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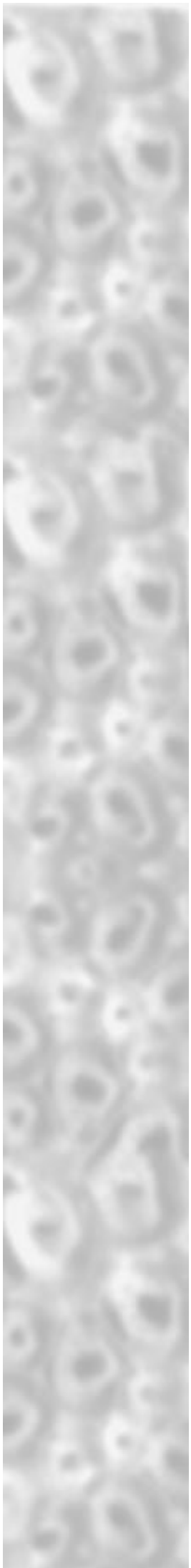
CANCER TREATMENT POLICIES & THEIR EFFECTS ON SURVIVAL

Pancreas

KEY SITES STUDY 4



CANCER TREATMENT POLICIES & THEIR EFFECTS ON SURVIVAL

Pancreas

Report Produced by

NY CRIS *Northern and Yorkshire*
Cancer Registry and Information Service
within the LEEDS Teaching Hospitals NHS Trust

CANCER OUTCOMES MONITORING

in collaboration with the
Research School of Medicine
University of Leeds

Key Sites Study Funded by the NHS R&D Program for Cancer

KEY SITES STUDY

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REPORT CONTENTS

1

2 INTRODUCTION

2.1. FOREWORD

2.1.1. Pancreatic Tumours

In the UK there are approximately 7,000 new diagnoses of pancreatic cancer each year, accounting for just over 3% of all malignancies for each sex. Pancreatic cancer is the eighth most common cancer in the UK and the sixth most common cause of cancer death with only 2-3% long-term survivors. Only about 10% of all pancreatic cancer patients are alive at 1 year and the survival of untreated patients is rarely more than a few months. Most patients present with inoperable tumours, although some series have reported 5-year survival rates of 20-25% after potentially curative resection. Prompt referral and assessment by a specialist multi-disciplinary team is necessary firstly to identify appropriate patients for resection and secondly to improve access to specialist palliation services in order that quality of life for patients not suitable for radical treatments can be improved.

2.1.2. Key Sites Study

This report contains the results of a retrospective study of population-based data collected by the Northern and Yorkshire Cancer Registry and Information Service. The aim of this work was to investigate, as far as possible, the degree of variation in the management of patients with primary pancreatic tumours in the former Yorkshire Region between the years 1986 and 1994, and to determine the impact of any variation on survival. A combination of descriptive analysis of treatment patterns, along with survival and multivariate analyses have been performed.

The pancreatic cancer study forms part of a larger project, funded by the NHS R&D programme for cancer, which investigates variation in the management and survival of a number of common cancers. The Calman-Hine report recommended a uniformly high standard of management for all patients with cancer. The establishment of cancer centres and units requires evidence upon which to base decision making regarding the optimal organisation and provision of cancer services. It is clear from the above that increased specialisation amongst those treating patients with pancreatic cancer and the adoption of a truly multi-disciplinary approach to its management are central to improved standards of care. The results of a study such as this may provide both a valuable starting point for establishing such standards to be achieved in cancer centres and units, and may contribute to the successful development of the process as a whole.

The formation of NYCRIS and the integration of the Northern and Yorkshire Cancer Registries occurred in 1997 but only data collected by the former Yorkshire Cancer Registry have been analysed in this report. Long term follow-up (survival up to five years from diagnosis) was an important component of the analysis, and retrospective methodologies were essential. The study period 1986 to 1994 was chosen to enable survival, up to five years from diagnosis, to be determined. At the beginning of this work, 1994 was the most recent year for which the cancer registry data set was complete. The research team acknowledge that some clinical practices will have changed since the end of the study period.

2.2. EXECUTIVE SUMMARY

Pancreatic cancer carries a gloomy prognosis. Half the patients receive no definitive treatment, either palliative or with curative intent. Histological confirmation rates are extremely low, casting doubt on diagnostic precision and pre-operative assessment in these patients. Care is highly fragmented with patients scattered amongst different consultants and hospitals, clinical caseloads are usually extremely small. This study suggests that even modest concentration of patients is likely to show a survival benefit, including reduction in post-operative mortality. Whilst there is some evidence of increases in resection rates and palliative stenting, the proportions of patients receiving these procedures varies considerably between hospitals and specialists.

