groups in the western half of the district. These areas include Kirkby, zones north of Huyton in the central part of the district, and the south west corner of Knowsley, around Halewood and the Ford motor works.

7.5 SUMMARY

The districts selected for this research differ sufficiently from one another in their socioeconomic make-up for there to be some interesting implications for the results presented in later chapters. What is common to all of them is that they have a much higher share of their populations in low SES groups than the nation as a whole. This is particularly striking in Liverpool, a city with notable social and economic problems, and in its neighbouring district of Knowsley, which contains many of the city's outlying areas of poorer housing. Meanwhile, Wirral has perhaps the greatest degree of socioeconomic contrast, between its richer west and poorer east.

CHAPTER 8

DATA AND METHODS

DATA AND METHODS

Outlined in this chapter are the techniques and datasets employed in this research project. Introduced in turn are the computer software used, the sources and contents of the various datasets, the attachment of the socioeconomic codes to the cancer and screening data, and the methods of data interrogation applied in each of the sections of analysis reported on in chapters 9, 10 and 11.

8.1 COMPUTER SOFTWARE

A range of software running on Unix and PC Windows platforms was used for the complete suite of analyses. The specific packages used are as follows:

i) Ingres and Access databases were utilised for management and querying of the data and its subsets

ii) The simpler statistical calculations were carried out in Excel, the more complex ones in SPSS for Windows

iii) The Arc/Info and ArcView GIS packages were employed for mapping purposes

iv) Excel provided spreadsheet and graphical display capabilities

The database module of Arc/Info is very unwieldy and not particularly suitable for carrying out preliminary analyses. Arc/Info was therefore used for mapping purposes only. Records read into INFO data files were linked to the boundary data using the relate facility available in Arc/Info. A series of Arc Macro Language (AML) files was developed to produce all mapped output, excepting figures 7.2, 7.4, 7.6 and 7.8, which were produced using ArcView.

8.2 THE SUPER PROFILES GEODEMOGRAPHIC DATA

The Department of Civic Design holds, for academic use, a program containing Super Profile codes (e.g. Lifestyles) for the whole of the UK. The user supplies a list of unit postcodes, and by matching these, the program provides the Census enumeration district and/or any of the Super Profile codes, as required. The original names of the Super Profile Lifestyles, when used in previous health-related applications (e.g. North West Regional Health Authority 1994), have been changed to names that are more immediately indicative of the types of persons and EDs assigned to those Lifestyles. Table 8.1 maps the original names of the 1991-based Super Profile Lifestyles to those used in this research, which are preferred by the health professionals involved.

8.3 BOUNDARY INFORMATION FOR MAPS

Digital boundary data for all the maps contained within this volume were obtained from UKBorders. Distribution is via Edinburgh University Data Library and the Census Dissemination Unit, Manchester Computing Centre, University of Manchester. Files were transferred in Arc/Info export format, imported into Arc/Info and saved within it as

Table 8.1 Mapping of the original Lifestyle names to those used in this thesis

Lifestyle	Original name	Descriptive name used in this research
A	Affluent Achievers	Affluent Professionals
B	Thriving Greys	Better Off Older People
C	Settled Suburbans	Settled Suburbans
D	Nestbuilders	Better Off Young Families
E	Urban Venturers	Younger/mobile persons
F	Country Life	Rural Communities
G	Senior Citizens	Lower Income Elderly
H	Producers	Blue Collar Families
I	Hard-Pressed Families	Lower Income Families
J	Have-Nots	Have-Nots Households
K	Unclassified EDs	Unclassified EDs
O	-	'Dummy' Lifestyle for non-matched cases

polygon coverages. In brief, a coverage may be described as a map 'layer', containing information on a particular type of feature, in this instance district and enumeration district boundaries. The boundaries used in this research relate to the Local Authority Districts (as the Super Profile classifications are linked to these). These are coterminous with the health districts in the case of Liverpool and Sefton. In Wirral, prior to 1996 boundary changes, a slight difference between the local authority and health authority boundaries occurred at the south west corner, the village of Neston being included in the health authority but not in the local authority area. Now, local and health authority boundaries are effectively coterminous, the Neston area being included in Chester district.

Screening data for Knowsley district were also analysed, as the mobile screening unit that covers Sefton also covers Knowsley. Knowsley local authority district constitutes the western part of the St Helens and Knowsley District Health Authority (St Helens being covered by another screening unit, which also visits sites in Warrington and Halton).

8.4 THE CANCER DATASET

8.4.1 Source and coverage

The dataset used for the analysis of breast cancer incidence and survival contains the 5190 cases of primary breast cancer registered in Wirral, Liverpool and Sefton by the Merseyside and Cheshire Cancer Registry for the years 1986 to 1993 inclusive. Details for each case are as complete as possible, up to June 1996, when the data were downloaded from the Registry's system. Table 8.2 shows the breakdown of cases by year and district.

Table 8.2 Number of cases in the breast cancer dataset, by year and district

Number of registrations by year			Number of registrations by district	
1986	628			
1987	598		Wirral	1758
1988	589			
1989	644		Liverpool	1983
1990	627			
1991	733		South Sefton	1449
1992	660			
1993	711			

8.4.2 Variables in the cancer dataset

The variables contained in the cancer dataset were as follows. Most are self-explanatory, although further information is provided where necessary.

- tumour identification number (the unique, 'key', variable in the data)
- unit postcode
- district of residence
- age
- date of diagnosis
- dead/alive flag
- date of death, if deceased
- tumour status at death (level of activity of the cancer- a proxy for whether the tumour was likely to be the cause of death)
- mode of presentation of cancer
- method of proof of cancer diagnosis
- surgery flag (yes/no)
- chemotherapy flag (yes/no)
- radiotherapy flag (yes/no)
- hormone therapy flag (yes/no)
- reason untreated, if no treatment recorded

8.4.3 Initial processing

The dataset was received in comma-delimited flat file format. Certain textual details were amended or tidied in a unix-based text editor so as to facilitate importing to the Access database, for subsequent querying. Super Profile codes were also attached at this stage (discussed shortly).

8.5 THE SCREENING DATASETS

8.5.1 Sources and coverage

The Wirral Breast Screening dataset was received in July 1995. It contains records for the first 5 complete years of screening at the Wirral unit since it began in May 1990, and the first month of the sixth year (second round).

The Liverpool and Sefton data were downloaded in early July 1996, in two parts (due to the large size of the file), which were later rejoined. Data refer to the first two complete rounds of screening, which effectively commenced in January 1989 for Liverpool and in the same month the following year for the Sefton & Knowsley mobile unit.

8.5.2 Variables in the screening datasets

Variables in the screening datasets were as follows, with explanation provided where necessary.

- unit postcode
- NHS number (the unique, 'key' variable in the data)
- date of birth
- episode character (whether the woman was a first call, repeat call, referral or non-routine recall)
- episode closure (attendance, nonattendance, for whatever reason)
- episode batch number
- screening location (for Liverpool and Sefton & Knowsley dataset)

8.5.3 Initial processing

Since the files were rather large, unnecessary characters were removed in a unix-based text editor. Long, regularly occurring text strings were replaced by acronyms for ease of subsequent storage and use. Additionally, certain characters or features of the original flat files would cause problems in importing to the software packages. Thus various characters were removed or replaced. Super Profile codes were also attached at this stage (discussed shortly).

8.5.4 Subsequent processing

Records of interest for the main analyses were only those pertaining to routine invitations for age-eligible women. Thus various records were removed from the initial datasets (using Ingres SQL commands) as follows:

- where the woman was known to have died
- where she had opted out permanently from the screening program. This can occur, for example, if the woman has had a bilateral mastectomy (Patnick and Muir Gray 1993)
- Wirral age-trial episodes, where women aged between 40 and 50 had been invited
- Self and GP referrals. Self referrals were retained in separate tables for use in a short section of later analysis
- Non-Routine Recall episodes
- episodes where the episode closure field was blank. These refer to invites for which the outcome (i.e., attendance or nonattendance) was not known at the time the screening data were downloaded from the units' systems.
- invitees who were known to be resident outside Merseyside. This study was concerned with uptake amongst Merseyside residents.

In total, around 13% of the original Wirral data and 10% of the Liverpool and mobile data were removed prior to subdivision and analysis. Table 8.3 shows the numbers of records in the original datasets, the numbers of records removed for each reason listed above, and the numbers remaining for analysis.

Table 8.3 Numbers of records removed from the original screening data files, and those remaining for inclusion in analysis

	Wirral	Liverpool	Sefton
Original records	56,176	173,125	
Known to have died	71	163	
Opted out permanently	111	767	
Age-trial episodes	1556	none at these units	
Non-routine recalls	687	1532	
Episode closure field blank	1439	4795	
Referrals (self and GP)	1402	5255	
Known to be not resident in Merseyside	1979	816	
Remaining records	48,931	160,613*, of which:	
Records analysed	**48,931**	**83,204**	**72,504**

*A further 4,080 Liverpool invites exceeded the cut-off date for sensible analysis (extending into screening years only just commenced at the time) and 9 Liverpool/Sefton records did not have a batch ID nor any suitable record of screening location with which to assign them to one unit or another. Thus, these were also removed prior to analysis.

The larger number of known non-Merseyside residents in the Wirral Unit data is attributable to the fact that many women resident in Chester district are sent invitations by the Wirral Unit, due to their being registered with GPs based in Wirral.

8.6 THE ATTACHMENT OF ED AND SUPER PROFILE CODES TO THE CANCER AND SCREENING DATA

8.6.1 The attachment process

For each dataset, the unit postcode plus the key (unique identifier) variable were extracted from the front of each record by means of a simple FORTRAN program. Super Profile codes and additionally for the screening data, Enumeration district codes, were obtained by running the postcodes through the 'rha' program held in Civic Design. This utilises the postcode to ED directory in attaching any or all of the spatial and geodemographic indicators required.

Geodemographic and screening data were rejoined by means of another FORTRAN program. The somewhat smaller cancer dataset was joined with the ED and geodemographic codes within the Access database.

8.6.2 Success rates in attaching Super Profile codes to the cancer data

Of the 5190 cancer records, 709 (13.7%) were not assigned geodemographic codes. This is rather a high level of matching failure and so the nature of these records was examined. There was an even split of nonmatched cases between years, and the age distribution was fairly similar to the overall composition of the dataset. However it was discovered that almost all were cases resident in Liverpool, with 673 records (33.9%) for this district not assigned ED or Super Profile codes, due to missing, incomplete or unrecognised postcodes. Further examination of these records is reported with incidence (chapter 9) and survival (chapter 10) results. Eighteen records in each of the other two districts remained unmatched, corresponding to 1% and 1.2% of Wirral and Sefton data respectively. The unmatched cases were included in the analyses where possible, identified as a 'dummy' Lifestyle, group 'O'.

8.6.3 Success rates in attaching Super Profile codes to the original screening datasets

1. Wirral Unit

i) Initial run through the RHA matching program:

54,456 records were immediately assigned ED and Super Profile codes; 1720 were unmatched at this stage (of which 907 had completely missing postcodes). This represents a success rate fractionally under 97%.

ii) Additional assignation of ED codes to unmatched postcodes:

86 complete and apparently sensible postcodes had not been matched to a Census Enumeration District (and therefore, to Super Profiles) in the initial processing. Since they were absent from the postcode to ED directory used in the attachment of Super Profiles, a different means of allocating these 86 postcodes to EDs had to be found. Therefore, they were then run through the Central Postcode Directory (CPD) for 1991, to provide a grid reference for each. Co-ordinates provided by the CPD are referenced to the south west corner of the 100 metre National Grid square within which they lie. It

is customary practice to ‘correct’ the figures by adding 50 metres to both easting and northing, to place each grid reference in the middle of its 100m square (see, for example, Gatrell 1989). A co-ordinate file was then generated and built as a point coverage in Arc/Info, following which point-in-polygon analysis (using the Identify command) was used to determine which ED each postcode was contained within. 79 of the tested postcodes fell into Wirral Enumeration Districts, and from these a further 277 records could be assigned Super Profile codes. At the end of this stage 97.4% of records had geodemographic data attached.

iii) Supplementary manual addition of postcodes and geodemographic details

An address file from the Wirral unit was supplied for records where the postcode was missing, the original hope being that postcodes could be added manually. However, few addresses were actually present in this file- most records having “moved, re FHSA list” as their address field. Only 38 new postcodes could be added manually, using the Royal Mail “Postal Address Book” 95-96 North West. These were run through the RHA Super Profile matching program, 33 giving a match to an ED code, of which 31 were in Wirral and thus added to the main data file. Since the increase in records matched to Super Profile codes was very small after the initial departmental run, it was decided that for the Liverpool and Mobile unit data, no extra addition of geodemographic codes would be attempted.

iv) Examination of the unmatched records

Most of the unmatched records had missing postcodes, although just over a third had incomplete or unrecognised data in this field. A series of quick queries of the data showed a much lower uptake rate from the subgroup of cases unmatched due to missing postcode in comparison with the rest of the data set (table 8.4). This and the fact that missing postcode episodes were much more likely to have "Moved Away" or "Not Known at Address" noted as their reason for closure suggests problems in getting invitations to those people more than possible reluctance to attend (21.9% compared with 1.4% for the full dataset).

Table 8.4 Analysis of the subset of Wirral screening unit data to which no Super Profile codes had been allocated after three attempts by different methods

	Number of records	% uptake of screening	% Episode closure field "Moved" or "Not Known at Address"
Missing postcode	873	50	21.9
Unmatched postcode	440	72.5	1.6
Partial postcode only, e.g. L42	91	72.5	3.3
Entire data file	56,176	73.3*	1.4

*Noting that this includes all the cases later excluded from analysis

2. Liverpool and Sefton Units

5196 records were not assigned Super Profile data. This represents a 97% success rate in matching the initial set of 173,125 records. As already stated above, no further attempt was made to link geodemographic data to the remaining 3% of these screening records. These were assigned to the 'dummy' Lifestyle, 'O'.

8.7 ANALYSIS OF BREAST CANCER INCIDENCE

Data were analysed collectively and by individual district, by year and by Super Profile Lifestyle group. Age-specific rates, directly age-standardised rates (using the world standard population), cumulative rates and cumulative risk statistics were all calculated in accordance with the methods discussed by Boyle and Parkin (1991) and outlined in the statistical appendix (appendix A). 95% Confidence Intervals for the Age standardised rates (ASRs) were calculated using the binomial approximation featured in the same chapter.

Population denominators used in calculations were provided by the Merseyside and Cheshire Cancer Registry. The file contains yearly estimates for each district, by sex and five-year age band. Only the figures for females were employed in this research.

Super Profile population denominators were calculated using this file. Based on each district's population breakdown by Super Profile category at the time of the 1991 Census, proportions of the overall female population by Lifestyle were calculated for each district and then applied to the subsequent yearly population estimates. Merseyside, and in particular Liverpool, has been experiencing population decline, and is expected to continue doing so (OPCS 1991). Whilst any predicted falls (or rises) in population are allowed for in the overall population denominators, it had to be assumed when dividing the data between Super Profile categories (in the absence of any additional information), that population growth and decline applied equally to all age-SES groups. It is recognised that this is probably not the case, and that if in- or out-migration are skewed towards persons of particular age or socioeconomic groups, then under- or over-estimation of some incidence rates may occur. For instance if a social grouping were to show greater than average levels of out-migration, post-1991 Census populations for that group within the district would be over-estimated and thus calculated incidence rates would be slightly lower than the 'true' figure. This possibility is returned to in the discussion of the breast cancer incidence results.

8.8 ANALYSIS OF BREAST CANCER SURVIVAL

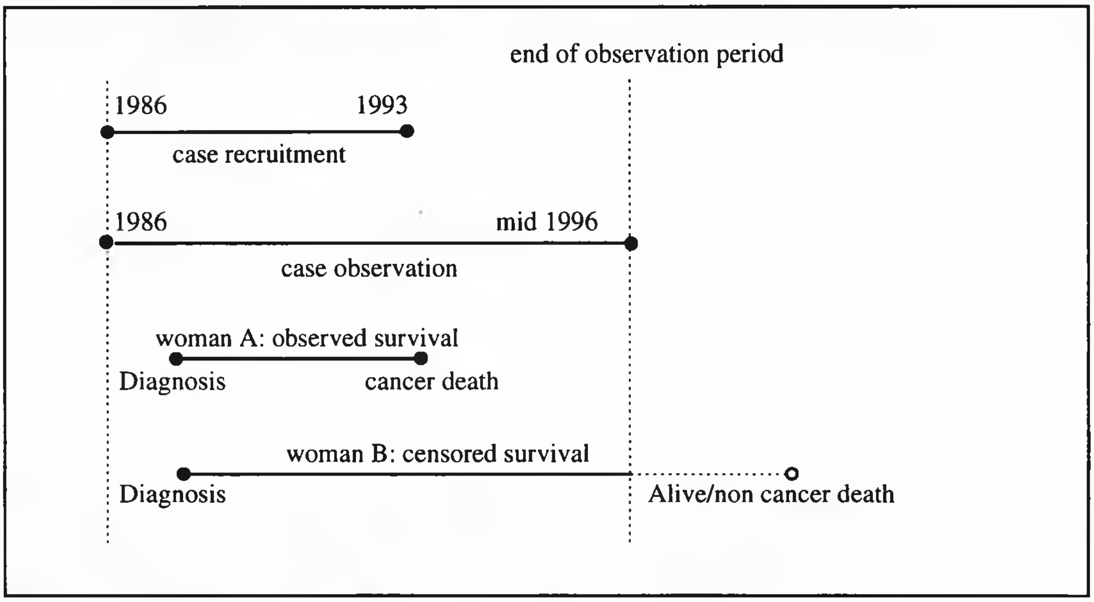
8.8.1 Records excluded from analysis

211 records (4% of the data) are Death Certificate Only (DCO) cases, i.e. recorded date of diagnosis is the same as date of death. These arise when the Merseyside and Cheshire Cancer Registry only has death certificate information for a record, despite attempts to gain complete information. These records were excluded from survival analysis, as their 'real' survival time was not known.

8.8.2 Calculation of survival times

In the analysis of survival data, allowance must be made both for observed and censored survival times. Observed times are those for which both the start and finish (death) points are known. In this research, censored times are those for which 'failure events' (death, or death from breast cancer, depending on whether crude or corrected survival was calculated; see section 8.8.3) had not been recorded by the end of the period of observation (i.e. mid 1996). Since the start ('left') time for these women is known, but their failure ('right') time is not, the survival times associated with this group are denoted as being right censored. Figure 8.1 provides a simple graphical illustration of survival time observation.

Figure 8.1 Survival data recruitment, observation period, and two example cases with observed and censored survival times



the idea for this diagram was taken from Altman (1991)

Survival time was thus calculated in two ways. For women who were recorded as having died, this time was calculated by subtracting date of diagnosis from date of death. These were usually observed survival times (but see below). For those who were, as far as recorded, alive, a right censored (i.e. minimum) survival time was calculated using date of last follow up minus date of diagnosis. In the analyses here, date of last follow-up was given as 12th June 1996, corresponding to the time the data were downloaded from the Registry's system. It is recognised that there may well have been further information on these women present in the Registry at that time, which had not yet been input to its computer system. As a result of this fact, details were not complete for all records, one example implication being that duration of survival in some women could have been overestimated. However, since the Registry processes death certificates more immediately than any other source of information (to maximise chances of successful traceback of further details), this effect on survival estimates is hoped to be small. Survival times were recorded in both weeks and years.

8.8.3 Calculation of survival rates

1. Overall (Crude) Survival

Crude survival was examined using the dead/alive flag variable as the sole means of case censoring, i.e. death, from whatever cause, was regarded as the failure event. The variable is a binary one; values of 1 indicate death and therefore observed survival times, whilst for values of 0, the cases are censored observations.

2. Corrected Survival

Corrected survival was used in this research in preference to relative survival, since the application of this latter technique is much more complex when examining socioeconomic differences in survival, requiring the construction of separate curves of 'expected' overall mortality for each SES stratum (if the results are to be properly interpreted). Here, corrected survival was examined using information from the tumour status at death variable (in conjunction with the dead/alive flag), in order that likely non-cancer deaths could be treated as censored observations. This variable is a three digit numerical field logging the level of tumour activity at the time of the patient's death. The first digit refers to the primary tumour (T), the second to the lymph nodes (N) and the third to activity of distant (metastatic) cancers (M). Information on these is derived from the death certificate, and hospital case records. Coding for each digit is as follows:

1 = disease free

2 = active, but not regarded as cause of death according to the death certificate

3 = active, and certified as cause of death

9 = not known

In consultation with the Merseyside and Cheshire Cancer Registry, which started collecting cause of death in 1994, a 'best estimate' determination of cancer versus non cancer deaths was made. Cases where any one or more digits are coded 3 were regarded as cancer deaths. Meanwhile records with TNM coding = 111 were regarded as non cancer deaths. Interpretation of tumours coded as 'active but not certified as cause of death' (2) is more problematic, but in practice the disease is usually considered to have contributed to death, especially if metastases are recorded. Thus, these cases are usually included in cancer deaths. Therefore, 185 of the non-DCO cases (section 8.8.1) with '111' coding were regarded as censored observations, all others as observed, being a mixture of probable and definite deaths due to breast cancer.

8.8.4 Examination of survival patterns

All the following methods were employed using the survival statistics options available in SPSS for Windows. Guidance in the use of all these methods was taken from Parkin and Hakulinen (1991) and Norušis (1993), in which are provided much fuller discussions of survival analysis.

1. Calculation of yearly survival rates

1, 3, 5 and, where possible, 10 year corrected survival rates were calculated for the whole group of women, and various subgroups within the data, using the Life Tables method. This assesses the number of cases dying from breast cancer during each year after diagnosis, and the number of cases remaining by the beginning of each subsequent year. Where possible, the output from this procedure also indicates the median survival time for a given group. This is the time at which 50% of a given group had died from breast cancer.

2. The comparison of survival amongst categories of individual variables

Kaplan-Meier analysis was used to generate survival curves for the full group of women, but more specifically to stratify by category of each individual variable. These curves greatly assist in the visualisation of the variations in survival amongst different subgroups. To examine the statistical significance of the survival patterns between categories, the log-rank test facility was used, in two ways. Firstly, log-rank tests examined whether the differences in survival between each category and each other category of a given variable were significant. Secondly, the tests were used to examine whether there was a significant trend in survival from the first category to the last. Indications of statistical significance, or otherwise, are given in the output from the procedure by p values, with p less than or equal to 0.05 used as significance level here. The Kaplan-Meier and log-rank tests served as initial indications as to what predictive value any given single variable might have in subsequent regression modelling.

3. The predictive effect of individual and multiple variables on survival outcomes

The Cox Proportional Hazards model, a form of multiple regression derived specifically for survival analysis (to take into account both observed and censored times), was used to examine a number of potential independent variables (covariates) in combination. Corrected survival times were used as the dependent variable in all these analyses. The method of covariate entry chosen was forward stepwise, in which variables were considered one at a time for entry into the model. After the addition of each variable to the model, all the variables already in the model are examined for removal. This process continues until no more variables can be entered into or removed from the model, based on its detailed statistical criteria.

An assumption of Cox regression, as it is also known, is that for any two cases, or categories within a variable, the ratio of the estimated hazard (risk of dying) is constant across time, i.e., the hazards for the two are proportional, hence the name of the model. This assumption can be tested relatively easily, in this research using the log-minus-log survival plots facility in SPSS. If the curves for a given variable's categories are parallel to one another on the resulting graphs, the proportional hazards assumption has been met. This test was applied to all the variables used in survival analysis, and all met this assumption.

8.8.5 The definition of the four broader SES bands used in survival analyses

In some sections of survival analysis, particularly in the visualisation of survival differences between the socioeconomic groups, the use of 12 categories (Lifestyles A to K, and the 'dummy' Lifestyle, O) was too unwieldy. Therefore, in graphical presentation of the socioeconomic dimension of survival, four broad SES categories were used. These SES groups were constructed by grouping the 40 original Target Markets according to the nested means of their income levels. Table 8.5 lists the original Target Markets which composed each of the four new categories.

Table 8.5 The Target Markets aggregated to form the four broad category SES variable used in the survival analyses

Target Market based category	Original Target Markets included	Lifestyles involved
1 (high SES)	A1 to D8	A, B, D, E
2	D9 to G22	B, C, D, E, F, G
3	G23 to H33	D, E, F, G, H, J
4 (low SES)	I34 to J40	H, I, J

8.9 ANALYSIS OF BREAST SCREENING UPTAKE

8.9.1 The definition of 'uptake' of invitations

The term 'uptake' (of breast screening, by a population) may refer to two related concepts. The first, coverage, is the percentage of the eligible population who attend an appointment for a mammogram. Closely related, but not identical, is the measure of compliance, which is the percentage of the *known* eligible population who attend for screening. Women eligible in age, but not registered on the NHS lists used as the basis for screening invitations, miss out when invitations are sent. The relative numbers of these women are hard to quantify. Uptake rates based on compliance are much simpler to calculate, since denominators are known. All uptake rates presented in this thesis refer to compliance, rather than to absolute coverage.

8.9.2 The definition of nonattenders

It has already been documented (section 8.5.4) that certain records were removed prior to analysis. For example, it is obviously not appropriate to retain episodes relating to women found to have died before or around the time their invitation was sent. Of the remaining, invitation episodes, all women who did not attend the appointment, for whatever reason, are counted as nonattenders. This includes women who declined an appointment in the self-stated grounds that they had been recently screened. Whilst many of these women may indeed have had at least one prior mammogram (for example, privately, or at another unit in the UK, if they were previously resident or GP-registered elsewhere), the fact or degree of recency of this attendance is not known to the unit issuing the invite. Therefore, for the purposes of the Breast Screening Programme uptake calculations, self-declared "Recently Screened" women are usually included as nonattenders (Mersey Breast Screening Quality Assurance Reference Centre, personal communication).

However, it was a separate point of interest in this research to look at the socioeconomic distribution of these "Recently Screened" women. Assuming the truthfulness of their statements of having had previous recent mammograms, the socioeconomic distribution of these women was examined, to determine whether this reinforced or reduced any differences found between socioeconomic groups in the main analyses of uptake.

8.9.3 Statistics used to examine uptake

Low and high uptake, in relation to the National Health Service Breast Screening Programme's 70% target, was analysed by calculating the following statistics for each subgroup of the data:

1. simple uptake rates (percentages)

2. 95% confidence intervals around the uptake rates. Where the denominator (number of invites) was 100 or greater, these were calculated by the method given in Gardner and

Altman (1989), and outlined in Appendix A. For subgroups with denominators of less than 100, the same calculation does not provide accurate enough intervals, and therefore 95% confidence intervals in these cases were taken manually from the Geigy Scientific tables (Lentner, 1982), pages 89-102.

3. the signed chi-squared (χ^2) measure, to indicate whether uptake was high or low to a significant degree. The sign of χ^2 is given by the sign of (attenders - expected attenders). Thus, when the number of attenders is greater than that expected, χ^2 is positive; conversely when expected attenders exceed actual attenders in number, χ^2 is negative. In this research a minimum of 17 invitees per census ED or socieconomic category is required to calculate the χ^2 statistic.

Measures 2 and 3 achieve similar aims, in that both provide an indication of whether uptake was significantly lower or higher than 70%. The χ^2 measure provides the better 'quick reference', and also has the benefit of indicating whether findings are significant to a much greater degree of certainty, for example 99.99% ($p = 0.001$). Meanwhile, the use of confidence intervals additionally indicates whether uptake rates between different socioeconomic and/or age groups are significantly different from one another. Since this thesis is potentially of interest to a range of audiences with different backgrounds, both approaches have been adopted, and are presented in parallel.

8.9.4 Subdividing the data

i) by time period

Individual rounds of screening were selected in accordance with the episode batch numbers.

ii) by age group

Age was not directly available in the screening datasets. Therefore, it was calculated using the year of the screening invitation and the year of birth of each woman. The ages derived for the Liverpool and Sefton data will be an almost exact match with the real ages of the women, since screening years here run from early January to early January. However, it is recognised that some error was introduced when calculating ages of Wirral invitees. At the Wirral unit, the screening years are not concurrent with calendar years, since they run from early May. Therefore, for example, the screening year classed for age calculations as 1990, commenced 4 months later than the calendar year 1990. The effect on calculations is that women born between January and April will have had their age at time of screening under-estimated by one year. Since ages were then grouped into 5 year bands, however, this under-estimation will not matter in most cases, as women will usually be grouped within their true 5 year age band. Exceptions to this occur at the boundaries between age bands. For example, approximately one third of Wirral invitees who were actually 55 at the time of screening will have erroneously been calculated as being aged 54, and therefore will have been counted with the 50-54 age group rather than the 55-59 age group. However, the screening results presented in chapter 11 do not appear to have been greatly influenced by this known source of error in Wirral based age calculations.

iii) The identification of women appearing in both rounds, or one round only

Women invited during both rounds, and those appearing in only one, were identified by matching (separately for each unit) the NHS numbers of the women in each screening round against each other.

CHAPTER 9

RESULTS OF THE ANALYSES OF BREAST CANCER INCIDENCE

RESULTS OF THE ANALYSES OF BREAST CANCER INCIDENCE

Incidence was analysed for each district and then by Lifestyle within district over the whole time period for the data (1986-93), and then for two more and less recent groups of years, approximating to 'pre-screening' and 'during-screening' times. The results are presented and discussed in order as follows, each of the first four sections being divided into i) overall rates/risks and ii) age-specific rates

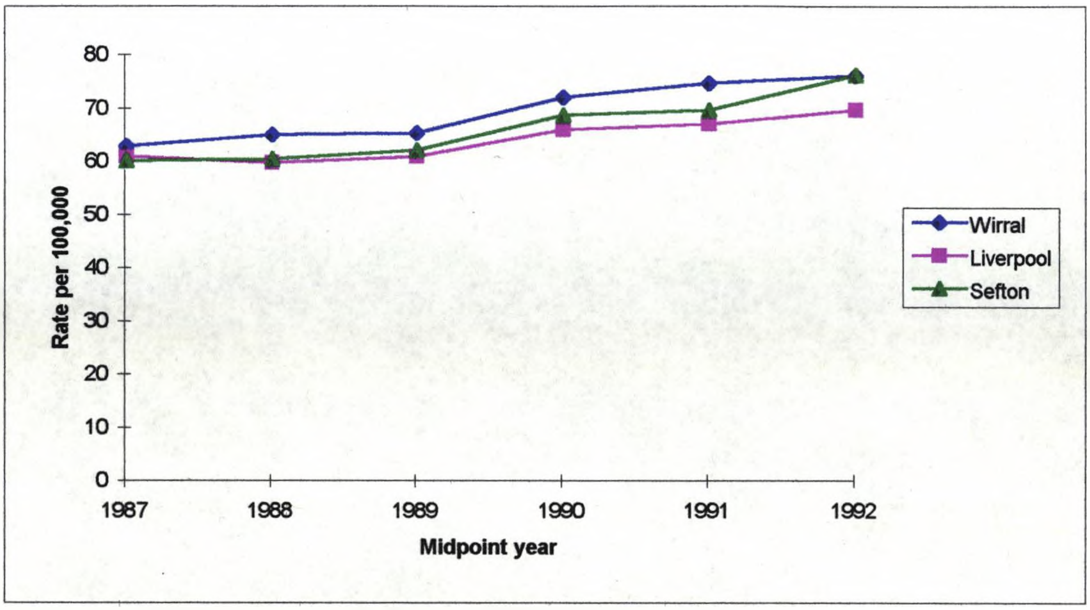
1. Breast cancer incidence by district, 1986-93
2. Incidence by Super Profile Lifestyle, 1986-93
3. Breast cancer incidence by district, in years before and after the introduction of routine breast screening
4. Incidence by Super Profile Lifestyle, before and after the introduction of routine breast screening
5. Comments on the high proportion of Liverpool cases unmatched to Super Profile codes
6. Summary of findings

9.1 BREAST CANCER INCIDENCE BY DISTRICT, 1986-93

9.1.1 Overall rates

Figure 9.1 shows the Age Standardised Rates (ASRs, world population), calculated as 3 year moving averages, for each of the districts over the whole time period studied, with the related figures shown in table 9.1. Overall, incidence has been increasing slightly year on year over that period in each of the districts. This is in line with the general trend mentioned in chapter 2. ASRs for Wirral are the highest until 1992, when the rate for Sefton was exactly equal, at 75.9 per 100,000 person-years. Incidence in Liverpool is generally slightly lower than in either Wirral or Sefton. Differences between Wirral and Liverpool are as expected, based on data for 1987-91 published in the Merseyside and Cheshire Cancer Registry's Breast Cancer Bulletin (1994). Meanwhile since the current Sefton District's figures are an amalgamation of the old Sefton (with a lower Standardised Registration Ratio than the Merseyside and Cheshire average) and Southport and Formby (with the highest SRR in the Registry's area) districts, an intermediate position in this research with regard to overall rates is unsurprising.

Figure 9.1
Age Standardised Rates of breast cancer per 100,000 (3 year moving averages) for each district, 1987-1992



Standardised to the World Standard Population, as with all ASRs for this research

Table 9.1 Age Standardised Rates of breast cancer per 100,000 (3 year moving averages) for each individual district and the three combined, 1987-1992, with 95% Confidence Intervals

	Wirral		Liverpool		Sefton		All three	
	ASR	**(95% C.I.)**	**ASR**	**(95% C.I.)**	**ASR**	**(95% C.I.)**	**ASR**	**(95% C.I.)**
1987	**62.5**	(56.6, 68.5)	**60.6**	(55.4, 65.8)	**59.8**	(53.6, 66.0)	**61.0**	(57.7, 64.3)
1988	**64.7**	(58.7, 70.6)	**59.4**	(54.2, 64.6)	**60.1**	(53.9, 66.4)	**61.3**	(58.0, 64.6)
1989	**65.0**	(59.1, 71.0)	**60.6**	(55.4, 65.8)	**61.7**	(55.4, 68.1)	**62.3**	(59.0, 65.7)
1990	**71.8**	(65.5, 78.0)	**65.6**	(60.2, 71.0)	**68.3**	(61.7, 75.0)	**68.3**	(64.9, 71.8)
1991	**74.3**	(67.9, 80.7)	**66.8**	(61.4, 72.2)	**69.3**	(62.6, 76.0)	**69.9**	(66.4, 73.4)
1992	**75.9**	(69.5, 82.3)	**69.4**	(63.8, 75.0)	**75.9**	(68.8, 82.9)	**73.2**	(69.5, 76.8)

All ASRs are slightly higher than the 58.5 per 100,000 given for the whole region for 1987-91 (Merseyside and Cheshire Cancer Registry 1994). Looking at the 95% confidence intervals for all the districts combined, it is seen that the ASRs are not significantly different from 58.5 for 1987 and 1988. Wirral's confidence interval for 1987 also includes this value. Figures for both Liverpool and Sefton do not significantly deviate from 58.5 during 1987-1989 inclusive. Overall, figures are therefore reasonably in accordance with those expected, based on existing knowledge of incidence in Merseyside and Cheshire, but also show a continuing trend towards increasing incidence of breast cancer. For instance, the cumulative lifetime risk of developing the disease before the age of 75 was between 1 in 14 and 1 in 15 in the three districts during 1986-88. By 1991-93 this risk had risen to around 1 in 12 (table 9.2).

9.1.2 Age-specific rates

Table 9.2 contains the age-specific incidence rates (3 year moving averages) for the three districts combined, plus the calculated cumulative (lifetime) rates and risks (of developing breast cancer) up to the age of 74. The most recent set of age-specific rates in table 9.2 are plotted in figure 9.2, alongside rates in the whole of Merseyside and Cheshire for the period 1990-94.

The combined pattern for all three districts is as anticipated; the disease is rare before the age of 30 (no records in the dataset concern people aged under 20), a sharp rise occurs towards 40, continuing though at times less steeply towards and beyond the menopause, with a peak in incidence at age 60-64. Age-specific rates then decline again before showing another upturn around the age of 75, after which they climb rapidly once more. In many age groups the Wirral + Liverpool + Sefton area of Merseyside and Cheshire shows almost identical rates to those for the Registry's area as a whole over the slightly wider time period. However, around the ages of 40, 55-64 and 85+, incidence was higher in the three districts combined than the average for the whole of Merseyside and Cheshire. In the 75-79 age group, rates were noticeably lower in the three districts than the whole area (figure 9.2). Any increase in rates within particular age groups between the late 1980s and early 1990s appears to be mainly amongst women of between 50 and 74 (table 9.2).

Age-specific rates for 1991-93 inclusive were also calculated for each individual district, and are shown in figure 9.3. The tabulated rates are available for consultation in the appendix. There is no consistent relationship between Wirral, Liverpool and

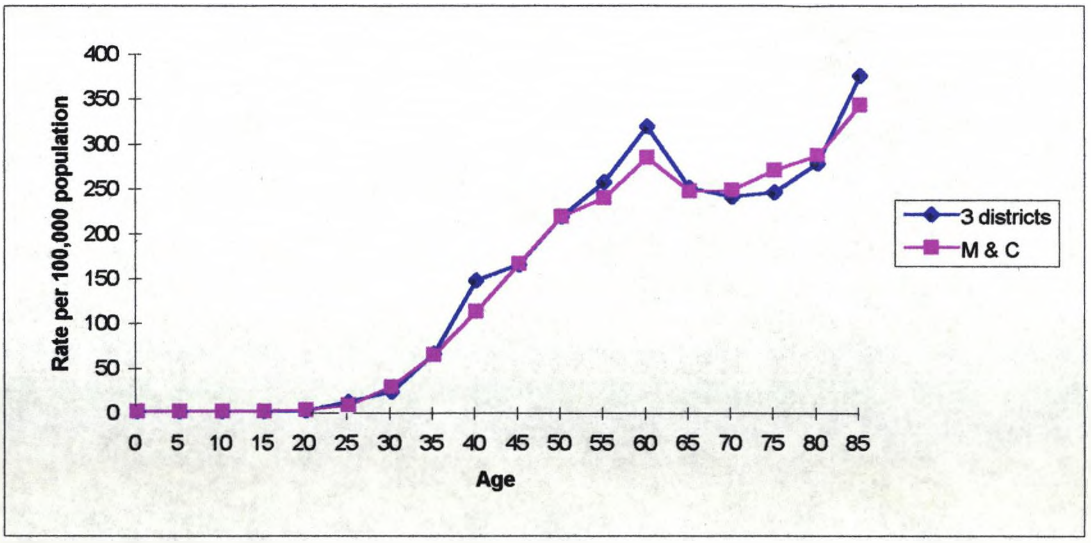
Table 9.2 Breast cancer age-specific incidence rates, cumulative rates and risks (three year moving averages) for Wirral, Liverpool and Sefton combined, 1987-92

Age-specific rates

Year (midpoint)	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus
1987	1.4	9.4	25.3	64.1	92.2	169.1	197.3	212.9	208.3	197.4	221.5	249.1	257.7	320.5
1988	1.5	11.5	31.9	55.6	101.3	162.5	194.0	201.9	207.7	214.7	215.2	258.7	282.1	316.5
1989	1.5	10.5	31.1	57.0	97.5	157.7	201.8	200.1	230.7	215.4	229.2	245.5	299.7	320.6
1990	2.3	8.1	26.8	55.9	111.7	158.0	217.5	240.5	294.1	229.6	238.7	242.4	291.0	345.4
1991	1.5	7.3	19.5	58.1	123.6	155.6	225.0	253.7	308.3	232.7	234.7	237.8	271.6	347.2
1992	.8	10.4	22.1	64.3	146.2	163.9	217.2	255.6	317.5	249.2	239.3	244.6	276.5	374.5

Year (midpoint)	Cumulative rate (0-74)	Cum. risk (0-74)
1987	7.0	6.8
1988	7.0	6.7
1989	7.2	6.9
1990	7.9	7.6
1991	8.1	7.8
1992	8.4	8.1

Figure 9.2 Age-specific incidence rates for the 3 districts combined, 1991-93 compared with rates for the whole of Merseyside and Cheshire, 1990-94

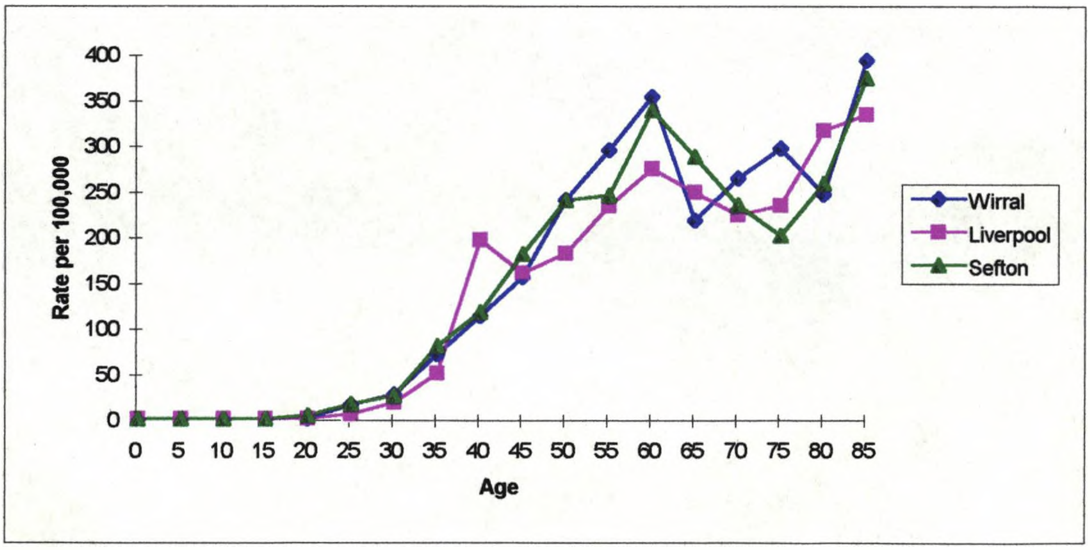


M & C: Merseyside and Cheshire

Data source for Merseyside and Cheshire rates: Cancer Registry 1997 (unpublished)

Figure 9.3

Age-specific incidence rates in Wirral, Liverpool and Sefton individually, 1991-93



Sefton with regard to age-specific rates, although figures are in reasonable agreement for younger women and in all areas there is the characteristic peak at the age of 60-64. Wirral and Sefton tend to have the highest age-specific incidence rates, particularly in the 50-64 age ranges where cases are concentrated (and indeed upon which screening is focused). Much of the fluctuation in the curves is to be expected, as inevitably, smaller numbers are involved than is the case for figure 9.2.

9.2 INCIDENCE BY SUPER PROFILE LIFESTYLE, 1986-93

9.2.1 Overall rates and risks

Figures 9.4 to 9.6 show the Age Standardised Rates (ASRs) by Lifestyle, for the period 1986-1993 inclusive in Wirral, Liverpool and Sefton separately. Figure 9.7 compares the results for the three, showing the cumulative risks of developing breast cancer by the age of 74 amongst the Lifestyles. The figures behind these four graphs are listed in tables 9.3 and 9.4.

With regard to Age Standardised Rates (ASRs), a similar general pattern appears for each area. Immediately it is evident that rates are by far the highest amongst women in Affluent Professional areas (Lifestyle A). ASRs for Lifestyle B, the Better Off Older People, are lower, but still significantly higher than for any of the other categories (with the exceptions of women resident in Wirral Lifestyle E EDs, and those in unclassified EDs in Sefton, due to the wide confidence intervals associated with these

Figure 9.4 Wirral, ASRs per 100,000 by Super Profile Lifestyle, 1986-93

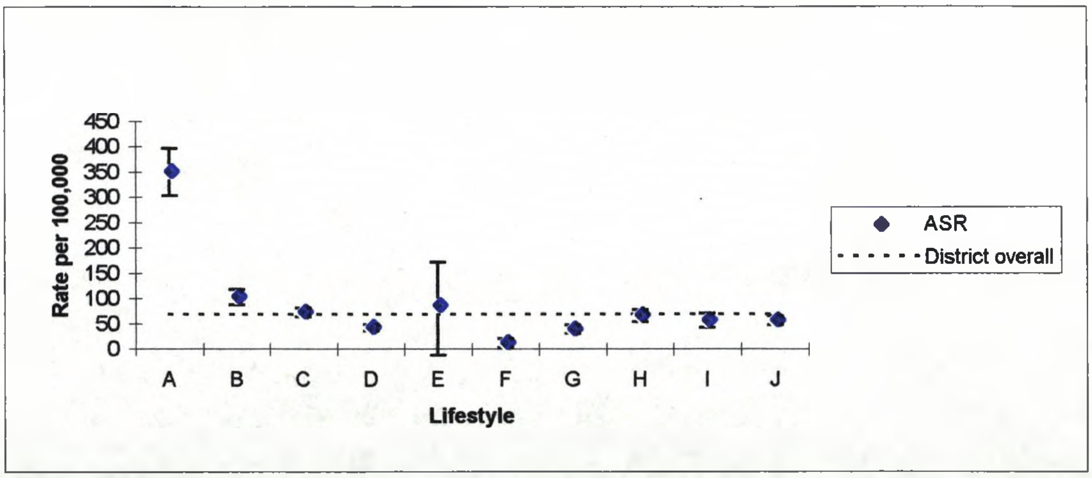


Figure 9.5 Liverpool, ASRs per 100,000 by Super Profile Lifestyle, 1986-93

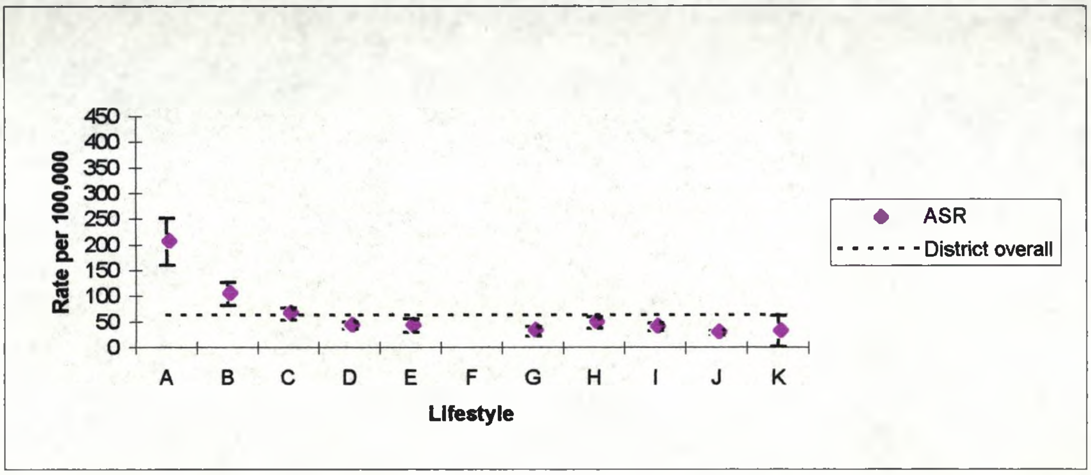
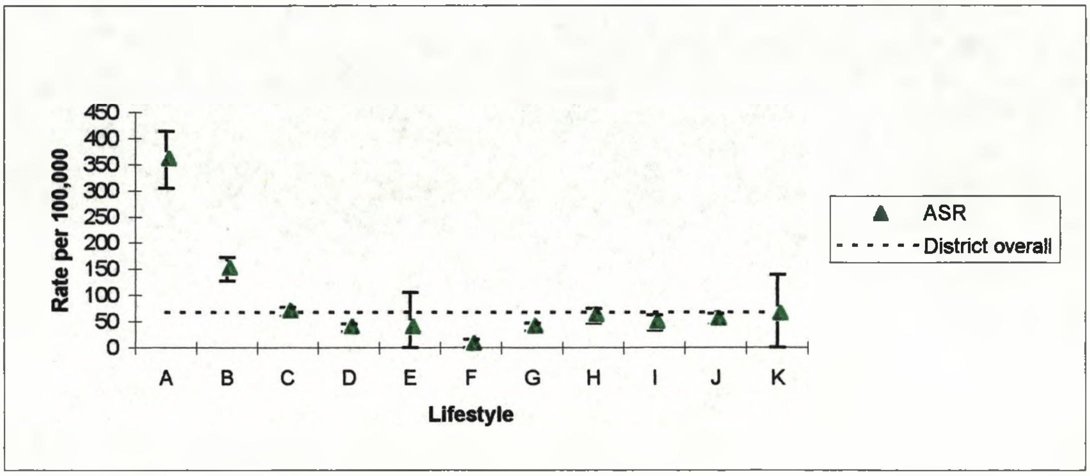


Figure 9.6 Sefton, ASRs per 100,000 by Super Profile Lifestyle, 1986-93



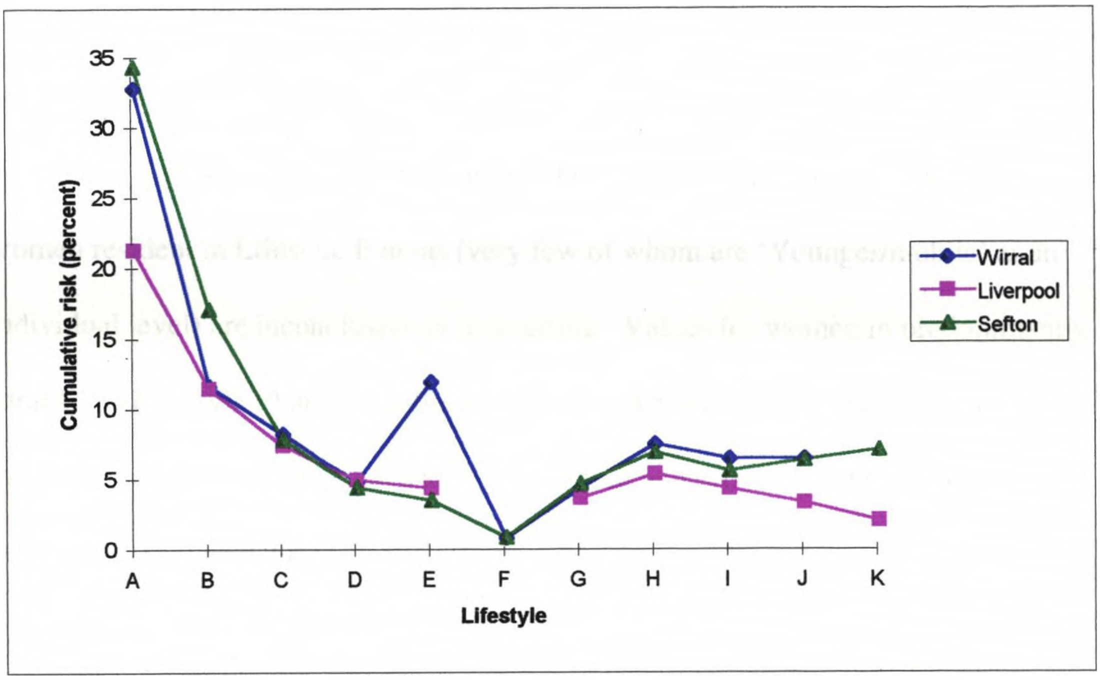
Error bars indicate 95% Confidence Intervals

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons

F: Rural communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households

K: Unclassified

Figure 9.7
Cumulative risk of developing breast cancer by the age of 74, by district and Lifestyle 1986-93 inclusive



A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified

groups). At the more affluent end of the Lifestyle classification, a notable trend of significantly decreasing incidence from group A to group D (the Better Off Young Families) is evident.

Values for Lifestyle E (Younger/mobile persons) and F (Rural Communities) are more variable and less reliable, due to smaller numbers (few Younger/mobile persons EDs in Wirral and Sefton, no Rural Communities EDs in Liverpool). Figures relating to women resident in Lifestyle E areas (very few of whom are 'Younger/mobile' at an individual level) are inconclusive in this setting. Values for women in predominantly rural EDs (Lifestyle F) are available for Wirral and Sefton, and would seem to indicate that breast cancer incidence rates are the lowest in non urban women, although this cannot be firmly concluded in this setting.

Within the less affluent half of the Lifestyle groups, although the ASRs are significantly lower than at the very top end of this socioeconomic scale, a slightly different picture emerges. Rates for women assigned to Lifestyle H (Blue Collar Families) EDs are higher than those amongst Lifestyle G (Lower Income Elderly) women, significantly so in Wirral and Sefton (table 9.3). Moving to the poorest end of the spectrum, values for groups I (Lower Income Families) and J ('Have Nots' Households) are lower than for Lifestyle H, though it is variable as to whether the ASR is slightly lower in the Lower Income Families or the Have Nots Households. In no district are the values for Lifestyles I and J significantly different from each other.

Table 9.3 ASRs per 100,000 by Lifestyle (with 95% Confidence Intervals) for each district, 1986-93 inclusive

	Wirral		Liverpool		Sefton	
Lifestyle	**ASR**	**(95% C.I.)**	**ASR**	**(95% C.I.)**	**ASR**	**(95% C.I.)**
A	**349.8**	(302.5, 397.1)	**205.4**	(159.7, 251.0)	**359.2**	(304.9, 413.4)
B	**102.3**	(87.3, 117.3)	**104.6**	(82.2, 127.0)	**149.8**	(126.7, 172.9)
C	**72.3**	(63.6, 81.1)	**65.2**	(53.5, 76.9)	**68.3**	(59.7, 76.9)
D	**42.1**	(35.9, 48.4)	**42.5**	(35.6, 49.3)	**38.0**	(31.1, 44.9)
E	**85.6**	(0.0, 183.3)	**42.2**	(29.2, 55.2)	**37.6**	(0.0, 105.5)
F	**11.5**	(3.2, 19.8)	-		**6.0**	(0.0, 16.2)
G	**38.5**	(30.6, 46.3)	**31.7**	(22.6, 40.9)	**39.1**	(32.1, 46.1)
H	**65.5**	(53.5, 77.5)	**48.0**	(37.0, 58.9)	**60.7**	(47.0, 74.5)
I	**55.8**	(41.7, 69.9)	**39.4**	(32.2, 46.6)	**47.7**	(32.6, 62.8)
J	**56.3**	(47.3, 65.3)	**28.9**	(25.4, 32.4)	**54.2**	(44.1, 64.2)
K	-		**31.5**	(0.8, 62.3)	**64.0**	(0.0, 139.6)

Table 9.4 Cumulative risk (0-74 years) by Lifestyle within each district, 1986-93 inclusive

Lifestyle	Wirral	Liverpool	Sefton
A	32.7	21.2	34.2
B	11.5	11.3	17.0
C	8.1	7.3	7.8
D	4.7	4.8	4.3
E	11.8	4.3	3.4
F	0.7	-	0.8
G	4.2	3.5	4.6
H	7.4	5.3	6.8
I	6.3	4.2	5.5
J	6.4	3.2	6.3
K	-	2.0	7.0

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified EDs

Overall, the general pattern is one of a rapid decrease in ASRs from Lifestyle A through to D, with lowest rates in rural women where present, followed by a small rise through Lifestyle G to H, then slightly lower rates once more in the most deprived Lifestyles, I and J. In each district, ASRs in the most affluent Lifestyle, A, are 6 to 7 times higher than those for J, the least affluent Lifestyle. However, the difference between the highest (Lifestyle A) and lowest absolute values for the ASRs by Lifestyle are even wider in two cases. Whilst in Liverpool the ASR for Affluent Professionals (A) is six and a half times higher than that for Lifestyles G (Lower Income Elderly) and K (Unclassified EDs, about which no conclusions can be made), the difference between A and F (Rural Communities) in Wirral and Sefton is greater. In these districts, the ASRs for Lifestyle A are 30 and 60 times greater, respectively, than those for Lifestyle F.

Whilst the relative positions of the Super Profile Lifestyle groups are similar between the districts when Age Standardised Rates are examined, there are differences in the absolute values. In Wirral and Sefton, ASRs for women in the Affluent Professional Lifestyle (A) are significantly in excess of 300 per 100,000, corresponding to a cumulative risk (0-74 years) of around 33%, i.e. a 1 in 3 chance of developing the disease before the age of 74 (Tables 9.3 and 9.4). In Liverpool, the ASR for Lifestyle A for 1986-93 inclusive was lower, at 205.35 per 100,000, corresponding to a 21% chance (1 in 5) of developing breast cancer by the age of 74. With the current total lifetime (by the age of 75) risk for the disease being around 1 in 12 (table 9.2, Merseyside and Cheshire Cancer Registry 1994), it is very evident that Affluent

Professional women appear to be at a greatly increased risk of experiencing breast cancer.

A higher than average risk also applies to women in Lifestyle B, the Better Off Older People. Sefton district has the highest values for this group, the cumulative risk (0-74) being 17% (around 1 in 6). In Liverpool and Wirral the calculated risks are lower and very similar to each other, with cumulative risks of around 11.5% (slightly less than 1 in 9).

Within all the other Lifestyle groups, risks approximate to one in twelve, or less. Elevated incidence appears to be almost exclusively confined to the two most affluent groups. Women living in Settled Suburban EDs (Lifestyle C) most closely mirror the overall picture, though again there is between-district variation in the results of incidence calculations. Rates are highest for this group of women in Wirral, with just under a 1 in 12 risk of the disease by the age of 74 (table 9.4). In Sefton the value is slightly lower, at around 1 in 13, whilst in Liverpool the calculated cumulative risk corresponds to approximately a 1 in 14 likelihood.

Absolute incidence rates and risks are variable through the middle and lower range of the Super Profile Lifestyle rankings, though all are lower than the currently accepted mean for all women combined (excepting Lifestyle E cases in Wirral, although the rate for these is based on very small numbers). After the Settled Suburbans (Lifestyle C), women in Lifestyle H (Blue Collar Families) would appear to have the next highest point estimates of lifetime risk, of between 1 in 13 and 14 women in Wirral and 1 in 19 in Liverpool. Where present, the calculated risk for women in Lifestyle F is notably lowest, with an estimate of less than one “Rural Communities” woman in every 133 expected to develop the disease by age 74. However, interpretation of this is reserved in the light of fairly small numbers of associated cases. Elsewhere, rankings of Lifestyles by risk level is not constant, ranging from a cumulative risk of 6.4% (roughly 1 in 16 chance) for women in Lifestyle J EDs in Wirral to a risk of 3.2% (less than a 1 in 31 chance) for women in the same Lifestyle resident in Liverpool. This is excluding estimates for women in unclassified EDs or those assigned to Lifestyle E in Wirral and Sefton districts, due to particularly unstable point estimates.

9.2.2 Age-specific rates

Age-specific rates by Lifestyle were calculated, and are available for consultation in appendix B, along with the numbers of breast cancer registrations in each age group and Lifestyle over the whole time period studied. The patterns are not presented in graphical form, due to their visual complexity (what with 10 or 11 strata) that would result, and, in particular, in view of the statistical instability of the point estimates in many cases where Lifestyle-age group populations are small. However, an examination of age-specific rates by Lifestyle was made, to assess whether elevated incidence in the more affluent groups, as seen in section 9.2.1, was due to especially high rates in some age groups, or to generally higher incidence across the whole age spectrum.

The pattern of Lifestyle-specific increase in incidence with advancing age is smoothest in Wirral. Age-specific rates amongst Affluent Professionals are notably higher than in all other groups with the exception of a sudden apparent peak in 70-74 year olds assigned to Lifestyle E (Younger/mobile persons). Amongst women in the top Lifestyle, a slight rise in incidence occurs all the way up to the age of 75-79, following which there is a small drop, before a very steep climb in women aged 85 and over. Rates for all the other Lifestyles are much lower and closer, though those for Lifestyle B are generally the highest of the rest, followed by the Settled Suburbans (Lifestyle C). The entirety of Younger/mobile persons registrations (Lifestyle E) occur in three specific age groups: 35-39, 50-54 and 70-74, and in fact there is only one case in each. This, and the relatively small population belonging to that Lifestyle on the Wirral, make the resultant estimates unreliable. There are also few registrations, in distinct age groups, for Rural Communities women (Lifestyle F), these being at 50-54 and over 70. The population denominators for this group are larger than for Lifestyle E, however.

Meanwhile, age-specific incidence rates by Lifestyle fluctuate much more in Liverpool and Sefton, even though in both these districts, as on the Wirral, certain general features can be picked out. Rates for Affluent Professionals are usually much higher (though for 50-54 year olds in Liverpool the point estimate drops below that for Lifestyle B). Better Off Older People (B) usually have the next highest rates, followed by the Settled Suburbans (Lifestyle C), the other Lifestyles having lower and closer patterns. In Liverpool, where there is a larger population and number of registrations associated with Lifestyle E than in either Wirral or Sefton, rates are close to many of the others in the less affluent two-thirds of the Lifestyles. In Sefton, Lifestyle E registrations (two in total) appear in the 50-54 and over 85s age groups only. Thus prominent but unstable ‘peaks’ in incidence occur at these points.

Overall, from examining age-specific breast cancer rates by Super Profile Lifestyle in each district, it can be seen that higher incidence in the top three Lifestyles, and particularly amongst the Affluent Professionals, occurs throughout most of the age range and that their elevated ASRs are not due to an extraordinarily high occurrence of the disease in specific age groups and relatively ‘normal’ ones in others. There is much less difference apparent between age-specific incidence amongst Lifestyles in the middle ground and more deprived end of the scale.

9.3 BREAST CANCER INCIDENCE BY DISTRICT, BEFORE AND AFTER THE INTRODUCTION OF NATIONAL SCREENING

9.3.1 Overall rates

To examine patterns of incidence in a little more detail, rates for each district were calculated for the time periods prior to and after the commencement of routine breast screening. In Liverpool, the years 1986-88 inclusive are those for which pre-screening calculations were made. In Sefton and Wirral, where the units opened a year later, data for 1986-89 inclusive have been used. It is recognised that, even in the more recent years, screening has predominantly been offered to women in the 50-64 age range, and that of course many women of this age would not immediately be offered or choose to undertake a mammography examination. However, dividing the data into ‘pre-screening' and 'during-screening' years was thought to be a sensible and useful option in assessing recent local patterns of breast cancer incidence.

Age standardised incidence rates increased in all districts between the 'pre-screening' and 'during-screening' groups of years (table 9.5). For Sefton, the increase was statistically significant. The detection of cancers through mammography will have contributed towards this rise, although much of the increase reflects the general trend in incidence.

Table 9.5 ASRs per 100,000 for each district (with 95% Confidence Intervals) in the years before and after the introduction of screening

	Prior to screening			Screening in operation			
	ASR	(95% C.I.)		ASR	(95% C.I.)		% increase
Wirral	**64.1**	(59.0,	69.3)	**74.1**	(68.6,	79.6)	15.5
Liverpool	**60.6**	(55.4,	65.8)	**65.8**	(61.6,	70.1)	8.6
Sefton	**60.8**	(55.4,	66.2)	**72.8**	(66.8,	78.8)	19.7*
All three districts	**61.9**	(58.9,	64.9)	**69.9**	(67.0,	72.8)	13.0*

* denotes a significant increase

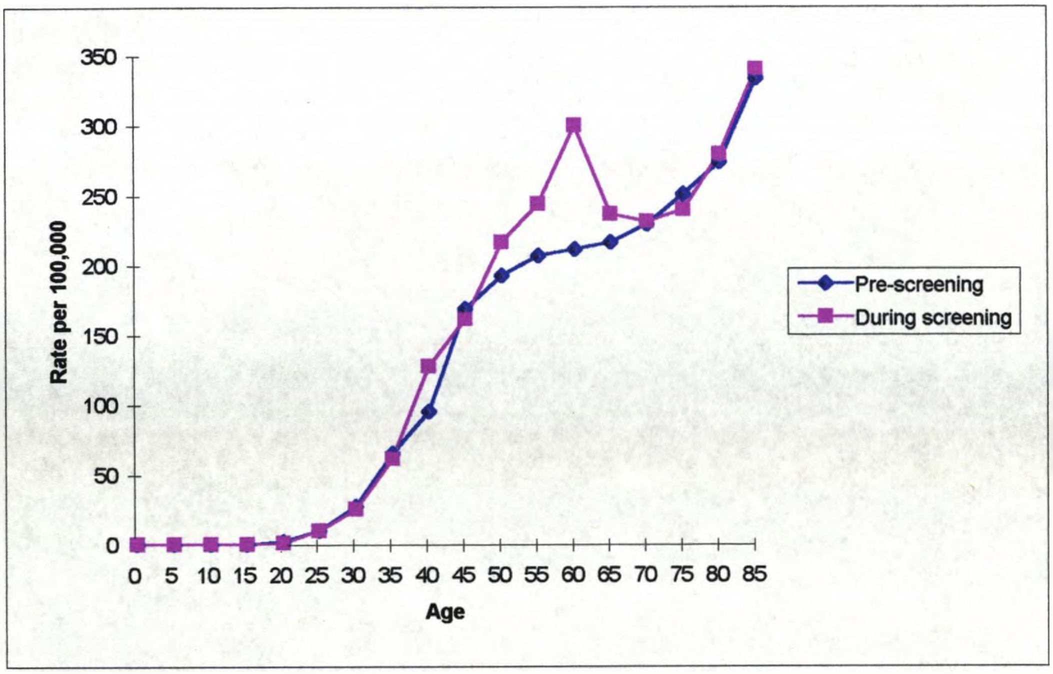
9.3.2 Age-specific rates

Figure 9.8 illustrates the change, for the three districts combined, in age-specific incidence rates for the pre- and during-screening time periods. It is immediately apparent from this that the major overall increases have occurred in the 40-44 and 50-69 age ranges (in which estimated populations and registration rates both increased). In all the other age groups, rates changed relatively little between the two time periods, even falling slightly in the 45-49 and 75-79 age groups. However, these changes are not always consistent between the districts, as discussed shortly.

Tables 9.6 to 9.8 show the age-specific incidence rates in the separate districts in their pre- and during-screening years, as well as the calculated cumulative rates and risks, and the number of breast cancer registrations by age group for each time period. Age-specific rates within a relatively small area, such as a district, are subject to fluctuations over short time periods, that are not necessarily reflective of wider trends. Thus, the changes in rates for Wirral, Liverpool and Sefton individually are not presented graphically, but are discussed below.

The pattern of change in Sefton's age-specific rates between the earlier and later time periods was the simplest of the districts (table 9.8). Calculated incidence increased in all ages except the 75-79 year olds; with a more or less identical population in this age group in both pre- and during-screening years, the decrease was due to fewer registrations for 1990-93 than for 1986-89. The absolute registration change was small- only 9 fewer breast cancers for this age group over the more recent four-year

Figure 9.8 Age-specific incidence rates in the three districts combined, during the time periods before and after the introduction of screening in the area



Pre' screening years are 1986-88 for Liverpool, and 1986-89 for Wirral and Sefton
During' screening years are 1989-93 for Liverpool, and 1990-93 for Wirral and Sefton

period, showing the sensitivity of age-specific rates to slight changes in numerator data.

In Liverpool, age-specific incidence increased between the pre- and during-screening years amongst women of 40-44, 60-74 and more than 80 years of age (table 9.7). Calculated rates decreased in all other age groups, despite a larger number of registrations in the more recent time period. The explanation behind this is in terms of the balance between registrations and population denominators. Although Liverpool has experienced notable population decline in relation to the rest of the country (OPCS 1991), population denominators for the later, 5 year period are inevitably larger than for the earlier, 3 year period in this district (data for Wirral and Sefton being split into two 4 year periods). A greater number of registrations is to be expected for 1990-93, both as a longer time period and if trends towards rising breast cancer incidence continue. However, the greater total number of registrations in the during-screening years has not necessarily been sufficient to result in a greater calculated risk per 100,000 person-years in many of the age groups. It is especially interesting to note that rates amongst the total group of 50-59 year olds, most of whom were presumably invited for screening at least once during 1989-93, remained similar, actually slightly lower for the during-screening years in Liverpool.

The changes in age-specific rates for Wirral, and the explanations behind them, are much more varied than in either of the other districts. Rates were observed to increase from the pre-screening to the during-screening years amongst women aged 35-39, 50-64 and 75-79 (table 9.6). The rise in the 50-64 age group is in keeping with what

Table 9.6 Wirral. Age-specific incidence rates, cumulative rates and risks, and number of breast cancer registrations in the "pre-" and "during-screening" groups of years

Age-specific rates

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
"Pre" (1986-89)	3.9	9.6	29.7	57.5	103.2	180.9	197.5	189.7	207.5	231.7	284.0
"During" (1990-93)	2.2	11.3	29.9	70.1	97.4	163.3	232.1	287.0	350.7	221.1	248.0

	75-79	80-84	85 plus
"Pre" (1986-89)	242.7	325.4	386.2
"During" (1990-93)	286.0	251.1	359.1

	Cumulative rate (0-74)	Cum. risk (0-74)
"Pre"	7.5	7.2
"During"	8.6	8.2

Number of registrations by age group

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
"Pre" (1986-89)	2	5	14	28	50	73	79	78	86	96	101
"During" (1990-93)	1	6	15	33	49	74	93	111	141	88	89

	75-79	80-84	85 plus
"Pre" (1986-89)	79	75	68
"During" (1990-93)	90	60	74

Table 9.7 Liverpool. Age-specific incidence rates, cumulative rates and risks, and number of breast cancer registrations in the "pre-" and "during-screening" groups of years

Age-specific rates

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
"Pre" (1986-88)	1.5	12.1	33.6	76.5	92.3	170.1	199.0	230.5	190.9	159.7	174.3
"During" (1989-93)	.0	6.7	23.0	51.8	160.3	143.9	195.2	227.6	253.6	231.4	206.1

	75-79	80-84	85 plus
"Pre" (1986-88)	272.9	271.0	278.4
"During" (1989-93)	232.0	308.5	300.1

	Cumulative rate (0-74)	Cum. risk (0-74)
"Pre"	6.7	6.48
"During"	7.5	7.22

Number of registrations by age group

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
"Pre" (1986-88)	1	7	16	34	37	62	78	96	81	65	63
"During" (1989-93)		7	21	39	115	88	118	143	163	149	113

	75-79	80-84	85 plus
"Pre" (1986-88)	84	57	44
"During" (1989-93)	111	108	83

Table 9.8 Sefton. Age-specific incidence rates, cumulative rates and risks, and number of breast cancer registrations in the "pre-" and "during-screening" groups of years

Age-specific rates

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
"Pre" (1986-89)	.0	7.0	15.9	61.8	88.2	153.9	179.9	199.1	239.8	263.2	231.0
"During" (1990-93)	2.6	14.1	23.9	68.2	106.6	188.3	235.9	226.8	321.5	265.1	256.0

	75-79	80-84	85 plus
"Pre" (1986-89)	234.8	217.7	328.2
"During" (1990-93)	200.9	261.7	376.4

	Cumulative rate (0-74)	Cum. risk (0-74)
"Pre"	7.2	6.9
"During"	8.5	8.2

Number of registrations by age group

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
"Pre" (1986-89)		3	6	24	35	54	63	72	85	93	70
"During" (1990-93)	1	6	10	26	42	71	82	78	115	90	79

	75-79	80-84	85 plus
"Pre" (1986-89)	64	44	52
"During" (1990-93)	55	54	75

would be expected as a combined result of general increases and the initial detection of a greater number of cancers through screening in the early years of the programme.

Figures were fairly stable for the under 35s; again this is as expected from knowledge of overall age-specific patterns for breast cancer. Elsewhere in the age spectrum, various 'irregularities' are observed, though each has its explanation. Firstly, calculated rates amongst 40-49 year olds were lower in 1990-93 than in the pre-screening years. In this case, estimated district female populations for this age group increased, but the number of registrations remained essentially constant for each time period. Secondly, amongst 65-69 year olds, the number of registrations had declined by 1990-93, as had the estimated population, the overall effect in this instance being a small drop in incidence. Third, in the oldest women (85+), both the population denominator and registrations increased, although again an overall drop in the age-specific rate was noted. Finally, the reason for lower rates in the 70-74 and 80-84 group in the during-screening time period was an increase in estimated population, combined with a decrease in registrations.

9.4 INCIDENCE BY SUPER PROFILE LIFESTYLE, BEFORE AND AFTER THE INTRODUCTION OF NATIONAL SCREENING

9.4.1 Overall rates

ASRs by Super Profile Lifestyle for the relevant pre-screening and during-screening periods are shown in figures 9.9 to 9.11, with tabulated values for these and the calculated cumulative rates and risks given in tables 9.9 to 9.11.

The shape of the pattern in overall breast cancer incidence amongst the Lifestyles was similar for the two time periods in each district. The most distinct change was that the difference in incidence between Lifestyle A (Affluent Professionals) and all the other groups widened. Looking at the absolute changes in age standardised rates, the most consistent and immediately apparent change is that the already high rates amongst women in Lifestyle A increased more than those for any other group. A few of the other Lifestyles, particularly in Sefton, had much greater *percentage* increases in their associated ASRs (table 9.12), but incidence was still much lower in these groups than in Lifestyle A. Rates amongst Lifestyle B women rose slightly in all three districts, as did those in Lifestyles D, G and I (Better Off Young Families, Lower Income Elderly and Lower Income Families). The increases in Sefton's Lifestyle D and G incidence were the only ones that were statistically significant. Meanwhile, the change amongst Liverpool's Lower Income Elderly Lifestyle was only fractional. Incidence amongst Rural Communities women (for Wirral and Sefton only), and those in "Blue Collar Families" EDs (Lifestyle H) declined slightly between 1986-88/89 and 1989/90-93.

Figure 9.9 Wirral. ASRs per 100,000 by Lifestyle, in years prior to and after the introduction of breast screening

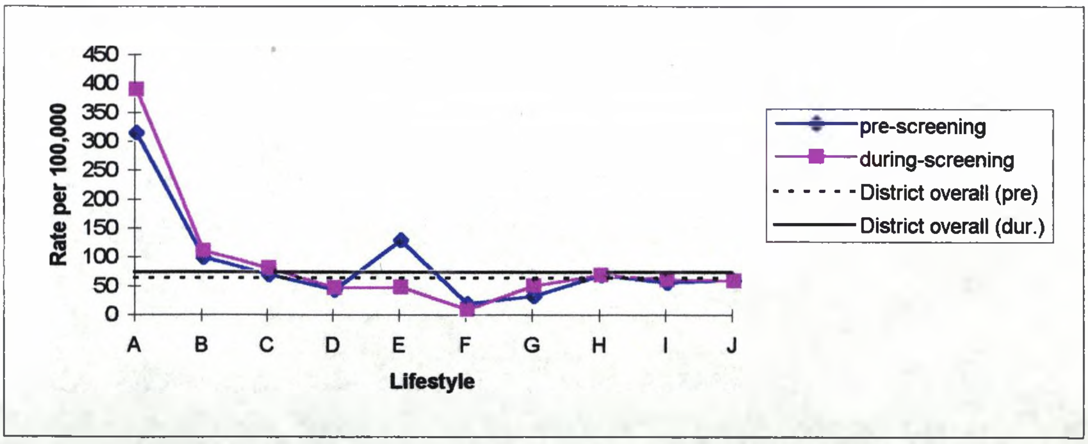


Figure 9.10 Liverpool. ASRs per 100,000 by Lifestyle, in years prior to and after the introduction of breast screening

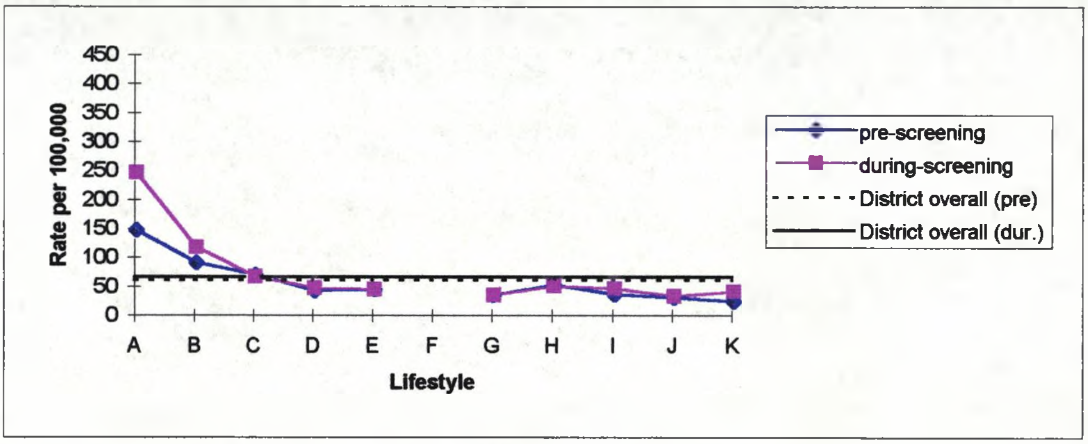
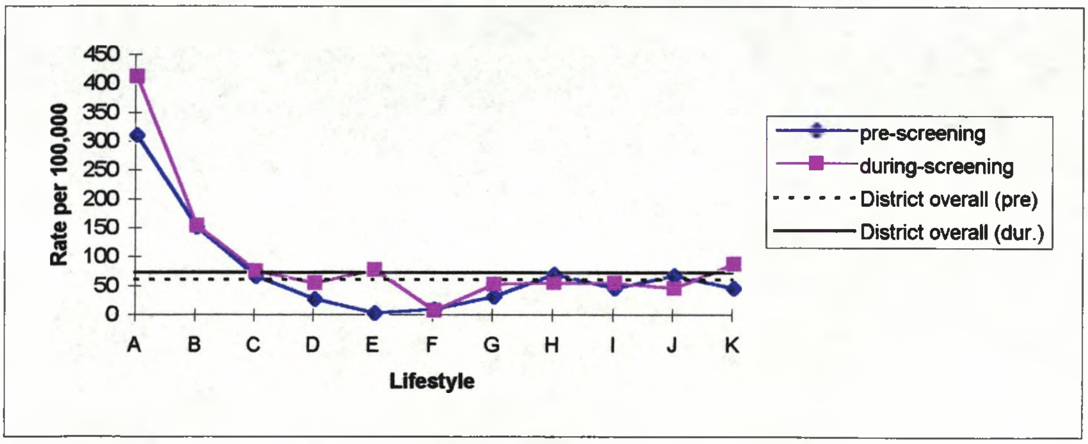


Figure 9.11 Sefton. ASRs per 100,000 by Lifestyle, in years prior to and after the introduction of breast screening



A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified

Table 9.9 Wirral. ASRs per 100,000 and cumulative rates and risks, by Super Profile Lifestyle in the "pre-" and "during-screening" groups of years

	Pre-screening years (1986-88)			During-screening years (1989-93)				
Lifestyle	**ASR**	**95% Confidence Interval**		**Lifestyle**	**ASR**	**95% Confidence Interval**		
		(low	high)			(low	high)	
A	**312.3**	246.6	377.9	**A**	**387.3**	319.3	455.3	A: Affluent Professionals
B	**96.7**	75.8	117.6	**B**	**108.4**	86.8	129.9	B: Better Off Older People
C	**67.1**	55.2	79.0	**C**	**77.9**	65.1	90.7	C: Settled Suburbans
D	**40.4**	31.8	49.1	**D**	**44.4**	35.3	53.6	D: Better Off Young Families
E	**126.5**	.0	300.6	**E**	**45.7**	.0	134.9	E: Younger/mobile persons
F	**16.5**	1.7	31.3	**F**	**6.2**	.0	13.6	F: Rural Communities
G	**29.4**	19.9	38.9	**G**	**47.7**	35.2	60.2	G: Lower Income Elderly
H	**66.3**	47.6	85.1	**H**	**65.7**	50.1	81.4	H: Blue Collar Workers
I	**53.3**	34.6	72.0	**I**	**58.2**	37.1	79.3	I: Lower Income Households
J	**57.2**	44.2	70.2	**J**	**55.8**	43.2	68.3	J: Have Nots Households

Lifestyle	**Cumulative rate (0-74)**		**Cum. risk (0-74)**	
	pre	during	pre	during
A	34.8	44.4	29.4	35.8
B	11.5	13.1	10.8	12.2
C	7.8	9.1	7.5	8.7
D	5.0	4.8	4.9	4.7
E	21.4	3.8	19.3	3.7
F	.6	.8	.6	.8
G	3.4	5.3	3.3	5.2
H	7.6	7.9	7.3	7.6
I	6.3	6.8	6.1	6.6
J	6.8	6.4	6.6	6.2

Table 9.10 Liverpool. ASRs per 100.000 and cumulative rates and risks. by Super Profile Lifestyle in the "pre-" and "during-screening" groups of years

	Pre-screening years (1986-88)				During-screening years (1989-93)			
Lifestyle	ASR	95% Confidence Interval		Lifestyle	ASR	95% Confidence Interval		
		(low	high)			(low	high)	
A	**144.5**	84.9	204.2	A	**244.1**	179.7	308.4	A: Affluent Professionals
B	**88.5**	54.4	122.7	B	**115.2**	85.5	144.9	B: Better Off Older People
C	**66.8**	46.5	87.1	C	**63.6**	49.4	77.7	C: Settled Suburbans
D	**39.5**	28.9	50.0	D	**44.5**	35.5	53.5	D: Better Off Young Families
E	**41.6**	22.0	61.1	E	**42.4**	25.3	59.5	E: Younger/mobile persons
G	**31.7**	16.3	47.1	G	**31.8**	20.4	43.1	G: Lower Income Elderly
H	**49.7**	31.7	67.7	H	**46.9**	33.2	60.7	H: Blue Collar Workers
I	**32.7**	22.5	42.9	I	**43.2**	33.5	52.9	I: Lower Income Households
J	**27.7**	22.1	33.3	J	**29.6**	25.1	34.0	J: Have Nots Households
K	**21.0**	.0	62.1	K	**37.9**	.0	80.7	K: Unclassified

Lifestyle	Cumulative rate (0-74)		Cum. risk (0-74)	
	pre	during	pre	during
A	16.5	28.6	15.2	24.9
B	10.2	13.3	9.7	12.4
C	7.7	7.5	7.4	7.2
D	4.3	5.4	4.2	5.2
E	4.6	4.2	4.5	4.1
G	3.2	3.9	3.2	3.8
H	5.6	5.3	5.4	5.2
I	3.6	4.7	3.6	4.6
J	3.1	3.3	3.1	3.3
K	1.3	2.4	1.3	2.4

Table 9.11 Sefton. ASRs per 100,000 and cumulative rates and risks, by Super Profile Lifestyle in the "pre-" and "during-screening" groups of years

	Pre-screening years (1986-88)				During-screening years (1989-93)			
Lifestyle	**ASR**	**95% Confidence Interval**		**Lifestyle**	**ASR**	**95% Confidence Interval**		
		(low	high)			(low	high)	
A	**308.1**	239.6	376.5	**A**	**409.5**	325.5	493.5	A: Affluent Professionals
B	**148.9**	116.1	181.7	**B**	**151.2**	118.4	183.9	B: Better Off Older People
C	**63.7**	52.0	75.3	**C**	**72.8**	60.2	85.5	C: Settled Suburbans
D	**23.9**	16.4	31.3	**D**	**51.6**	40.1	63.1	D: Better Off Young Families
E	**.0**	.0	.0	**E**	**75.0**	.0	210.7	E: Younger/mobile persons
F	**6.9**	.0	20.4	**F**	**4.8**	.0	19.1	F: Rural Communities
G	**28.9**	20.6	37.2	**G**	**49.2**	38.0	60.4	G: Lower Income Elderly
H	**67.8**	47.0	88.5	**H**	**53.4**	35.5	71.4	H: Blue Collar Workers
I	**43.5**	22.4	64.5	**I**	**52.3**	30.4	74.1	I: Lower Income Households
J	**65.6**	49.6	81.6	**J**	**42.8**	30.5	55.1	J: Have Nots Households
K	**43.4**	.0	147.5	**K**	**85.4**	.0	196.0	K: Unclassified

Lifestyle	**Cumulative rate (0-74)**		**Cum. risk (0-74)**	
	pre	during	pre	during
A	38.1	45.6	31.7	36.6
B	18.8	18.6	17.1	17.0
C	7.2	8.9	7.0	8.5
D	2.6	6.1	2.6	5.9
E	.0	6.9	.0	6.7
F	.9	.6	.9	.6
G	3.6	5.7	3.5	5.6
H	7.8	6.3	7.5	6.1
I	5.2	6.1	5.1	5.9
J	7.9	5.1	7.6	5.0

Changes were variable for Lifestyles C, E and J. Whilst the more recent ASRs for Settled Suburbans (C) were slightly higher in Wirral and Sefton, point estimates decreased by a small amount for Liverpool. Confidence intervals for Lifestyle E-related estimates are very wide in two of the districts as mentioned previously. In Liverpool, the ASR for this group indicated that incidence was slightly higher during 1989-93 than for 1986-88. Meanwhile, amongst the Have Nots (Lifestyle J), point estimates for the ASRs dropped slightly between the earlier and later time periods in Wirral and Sefton, but increased in Liverpool.

Table 9.12 Absolute and percentage changes in ASRs, by Super Profile Lifestyle, between each district's pre- and during-screening years

	change				% change		
Lifestyle	Wirral	Liverpool	Sefton		Wirral	Liverpool	Sefton
A	75.1	99.5	101.5		24.0	68.9	32.9
B	11.6	26.7	2.3		12.0	30.2	1.5
C	10.7	-3.2	9.2		16.0	-4.8	14.4
D	4.0	5.0	27.7*		9.9	12.7	116.0*
E	-80.8	0.8	75.0		-63.9	2.0	n/c
F	-10.3		-2.1		-62.3		-30.0
G	18.3	0.1	20.3*		62.4	0.2	70.3*
H	-0.6	-2.7	-14.3		-0.9	-5.5	-21.1
I	4.9	10.5	8.8		9.2	32.2	20.2
J	-1.4	1.9	-22.8		-2.5	6.8	-34.8
K		16.9	42.0			80.7	96.8

*statistically significant at 95% confidence level
n/c: not calculable for Sefton, as there were no Lifestyle E registrations for 1986-89

The main feature of these findings is that the already distinct gap in incidence between the most affluent women and the majority of the population has widened in more recent times, Lifestyle A women contributing much (in comparison with their population shares) to the observed district increases in breast cancer occurrence. By the during-screening years, the estimated risk, for Lifestyle A women, of developing breast cancer by the age of 84 was 1 in 3 or greater (tables 9.9 to 9.11). This was much higher than for any of the other Lifestyles, even B (Better Off Older People), which had the next closest 0-74 year risk, of 1 in 5 in Sefton (table 9.11).

9.4.2 Age-specific rates

An examination of changes in age-specific rates with Lifestyle group has not been attempted in detail since the number of registrations in each age-Lifestyle category is often quite small, and the balance of registrations to population denominators is even more delicate than that discussed in section 9.3.2. Insofar as the changes in age-Lifestyle rates from the earlier time period to the later one were looked at, little consistency emerges with regard to direction and magnitude of changes. However, what was most notable across all the districts was that much of the rise in incidence amongst women in Lifestyle A (Affluent Professionals) areas was due to increases in the middle age ranges, 40-69. This increase in age-specific incidence, amongst 40-64 year olds in Liverpool and Sefton and 45-69 year olds in Wirral will, in part, be linked to patterns of mammography uptake (i.e. greater detection rates of presymptomatic disease during the early years of a mass screening programme), set against a background trend of increasing rates of both premenopausal and postmenopausal disease.

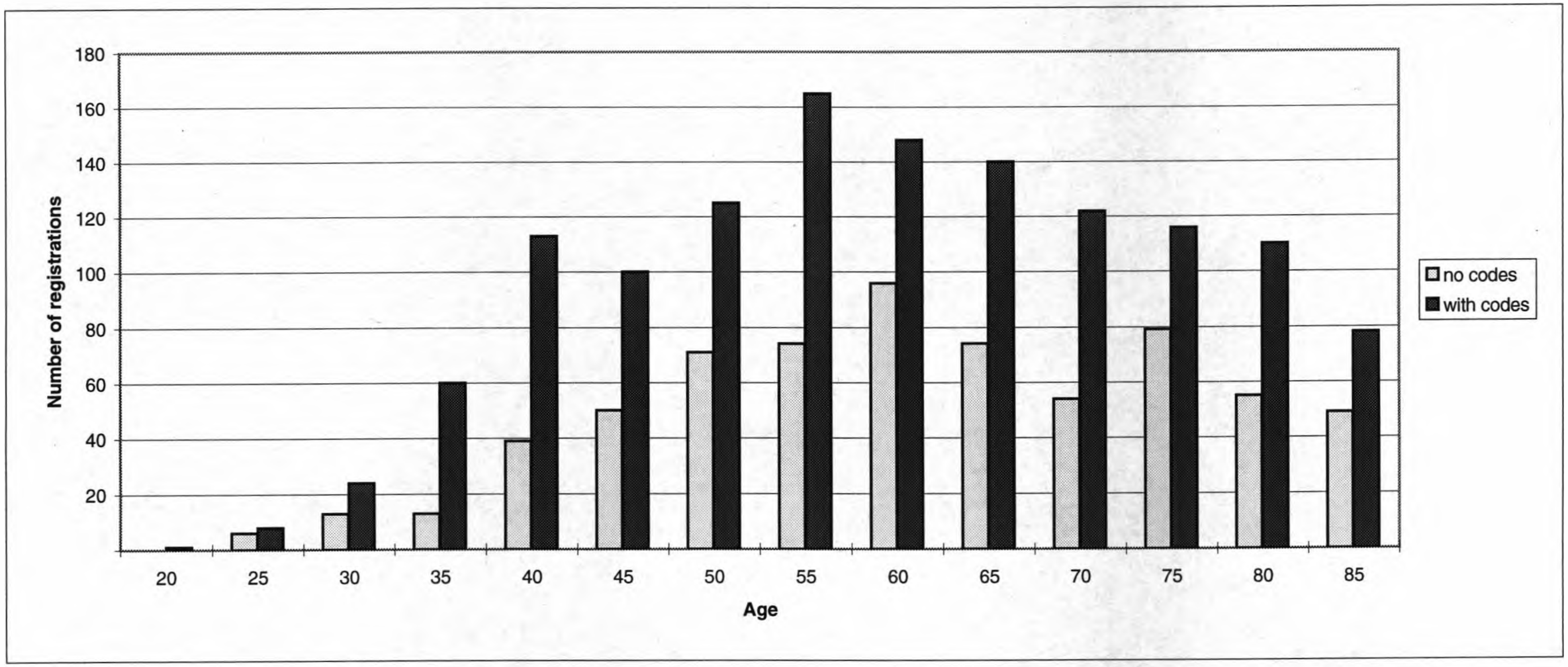
Amongst Lifestyles B (Better Off Older People) to I (Lower Income Households), incidence rose in some of the screening-eligible age groups, though changes were patchy across both Lifestyles and districts. Lifestyle J (Have Nots Households) showed the least tendency towards increasing incidence between the pre- and during-screening time periods, actually appearing to decrease amongst 50-64 year olds in Sefton, for example (data not shown).

9.5 COMMENTS: THE HIGH PROPORTION OF LIVERPOOL CASES UNMATCHED TO SUPER PROFILE CODES

As stated in chapter 8, over a third of the breast cancer cases registered in Liverpool for the years 1986-93 (673 of 1983) could not be matched to Super Profile codes. This does not have any bearing on the overall district calculations discussed in sections 9.1 and 9.3. However, this fact could potentially have a great influence on the calculated variations in incidence by Super Profile Lifestyle, since only two thirds of the Liverpool data were available for these analyses. Unlike the analyses of survival and screening uptake, which use the case datasets themselves to provide denominators for rate calculations, the determination of incidence rates requires the use of separate population data for the areas and time periods under study. In the division of district population estimates between Super Profile Lifestyles, there is no subgroup for which Lifestyle is not known. Therefore, with no associated population denominator, incidence rates for non-matched cases can not be calculated for comparison with the Lifestyle groups.

What is known about the group of cases without socioeconomic data attached is that the age distribution is very similar to that for the rest of the cases in Liverpool (figure 9.12). Therefore, in theory, the omission of these cases from Lifestyle-based calculations should not have overly influenced findings in particular age ranges. It cannot be known what the 'true' Lifestyles of these women are. The age distribution of these women by their true SES, and from this, the resultant effect, could vary. For example, one extreme could be that the older women are predominantly of lower SES, and the younger women are predominantly of higher SES. However, there is reason to believe that, whatever the 'true' socioeconomic status of these non-coded women, the ages are probably split fairly evenly between the Lifestyles involved. This belief is based upon the similarity and consistency of the incidence by Lifestyle findings across the three districts, Wirral and Sefton data being 99% complete for those calculations. From this, there is little reason to suppose that the pattern of Liverpool's Lifestyle-specific incidence would differ widely from that found here, even if the failure rate in matching cases to Super Profile codes was much lower, in keeping with the other datasets used in this research.

Figure 9.12 Number of breast cancer registrations 1986-93, by age group, amongst the 673 Liverpool women not matched to Super Profile codes, compared with the age distribution of registrations with Super Profile codes attached



9.6 SUMMARY OF FINDINGS

- Age standardised incidence rates of breast cancer increased slightly in each district during the period 1987 to 1992. Rates were highest in Wirral, lowest in Liverpool, and intermediate in Sefton.

- The pattern of age-specific incidence for the three districts combined closely followed the expected pattern, the peak in incidence around age 60 being higher in the three districts than in Merseyside and Cheshire as a whole.

- A direct socioeconomic trend in incidence was noted (i.e., higher SES, higher incidence), although the effect was more pronounced in the upper half of the SES ranking. In particular, incidence was far higher, over all the time periods studied, in the most affluent Lifestyle than in any of the others.

- Elevated incidence (in comparison with average lifetime risks) was predominantly confined to this group and Lifestyle B (Better Off Older People). For Affluent Professionals (A), the calculated lifetime risk of developing breast cancer by the age of 74 was especially high, between 1 in 3 and 1 in 5.

- The elevated incidence in Lifestyle A occurred across all age groups. The pattern for Lifestyle B was similar, but lower.

- Incidence increased between the late 1980s and early 1990s in every district. The rise in the three districts combined was most notable in the 40-44 and 50-69 age ranges, although this was not consistent by individual Lifestyle.

- Lifestyle A (Affluent Professionals) showed the largest absolute increase in incidence between the pre- and during-screening time periods, further accentuating the socioeconomic gradient observed. The increase occurred across several age bands, including, but not exclusively, 50-64 (screening-eligible) year olds.

CHAPTER 10

RESULTS OF THE ANALYSES OF BREAST CANCER SURVIVAL

RESULTS OF THE ANALYSES OF BREAST CANCER SURVIVAL

The results from the survival analyses are presented within this chapter in the following order:

1. Rates and patterns for the whole group of cases
2. Outcomes and associated survival curves from Kaplan-Meier analysis of the individual variables
3. Socioeconomic differences in survival when adjusted for age band
4. Cox regression modelling of the data
   i) examining general, sociodemographic and clinical factors in turn
   ii) examining the effect of SES when modelled in conjunction with each other factor
   iii) the overall model (for which all the variables were put forward)
5. Summary of findings

10.1 SURVIVAL IN THE TOTAL STUDY GROUP

As stated in chapter 8 (data and methods), 211 Death Certificate Only (DCO) cases were excluded from survival analysis. Figure 10.1 shows the corrected survival curve for the 4979 non-DCO cases diagnosed between 1986 and 1993. The one year corrected rate was 88.3%, 3 year 73.9%, 5 year 65.6%, and 10 year (for the relatively small number of women who could be observed for this period of time), 55.4% (table 10.1). 3197 records (64.2%) were censored with regard to examination of corrected survival, i.e. these women were still alive at the last date of follow up for that dataset, or had died from causes other than breast cancer. Refer back to chapter 8 (methods) for an introduction to the concept of censoring.

Table 10.1 Life Table showing all ages corrected survival for women diagnosed with breast cancer during 1986-1993 in Wirral, Liverpool and Sefton districts combined (n = 4979)

Year (beginning)	Number entering interval	Number of events (cancer deaths)	Number of censored cases	Proportion surviving interval (%)	Cumulative proportion surviving
0	4979	581	19	88.3	88.3
1	4379	398	27	90.9	80.3
2	3954	299	322	92.1	73.9
3	3333	204	512	93.4	69.0
4	2617	118	515	95.0	65.6
5	1984	76	449	95.7	62.7
6	1459	57	348	95.6	60.0
7	1054	29	340	96.7	58.0
8	685	16	297	97.0	56.3
9	372	4	250	98.4	55.4
10	118	0	118	100	55.4

Figure 10.1 All ages corrected survival curve for women (n = 4979) diagnosed with breast cancer during 1986-93 in Wirral, Liverpool and Sefton districts combined

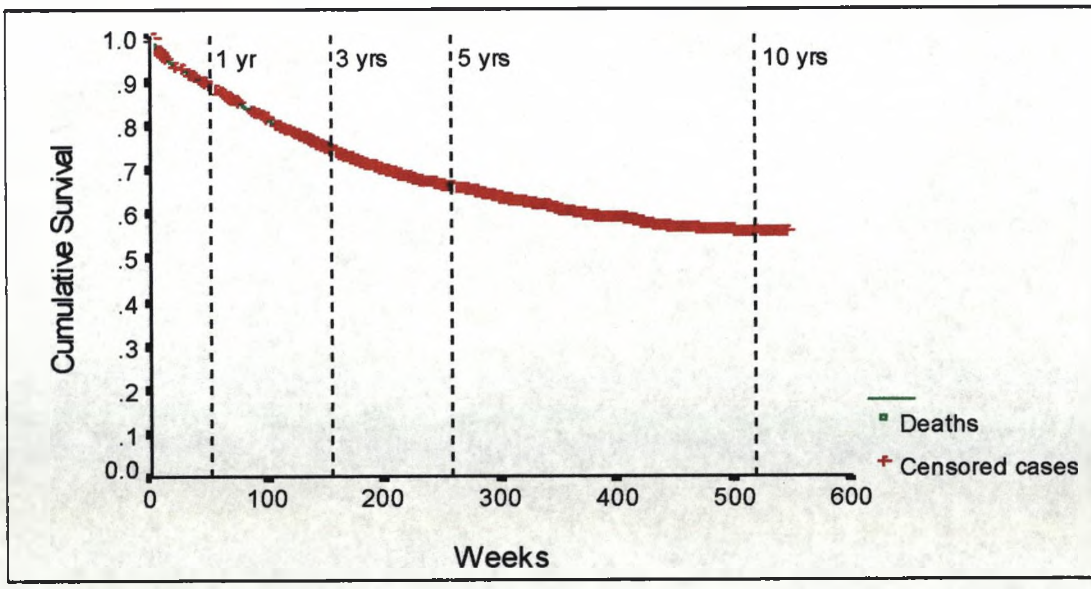


Figure 10.2 Histogram of survival times (known and censored), all ages, for women (n = 4979) diagnosed with breast cancer during 1986-93 in Wirral, Liverpool and Sefton districts combined

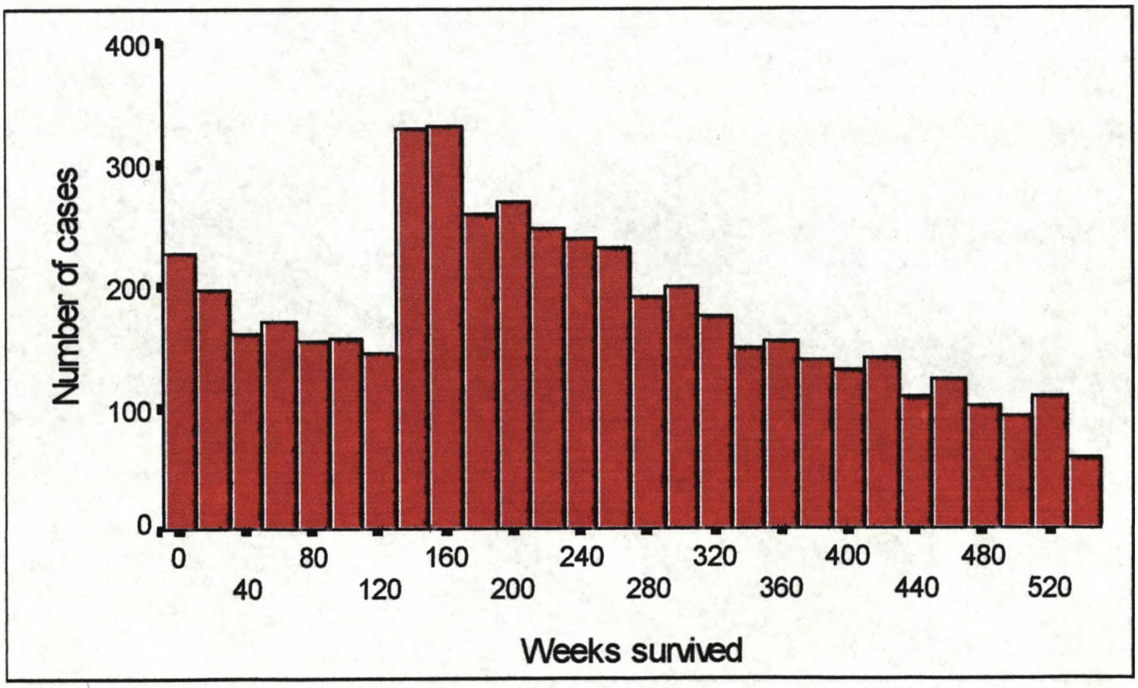


Figure 10.2 illustrates the frequency distribution of observed survival times amongst all the women, i.e. irrespective of cause of death. Meanwhile, table 10.1 also documents the number of failures and censored events occurring during each whole year of observation. Very few cases were censored within two years of follow up; conversely, over half of the cancer deaths recorded occurred within this initial, relatively short period after diagnosis. Progressively smaller proportions of the remaining women died of breast cancer in subsequent years. Both figure 10.2 and table 10.1 would suggest that there are two subgroups of women involved, one showing a large number of deaths within the first couple of years, the other showing much longer survival times. Since the minimum period of case follow-up was three years (last registration = 1993, date of last follow-up = 1996), and relatively few deaths in the first two years were censored (table 10.2), it is probable that the group dying early had advanced stages of cancer.

10.2 SURVIVAL DIFFERENCES BY INDIVIDUAL FACTORS

Findings from the Kaplan-Meier analysis investigating survival differences between various subgroups are divided here into three broad areas; general factors, sociodemographic variables, and clinical indicators such as treatment.

10.2.1 GENERAL FACTORS

10.2.1.1 Year of diagnosis

Cases were split fairly evenly by year of diagnosis, ranging from 569 registrations in 1988 to 703 registrations in 1991. There was no trend for either increasing or decreasing numbers of registrations between 1986 and 1993. In part, this would have been a result of population changes (in particular, population decline) in the districts over years including 1986-93, since incidence rates per 100,000 were observed in increase over the same time period (chapter 9). Survival varied with year of diagnosis, with the p value for linear trend indicating a significant increase in survival from 1986 through to 1993 (for both crude and corrected rates). Figure 10.3, whilst illustrating this for corrected survival, also highlights the variation in maximum possible observation times. Only the 1986 cases could have a follow up period of 10 years; for the 1993 registrations, the maximum observation time was just over 3 years. As would be expected, the percentages of survival times that are censored are higher in the more recent registrations. Nonetheless, improvement over time does appear to be fairly constant and progressive (table 10.2), and is likely to reflect changes in diagnosis and treatment patterns, as suggested in the Merseyside and Cheshire Cancer Registry's Breast Cancer Bulletin (1994).

The overall survival patterns for each year were compared with each other year, using the log-rank test facility available in SPSS for Windows. These pairwise comparisons between individual years showed significant differences between most pairs when crude survival was analysed. For corrected survival, differences between rates (at least at an early stage after diagnosis) were significant between each year and the latest years ($p <= 0.05$), and between all pairs of years from 1990 onwards.

Table 10.2 All ages corrected survival rates for Wirral, Liverpool and Sefton combined, by year of diagnosis, 1986-1993

Year of diagnosis	1 year	3 year	5 year	10 year	median survival (years)
1986	85.5	68.0	59.2	47.4	8.3
1987	86.1	72.1	62.5	-	-
1988	86.8	70.4	60.7	-	-
1989	87.5	71.5	62.4	-	-
1990	88.3	73.4	63.9	-	-
1991	89.8	76.8	70.8	-	-
1992	90.1	77.2	74.1	-	-
1993	91.8	81.3	-	-	-

10.2.1.2 District

Only very slight variation in survival between the three districts was observed (figure 10.4). Generally, survival was highest in Sefton (n = 1384), only slightly lower in Wirral (n = 1692), and lowest in Liverpool (n = 1903), where median crude survival was calculable and found to be just under 8.5 years. Five year corrected survival rates were 67%, 66% and 64% in Sefton, Wirral and Liverpool, respectively. Crude survival in Liverpool was significantly lower than that in Sefton over this period ($p = 0.03$), but the difference in corrected survival between these two did not reach significance ($p = 0.051$). Differences between Wirral and either of the other two are small and not significant, although there is some widening of the gap between it and Liverpool's

Figure 10.3 All ages corrected survival curves by year of diagnosis, for women diagnosed with breast cancer during 1986-93 in Wirral, Liverpool and Sefton districts combined

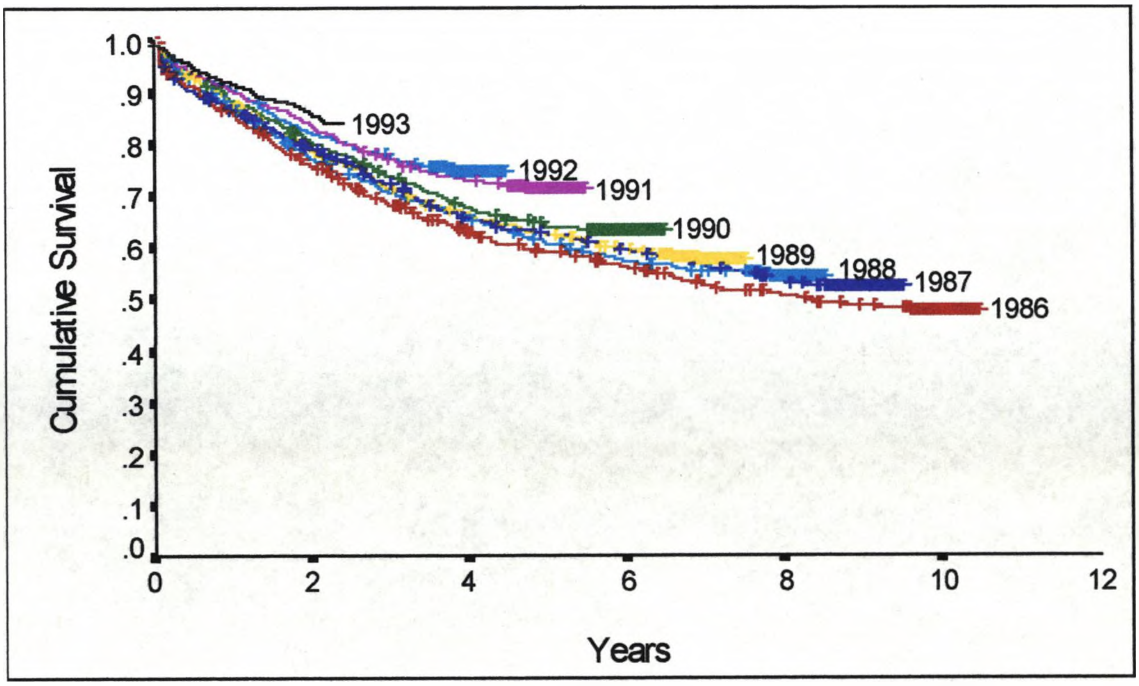
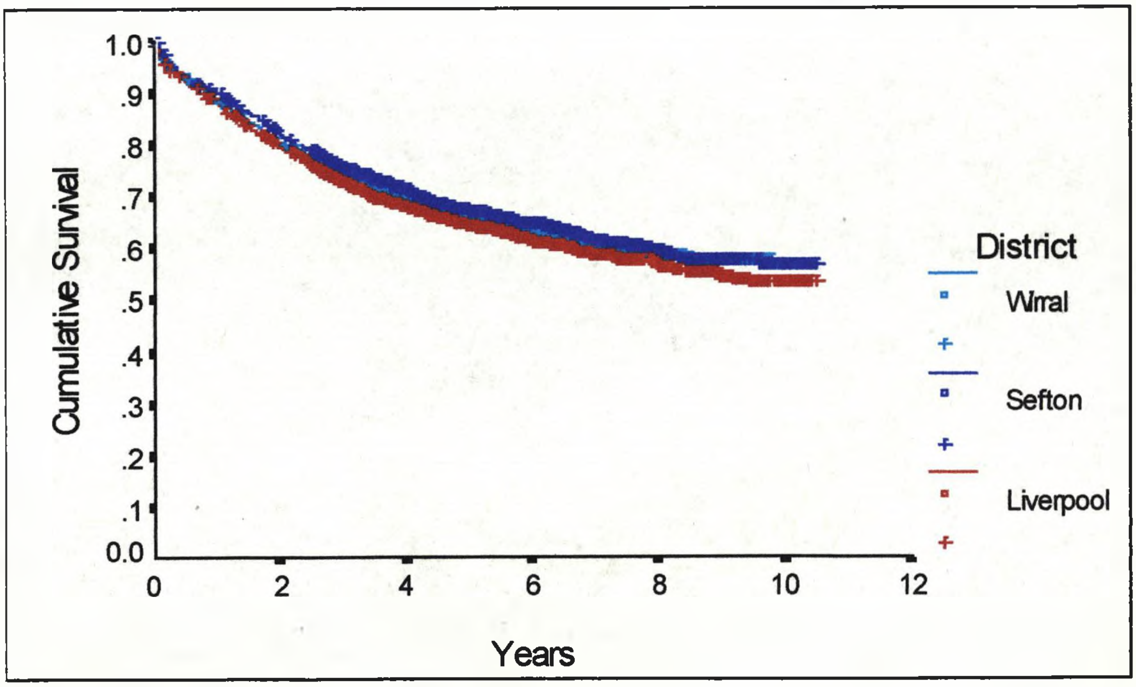


Figure 10.4 All ages corrected survival curves by district of residence, for women diagnosed with breast cancer during 1986-93



curves after a little over 8 years. A similar proportion of cases in each district are censored.

10.2.2 SOCIODEMOGRAPHIC VARIABLES

10.2.2.1 Age

Age is known to be strongly associated with survival. In the youngest women in this dataset (those aged under 50), rates are not as favourable as in the middle to retirement/pension age groups, but after this, rates drop rapidly in the more elderly. The overall trend is significant both for crude and corrected survival in this dataset. Pairwise log-rank tests on the corrected rates (which compared each 5 year age group with each other age group) showed little difference in survival patterns between 5 year age groups at the younger end of the spectrum, from 20 to 69, excepting the comparison between 50-54 year olds (better survival) and 65-69 year olds, which was significant. There was also relatively little difference in survival rates between the (small number of) the very youngest women (aged 20-29) and many of the oldest groups. The disease may be more aggressive in young women, thus observed survival rates will be low, but small numbers of cases also affect the statistical comparisons.