2.2.1. Frequency and Incidence

Over the 9 years (1986-94) the annual incidence of pancreatic cancer showed little variation (10.4 to 12 per 100,000 pop.) with a mean of 11.5 per 100,000. This represents 416 new patients each year in Yorkshire, 2.3% of all malignant neoplasms amongst males and 2.5% females. The peak age incidence was in the age group 80-84 years for males and 85+ years for females. Only 4% of pancreatic cancers occurred in people below the age of 50 years. There were slightly more female than male patients - 52.8% female, 47.2% male. The site of the tumour was identified as the head of the pancreas in 51.8% of cases, and unspecified in 43.0%. Tumour type was unspecified in the majority of cases, 70.4%. Where known it was almost always reported as adenocarcinoma.

A total of 12.6% of pancreatic cancer cases were excluded from the analysis due to insufficiently detailed information. These were mainly patients registered by their death certificate only and a few patients who were managed at certain GP/cottage hospitals, as private patients, or were managed extra-regionally.

2.2.2. Hospital and Consultant Management

A total of 58 hospitals treated pancreatic cancer patients. 22% of patients were managed in 45 different hospitals managing less than 1 new pancreatic cancer patient per month. A further 24% were managed in three hospitals seeing more than 25 new cases a year. The remaining 54% were evenly spread between these two workload bands.

Two thirds of pancreatic cancer patients were managed by surgeons, with the remaining third predominantly cared for by physicians or physicians in medicine for the elderly. This showed little change during the period. The distribution of consultant workloads in relation to pancreatic cancer showed a total of 318 consultants treating the 3,262 patients over the 9 years. A quarter of patients were managed by consultants seeing 1 or less new case per year. A further 30% were seen by 78 consultants seeing between 1-3 new cases per year. Just 14 consultants managed more than 5 new cases per year. The highest individual workload being 15 cases per year. None of those physicians in medicine for the elderly saw more than 3 cases of pancreatic cancer per year.

2.2.3. Histological Confirmation

Rates of histological confirmation for pancreatic cancer are among the lowest of all cancers at just under 36%. This compares with over 80% for large bowel cancer and 64% for lung cancer. The older a patient is, the less likely is their pancreatic cancer to be histologically confirmed. The rate of confirmation declined steadily in each successive age band from 74% in those under 50 years to just under 20% in those over 80 years.

This lack of confirmation reflects, in part, the technical difficulties involved in obtaining biopsy material.

2.2.4. Treatment

Over half of all patients received no definitive treatment, ranging from just over one third in the age group 30-39, to just over two thirds in those 80-89, and over 80% in the 90+ group. One third (31.4%) of patients received surgery of a palliative nature, rates declining from 38.1% between 1986-88 to 24.2% during 1992-94, matched by a recorded increase in stenting from 3.2% to 11.7%. Data for stenting were incomplete, particularly the early years. Use of palliative surgery was not associated with age until 79 years, after which it declined rapidly. Stenting by contrast was most frequent in the over-80's.

Only 130 surgical resections were performed across the 9 years, in the 3,278 patients (4%). The resection rate of 4% showed a slight increase in the most recent time period. Resections were carried out at 16 hospitals, the majority performing less than 1 per year. Even the hospitals managing the highest number of cases overall performed on average no more than 5-6 resections per year, although with a slight upward trend. Three quarters of resections took place under age 70, with the peak rate under 50. Two thirds of resections were performed in 4 trusts, with the remainder divided between 17 trusts. Palliative surgery was more evenly distributed. Very little radiotherapy (1%) or chemotherapy (1.9%) was given. With the restriction on the timing of treatments included in this study (within 9 weeks from diagnosis) it is possible that the true rate of chemotherapy and radiotherapy use may be slightly higher. Patients with pancreatic cancer are, however, mainly treated shortly after diagnosis.

2.2.5. Hospital and Clinician Workloads

Hospitals with the smallest workload had a high proportion of untreated cases. Those hospitals with higher workload had the highest resection rates. Palliative surgical rates were lowest in these hospitals, possibly reflecting access to stenting services. Consultants with higher workloads (5+ new patients per year) had the highest resection rates (8.6%) with the lowest resection rates amongst those seeing 1 or less cases per year. The highest proportion of untreated cases were managed by a consultant in the lowest workload category.

30 day post operative mortality rates showed little difference between resection and palliative surgery, with rates averaging 17.7% over the period. Higher workload consultants achieved the lowest 30 day post operative mortality rates for resections, ranging from 14.5% in the 5+ workload group, to 24.1% in the 3-5 workload group. The figures are less dramatic for palliative surgery, from 15.0% in the 5+ workload group to 20.4% in the less than 1 workload group. Although differences are small there is a clear gradient of declining mortality with rising workload. Amongst trusts (excluding very low numbers), 30 day mortality varied from 8.9% to 26.7%.