Most other pairwise comparisons, between women aged 35 and older and those aged 70 and older, showed significant differences in corrected survival, rates being better in the younger group in each pairwise comparison. One would expect quite noticeable differences in survival experience between, say, a 45 year old and a 79 year old, but the comparisons also highlight the acceleration in breast cancer-specific (as well as general) deaths from one age group to the next in women aged over 60.

For greater simplicity and ease of visualisation, these five year age groups were aggregated to form 3 bands, the under 50s, the 50 to 64s (some of whom will have been invited for screening in the later years of data recruitment), and the over 65s. The number and percentage of cases in each age group are shown in table 10.3. The proportions are reflective of the peak in incidence around the age of 60, and progressively higher rates of breast cancer in the elderly (chapters 2 and 9). Figure 10.5 illustrates the significantly lower survival rates of the oldest band ($p < 0.001$) and the relatively closer values of the other two bands. Additionally, table 10.4 shows the 1, 3, 5 and 10 year corrected survival rates for the three age bands. One year survival rates were highest in the youngest age band (the under 50s). However, between approximately two and nine years, survival was actually highest in the middle band (50-64). 10 year corrected survival rates are almost identical in the two younger bands. As would be expected, a lower proportion of censoring (i.e., a higher proportion of deaths attributed to cancer) occurs in the oldest women. In the over 65s, median corrected survival was a little under 6.5 years, and was over 10 years for both younger age bands.

Table 10.3 Number and percentages of cases (Wirral, Liverpool and Sefton combined) in each of three broad age bands: <50, 50-64 and 65+

Age Band	Number of cases	Percent
under 50	1047	21.0
50-64	1746	35.1
65 and over	2186	43.9

Table 10.4 Corrected survival rates for Wirral, Liverpool and Sefton combined, 1986-93, in each of three broad age bands: <50, 50-64 and 65+

Age Band	1 year	3 year	5 year	10 year	median survival (years)
under 50	95.8	80.5	72.2	64.1	-
50-64	93.4	83.7	75.6	64.2	-
65 and over	80.7	62.9	54.3	44.0	6.4

It could be argued that the very elderly women (aged 85 and over) should be excluded from survival analysis since the quality of the data in these cases is often poorer, with respect to factors such as the percentage of cases that are DCO, errors in the coding of death in the most elderly groups, and the lower likelihood of these women receiving specific diagnosis or treatment. A series of investigations was made into the potential effect of including or excluding the 310 women aged 85 and over from these analyses. The over 85s did have very poor survival rates, with a median survival time just under two years after recorded diagnosis. However, it was decided *not* to exclude the over 85s from analysis, following these investigations, as the inclusion of the most elderly women in these data did not appear to bias the findings in specific categories of any of the variables. The inclusion for analysis of women of all ages is also in keeping with the approach adopted by the majority of the SES and survival studies reviewed in chapter 4.

10.2.2.2 Lifestyle and other geodemographic groupings

Table 10.5 shows the distribution of the 4979 cases included in survival analysis amongst the Super Profile Lifestyles.

Table 10.5 Number and percentage of breast cancer cases assigned to each Lifestyle, Wirral, Liverpool and Sefton combined, 1986-93

Lifestyle	Number of cases	Percent*
A: Affluent Professionals	577	11.6
B: Better Off Older People	591	11.9
C: Settled Suburbans	770	15.5
D: Better Off Young Families	523	10.5
E: Younger/mobile persons	59	1.2
F: Rural Communities	11	0.2
G: Lower Income Elderly	419	8.4
H: Blue Collar Families	413	8.3
I: Lower Income Households	273	5.5
J: 'Have Nots' Households	662	13.3
K: Unclassified	10	0.2
O: No codes attached	671	13.5

*adds up to 100.1, due to rounding

Survival was found to vary significantly by Super Profile Lifestyle ($p < 0.03$), although the picture when using the ten Lifestyles in their basic form was complex. There was an overall trend in survival apparent, in that the top few groups (i.e. high SES) had higher rates than the bottom few groups (low SES). Pairwise log-rank tests indicated that survival over time was significantly better in Lifestyles A, B and C than in Lifestyles G to J and non-coded women ($p < 0.05$), excepting the B:J comparison, which did not attain significance ($p = 0.1$). Survival was also significantly better amongst Lifestyle D women than those in Lifestyle G and the dummy Lifestyle, O. Much of this difference is likely to be due to a confounding effect of age. Comparisons involving Lifestyles E and F were not significant, due to the small numbers of cases in these SES groups.

The pattern of decline in survival was not entirely consistent with the ordering of Lifestyle categories, however, as shown in table 10.6. For example, survival was generally highest amongst women in Lifestyle C (Settled Suburbans), although rates in women of the two most affluent Lifestyles were only slightly (and not significantly) lower, at least in the short term.

Table 10.6 All ages corrected survival rates by Lifestyle, Wirral, Liverpool and Sefton combined, 1986-93

Lifestyle	1 year	3 year	5 year	10 year	median (years)
A: Affluent Professionals	89.9	77.5	70.6	61.3	-
B: Better Off Older People	89.8	77.8	68.9	57.7	-
C: Settled Suburbans	90.6	78.8	69.6	64.1	-
D: Better Off Young Families	89.3	75.5	67.0	55.7	-
E: Younger/mobile persons	86.4	67.6	65.7	supp.	-
F: Rural Communities	81.8	supp.	supp.	supp.	-
G: Lower Income Elderly	85.7	67.1	60.0	45.1	8.4
H: Blue Collar Families	86.4	70.9	63.1	56.0	-
I: Lower Income Households	84.2	70.8	61.8	supp.	-
J: 'Have Nots' Households	88.5	72.2	64.5	51.3	-
K: Unclassified	supp.	supp.	supp.	supp.	-
O: No codes attached	86.7	70.4	60.5	48.3	8.3

supp. : rates suppressed as based on less than 10 individuals

The lowest 10 year corrected survival rates, less than 50%, occurred in Lifestyles G (Lower Income Elderly) women, and in those to whom no Super Profile codes could be attached. Median survival in both these groups was a little over 8 years (table 10.6). Pairwise log-rank tests indicated that rates were significantly lower in Lifestyle G women than in the poorest Lifestyle, J. Much of this effect in Lifestyle G will be due to the greater proportion of very elderly cases resident in these EDs (as indicated in this Lifestyle's name and Pen Picture), in comparison with the other Lifestyles. The age-SES interaction is explored later in this chapter. Meanwhile, looking at the survival rates amongst the non-coded women (the dummy Lifestyle, O), it is clear that they are closer to those shown in women in the lower half of the SES ranking than to those in the upper half. It was demonstrated in chapter 9 (section 9.5) that the age distribution of these cases, nearly all of whom are Liverpool residents, is similar to that for the rest of the Liverpool registrations. Therefore, their relatively poor survival patterns are not due to an age bias. From these two pieces of evidence, it is suggested that the 'true' SES composition of this group of women tends towards lower SES categories.

For the purposes of illustrating survival curves by SES, and visually exploring the age-SES interaction, the use of 12 groups (10 Lifestyles plus 2 unknowns, K and O) would provide too complex a picture. Figure 10.6 illustrates survival curves for 4 broader SES groups (plus a fifth for women of unknown SES), which were constructed by aggregating the target market groups according to income rankings. Refer to chapter 8 (data and methods) for more information on the aggregation process.

The trend in survival rates was clear when these four Target Market-based groups were employed, although after approximately 3 years rates were slightly poorer in the third group than in the least affluent. Corrected survival in the most affluent of these groups was significantly higher than in any of the others. The difference between groups 2 and 3 was also significant overall. The curves for women of unknown SES, being lower than for any of the other broad SES groups, again suggests that in a less aggregated

Figure 10.5 Corrected survival curves in three broad age bands (<50, 50-64, 65+), for women diagnosed with breast cancer during 1986-93 in Wirral, Liverpool and Sefton districts combined

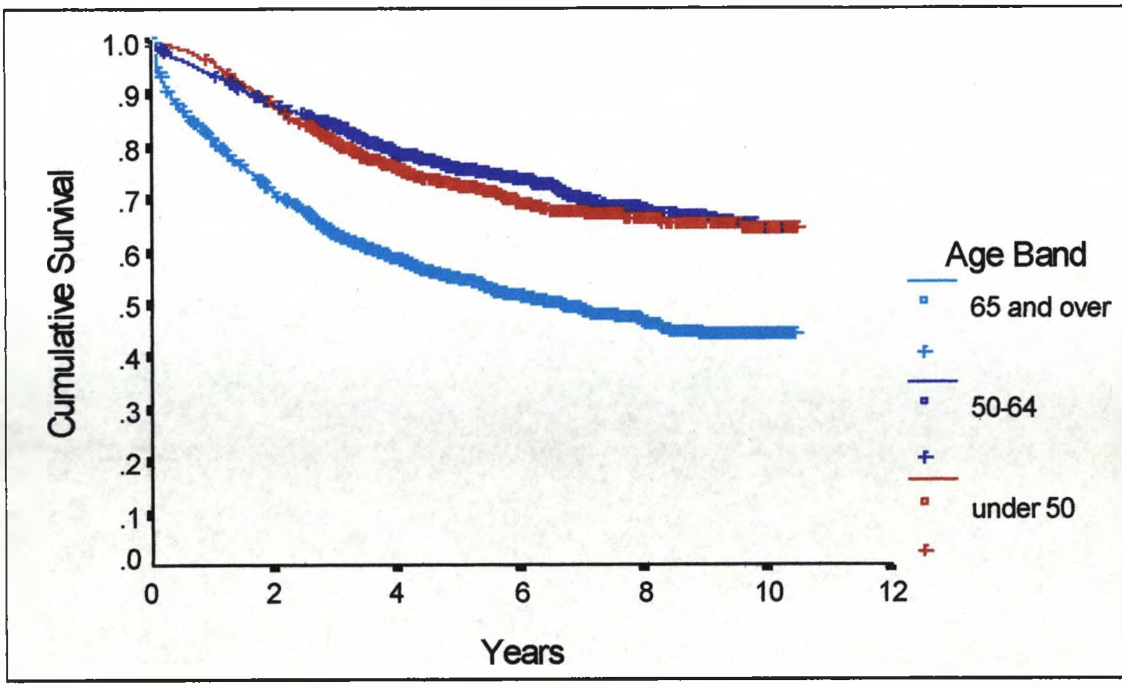
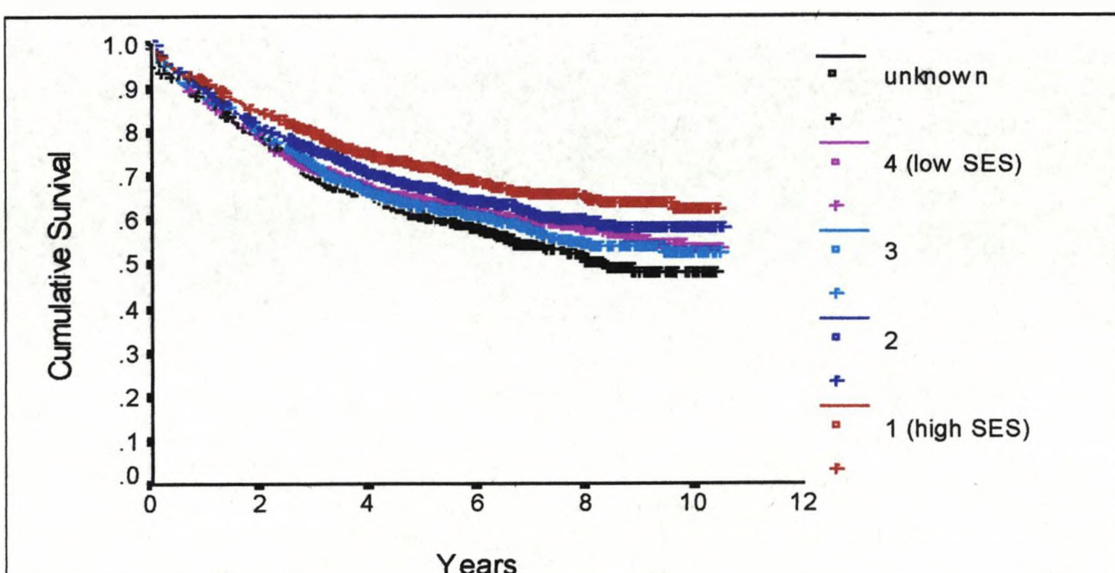


Figure 10.6 All ages corrected survival curves by SES, as defined by 4 Target Market based groups, for women diagnosed with breast cancer during 1986-93 in Wirral, Liverpool and Sefton districts combined



classification of socioeconomic status, these women belong predominantly to one of the individual groups that is associated with relatively poor survival.

Table 10.7 Number and percentages of breast cancer cases assigned to each of the four Target Market based SES categories, Wirral, Liverpool and Sefton combined, 1986-93

SES group	Number of cases	Percent
1 (high SES)	958	19.2
2	1418	28.5
3	852	17.1
4 (low SES)	1071	21.5
unknown SES	680	13.7

Table 10.8 All ages corrected survival rates in the four Target Market based SES categories, Wirral, Liverpool and Sefton combined, 1986-93

SES group	1 year	3 year	5 year	10 year	median (years)
1 (high SES)	90.7	79.2	71.8	62.2	-
2	89.0	75.4	67.0	57.9	-
3	87.5	71.8	62.5	52.2	-
4 (low SES)	86.9	71.3	63.9	53.1	-
unknown SES	86.7	70.4	60.5	48.3	8.3

10.2.3 CLINICAL INDICATORS

10.2.3.1 Mode of Presentation

The association between survival and how the cancer was first presented was significant. Where mode of presentation was known, survival was highest amongst the 306 (6.1%) cases detected via screening, with 92.4% 5 year corrected survival (table 10.9). The 2458 women diagnosed after the appearance of symptoms had significantly lower rates. Significantly lower still was survival in the 180 women where the cancer was an incidental finding or listed in registry records as “previously diagnosed; details not known". Median survival for this group was 2.7 years; 5 year corrected survival was only 34.4%. The curve for women in whom mode was not known (2035 cases) was extremely similar to that for women with symptoms at time of presentation (figure 10.7).

Table 10.9 All ages corrected survival rates by mode of disease presentation, Wirral, Liverpool and Sefton combined, 1986-93

Mode of presentation	1 year	3 year	5 year	10 year	median (years)
Screening	98.0	95.1	92.4	n/a	-
Symptoms	89.1	74.3	64.6	55.7	-
Other	68.8	47.2	34.4	supp.	2.7
Unknown	87.7	72.7	65.9	55.8	-

n/a: First case coded as having been screen-detected was 1987. Therefore, max. follow up was 9 years
supp. : rates suppressed as based on less than 10 individuals

10.2.3.2 Proof of diagnosis

The method of diagnosis was significantly associated with survival. The majority of the women in this dataset (4323, or 87%) had their cancers confirmed by microscopic (histological or cytological) tests. This group had better survival rates than women in other diagnosis groups. For example, 5 year corrected survival was 71.4% (table 10.10). Survival amongst the 555 women (11%) only clinically diagnosed was significantly the poorest, even when compared with the group in whom method of proof was not known (43 women, or 0.9% of the data). Figure 10.8 illustrates the wide differences between the survival curves when the general methods of proof of diagnosis are compared. Proof of diagnosis and mode of presentation are both to some degree indicative of stage of disease at the time of diagnosis. Stage is an important factor in survival, although it is not available as a separate indicator in these data. Microscopic confirmation of

Figure 10.7 All ages corrected survival curves by mode of disease presentation, for women diagnosed with breast cancer during 1986-93 in Wirral, Liverpool and Sefton districts combined

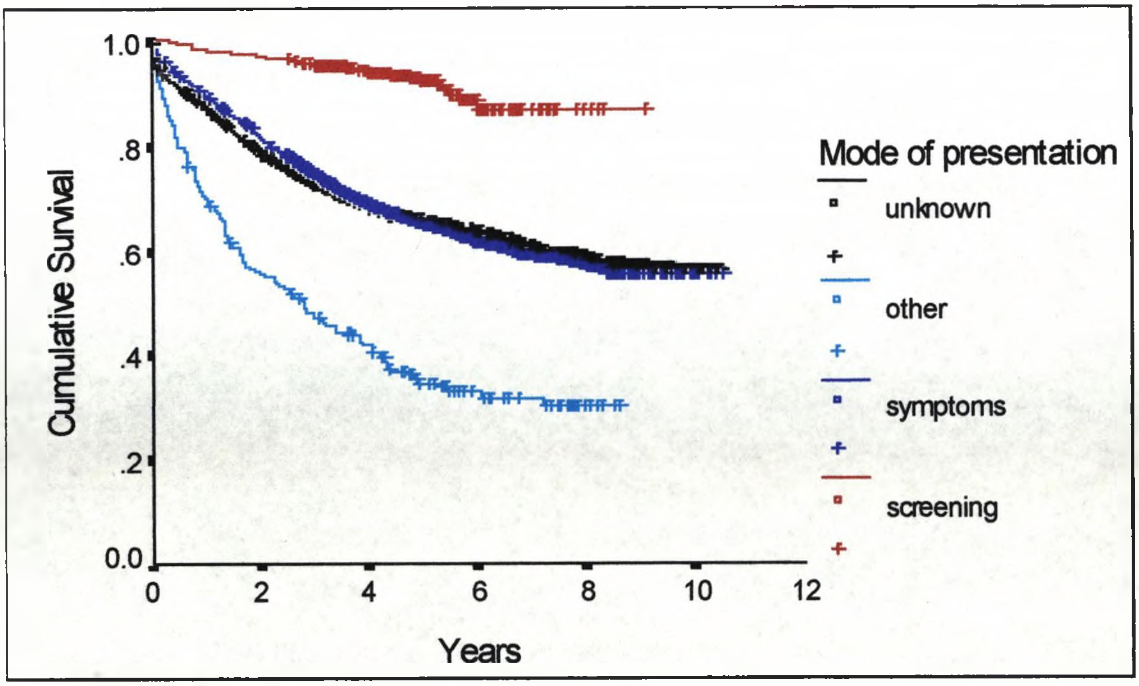
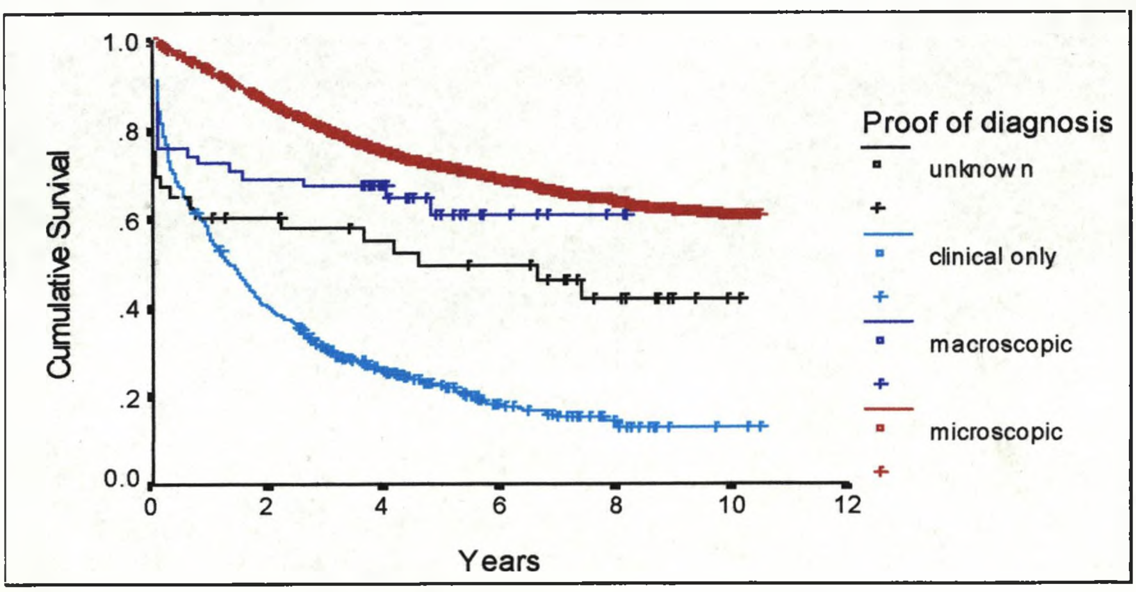


Figure 10.8 All ages corrected survival curves by method of diagnosis confirmation, for women diagnosed with breast cancer during 1986-93 in Wirral, Liverpool and Sefton districts combined



diagnosis implies an earlier stage of disease than macroscopic methods (n = 58), and, more particularly, than in women diagnosed only clinically.

Table 10.10 All ages corrected survival rates by proof of diagnosis, Wirral, Liverpool and Sefton combined, 1986-93

Proof of diagnosis	1 year	3 year	5 year	10 year	median (years)
Microscopic	93.1	79.8	71.4	60.7	-
Macroscopic	72.4	67.2	60.8	n/a	-
Clinical only	55.1	30.4	22.1	supp.	1.3
Unknown	60.5	57.9	49.7	supp.	4.9

n/a: First case coded with macroscopic proof was in 1988. Therefore, max. follow up was 8 years
supp. : rates suppressed as based on less than 10 individuals

10.2.3.3 Treatment

Since the choice of treatment is influenced by stage of disease, the significant association of therapy with survival was anticipated. Table 10.11 lists the frequencies of the various treatment status categories amongst all 4979 women (1986-93 cases) included in survival analyses. 104 (2.1%) of the women had received no treatment, due to their disease being too advanced, or their being in generally poor health. Meanwhile, 1372 (27.6%) of the group had either received no treatment for other reasons (n = 32, including women coded as having a planned delay before treatment, or who refused it), or their treatment details had not entered the registry's case records at the time the dataset was provided (n = 1340). In the middle of 1996, when the dataset was received, only about 50% of all 1992 and about 10% of all 1993 cancer registrations had treatment details recorded (Merseyside and Cheshire Cancer Registry, personal communication).

Amongst those with treatment information available, however, approximately one third (n = 1120) were coded as having received surgery, the other two thirds (n = 2321) as not having received surgery. This is contrary to the proportion of breast cancer cases treated surgically, of around 70% or more, known from earlier work (Merseyside and Cheshire Cancer Registry 1994). On investigation, an error appeared to have arisen within the Registry. This was traced specifically to the construction of the binary surgery and chemotherapy flags (from the original treatment data) prior to download of this dataset, for registrations from 1988 onwards. The surgery and chemotherapy treatment flags for 1986 and 1987 were not affected. Table 10.11 also indicates the frequency of treatment combinations amongst only 1986 and 1987 registrations and expresses the magnitude of the errors. Treatment information for that period is virtually complete, with over 72% of all cases coded as receiving some form of surgery.

This error in the data came to light after completion of the main data analysis. However, its impact with respect to analyses involving the treatment variable was investigated. Figure 10.9a shows the corrected survival curves in four broad treatment status groups, for the whole dataset (1986-93), whilst figure 10.9b shows the curves for the same four groups, for 1986 and 1987 registrations only. The non-treatment groups are those whose cancer was too advanced, or who were in generally poor health, versus those with no treatment for other reasons (including treatment details not yet recorded by the Cancer Registry). Meanwhile, table 10.12 shows the 1, 3, 5 and 10 year survival rates in the same four broad treatment status groups, for 1986-93 inclusive, and the 1986-87 registrations only.

Table 10.11 Frequency of treatment status category amongst the whole dataset (years 1986-93, n = 4979), and 1986-87 registrations only (n = 1219)

Treatment	1986-1993		1986-1987	
	Number	Proportion (%)	Number	Proportion (%)
surgery (surg) only	202	4.1	190	15.6
radiotherapy (xrt) only	166	3.3	7	0.6
hormone therapy (ht) only	68	1.4	0	0.0
chemotherapy (ct) only	184	3.7	153	12.6
surg + xrt	171	3.4	128	10.5
surg + ct	202	4.1	199	16.3
surg + xrt + ct	209	4.2	206	16.9
surg + ht + ct	130	2.6	81	6.6
surg + xrt + ht + ct	206	4.1	78	6.4
xrt + ct	70	1.4	17	1.4
xrt + ht + ct	800	16.1	14	1.1
ct + ht	1033	20.7	59	4.8
other- xrt status unknown[1]	62	1.2	4	0.3
No treatment- too advanced/general health too poor	104	2.1	36	3.0
No treatment- other reasons, or details not yet recorded by Registry	1372	27.6	47	3.9
Totals	4979	100	1219	100
all combinations involving surgery[2]	1120	22.5	882	72.4
all combinations not involving surgery[2]	2321	46.6	250	20.5

[1]ct, ht and surg in various combinations or singly, xrt status unknown
[2]excluding the 'other- xrt status unknown' group

Survival rates in women receiving surgery, and those receiving no treatment due to poor health or advanced disease, were extremely similar when the whole dataset was compared with the subset of 1986-87 registrations. Amongst women where treatment information was present, the difference between groups coded as having had surgery and those coded as not having had surgery, although statistically significant over the whole time period, was much wider in the 1986-87 subset of cases than in the whole dataset (figures 10.9a and 10.9b). Therefore, in the construction of the surgery flag for this

Figure 10.9a All ages corrected survival curves by broad treatment status group, for women diagnosed with breast cancer during **1986-93** in Wirral, Liverpool and Sefton districts combined

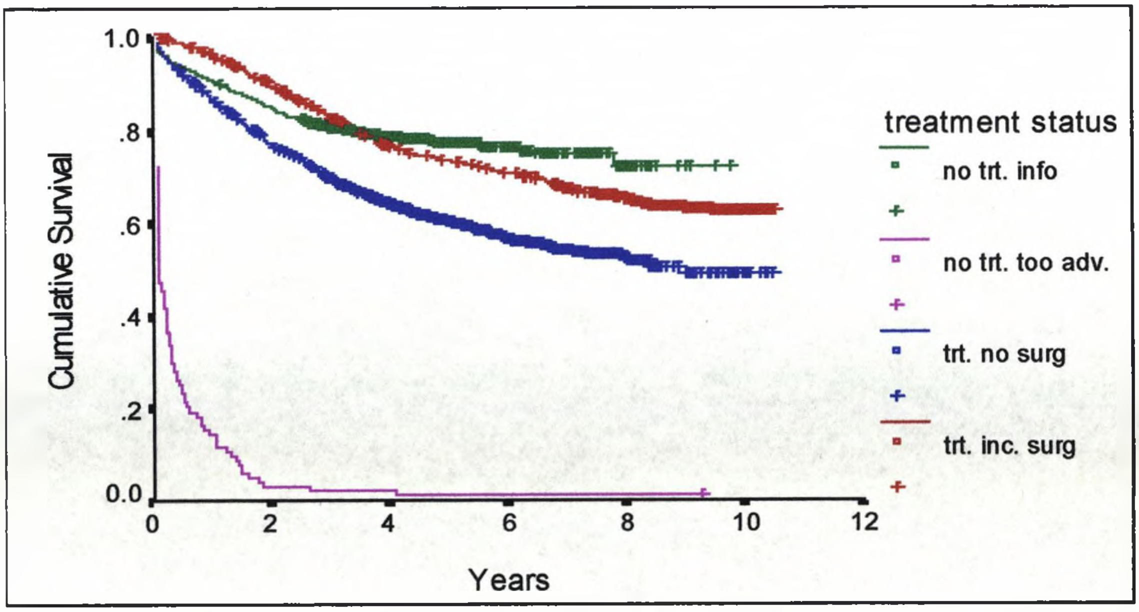
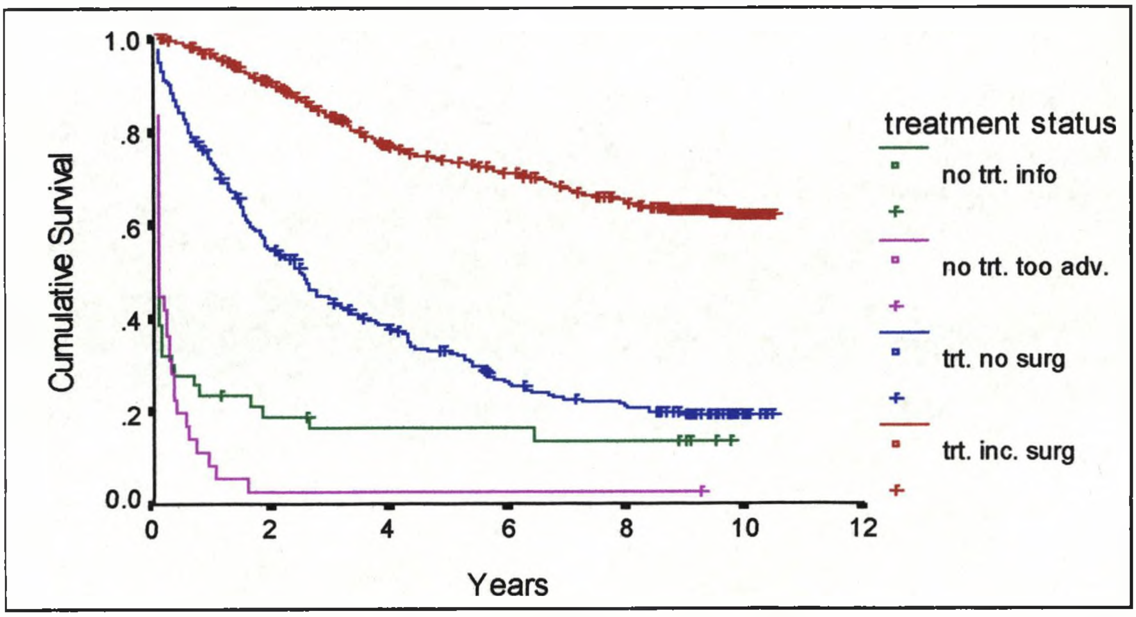


Figure 10.9b All ages corrected survival curves by broad treatment status group, for women diagnosed with breast cancer during **1986-87** in Wirral, Liverpool and Sefton districts combined



no trt. too adv.: refers to patients either with advanced cancer, or whose general health was too poor

no trt. info: refers to women who refused treatment, in whom there was a recorded planned delay before treatment, in whom treatment was recorded as 'not necessary', and for records without treatment details recorded by the Cancer Registry at the time the dataset was provided. The proportion without treatment details recorded is much lower in the case of 1986-87 data (figure 10.9b and table 10.11) dataset, a proportion of cases that were surgically treated had clearly not been correctly coded. The other main difference between the whole dataset and the 1986-87 subset was in the survival amongst women who did not receive treatment, or did not have treatment information present. This was seen to be much lower in the 1986-87 subset, for the reason that these women in the earliest two years studied *genuinely* had received no treatment, unlike the vast majority when more recent years were considered, who were more strictly '*treatment information pending*'.

Table 10.12 All ages corrected survival rates in four broad (non) treatment groups, for the whole dataset (1986-93), and for the 1986-87 registrations only

treatment status group from case coding	Time period	1 year	3 year	5 year	10 year	median (years)
Treated, including surgery	1986-93	96.1	82.5	73.3	62.2	-
	1986-87	96.0	82.8	73.4	61.6	-
Treated, without surgery	1986-93	86.3	69.6	59.9	50.6	-
	1986-87	72.7	44.0	32.4	19.2	2.4
No treatment- too advanced/	1986-93	14.4	supp.	supp.	supp.	0.6
general health too poor	1986-87	8.3	supp.	supp.	supp.	0.6
No treatment- other reasons,	1986-93	90.6	80.1	76.9	n/a	-
or details not yet recorded by Registry	1986-87	23.4	supp.	supp.	n/a	0.7

n/a: no 1986 cases were coded with no treatment for other reasons or reasons unknown. Therefore, max. follow up was 9 years

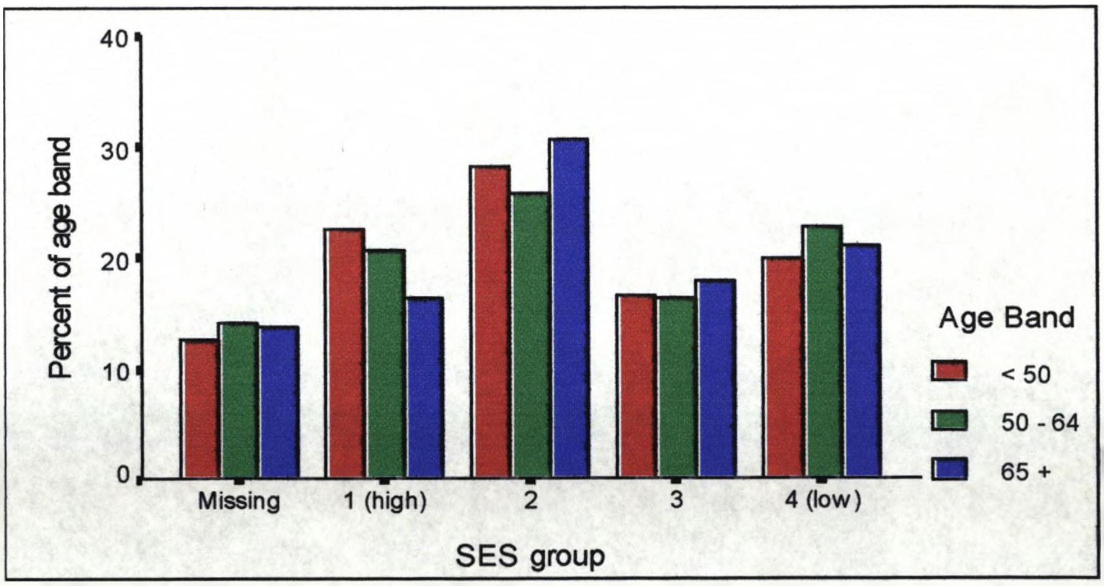
supp. : rates suppressed as based on less than 10 individuals

10.3 SURVIVAL BY SOCIOECONOMIC STATUS WITHIN AGE BAND

The relationship between age band and broad socioeconomic group, and survival curves associated with the two in combination, were inspected. The later use of the Cox regression procedure (section 10.4) allowed for the consideration of SES and age at a more detailed level. Figure 10.10 illustrates the proportional representation of each age band in each socioeconomic group when the four Target Market derived categories were used. Only the most affluent has a greater share of the youngest women than it does of the oldest.

Figures 10.11a to 10.11c show the survival curves by the four Target Market based categories within each age band. Table 10.13 shows the 5 year corrected survival rates in each of these broad age-SES groups. The socioeconomic influence is least in the oldest women (figure 10.11c), probably indicative of the generally higher all-causes and breast cancer-specific death rates in women aged 65 and over. Some difference is noted amongst the middle group, the 50 to 64 year olds, particularly when comparing the two higher with the two lower SES groups. However, at this level of socioeconomic discrimination, relative survival differences appear to be greatest in the younger, pre- or early postmenopausal women. This could be related to factors such as differences in levels of breast awareness, and from this, stage at presentation. The two highest SES groups have the best and second best rates respectively, although, interestingly the least affluent group have more favourable rates than the third (figure 10.11a). In general though, the more affluent women have better survival than the less affluent.

Figure 10.10 Percentages of women in each of three age bands (<50, 50-64, 65+) assigned to the four Target Market based SES categories



Missing: refers to the (mainly Liverpool) women who could not be assigned Super Profile codes

Figure 10.11a Corrected survival curves by SES group amongst women aged under 50, for Wirral, Liverpool and Sefton combined, 1986-93

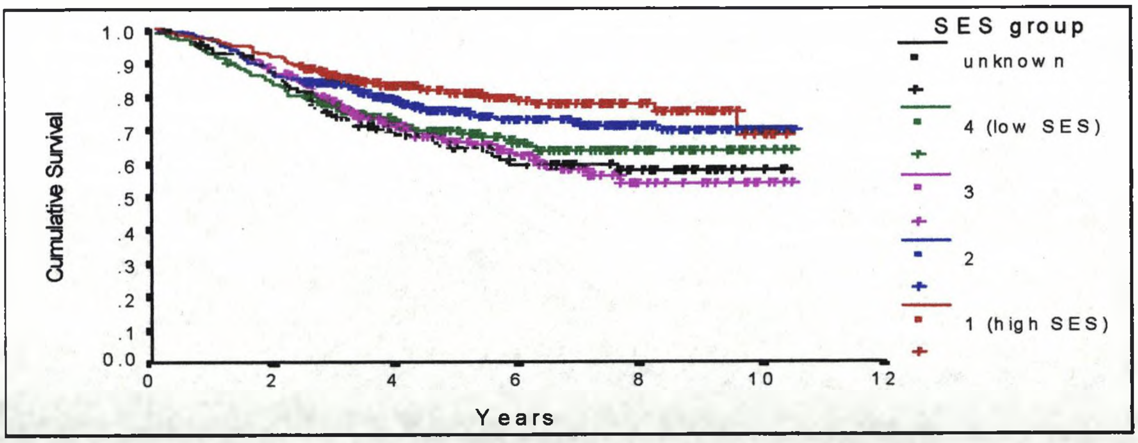


Figure 10.11b Corrected survival curves by SES group amongst women aged 50-64, for Wirral, Liverpool and Sefton combined, 1986-93

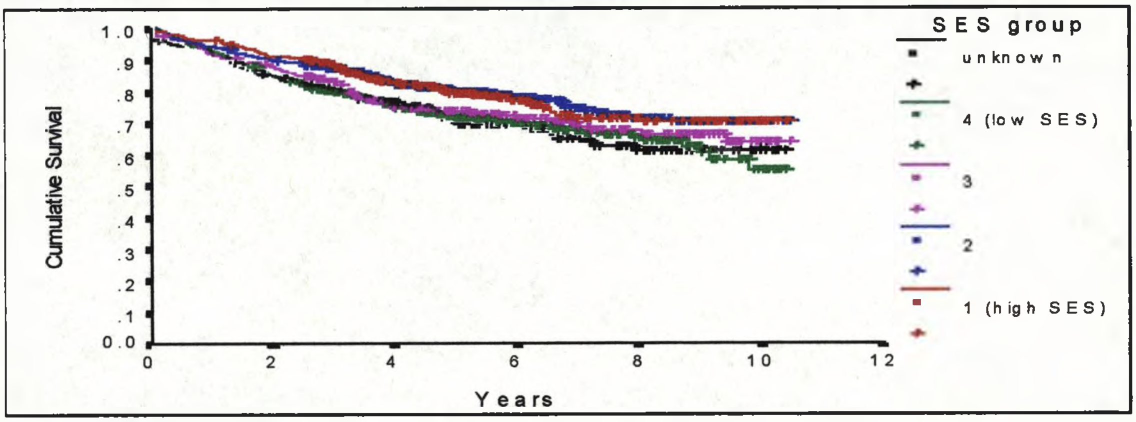


Figure 10.11a Corrected survival curves by SES group amongst women aged 65 and over, for Wirral, Liverpool and Sefton combined, 1986-93

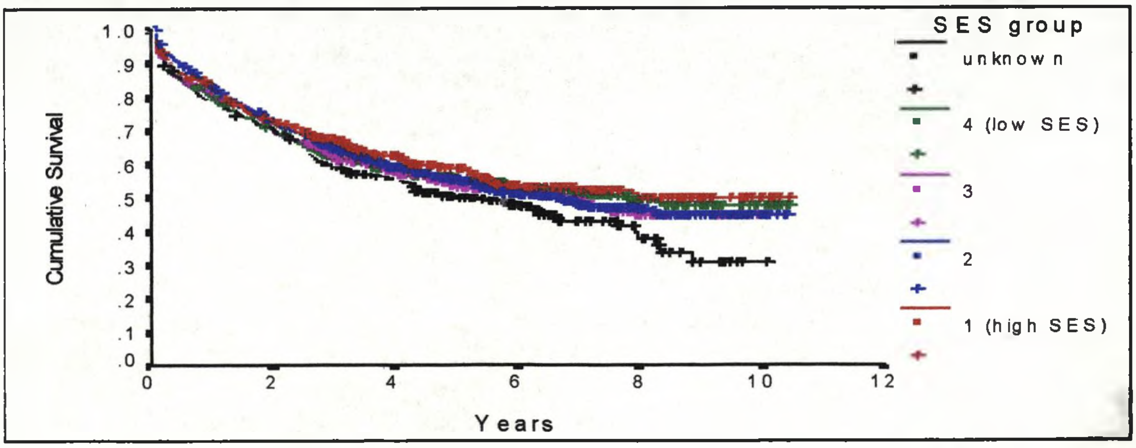


Table 10.13 5 year corrected survival rates by age band/SES group (as defined by the 4 Target Market based categories)

SES group	age under 50		age 50-64		age 65 +		all ages	
	rate (%)	median (years)	rate (%)	median (years)	rate (%)	median (years)	rate (%)	median (years)
1 (high SES)	80.6	-	79.4	-	58.3	7.9	71.8	-
2	74.7	-	79.8	-	54.9	6.2	67.0	-
3	65.8	-	73.5	-	52.9	6.6	62.5	-
4 (low SES)	69.2	-	71.8	-	54.7	7.6	63.9	-
Unknown SES	65.1	-	71.0	-	49.7	5.0	60.5	8.3

10.4 COX REGRESSION MODELLING OF THE DATA

10.4.1 SELECTION OF VARIABLES FOR INCLUSION

10.4.1.1 General factors

District was not put forward as a possible independent variable as the earlier Kaplan-Meier inspection had shown relatively little difference in survival outcomes between districts (figure 10.4). Year of diagnosis, found to have a stronger association, was included for consideration in subsequent regression models.

10.4.1.2 Sociodemographic variables

i) Age

Given the range of similar age variables available, a likely best candidate for later regression models was selected by first testing the group of related factors together and examining the outcome. When age, age group and broad age band were considered together, individual year of age initially entered the model first, but was then dropped after the addition of five year age group, which remained as the statistically most predictive of these variables. The coefficients for each of the four groups covering the age span 50 to 69 were also individually significant.

ii) Super Profile Lifestyle

Super Profile Lifestyle, having been found to be a significant single indicator of survival differences, and only partially confounded by age, was included as a possible covariate in the Cox Regression models.

10.4.1.3 Clinical indicators

In a model considering mode of presentation, proof of diagnosis and treatment status, all three entered the equation in the order presentation, proof, treatment status. To some degree these variables can be used as a rough indication of early versus late stage disease. For example, screening-indicated, microscopically confirmed cancers will generally be early stage as opposed to incidentally discovered, clinically diagnosed tumours, or many of those confirmed after the onset of symptoms.

10.4.2 THE PREDICTIVE POWER OF SUPER PROFILE LIFESTYLE WITH EACH OTHER INDIVIDUAL FACTOR

It has already been demonstrated that socioeconomic status had a degree of explanatory potential with regard to survival rates from breast cancer in this group of women. Its utility when considered with each of the other variables in turn is now examined.

The resulting models were essentially the same in two respects. Firstly, each of the variables (year of diagnosis, age group, mode of presentation, proof of diagnosis, treatment status variable) entered the regression equations first. Secondly, SES as defined by Super Profile Lifestyle, provided additional predictive power, appearing in all of the possible two-variable models. Thus, whilst socioeconomic status was not as strong an independent variable as any of the other single factors considered, it provided added predictive value.

10.4.3 THE FINAL MODEL: SELECTION FROM ALL THE VARIABLES

Lastly, all the variables were collectively included for consideration. The resulting Cox model included elements of all the information available for 1986-93, with variables entering in the order age group, proof of diagnosis, treatment status, mode of presentation, year of diagnosis, Lifestyle.

The data were then investigated for individual cases which may have exerted an unusually high influence on the calculation of the regression coefficients. This was done by plotting tumour number (each patient's unique identifier) against DfBeta, this being a statistic that estimates the change in regression coefficients with and without each case. In a scatterplot of case versus DfBeta value, outliers from the main body of points relate to those cases which might have an unusually high influence on predicted outcomes.

Each category of the six variables appearing in the final model was examined in this way. Four particular cases had noticeably outlying DfBeta values, the first with respect to the age group variable, the other three involving the treatment status variable:

i) A woman aged 103 years with a recorded survival time of just under two weeks, with clinical proof of diagnosis and no treatment noted, for reason unknown.

ii) A 76 year old, recorded as being untreated due to the disease being too advanced, yet her subsequent survival was nearly 7 years (the case being censored).

iii) A 77 year old, coded as untreated due to her general condition being too poor, actually died just over 4 years later.

iv) A similarly coded 87 year old had a recorded survival time of just over two and a half years.

These latter three women experienced much better survival times than would ordinarily have been expected in patients untreated due to disease advancement or poor general health status, whilst the 103 year old (the oldest woman in the dataset) lived for only a very short period of time subsequent to her recorded date of diagnosis. These four cases were excluded from the data and the model re-run to examine the effects of removing the statistical outliers. There was little effect on the overall model, the six variables again entering the equation in the same order.

Tables 10.14a and 10.14b show the relative risk of dying (with 95% confidence interval), associated with each indicator category (when all other factors are held constant) for the overall model, which excluded the four outlier cases. A slightly confusing feature of the Cox Regression procedure in SPSS for Windows is that either the first or the last (numerically coded) category of each variable must be used as a 'reference' category, for which relative risks are not calculated. The user may choose that the effect of each other category is measured with respect to the reference. In these analyses, this was not chosen, instead retaining the system default option of each category except the reference being compared with average survival across the cases. Where possible, the reference category of each variable was chosen in that it was the 'least useful' (e.g. unknown) category. The categories chosen as 'references' are shown in tables 10.14a and 10.14b.

From table 10.14a, it can be seen that women aged 25-29, 35-69 and 75-79 have relatively high predicted survival when compared with the overall effect of the age group variable, whilst the other age groups are associated with reduced predicted times. The relative risks for each group from 40-69 and the groups 80-84 and 90-94 are also individually significant.

Table 10.14a Relative risk of dying (when all other factors are held constant), with 95% confidence intervals, for the individual categories of each non-clinical variable included in the overall Cox model (minus 4 outliers)

Variable	Relative Risk	95% confidence interval
Age group		
20-24	1.64	(0.56 to 4.79)
25-29	0.89	(0.50 to 1.57)
30-34	1.11	(0.76 to 1.61)
35-39	0.83	(0.63 to 1.09)
40-44	0.74	(0.59 to 0.93)
45-49	0.76	(0.63 to 0.93)
50-54	0.71	(0.59 to 0.86)
55-59	0.71	(0.60 to 0.86)
60-64	0.68	(0.57 to 0.81)
65-69	0.82	(0.69 to 0.96)
70-74	1.04	(0.89 to 1.22)
75-79	0.95	(0.81 to 1.12)
80-84	1.22	(1.03 to 1.45)
85-89	1.20	(0.98 to 1.47)
90-94	1.58	(1.19 to 2.10)
95-99	'reference'	
Super Profile Lifestyle		
A: Affluent Professionals	0.84	(0.70 to 1.02)
B: Better Off Older People	0.85	(0.71 to 1.01)
C: Settled Suburbans	0.84	(0.71 to 1.00)
D: Better Off Young Families	1.10	(0.89 to 1.28)
E: Younger/mobile persons	1.18	(0.79 to 1.75)
F: Rural Communities	0.66	(0.26 to 1.63)
G: Lower Income Elderly	1.00	(0.84 to 1.21)
H: Blue Collar Families	1.04	(0.86 to 1.26)
I: Lower Income Households	1.18	(0.96 to 1.46)
J: 'Have Nots' Households	1.01	(0.85 to 1.19)
O: No codes attached	1.13	(0.96 to 1.33)
K: Unclassified	'reference'	
Year of diagnosis		
1986	1.46	(1.25 to 1.71)
1987	1.36	(1.16 to 1.58)
1988	1.00	(0.88 to 1.13)
1989	1.00	(0.87 to 1.13)
1990	0.90	(0.78 to 1.02)
1991	0.84	(0.73 to 0.97)
1992	0.85	(0.72 to 1.01)
1993	'reference'	

Risk is relative to the overall survival curve of the whole study group

Table 10.14b Relative risk of dying (when all other factors are held constant), with 95% confidence intervals, for the individual categories of each clinical variable included in the overall Cox model (minus 4 outliers)

Variable	Relative Risk	95% confidence interval
Mode of presentation		
screening	0.37	(0.27 to 0.50)
symptoms	1.23	(1.09 to 1.39)
other	1.68	(1.41 to 2.01)
unknown	'reference'	
Proof of diagnosis		
microscopic	0.55	(0.47 to 0.65)
macroscopic/direct observation.	0.99	(0.71 to 1.40)
clinical only	1.58	(1.32 to 1.88)
unknown	'reference'	
Treatment status (1986-93)		
ct only	1.41	(1.15 to 1.71)
ht only	0.80	(0.49 to 1.32)
surg only	0.44	(0.33 to 0.58)
xrt only	0.53	(0.37 to 0.75)
ct + ht	1.30	(1.13 to 1.50)
ct + xrt	1.80	(1.33 to 2.44)
ct + surg	0.66	(0.52 to 0.84)
surg + ct	0.49	(0.37 to 0.66)
ct + ht + surg	0.72	(0.55 to 0.94)
ct + ht + xrt	1.12	(0.95 to 1.31)
ct + surg + xrt	0.65	(0.50 to 0.83)
ct + ht + surg + xrt	1.01	(0.81 to 1.26)
no treatment (too advanced/condition too poor)	8.24	(6.51 to 10.44)
no treatment- other or reason unknown	0.83	(0.70 to 0.99)
other treatment- xrt status unknown[1]	'reference'	

Risk is relative to the overall survival curve of the whole study group

[1]ct, ht and surg in various combinations or singly, xrt status unknown

In the overall model the top three Lifestyles, A to C, are associated with increased expected survival times, as is Lifestyle F. Meanwhile, the other Lifestyles and the women with no Super Profile codes attached have poorer survival times. Although the tabulated confidence interval for Lifestyle C includes the figure of 1.00, to three decimal places, the upper value of this interval is 0.996, indicative of statistical significance ($p < 0.05$).

The pattern for year of diagnosis illustrates again the trend towards improved survival rates at a given time in more recent years. 1993 has no relative risk calculated since SPSS requires that either the first or last category in a group be a reference variable; this year was chosen as it has the shortest period of case observation. The years 1986, 1987 and 1991 were individually significant in their potential predictive power with respect to survival time.

Each category of mode of disease presentation was significantly predictive in its own right (table 10.14b). The low relative risk associated with the screening-detected cases indicates the better survival times associated with this group. With respect to proof of diagnosis, those confirmed by clinical means only had the poorest predicted chances of survival. Microscopic (improved survival) and clinical proof (lessened chances of survival) were both individually significant in their predictive values.

Mathematical predictions of survival rates are higher in cases where only hormone therapy (ht) or radiotherapy (xrt) was given, and in treatments involving surgery (excepting those women receiving all four forms of treatment). The highest expected values relate to those cases where surgery was performed but other therapies were absent, probably indicative of early, localised disease not requiring further intervention. The particularly high relative risk (8.24) relating to women receiving no treatment due to their disease being too advanced or their general condition being too poor illustrates again the reduced survival expectancy in this group. Meanwhile, women with no treatment information for other or unknown reasons had good outcomes when compared with the overall effect of the treatment status variable. The explanation for this lies with the fact that many of these 'no treatment' cases will actually have received treatment, although their details had not yet been received and recorded by the Cancer Registry at the time the dataset was provided. The predictive values of all categories in this variable were significant, excepting those for ht only, chemotherapy + ht + xrt, and all four therapies combined (table 10.14b).

The impact on these findings, of the erroneously low proportion of cases with surgical treatment (discussed already, in section 10.2.3.3), was examined. Firstly, the Cox model procedure involving treatment status and Super Profile Lifestyle was re-run, using only the 1986 and 1987 registrations, to examine whether a fuller picture of treatment or non treatment would explain more of the SES differences observed. Both variables entered this model, indicating that there was still an SES gradient after adjusting only for treatment status.

Secondly, the final Cox regression procedure described above was re-run, using only the 1986 and 1987 registrations. Three variables entered this model, in the order age group, proof of diagnosis, treatment status. Super Profile Lifestyle did not enter this model, although neither did mode of presentation and year of diagnosis. One reason for mode of presentation not being selected was that in this earlier subset of data the screening-detected group was virtually non-existent. The overall survival difference between 1986 and 1987 registrations was also relatively small. The range of corrected survival rates amongst the different Lifestyles was slightly wider for the 1986-87 subset than that shown for the whole dataset (table 10.6). Lifestyle may not have been included as a covariate in the repeat of the final model because socioeconomic variation in survival during these earlier years was largely accounted for after adjustment for age, more accurately recorded treatment status and proof of diagnosis. It may also be the case that, as with year of diagnosis and mode of presentation, SES has a greater 'true' independent effect on survival when considered over a longer time period.

From these later investigations, it is concluded that whilst SES certainly has a significant influence on survival which is not fully explained by adjusting for each of the other variables individually, its effect *might or might not* be reduced to an insignificant one if more accurate treatment status information were available in the specific dataset used for these analyses. It is with that caveat that the relative risks in tables 10.14a and 10.14b, which do indicate improved or reduced survival in the anticipated direction for each category of each variable, have still been presented.

10.5 SUMMARY OF FINDINGS

- Five year corrected survival for the study group was 65.6%.

- District of residence was the only variable considered here that was not significantly associated with survival overall, although the rates for Liverpool were clearly lower than those in Sefton, which had the most favourable rates.

- Survival was found to vary significantly by Super Profile Lifestyle. A smaller number of broader SES categories were used for reasons of practicality in visual analyses of survival.

- Survival rates were higher in more recently diagnosed women and those in middle (50-64 years) as opposed to the youngest or oldest age bands. Regarding the clinical variables, survival was higher amongst women presenting via screening, or with microscopically proved diagnoses, or in those whose treatment was radiotherapy alone or involved surgery. Much poorer rates were observed in women diagnosed only clinically, in those not receiving surgery, or amongst those receiving no treatment due to advanced disease or poor general condition.

- The socioeconomic gradient in survival persisted after adjustment for each of the other factors individually, these being age group, year of diagnosis, mode of presentation, proof of diagnosis, and, *possibly*, treatment status.

- SES as defined by Super Profile Lifestyle was included with each of the other variables in a Cox regression model. It entered the model last, indicating that it was by no means the strongest predictor of survival, but also that after accounting for age group, proof of diagnosis, treatment status (with the caveat that some of this coding was found to be erroneous), mode of presentation and year of diagnosis (in that order), socioeconomic status *probably* had additional value in predicting survival outcomes. Women of high SES had longer predicted survival times, whilst those of lower SES had shorter expected times.

CHAPTER 11

RESULTS OF THE ANALYSES OF BREAST SCREENING UPTAKE

RESULTS OF THE ANALYSIS OF BREAST SCREENING UPTAKE

The results from the analyses of screening unit data are presented within this chapter in the following order:

1. Overall uptake rates for each screening unit, including total and age-specific rates
2. The spatial patterns of uptake across each district- small area variations in response
3. Socioeconomic variations in uptake, by
    i) Super Profile Lifestyle
    ii) Super Profile Target Market
4. Lifestyle characteristics of Census enumeration districts (EDs) showing significantly low and high response rates: the 'socio-spatial link'
5. Uptake by Super Profile Lifestyle and 5 year age band
6. Uptake amongst repeat invitees versus first timers- 'novices' and 'veterans'
7. Self-Referral rates and "Recently Screened" status by Lifestyle
8. Summary of findings

11.1 OVERALL FIGURES

11.1.1 Total uptake rates for the units

Figure 11.1 illustrates the levels of response to invitation during the first years of screening in each district. The actual percentages for uptake in each year and screening round are shown in table 11.1. The Liverpool unit, which commenced screening a year earlier than the other two, has had the lowest overall uptake rates, although from an initially poor 53.2%, response has been rising and had improved by just over 10% by 1995. Wirral has the most favourable rates, always exceeding 70% overall, particularly in 1992, when invitations were concentrated on the more affluent western parts. Overall uptake figures for the Sefton and Knowsley unit lie between those of the other two districts, and whilst slightly declining between the beginning of round 1 and round 2, appeared to pick up again during the second round. Again, these yearly fluctuations may be related to the characteristics of the particular geographical area within which invitations were concentrated in given years.

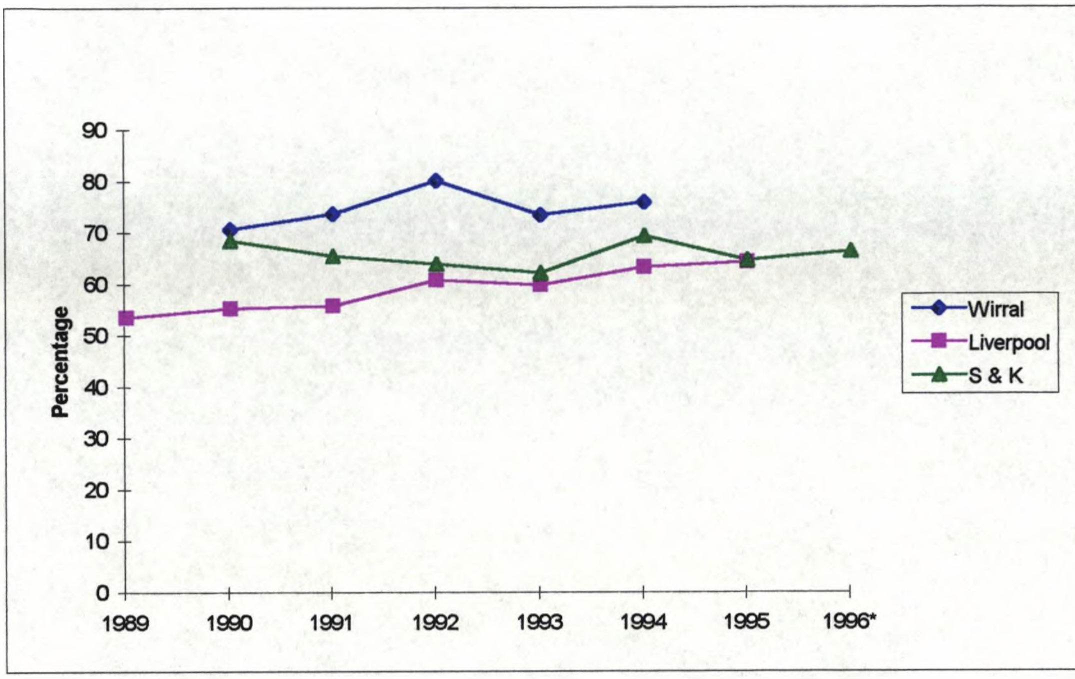
Table 11.1 Percentage uptake of screening invitations for each unit, by year and round

District	Round 1	Round 2
Wirral	75.2	74.5[1]
Liverpool	56.2	62.0
Sefton & Knowsley	64.4	66.3
Total	64.2	66.5

District	1989	1990	1991	1992	1993	1994	1995
Wirral		70.4	73.4	79.8	73.1	75.6	
Liverpool	53.2	55.0	55.5	60.4	59.5	63.0	63.9
Sefton & Knowsley		68.1	65.2	63.5	61.8	69.0	64.3
Total		63.9	63.9	68.1	64.5	68.9	64.1[2]

[1]Wirral's second round was not complete when the data were provided. See chapter 8 (data and methods)
[2]Liverpool and Sefton & Knowsley average

Figure 11.1 Yearly rates of screening uptake, for the Wirral, Liverpool and Sefton & Knowsley units



S & K: Sefton & Knowsley *to March

11.1.2 Yearly spatial distribution of invitations

The possible correspondence between the geographical (and therefore social) spread of invitations in each year and the overall uptake for that period was examined. Figures 11.2a to 11.2d illustrate the yearly spatial distributions of invitations during the first round of screening by each unit. The distribution of second round invitations is extremely similar in terms of the order in which areas of each district were covered. The areas focused on in the first two years of Wirral's second round are essentially identical to those covered during the first two years of its initial round. Meanwhile, in Liverpool and Sefton, the geographical patterns of invites each year of their second rounds correspond with those for years 2, 3 and 4 in their first rounds. In Knowsley, the distribution of invites during year 5 (1994) was the same as that during year 2 (1991), whilst the pattern in year 6 (1995) was virtually identical to that for year 3 (1992).

In Wirral, the geographical variation in the main body of invitations is particularly striking (figure 11.2a). In the first year of the round, invited women were mainly concentrated in Birkenhead and nearby, predominantly deprived areas. Year two saw a move to the north and south of Birkenhead, with very mixed socioeconomic characteristics of invitees, although with fewer deprived groups this could be a partial explanation for year two's better uptake. Many of year three's invitees were the most affluent women in the district, hence a higher uptake overall. It should not be surprising, then, that response fell again by the first year of round two, when invitations were once more sent predominantly to women resident in Birkenhead and its neighbouring areas.

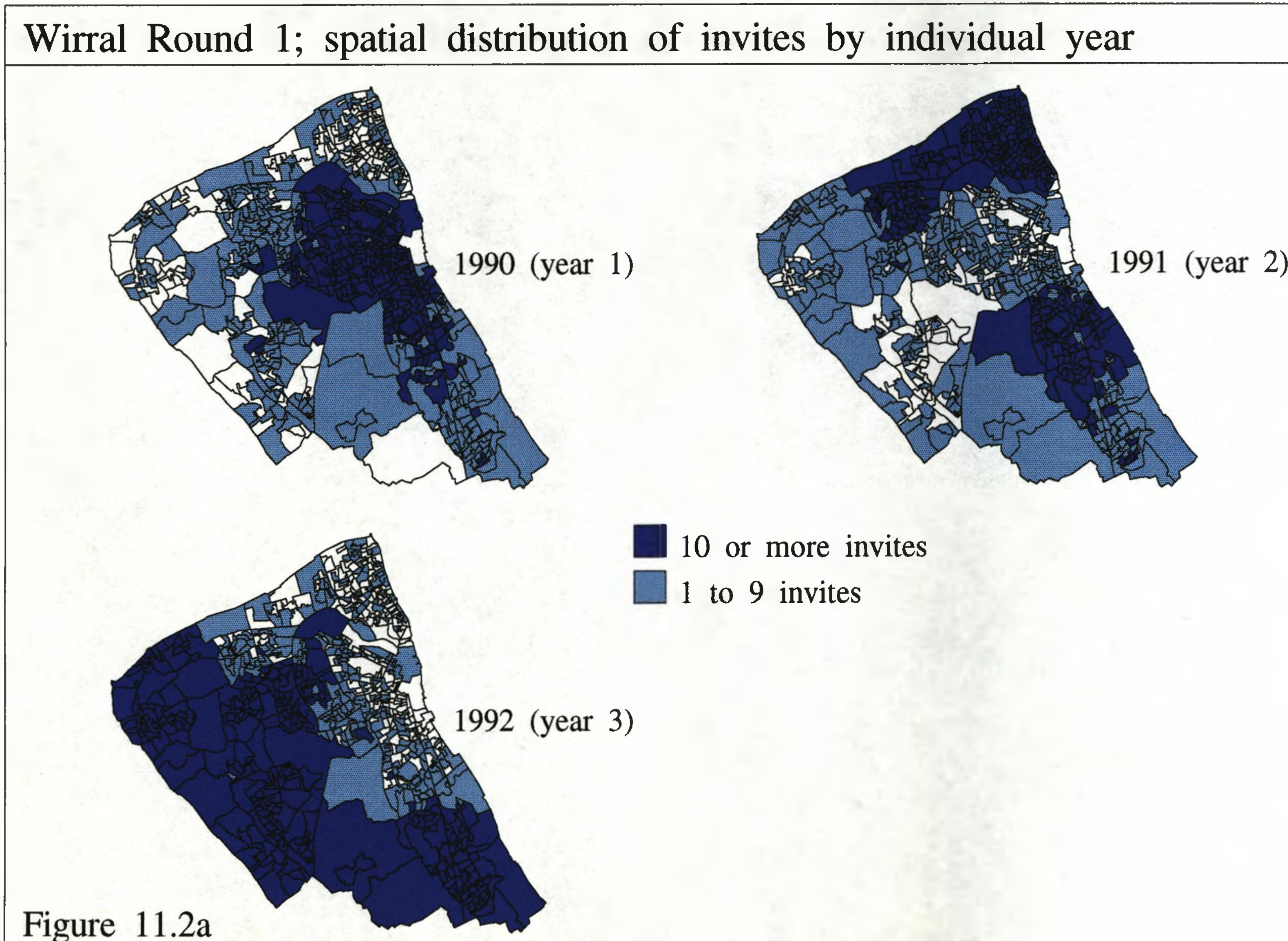

Wirral Round 1; spatial distribution of invites by individual year
1990 (year 1)
1991 (year 2)
1992 (year 3)
10 or more invites
1 to 9 invites

Figure 11.2a

Liverpool Round 1; spatial distribution of invites by individual year

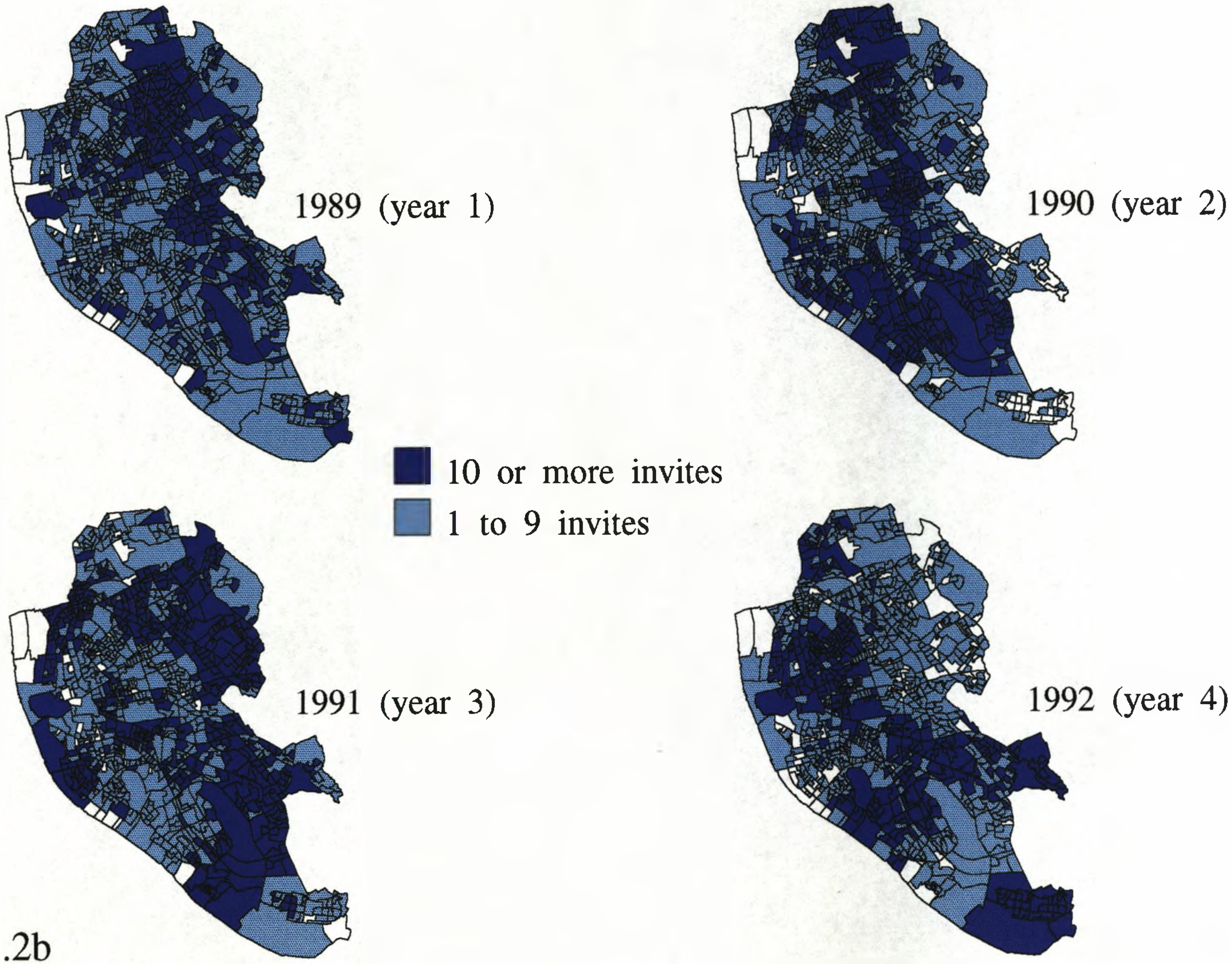


Figure 11.2b

Sefton Round 1; spatial distribution of invites by individual year

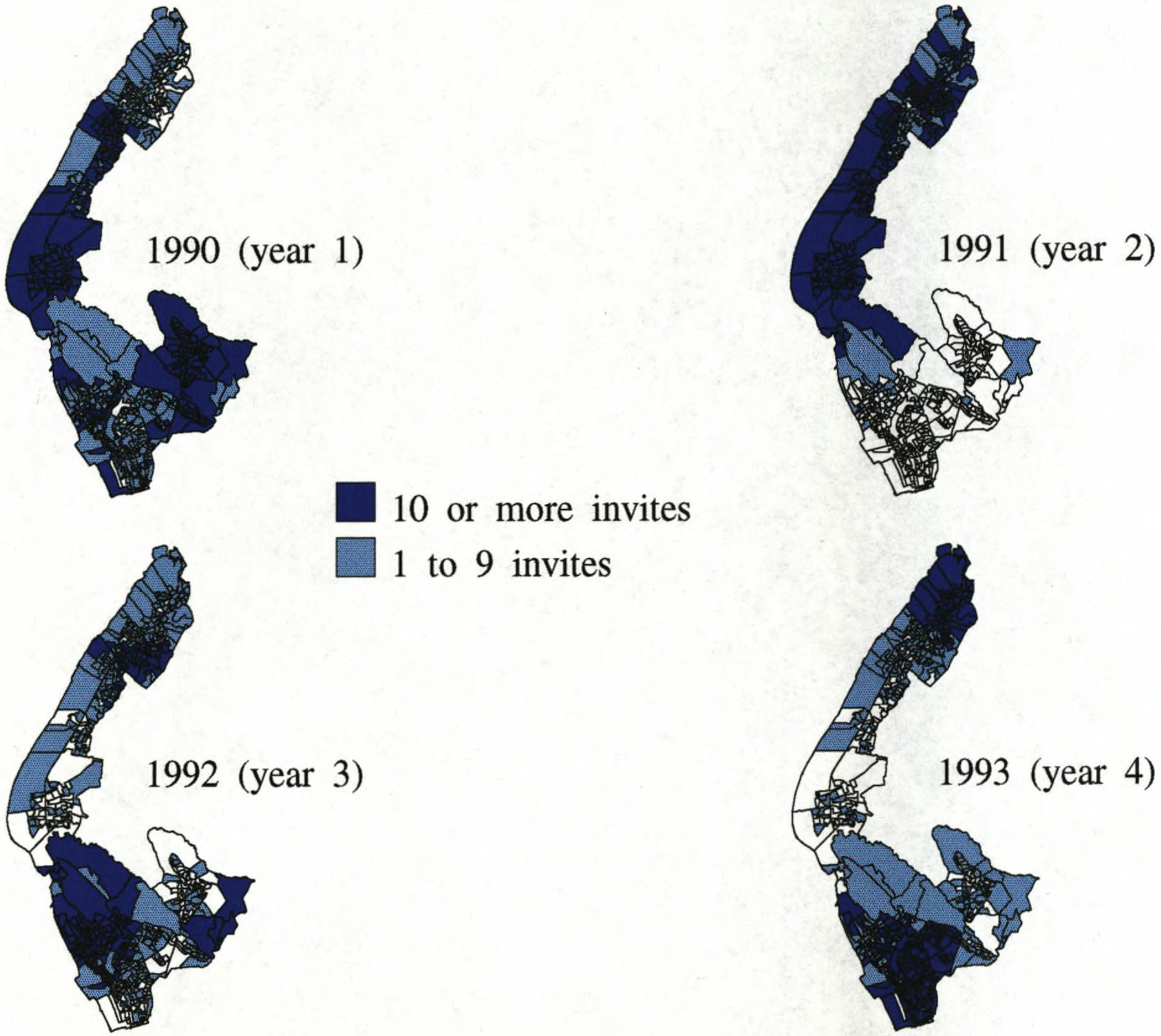


Figure 11.2c

Knowsley Round 1; spatial distribution of invites by individual year

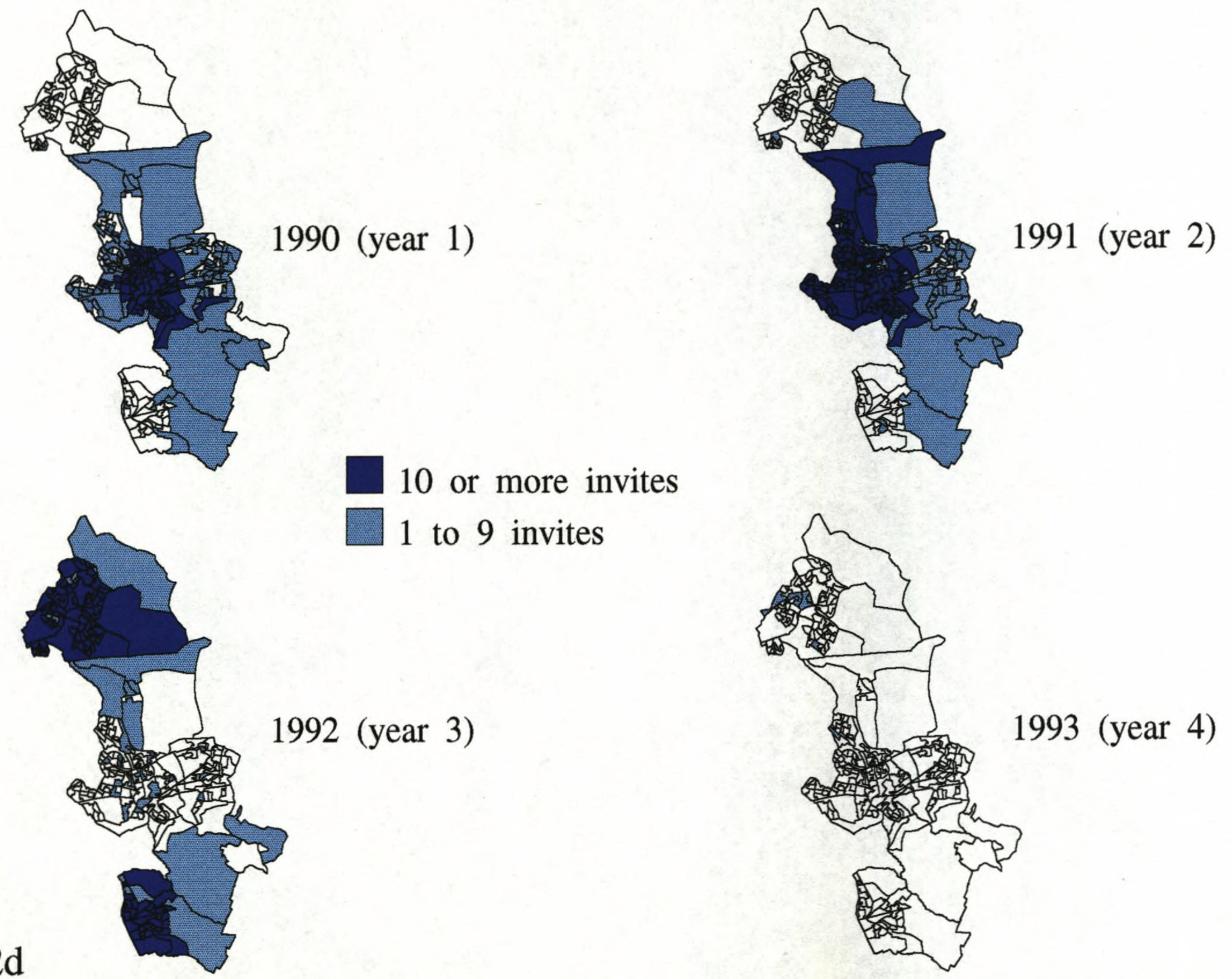


Figure 11.2d

The changing pattern in Liverpool is less distinct (figure 11.2b), though it can be seen that some particular neighbourhoods received most attention during specific years, for example Speke (at the southern tip) during 1992. Whilst attendance during each round tended to improve year on year, any potential explanation based on the predominant social characteristics of the areas targeted during each year is less immediately clear in this district.

The Sefton and Knowsley screening unit, in contrast to the other two, shows some evidence of year on year decline in uptake within each round. Figure 11.2c shows that, in Sefton, earlier invitations tended to come from more affluent areas, such as Formby and Maghull. Subsequent invitations concentrated on other affluent or moderately affluent areas such as Crosby and Ince Blundell, whilst the end of the rounds focused on women in Southport and the deprived southern part of the district. As with Wirral, the fairly distinct spatial changes in invitation patterns partially explains yearly fluctuations in overall uptake rates. The majority of this mobile unit's data relate to Sefton residents, only around one quarter of the invitations being sent to women resident in the smaller district of Knowsley in each round (c.9500 of c.36,000 invitations in total). Each year of invitations in Knowsley (figure 11.2d) involved areas that were identified in chapter 7 as particularly deprived, although the main area covered in year one has fewer of the most deprived EDs than do those in the two following years. Although Knowsley's share of the invitations is much the smaller one, this would reinforce the reasoning that the mobile unit's uptake figures tended to decline from the first to last year of each round due, at least in part, to the socioeconomic characteristics of the areas concentrated on in each year.

11.1.3 Overall uptake by age band

Figures 11.3a, 11.3b and 11.3c illustrate yearly variations in uptake by 5 year age band in each district. The values are shown in table 11.2. Rates amongst 50-54 year olds are almost identical to those in 55-59 year olds on the Wirral, and similar for the Liverpool and Sefton units. Uptake is sometimes slightly higher amongst the middle age group than in the youngest women who are automatically invited. However, response in the oldest group of invitees, the 60-64s, is lowest. This is true for all of the units, although the difference is more pronounced in Liverpool and Sefton than in Wirral.

11.2 SPATIAL PATTERNS OF UPTAKE

The large numbers of records within the screening datasets permit a fairly detailed investigation of the spatial variations in local mammography uptake. Figures 11.2b to 11.2d have already provided an illustration of the yearly distribution of invites from the Liverpool and Sefton & Knowsley units, within their districts of operation. Figure 11.4 highlights, as an example, the 'overspill' of Liverpool unit invites to Sefton district residents, and vice versa, during the first round; second round data are similar. Since women are invited according to the location of their GP practice and not their own district of residence, such spatial 'fuzziness' of invitation patterns will be a feature of any screening unit's data, to a greater or lesser degree. For instance, some Knowsley residents are invited to the Liverpool unit, and vice versa.

Figure 11.3a Wirral unit; yearly uptake rates by 5 year age band

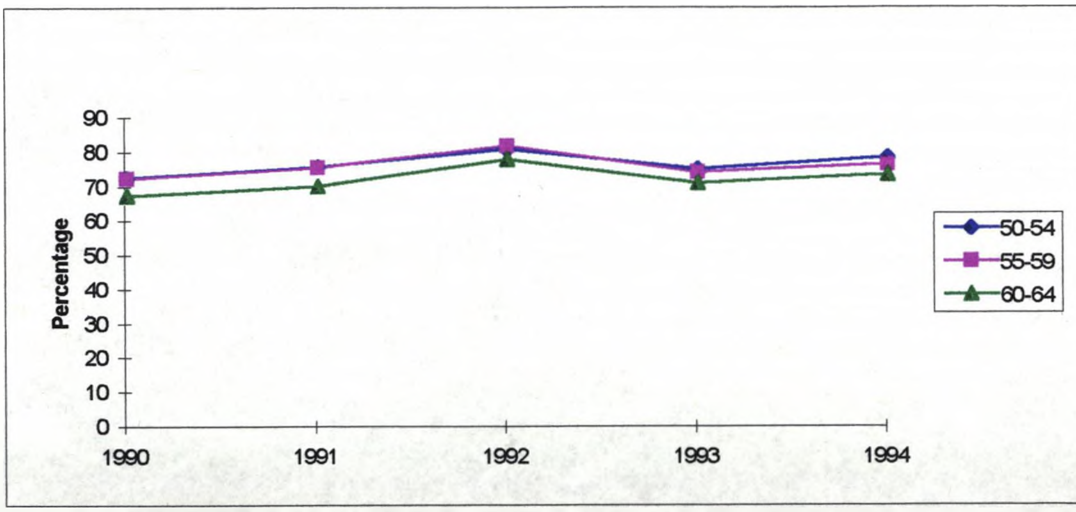


Figure 11.3b Liverpool unit; yearly uptake rates by 5 year age band

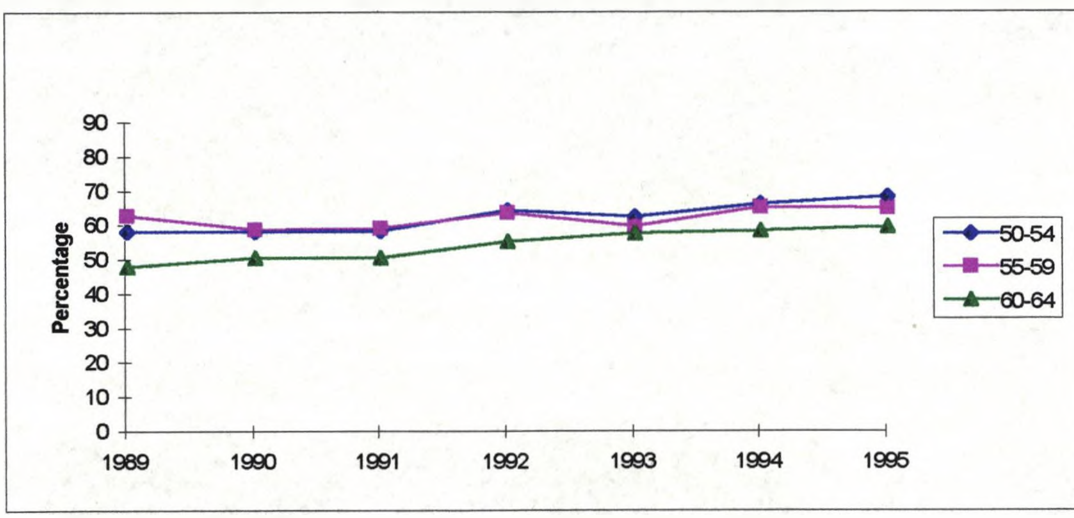


Figure 11.3c Sefton & Knowsley unit; yearly uptake rates by 5 year age band

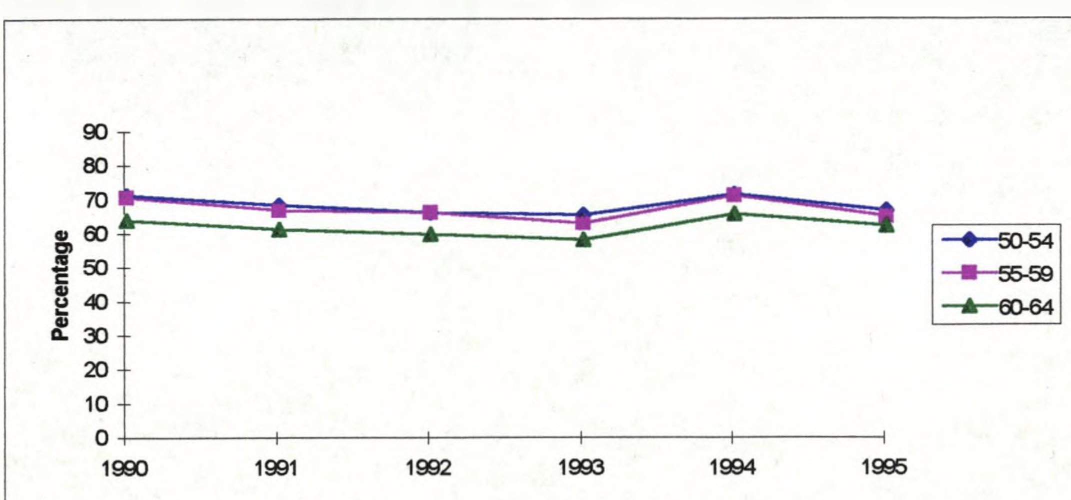


Table 11.2 Percentage uptake rates by screening unit and 5 year age group

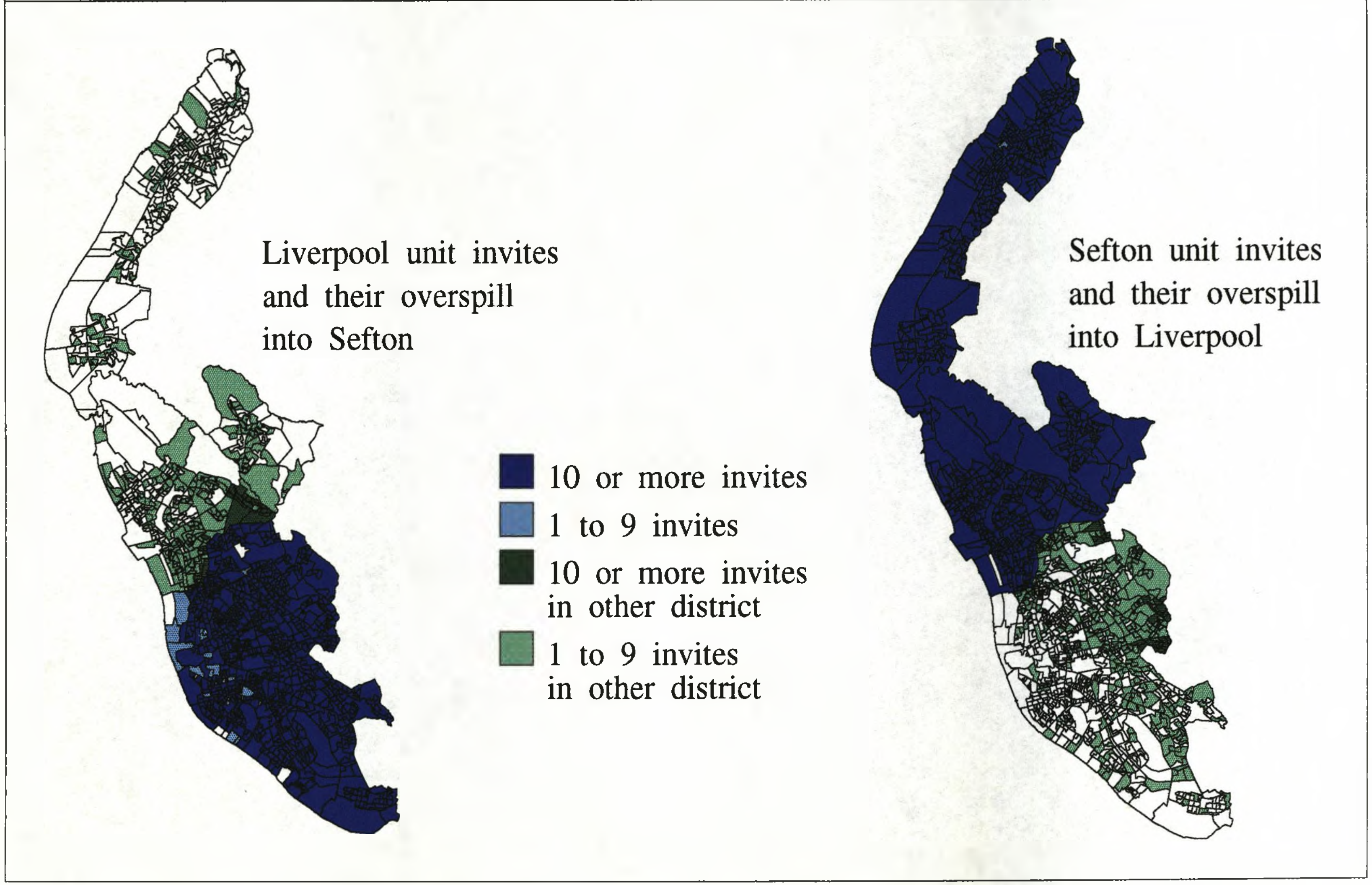
Wirral		**1990**	**1991**	**1992**	**1993**	**1994**			**round 1**	**round 2**	**overall**
50-54		72.1	75.4	80.4	74.6	78			76.6	76.3	76.5
55-59		71.9	75.1	81.2	73.7	75.8			76.7	74.8	75.9
60-64		66.9	69.7	77.4	70.5	72.9			72.1	71.8	72
Liverpool	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**		**round 1**	**round 2**	**overall**
50-54	57.8	57.8	58.1	63.9	62.1	65.9	67.9		59.3	65.4	62.1
55-59	62.4	58.3	58.8	63.2	59.3	64.9	64.6		60.2	63.2	61.7
60-64	47.6	50.2	50.2	54.8	57.3	58.1	59.2		50.9	57.7	54
Sefton & Knowsley		**1990**	**1991**	**1992**	**1993**	**1994**	**1995**		**round 1**	**round 2**	**overall**
50-54		70.8	68	65.8	65.1	71	66.4		67.2	68.5	67.9
55-59		70.4	66.5	65.9	62.6	70.7	64.6		66.2	67.1	66.7
60-64		63.5	61	59.4	57.8	65.3	61.9		60	63.2	61.5
3 UNITS TOTAL		**1990**	**1991**	**1992**	**1993**	**1994**	**1995***		**round 1**	**round 2**	**overall**
50-54		67.1	66.8	70.6	67.2	71.4	67.1		66.8	69.2	67.9
55-59		66.1	65.8	70.1	64.8	70.1	64.6		67.0	67.2	67.1
60-64		58.8	59.1	63.2	61.2	64.7	60.7		59.3	62.8	60.9

*Liverpool and Sefton & Knowsley figures only

Wirral, being geographically more separate, bounded on three sides by water, has a much lower rate of cross-boundary flow of invitations, though where it does occur it usually follows the same pattern. At its southern tip, some women registered with Cheshire-based GPs are not invited for screening at the Wirral unit. Conversely, a few Cheshire women are invited to Birkenhead.

Most of the analysis of the screening data was performed according to unit of operation (i.e. Wirral static, Liverpool static, Sefton & Knowsley mobile). However, it was decided, for purposes of completeness, that the examination of spatial variation in uptake rates in Liverpool, Sefton and Knowsley should be presented according to each invitee's district of residence. Figure 11.4 illustrates that in most cases fewer than ten women resident in any given Census Enumeration District in Sefton were invited for screening in Liverpool, and that the same was true in reverse. This would be insufficient for a full spatial analysis based on unit of operation, but neither was it thought suitable to omit these women from this examination. Therefore, geographical variation in uptake amongst all the Liverpool residents was considered together, regardless of which unit they had been invited to. The same was done for Sefton and Knowsley residents. The mapped patterns which emerge for these districts, and are shown in this chapter, are similar to those which appeared when experimental maps by unit of operation were produced. Spatial analysis by district of residence rather than by unit of operation simply allowed the inclusion of a larger number of cases within each ED. With respect to Wirral, uptake amongst this district's residents invited for screening in Cheshire cannot be known from the datasets used here.

Figure 11.4 Round 1: Maps illustrating the invitation of Sefton residents to the Liverpool screening unit, and vice versa



11.2.1 Spatial variation in uptake in Wirral

Uptake in Wirral EDs in which there were a minimum of 10 invitees ranged from 36.8% (19 women) to 100% (28 women). The range of absolute values for the second round is not representative of the whole district since the data are incomplete. Figures 11.5 and 11.6 illustrate the levels of attendance by Census Enumeration District during the first round and much of the second round of screening at the St Catherine's Hospital unit. For the general locations of the district's villages and towns, refer back to figure 7.2.

From the mapped results for the first round, it is evident that within much of the district response to invitation was good, with areas such as Bebington, Caldy (just south of West Kirby), Upton and Heswall showing attendance rates significantly above the national target. In total, 480 of the 709 EDs into which Wirral was divided for the 1991 Census showed more than 70% attendance (table 11.3). 160 EDs had rates slightly below the target. These related to areas such as Seacombe (north of central Birkenhead, on the River Mersey), parts of Bromborough, Birkenhead and New Brighton, Leasowe (between Wallasey and Moreton), sections of West Kirby and Hoylake. Relatively few (21) small areas of the Wirral showed significantly poor uptake during the first round of screening. With one exception, these areas are all located to the east and north east of the M53 motorway, in parts of Bidston (between Birkenhead and Moreton), Birkenhead, Bromborough and the north east tip of the district around Egremont and New Brighton.

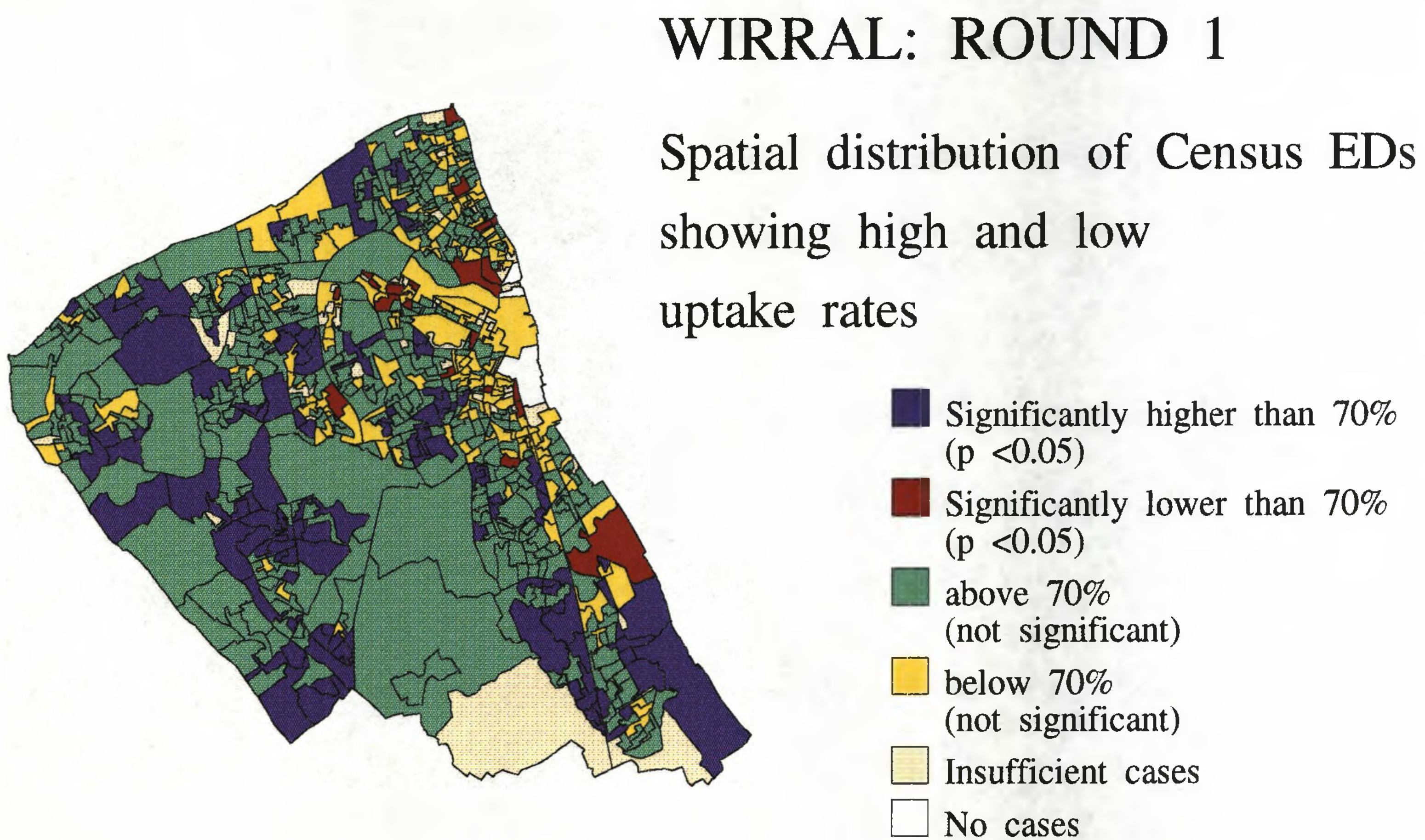

WIRRAL: ROUND 1
Spatial distribution of Census EDs showing high and low uptake rates
Significantly higher than 70% (p <0.05)
Significantly lower than 70% (p <0.05)
above 70% (not significant)
below 70% (not significant)
Insufficient cases
No cases

Figure 11.5

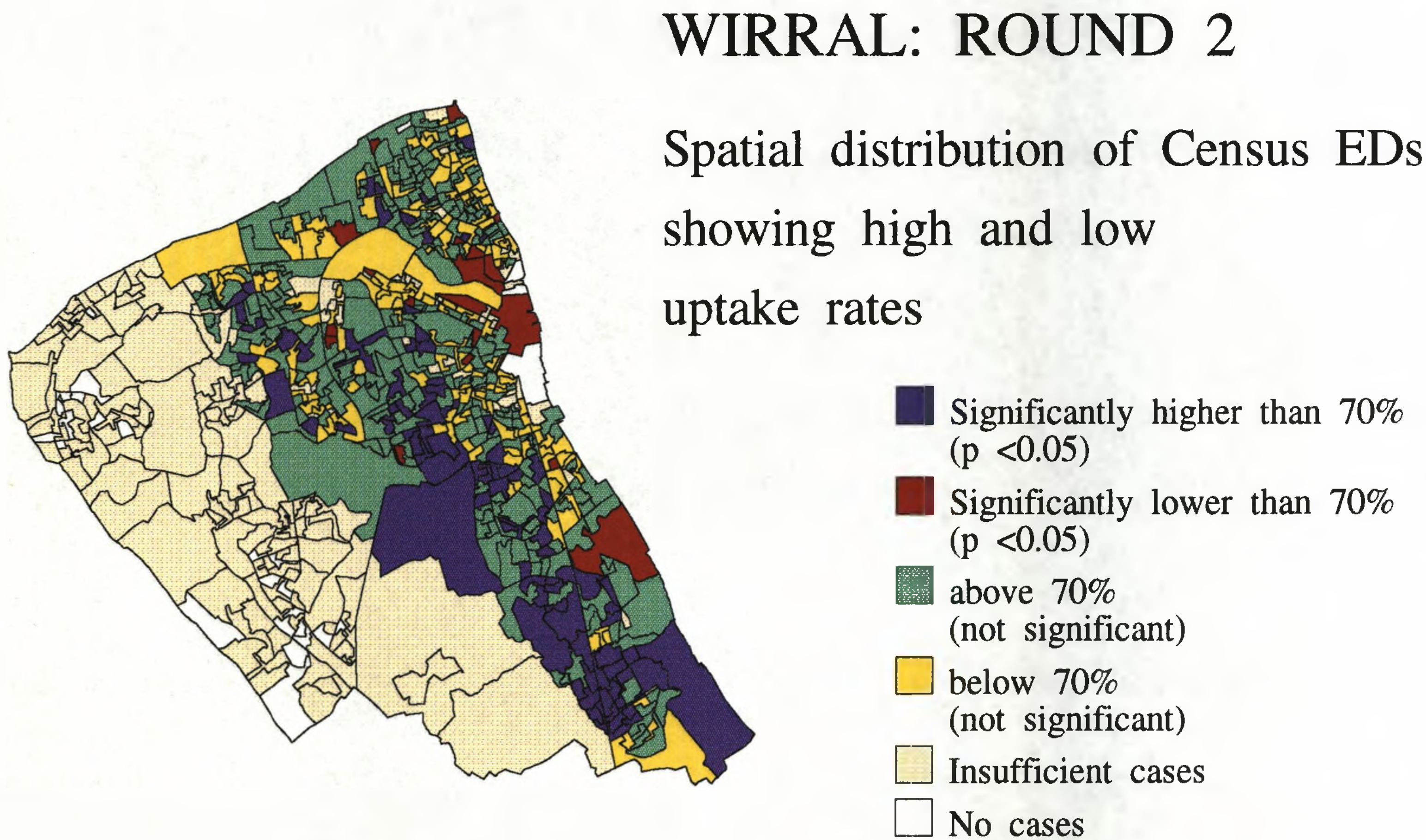

WIRRAL: ROUND 2
Spatial distribution of Census EDs showing high and low uptake rates
Significantly higher than 70% (p <0.05)
Significantly lower than 70% (p <0.05)
above 70% (not significant)
below 70% (not significant)
Insufficient cases
No cases

Figure 11.6

A number of areas did not have sufficient numbers of cases present to enable the calculation of the chi-squared statistic. Mostly these were relatively small, probably low population EDs, in various parts of the district. However, particularly in the case of the two large EDs at the southern end of Wirral, there are likely to be women who are registered with Cheshire-based GPs, and therefore are invited for screening at another unit.

Table 11.3 Numbers of enumeration districts (EDs) showing uptake rates above and below 70%, by screening round and district of residence

	Wirral		Liverpool		Sefton		Knowsley	
	Round 1	Rd. 2	Rd. 1	Rd. 2	Rd. 1	Rd. 2	Rd. 1	Rd. 2
Total no. EDs	709		988		580		299	
Significantly High attendance	114	90	3	16	30	36	3	4
Significantly Low attendance	21	20	438	278	114	75	98	67
Nonsignificantly High attendance	366	267	118	215	198	214	39	49
Nonsignificantly Low attendance	160	157	346	345	215	229	84	104
Insufficient cases	44	162	74	106	13	13	62	64
No cases	4	13	9	28	10	13	13	11

As mentioned above, figure 11.2a illustrates that the earlier years of each round concentrated mainly on women living in the eastern half of the district (or more strictly, those registered with GPs located on that side). Many of the more affluent areas, such as Hoylake and Heswall, had yet to be covered during Wirral's second round when that dataset was received in Summer 1995. However, amongst those EDs for which sufficient data were available, a fairly similar pattern of uptake presents itself. There appeared to be a slight improvement in (already satisfactory) uptake in some areas such as parts of Bromborough and some fluctuation about the 70% mark in other EDs throughout the eastern half of the Wirral. Twenty areas showed significantly low uptake during the first 25 months of round 2, all similarly located to those for round 1.

11.2.2 Spatial variation in uptake in Liverpool

Uptake in Liverpool EDs in which there were a minimum of 10 invitees ranged from 6.7% (15 women) to 89.3% (28 invitees) in the first round. In the second round the minimum was 10.5% (19 women), and the maximum, 90.2% (41 invites). Figures 11.7 and 11.8 illustrate ED-level variations in uptake amongst women resident in Liverpool. (For the basic locations of Liverpool's inner city and suburban areas, refer back to figure 7.4). From the maps it is immediately evident that response rates have not been as favourable in Liverpool as in Wirral. Swathes of red across the district, particularly in Figure 11.7, highlight the significantly low response noted from many enumeration districts in the city. During the first round of screening only 3 EDs had uptake rates significantly above 70%, these being located in Woolton, Aigburth, and between Wavertree and Old Swan. 464 of the 988 EDs had point estimates for uptake that were not significantly higher or lower than the target (table 11.3); however more than two thirds of these had rates on the lower side. Those EDs with uptake slightly in excess of 70% are predominantly located in the southern and eastern parts of the district, particularly in Aigburth, Mossley Hill, Allerton, Woolton and Childwall (between Broad Green and Belle Vale), as well as throughout many of the city's suburbs.

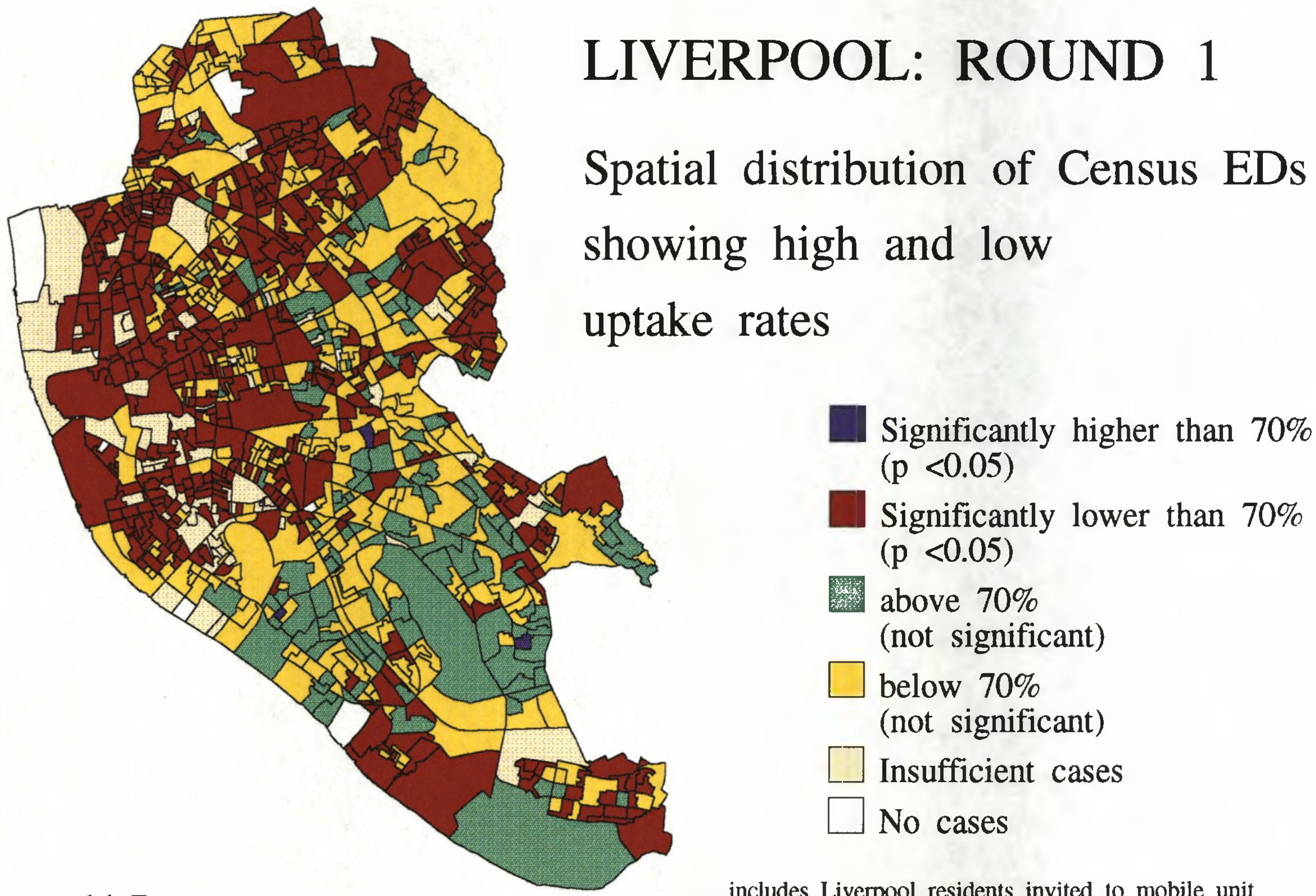

LIVERPOOL: ROUND 1
Spatial distribution of Census EDs showing high and low uptake rates
Significantly higher than 70% (p <0.05)
Significantly lower than 70% (p <0.05)
above 70% (not significant)
below 70% (not significant)
Insufficient cases
No cases
includes Liverpool residents invited to mobile unit

Figure 11.7

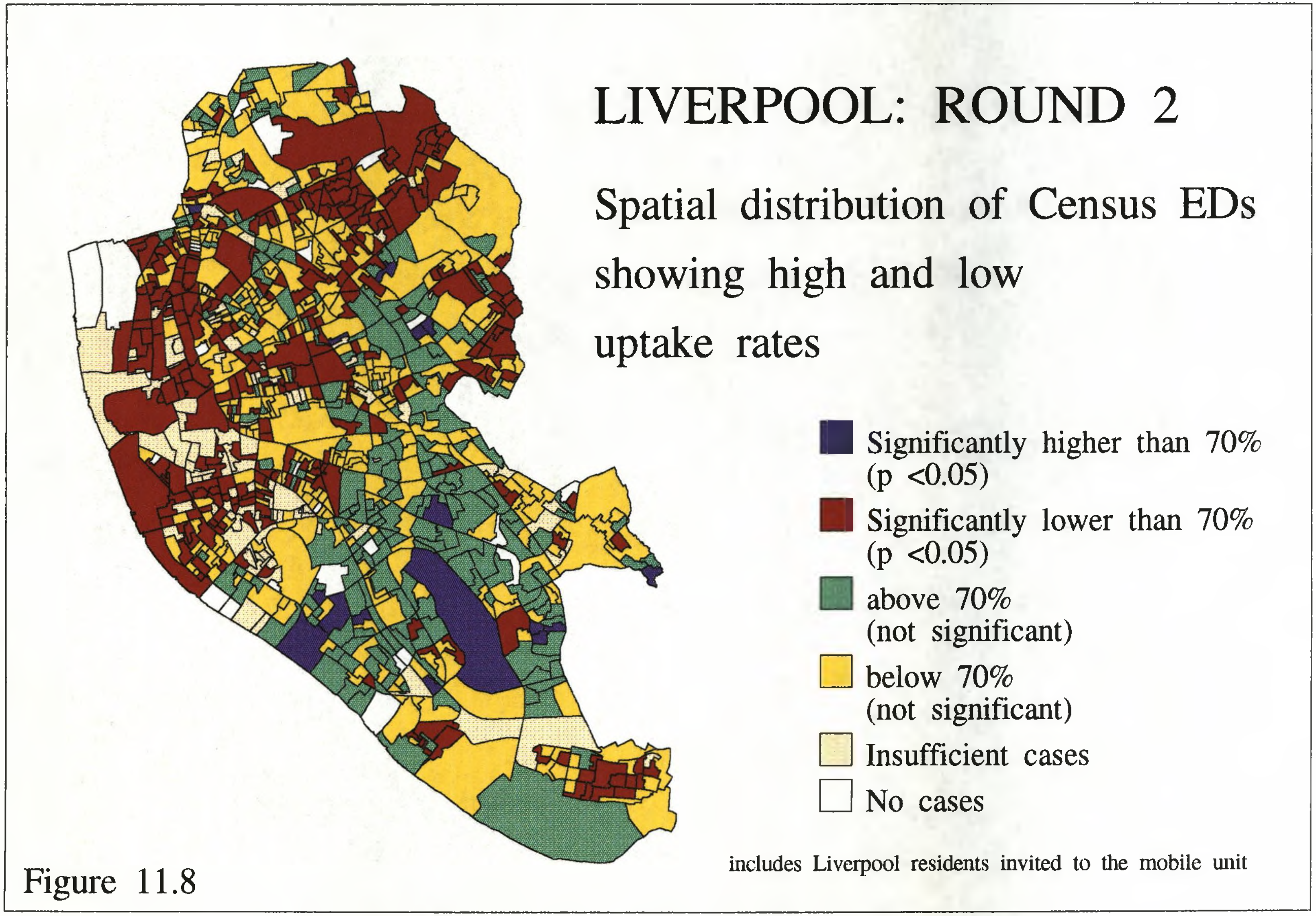

LIVERPOOL: ROUND 2
Spatial distribution of Census EDs showing high and low uptake rates
Significantly higher than 70% (p <0.05)
Significantly lower than 70% (p <0.05)
above 70% (not significant)
below 70% (not significant)
Insufficient cases
No cases
includes Liverpool residents invited to the mobile unit

Figure 11.8

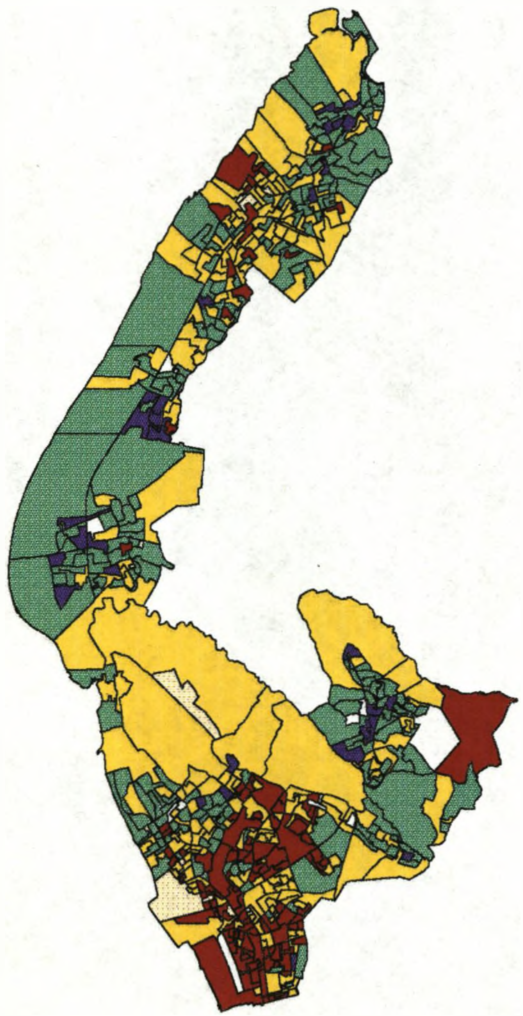
Most strikingly, very nearly half of Liverpool's EDs showed significantly poor response rates to the first round of invitations. These are concentrated throughout the inner city areas and also parts of Hunts Cross (north west of Speke), Garston, Grassendale, Belle Vale, Fazakerley, Walton and Anfield. Parts of the docklands, certain city centre areas and other EDs, 74 in total, did not have enough cases to calculate the chi-squared statistic.