2.2.6. Survival

Survival from pancreatic cancer was extremely poor, with only 11% of cases alive after 1 year. 42% of patients who received a resection were alive at one year, compared with 17% of those who received palliative surgery. At 2 years 20% of resected patients were still alive compared with 5% in the other groups. Very few patients survived three or more years. There was a significant difference in survival based on consultant workload. Survival was poorest for those patients who were managed by consultants with the lowest median annual workloads, and better for those who were managed by consultant with higher workloads.

Multivariate analysis showed the relative risks, presented for each factor alone, allowing for casemix, and putting all factors in the analysis together. The relative risk of dying from pancreatic cancer was higher in the 75+ age group than amongst patients 60 or younger, relative risk 1.27 (1.13 - 1.42). The relative risk appeared to reduce slightly in the more recent time periods, being 0.91 (0.83-0.99) in 1992-94 relative to 1986-88. There was some increase in relative risk with poorer social circumstances, although this was not a large effect and possibly due to later presentation. Relative risk was much improved when active treatment was given being 0.37 (0.31-0.46) (where no treatment is the baseline). Palliative surgery and stenting resulted in improvements in relative risk.

Data on hospital workload were not conclusive, although there was a definite gradient with a reduced relative risk with hospital workload when factors were considered alone, and when allowing for casemix. When all factors were together this did not appear to be statistically significant. However, for consultant workload the relative risk above 3 cases per year was significantly better than for lower workloads. As might be expected, relative risk was higher where patients were cared for by physicians or physicians in medicine for the elderly. This may reflect a range of issues about referral patterns; but allowing for both casemix and all other factors together the relative risks for patients managed by a physician were 1.14 (1.02-1.28) and for physicians in medicine for the elderly were 1.24 (1.08-1.43).

2.2.7. Recommendations for future work

The present extremely poor survival and fragmentation of care require alternative service models to be tried and results systematically audited.

1. There are grounds for examining the effectiveness of the diagnostic and assessment arrangements, and the referral criteria for access to definitive palliative and potentially curative treatments. The existence of histological subtypes with a better prognosis make a more structured approach to assessment and histological confirmation essential.
2. This evidence suggests that it is worth concentrating surgical management, particularly potentially curative resections for pancreatic cancers, to see whether surgeons with higher workloads and specialist supportive teams are capable of bringing down post operative mortality and improving medium term survival.
3. During the time period of this study hardly any neo-adjuvant or adjuvant therapy was used. The potential contribution of such therapies has been difficult to assess, but clinical trials of multi-modality therapy must be worthwhile given the present outcomes and the evidence from large volume specialist centres in other countries.
4. Whilst the data on stenting in this study were not consistent, they provided some indication of an inverse ratio between palliative surgery and stenting, with stenting on the increase. Work is needed to assess the optimum (and least invasive) palliative options, and how they should be organised for best palliative outcomes. It is not clear in this study whether palliative procedures can safely be left in their present fragmented form or concentrated as with potentially curative procedures. Given the short survival, prompt and efficient access to the palliative relief of jaundice may improve quality of life for those patients not going on for radical treatments.

2.3. ACKNOWLEDGEMENTS

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2.3.2. Other Acknowledgements

The preliminary work for this study was carried out under the guidance of the Yorkshire Gastro-Intestinal Tumour Group.

The University of Leeds and NYCRIS, who received funding from the NHS Executive, undertook this work. The views expressed in this publication are those of the authors and not necessarily those of the NHS Executive.

Many thanks are due to Mr M Larvin, Leeds General Infirmary, who provided many helpful comments on the draft report.

3 POPULATION DESCRIPTION

3.1. ALL PANCREATIC TUMOURS

3.1.1. Patient Characteristics

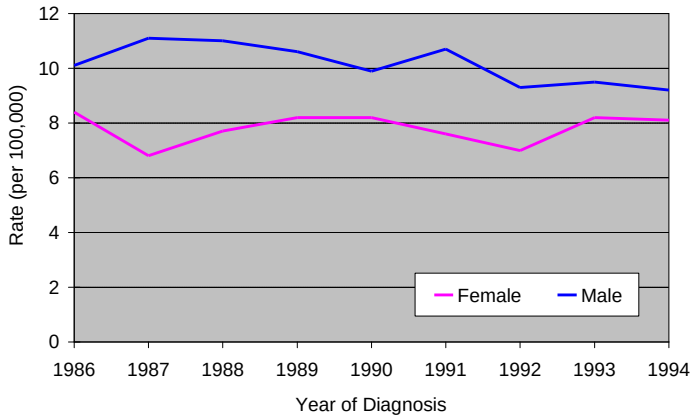
▼ **Characteristics of All Pancreatic Tumour Patients 1986-94**

Factor		N	%
Sex	Male	1747	***46.6%***
	Female	2004	***53.4%***
Age	20-29	1	***0.3%***
	30-39	23	***0.6%***
	40-49	128	***3.4%***
	50-59	373	***9.9%***
	60-69	990	***26.4%***
	70-79	1304	***34.8%***
	80-89	818	***21.8%***
	90+	114	***3.0%***
Total	All ages	3751	***100.0%***

During the study period, 1986-94, a total of 3751 patients were registered with pancreatic tumours (ICD9 Codes: 1571-9) in the former Yorkshire region, averaging approximately 416 new cases per annum.