By the end of Liverpool's second round, the situation appeared to have improved slightly (figure 11.8). Some 'thinning out' of the poorest attending zone seems to have occurred, and response apparently improved in particular areas such as Garston and Belle Vale. A very similar number of EDs to that in the first round displayed rates not significantly below 70%, although the exact spatial composition of this group had changed. Many of the first round's worst-performing EDs moved up to this slightly below-target category, whilst several dozen of the areas which did not quite meet the uptake target during round 1 did so during round 2. Overall, during the second round, 231 EDs in Liverpool had uptake rates above 70%, an improvement on 121 for the first round (table 11.3). Sixteen EDs in the eastern and, more particularly, the southern suburbs of the city showed significantly high uptake, not a great number but a further indication of the slight overall shift towards improved screening rates in the district. Despite this improvement it remains clear, however, just how widespread is the problem of poor uptake in the city.

11.2.3 Spatial variation in uptake in Sefton

Uptake in Sefton EDs with at least 10 invitees ranged from 22.9% (amongst 35 women) to 94.3% (also 35 women) during the first round. For the second round, the range was from 22.2% (36 invitees) to 95.6% (29 women). Figures 11.9 and 11.10 illustrate the spatial variation in uptake amongst Sefton residents, taking account of cross-boundary flow as discussed earlier (which particularly involves women living in Bootle and other southern parts of the district). (For the general locations of the villages and towns within this district, refer back to figure 7.6). The picture in Sefton is intermediate to that which emerged for Wirral and Liverpool. Uptake during the first and second rounds of screening by the Sefton and Knowsley mobile unit was around the 65% (table 11.1), being slightly higher in the second round. Distinct pockets of favourable as well as poor uptake can be picked out.

During the first round, more than two thirds of the EDs within Sefton showed a response rate not significantly either above or below 70% (table 11.3). Those with more favourable uptake tended to be concentrated in the northern areas (the old Southport and Formby district), in Crosby or around Maghull and Aintree. Just thirty of the 580 EDs had significantly high uptake rates, and most of these were concentrated in clusters within Churchtown, Ainsdale, Formby, Lydiate, Maghull, Great Crosby (north east of Crosby) and Thornton. The distribution of the 114 significantly under-responding enumeration districts was even more distinct, these being mostly located in Bootle, Litherland and central Southport in particular. Only very few areas had insufficient data to enable results to be mapped.



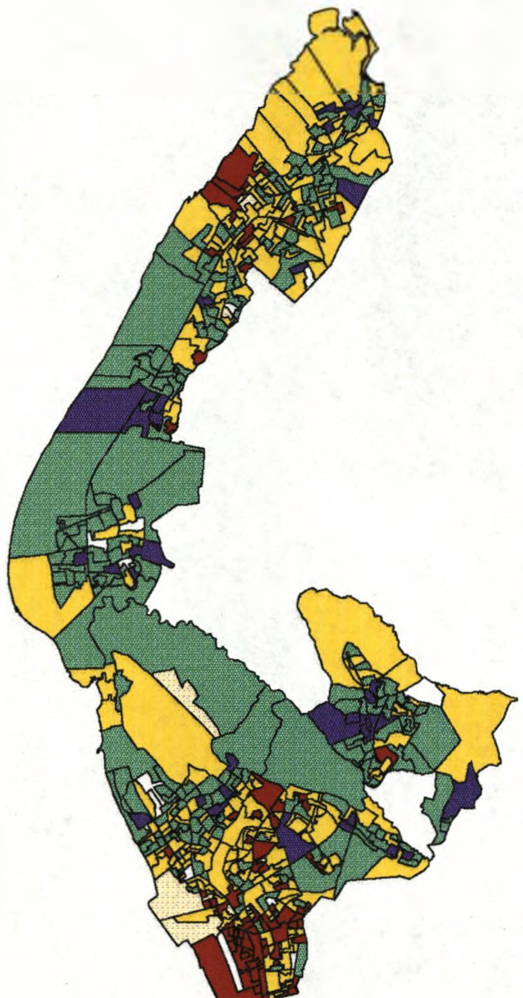
SEFTON: ROUND 1

Spatial distribution of Census EDs showing high and low uptake rates

- Significantly higher than 70% ($p < 0.05$)
- Significantly lower than 70% ($p < 0.05$)
- above 70% (not significant)
- below 70% (not significant)
- Insufficient cases
- No cases

includes Sefton residents invited to the Liverpool unit

Figure 11.9



SEFTON: ROUND 2

Spatial distribution of Census EDs showing high and low uptake rates

- Significantly higher than 70% (p <0.05)
- Significantly lower than 70% (p <0.05)
- above 70% (not significant)
- below 70% (not significant)
- Insufficient cases
- No cases

includes Sefton residents invited to Liverpool unit

Figure 11.10

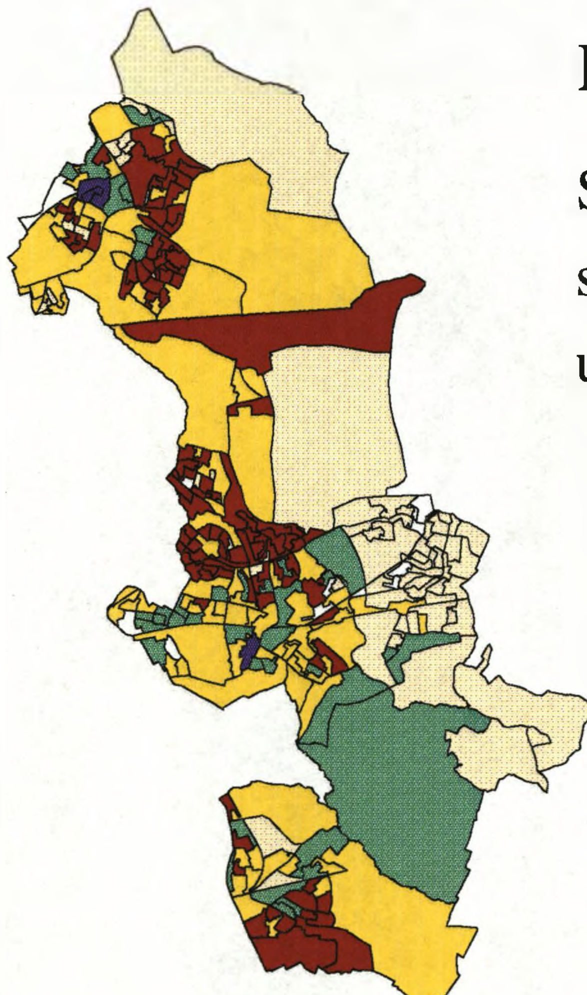
By the second round of screening in Sefton, the picture appears to have improved slightly. As with Liverpool, there was a thinning out of the worst uptake areas, specifically in Litherland. However, poor rates persisted in Bootle and parts of central Southport. Additionally, a greater number of EDs showed more than 70% response. In a reverse of that trend, point estimates for uptake worsened slightly at the northern end of the district, though most of these values are not significantly different from 70%. Overall, whilst the situation improved by the second round, the results of the spatial analysis highlight the most problematic areas.

11.2.4 Spatial variation in uptake in Knowsley

Figures 11.11 and 11.12 illustrate the ED level variation in uptake amongst women resident in Knowsley district. Within the EDs with 10 or more invited women, first round uptake rates ranged from 21.4% (amongst 28 women) to 85% (amongst 20 women). During round 2 the minimum rate was 18.2% (of 11 women), whilst the maximum was 85.7% (in 56 women). However, it is clear from the maps that, as with Liverpool in particular, many areas have shown fairly low response to invitation. Additionally, it is seen that there were relatively few Sefton & Knowsley unit invitees living in some of the eastern parts of Knowsley district, including the Prescot/Whiston area. Some of this may be due to relatively small eligible populations in the larger, semi-rural EDs. However, much of this lack of numbers will be due to women resident in those areas being invited for screening in the neighbouring district of St Helens. This is another example of cross-boundary flow of invitees.

KNOWSLEY: ROUND 1

Spatial distribution of Census EDs showing high and low uptake rates



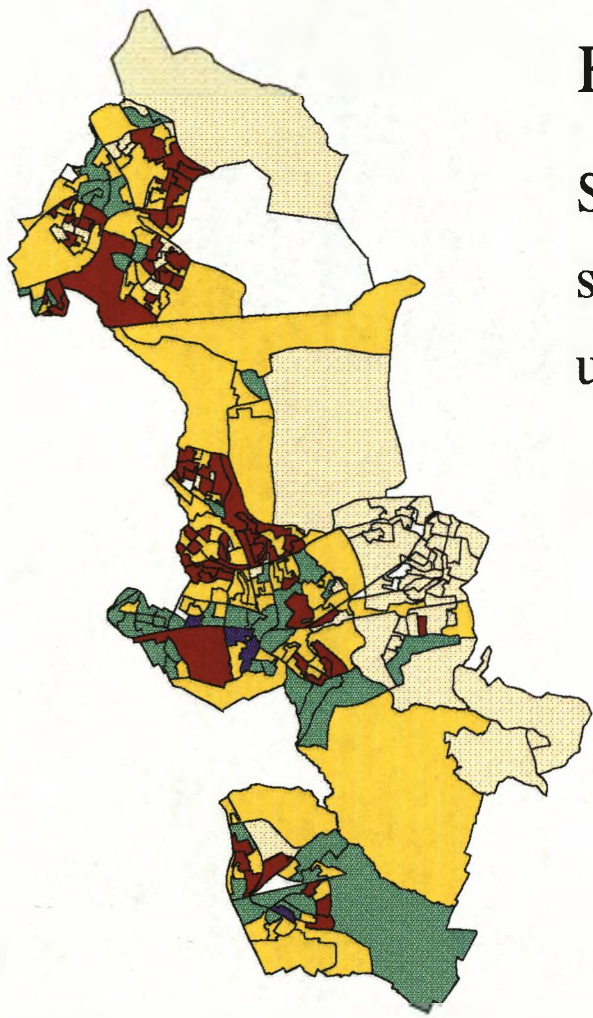
- Significantly higher than 70% (p <0.05)
- Significantly lower than 70% (p <0.05)
- above 70% (not significant)
- below 70% (not significant)
- Insufficient cases
- No cases

includes Knowsley residents invited to the Liverpool unit

Figure 11.11

KNOWSLEY: ROUND 2

Spatial distribution of Census EDs showing high and low uptake rates



- Significantly higher than 70% (p <0.05)
- Significantly lower than 70% (p <0.05)
- above 70% (not significant)
- below 70% (not significant)
- Insufficient cases
- No cases

includes Knowsley residents invited to the Liverpool unit

Figure 11.12

During the first round, 99 of Knowsley's 299 EDs had response rates that were significantly below 70% (table 11.3). Clusters of these low uptake EDs occurred, for the most part, in areas such as Kirkby (in the north), Halewood (in the south), and the central, densely populated parts of the district, near the western end of the M62 motorway. Refer back to figure 7.8 for the locations of the main suburbs/villages in the district. Another 84 EDs had uptake rates below 70%, spread throughout the western parts of the district that had sufficient cases for calculations to be made.

Only 42 EDs with sufficient cases had response rates higher than 70%, and this was only statistically significant in 3. These figures improved slightly by the second round, to 53 above the target (with 4 significantly higher). A similar thinning out (to that observed in Liverpool and Sefton) of the clusters of significantly low response EDs occurred by the second round, and absolute levels of uptake increased slightly through most of the district. However, four out of every five EDs with sufficient numbers of invitees to calculate rates still failed to reach a 70% response level during the second round.

11.3 UPTAKE BY SUPER PROFILE LIFESTYLE AND TARGET MARKET

11.3.1 Uptake by Lifestyle

1. Patterns of uptake by Lifestyle

Uptake by Super Profile Lifestyle shows a similar broad pattern for each screening unit, although the absolute values of response to invitation are variable. Generally, rates for a given Lifestyle are highest in Wirral and lowest for the Liverpool unit. The figures for the Sefton & Knowsley mobile unit, often lying between those for the other two, are those presented for example in this chapter. Tables 11.4 and 11.5 illustrate the pattern of uptake by Lifestyle for the Sefton & Knowsley unit. Tabulated figures by Lifestyle for the other units are available for consultation in appendix C.

i) Lifestyles A to D

The four most affluent groups, A (Affluent Professionals) to D (Better Off Young Families) tend to show higher uptake than any of the other groups. Only two exceptions to this appear. Firstly, women in Lifestyle F (Rural communities) EDs during Wirral's first round had higher uptake than Lifestyle D. Secondly, women in unclassified EDs (K) during Sefton and Knowsley's second round had the highest uptake of any invited to that unit. However, the confidence intervals around both these point estimates are relatively wide, and the very statement of some women being of 'unclassified' Lifestyle means that nothing is known about their socioeconomic environment, except that they live in EDs with very small, or otherwise poorly classified populations.

Table 11.4 Sefton & Knowsley unit, First Round. Uptake rates and signed chi-squared values, by Lifestyle

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	3630	73.6	(72.2 to 75.0)	**22.17**	****
B	4156	73.9	(72.5 to 75.2)	**29.63**	****
C	7078	71.2	(70.2 to 72.3)	**5.14**	*
D	3895	66.3	(64.9 to 67.8)	**-24.83**	****
E	93	50.5	(40.0 to 61.1)	**-16.77**	****
F	74	60.8	(48.8 to 72.0)	**-2.98**	
G	2691	64.4	(62.6 to 66.3)	**-39.66**	****
H	3731	64.3	(62.8 to 65.8)	**-57.74**	****
I	2879	55.8	(54.0 to 57.6)	**-277.09**	****
J	7753	52.1	(51.0 to 53.2)	**-1188.58**	****
K	41	58.5	(42.1 to 73.7)	**-2.57**	
O	852	56.3	(53.0 to 59.7)	**-75.73**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001 CI = Confidence Interval

Table 11.5 Sefton & Knowsley unit, Second Round. Uptake rates and signed chi-squared values, by Lifestyle

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	3908	75.1	(73.8 to 76.5)	**48.94**	****
B	3772	74.5	(73.1 to 75.9)	**36.74**	****
C	6913	72.1	(71.0 to 73.1)	**14.07**	****
D	3984	68.0	(66.6 to 69.5)	**-7.42**	**
E	87	59.8	(48.7 to 70.2)	**-4.34**	*
F	61	62.3	(49.0 to 74.4)	**-1.72**	
G	2540	66.6	(64.7 to 68.4)	**-14.19**	****
H	3436	66.0	(64.4 to 67.6)	**-26.09**	****
I	2869	57.6	(55.8 to 59.4)	**-210.71**	****
J	7304	54.6	(53.4 to 55.7)	**-827.78**	****
K	44	81.8	(67.3 to 91.8)	**2.93**	
O	713	63.7	(60.1 to 67.2)	**-13.58**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001 CI = Confidence Interval

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile groups
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Uptake tends to be highest in Lifestyle A and drops slightly towards D, with a couple of minor exceptions. Firstly, in Wirral, uptake for 'Settled Suburban' women (C) was slightly higher than for those in 'Better Off Older People' EDs (B). Secondly, during Sefton and Knowsley's first round, Lifestyle B cases had the highest uptake, higher even than the 'Affluent Professionals' (A). However, the absolute difference in uptake rates were fractions of a percent.

ii) Lifestyles E and F

Moving down the Lifestyle ranking, uptake rates noticeably drop amongst women living in Lifestyle E EDs. These invitees are obviously older than the 'Younger/Mobile persons' described as predominating in this Lifestyle. Rather, screening-eligible women living in these areas will be part of the background population, who are probably longer-term residents than the younger groups residing in such localities. As noted in the Pen Picture (section 6.3.5), this Lifestyle occurs "in areas of major cities that are undergoing gentrification but retain a significant proportion of poorer quality housing". Invitees in Lifestyle E areas are thus likely to be relatively poorly-off, particularly in Liverpool. Uptake in Lifestyle E women tends to be amongst the lowest, if not usually the absolute lowest, of any of the groups.

Lifestyle F (Rural communities) is not present in Liverpool. For the Wirral and Sefton & Knowsley units, uptake amongst these women was higher than that for Lifestyle E, but still lower than that for groups A to D. The single exception is in the findings for Wirral's first round, which had Lifestyle F women showing uptake comparable with those assigned to Lifestyles B and C. The confidence intervals associated with Lifestyle F are wide, however.

iii) Lifestyles G to J

At the lower end of the socioeconomic scale, the pattern that emerges is generally one of Lifestyle G (Lower Income Elderly) showing higher response to invitation than Lifestyle F. Rates amongst women from 'Blue Collar Families' (Lifestyle H) areas are similar, or slightly higher than those for Lifestyle G. Below Lifestyle H, rates decline through Lifestyle I (Lower Income Households) to the poorest Lifestyle, the 'Have Nots' Households (J). Uptake in Lifestyle J women is not usually as poor as that from those in Lifestyle E, but it is amongst the worst.

iv) Lifestyle K and unassigned cases

Response from invitees not included in this main socioeconomic classification does not follow any particular pattern. Rates in Lifestyle K, the unclassified EDs, are variable and often associated with small numbers of women and therefore wide confidence intervals. Since these women have unknown socioeconomic characteristics, little further knowledge is gathered.

Women with no Super Profile codes attached also showed a variable relationship with the other Lifestyle groups in terms of their uptake rates. It is likely that more women in this group than in the other Lifestyles will not have received invitations in the first place, since address details are often vague, but the level of non-attendance for that reason cannot be inferred here. All that is obvious is that the non-coded women tend to show one of the lower rates of uptake. Similarly to Lifestyle K, the socioeconomic nature of this group is unknown, but is probably very mixed, hence the variable and unpredictable results within this group.

2. Changes in uptake between round 1 and round 2

Figures 11.13a through to 11.15b show the similarities, and the differences, in uptake rates amongst the Lifestyles during each round of screening by the three separate units. In Wirral, groups A to D inclusive showed uptake significantly higher than the 70% target during both rounds, as did Lifestyles G and H in the first. For the Liverpool unit, only Lifestyle A invitees met the target during round 1, but by round two the top three groups all significantly exceeded it. Lifestyle A, B and C women invited to the Sefton & Knowsley unit showed response rates significantly higher than 70% in both rounds.

Uptake in each Lifestyle group improved by the second round of screening in Liverpool and Sefton & Knowsley. Improvement was greatest for the Liverpool unit, but figure 11.14b illustrates that rates were still quite low in most groups. Uptake also increased in several of the groups in Wirral. However, data for Wirral's second round are not complete, and it is expected that a full dataset would indicate a greater improvement in rates than is shown here, since the area yet to be covered in the second round was the more affluent, western half of the district. In Wirral, only women from Lifestyles E and J, and those to whom no Super Profile codes could be attached, showed significantly low uptake in relation to the 70% target (figure 11.13b). For the Liverpool and Sefton & Knowsley units, most of the Lifestyles from D to J failed to reach a 70% response rate, although in Lifestyle D women (Better Off Young Families), uptake was only just below it by the second round.

Figure 11.13a
Wirral unit First Round, uptake by Lifestyle, with 95% Confidence Intervals

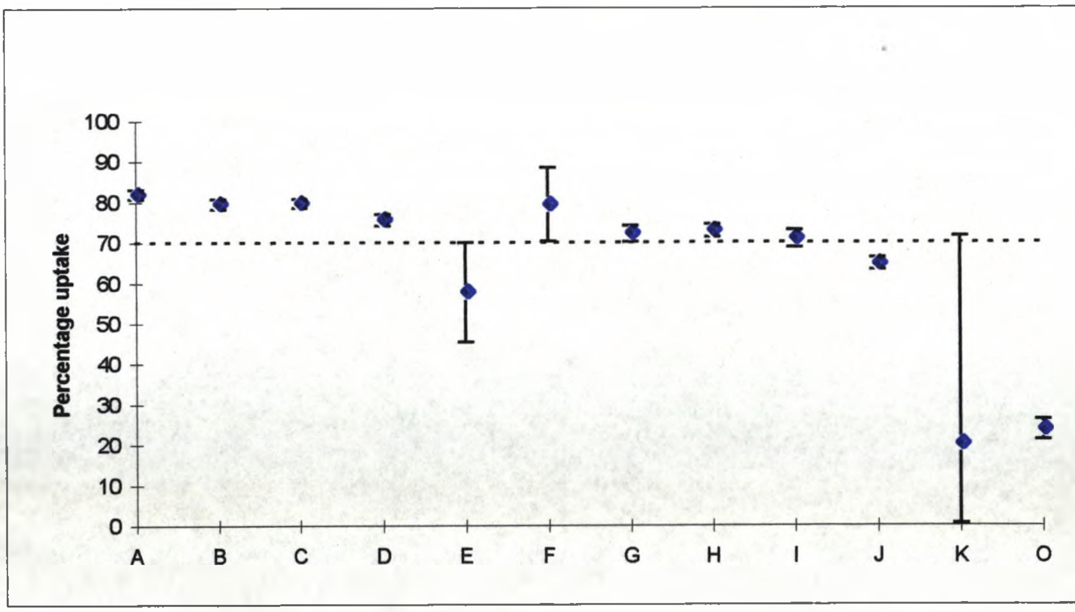
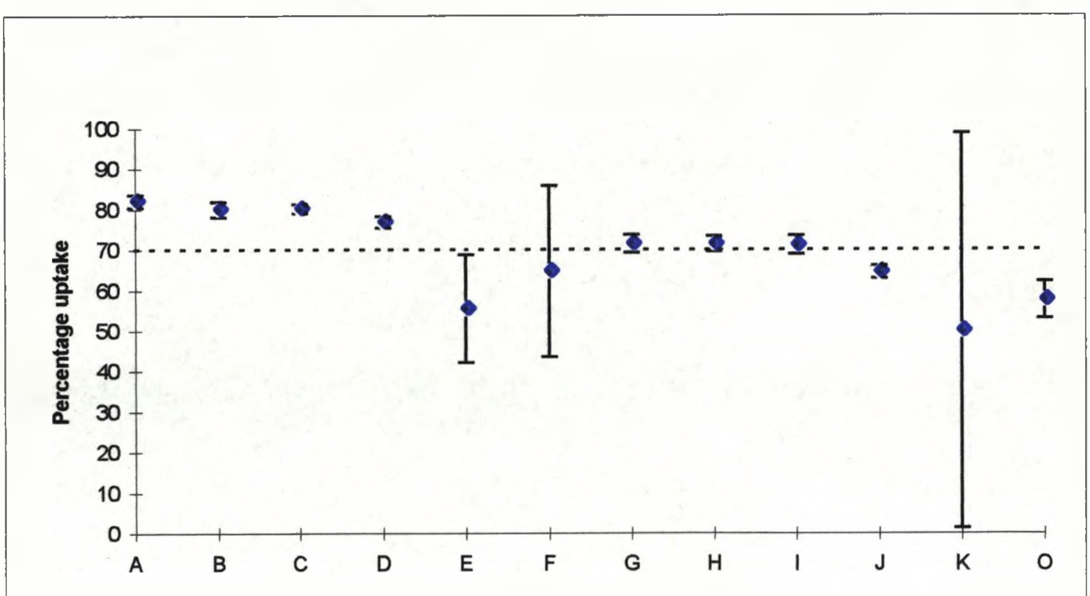


Figure 11.13b
Wirral unit Second Round, uptake by Lifestyle, with 95% Confidence Intervals



Data are for the first 25 months of this round

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: Super Profile codes not attached

Figure 11.14a
Liverpool unit First Round, uptake by Lifestyle, with 95% Confidence Intervals

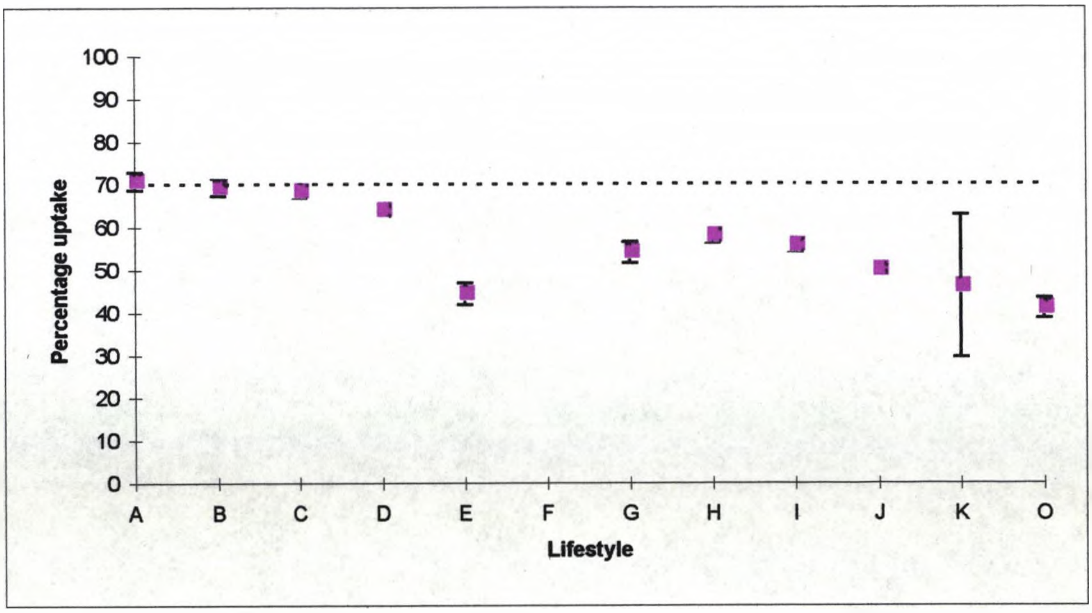
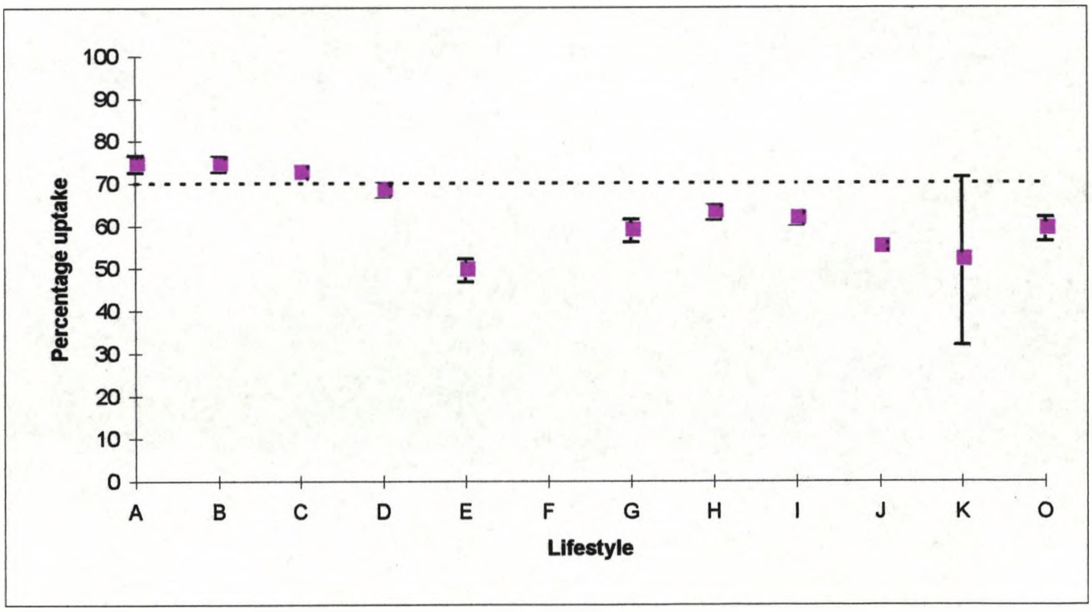


Figure 11.14b
Liverpool unit Second Round, uptake by Lifestyle, with 95% Confidence Intervals



Both include Sefton and Knowsley residents invited to the Liverpool unit

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: Super Profile codes not attached

Figure 11.15a Sefton & Knowsley unit
First Round, uptake by Lifestyle, with 95% Confidence Intervals

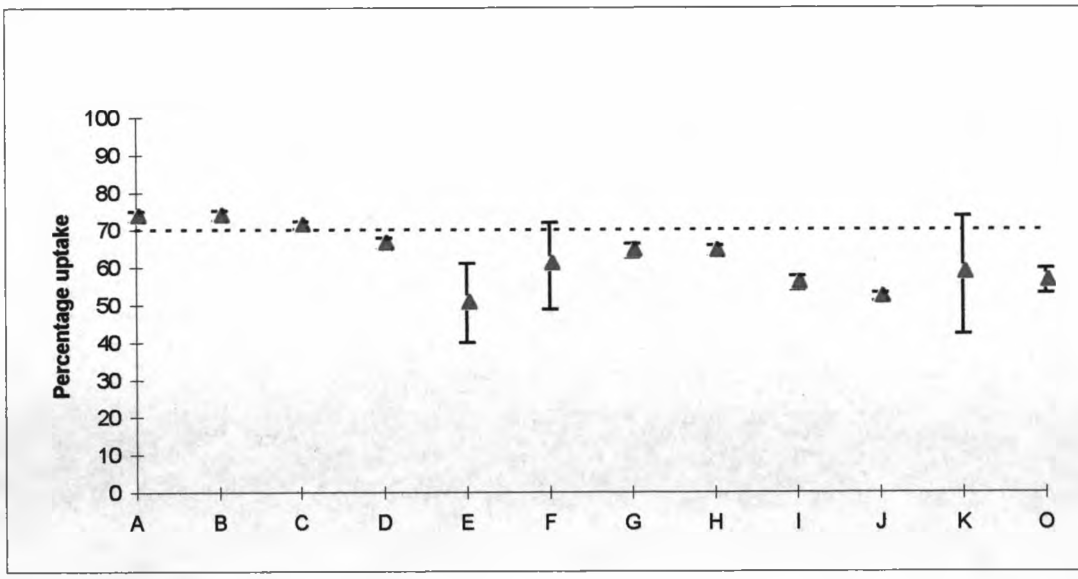
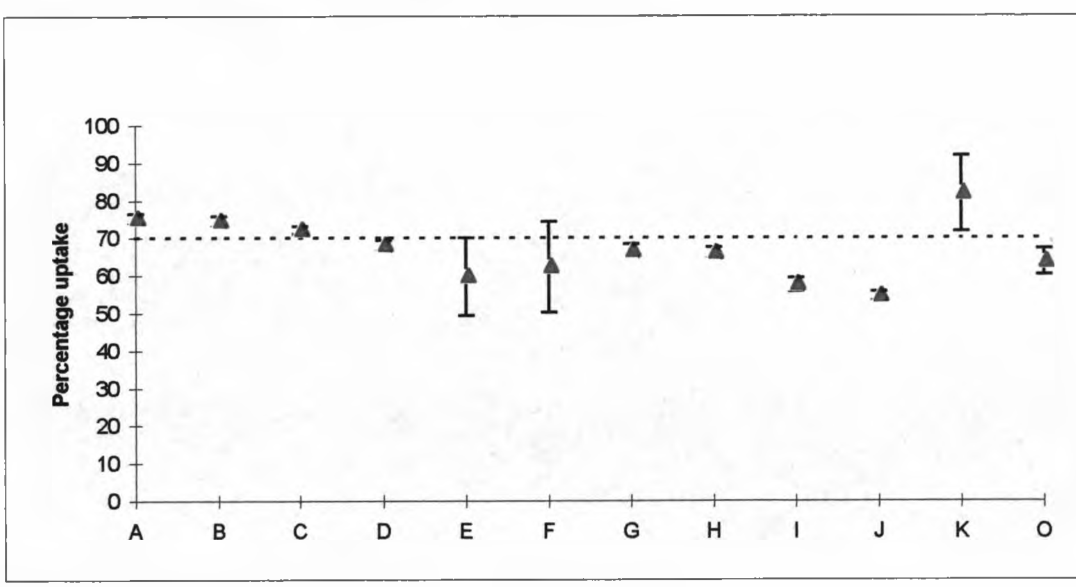


Figure 11.15b Sefton & Knowsley unit
Second Round, uptake by Lifestyle, with 95% Confidence Intervals



Both include Liverpool residents invited to the Sefton & Knowsley mobile unit

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities

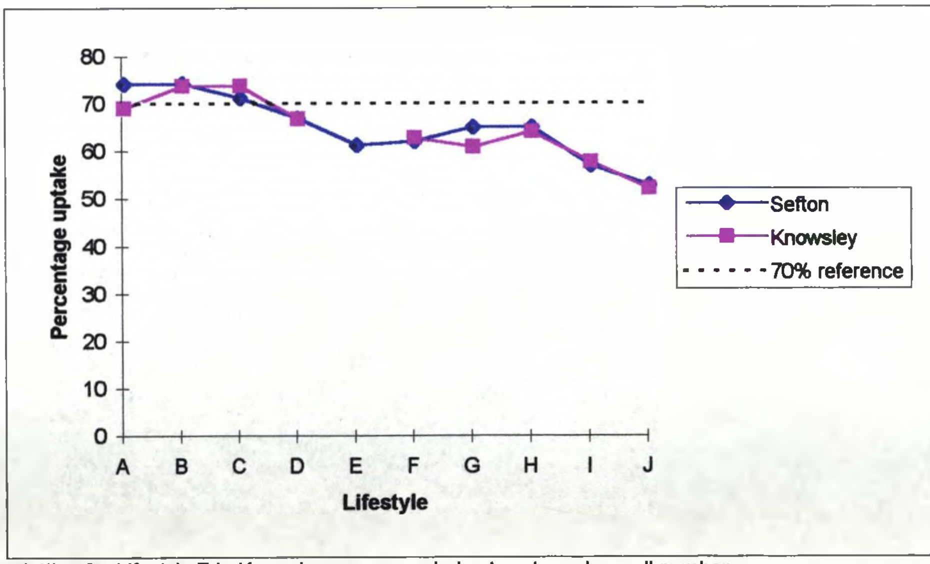
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: Super Profile codes not attached

3. Patterns in Knowsley versus Sefton residents invited to the mobile screening unit

It was stated earlier that Knowsley district residents constituted around one quarter of the women invited to the Sefton and Knowsley mobile unit. Sefton district is larger and more populous than Knowsley, and in addition, some women resident in Liverpool are invited to the mobile screening unit, as discussed earlier. It has also been mentioned that some women from Knowsley will be invited for screening by the mobile unit covering St Helens district. In the more detailed analyses discussed later in this chapter, Knowsley and Sefton residents were not examined separately, as many of the Knowsley resident groups (e.g. age-SES) contained only very small numbers of invitees. This applied particularly to Lifestyles A, B, E, F and G, which have low representation in Knowsley (tables 7.2, c.11b and c.12b). Instead, it was preferable to examine the Sefton & Knowsley mobile unit invitees collectively. However, in the current examination of overall uptake by Lifestyle, it is useful to show some of the basic differences between the larger Sefton group of invitees and the smaller Knowsley group of invitees.

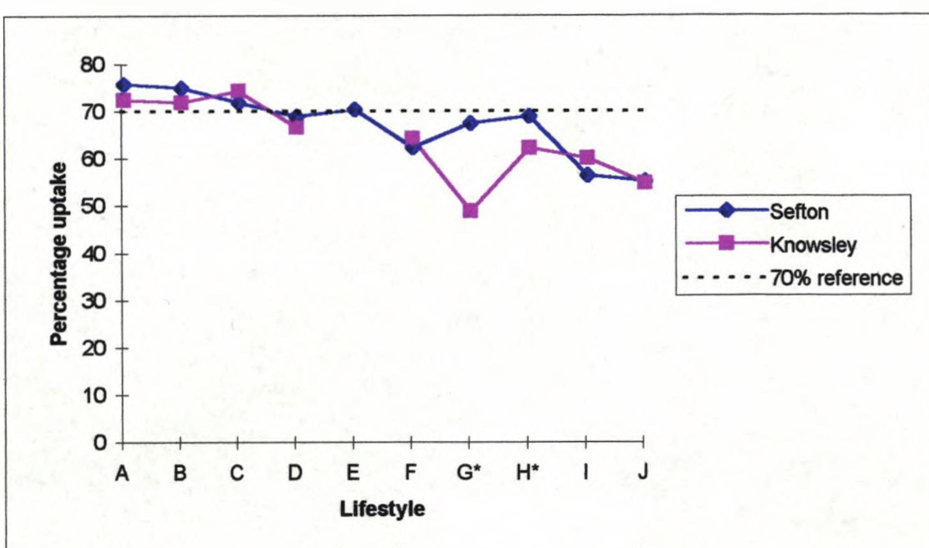
Figures 11.16a and 11.16b illustrate the similarities, and the differences, between Lifestyle-specific uptake amongst Sefton district and Knowsley district residents invited to the Sefton & Knowsley mobile unit. The figures behind this are available in appendix C. There was a tendency for each group of women in Knowsley to have lower uptake rates than those of comparable SES in Sefton. However, in many cases during round 1, the differences were less than 1%, and in both rounds, Knowsley women assigned to Lifestyle C (Settled Suburbans) showed slightly higher uptake than Sefton women in the same Lifestyle.

Figure 11.16a Sefton & Knowsley unit First Round, uptake in Lifestyles A to J amongst Sefton district residents, as compared with Knowsley district residents



plotting for Lifestyle E in Knowsley suppressed, due to extremely small numbers

Figure 11.16b Sefton & Knowsley unit Second Round, uptake in Lifestyles A to J amongst Sefton district residents, as compared with Knowsley district residents



*denotes that the difference between Sefton and Knowsley is significant ($p<0.05$) for these Lifestyles

A: Affluent Professionals	F: Rural Communities
B: Better Off Older People	G: Lower Income Elderly
C: Settled Suburbans	H: Blue Collar Families
D: Better Off Young Families	I: Lower Income Households
E: Younger/mobile persons	J: 'Have Nots' Households

The biggest differences between the Knowsley and Sefton residents in round 1 occurred in Lifestyles A and G, where uptake was 5% and 4% lower, respectively, in Knowsley. These differences were not statistically significant. Greater differences between the two areas are apparent for round 2, with uptake rates between 2% and 3% lower in Knowsley residents from Lifestyles A, B and D. Conversely, total response from Lifestyle I areas was 3.7% higher in Knowsley. The largest (and statistically significant) differences occurred in Lifestyles G and H. Contrary to the results for the whole group of invitees to the unit, uptake actually *fell* in these groups in Knowsley district by the second round (as did response from Lifestyle B women, to a lesser degree). Amongst Knowsley residents from Lifestyle G EDs (Lower Income Elderly), the drop in response to invite was from 60.6% to 48.5%, although these rates are based on only around 70 women in each round. The observed decline in total response from women resident in Lifestyle H EDs (Blue Collar Families), based on around 1,200 women, was much smaller, from 63.8% to 61.9%.

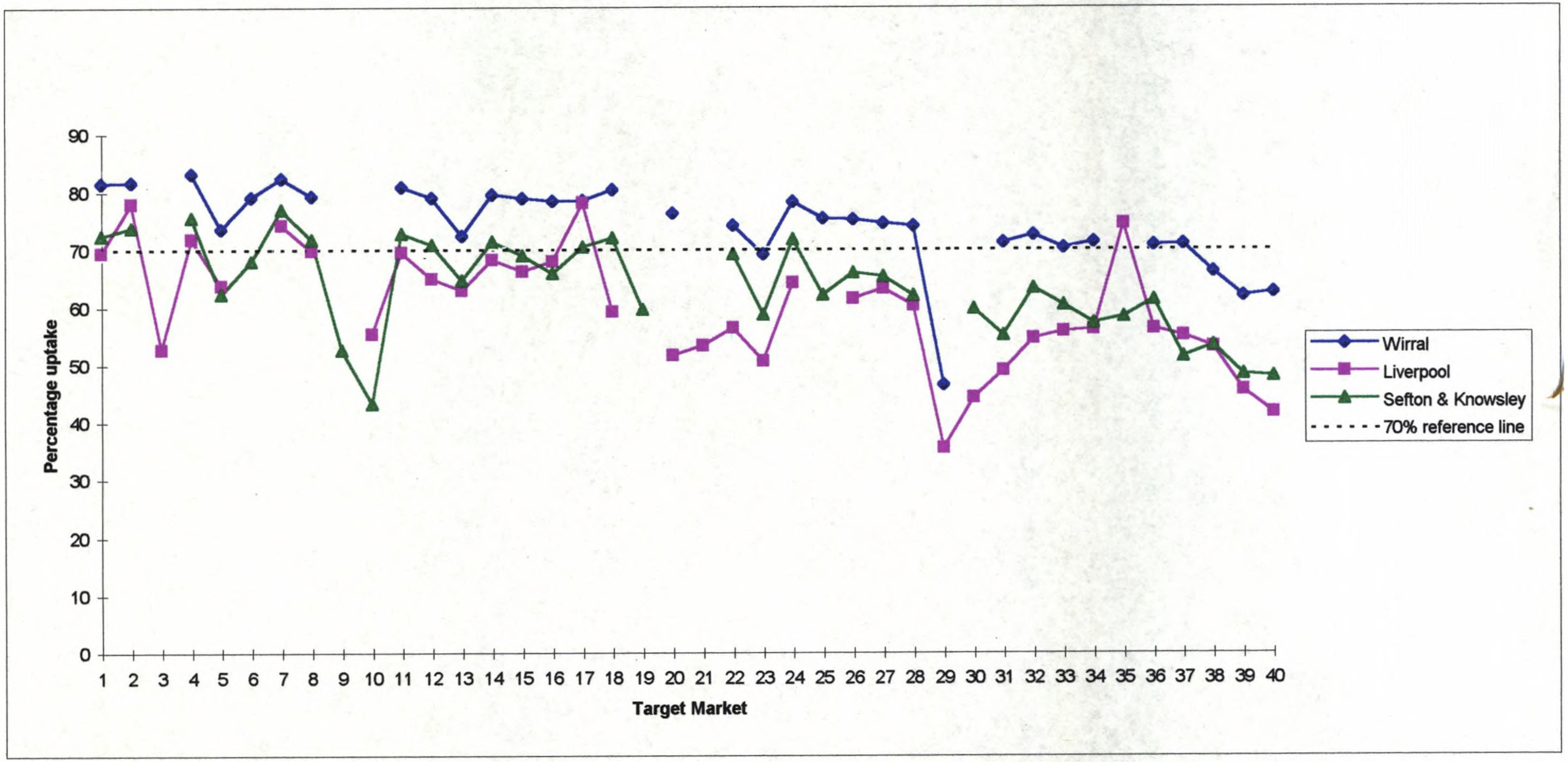
11.3.2 Uptake by Target Market

The large number of records contained in the screening datasets permits an exploration of uptake at the Target Market level. The tabulated distributions of the invited populations amongst the Target Markets for each unit, and the associated uptake statistics, may be consulted in appendix C. However, a much simpler (and more easily assimilated) picture is provided by figure 11.17, which charts the uptake rates by Target Market for each unit's first round of screening, and illustrates both the similarities in overall pattern and the differences in terms of absolute response rates achieved. Rates are not shown where the values have been suppressed due to very small numbers of invites ($n < 10$), or, obviously, when that Target Market has no representation amongst the women invited.

The general trend for all three units' figures is for a slight decline in uptake rates from Target Market A1 (most affluent) to J40 (least affluent). Overall, response in the upper half of the affluence ranking is more favourable than in the lower half. Within this broad pattern, certain peaks and troughs are evident and fairly consistent between the units. Response in the two most affluent Target Markets, A1 and D2, is predictably amongst the best. Peaks also occur in Target Markets A4, B7, and, perhaps more curiously, Target Market H24- "Older White Collar Owner-Occupiers in semis". The Target Market with the highest uptake varies but is usually one constituent to either Lifestyle A, B or D.

The lowest uptake rates occur in two distinct groups of Target Markets. Firstly, response was consistently below target in the three poorest Target Markets, J38, J39 and J40, constituents of the 'Have Nots' Households. Secondly, and more strikingly, uptake in the Target Markets belonging to Lifestyle E, characterised by the 'Younger/mobile persons', was usually very low. This applied particularly to invitees living in Target Market E29 EDs, "Young families renting basic accommodation in multi-racial areas". In these localities, the observed rates were the lowest for every unit in both rounds (though only a handful of Sefton & Knowsley invitees were assigned to this group).

Figure 11.17 First Round, uptake by Target Market for each of the units



1 = most affluent (high SES), 40 = least affluent (low SES)

Plotting suppressed where number of invitees less than 10

Uptake by women in Target Market E10 areas was also poor. It is probable that whilst Lifestyle E Target Markets are characterised by young professionals, often with good incomes, the background population of long-term residents, which includes the screening invitees, is likely to be of somewhat lower SES, as stated previously in this chapter (section 11.3.1).

Whilst a general pattern appears, the absolute levels of response across the groups vary by screening unit. In Wirral, only four Target Markets had rates significantly below 70% in either round, these being E29 and the three poorest groups, J38, J39 and J40. For the Sefton & Knowsley unit, fifteen Target Markets showed significantly low rates during the first round, and twelve did so for the second. Usually these were concentrated in the lower half of the affluence ranking, with a few in the middle groups. This does not include any of the rates for Lifestyle E Target Markets, which are very low, but, being based on relatively small numbers, did not reach statistical significance. Liverpool had the highest number of significantly lower uptake Target Markets, 26 in the first round and 17 in the second (of 38 with representation in this group of invitees). What the figures for the Liverpool and Sefton & Knowsley units have in common is that none of the significantly under-responding Target Markets are constituents of the top Lifestyle, the Affluent Professionals, and few belong to the other generally higher SES Lifestyles, B (Better Off Older People) and C (Settled Suburbans).

Common to all units is the finding that Target Markets showing a response significantly higher than 70% tended to belong to the top three Lifestyles, A, B and C. Far fewer groups showed the high rates in Liverpool than in Wirral, however, with Sefton &

Knowsley's figures being intermediate. During Liverpool's first round, only Target Market B7 showed a total response that was significantly higher than 70%, although by this unit's second round, five groups showed such favourable rates. Wirral also had significantly high uptake from four Target Markets in Lifestyle D during each round, and also in G22 and H24. The patterns of uptake by Target Market during Liverpool and Sefton & Knowsley's second rounds were essentially the same as that shown in figure 11.17, but absolute rates were slightly higher, if not as favourable as Wirral's.

11.4 SOCIO-SPATIAL ANALYSIS: THE SUPER PROFILE CHARACTERISTICS OF HIGH AND LOW RESPONSE EDs

The Super Profile Lifestyle categories of those enumeration districts showing significantly higher or lower attendance than the 70% target were examined for each round of screening. Whilst for the spatial analysis of uptake for the Liverpool and Sefton & Knowsley units it was decided to show maps based on location of residence (see section 11.2), all other calculations for these two units have been carried out according to which screening unit issued the invitation. This was done since the aim was to compare variability by operational unit as well as by district of residence. Therefore, in the following considerations of the Lifestyle characteristics of high and low response EDs, absolute numbers involved may not necessarily be an exact match with those discussed in section 11.2 and the figures in table 11.3. However, the results of a Lifestyle based consideration of ED performance when women are grouped by district of residence does not differ substantially from that when women are grouped by operational unit. The choice does not crucially influence the results.

11.4.1 Significantly high response EDs

Tables 11.6 to 11.8 show the numbers and Lifestyle categories of EDs showing uptake rates significantly above 70% for each unit and screening round. For both rounds of screening in the three units (insofar as Wirral's second round data are complete), Census EDs showing response to invitation significantly above 70% were predominantly classified as one of the top four Lifestyles. For Wirral's first round, most high response EDs were in Lifestyles A to C, with nearly 45% of the 85 Affluent Professional (A) EDs being significantly above 70%, as were around a quarter each of the Better Off Older People (B) and Settled Suburban (C) EDs in this district. The missing portion of the second round Wirral data concern many of the district's wealthier areas, but it is anticipated that total round 2 figures would be comparable to, or perhaps slightly better than those for round 1.

Only a very small number of Liverpool EDs showed uptake significantly above 70% during the first round of screening. These were a very small proportion of the Lifestyle B and D EDs in the area. By the second round, high rates were found in a small proportion of the top four Lifestyles' EDs. The correspondence between initial high uptake areas and good performers in the second round was minimal; therefore there seemed to be little systematic reason for high uptake in this instance.

Table 11.6 Wirral unit, Lifestyle categories of EDs having uptake significantly higher than 70%

Lifestyle	Number of EDs in Lifestyle	Round 1		Round 2 (to June 1995)	
		Number of EDs	Proportion (%)	Number of EDs	Proportion (%)
A	85	38	44.7	22	25.9
B	84	20	23.8	15	17.9
C	121	35	28.9	34	28.1
D	103	9	8.7	12	11.7
G	59	3	5.1	2	3.4
H	70	7	10.0	2	2.9
I	47	2	4.3	2	4.3
J	130			1	0.8

Table 11.7 Liverpool unit, Lifestyle categories of EDs having uptake significantly higher than 70%

Lifestyle	Number of EDs in Lifestyle	Round 1		Round 2	
		Number of EDs	Proportion (%)	Number of EDs	Proportion (%)
A	34			4	11.8
B	43	1	2.3	3	7.0
C	64			4	6.3
D	115	3	2.6	1	0.9
H	64			2	3.1

Table 11.8 Sefton & Knowsley unit, Lifestyle categories of EDs having uptake significantly higher than 70%

Lifestyle	Number of EDs in Lifestyle	Round 1		Round 2	
		Number of EDs	Proportion (%)	Number of EDs	Proportion (%)
A	70	7	10.0	7	10.0
B	78	10	12.8	10	12.8
C	164	9	5.5	7	4.3
D	110	2	1.8	2	1.8
G	82	1	1.2	1	1.2
H	90	1	1.1	6	6.7

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile groups
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households

Around half of the high uptake EDs in Sefton & Knowsley were of Lifestyles A and B. However, as with Liverpool, relatively few of Sefton and Knowsley's EDs had high uptake during either round of screening, particularly the first.

In none of the three districts did any EDs in Lifestyles E (Younger/mobile persons) or J ('Have Nots' Households) show a significantly high response, with the sole exception of one Lifestyle J ED during Wirral's second round. Additionally, only in Wirral did two Lifestyle I (Lower Income Households) EDs show uptake significantly higher than 70%. The frequency of favourable uptake in EDs of Lifestyles G and H was also relatively low. No Lifestyle G (Lower Income Elderly) EDs in Liverpool were of significantly high response, and only up to three in the other districts. Lifestyle H (Blue Collar Families) had slightly better representation, up to 7 (of 70 EDs belonging to this Lifestyle) in Wirral's second round and 6 (of 90) in the Sefton & Knowsley unit's second round.

11.4.2 Significantly low response EDs

The numbers and Lifestyle categories of EDs with uptake rates falling significantly below 70% are shown in tables 11.9 to 11.11. As anticipated, the Lifestyle characteristics of significantly low response EDs were biased towards the lower SES categories for all units. The greatest frequency of significant under-response in every district was amongst EDs assigned to the poorest Lifestyle, J, the 'Have Nots'

Table 11.9 Wirral unit, Lifestyle categories of EDs having uptake significantly lower than 70%

Lifestyle	Number of EDs in Lifestyle	Round 1		Round 2 (to June 1995)	
		Number of EDs	Proportion (%)	Number of EDs	Proportion (%)
E	4	1	25.0	1	25.0
G	59	2	3.4	3	5.1
H	70	3	4.3	2	2.9
I	47	1	2.1	1	2.1
J	130	15	11.5	14	10.8

Table 11.10 Liverpool unit, Lifestyle categories of EDs having uptake significantly lower than 70%

Lifestyle	Number of EDs in Lifestyle	Round 1		Round 2	
		Number of EDs	Proportion (%)	Number of EDs	Proportion (%)
A	34	1	2.9		
B	43	5	11.6		
C	64	4	6.3	2	3.1
D	115	20	17.4	10	8.7
E	74	28	37.8	22	29.7
G	57	22	38.6	14	24.6
H	64	30	46.9	15	23.4
I	122	53	43.4	28	23.0
J	403	265	65.8	172	42.7

Table 11.11 Sefton & Knowsley unit, Lifestyle categories of EDs having uptake significantly lower than 70%

Lifestyle	Number of EDs in Lifestyle	Round 1		Round 2	
		Number of EDs	Proportion (%)	Number of EDs	Proportion (%)
A	70	1	1.4		
B	78	2	2.6		
C	164	5	3.0	1	0.6
D	110	11	10.0	4	0.4
G	82	15	18.3	9	11.0
H	90	16	17.8	11	12.2
I	61	27	44.3	20	32.8
J	213	125	58.7	90	42.3

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile groups

F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households

Households. 65.8% of Liverpool's 403 Lifestyle J EDs, and 58.7% of Sefton & Knowsley's similarly classified EDs showed significantly low response during round 1. A little improvement had occurred by the end of the second round, with 42.7% and 42.3% of Liverpool's and Sefton & Knowsley's Lifestyle J EDs, respectively, having significantly low uptake. Lifestyle J EDs fared the worst in Wirral too, although the associated figures are somewhat smaller, with a little more than a tenth of the 130 such EDs showing rates significantly below 70% during both rounds.

Frequency of significant under-response was also fairly high amongst Lifestyles G, H and I, for the Liverpool and Sefton & Knowsley units at least. In particular, more than a third of EDs in each group had significantly unfavourable rates during Liverpool's first round. This had reduced to around a quarter each by the end of its second. In Sefton and Knowsley, around 40% of Lifestyle I (Lower Income Households) EDs, slightly lower in the second round, were in this low response group. A fifth each of Lifestyle G (Lower Income Elderly) and H (Blue Collar Families) EDs showed significantly low response during round one. The figures for these Lifestyles were better for the second round, with 11% and 12% of Lifestyle G and H EDs, respectively, showing uptake rates significantly below 70%.

A seemingly high proportion (25%) of Lifestyle E EDs in Wirral showed significantly low response to invite. In actuality, this proportion refers to one ED out of four assigned to Lifestyle E in this district. Only 4 EDs in Sefton and Knowsley are described as being dominated by such 'Younger/mobile persons'. None of these showed significantly low uptake, although this was due to a small number of cases, and the resulting instability of the denominators. In Liverpool, where the concentration of Lifestyle E areas is greatest, the picture that emerged from the socioeconomic analysis of uptake (section 11.3) was more clearly evident spatially than in either of the other districts. Here, 28 (37.8%) and 22 (29.7%) of 74 such EDs showed significantly low response in the first and second rounds, respectively.

In Wirral, where response to invitation was generally highest, no individual EDs assigned to the top four Lifestyles were noted to show uptake significantly lower than 70% during either round of screening. In Liverpool and Sefton & Knowsley, very few Lifestyle A, B or C EDs with sufficient invited populations to provide stable denominators showed significantly low response either. With regard to Lifestyle D (Better Off Young Families) EDs, 20 of the 115 in this category in Liverpool, and 11 of 110 in Sefton & Knowsley, had significantly low response during the first round. The proportions of low uptake Lifestyle D EDs in round 2 was much lower. None of the two Wirral and two Sefton & Knowsley Lifestyle F (Rural Communities) EDs showed significantly low response, but small numbers of cases were involved in each.

11.4.3 The contribution of low response EDs towards overall uptake by Lifestyle group

The extent to which variations in uptake by Super Profile Lifestyle might be influenced by particularly poor response in some geographical areas was examined by temporarily removing all women resident in significantly low response EDs and then repeating the analysis by Super Profile Lifestyle. As would be expected when the reduced datasets were analysed, uptake rates increased in all socioeconomic groups concerned. Of particular interest is whether or not a few small areas showing significantly low uptake exerted a large influence on the overall uptake rates within significantly under-responding Lifestyle groups. Tables 11.12 to 11.14 list the changes in uptake status that occurred for each unit when the reduced datasets were analysed.

One finding was common to all three screening units. This was that even after the removal of cases relating to specific low response EDs, uptake was still significantly below 70% amongst the remaining Lifestyle J ('Have Nots' Households) women. This was also the case for Lifestyle H (Blue Collar Families) and I (Lower Income Households) women invited by the Liverpool and Sefton & Knowsley units. In Liverpool and Sefton & Knowsley's first rounds, uptake in Lifestyle G (Lower Income Elderly) remained significantly low in the reduced datasets. For Sefton and Knowsley's second round, removal of the EDs with uptake significantly below 70% resulted in these women only just failing to reach 70% uptake. The findings for Lifestyles G, H and I did not apply in the same way to Wirral, which had response rates of above 70% in all these groups, even before the removal of the significantly low response EDs.

Removal of specific poorly performing Lifestyle E EDs from the Liverpool dataset also had relatively little effect on the overall findings relating to women resident in these areas. Response from invitees living in areas characterised by the 'Younger/mobile persons' was still significantly below target. In Wirral, removal of the significantly under-responding Lifestyle E ED had a more noticeable effect. Now this group of women showed uptake not significantly below the target. However, the effect of

Table 11.12 Wirral unit, Changes in uptake status, by Lifestyle, after removal of cases from significantly low response EDs

Lifestyle	Initial uptake in relation to 70% (both rounds)	Re-analysis uptake	
		First Round	Second Round
E	- sig.	-	-
G	+		+ sig.
H	+		+ sig.
I	+	+	+
J	- sig.	- sig.	- sig.

- = lower than 70%; + = higher than 70%; sig. = statistically significant ($p < 0.05$)

Table 11.13 Liverpool unit, Changes in uptake status, by Lifestyle, after removal of cases from significantly low response EDs

Lifestyle	Initial uptake in relation to 70% (both rounds)	Re-analysis uptake	
		First Round	Second Round
A	+	+	
B	-	+	
C	- sig.	-	
D	- sig.	- sig.	-
E	- sig.	- sig.	- sig.
G	- sig.	- sig.	- sig.
H	- sig.	- sig.	- sig.
I	- sig.	- sig.	- sig.
J	- sig.	- sig.	- sig.

Table 11.14 Sefton & Knowsley unit, Changes in uptake status, by Lifestyle, after removal of cases from significantly low response EDs

Lifestyle	Initial uptake in relation to 70% (both rounds)	Re-analysis uptake	
		First Round	Second Round
D	- sig.	- sig.	-
G	- sig.	- sig.	-
H	- sig.	- sig.	- sig.
I	- sig.	- sig.	- sig.
J	- sig.	- sig.	- sig.

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile groups
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households

removing one ED's data was likely to be larger in this district, since there are only 4 Lifestyle E EDs in Wirral district.

Overall uptake from Lifestyle D (Better Off Young Families) was sufficiently below target for the Liverpool and Sefton & Knowsley units' first rounds that removal of data from certain EDs had relatively little effect. By the second round, when rates in this Lifestyle, though still poor, had improved, uptake was only slightly below target after the removal of the significantly low response EDs. A similar effect was noted for Lifestyle C (Settled Suburbans) women in Liverpool's first round.

This section of analysis involved the removal only of data from *significantly* low response EDs. Whether or not an area's uptake is found to be significantly below 70% is to large degree denominator- dependent, i.e. relating to the number of cases attached to that ED. Obviously, if one removes data from poor response EDs, calculated total uptake will be higher in the remaining women. The analysis in this section sought to examine whether any geographical localities, with sufficiently stable calculated uptake rates, had a large influence on the apparent socioeconomic variations. The results indicated that this was generally not the case, and that overall poor response in low SES groups was not usually attributable to a few specific geographical areas. Meanwhile, improvements from significantly to not significantly low uptake in some Lifestyle groups were usually small in absolute terms. Therefore, it should not be said in these cases that certain geographical localities had an undue influence either. In summary to this section, uptake 'status' of a given socioeconomic group tended to be affected relatively little by significantly poor response within any of its member enumeration districts.

11.5 UPTAKE OF SCREENING BY AGE GROUP WITHIN LIFESTYLE

As with overall uptake by Super Profile groups, the patterns of response by age group within Lifestyle category are very similar for each screening unit. The differences between the figures for the three screening units are mainly in the absolute levels of response achieved in each age-SES group, with Liverpool's being the lowest, Wirral's the highest, and the Sefton & Knowsley mobile's figures being between the other two, closest to the average for all three units. These basic similarities and differences between the units have already been noted in this chapter.

11.5.1 Patterns in age-SES uptake rates

Figures 11.18 and 11.19 illustrate the pattern of response to invitation amongst the three age bands in each Lifestyle for all the units combined. The figures are shown in tables 11.15a to 11.16b. Those relating to the separate screening units may be consulted in appendix C.

Across all units, invitees in the oldest (60-64 years) age band of a given Lifestyle from A to J tended to show lower uptake than either younger group of women. Only a few exceptions to this occurred, usually where there were a small number of women

Figure 11.18
All units, First Round, uptake by 5 year age band within Lifestyle

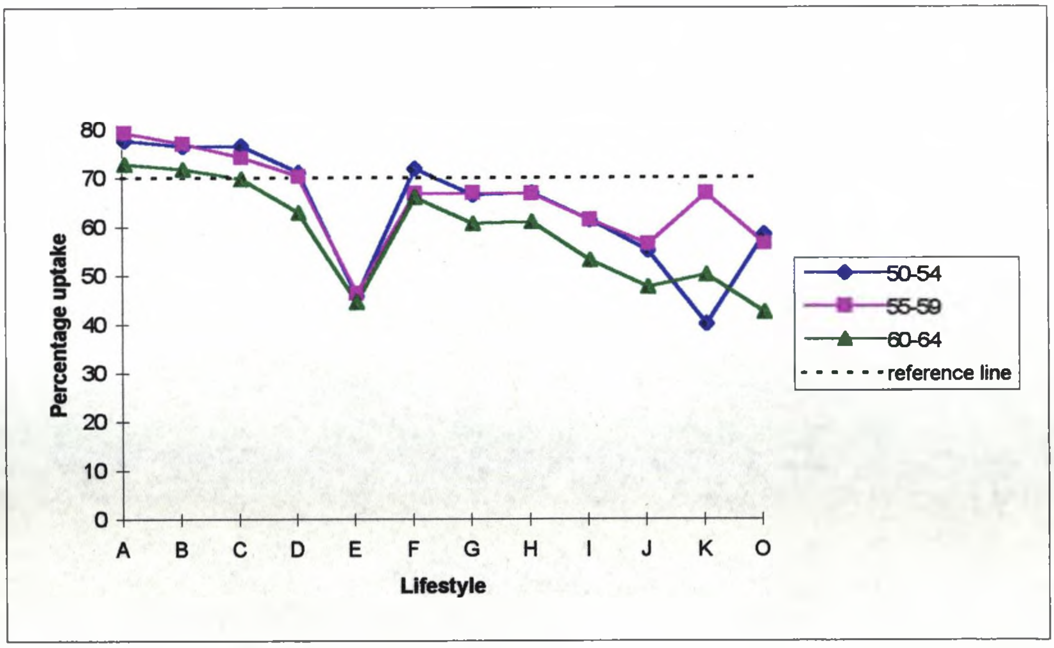
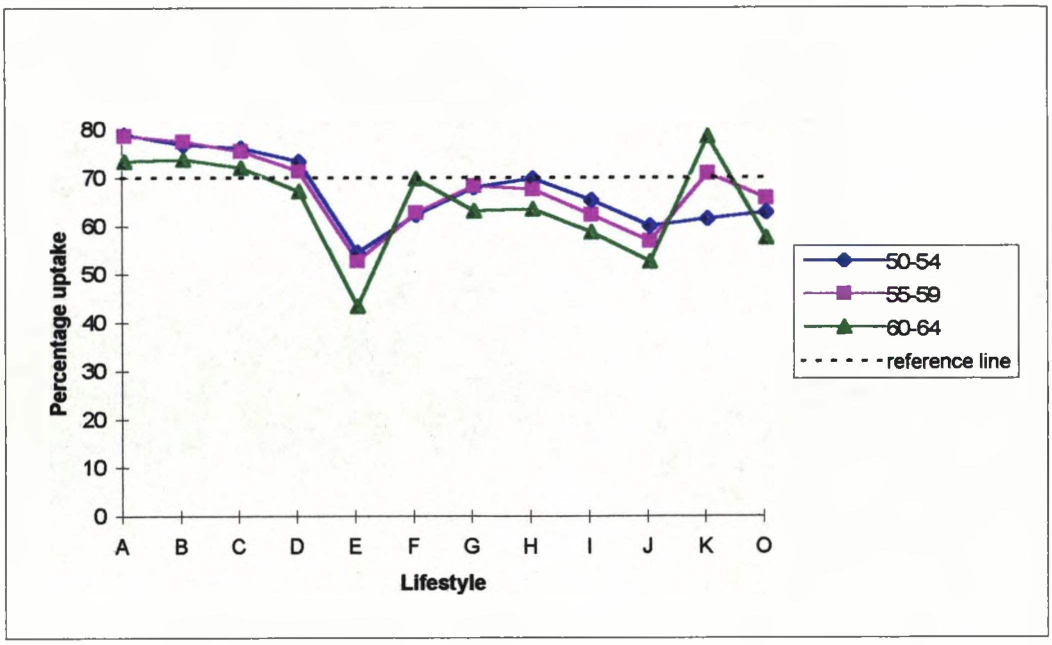


Figure 11.19
All units, Second Round, uptake by 5 year age band within Lifestyle



A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: Super Profile codes not attached

involved, such as Lifestyle F (Rural Communities) on the Wirral, but also amongst Lifestyle E in Liverpool, which was associated with similarly low uptake across all age groups. Response rates in the 50-54 year olds and 55-59s were usually very similar to one another, and not necessarily higher in the youngest women. Thus any trend in uptake with age tended to be in relation to the two younger groups versus the oldest.

In terms of a possible socioeconomic gradient in uptake within a given age group, certain repeating patterns emerged. Consistent with what was found in section 11.3.1, invitees associated with Lifestyle E (Younger/mobile) and Lifestyle J ('Have Nots' Households) areas had the lowest uptake in a given age group (excluding women from unclassified EDs and those with no Super Profile codes attached). In the more affluent groups, there was an overall tendency towards declining uptake from Lifestyle A (Affluent Professionals) to Lifestyle D (Better Off Young Families). The figures for the individual units show some variation about this, with Lifestyles B (Better Off Older People) and C (Settled Suburbans) sometimes showing higher uptake in a given age group than Lifestyle A. However, the differences were generally small, usually less than two percent.

Another consistent pattern related to the four least affluent Lifestyles. Uptake in a given age band in all Lifestyles from G (Lower Income Elderly) to J was lower than that in A through to D. Response rates were often slightly higher in Lifestyle H (Blue Collar Workers) invitees than Lifestyle G women, but from G and/or H there was a decline in uptake through Lifestyle I (Lower Income Households) to Lifestyle J.

Table 11.15a All units, First Round. Numbers of invites by 5 year age group and Lifestyle

Lifestyle	age 50-54	age 55-59	age 60-64
A	3437	3111	2826
B	3256	3284	3389
C	5535	5341	5289
D	4201	3885	3832
E	575	478	573
F	53	36	44
G	1851	1940	2329
H	2939	3395	3860
I	3118	3008	3168
J	8924	8420	9919
K	30	18	32
O	906	777	1113

Table 11.15b All units, First Round. Signed chi-squared analysis of uptake in relation to 70% target, by 5 year age group and Lifestyle

top row: uptake rate (%) with 95% confidence interval bottom row: signed chi-squared value
Age-SES groups with uptake significantly below 70% are lightly shaded

Lifestyle	age 50-54	age 55-59	age 60-64
A	77.6 (76.2 to 79.0) **93.73******	79.1 (77.6 to 80.5) **121.98******	72.7 (71.1 to 74.4) **9.94*****
B	76.4 (74.9 to 77.8) **63.15******	76.9 (75.5 to 78.4) **74.85******	71.6 (70.1 to 73.1) **4.20***
C	76.5 (75.4 to 77.6) **111.81******	74.1 (72.9 to 75.2) **41.71******	69.7 (68.5 to 71.0) **-0.21**
D	70.9 (69.6 to 72.3) **1.75**	70.2 (68.8 to 71.7) **0.09**	62.7 (61.2 to 64.3) **-96.31******
E	45.7 (41.7 to 49.8) **-161.16******	46.2 (41.8 to 50.7) **-128.56******	44.3 (40.3 to 48.4) **-179.83******
F	71.7 (57.7 to 83.2) **0.07**	66.7 (49.0 to 81.4) **-0.19**	65.9 (50.1 to 79.5) **-0.35**
G	66.3 (64.2 to 68.5) **-11.79******	66.8 (64.7 to 68.9) **-9.74*****	60.5 (58.6 to 62.5) **-99.23******
H	66.8 (65.1 to 68.5) **-14.72******	66.7 (65.1 to 68.2) **-18.07******	60.9 (59.4 to 62.5) **-151.12******
I	61.3 (59.6 to 63.0) **-113.49******	61.2 (59.5 to 63.0) **-110.00******	53.0 (51.2 to 54.7) **-437.66******
J	55.0 (54.0 to 56.1) **-953.57******	56.3 (55.3 to 57.4) **-750.54******	47.6 (46.6 to 48.6) **-2375.20******
K	40.0 (22.7 to 59.4) **-12.86******	66.7 (41.0 to 86.7) **-0.10**	50.0 (31.9 to 68.1) **-6.10***
O	58.3 (55.1 to 61.5) **-59.28******	56.4 (52.9 to 59.9) **-68.73******	42.2 (39.3 to 45.1) **-408.77******

Chi-squared : *p<0.05; **p<0.01; ***p<0.005; ****p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table 11.16a All units, Second Round. Numbers of invites by 5 year age group and Lifestyle

Lifestyle	age 50-54	age 55-59	age 60-64
A	3069	2598	2248
B	2461	2681	2578
C	5095	5142	4664
D	4065	3827	3480
E	510	482	433
F	29	24	23
G	1721	1747	1851
H	2477	2984	3164
I	2790	2941	2835
J	7537	8323	8212
K	31	17	23
O	753	679	667

Table 11.16b All units, Second Round. Signed chi-squared analysis of uptake in relation to 70% target, by 5 year age group and Lifestyle

top row: uptake rate (%) with 95% confidence interval bottom row: signed chi-squared value
Age-SES groups with uptake significantly below 70% are lightly shaded

Lifestyle	age 50-54	age 55-59	age 60-64
A	78.7 (77.2 to 80.1) **110.36******	78.4 (76.8 to 80.0) **86.63******	73.1 (71.3 to 74.9) **10.20*****
B	76.5 (74.8 to 78.2) **49.72******	77.3 (75.7 to 78.8) **67.05******	73.6 (71.9 to 75.3) **15.77******
C	76.0 (74.8 to 77.1) **86.09******	75.2 (74.0 to 76.4) **66.81******	71.8 (70.5 to 73.1) **7.24****
D	73.2 (71.8 to 74.5) **19.34******	71.2 (69.7 to 72.6) **2.53**	66.9 (65.3 to 68.5) **-15.96******
E	54.3 (50.0 to 58.6) **-59.76******	52.5 (48.0 to 57.0) **-70.38******	43.2 (38.5 to 47.9) **-148.24******
F	62.1 (42.3 to 79.3) **-0.87**	62.5 (40.6 to 81.2) **-0.64**	69.6 (47.1 to 86.8) **-0.00**
G	67.8 (65.5 to 70.0) **-4.14***	68.0 (65.8 to 70.1) **-3.51**	62.8 (60.6 to 65.0) **-45.30******
H	69.5 (67.7 to 71.3) **-0.27**	67.3 (65.6 to 69.0) **-10.16*****	63.2 (61.5 to 64.9) **-70.09******
I	65.0 (63.3 to 66.8) **-32.98******	62.1 (60.3 to 63.8) **-87.68******	58.5 (56.7 to 60.3) **-179.06******
J	59.8 (58.7 to 60.9) **-374.50******	56.6 (55.5 to 57.6) **-713.98******	52.4 (51.3 to 53.5) **-1211.46******
K	61.3 (42.2 to 78.2) **-1.12**	70.6 (44.0 to 89.7) **0.00**	78.3 (56.3 to 92.5) **0.75**
O	62.6 (59.1 to 66.0) **-19.90******	65.5 (62.0 to 69.1) **-6.44***	57.3 (53.5 to 61.0) **-51.46******

Chi-squared : *p<0.05; **p<0.01; ***p<0.005; ****p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

The rates for Lifestyle F (Rural Communities) and K (unclassified) are inconclusive due to their being based on small numbers of cases. No consistent relationship emerged between uptake in women who could not be assigned to Super Profile categories and those who could. Again this probably will be due to this group being an 'unknown' in terms of socioeconomic characteristics.

11.5.2 Age-SES groups showing uptake rates above 70%

Results for the Wirral unit indicate that response was significantly higher than 70% across all age groups in the three most affluent Lifestyles, the Affluent Professionals, Better Off Older People, and Settled Suburbans. It was also significantly high in the two younger age groups from Lifestyle D (Better Off Young Families) areas, and slightly above 70% in the oldest women in this Lifestyle. Interestingly, uptake of screening invitation was significantly above 70% in 50-59 year olds living in Lifestyle H (Blue Collar Families) areas during round 1, and amongst the 50-54 year olds according to the second round data available here. Most other groups in Lifestyles G, H and I met or exceeded a 70% response level (appendix C).

Amongst the Liverpool unit's invitees, only the 50-54 year olds in Lifestyles A and C had uptake rates significantly above 70% in the first round. The 55-59 year olds from Lifestyle A areas and the two youngest groups in Lifestyle B also showed more than 70% response to invitation. Round two's figures were a little better, with the two younger groups in each of the top three Lifestyles having significantly high uptake, whilst the oldest women in each also met or slightly exceeded 70%. Uptake in women living in Lifestyle D (Better Off Young Families) areas was borderline, close to 70% for the two younger groups.

The figures for the Sefton & Knowsley unit were a little more encouraging than Liverpool's, but not nearly as good as Wirral's. During the first round, response to invitation was significantly above 70% amongst 50-59 year olds in the two most affluent Lifestyles, and also the youngest group in Lifestyle C (Settled Suburbans). It just exceeded the target in 60-64 year olds in Lifestyle A (Affluent Professionals) and the middle age group in Lifestyle C. Slightly improved second round figures saw uptake significantly exceeding 70% in both younger groups in the three most affluent Lifestyles, and also the oldest women in Lifestyle B (Better Off Older People). Again it was just above 70% amongst 60-64 year olds assigned to Lifestyle A.

11.5.3 Groups of 'concern' - i.e. with particularly low response rates

Across the three units, as already mentioned, all age groups within Lifestyles E and J showed response rates well under 70%. In particular, uptake was often worryingly low in the over 60s in these groups. The lowest absolute rates of screening tended to be in 60-64 year olds living in Lifestyle E areas. Meanwhile, younger women resident in EDs of this type tended to show slightly less unfavourable rates than the 60-64 age group in Lifestyle J, the least affluent Lifestyle.

These were the main age-SES groups showing such low uptake in Wirral. The oldest group in Lifestyle I, the Lower Income Households, fell just short of 70% during round 1, but not by a large margin. In contrast, during the Liverpool unit's first round, the oldest invitees in every Lifestyle group had response rates significantly lower than 70%. By the same unit's second round, matters had improved somewhat, and the 60-64 year olds in the three most affluent Lifestyles were showing response around or slightly above 70%. In addition, the two younger age groups in the bottom four Lifestyles, G to J, showed significantly low response rates during both rounds of screening by the Liverpool unit.

Amongst the women invited to the Sefton & Knowsley mobile screening unit, uptake was significantly below 70% in the oldest age groups in every Lifestyle from D to J, during both rounds. This is similar to the findings for the Liverpool unit's second round. Also similar to Liverpool's results were that the two younger age groups in the lower SES Lifestyles G to J showed response mostly significantly below 70%, more so during Sefton & Knowsley's first round. The oldest Sefton & Knowsley invitees assigned to Lifestyle C (Settled Suburbans) during both rounds, and the 60-64s in Lifestyle B (Better Off Older People) areas for round 1, had rates just slightly below 70%.

11.6 RESPONSE TO FIRST VERSUS REPEAT INVITATION

As already seen (section 11.1.1), uptake rates for all three units were better during the second round of screening than in the first. Next, response amongst women recalled during the second round ('veterans') was compared with that from women invited for the first time by one of the units ('novices'), to examine the extent to which each group contributed to overall improvements in uptake. Some 'novices' will be women who had recently moved to the district concerned (and, therefore, may well have already experienced mammography), but the majority will be women who had entered the lower end of the 50-64 age range. Table 11.17 shows the uptake rates for the two groups in each district. In all cases, total uptake was higher in first-time invitees that amongst recalled women, although in Wirral and Sefton the difference was small, at less than 1 percent. In Liverpool there was a more notable, significant difference of 4.3%.

Table 11.17 Second round of screening: Overall uptake amongst recalled women ('veterans'), versus those invited for the first time ('round 2 novices')

	Women recalled in second round ('veterans')		Women first called in second round ('round 2 novices')	
	no. of cases	**uptake (%)**	**no. of cases**	**uptake (%)**
Wirral	16174	74.3	4665	75.1
Liverpool	27067	60.9	9475	65.2
Sefton & Knowsley	26521	66.1	9110	66.9
Total	69762	66.0	23250	67.9

11.6.1 Second round novices versus second round veterans

Figures 11.20a to 11.20c illustrate each unit's patterns of response to invitation by Lifestyle, amongst second round novices and veterans (the figures for which are tabulated in appendix C). From these, it can be seen that the relationship between the first-timers and repeat invitees is variable, and also that there is relatively little consistency between each of the units. What the three have in common is that novices from Lifestyle D (Better Off Young Families) and J ('Have Nots' Households) areas had higher uptake rates than the corresponding veterans. The difference in response between Lifestyle J novices and veterans was significant for the Liverpool unit. Additionally, veterans resident in unclassified EDs (Lifestyle K) showed better response than the novices. This result cannot be readily interpreted, however, since little is known of these women. Apart from these similarities, the relationship between novices and veterans is different for each unit. Therefore the three will be discussed separately.

The findings for the Wirral unit's second round, or at least the first 25 months of it, are that veterans in the three most affluent Lifestyles, and in group F (Rural Communities), had better uptake rates than novices in these socioeconomic groups. In all the other categories, response was better amongst the novices. Excepting Lifestyle F, which had a small number of cases, the largest difference between the response shown by novice and veteran invitees were in Lifestyle G (Lower Income Elderly) and A (Affluent Professionals). None of the differences between the two were statistically significant for any Lifestyle.

Figure 11.20a Wirral unit Second Round.
Uptake by Lifestyle amongst 'novices' and 'veterans'

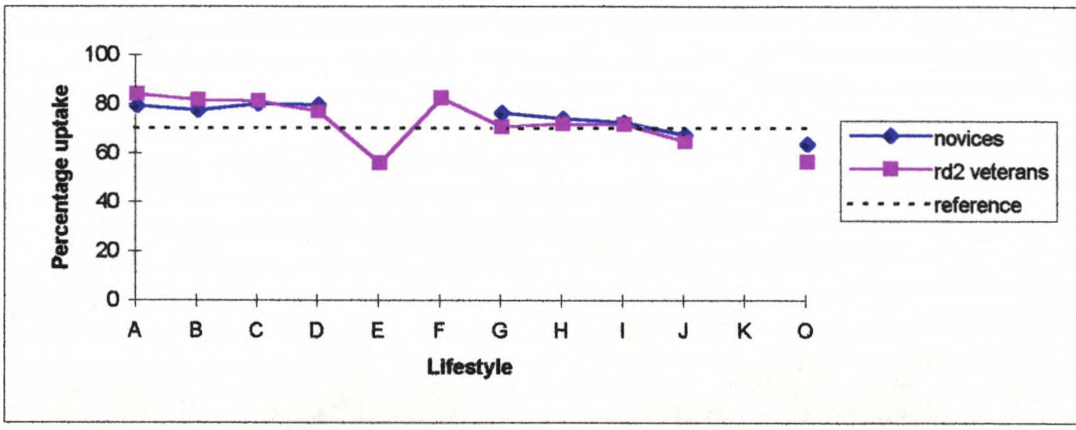


Figure 11.20b Liverpool unit Second Round.
Uptake by Lifestyle amongst 'novices' and 'veterans'

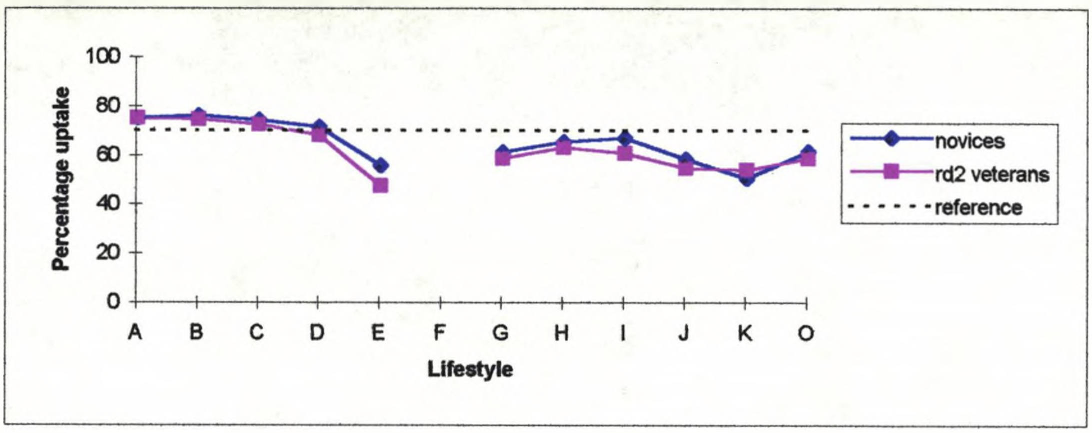
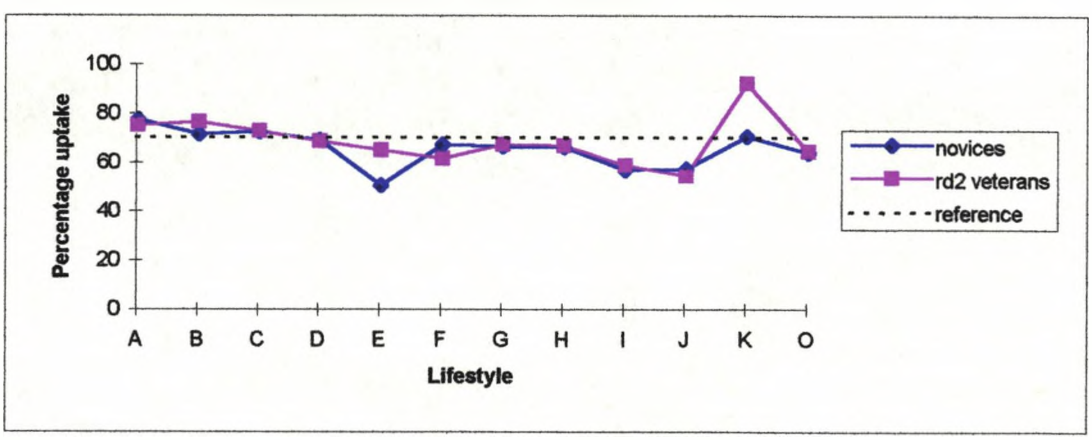


Figure 11.20c Sefton & Knowsley unit Second Round.
Uptake by Lifestyle amongst 'novices' and 'veterans'



A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
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I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: Super Profile codes not attached

plotting suppressed
where n < 10

The relationship between the two groups of women invited to Liverpool was the least variable. Novices showed better response than recalled women, excepting those in Lifestyle A, where percentage uptake was essentially identical in both groups, and those from Lifestyle K areas, as already stated above. The widest difference between the groups occurred in residents of Lifestyle E (Younger/mobile persons) areas, with veterans showing uptake 8.3% lower than second round novices (both being significantly lower than the 70% target). This difference was of borderline significance. The gap in uptake between Lifestyle I (Lower Income Families) novices and veterans was significant, however, as well as that in Lifestyle J women (mentioned above).

The picture for Sefton & Knowsley was different again, with novices having better uptake than veterans from Lifestyles A, D (Better Off Young Families), F and J areas. In all the other groups, response to invite was better amongst the veterans. Often the difference between the two was only a fraction of a percent; only the 5.1% gap between the first-timers and the re-invited in Lifestyle B (Better Off Older People) was significant.

Data for the Wirral and Sefton & Knowsley units indicate that women invited before can show better response than women contacted for the first time by the screening service. There could be a variety of reasons for this finding, such as veterans having familiarity with the process and fewer fears about (re)attending, or the younger group of first-timers having a greater number of other demands on their time.

Whilst overall for each unit, and in the greater number of Lifestyle groups, veterans do indeed have lower uptake than novices, the difference between these two groups of women is often small. The Liverpool unit's figures most closely conform to what might be expected if one hypothesises that the second round first-timers, being of younger average age than the veterans, will show higher response to invitation. However, as discussed in section 11.5.1, uptake often did not drop off until after the age of 60. Therefore, age differences do not fully explain the differences between novices and veterans, especially not in the cases where uptake was actually higher in the re-invited women. Experience of and satisfaction with the screening service would influence the decision of previously attending veterans to whether or not to re-attend, as well as other motivating and inhibiting factors as discussed in chapter 5. From these results, it would appear that the acceptability of the screening service was generally good, and therefore those who have attended once will make an effort to do so again. First and second round response levels in the group of women invited during both are examined directly in the following section.

11.6.2 Second round veterans compared with themselves as novices, and with women only invited in the first round

Investigated in this section is the similarity of response of the round two veterans to their own uptake rates in the first round, and to the patterns in women only invited during each unit's first round of screening. The comparisons of round two veterans with their first round response as novices is a useful marker with respect to the acceptability of the screening service, since it measures the 'staying power' of these particular groups of women. Table 11.18 shows the overall response rates during the first round of screening, in women only invited during this round, and in those who would later be re-invited during round 2 of screening at each unit. Uptake rates amongst this latter group of women, who became the second round 'veterans', were shown in the previous table, 11.17.

Uptake in the group of women only invited during the first round was significantly lower than amongst the women later re-invited during the second round. In the majority of cases (excepting, for example, women moving out of the areas), these women were the oldest invitees during round 1, and were not re-invited during the second round due to their having reached or exceeded the age of 65. Therefore, this observation is a predictable, largely age-related effect. 'Round 1 only' women also had lower total uptake than either the second round veterans or the second round novices discussed in the previous section. These differences were statistically significant for the Liverpool and Sefton & Knowsley units, but not Wirral's. The overall uptake rates of round 2 veterans were only slightly lower than their total rates when they were invited during the first round.

Table 11.18 First round of screening: Overall uptake amongst women only invited during this round, versus those also invited during the second round

	Women only invited in first round		Women also invited in second round	
	no. of cases	uptake (%)	no. of cases	uptake (%)
Wirral	11809	73.3	16174	76.2
Liverpool	14316	46.8	28136	61.0
Sefton & Knowsley	10429	56.5	26444	64.5
Total	36554	58.1	70754	66.9

Figures 11.21a to 11.21c show the Lifestyle-specific uptake of screening in women invited during both rounds of screening by each unit (firstly as round 1 novices, then as round 2 veterans), as well as uptake rates in women only invited during the first round. The actual values are contained in appendix C.

Decay in response amongst round 2 veterans when compared with their own rates as novices in round one was often fractional. The largest drops in uptake occurred in lower SES women in Wirral (Lifestyles G to J) and in groups with relatively few cases, such as residents of Lifestyle E EDs. Lifestyle B (Better Off Older People) women invited to the Liverpool and Sefton & Knowsley units actually showed a little higher collective response to subsequent invitation than they did to their first. A little of the overall decline in response may be related to age, but with such a generally small difference, it is evident that motivation to re-attend is good. Note that a quick inspection of the data indicated that, of those invited twice, the attenders in each round are predominantly the same individual women.

Very clear from figures 11.21a to 11.21c is that uptake amongst the women only invited during the first round of screening was usually much lower than that in women later re-invited. Exceptions to this only occurred in Wirral, where second round veterans in Lifestyle G (Lower Income Elderly) and H (Blue Collar Families) showed fractionally lower response than women only invited during round 1. Mostly, however, women only invited during round 1 had significantly lower response rates than those later recalled, or those invited for the first time during round 2. All women involved in the first round were essentially being invited for mammography for the first time (excepting any privately screened women, or those x-rayed for previous problems). Much of the

Figure 11.21a Wirral unit. Uptake by Lifestyle
amongst women invited in both rounds, and those invited only during the first

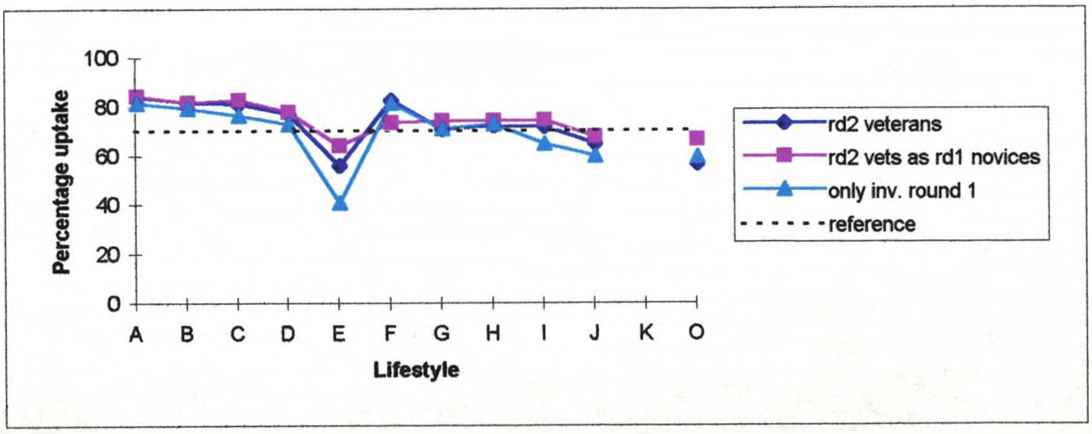


Figure 11.21b Liverpool unit. Uptake by Lifestyle
amongst women invited in both rounds, and those invited only during the first

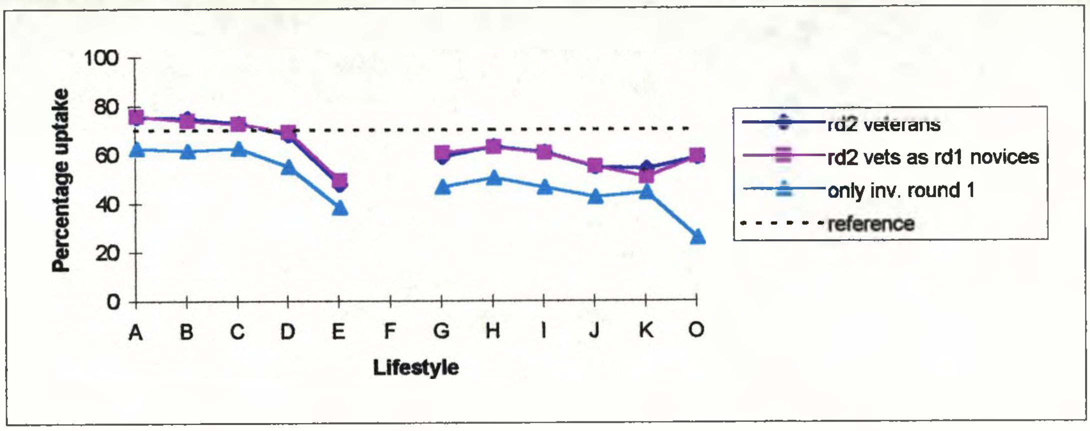
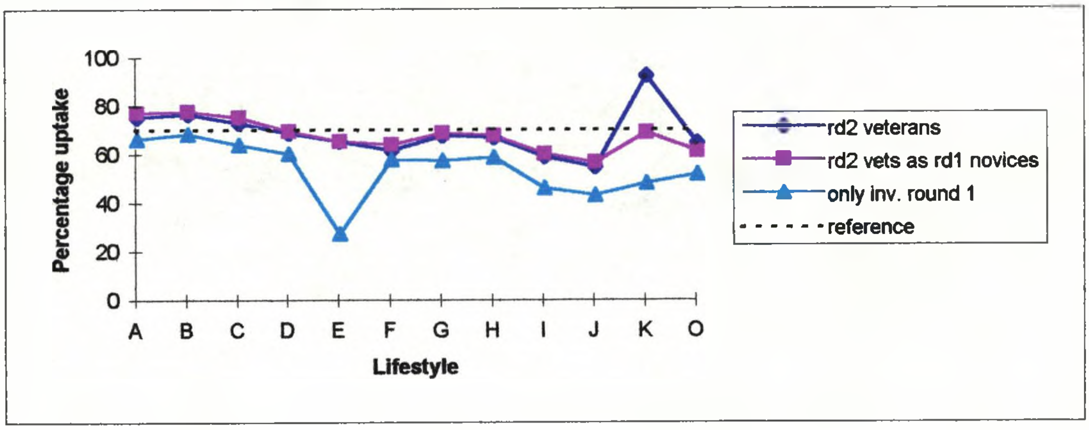


Figure 11.21c Sefton & Knowsley unit. Uptake by Lifestyle
amongst women invited in both rounds, and those invited only during the first



A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities

G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: Super Profile codes not attached

plotting suppressed
where n < 10

observed difference will be age-related, since the vast majority of women only invited during round 1 will have been at the older end of the eligible age range. Only a small proportion will be individuals who were young enough for re-invitation but moved out of the area, or who were not re-invited for health reasons, for example. The extent of improved awareness of the service by the time of the second round, and its possible influence on findings, cannot be known from this data. At any rate, evident from figures 11.21a to 11.21c is the contribution of 'round 1 only' women to the lower overall uptake rates shown in the first round of screening in each unit.

11.7 SOCIOECONOMIC DIFFERENCES IN SELF-REFERRAL AND "RECENTLY SCREENED" STATUS

In addition to response to invitation varying by socioeconomic group, it was thought likely that the proportions of women self-referring, or declining an invite whilst stating that they had been recently screened, would also differ by Super Profile Lifestyle. The numbers of self referrals (this does not include GP referrals) and "Recently Screened" women, in comparison with the total numbers of invites analysed, are shown for each unit in table 11.19. Meanwhile, Figures 11.22a to 11.22c illustrate, for comparison, the proportional distribution of each of these three groups amongst the Lifestyles for each screening unit. 95% confidence intervals for the proportions, in the form of error bars, have been included to take account of the often large differences in absolute numbers. Table 11.19 indicates that self-declared "Recently Screened" status is around three times more common for Wirral unit invites than for either of the other units. Self-referral is relatively more common in the Liverpool unit data, perhaps surprisingly, given the otherwise consistently lower uptake of screening associated with this unit.

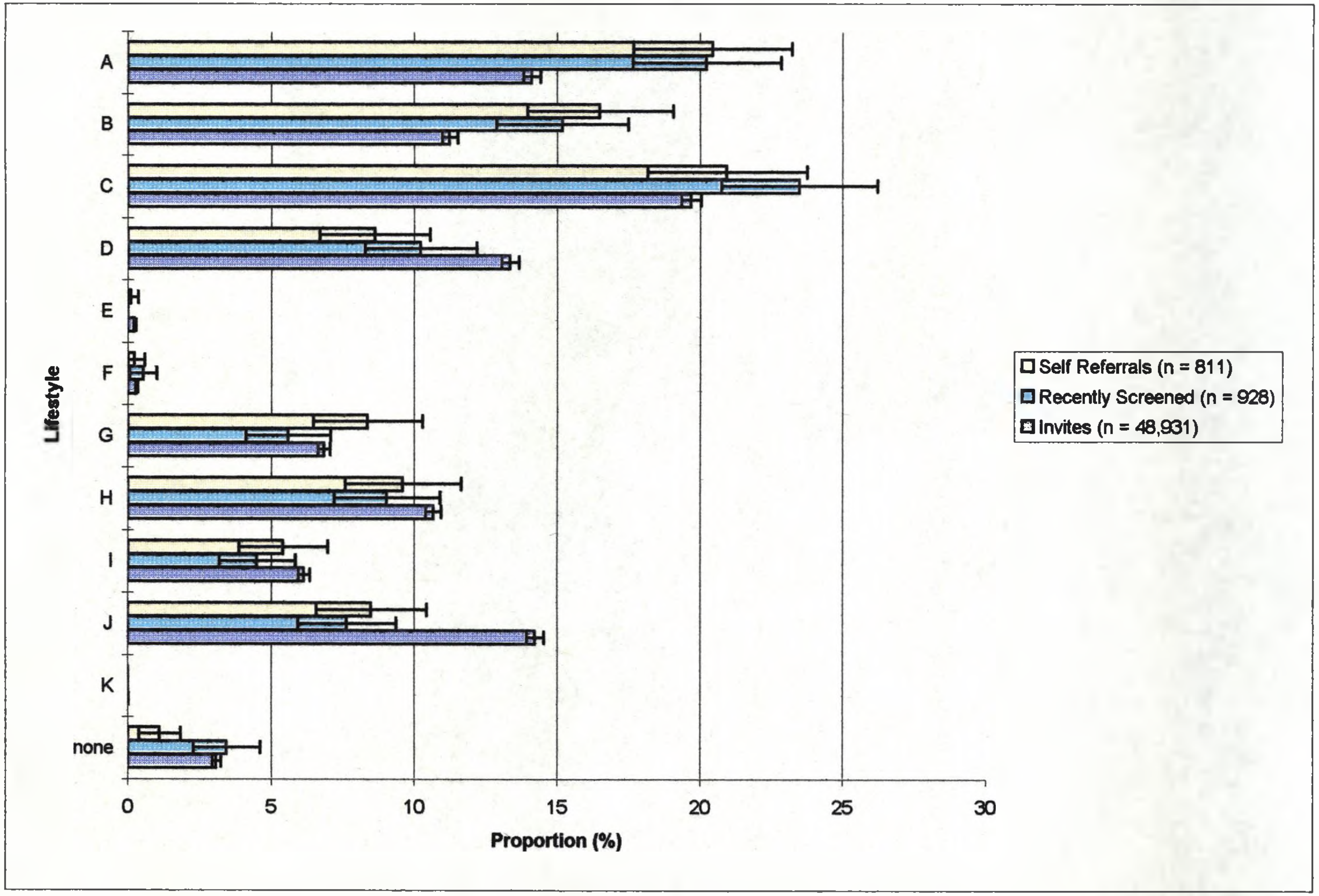
Table 11.19 Total numbers of invites analysed, self referred and self-declared "Recently Screened" women for each screening unit

	Self Referrals		"Recently Screened"		Invites analysed
	no.	% of all three groups	no.	% of invites	
Wirral	811	1.6	928	1.9	48931
Liverpool	2485	2.9	608	0.7	83204
Sefton & Knowsley	1056	1.4	374	0.5	72504

11.7.1 Frequency of Self-Referral by Super Profile Lifestyle

Whilst women aged 65 and over are not automatically invited for screening, they are free to self-refer, that is, personally request an appointment. Common to all units is that self-referral was relatively frequent (in comparison with the proportional share of invited women) in the three most affluent Lifestyles, and also Lifestyle G (Lower Income Elderly). For example, whilst 14% of the Wirral unit invites were assigned to Lifestyle A, 20.5% of the self-referred women were assigned to this SES group (figure 11.22a). Amongst Affluent Professionals (A) and Better Off Older People (B), the proportional share of self-referred women was significantly high across all units. In Lifestyle C (Settled Suburbans), the difference was significant only for the Liverpool unit; for Lifestyle G it was significant only for Sefton & Knowsley.

Figure 11.22a
Wirral unit. Proportional shares of all invites, recently screened, and self-referred women, amongst the Lifestyle categories



A: Affluent Professionals
B: Better Off Older People
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D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
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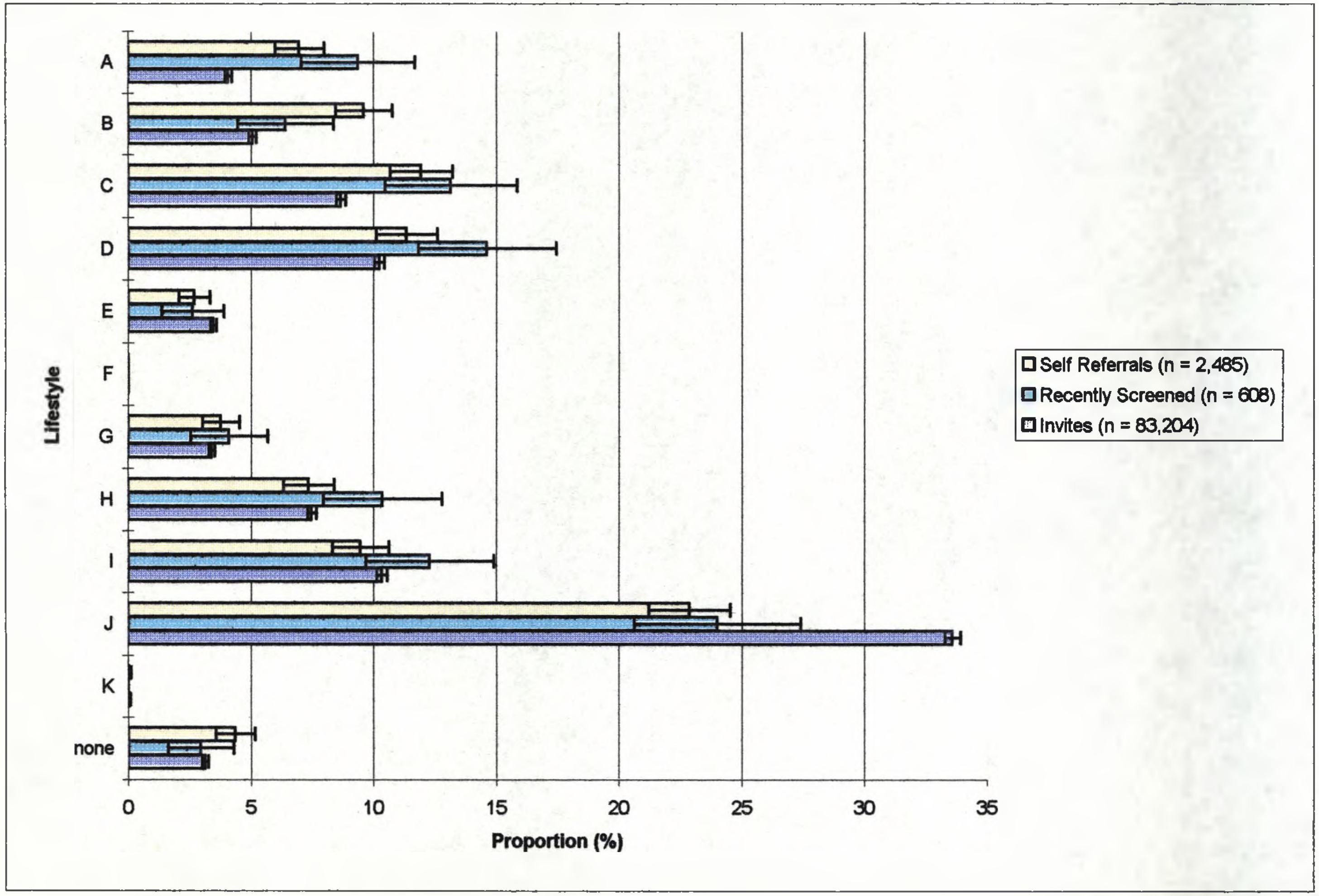
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes

Error bars show 95% Confidence Intervals

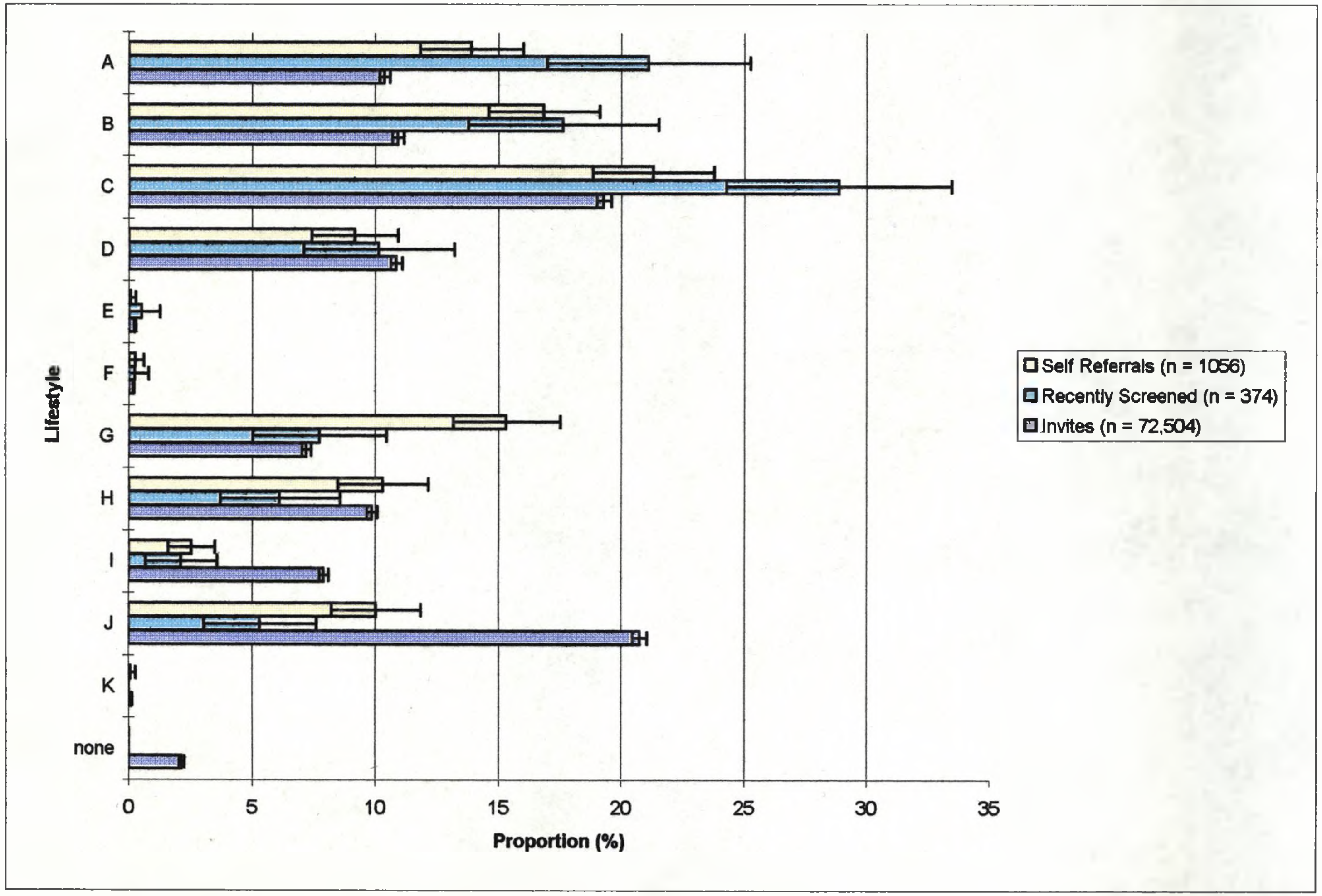
Figure 11.22b
Liverpool unit. Proportional shares of all invites, recently screened, and self-referred women, amongst the Lifestyle categories



Error bars show 95% Confidence Intervals

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes

Figure 11.22c
Sefton & Knowsley unit. Proportional shares of all invites, recently screened, and self-referred women, amongst the Lifestyle categories



A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
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I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes

Error bars show 95% Confidence Intervals

The second feature common to all units was that self-referral was relatively infrequent amongst women in the two most deprived Lifestyles, I (Lower Income Households) and J ('Have Nots' Households). For Lifestyle I, proportional share of self-referred as opposed to invited women was significantly different only for the Sefton & Knowsley unit. The differences in Lifestyle J were statistically significant across all units. Absolute numbers were usually small in Lifestyles E, F, and K (unclassified areas); in Liverpool, however, self-referral was relatively infrequent in women residing in Lifestyle E (Younger/mobile) areas.

There was no consistent pattern for women in Lifestyles D and H, or with no Super Profile codes attached. Amongst women from Lifestyle D (Better Off Young Families) areas, the proportional share of women self-referring was significantly lower than the share of invites in Wirral, non-significantly lower for the Sefton & Knowsley unit, and non-significantly higher for the Liverpool unit. Meanwhile, self-referral was relatively infrequent in Wirral and Liverpool-invited Lifestyle H (Blue Collar Families) women, though not for Sefton & Knowsley. None of these differences were significant. There were no Sefton & Knowsley-attending self-referred women that could not be assigned Super Profile codes. In Wirral, unassigned self-referred women were relatively infrequent in comparison with the share of invites. For the Liverpool unit, the opposite was true. Both differences were statistically significant.

Self-referral results in an increased overall usage of mammography by a given socioeconomic group. These results indicate that relatively high proportions of self-referring women came from the three highest SES groups, and also from Lifestyle G

(Lower Income Elderly) areas. Motivation to actively seek screening (either for the first time or subsequent to routine invitation) is thus higher in these groups. Amongst women of low SES, there was consistently relatively little tendency for older women to self-refer. Amongst women in middle SES groups there was a mixed pattern, though tending more towards less rather than more self-referral, when compared with the proportional share of invites. Overall, these findings reinforced the socioeconomic gradient in total mammography usage.

11.7.2 Frequency of self-reported 'Recently Screened' status by Lifestyle

The findings here were broadly similar to those reported above. Women declining an invitation on the (usually self-reported) grounds of being recently screened had proportionately high representation in the three most affluent Lifestyles across all units. The difference from the share of invites in these groups was significant in all cases excepting Lifestyle B (Better Off Older People) women invited to the Liverpool unit. Conversely, Lifestyle J ('Have Nots' Households) invitees declaring themselves to be recently screened were significantly infrequent. Again, numbers in Lifestyles E, F and K were small, though in Lifestyle E (Younger/mobile persons) ED residents invited to the Liverpool unit, recently screened status was relatively infrequent (figure 11.22b).

Findings were mixed for the other socioeconomic groups. For instance, proportional share of "Recently Screened" women was significantly lower than the invited group in Lifestyle D women at the Wirral and Sefton & Knowsley units. It was significantly higher for Liverpool. In Lifestyle I, the second most deprived group, recently screened status was significantly infrequent for the Wirral and Sefton & Knowsley units, though slightly higher than the proportional share of invites in Liverpool.

If most women who state themselves to be recently screened genuinely have been for a mammogram in the short-term past (e.g. having been privately screened, or having moved from another part of the country, where they had attended), then the actual usage of mammography is higher than that calculated here. As with the findings in Section 11.8.1, this would serve to reinforce the higher overall rates of breast screening achieved in high SES women, and low rates at the poorest end of the socioeconomic scale. The effect does not appear to be systematic in the middle ground.

11.8 SUMMARY OF FINDINGS

- Overall, uptake of screening was highest for the Wirral unit and lowest for the Liverpool unit. Rates improved for all three units between the first and second rounds, but only Wirral was above the 70% target.

- Yearly fluctuations in uptake were, to some degree, influenced by the geographical focus of invitations in a given year.

- Overall, uptake rates in 50-54 year olds and 55-59 year olds were similar. Response in the over 60s was clearly lower.

- Spatial analysis of uptake showed a large number of small geographical localities (Census enumeration districts) had low response to invite in Liverpool, Sefton and Knowsley. Small improvements were noted by the second round. Wirral's overall uptake was better, but a few low response areas were still noted in the less affluent eastern half of the district.

- A general socioeconomic trend in uptake of breast screening was noted. The four most affluent Lifestyles, A to D, showed the highest response to invitation. Uptake rates tended to be lowest in women resident in Lifestyle E areas- the 'background' population to the 'Younger/mobile' persons, and in women in the poorest Lifestyle, J ('Have Nots' Households).

- Socioeconomic variations in uptake were similar in pattern for each of the three units, but different in terms of absolute values, Liverpool's being the lowest. Second round improvements occurred across the socioeconomic scale.

- The same overall trend from higher SES- higher response to low SES- lower response was seen when the data were analysed at Super Profile Target Market level. The lowest response groups were constituents of Lifestyles E and J, as mentioned above.

- Census EDs showing high response to invite were predominantly of higher SES. EDs showing low response were nearly all of low SES.

- Women in the oldest age group (60-64) and/or of lower SES were least likely to reach the target of 70% response. This was particularly clear in Wirral, where despite overall favourable uptake rates, some distinct older or poorer groups are still of concern.

- Total response to invite was relatively similar between second round 'novices' and 'veterans', although significantly lower for the 'veterans' invited back to the Liverpool unit. The response of the 'veterans' had actually declined relatively little in comparison with their first round response as novices, thus motivation to re-attend was good.

- Women only invited during round 1 showed lower response than any of the other groups for all units, significantly so for the Liverpool and Sefton & Knowsley units. Most of this group would have been relatively old, and perhaps less aware of the purpose of the screening service, though the extent of this latter factor cannot be known from this research.

- Self-referral and self-declared "Recently Screened" status were both relatively frequent amongst women of high socioeconomic status, and infrequent in women of lowest SES. Both these findings served to reinforce the observed socioeconomic gradient in mammography usage.

CHAPTER 12

DISCUSSION AND CONCLUSIONS

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The findings of this research are in agreement with what is known from earlier studies elsewhere. Socioeconomic status has a direct and significant association with breast cancer incidence, survival and the uptake of screening by mammography. This work has confirmed the picture in Merseyside, an area in which no study of this sort and scope has previously been carried out. It has provided a wealth of new information regarding local patterns and trends in each of the issues studied.

Unlike previous work, the original research reported on here has collectively encompassed breast cancer incidence, survival and screening data within a distinct geographical area, from comparable time periods, and with socioeconomic status defined in a consistent manner throughout. Therefore, the three issues have been linked as closely as possible within the limits of the datasets. This has allowed a direct comparison of incidence and survival patterns amongst the same group of women. There is also a high level of comparability between the cancer and screening data. Not only were the geographical areas and time periods closely correspondent, but also many of the women in the cancer dataset will also have been invited for breast screening.

This work is also repeatable elsewhere, given the existence of the same basic cancer registration and screening data throughout the country. Some of the main points arising from the findings of this research are discussed in this closing chapter.

12.1 BREAST CANCER INCIDENCE IN THE THREE DISTRICTS

12.1.1 Socioeconomic gradients in breast cancer incidence

The differences in breast cancer incidence observed in this research, between the highest and lowest SES groups, are all greater in magnitude than those observed in the studies reviewed in chapter 3. Of those, Barbone et al's (1996) Italian study noted the greatest difference, with breast cancer rates amongst high SES women that were more than 3 times those amongst low SES women. This research found the difference between those of lowest SES and those of highest SES to be around 6 fold. This is possibly due to the use of a greater number of SES categories here than in many of the previous studies. The most notable difference in incidence has been observed in the highest socioeconomic group of ten (main Super Profile Lifestyles). Lifestyle A was found to be associated with greatly elevated rates, with a similar, although smaller heightened risk, noted amongst women resident in Lifestyle B areas. The use of a smaller number of categories might dilute any effect seen amongst those of very high SES. However, even compared with the previous papers using 8 to 10 categories of SES, the results here would appear to provide a still stronger verification of the direct association of socioeconomic status with incidence.

The socioeconomic gradient in incidence observed here may have been influenced by the use of an ecological (area) SES variable and/or differential migration to or from each district by Lifestyle. The matching of cases to Lifestyles based on postcode of residence inevitably results in misallocation of some individuals. Misclassification of this type would most likely dampen the observed gradient, therefore the 'true' decline in incidence from high SES to low SES might be greater, perhaps showing more of a distinction between the middle and lower groups.

Additionally, it had to be assumed, for the purposes of denominator calculation, that population changes by age group (in particular, net out-migration in Liverpool) applied equally across the Lifestyles. This is probably not the case. As an example of the potential effect, calculated population denominators for Lifestyle groups in fact showing higher than average out-migration would be erroneously large, and thus the calculated incidence for that group would be lower than the 'true' value. If out-migration was greater amongst people of high SES, as opposed to low SES, the 'true' difference between the incidence rates at the top and bottom end of the socioeconomic scale would be even greater than that seen here. Conversely, greater outflow of low SES persons would result in a lower 'true' gradient in incidence.

However, even allowing for potential dampening effects, the results seen here are quite clear. Meanwhile, factors serving to increase the socioeconomic gradient in incidence would add to an already convincing picture.

12.1.2 Changes in breast cancer incidence

In line with recent trends discussed in chapter 2, the incidence of breast cancer increased between 1986 and 1993 in all the districts of Merseyside studied. This observation is due to the combined effect of general increases in rates of this disease (although it remains relatively rare in those aged under 30) and the anticipated increase in diagnosis of breast tumours amongst screened women, particularly during the early years of the screening programme. The smaller increases in incidence observed in Liverpool could, at least in part, be due to the fact that some screening had been carried out in the district in 1988, prior to the main commencement of routine screening in 1989.

The background rise in incidence, coupled with transient increases in diagnosis rates (as anticipated in the early years of the National Breast Screening Programme), is particularly evident in women resident in Lifestyle A (Affluent Professional) EDs. Already showing significantly higher rates of the disease than women in any other Lifestyle group, incidence rose noticeably in Lifestyle A women between the pre-screening and during-screening time periods. The greatly elevated lifetime (0-74) risk of breast cancer (over the whole time period studied) in Lifestyle A women, of between 1 in 3 and 1 in 5, was due to high rates in most age groups. Similarly, increases in incidence occurred across several age groups, not just in the screening-eligible women, although registrations in the 50-64 year olds increased markedly. Looked at simply in terms of pure incidence rates, attenders for screening increase their own likelihood of diagnosis, at least in the short term after their entry to a screening programme. However, what is more important is that, with inevitably high susceptibility of some population groups to the disease, a greater proportion of women are diagnosed at an early stage. Relatively few of the cases in this cancer dataset (6%) appeared to have presented through screening. This may be an underestimate, due to this fact not being recorded in every relevant patient's notes. Future research potential exists for the examination of socioeconomic variations in incidence patterns (particularly age- and stage-specific) and subsequent survival, as a result of screening behaviour.

12.2 BREAST CANCER SURVIVAL IN THE THREE DISTRICTS

12.2.1 Socioeconomic gradients in breast cancer survival

The findings of the previous research into SES and survival from breast cancer that noted a direct association between the two, found that differences in survival between the highest and lowest SES women ranged from about 2% (Kogevinas et al 1990) to more than one hundred percent (Gordon et al 1992), although the latter study used continuous, rather than categorical SES indicators. This research noted a socioeconomic gradient in survival that persisted after adjustment for age, year of diagnosis, treatment and other rough indicators of stage. However, with an apparent survival advantage of high SES women over those of low SES being generally in the range 2-10%, the findings here are closer to those from the Longitudinal study in the UK (Kogevinas et al 1990) than they are to the other extreme, such as the Italian work reported by Gordon et al (1992). Between-country variations in the access of different socioeconomic groups to medical care could offer a partial explanation for this.

However, access to health care is by no means equitable in this country, and some differences between the socioeconomic groups are to be expected.

In contrast to the utility of ten main SES categories in the examination of breast cancer incidence patterns, the division of the cases into the same number of categories for survival analysis has perhaps not been so helpful. Most of the previous work subdivided the studied women into a smaller number of broader SES groups. When four SES bands were used in this research, for illustrative purposes, wider differences between the groups were noted, especially in women aged under 50. In terms of the general socioeconomic gradient in survival, the use of ten categories rather than, say, around half that number, added relatively little discriminatory power. For example, the final Cox regression model indicated that lower survival rates in Lifestyle G were largely due to confounding by age and/or the other variables.

With respect to the recognised error in the coding of some of the 1988-93 treatment data (discussed in chapter 10), some points should be noted. If it is the case that socioeconomic differences in survival do not persist after adjustment for all the other factors available, including treatment, the implication is that improving treatment opportunities (as well as detection of cancers, etc.) across the socioeconomic scale should have a substantial impact on reducing survival differentials between the groups. If these differences do persist after adjustment for 'correct' treatment status in addition to age, year of diagnosis, mode of presentation and proof of diagnosis, then indeed SES has an even deeper influence on survival experience than could be accounted for here, since information on stage, delay in seeking treatment, etc. was not available in the dataset used in this research. However, in light of either of these possibilities, the fact remains that socioeconomic status is a valuable marker with respect to the likelihood of breast cancer survival in population groups.

12.2.2 Changes in breast cancer survival

Survival from breast cancer in the three districts of Merseyside was observed to improve between 1986 and 1993, at least in the short and medium term. Progressive trends towards earlier detection and improved treatment methods are favoured explanations. A recent study in East Anglia concluded that over half the fall in mortality amongst women registered during the 1980s was due to earlier diagnosis (pre-dating the national screening programme), and that relatively little appeared to be due to changes in treatment (Stockton et al 1997). The ability to assess improvements in long-term survival was limited from the data used here. That would require the recruitment of cases from an earlier time period. From a geodemographic viewpoint, difficulties could well arise in such analysis. For example, cases dating from an earlier time period, approximating more closely to the 1981 Census rather than the 1991 Census, would more appropriately be classified according to the original Super Profiles typologies. These are not directly comparable with the current classification, although in both the Lifestyles are ranked in order of an approximate high to low SES ranking. Additionally, the attachment of area based socioeconomic data to postcoded records prior to the 1991 Census was prone to a greater number of errors than is now the case.

12.3 UPTAKE OF SCREENING AT THE THREE UNITS

12.3.1 Socioeconomic gradients in the uptake of breast screening

The previous work examining the socioeconomic dimension of mammography usage did not universally consider actual response to invitation. Much of the approach was from a slightly different angle, such as seeking to identify the socioeconomic characteristics of the nonattending and attending subgroups, or of women requiring different levels of effort to get them to attend. During the first two rounds of screening by the three Merseyside units studied here, response to invite from women in Lifestyle A (Affluent Professional) areas was around 20% greater than that from women in the poorest areas (Lifestyle J, the 'Have Nots' Households). The difference between the highest SES group and women resident in the areas also popularly inhabited by the 'Younger/mobile persons' (Lifestyle E) was nearly always even greater, most frequently around 25%. The possible consequences of applying an ecological SES measure, as discussed above with reference to incidence, could also apply here (and indeed, in the survival calculations); the 'true' socioeconomic gradient in uptake of screening might be even greater than that observed here.

12.3.2 Changes in the uptake of screening

Second round uptake of screening at each unit studied here was seen to improve upon the response achieved during the first round. This appears to be largely due to the retention of first round attenders, plus the entry of a new cohort of women to the younger end of the eligible age band. Lower first round uptake rates were influenced by relatively poor response to invite amongst women only invited that once, most of whom were at the older end of the 50-64 age range. It is likely that the gradient in uptake with age may lessen over subsequent rounds of screening, as the decline in response with age may be offset by increasing familiarity with the screening service, and perception of potential benefits of attending. Improved awareness of the service cannot be quantified here.

In the second follow-up report to the 'Health of the Nation', the Department of Health identified two key challenges for the NHS in taking forward the breast screening target (DoH 1995a). The first concerned the identification of areas and groups in which compliance falls short of 70%, in order that they may be specifically targeted. This research has provided detailed information on these groups in the studied part of Merseyside. The second was to ensure that compliance with subsequent screening invites remains high. Repeat attendance levels have been shown to be good in this area, at least between first and second rounds.

One message emerging from these results is that, since the 'staying power' of the screening service seems to be high after initial attendance, large improvements in district uptake would have to be achieved by directing effort specifically at women who have never been screened. This might prove difficult, though based on the local knowledge provided by this research, certain approaches to targeting could be tailored.

The socioeconomic patterns and rates uncovered here could lead to either one or both of two targeting approaches:

i) target the entire eligible population in a district, to continue improving total mammography usage. For example, it was clear in Wirral that where one socioeconomic group responded better than the equivalent group in Liverpool, so did the rest, if only by a few percent. Aiming to increase uptake across the socioeconomic scale would also assist in the detection and treatment of progressively greater proportions of early stage tumours. High overall increases in district uptake would need to be achieved since, as also shown in Wirral, favourable total response to invite can mask low response in specific age-SES groups. Since socioeconomic differences in survival were not completely confounded by age and, by inference from the clinical variables available, still owed much to stage at diagnosis (and perhaps other factors such as lead time bias in screened women), it is clear that more emphasis should be placed on improving the survival experience of lower SES women. An all-encompassing approach to improving uptake might include further community publicity campaigns, but probably more effectively, greater personalisation of invites, which has been identified as a successful strategy (Turner et al 1994).

ii) target the specific subgroups of the population showing a particular tendency towards low response rates. This approach would have the more direct aim of reducing the breast cancer survival divide between women at different ends of the socioeconomic spectrum. Individual or population-based approaches to targeting could be adopted, because the screening units are aware which individual women do not attend for a mammogram. Follow-up letters, already sent to non-attenders, could be further tailored according to the general likely socioeconomic circumstances of each woman, as it is probable that a proportion of residents of Lifestyle A areas fail to attend for slightly different reasons to those from the more deprived localities. Admittedly, cost considerations might prohibit this approach in all but a basic sense. Alternatively, knowledge of the consumption habits of the SES groups showing lower uptake, afforded by the Super Profiles Lifestyle descriptors, could assist in a population based publicity campaign, in specific newspapers or supermarkets, for example. This type of targeting approach might also reach more of the women who did not receive their invite due to out of date address records, or indeed the unknown proportion of women who are not GP-registered (although this is believed to be small). However, this type of approach also relies in part on increased awareness resulting in an increased motivation to approach the screening service. Based on what is known of the relationship between SES and the uptake of screening, this may not occur.

On balance, if resources are available, a combination of generic and sector-specific targeting approaches could be used to improve the detection rates of early breast cancers. Improvements in awareness do seem to be occurring. Both the screening programme and local health authorities, such as Liverpool, have been making efforts to increase women's awareness of cancer and the potential for screening. For instance, the Liverpool Health Authority ran a series of leaflet and poster campaigns, locating them in prominent places such as the interiors of buses and taxis (Liverpool Health Authority 1997). Meanwhile, steps taken by the screening service include informing women that if they miss their original appointment they can request another, something the invitees might not have previously realised was possible. Liverpool Health Authority (1997) note that third round screening in this district, amongst patients of GP practices that had completed all three rounds of screening, reached 70% (with a 95% Confidence Interval of 68-72%). This is encouraging, although the data do not yet refer to the complete district (the third round of screening is still in progress) and, as shown in chapter 11, this overall increase will still mask very low response rates from some areas and age-SES groups.

12.4 CONSISTENCY IN SES PATTERNS, DIFFERENCES IN ABSOLUTE VALUES

With respect to overall rates of breast cancer survival, there was relatively little difference between Wirral, Liverpool and Sefton, although of the three districts, survival in Liverpool was lowest by a small margin. In view of these marginal differences in survival, cases were not grouped by separate district in subsequent survival analyses. In contrast, overall breast cancer incidence and screening uptake rates vary more by district. These observed differences are partly due to variations in the underlying socioeconomic characteristics of the districts. For example Liverpool, with a high proportion of its population assigned to low SES groups (chapter 7), had lower overall rates of incidence and uptake than either Sefton or Wirral, which have lower proportions of their populations in the lowest SES groups.

When the socioeconomic dimensions of breast cancer incidence and screening uptake were studied for each district/screening unit, the variations in absolute values were found to carry further. Whilst the shapes of the socioeconomic patterns in incidence and uptake were consistent, the absolute values within each socioeconomic group varied across the districts. For example, although breast cancer incidence amongst women in Lifestyle A (Affluent Professional) areas was significantly higher than in any other Lifestyle for each of the districts, the Age Standardised Rate per 100,000 persons in this SES group (for 1986-93 inclusive) ranged from 205 in Liverpool to 359 in Sefton. Women in this Lifestyle also tended to show around the highest rates of screening uptake, although absolute rates of response to invitation varied by about 10%, from 74.6% in Liverpool's second round, to 85% during the first two years of Wirral's second round (appendix C). The absolute differences in incidence rates by SES across the districts are hard to explain. This finding could imply that there are geographical variations in the prevalence of certain breast cancer risk factors, or geographical variations in the magnitude of the effects of these risk factors on later incidence by socioeconomic group. It could also imply, as an example, that there are absolute, but subtle, differences between the population of a given socioeconomic group in Sefton compared with Liverpool. Each SES group is composed of a number of diverse elements, the emphasis of which may vary slightly from area to area, which in turn may relate to risk factors for breast cancer. Any 'failures' in the Super Profile typologies should be common to all three districts, and therefore not sufficient to explain the differences between them.

Screening uptake is a more immediate indicator of socioeconomic variations in lifestyles and behavioural choices. Variations in uptake rates amongst a given Super Profile group across the three screening units could be partly due to differences in the prevailing ‘social norms’ in each. That is to say, the likelihood of accepting a screening invitation in Wirral might be slightly higher than in Liverpool, for any given socioeconomic group, as a feature of the higher ‘average’ socioeconomic status prevailing in Wirral. In areas such as Liverpool, where women of low and high SES live in relatively close proximity, and areas of low SES are dominant, behaviour associated with low SES appears to be reinforced, i.e. lower response to invitation. In contrast, districts such as Sefton and Wirral have slightly better overall socioeconomic circumstances, and a greater degree of geographical separation between their more affluent and more deprived communities. In these areas, there may be a lower tendency for one socioeconomic group to have an influence on another in any way.

12.5 THE UTILITY OF STUDYING THE ASSOCIATION OF SES WITH EACH ISSUE

Haan et al (1989) note that “The SES-health link is one of the most profound and pervasive observations ever made in public health” (p106). However, the same authors previously observed that the general acceptance of SES as an influence (or reflection?) on health and health behaviour, paradoxically has led to the consideration of SES merely as a background characteristic and not as a central issue.

Socioeconomic status has a more direct effect on health behaviour than health status, e.g. via levels of education and motivation to maximise one’s own health potential. With respect to health status, SES serves as a proxy for factors that are directly related to the health issues in question. For example, the findings with respect to incidence could be used to infer links. The greatly elevated incidence amongst women of highest SES relates to both pre- and post-menopausal disease. It is very likely that this group collectively exhibits many of the lifestyle and behavioural (including reproductive) factors that are known to be most influential on risk. It cannot be speculated here whether there is any socioeconomic dimension to genetically inherited tendencies towards breast cancer. Each of the major risk factors for breast cancer will apply to many individual women in the other Lifestyles (and not necessarily to all in the most affluent). However, the frequency and combined impact of features such as relatively late childbirth, may be greater in the very top Lifestyle.

The problem with the more directly linked factors, for instance (in the case of this research) age at first full term pregnancy, stage of breast cancer at diagnosis, and perception of the benefits of screening, is that they are extremely difficult, if not impossible, to identify and locate in populations. Table 12.1 lists some of the main strengths and weaknesses of individual and area based measures of SES with respect to research in the UK. It is true that, in research in this country, area based SES is considerably easier to define, since such data are routinely available. However, in a policy/service setting, the use of ecological rather than individual measures is preferable.

One of the great strengths of using SES as a central indicator in studies such as this one, is its tendency to be associated with many of the more directly influential factors. Another benefit of area based SES as a main indicator, recognised earlier by the North West Regional Health Authority (1994), is in terms of its utility in resource allocation and policy making decisions. Areas and even postcodes of high and low concern with regard to a particular health issue can be identified. Assessments of resource provision in relation to the need for those resources ('demand' being different again) can gain much from geodemographic analysis, as exampled by Todd et al (1994b) and Bundred et al (1995b), mentioned in chapter 6.

Table 12.1 General advantages and disadvantages of individual and area-based SES indicators in UK studies

	Advantages	Disadvantages
Area	Census based area information available nationally	Misclassification of some individuals
	Can be attached to large datasets	Ecological fallacy effects, i.e. results may be dependent on choice of spatial scale
	Easy to identify groups in resource allocation/policy decisions	Loss of information through 'averaging'
Individual	Much less misclassification of individuals*	Not available nationally
	Can encompass more of the heterogeneity of a group	User cannot generally apply to large datasets

*although this is still possible, e.g. where married women are classified according to their husband's socioeconomic characteristics

12.6 THE APPROPRIATENESS OF THE SUPER PROFILE CATEGORIES TO THE WOMEN BEING STUDIED

It should be remembered that, in the use of area-based geodemographic classifications, persons assigned to a given geodemographic category cannot necessarily be assumed to possess that group's dominant characteristics at an individual level. It was with this in mind that, in the results of the various analyses presented in chapters 9 to 11, emphasis was placed on the women being resident in areas assigned to Lifestyle C, etc., rather than necessarily being 'Settled Suburbans' themselves. What of the appropriateness of the individual Lifestyles to the women being studied?

Whilst recognising the inevitable misclassification of some individuals to Lifestyles, some of the categories are obviously more appropriate than others with respect to the women studied here. This is less apparent when studying the cancer data, as the women covered a wide range of ages, excepting the under 20s. However, the inappropriateness of certain Lifestyle descriptive characteristics became more evident when studying uptake of screening. In particular, screening invitees could not be the 'Younger/mobile persons' whose characteristics predominate in Lifestyle E areas. Neither, for that matter, were all of the breast cancer cases in these EDs 'Younger' or 'mobile' themselves. It was discussed in chapter 11 that the women studied here who are resident in Lifestyle E EDs are in nearly all cases going to be members of the background population of these often deprived areas, where the younger group may also be found in relatively large numbers. Obviously, a Lifestyle such as the 'Better Off Older People' (B) is more easily envisaged as applying to screening invitees. However, it is also true that any given ED cannot be exclusively populated by the group that characterises it, hence the statement in section 6.2 that high index values of certain Census variables in certain Lifestyles can not be taken to imply that those variables are associated with the majority of the people in that Lifestyle.

The current Super Profile Lifestyle descriptions are somewhat consumer orientated. Possibilities exist for developing 'health specific' elements of the Lifestyle descriptions.

In any study, some Lifestyles will be associated with more clearly pronounced characteristics than others. Possible breast cancer and screening-specific profiles of three of the Lifestyles are developed as examples. These examples relate to residents of Lifestyle A, E and J areas, which in this research displayed some of the most distinct patterns.

Lifestyle A: Affluent Professionals

Characterised by a greatly elevated lifetime risk (0-74) of breast cancer, ranging from 1 in 5 to as high as 1 in 2 individuals, compared with population averages of around 1 in 12. However, survival in this group is relatively favourable in comparison with women of lower SES, even after accounting for age and other prognostic factors. Screening-invited women in these areas are amongst the most likely to attend, or to be screened at other stages in their lives. Screening behaviour only partially accounts for the observed rise in breast cancer incidence in this group.

Lifestyle E: Younger/mobile persons

Excepting Liverpool, relatively few cancer or screening cases have been associated with Lifestyle E EDs in this research. However, women resident in these EDs showed the lowest tendency to attend for screening, across all the districts and age groups. Incidence levels are relatively close to the district averages, but survival is also relatively low, and comparable with other women of lower SES. Improving screening rates in these women should help to address this.

Lifestyle J: 'Have Nots' Households

Women resident in these EDs have amongst the lowest incidence rates of any of the socioeconomic groups. Survival is also relatively low, and although partially confounded by age, persists as unfavourable after age adjustment, most likely due to stage and treatment factors. This Lifestyle often shows poor uptake of screening invitations, a problem which should be addressed.

12.7 CONCLUSIONS

- This large, population based study, in an area previously without such information, has provided a wealth of new detail, and adds further weight to the body of evidence from previous literature. It would also be repeatable elsewhere in the UK, since closely comparable data are available nationally.

- The Super Profiles geodemographic classification has emerged as a practical and useful measure of SES in such research. Its strengths include its utility in service and policy settings, in identifying local populations in greatest need, for resource allocation or targeting.

- Socioeconomic status has a direct, significant association with breast cancer incidence, survival, and the uptake of screening in the part of Merseyside studied. Women of low SES have a significantly lower risk of developing the disease than women of high SES, but they also have a significantly lower chance of surviving from breast cancer. The significantly lower response of low SES women to screening invitation relates to this.

- The range of incidence rates between women of high SES and those of low SES is large, a particular excess risk applying to women in Lifestyle A areas.

- The socioeconomic gradient in survival, although less pronounced than that for incidence, persisted after adjustment for age, year of diagnosis, mode of disease presentation, proof of diagnosis and, *possibly*, treatment. From this investigation it is known that within the age group eligible for routine breast screening, local women of high SES have shown the highest uptake, which may partly explain their having the largest absolute increases in incidence rates since the screening programme commenced. Assuming that screening is effective, this will thus tend to increase the proportion of these women having their cancers diagnosed at an early stage. Therefore, all else being equal, the observed socioeconomic gradient in screening uptake will tend to widen any existing survival gap between women of high and low SES. In this study, a similar pattern of socioeconomic differences in survival was also noted outside the screening eligible age group, particularly in women aged under 50. Thus, socioeconomic differences appear not to be mediated entirely through screening. One explanation could be higher levels of breast awareness in high SES women, and thus earlier presentation. One of the key known determinants of survival is stage at diagnosis, which was not available in this research. The possibility thus remains that survival variations by SES are explained by variations in stage distribution, although previous work is inconclusive (section 4.3.2). If it were the case that differences in stage at diagnosis accounted for most of the SES variation in survival, attempts to reduce these differences would need to focus primarily on promoting screening uptake and other aspects of health behaviour leading to earlier diagnosis, such as breast awareness. However, were the socioeconomic survival gradient to persist after adjustment for stage, this would suggest that effort also needs to be directed at improving access to treatment and perhaps the quality of treatment decisions for patients of lower SES, having first assured the precision of staging. This research has highlighted the fact that the relative influences of stage and treatment on SES differences in breast cancer survival clearly needs to be examined further, particularly in the light of the National Breast Screening Programme.

- The investigations of the uptake of routine invitations for breast screening showed that overall district rates masked socioeconomic variations in response of 20-25%. Therefore, caution should be exercised when monitoring overall uptake rates, since higher SES groups are often seen to ‘overcompensate’ for lower SES groups.

- The acceptability of the screening service in this part of the UK appears to be high, in that women attending once for screening are likely to do so again. Therefore, effort at improving uptake rates needs primarily to be directed at women who have never been screened.

- Both geography and SES appear to have an effect on incidence and screening; geographical variation was much smaller with respect to survival. The geographical variation in the absolute values of incidence and uptake rates within a given socioeconomic group may be an effect that is related to the overall ‘average’ SES of each area studied. The potential for such ‘social norms’ to influence health patterns is worthy of future research.

- Socioeconomic status is a valuable marker that should be more extensively used by Health Authorities and other agencies in highlighting sectors of the population who are in particular need with respect to specific health issues, and/or who should be the focus of targeted approaches to improving inequalities in health.

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APPENDIX A

STATISTICAL NOTES: INCIDENCE, SURVIVAL AND UPTAKE CALCULATIONS

STATISTICAL NOTES

In this appendix, the equations used in the calculations of breast cancer incidence and screening uptake calculations are outlined. These were all converted into SPSS for Windows syntax files. The survival analyses made use of the relevant facilities already available in SPSS for Windows. However, for information, introductory notes on the survival analysis methods selected are also provided.

a.1 INCIDENCE CALCULATIONS

All the incidence calculations in this research used the methods described by Boyle and Parkin (1991).

a.1.1 Age-specific rates

The age-specific rate for age group *i*, denoted as a_i, is calculated as a rate per 100,000 by dividing the number of cancer cases in the age class (r_i) by the corresponding person-years of observation (n_i) and multiplying the result by 100,000:

$$a_i = \left(\frac{r_i}{n_i}\right) \times 100\,000$$

As stated in chapter 8 (data and methods), the population denominators (which provide an approximate equivalent of person-years of observation) were provided by the Merseyside and Cheshire Cancer Registry.

a.1.2 Age Standardised Rates (ASRs)

The age standardised rate (ASR) is that which would have occurred if the observed age-specific rates had operates in a standard (reference) population. The general equation is of the form:

$$ASR = \frac{\sum_{i=1}^{A} a_i w_i}{\sum_{i=1}^{A} w_i}$$

Where w_i is the standard population in the *i*th age group and
A is the number of age groups

Each age specific rate is multiplied by the weight from the standard population. These are then summed, and divided by the total number in the standard population (100,000), to obtain the Age standardised incidence rate (ASR). The reference population used in this research was the World Standard Population, shown in table a.1.

Table a.1 World Standard Population used in the calculation of Age Standardised Rates (ASRs) in this research

Age class	Standard Population
0 - 4	12,000
5 - 9	10,000
10 - 14	9,000
15 - 19	9,000
20 - 24	8,000
25 - 29	8,000
30 - 34	6,000
35 - 39	6,000
40 - 44	6,000
45 - 49	6,000
50 - 54	5,000
55 - 59	4,000
60 - 64	4,000
65 - 69	3,000
70 - 74	2,000
75 - 79	1,000
80 - 84	500
85 and over	500
Total	100,000

The 95% Confidence Interval for the ASR was calculated as:

$$ASR \pm Z_{\alpha/2} \times (s.e.(ASR))$$

where $Z_{\alpha/2}$ = a standardised normal deviate and
s.e. = the standard error of the ASR

In this research, the value of $Z_{\alpha/2}$ was set as 1.96 (the 97.5 percentile of the Normal distribution, to provide a 95% confidence interval)

The standard error of the ASR was calculated using the binomial approximation:

$$s.e. = \sum_{i=1}^{18}\left[a_i w_i^2 (100000 - a_i)/n_i\right]$$

(i = 1 to 18, since there are 18 age classes)

a.1.3 Cumulative incidence rates

The cumulative incidence rate is the sum, over each year of age, of the age-specific incidence rates, most commonly from birth to age 74. The cumulative rate is expressed as a percentage, as opposed to a rate per 100,000, as is the case with age-specific rates and ASRs. For values of less than 10%, the cumulative rate approximates to the cumulative risk, described below. The calculation used was:

$$\text{Cumulative rate (0-74 years)} = \sum_{i=1}^{15} 5a_i$$

i.e., its value is equal to five times the sum of the age-specific incidence rates in each 5 year age class, up to the 15th age class (70-74).

a.1.4 Cumulative risk

The cumulative risk is the risk which an individual would have of developing the cancer in question over a specific lifespan (here, from 0-74 years) if no other causes of death were in operation. It was calculated as:

Cumulative risk (0-74 years) = 100 $\times$ [1 - exp(-cum. rate)/100]

a.2 SURVIVAL STATISTICS

a.2.1 Life Tables

In Life Table analysis, also known as the actuarial method, the period of time under study is subdivided into pre-determined intervals, such as years or months. The probability of an event (such as a death from breast cancer) occurring during each of these intervals is calculated, based on the number of people under observation in the interval and the number of events that occur within it. Estimates from the individual intervals are combined to give cumulative survival probabilities. Cases for whom the event occurs within a given time interval are assumed to have been observed, on average, for half that interval. Censored individuals (those for whom the event of interest is not recorded during the period of observation) contribute to the denominators for all the intervals during which they are observed.

a.2.2 Kaplan-Meier analysis

This is similar to the Life Table method, the crucial difference being that the intervals into which the period of observation is subdivided are not pre-determined. Instead, survival probabilities are re-evaluated every time an event occurs. Therefore, these intervals are as short as the precision of survival time recording allows.

a.2.3 The Cox Proportional Hazards model

The Cox Proportional Hazards model is a form of multiple regression that can take account of both observed and censored survival times. One means of expressing this model is with the hazard function, or death rate at time *t*, as the dependent variable. The general equation for this is of the form:

$$h(t) = [h_0(t)]e^{(\beta_1 X_1 + ... + \beta_p X_p)}$$

where

$h(t)$ = the hazard function at time t

$h_0(t)$ = the baseline hazard function, which depends only on time. This is analogous to the constant term in general multiple regression in that it is the reference value, which is then increased or decreased depending on the values of the independent variable and their relationship with $h(t)$, and

β_1 to β_p are the regression coefficients for the independent variables (covariates), X_1 to X_p

When categorical variables are included in the model (as they were in this research), a separate regression coefficient is calculated for each individual category.

Holding all other factors constant, the relative risk of dying, at a given time point, that is associated with a particular category of a variable, is denoted by e^{β}. In this research, risk was assessed relative to the overall survival amongst the whole study group. Therefore, for example, relative risks of less than 1 indicate a lower than average likelihood of dying at a given time point, i.e. increased survival chances.

The 95% confidence interval for the estimated relative risk is calculated by exponentiating the lower and upper limits for the regression coefficients (Collett, 1994), denoted as:

$$\beta \pm (1.96 \times s.e.(\beta))$$

where

1.96 is the selected value of $Z_{\alpha/2}$, introduced in section a.1.2 and

$s.e.$ is the standard error of β.

a.3 STATISTICS USED IN ANALYSING UPTAKE

a.3.1 95% Confidence intervals around uptake rates

Using the method in Gardner and Altman (1989), the 95% confidence interval for uptake rates with denominators (number of invitations) greater than 100 was calculated as:

$$r \pm (1.96 \times s.e.(r))$$

where r = proportion of invitees attending for screening
1.96 is the selected value of $Z_{\alpha/2}$, as in the incidence calculations described above, and $s.e.$ is the standard error of r.

The standard error of r was calculated as:

$$s.e. = \sqrt{\frac{r \times (1-r)}{n}}$$

where n = number of invites

a.3.2 The signed chi-squared measure

This was calculated as:

$$\chi^2 = \sum \frac{(o-e)^2}{e}$$

where, in this research, o = observed number women in each category (attenders, non attenders)
e = the expected number of women in each category, based on a 70% response rate with the sign of χ^2 given by the sign of (attenders - expected attenders)

The statistic can only be calculated where the expected number of cases in each category is greater than or equal to 5. In this research, based on an 'expected' 70% response rate, 17 cases was the minimum required for calculation of χ^2.

The calculated χ^2 statistic can be tested for significance at a range of confidence levels. In this research, since there are two possible categories for the cases (attenders, non attenders) there is one degree of freedom. Table a.2 lists the critical values of χ^2 that must be exceeded if the statistic is to be significant at a given level.

Table a.2 Critical Values of Chi-squared when testing for significance, in a two-category test with one degree of freedom

Significance Level (p value)	Critical Value of Chi-squared
0.05	3.84
0.01	6.64
0.005	7.88
0.001	10.83

taken from Ebdon (1987)

APPENDIX B

TABULATED INCIDENCE FIGURES AND CANCER REGISTRATION NUMBERS NOT SHOWN IN CHAPTER 9

Table b.1 Wirral. Age-specific breast cancer incidence rates and cumulative rates and risks (0-74), three year moving averages, for 1987 to 1992

Age-specific rates

YEAR	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus
1987	2.6	7.8	25.7	46.1	100.9	179.5	207.2	199.4	198.3	219.4	285.8	229.7	281.0	380.3
1988	2.6	10.1	36.6	50.2	96.4	168.1	206.6	195.9	211.1	227.5	295.2	278.1	353.7	408.0
1989	5.4	10.0	33.2	67.8	83.7	168.5	192.2	196.2	248.3	229.1	270.4	281.8	331.1	363.0
1990	5.6	7.4	32.7	79.2	88.0	173.6	209.2	260.6	330.7	227.1	252.7	274.8	316.3	294.5
1991	2.9	9.9	21.5	68.0	91.6	169.0	236.6	299.8	365.1	225.7	256.1	261.8	250.1	297.8
1992	.0	15.2	26.3	70.7	112.3	155.1	240.2	294.6	353.1	217.7	263.6	296.3	245.9	393.2

YEAR	Cumulative rate (0-74)	Cum. risk (0-74)
1987	7.4	7.1
1988	7.5	7.2
1989	7.5	7.2
1990	8.3	8.0
1991	8.7	8.4
1992	8.7	8.4

Table b.2 Liverpool. Age-specific breast cancer incidence rates and cumulative rates and risks (0-74), three year moving averages, for 1987 to 1992

Age-specific rates

YEAR	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus
1987	1.5	12.1	33.6	76.5	92.3	170.1	199.0	230.5	190.9	159.7	174.3	272.9	271.0	278.4
1988	1.5	13.6	34.9	59.7	107.6	162.3	199.7	217.5	185.4	161.4	165.3	269.7	289.0	243.2
1989	.0	11.6	33.8	59.9	105.1	138.6	213.1	218.6	210.0	179.5	184.7	239.0	321.3	258.8
1990	.0	8.0	24.8	52.4	129.0	130.4	214.8	255.2	267.1	202.4	201.8	231.2	311.6	348.5
1991	.0	4.7	20.1	55.7	163.9	116.0	198.6	245.1	263.7	227.2	219.2	246.9	313.4	369.0
1992	.0	4.7	17.5	49.8	195.5	159.3	181.3	232.7	274.3	248.6	223.3	233.5	316.2	333.7

	Cumulative rate (0-74)	Cum. risk (0-74)
1987	6.7	6.5
1988	6.5	6.3
1989	6.8	6.5
1990	7.4	7.2
1991	7.6	7.3
1992	7.9	7.6

Table b.3 Sefton. Age-specific breast cancer incidence rates and cumulative rates and risks (0-74), three year moving averages, for 1987 to 1992

Age-specific rates

YEAR	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus
1987	.0	6.3	10.8	67.9	81.6	155.8	183.4	201.5	247.8	230.5	219.5	236.1	212.7	311.3
1988	.0	9.2	21.0	56.0	98.8	156.3	171.1	185.4	238.3	281.9	197.4	219.3	190.2	311.6
1989	.0	9.1	23.8	39.1	104.0	170.6	196.5	177.1	241.5	253.8	247.1	212.1	233.8	352.6
1990	3.4	9.1	23.0	32.1	116.9	175.8	230.7	195.9	292.1	273.4	276.2	220.5	233.3	367.4
1991	3.5	9.3	16.1	49.5	106.2	191.5	248.1	214.1	308.4	249.3	232.0	197.3	239.7	346.1
1992	3.6	15.9	25.3	79.8	116.8	180.4	239.4	244.9	338.7	287.2	234.1	200.9	258.3	373.7

YEAR	Cumulative rate (0-74)	Cum. risk (0-74)
1987	7.0	6.8
1988	7.1	6.8
1989	7.3	7.1
1990	8.1	7.8
1991	8.1	7.8
1992	8.8	8.5

Table b.4 Wirral, age-specific incidence rates, and cumulative rates and risks not shown in chapter 9 by Super Profile Lifestyle, 1986-1993 inclusive

Age-specific rates

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus
A	0.0	89.3	285.5	480.7	491.8	824.6	909.9	958.5	1184.0	1280.3	1406.5	1456.1	1214.3	3164.1
B	0.0	15.6	52.2	68.8	111.4	303.0	339.5	363.0	460.4	346.1	385.9	386.0	348.4	274.8
C	0.0	15.6	24.7	73.2	128.3	182.4	181.6	293.3	314.3	153.9	323.1	195.3	370.7	391.5
D	4.6	11.9	24.6	32.0	51.0	96.0	140.3	139.0	177.0	111.8	183.4	234.1	168.8	130.0
E	0.0	0.0	0.0	374.3	0.0	0.0	680.5	0.0	0.0	0.0	1453.9	0.0	0.0	0.0
F	0.0	0.0	0.0	0.0	0.0	0.0	61.5	0.0	0.0	0.0	84.9	414.4	430.8	77.4
G	0.0	0.0	21.8	0.0	93.8	33.3	139.4	140.7	133.8	170.8	134.6	165.3	238.2	319.5
H	0.0	0.0	40.7	56.3	74.4	234.0	209.9	211.6	210.6	245.8	254.1	303.7	193.6	404.5
I	12.6	0.0	0.0	71.7	76.2	170.1	156.9	155.9	197.4	268.4	202.3	179.1	332.2	309.1
J	4.3	12.6	17.4	56.7	55.5	97.3	212.9	200.0	281.8	189.8	188.5	151.8	195.6	275.9

Lifestyle	Cumulative rate (0-74)	
A	39.6	A: Affluent Professionals
B	12.2	B: Better Off Older People
C	8.5	C: Settled Suburbans
D	4.9	D: Better Off Young Families
E	12.5	E: Younger/mobile persons
F	0.7	F: Rural Communities
G	4.3	G: Lower Income Elderly
H	7.7	H: Blue Collar Workers
I	6.6	I: Lower Income Households
J	6.6	J: Have Nots Households

Table b.5 Wirral. Number of breast cancer registrations by Lifestyle 1986-1993

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus
A	0	1	5	14	20	30	28	30	32	30	26	22	15	34
B	0	1	4	6	12	26	26	26	36	28	29	30	23	17
C	0	3	5	15	26	32	29	47	50	22	38	19	24	21
D	1	3	6	8	13	21	26	24	29	16	23	25	13	8
E	0	0	0	1	0	0	1	0	0	0	1	0	0	0
F	0	0	0	0	0	0	1	0	0	0	1	4	4	1
G	0	0	2	0	9	3	13	14	14	18	14	18	22	25
H	0	0	3	4	6	16	16	19	22	31	26	26	11	17
I	1	0	0	4	4	8	7	7	10	14	10	8	9	6
J	1	3	3	8	7	11	24	22	32	23	20	14	12	11
O	0	0	1	1	2	0	1	0	3	2	2	3	2	1
Total	3	11	29	61	99	147	172	189	228	184	190	169	135	141

Lifestyle	all ages
A	287
B	264
C	332
D	216
E	3
F	11
G	152
H	197
I	88
J	191
O	18
Total	1759

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Workers
I: Lower Income Households
J: Have Nots Households
O: No Super Profile codes attached

Table b.6 Liverpool, age-specific incidence rates, and cumulative rates and risks not shown in chapter 9 by Super Profile Lifestyle, 1986-1993 inclusive

Age-specific rates

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus
A	.0	.0	.0	322.6	410.4	646.6	314.0	1007.9	732.9	549.0	784.7	765.5	1385.7	685.9
B	.0	21.4	40.7	121.1	209.5	204.1	373.9	401.7	272.0	442.6	322.4	439.3	292.9	245.9
C	.0	25.6	29.4	115.4	98.6	180.1	184.6	128.9	240.7	177.6	332.3	236.8	326.6	268.6
D	.0	3.9	16.3	44.9	68.8	97.3	140.3	178.0	152.0	153.9	138.2	153.0	135.6	133.0
E	.0	.0	13.0	82.4	117.5	70.8	97.2	207.8	126.4	132.1	29.4	86.6	292.0	300.0
G	.0	.0	.0	84.7	50.2	34.4	128.6	160.7	37.5	101.9	122.9	59.8	198.8	157.2
H	10.7	.0	38.4	42.8	109.8	137.9	150.6	140.2	195.3	125.1	131.9	130.2	178.2	121.5
I	.0	.0	10.4	20.4	165.9	70.2	128.6	118.7	114.4	107.0	130.2	133.0	260.1	117.9
J	.0	4.3	16.1	19.8	65.5	63.2	79.2	125.9	99.7	100.6	79.3	115.4	89.0	153.4
K	.0	93.4	.0	.0	132.1	169.8	.0	.0	.0	.0	.0	.0	615.9	1249.8

Lifestyle	Cumulative rate (0-74)	
A	23.8	A: Affluent Professionals
B	12.0	B: Better Off Older People
C	7.6	C: Settled Suburbans
D	5.0	D: Better Off Young Families
E	4.4	E: Younger/mobile persons
G	3.6	G: Lower Income Elderly
H	5.4	H: Blue Collar Workers
I	4.3	I: Lower Income Households
J	3.3	J: Have Nots Households
K	2.0	K: Unclassified

Table b.7 Liverpool. Number of breast cancer registrations by Lifestyle 1986-93

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus
A				7	11	13	5	14	11	7	9	9	12	5
B		1	2	6	10	8	12	12	9	15	9	14	9	8
C		2	3	12	10	16	15	11	20	14	22	14	13	8
D		1	4	10	14	16	21	26	22	20	15	15	9	7
E			1	5	6	3	4	8	5	5	1	3	8	6
G				5	3	2	8	11	3	9	11	5	12	9
H	1		3	3	7	9	11	13	20	13	12	10	10	5
I			2	3	24	9	17	17	15	13	14	12	17	5
J		3	9	9	27	23	32	53	43	44	29	34	18	23
K		1			1	1							2	2
O		6	13	13	39	50	71	74	96	74	54	79	55	49
Total	1	14	37	73	152	150	196	239	244	214	176	195	165	127

Lifestyle	all ages	
A	103	A: Affluent Professionals
B	115	B: Better Off Older People
C	160	C: Settled Suburbans
D	180	D: Better Off Young Families
E	55	E: Younger/mobile persons
G	78	G: Lower Income Elderly
H	117	H: Blue Collar Workers
I	148	I: Lower Income Households
J	347	J: Have Nots Households
K	7	K: Unclassified
O	673	O: No Super Profile codes attached
Total	1983	

Table b.8 Sefton, age-specific incidence rates, and cumulative rates and risks not shown in chapter 9 by Super Profile Lifestyle, 1986-1993 inclusive

Age-specific rates

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus
A	.0	89.8	61.2	225.6	622.2	765.3	1607.5	948.9	1652.8	1139.2	1263.0	1031.1	1098.9	1429.0
B	.0	27.7	72.3	109.5	98.7	369.9	403.2	580.7	814.6	555.6	704.4	547.0	260.4	490.5
C	.0	21.2	9.8	88.8	78.9	180.6	204.9	159.2	279.1	335.8	257.0	214.1	256.0	465.2
D	6.7	6.1	24.2	42.1	75.0	64.3	80.7	157.8	138.2	171.1	112.5	175.3	119.3	68.7
E	.0	.0	.0	.0	.0	.0	692.1	.0	.0	.0	.0	.0	.0	605.6
F	.0	.0	.0	.0	.0	62.6	.0	88.5	.0	.0	.0	.0	.0	.0
G	.0	.0	19.0	35.6	49.9	95.9	102.7	62.6	219.1	148.3	201.5	140.2	233.3	317.2
H	.0	15.3	36.4	99.7	101.0	125.7	165.4	315.2	182.1	178.3	191.7	132.1	159.5	158.3
I	.0	17.2	21.7	52.4	54.7	58.7	121.5	117.1	207.9	224.6	252.6	193.2	210.8	475.0
J	.0	.0	7.1	26.5	103.8	159.8	152.7	234.3	208.3	256.0	149.2	124.4	240.5	213.7
K	.0	.0	.0	.0	.0	846.8	.0	.0	.0	602.5	.0	445.0	.0	1514.0

Lifestyle	Cumulative rate (0-74)	
A	41.9	A: Affluent Professionals
B	18.7	B: Better Off Older People
C	8.1	C: Settled Suburbans
D	4.4	D: Better Off Young Families
E	3.5	E: Younger/mobile persons
F	.8	F: Rural Communities
G	4.7	G: Lower Income Elderly
H	7.1	H: Blue Collar Workers
I	5.6	I: Lower Income Households
J	6.5	J: Have Nots Households
K	7.2	K: Unclassified

Table b.9 Sefton. Number of breast cancer registrations by Lifestyle 1986-93

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus
A		1	1	5	19	23	36	22	30	19	15	12	13	21
B		1	3	6	6	21	19	26	34	26	31	27	12	23
C		4	2	17	15	31	33	25	41	46	29	21	18	26
D	1	1	4	7	13	10	11	20	17	20	11	15	7	3
E							1							1
F						1		1						
G			2	4	6	12	13	9	33	23	29	20	28	37
H		1	2	5	5	6	10	21	15	15	14	7	5	4
I		1	1	2	2	2	4	4	7	6	6	4	3	4
J			1	3	11	14	14	22	20	24	13	9	11	6
K						2				2		1		2
O				1		3	4		3	2	1	3	1	
Total	1	9	16	50	77	125	145	150	200	183	149	119	98	127

Lifestyle	all ages
A	217
B	235
C	308
D	140
E	2
F	2
G	216
H	110
I	46
J	148
K	7
O	18
Total	1449

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Workers
I: Lower Income Households
J: Have Nots Households
K: Unclassified
O: No Super Profile codes attached

Table b.10a Wirral. Number of breast cancer registrations by Lifestyle 1986-89

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus	All ages
A		1	2	8	10	11	10	14	10	13	14	11	8	15	127
B			3	5	6	13	13	13	11	11	16	13	12	9	125
C		1	3	6	15	14	14	19	19	12	20	9	15	9	156
D		3	4	2	6	9	11	10	12	9	17	13	4	1	101
E							1				1				2
F							1					4	2		7
G			1		1	2	6	4	4	10	6	9	14	9	66
H				2	4	13	9	7	9	13	10	9	7	11	94
I	1			2	2	3	2	1	5	11	5	4	7	4	47
J	1		1	3	4	8	12	10	14	15	11	6	5	9	99
O					2				1	2	1	1	1	1	9

Table b.10b Wirral. Number of breast cancer registrations by Lifestyle 1990-93

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus	All ages
A			3	6	10	19	18	16	22	17	12	11	7	19	160
B		1	1	1	6	13	13	13	25	17	13	17	11	8	139
C		2	2	9	11	18	15	28	31	10	18	10	9	12	175
D	1		2	6	7	12	15	15	16	7	6	12	9	7	115
E				1											1
F											1		2	1	4
G			1		8	1	7	10	10	8	8	9	8	16	86
H			3	2	2	3	7	12	13	18	16	17	4	6	103
I				2	2	5	5	6	5	3	5	4	2	2	41
J		3	2	5	3	3	12	12	18	8	9	8	7	2	92
O			1	1			1		2		1	2	1		9

Table b.11a Liverpool. Number of breast cancer registrations by Lifestyle 1986-88

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus	All ages
A				4	2	2		3	2	5	2	5	3	1	29
B			2	3	1	5	4	1	4	5	3	4	6	1	39
C		2		4	4	9	5	5	6	7	7	5	2	3	59
D			3	5	3	5	10	8	7	4	6	7	4	5	67
E				2	2			4	3	3	1		4	3	22
G				3	1		4	4	2	3		2	3	1	23
H	1		2	1	2	3	4	7	8	2	7	4	3	2	46
I			1		4	2	8	8	5	3	6	5	6	3	51
J		1	2	5	6	10	13	26	13	11	13	14	6	10	130
K		1													1
O		3	6	7	12	26	30	30	31	22	18	38	20	15	258

Table b.11b Liverpool. Number of breast cancer registrations by Lifestyle 1989-93

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus	All ages
A				3	9	11	5	11	9	2	7	4	9	4	74
B		1		3	9	3	8	11	5	10	6	10	3	7	76
C			3	8	5	7	10	6	14	7	15	9	11	5	100
D		1	1	5	11	11	11	18	15	16	9	8	5	2	113
E			1	3	4	3	4	4	2	2		3	4	3	33
G				2	2	2	4	7	1	6	11	3	9	8	55
H			1	2	5	6	7	6	12	11	5	6	7	3	71
I			1	3	20	7	9	9	10	10	8	7	11	2	97
J		2	7	4	21	13	19	27	30	33	16	20	12	13	217
K					1	1							2	2	6
O		3	7	6	27	24	41	44	65	52	36	41	35	34	415

Table b.12a Sefton. Number of breast cancer registrations by Lifestyle 1986-89

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus	All ages
A				3	8	7	15	6	12	14	9	5	7	9	95
B			3	2	2	12	10	15	14	13	16	13	6	9	115
C		2	1	11	8	11	14	13	16	22	12	14	8	13	145
D			1	2	2	3	4	7	6	7	3	11	5		51
E															
F								1							1
G				1	2	5	4	3	13	11	12	10	9	12	82
H		1		4	3	3	5	12	9	7	8	3	3	2	60
I			1		2	2	1	2	2	3	3	2	1	2	21
J				1	8	10	8	13	11	16	7	5	5	4	88
K						1								1	2
O							2		2			1			5

Table b.12b Sefton. Number of breast cancer registrations by Lifestyle 1990-93

Lifestyle	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 plus	All ages
A		1	1	2	11	16	21	16	18	5	6	7	6	12	122
B		1		4	4	9	9	11	20	13	15	14	6	14	120
C		2	1	6	7	20	19	12	25	24	17	7	10	13	163
D	1	1	3	5	11	7	7	13	11	13	8	4	2	3	89
E							1							1	2
F						1									1
G			2	3	4	7	9	6	20	12	17	10	19	25	134
H			2	1	2	3	5	9	6	8	6	4	2	2	50
I		1		2			3	2	5	3	3	2	2	2	25
J			1	2	3	4	6	9	9	8	6	4	6	2	60
K						1				2		1		1	5
O				1		3	2		1	2	1	2	1		13

APPENDIX C

TABULATED RESULTS OF THE SCREENING ANALYSIS NOT SHOWN IN CHAPTER 11

Table c.1 Wirral unit, First Round. Uptake rates and signed chi-squared values, by Lifestyle

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	4075	81.9	(80.7 to 83.1)	**275.44**	****
B	3603	79.5	(78.2 to 80.8)	**154.50**	****
C	5389	79.7	(78.6 to 80.8)	**241.42**	****
D	3510	75.5	(74.1 to 76.9)	**50.53**	****
E	64	57.8	(44.8 to 70.1)	**-4.53**	*
F	63	79.4	(67.3 to 88.5)	**2.63**	
G	1907	72.2	(70.2 to 74.2)	**4.43**	*
H	2985	72.9	(71.3 to 74.5)	**12.21**	****
I	1609	70.9	(68.7 to 73.1)	**0.64**	
J	3701	64.7	(63.1 to 66.2)	**-49.78**	****
K	5	20.0	(0.5 to 71.6)	**n/a**	
O	1116	23.7	(21.2 to 26.2)	**-1141.39**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

Table c.2 Wirral unit, Second Round (first 25 months). Uptake rates and signed chi-squared values, by Lifestyle

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	2288	82.0	(80.5 to 83.6)	**157.85**	****
B	1760	79.9	(78.1 to 81.8)	**82.86**	****
C	4380	80.1	(78.9 to 81.2)	**210.48**	****
D	3217	76.8	(75.3 to 78.2)	**70.41**	****
E	56	55.4	(41.5 to 68.7)	**-5.72**	*
F	17	64.7	(38.3 to 85.8)	**-0.23**	
G	1516	71.4	(69.1 to 73.6)	**1.36**	
H	2232	71.5	(69.6 to 73.4)	**2.41**	
I	1482	71.2	(68.9 to 73.5)	**1.00**	
J	3496	64.5	(62.9 to 66.1)	**-50.84**	****
K	2	50.0	(1.3 to 98.7)	**n/a**	
O	458	57.6	(53.1 to 62.2)	**-33.31**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.3 Wirral unit, First Round. Uptake rates and signed chi-squared values, by Target Market

Target Market	Invites	Uptake rate (%) with 95% CI		Chi-squared	
1 (A)	1028	81.1	(78.7 to 83.5)	**60.62**	****
2 (D)	316	81.3	(77.0 to 85.6)	**19.31**	****
4 (A)	2587	82.8	(81.3 to 84.3)	**201.79**	****
5 (B)	273	73.3	(68.0 to 78.5)	**1.38**	
6 (A)	460	78.7	(75.0 to 82.4)	**16.56**	****
7 (B)	1355	82.0	(79.9 to 84.0)	**92.80**	****
8 (D)	213	78.9	(73.4 to 84.4)	**7.99**	***
11 (C)	2792	80.4	(79.0 to 81.9)	**145.02**	****
12 (B)	1754	78.6	(76.7 to 80.5)	**62.07**	****
13 (D)	147	72.1	(64.9 to 79.4)	**0.31**	
14 (C)	1944	79.2	(77.4 to 81.0)	**77.79**	****
15 (D)	368	78.5	(74.3 to 82.7)	**12.76**	****
16 (C)	653	78.1	(74.9 to 81.3)	**20.41**	****
17 (B)	151	78.2	(71.6 to 84.7)	**4.77**	*
18 (B)	70	80.0	(68.7 to 88.6)	**3.33**	
19 (F)	27	85.2	(66.3 to 95.8)	**2.96**	
20 (E)	25	76.0	(54.9 to 90.6)	**0.43**	
22 (G)	780	73.9	(70.8 to 76.9)	**5.49**	*
23 (G)	548	68.8	(64.9 to 72.7)	**-0.38**	
24 (H)	1070	77.9	(75.4 to 80.3)	**31.40**	****
25 (F)	36	75.0	(57.8 to 87.9)	**0.43**	
26 (G)	231	74.9	(69.3 to 80.5)	**2.63**	
27 (D)	2348	74.2	(72.5 to 76.0)	**20.04**	****
28 (D)	118	73.7	(65.8 to 81.7)	**0.78**	
29 (E)	39	46.2	(30.1 to 62.8)	**-10.56**	***
31 (J)	134	70.9	(63.2 to 78.6)	**0.05**	
32 (G)	348	72.1	(67.4 to 76.8)	**0.75**	
33 (H)	834	69.9	(66.8 to 73.0)	**-0.00**	
34 (I)	1320	71.0	(68.5 to 73.4)	**0.61**	
36 (H)	1081	70.4	(67.7 to 73.1)	**0.08**	
37 (I)	289	70.6	(65.3 to 75.8)	**0.05**	
38 (J)	2368	65.8	(63.8 to 67.7)	**-20.35**	****
39 (J)	533	61.5	(57.4 to 65.7)	**-18.17**	****
40 (J)	666	62.2	(58.5 to 65.8)	**-19.48**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

Table c.4 Wirral unit, Second Round (first 25 months). Uptake rates and signed chi-squared values, by Target Market

Target Market	Invites	Uptake rate (%) with 95% CI		Chi-squared	
1 (A)	324	82.7	(78.6 to 86.8)	24.95	****
2 (D)	268	81.3	(76.7 to 86.0)	16.42	****
4 (A)	1662	82.4	(80.6 to 84.3)	122.30	****
5 (B)	240	73.3	(67.7 to 78.9)	1.27	
6 (A)	302	79.1	(74.6 to 83.7)	12.01	****
7 (B)	734	83.5	(80.8 to 86.2)	63.84	****
8 (D)	127	78.0	(70.7 to 85.2)	3.82	
11 (C)	2328	81.2	(79.6 to 82.8)	139.77	****
12 (B)	740	78.7	(75.7 to 81.6)	26.36	****
13 (D)	150	83.3	(77.4 to 89.3)	12.70	****
14 (C)	1514	79.7	(77.6 to 81.7)	67.23	****
15 (D)	342	76.9	(72.4 to 81.4)	7.75	**
16 (C)	538	76.0	(72.4 to 79.6)	9.29	***
17 (B)	30	83.3	(65.3 to 94.4)	2.54	
18 (B)	16	68.8	(41.3 to 89.0)	n/a	
19 (F)	1	100	n/a	n/a	
20 (E)	24	75.0	(53.3 to 90.2)	0.29	
22 (G)	540	74.4	(70.8 to 78.1)	5.08	*
23 (G)	520	70.0	(66.1 to 73.9)	0.00	
24 (H)	676	76.8	(73.6 to 80.0)	14.78	****
25 (F)	16	62.5	(35.4 to 84.8)	n/a	
26 (G)	185	73.0	(66.6 to 79.4)	0.78	
27 (D)	2204	75.8	(74.0 to 77.6)	35.51	****
28 (D)	126	74.6	(67.0 to 82.2)	1.27	
29 (E)	32	40.6	(23.7 to 59.4)	-13.15	****
31 (J)	122	64.7	(56.3 to 73.2)	-1.60	
32 (G)	271	66.8	(61.2 to 72.4)	-1.33	
33 (H)	678	69.3	(65.9 to 72.8)	-0.15	
34 (I)	1221	71.3	(68.7 to 73.8)	0.91	
36 (H)	878	69.1	(66.1 to 72.2)	-0.31	
37 (I)	261	70.9	(65.4 to 76.4)	0.10	
38 (J)	2220	66.2	(64.2 to 68.1)	-15.50	****
39 (J)	535	60.8	(56.6 to 64.9)	-21.81	****
40 (J)	619	61.6	(57.7 to 65.4)	-21.04	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

Table c.5 Liverpool unit, First Round. Uptake rates and signed chi-squared values, by Lifestyle

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	1848	70.8	(68.8 to 72.9)	**0.61**	
B	2330	69.3	(67.4 to 71.1)	**-0.59**	
C	3904	68.4	(67.0 to 69.9)	**-4.66**	*
D	4723	63.9	(62.6 to 65.3)	**-82.53**	****
E	1512	44.4	(42.0 to 47.0)	**-470.22**	****
F	0	no cases		**n/a**	
G	1637	54.1	(51.7 to 56.5)	**-196.49**	****
H	3644	57.9	(56.3 to 59.5)	**-255.07**	****
I	4940	55.6	(54.2 to 57.0)	**-485.93**	****
J	16242	50.1	(49.3 to 50.8)	**-3072.80**	****
K	39	46.2	(30.1 to 62.8)	**-10.56**	***
O	1633	40.9	(38. to 43.4)	**-655.44**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

Table c.6 Liverpool unit, Second Round. Uptake rates and signed chi-squared values, by Lifestyle

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	1823	74.6	(72.6 to 76.6)	**17.95**	****
B	2254	74.5	(72.7 to 76.3)	**22.07**	****
C	3769	72.5	(71.1 to 73.9)	**11.09**	****
D	4288	68.3	(67.0 to 69.7)	**-5.69**	*
E	1285	49.5	(46.8 to 52.2)	**-257.30**	****
F	0	no cases		**n/a**	
G	1290	58.8	(56.1 to 61.5)	**-77.61**	****
H	3033	63.1	(61.4 to 64.8)	**-69.30**	****
I	4265	61.6	(60.1 to 63.0)	**-145.10**	****
J	13373	54.9	(54.1 to 55.8)	**-1444.49**	****
K	27	51.9	(32.0 to 71.3)	**-4.23**	*
O	1135	59.0	(56.2 to 61.9)	**-65.03**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities

G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.7 Liverpool unit, First Round. Uptake rates and signed chi-squared values, by Target Market

Target Market	Invites	Uptake rate (%) with 95% CI		Chi-squared	
1 (A)	550	69.1	(65.2 to 73.0)	**-0.22**	
2 (D)	94	77.7	(67.9 to 85.6)	**2.63**	
3 (E)	88	52.3	(41.4 to 63.0)	**-13.17**	****
4 (A)	1290	71.6	(69.1 to 74.0)	**1.48**	
5 (B)	585	63.4	(59.5 to 67.3)	**-12.07**	****
6 (A)	8	75.0	(34.9 to 96.8)	**n/a**	
7 (B)	1173	73.9	(71.4 to 76.4)	**8.55**	***
8 (D)	36	69.4	(51.9 to 83.7)	**-0.00**	
9 (D)	2	50.0	(1.3 to 98.7)	**n/a**	
10 (E)	182	55.0	(47.7 to 62.2)	**-19.64**	****
11 (C)	1578	69.2	(66.9 to 71.5)	**-0.48**	
12 (B)	475	64.6	(60.3 to 68.9)	**-6.52**	*
13 (D)	147	62.6	(54.8 to 70.4)	**-3.85**	*
14 (C)	2110	67.9	(65.9 to 69.9)	**-4.37**	*
15 (D)	1350	65.9	(63.4 to 68.5)	**-10.67**	***
16 (C)	216	67.6	(61.4 to 73.8)	**-0.60**	
17 (B)	63	77.8	(65.5 to 87.3)	**1.81**	
18 (B)	34	58.8	(40.7 to 75.4)	**-2.02**	
20 (E)	80	51.3	(39.8 to 62.6)	**-13.39**	****
21 (E)	251	53.0	(46.8 to 59.2)	**-34.59**	****
22 (G)	232	56.0	(49.7 to 62.4)	**-21.55**	****
23 (G)	422	50.2	(45.5 to 55.0)	**-78.49**	****
24 (H)	977	63.9	(60.9 to 66.9)	**-17.49**	****
26 (G)	172	61.1	(53.8 to 68.3)	**-6.57**	*
27 (D)	2947	62.8	(61.1 to 64.6)	**-72.55**	****
28 (D)	147	59.9	(51.9 to 67.8)	**-7.19**	**
29 (E)	544	35.1	(31.1 to 39.1)	**-315.34**	****
30 (E)	367	43.9	(38.8 to 49.0)	**-119.33**	****
31 (J)	253	48.6	(42.5 to 54.8)	**-55.09**	****
32 (G)	811	54.1	(50.7 to 57.6)	**-97.26**	****
33 (H)	762	55.4	(51.9 to 58.9)	**-77.55**	****
34 (I)	4137	55.7	(54.2 to 57.2)	**-403.27**	****
35 (I)	27	74.1	(53.7 to 88.9)	**0.21**	
36 (H)	1905	55.8	(53.6 to 58.0)	**-182.90**	****
37 (I)	776	54.6	(51.1 to 58.1)	**-87.19**	****
38 (J)	12046	52.7	(51.8 to 53.6)	**-1725.43**	****
39 (J)	987	45.2	(42.1 to 48.3)	**-289.36**	****
40 (J)	2956	41.3	(39.5 to 43.1)	**-1161.71**	****

* $p<0.05$; ** $p<0.01$; *** $p<0.005$; **** $p<0.001$

Table c.8 Liverpool unit, Second Round. Uptake rates and signed chi-squared values, by Target Market

Target Market	Invites	Uptake rate (%) with 95% CI		Chi-squared	
1 (A)	537	74.1	(70.4 to 77.8)	**4.33**	*
2 (D)	109	69.7	(61.1 to 78.4)	**-0.00**	
3 (E)	81	46.9	(35.7 to 58.3)	**-20.56**	****
4 (A)	1267	74.8	(72.4 to 77.2)	**14.03**	****
5 (B)	538	69.0	(65.1 to 72.9)	**-0.28**	
6 (A)	19	68.4	(43.5 to 87.4)	**-0.02**	
7 (B)	1184	76.4	(73.9 to 78.8)	**22.74**	****
8 (D)	34	64.7	(46.5 to 80.3)	**-0.45**	
9 (D)	1	100	n/a	**n/a**	
10 (E)	149	58.4	(50.5 to 66.3)	**-9.57**	***
11 (C)	1579	71.4	(69.2 to 73.7)	**1.55**	
12 (B)	439	75.4	(71.4 to 79.4)	**6.09**	*
13 (D)	122	72.1	(64.2 to 80.1)	**0.26**	
14 (C)	1990	73.5	(71.5 to 75.4)	**11.39**	****
15 (D)	1194	69.4	(66.8 to 72.0)	**-0.18**	
16 (C)	200	71.0	(64.7 to 77.3)	**0.10**	
17 (B)	63	79.4	(67.3 to 88.5)	**2.63**	
18 (B)	30	80.0	(61.4 to 92.3)	**1.43**	
20 (E)	84	51.2	(40.0 to 62.3)	**-14.15**	****
21 (E)	223	61.4	(55.1 to 67.8)	**-7.79**	**
22 (G)	209	68.4	(62.1 to 74.7)	**-0.25**	
23 (G)	357	53.5	(48.3 to 58.7)	**-46.27**	****
24 (H)	872	68.0	(64.9 to 71.1)	**-1.65**	
26 (G)	146	68.5	(61.0 to 76.0)	**-0.16**	
27 (D)	2702	67.7	(66.0 to 69.5)	**-6.64**	**
28 (D)	126	66.7	(58.4 to 74.9)	**-0.67**	
29 (E)	441	42.0	(37.3 to 46.6)	**-165.23**	****
30 (E)	307	47.6	(42.0 to 53.1)	**-73.63**	****
31 (J)	203	52.7	(45.8 to 59.6)	**-28.90**	****
32 (G)	578	56.1	(52.0 to 60.1)	**-53.52**	****
33 (H)	624	61.2	(57.4 to 65.0)	**-22.92**	****
34 (I)	3608	62.1	(60.5 to 63.7)	**-106.90**	****
35 (I)	29	86.2	(68.3 to 96.1)	**3.63**	
36 (H)	1537	61.0	(58.6 to 63.5)	**-58.92**	****
37 (I)	628	57.2	(53.3 to 61.0)	**-49.26**	****
38 (J)	9928	56.7	(55.7 to 57.7)	**-837.76**	****
39 (J)	842	50.4	(47.0 to 53.7)	**-154.72**	****
40 (J)	2400	49.5	(47.5 to 51.5)	**-480.29**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

Table c.9 Sefton & Knowsley unit, First Round. Uptake rates and signed chi-squared values, by Target Market

Target Market	Invites	Uptake rate (%) with 95% CI			Chi-squared	
1 (A)	753	72.1	(68.9	to 75.3)	**1.60**	
2 (D)	384	73.4	(69.0	to 77.9)	**2.16**	
3 (E)	3	33.3	(0.8	to 90.6)	**n/a**	
4 (A)	2413	75.2	(73.5	to 76.9)	**30.79**	****
5 (B)	278	61.9	(56.2	to 67.6)	**-8.75**	***
6 (A)	464	67.7	(63.4	to 71.9)	**-1.20**	
7 (B)	2623	76.6	(75.0	to 78.3)	**54.90**	****
8 (D)	105	71.4	(62.8	to 80.1)	**0.10**	
9 (D)	69	52.2	(39.8	to 64.4)	**-10.44**	***
10 (E)	14	42.9	(17.7	to 71.1)	**n/a**	
11 (C)	3587	72.5	(71.0	to 73.9)	**10.30**	***
12 (B)	896	70.5	(67.6	to 73.5)	**0.12**	
13 (D)	168	64.3	(57.0	to 71.5)	**-2.61**	
14 (C)	2829	71.0	(69.3	to 72.7)	**1.39**	
15 (D)	929	68.7	(65.7	to 71.7)	**-0.78**	
16 (C)	662	65.6	(61.9	to 69.2)	**-6.22**	*
17 (B)	87	70.1	(59.4	to 79.5)	**0.00**	
18 (B)	272	71.7	(66.3	to 77.1)	**0.37**	
19 (F)	27	59.3	(38.8	to 77.6)	**-1.48**	
20 (E)	8	50.0	(15.7	to 84.3)	**n/a**	
21 (E)	1	0.0	n/a		**n/a**	
22 (G)	1349	68.9	(66.4	to 71.3)	**-0.83**	
23 (G)	936	58.3	(55.2	to 61.5)	**-60.67**	****
24 (H)	1316	71.4	(69.0	to 73.9)	**1.28**	
25 (F)	47	61.7	(46.4	to 75.5)	**-1.54**	
26 (G)	128	65.6	(57.4	to 73.9)	**-1.17**	
27 (D)	1927	65.0	(62.8	to 67.1)	**-23.20**	****
28 (D)	313	61.7	(56.3	to 67.1)	**-10.36**	***
29 (E)	8	12.5	(0.3	to 52.7)	**n/a**	
30 (E)	59	59.3	(45.8	to 71.9)	**-3.20**	
31 (J)	150	54.7	(46.7	to 62.6)	**-16.79**	****
32 (G)	278	63.0	(57.3	to 68.6)	**-6.58**	*
33 (H)	1267	60.0	(57.3	to 62.7)	**-60.52**	****
34 (I)	2306	56.9	(54.8	to 58.9)	**-189.84**	****
35 (I)	38	57.9	(40.8	to 73.7)	**-2.65**	
36 (H)	1148	60.9	(58.1	to 63.7)	**-45.38**	****
37 (I)	535	51.0	(46.8	to 55.3)	**-91.70**	****
38 (J)	6220	52.9	(51.7	to 54.2)	**-861.83**	****
39 (J)	818	47.9	(44.5	to 51.4)	**-189.87**	****
40 (J)	565	47.6	(43.5	to 51.7)	**-134.87**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

Table c.10 Sefton & Knowsley unit, Second Round. Uptake rates and signed chi-squared values, by Target Market

Target Market	Invites	Uptake rate (%) with 95% CI			Chi-squared	
1 (A)	837	76.2	(73.3	to 79.1)	**15.44**	****
2 (D)	447	74.1	(70.0	to 78.1)	**3.49**	
3 (E)	1	0.0	n/a		**n/a**	
4 (A)	2632	75.4	(73.7	to 77.0)	**36.28**	****
5 (B)	263	67.7	(62.0	to 73.3)	**-0.67**	
6 (A)	439	71.5	(67.3	to 75.8)	**0.49**	
7 (B)	2370	76.2	(74.5	to 78.0)	**44.01**	****
8 (D)	103	68.9	(60.0	to 77.9)	**-0.06**	
9 (D)	67	67.2	(54.6	to 78.2)	**-0.26**	
10 (E)	13	69.2	(38.6	to 90.9)	**n/a**	
11 (C)	3570	72.3	(70.8	to 73.7)	**8.75**	***
12 (B)	877	72.5	(69.6	to 75.5)	**2.65**	
13 (D)	196	62.8	(56.0	to 69.5)	**-4.90**	*
14 (C)	2724	72.4	(70.8	to 74.1)	**7.66**	**
15 (D)	1020	70.9	(68.1	to 73.7)	**0.38**	
16 (C)	619	69.3	(65.7	to 72.9)	**-0.14**	
17 (B)	73	71.2	(59.5	to 81.2)	**0.05**	
18 (B)	189	73.0	(66.69	to 79.3)	**0.82**	
19 (F)	29	65.5	(45.7	to 82.1)	**-0.28**	
20 (E)	7	42.9	(9.9	to 81.6)	**n/a**	
21 (E)	1	0.0	n/a		**n/a**	
22 (G)	1259	70.9	(68.34	to 73.4)	**0.43**	
23 (G)	906	60.0	(56.85	to 63.2)	**-42.76**	****
24 (H)	1194	73.5	(71.03	to 76.0)	**7.10**	**
25 (F)	32	59.4	(40.6	to 76.3)	**-1.72**	
26 (G)	122	71.3	(63.29	to 79.3)	**0.10**	
27 (D)	1826	66.3	(64.10	to 68.4)	**-12.13**	****
28 (D)	325	63.7	(58.46	to 68.9)	**-6.16**	*
29 (E)	6	16.7	(0.4	to 64.1)	**n/a**	
30 (E)	59	66.1	(52.6	to 77.9)	**-0.43**	
31 (J)	153	56.2	(48.35	to 64.1)	**-13.86**	****
32 (G)	253	66.4	(60.58	to 72.2)	**-1.56**	
33 (H)	1227	62.8	(60.05	to 65.5)	**-30.67**	****
34 (I)	2397	58.2	(56.27	to 60.2)	**-157.87**	****
35 (I)	32	68.8	(50.0	to 83.9)	**-0.02**	
36 (H)	1015	61.1	(58.08	to 64.1)	**-38.42**	****
37 (I)	440	53.2	(48.52	to 57.8)	**-59.26**	****
38 (J)	5758	55.4	(54.08	to 56.7)	**-587.15**	****
39 (J)	819	51.7	(48.23	to 55.1)	**-131.35**	****
40 (J)	574	50.4	(46.26	to 54.4)	**-105.56**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

Table c.11a Sefton & Knowsley unit, First Round. Uptake rates and signed chi-squared values, by Lifestyle, amongst women resident in Sefton district

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared
A	3393	74.0	(72.5 to 75.4)	**25.16** ****
B	3821	74.1	(72.7 to 75.5)	**30.45** ****
C	5477	71.0	(69.8 to 72.2)	**2.64**
D	2588	66.7	(64.8 to 68.5)	**-13.80** ****
E	59	61.0	(47.4 to 73.5)	**-2.27**
F	34	61.8	(43.6 to 77.8)	**-1.10**
G	2556	64.8	(62.9 to 66.6)	**-33.05** ****
H	2226	64.8	(62.8 to 66.8)	**-28.88** ****
I	1127	56.7	(53.8 to 59.6)	**-94.94** ****
J	3127	52.5	(50.7 to 54.2)	**-457.15** ****
K	39	59.0	(42.1 to 74.4)	**-2.26**

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

Table c.11b Sefton & Knowsley unit, First Round. Uptake rates and signed chi-squared values, by Lifestyle, amongst women resident in Knowsley district

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared
A	167	68.9	(61.8 to 75.9)	**-0.10**
B	147	73.5	(66.3 to 80.6)	**0.84**
C	1443	73.5	(71.2 to 75.7)	**8.22** ***
D	1014	66.5	(63.6 to 69.4)	**-6.02** *
E	2	0.0	(15.8 to 100)	**n/a**
F	24	62.5	(40.6 to 81.2)	**-0.64**
G	71	60.6	(48.3 to 72.0)	**-3.01**
H	1272	63.8	(61.2 to 66.5)	**-23.01** ****
I	1305	57.3	(54.6 to 60.0)	**-99.95** ****
J	4172	51.9	(50.3 to 53.4)	**-654.77** ****
K	0	no cases		**n/a**

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.12a Sefton & Knowsley unit, Second Round. Uptake rates and signed chi-squared values, by Lifestyle, amongst women resident in Sefton district

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	3662	75.6	(74.2 to 77.0)	**54.43**	****
B	3529	74.8	(73.3 to 76.2)	**37.95**	****
C	5291	71.6	(70.4 to 72.8)	**6.25**	*
D	2536	68.7	(66.9 to 70.5)	**-1.95**	
E	57	70.2	(56.6 to 81.6)	**0.00**	
F	29	62.1	(42.3 to 79.3)	**-0.87**	
G	2422	67.1	(65.3 to 69.0)	**-9.47**	***
H	2056	68.6	(66.6 to 70.6)	**-1.84**	
I	1141	56.1	(53.2 to 59.0)	**-105.11**	****
J	3192	54.9	(53.2 to 56.6)	**-345.72**	****
K	41	85.4	(70.8 to 94.4)	**4.61**	*

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

Table c.12b Sefton & Knowsley unit, Second Round. Uptake rates and signed chi-squared analysis, by Lifestyle, amongst women resident in Knowsley district

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	165	72.1	(65.3 to 79.0)	**0.35**	
B	155	71.6	(64.5 to 78.7)	**0.19**	
C	1481	74.0	(71.8 to 76.2)	**11.31**	****
D	1117	66.4	(63.7 to 69.2)	**-6.79**	**
E	3	0.0	(0.0 to 70.8)	**n/a**	
F	25	64.0	(42.5 to 82.0)	**-0.43**	
G	68	48.5	(36.2 to 61.0)	**-14.93**	****
H	1197	61.9	(59.2 to 64.7)	**-37.35**	****
I	1277	59.8	(57.1 to 62.4)	**-63.90**	****
J	3699	54.5	(52.9 to 56.1)	**-421.64**	****
K	1	0.0	n/a	**n/a**	

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

A: Affluent Professionals
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C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.13a Wirral unit, First Round. Numbers of invites by 5 year age group and Lifestyle

Lifestyle	age 50-54	age 55-59	age 60-64
A	1469	1339	1145
B	1183	1154	1159
C	1870	1739	1658
D	1226	1120	1043
E	25	18	19
F	21	21	18
G	568	643	645
H	834	986	1093
I	514	515	540
J	1248	1182	1186
K	2	0	2
O	140	136	154

Table c.13b Wirral unit, First Round. Signed chi-squared analysis of uptake in relation to 70% target, by 5 year age group and Lifestyle

top row: Uptake rate (%) with 95% confidence interval bottom row: signed chi-squared value
Age-SES groups with uptake significantly below 70% are lightly shaded

Lifestyle	age 50-54	age 55-59	age 60-64
A	81.5 (79.5 to 83.5) **92.25******	84.5 (82.6 to 86.5) **134.81******	79.8 (77.5 to 82.1) **52.64******
B	80.2 (77.9 to 82.5) **58.84******	80.5 (78.2 to 82.8) **60.62******	77.7 (75.3 to 80.1) **33.06******
C	82.5 (80.7 to 84.2) **138.25******	80.9 (79.1 to 82.8) **98.54******	75.6 (73.6 to 77.7) **25.05******
D	77.6 (75.2 to 79.9) **33.45******	76.7 (74.2 to 79.2) **23.92******	70.7 (67.9 to 73.4) **0.22**
E	60.0 (38.7 to 78.9) **-1.19**	66.7 (41.0 to 86.7) **-0.10**	42.1 (20.3 to 66.5) **-7.04****
F	76.2 (52.8 to 91.8) **0.38**	76.2 (52.8 to 91.8) **0.38**	83.3 (58.6 to 96.4) **1.52**
G	73.1 (69.4 to 76.7) **2.54**	72.2 (68.7 to 75.6) **1.43**	71.8 (68.3 to 75.3) **0.98**
H	73.4 (70.4 to 76.4) **4.54***	73.1 (70.4 to 75.9) **4.58***	71.8 (69.2 to 74.5) **1.73**
I	72.4 (68.5 to 76.2) **1.38**	72.6 (68.8 to 76.5) **1.69**	68.3 (64.4 to 72.3) **-0.71**
J	66.8 (64.2 to 69.4) **-5.98***	67.9 (65.3 to 70.6) **-2.40**	59.3 (56.5 to 62.1) **-64.96******
K	0.0 (0.0 to 84.2) **n/a**	**n/a**	0.0 (0.0 to 84.2) **n/a**
O	76.4 (69.4 to 83.5) **2.76**	75.0 (67.7 to 82.3) **1.62**	68.2 (60.8 to 75.5) **-0.24**

Chi-squared : *p<0.05; **p<0.01; ***p<0.005; ****p<0.001

A: Affluent Professionals
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D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.14a Wirral unit, Second Round (first 25 months). Numbers of invites by 5 year age group and Lifestyle

Lifestyle	age 50-54	age 55-59	age 60-64
A	873	747	582
B	567	597	549
C	1484	1503	1259
D	1203	1012	905
E	17	19	19
F	6	5	4
G	501	477	516
H	653	730	790
I	490	496	453
J	1184	1166	1076
K	0	1	0
O	107	77	76

Table c.14b Wirral unit, Second Round (first 25 months). Signed chi-squared analysis of uptake in relation to 70% target, by 5 year age group and Lifestyle

top row: Uptake rate (%) with 95% confidence interval bottom row: signed chi-squared value
Age-SES groups with uptake significantly below 70% are lightly shaded

Lifestyle	age 50-54	age 55-59	age 60-64
A	82.0 (79.5 to 84.6) **60.02******	83.7 (81.0 to 86.3) **66.45******	80.2 (77.0 to 83.5) **29.06******
B	80.4 (77.2 to 83.7) **29.33******	81.1 (77.9 to 84.2) **34.85******	78.5 (75.1 to 81.9) **18.92******
C	81.3 (79.4 to 83.3) **90.78******	80.6 (78.6 to 82.6) **80.00******	77.4 (75.1 to 79.7) **32.50******
D	80.5 (78.2 to 82.7) **62.74******	76.9 (74.3 to 79.5) **22.79******	72.2 (69.2 to 75.1) **2.00**
E	70.6 (44.0 to 89.7) **0.00**	52.6 (28.9 to 75.6) **-2.73**	42.1 (20.3 to 66.5) **-7.04****
F	66.7 (22.3 to 95.7) **n/a**	60.0 (14.7 to 94.7) **n/a**	100 (39.8 to 100) **n/a**
G	73.3 (69.4 to 77.1) **2.53**	73.2 (69.2 to 77.1) **2.28**	68.2 (64.2 to 72.2) **-0.78**
H	73.7 (70.3 to 77.0) **4.17***	71.1 (67.8 to 74.4) **0.42**	70.4 (67.2 to 73.6) **0.05**
I	72.0 (68.1 to 76.0) **0.97**	71.0 (67.0 to 75.0) **0.22**	70.6 (66.4 to 74.8) **0.09**
J	66.7 (64.0 to 69.4) **-6.05***	63.4 (60.6 to 66.1) **-24.34******	62.6 (59.7 to 65.5) **-27.76******
K	 **n/a**	0.0 n/a **n/a**	 **n/a**
O	70.1 (61.4 to 78.8) **0.00**	72.7 (61.4 to 82.3) **0.27**	61.8 (50.0 to 72.8) **-2.41**

Chi-squared : *p<0.05; **p<0.01; ***p<0.005; ****p<0.001

A: Affluent Professionals
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D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.15a Liverpool unit, First Round. Numbers of invites by 5 year age group and Lifestyle

Lifestyle	age 50-54	age 55-59	age 60-64
A	657	558	611
B	727	730	844
C	1257	1228	1366
D	1587	1459	1598
E	517	424	530
F	0	0	0
G	445	444	695
H	980	1167	1426
I	1679	1518	1657
J	5288	4762	5877
K	19	9	10
O	506	412	631

Table c.15b Liverpool unit, First Round. Signed chi-squared analysis of uptake in relation to 70% target, by 5 year age group and Lifestyle

top row: Uptake rate (%) with 95% confidence interval bottom row: signed chi-squared value
Age-SES groups with uptake significantly below 70% are lightly shaded

Lifestyle	age 50-54	age 55-59	age 60-64
A	75.5 (72.2 to 78.8) 9.45***	73.3 (69.6 to 77.0) 2.89	63.8 (60.0 to 67.6) -11.08****
B	71.7 (68.4 to 74.9) 0.96	72.1 (68.8 to 75.3) 1.47	66.0 (62.8 to 69.2) -6.45*
C	72.6 (70.2 to 75.1) 4.15*	68.7 (66.1 to 71.3) -0.94	65.2 (62.6 to 67.7) -15.28****
D	67.4 (65.1 to 69.7) -5.27*	68.1 (65.7 to 70.5) -2.43	57.8 (55.3 to 60.2) -114.01****
E	44.3 (40.0 to 48.6) -162.68****	44.6 (39.8 to 49.3) -130.51****	44.9 (40.7 to 49.1) -158.93****
G	59.3 (54.8 to 63.9) -24.14****	56.5 (51.9 to 61.1) -38.35****	50.2 (46.5 to 53.9) -129.54****
H	61.5 (58.5 to 64.6) -33.47****	62.9 (60.1 to 65.7) -28.04****	51.5 (48.9 to 54.1) -231.33****
I	57.8 (55.4 to 60.1) -119.54****	60.1 (57.6 to 62.5) -71.15****	50.2 (47.7 to 52.6) -310.88****
J	52.4 (51.0 to 53.7) -781.53****	54.3 (52.9 to 55.7) -558.60****	45.2 (43.9 to 46.4) -1724.55****
K	36.8 (16.3 to 61.6) -9.95***	66.7 (29.9 to 92.5) n/a	50.0 (18.7 to 81.3) n/a
O	50.8 (46.4 to 55.1) -88.91****	49.5 (44.7 to 54.3) -82.33****	30.7 (27.1 to 34.3) -463.02****

Chi-squared : *p<0.05; **p<0.01; ***p<0.005; ****p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities

G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.16a Liverpool unit, Second Round. Numbers of invites by 5 year age group and Lifestyle

Lifestyle	age 50-54	age 55-59	age 60-64
A	670	608	538
B	685	790	773
C	1279	1262	1222
D	1483	1421	1371
E	463	427	393
F	0	0	0
G	400	414	473
H	834	1027	1162
I	1369	1451	1441
J	4157	4640	4556
K	11	8	7
O	396	376	358

Table c.16b Liverpool unit, Second Round. Signed chi-squared analysis of uptake in relation to 70% target, by 5 year age group and Lifestyle

top row: Uptake rate (%) with 95% confidence interval bottom row: signed chi-squared value
Age-SES groups with uptake significantly below 70% are lightly shaded

Lifestyle	age 50-54			age 55-59			age 60-64		
A	75.4	(72.1	to 78.6)	76.6	(73.3	to 80.0)	71.4	(67.6	to 75.2)
		9.21****			**12.78*******			**0.48**	
B	76.5	(73.3	to 79.7)	75.7	(72.7	to 78.7)	71.7	(68.5	to 74.8)
		13.77******			**12.21********			**1.03**	
C	73.3	(70.9	to 75.8)	74.0	(71.6	to 76.4)	70.0	(67.4	to 72.5)
		6.79**			**9.66******			**-0.00**	
D	71.1	(68.8	to 73.4)	70.2	(67.8	to 72.5)	63.5	(61.0	to 66.1)
		0.81			**0.02**			**-27.33********	
E	52.9	(48.4	to 57.5)	51.3	(46.5	to 56.0)	43.5	(38.6	to 48.4)
		-64.35******			**-71.19********			**-131.31********	
G	61.3	(56.5	to 66.0)	60.6	(55.9	to 65.3)	55.4	(50.9	to 59.9)
		-14.58******			**-17.32********			**-48.07********	
H	67.1	(64.0	to 70.3)	65.4	(62.5	to 68.3)	58.3	(55.4	to 61.1)
		-3.23			**-10.20******			**-76.24********	
I	66.5	(64.0	to 69.0)	60.5	(58.0	to 63.0)	57.9	(55.4	to 60.5)
		-8.11****			**-62.23********			**-99.70********	
J	59.1	(57.6	to 60.6)	56.0	(54.5	to 57.4)	50.1	(48.7	to 51.6)
		-234.97******			**-434.94********			**-856.42********	
K	45.5	(16.8	to 76.6)	50.0	(15.7	to 84.3)	57.1	(18.4	to 90.1)
		n/a			**n/a**			**n/a**	
O	60.9	(56.1	to 65.7)	61.4	(56.5	to 66.4)	54.5	(49.3	to 59.6)
		-15.76******			**-13.13********			**-41.12********	

Chi-squared : *p<0.05; **p<0.01; ***p<0.005; ****p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.17a Sefton & Knowsley unit, First Round. Numbers of invites by 5 year age group and Lifestyle

Lifestyle	age 50-54	age 55-59	age 60-64
A	1311	1214	1070
B	1346	1400	1386
C	2408	2374	2265
D	1388	1306	1191
E	33	36	24
F	32	15	26
G	838	853	989
H	1125	1242	1341
I	925	975	971
J	2388	2476	2856
K	9	9	20
O	260	229	328

Table c.17b Sefton & Knowsley unit, First Round. Signed chi-squared analysis of uptake in relation to 70% target, by 5 year age group and Lifestyle

top row: Uptake rate (%) with 95% confidence interval bottom row: signed chi-squared value
Age-SES groups with uptake significantly below 70% are lightly shaded

Lifestyle	age 50-54	age 55-59	age 60-64
A	74.2 (71.9 to 76.6) **11.11******	75.7 (73.3 to 78.1) **18.78******	70.2 (67.4 to 72.9) **0.02**
B	75.6 (73.3 to 77.9) **19.79******	76.5 (74.3 to 78.7) **28.17******	69.9 (67.5 to 72.3) **-0.00**
C	73.9 (72.2 to 75.7) **17.62******	71.8 (70.0 to 73.6) **3.57**	68.1 (66.2 to 70.0) **-3.80**
D	69.2 (66.7 to 71.6) **-0.46**	67.0 (64.4 to 69.5) **-5.60***	62.5 (59.7 to 65.2) **-32.17******
E	57.6 (39.2 to 74.5) **-2.43**	55.6 (38.1 to 72.1) **-3.58**	33.3 (15.6 to 55.3) **-15.37******
F	68.8 (50.0 to 83.9) **-0.02**	53.3 (26.6 to 78.7) **n/a**	53.9 (33.4 to 73.4) **-3.23**
G	65.5 (62.3 to 68.7) **-8.03*****	68.0 (64.9 to 71.1) **-1.63**	60.5 (57.4 to 63.5) **-42.82******
H	66.4 (63.6 to 69.2) **-6.94****	65.1 (62.4 to 67.7) **-14.45******	62.0 (59.4 to 64.6) **-40.43******
I	61.4 (58.3 to 64.5) **-32.54******	57.0 (53.9 to 60.1) **-78.16******	49.2 (46.1 to 52.4) **-199.51******
J	54.7 (52.7 to 56.7) **-266.54******	54.6 (52.7 to 56.6) **-278.01******	47.7 (45.8 to 49.5) **-679.10******
K	55.6 (21.2 to 86.3) **n/a**	66.7 (29.9 to 92.5) **n/a**	55.0 (31.5 to 76.9) **-2.14**
O	63.1 (57.2 to 68.9) **-5.93***	57.6 (51.2 to 64.0) **-16.65******	52.1 (46.7 to 57.5) **-49.85******

Chi-squared : *p<0.05; **p<0.01; ***p<0.005; ****p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.18a Sefton & Knowsley unit, Second Round. Numbers of invites by 5 year age group and Lifestyle

Lifestyle	age 50-54	age 55-59	age 60-64
A	1526	1243	1128
B	1209	1294	1256
C	2332	2377	2183
D	1379	1394	1204
E	30	36	21
F	23	19	19
G	820	856	862
H	990	1227	1212
I	931	994	941
J	2196	2517	2580
K	20	8	16
O	250	226	233

Table c.18b Sefton & Knowsley unit, Second Round. Signed chi-squared analysis of uptake in relation to 70% target, by 5 year age group and Lifestyle

top row: Uptake rate (%) with 95% confidence interval bottom row: signed chi-squared value
Age-SES groups with uptake significantly below 70% are lightly shaded

Lifestyle	age 50-54	age 55-59	age 60-64
A	78.2 (76.2 to 80.3) **49.38******	76.0 (73.7 to 78.4) **21.49******	70.2 (67.5 to 72.9) **0.02**
B	74.7 (72.2 to 77.1) **12.66******	76.4 (74.1 to 78.7) **25.47******	72.6 (70.1 to 75.1) **4.08***
C	74.0 (72.2 to 75.8) **17.51******	72.5 (70.7 to 74.3) **7.00****	69.6 (67.7 to 71.6) **-0.14**
D	69.0 (66.6 to 71.5) **-0.61**	68.1 (65.6 to 70.5) **-2.45**	66.8 (64.1 to 69.4) **-5.95***
E	66.7 (47.2 to 82.7) **-0.16**	66.7 (49.0 to 81.4) **-0.19**	38.1 (18.1 to 61.6) **-10.18*****
F	60.9 (38.5 to 80.3) **-0.91**	63.2 (38.4 to 83.7) **-0.42**	63.2 (38.4 to 83.7) **-0.42**
G	67.6 (64.4 to 70.8) **-2.32**	68.6 (65.5 to 71.7) **-0.83**	63.7 (60.5 to 66.9) **-16.35******
H	68.8 (65.9 to 71.7) **-0.69**	66.7 (64.0 to 69.3) **-6.49***	63.2 (60.5 to 65.9) **-26.68******
I	59.2 (56.0 to 62.3) **-51.87******	60.0 (56.9 to 63.0) **-47.72******	53.5 (50.3 to 56.6) **-122.68******
J	57.3 (55.3 to 59.4) **-167.83******	54.5 (52.6 to 56.5) **-286.14******	52.1 (50.2 to 54.1) **-392.25******
K	70.0 (45.7 to 88.1) **0.00**	100 (63.1 to 100) **n/a**	87.5 (61.7 to 98.5) **n/a**
O	62.0 (56.0 to 68.0) **-7.62****	69.9 (63.9 to 75.9) **-0.00**	60.1 (53.8 to 66.4) **-10.91******

Chi-squared : *p<0.05; **p<0.01; ***p<0.005; ****p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.19 Wirral unit, Second Round (first 25 months); Uptake rates and signed chi-squared values, by Lifestyle, amongst women previously invited in the first round ('veterans')

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	1696	83.3	(81.5 to 85.1)	**143.15**	****
B	1362	81.1	(79.0 to 83.1)	**79.30**	****
C	3421	80.4	(79.1 to 81.7)	**176.71**	****
D	2435	76.3	(74.6 to 78.0)	**46.08**	****
E	49	55.1	(40.2 to 69.3)	**-5.18**	*
F	11	81.8	(48.2 to 97.7)	**n/a**	
G	1181	70.1	(67.5 to 72.7)	**0.00**	
H	1795	71.3	(69.2 to 73.4)	**1.47**	
I	1163	71.0	(68.4 to 73.6)	**0.58**	
J	2729	64.1	(62.3 to 65.9)	**-45.40**	****
K	1	0.0	n/a	**n/a**	
O	331	55.6	(50.2 to 60.9)	**-32.73**	****
Total	16174	74.4	(73.7 to 75.1)	**147.25**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

Table c.20 Wirral unit, Second Round (first 25 months); Uptake rates and signed chi-squared values, by Lifestyle, amongst women not invited in the first round ('novices')

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	587	78.7	(75.4 to 82.0)	**21.18**	****
B	394	76.9	(72.7 to 81.1)	**8.94**	***
C	945	79.4	(76.8 to 81.9)	**39.47**	****
D	775	78.8	(76.0 to 81.7)	**28.83**	****
E	7	57.1	(18.4 to 90.1)	**n/a**	
F	6	33.3	(4.3 to 77.7)	**n/a**	
G	333	75.7	(71.1 to 80.3)	**5.11**	*
H	424	73.3	(69.1 to 77.6)	**2.26**	
I	317	71.9	(67.0 to 76.9)	**0.56**	
J	749	66.8	(63.4 to 70.1)	**-3.75**	
K	1	100	n/a	**n/a**	
O	127	63.0	(54.6 to 71.4)	**-2.97**	
Total	4665	75.1	(73.9 to 76.4)	**58.06**	****

* p<0.05; ** p<0.01; *** p<0.005; ****p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.21 Liverpool unit, Second Round; Uptake rates and signed chi-squared values, by Lifestyle, amongst women previously invited in the first round ('veterans')

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	1267	74.6	(72.2 to 77.0)	**12.69**	****
B	1555	74.1	(71.9 to 76.3)	**12.35**	****
C	2564	72.0	(70.2 to 73.7)	**4.68**	*
D	3127	67.4	(65.8 to 69.1)	**-9.97**	***
E	898	47.0	(43.7 to 50.3)	**-226.34**	****
F	0	n/a			
G	950	58.1	(55.0 to 61.2)	**-64.01**	****
H	2326	62.5	(60.5 to 64.5)	**-62.13**	****
I	3290	60.1	(58.4 to 61.8)	**-153.82**	****
J	10319	54.1	(53.1 to 55.1)	**-1243.14**	****
K	15	53.3	(26.6 to 78.7)	**n/a**	
O	756	58.1	(54.6 to 61.6)	**-51.25**	****
Total	27067	60.9	(60.3 to 61.5)	**-1067.17**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

Table c.22 Liverpool unit, Second Round; Uptake rates and signed chi-squared values, by Lifestyle, amongst women not invited in the first round ('novices')

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	556	74.5	(70.8 to 78.1)	**5.27**	*
B	699	75.5	(72.4 to 78.7)	**10.20**	***
C	1205	73.6	(71.1 to 76.1)	**7.48**	**
D	1161	70.8	(68.2 to 73.4)	**0.35**	
E	387	55.3	(50.3 to 60.3)	**-39.84**	****
F	0	n/a			
G	340	60.6	(55.4 to 65.8)	**-14.34**	****
H	707	64.9	(61.4 to 68.4)	**-8.68**	***
I	975	66.5	(63.5 to 69.4)	**-5.81**	*
J	3054	57.8	(56.0 to 59.5)	**-216.70**	****
K	12	50.0	(21.1 to 78.9)	**n/a**	
O	379	61.0	(56.0 to 65.9)	**-14.78**	****
Total	9475	65.2	(64.3 to 66.2)	**-102.91**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.23 Sefton & Knowsley unit, Second Round; Uptake rates and signed chi-squared values, by Lifestyle, amongst women previously invited in the first round ('veterans')

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	2735	74.4	(72.8 to 76.1)	**25.70**	****
B	2774	75.9	(74.3 to 77.4)	**45.16**	****
C	5042	72.2	(70.9 to 73.4)	**11.14**	****
D	2874	67.9	(66.1 to 69.6)	**-6.33**	*
E	59	64.4	(50.9 to 76.5)	**-0.88**	
F	46	60.9	(45.4 to 74.9)	**-1.83**	
G	1870	66.8	(64.7 to 68.9)	**-9.17**	***
H	2702	66.1	(64.4 to 67.9)	**-19.21**	****
I	2192	58.0	(56.0 to 60.1)	**-149.58**	****
J	5729	54.0	(52.7 to 55.3)	**-699.40**	****
K	24	91.7	(73.0 to 99.0)	**5.37**	****
O	474	63.9	(59.6 to 68.3)	**-8.33**	***
Total	26521	66.1	(65.5 to 66.6)	**-195.96**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

Table c.24 Sefton & Knowsley unit, Second Round; Uptake rates and signed chi-squared values, by Lifestyle, amongst women not invited in the first round ('novices')

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	1173	76.7	(74.3 to 79.1)	**25.27**	****
B	998	70.8	(68.0 to 73.7)	**0.34**	
C	1871	71.8	(69.8 to 73.9)	**2.99**	
D	1110	68.5	(65.7 to 71.2)	**-1.24**	
E	28	50.0	(30.7 to 69.4)	**-5.33**	*
F	15	66.7	(38.4 to 88.2)	**n/a**	
G	670	66.0	(62.4 to 69.6)	**-5.18**	*
H	734	65.5	(62.1 to 69.0)	**-6.98**	**
I	677	56.1	(52.4 to 59.9)	**-62.02**	****
J	1575	56.7	(54.3 to 59.2)	**-132.70**	****
K	20	70.0	(45.7 to 88.1)	**0.00**	
O	239	63.2	(57.1 to 69.3)	**-5.29**	*
Total	9110	66.9	(66.0 to 67.9)	**-41.27**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.25 Wirral unit, First Round; Uptake rates and signed chi-squared values, by Lifestyle, amongst women later re-invited in the second round ('veterans' as first timers)

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	1696	83.6	(81.8 to 85.4)	**149.56**	****
B	1362	81.1	(79.0 to 83.1)	**79.30**	****
C	3421	82.0	(80.7 to 83.3)	**235.48**	****
D	2435	77.1	(75.4 to 78.8)	**58.19**	****
E	49	63.3	(48.3 to 76.6)	**-1.06**	
F	11	72.7	(39.0 to 94.0)	**n/a**	
G	1181	73.4	(70.9 to 75.9)	**6.55**	*
H	1795	73.5	(71.4 to 75.5)	**10.36**	***
I	1163	73.6	(71.1 to 76.1)	**7.19**	**
J	2729	66.9	(65.1 to 68.6)	**-12.70**	****
K	1	0	n/a	**n/a**	
O	331	65.6	(60.4 to 70.7)	**-3.11**	
Total	16174	76.2	(75.6 to 76.9)	**298.08**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

Table c.26 Wirral unit, Second Round (first 25 months); Uptake rates and signed chi-squared values, by Lifestyle, amongst women only invited in the first round

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	2375	80.8	(79.2 to 82.3)	**130.89**	****
B	2233	78.7	(77.0 to 80.4)	**81.01**	****
C	1960	75.9	(74.0 to 77.8)	**32.13**	****
D	1071	72.1	(69.4 to 74.8)	**2.21**	
E	15	40.0	(16.3 to 67.7)	**n/a**	
F	52	80.8	(67.5 to 90.4)	**2.87**	
G	723	70.4	(67.1 to 73.7)	**0.06**	
H	1182	72.2	(69.6 to 74.7)	**2.64**	
I	442	64.0	(59.6 to 68.5)	**-7.51**	**
J	964	59.0	(55.9 to 62.1)	**-55.29**	****
K	5	20	(0.5 to 71.6)	**n/a**	
O	787	58.7	(55.3 to 62.1)	**-47.82**	****
Total	11809	73.3	(72.5 to 74.1)	**62.50**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.27 Liverpool unit, First Round; Uptake rates and signed chi-squared values, by Lifestyle, amongst women later re-invited in the second round ('veterans' as first timers)

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	1275	74.8	(72.4 to 77.2)	**14.13**	****
B	1588	73.2	(71.1 to 75.4)	**7.92**	***
C	2617	71.7	(70.0 to 73.4)	**3.54**	
D	3219	68.4	(66.8 to 70.0)	**-3.89**	*
E	941	48.6	(45.4 to 51.8)	**-205.87**	****
F	0				
G	978	59.7	(56.6 to 62.8)	**-49.28**	****
H	2400	62.2	(60.3 to 64.2)	**-69.38**	****
I	3440	59.9	(58.3 to 61.6)	**-166.68**	****
J	10879	54.2	(53.3 to 55.1)	**-1293.88**	****
K	16	50.0	(24.6 to 75.4)	**n/a**	
O	783	58.1	(54.6 to 61.6)	**-52.71**	****
Total	28136	61.0	(60.4 to 61.5)	**-1097.24**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

Table c.28 Liverpool unit, Second Round; Uptake rates and signed chi-squared values, by Lifestyle, amongst women only invited in the first round

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	573	62.0	(58.0 to 65.9)	**-17.66**	****
B	742	60.8	(57.3 to 64.3)	**-30.03**	****
C	1287	61.8	(59.1 to 64.4)	**-41.49**	****
D	1504	54.4	(51.9 to 56.9)	**-174.55**	****
E	571	37.7	(33.7 to 41.6)	**-284.50**	****
F	0				
G	659	45.8	(42.0 to 49.6)	**-183.37**	****
H	1244	49.5	(46.7 to 52.3)	**-248.52**	****
I	1500	45.8	(43.3 to 48.3)	**-418.31**	****
J	5363	41.7	(40.4 to 43.0)	**-2046.32**	****
K	23	43.5	(23.2 to 65.5)	**-7.70**	**
O	850	25.2	(22.3 to 28.1)	**-813.23**	****
Total	14316	46.8	(46.0 to 47.6)	**-3671.22**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached

Table c.29 Sefton & Knowsley unit, First Round; Uptake rates and signed chi-squared values, by Lifestyle, amongst women later re-invited in the second round ('veterans' as first timers)

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	2743	76.2	(74.6 to 77.8)	**50.11**	****
B	2796	76.9	(75.3 to 78.4)	**62.65**	****
C	5069	74.4	(73.2 to 75.6)	**46.59**	****
D	2885	68.8	(67.1 to 70.5)	**-2.08**	
E	59	64.4	(50.9 to 76.5)	**-0.88**	
F	46	63.0	(47.6 to 76.8)	**-1.06**	
G	1877	67.8	(65.7 to 69.9)	**-4.24**	*
H	2656	66.9	(65.2 to 68.7)	**-11.82**	****
I	2185	59.1	(57.1 to 61.2)	**-122.93**	****
J	5632	55.7	(54.4 to 57.0)	**-547.09**	****
K	22	68.2	(45.1 to 86.1)	**-0.03**	
O	474	60.6	(56.2 to 65.0)	**-20.16**	****
Total	26444	67.5	(66.9 to 68.0)	**-80.07**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

Table c.30 Sefton & Knowsley unit, Second Round; Uptake rates and signed chi-squared values, by Lifestyle, amongst women only invited in the first round

Lifestyle	Invites	Uptake rate (%) with 95% CI		Chi-squared	
A	887	65.5	(62.4 to 68.6)	**-8.55**	***
B	1360	67.7	(65.2 to 70.2)	**-3.36**	
C	2009	63.3	(61.2 to 65.4)	**-43.39**	****
D	1010	59.4	(56.4 to 62.4)	**-53.98**	****
E	34	26.5	(12.9 to 44.4)	**-30.68**	****
F	28	57.1	(37.2 to 75.5)	**-2.20**	
G	814	56.6	(53.2 to 60.0)	**-69.25**	****
H	1075	57.8	(54.8 to 60.7)	**-76.60**	****
I	694	45.2	(41.5 to 49.0)	**-202.52**	****
J	2121	42.3	(40.2 to 44.4)	**-772.81**	****
K	19	47.4	(24.5 to 71.1)	**-4.63**	*
O	378	51.1	(46.0 to 56.1)	**-64.58**	****
Total	10429	56.5	(55.6 to 57.5)	**-903.01**	****

* p<0.05; ** p<0.01; *** p<0.005; **** p<0.001

A: Affluent Professionals
B: Better Off Older People
C: Settled Suburbans
D: Better Off Young Families
E: Younger/mobile persons
F: Rural Communities
G: Lower Income Elderly
H: Blue Collar Families
I: Lower Income Households
J: 'Have Nots' Households
K: Unclassified
O: No Super Profile codes attached