Incidence

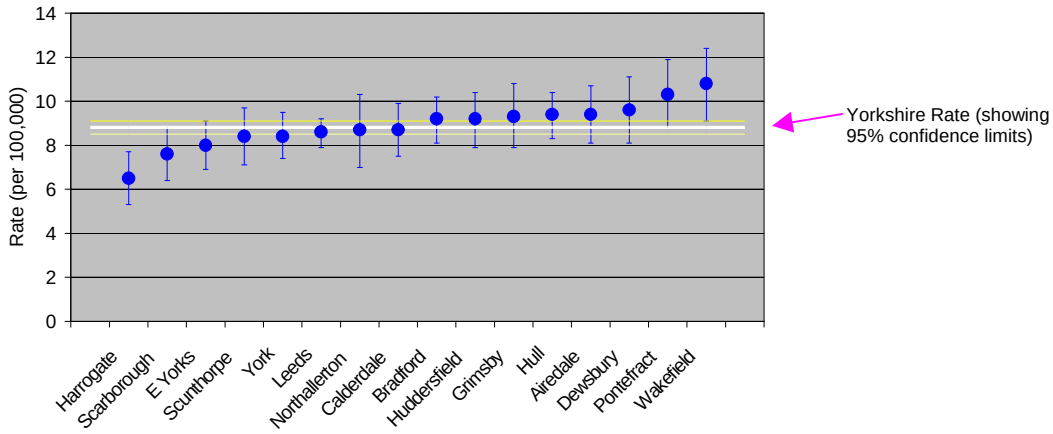
▼ **Age Standardised Rate of Pancreatic Cancer in Yorkshire 1986-94**



The overall age standardised incidence rate for pancreatic cancer over the entire time period was 10.1 and 7.8 per 100,000 for males and females respectively. These rates showed some variation across the time period. The incidence in males was consistently higher than that for females, particularly at the beginning of the time period (1986) but has shown some decline across the study period while the rate for females is relatively unchanged.

District of Residence

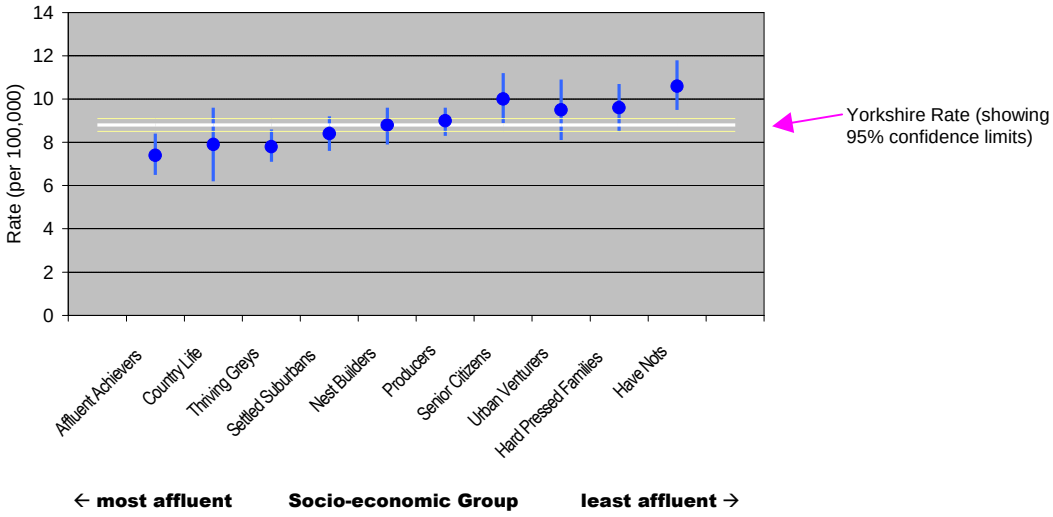
▼ **Age Standardised Incidence Rates by District of Residence 1986-94**



Overall there appeared to be large variation in incidence by district of residence. The highest pancreatic cancer incidence rate was found in Wakefield and Pontefract with the lowest in Harrogate and Scarborough.

Socio-Economic Group

▼ **Age Standardised Incidence Rates by Socio-Economic Status 1986-94**



Incidence of pancreatic cancer showed some correlation with socio-economic status. The highest incidence rates, which were just over 10 cases per 100,000 population, were found in the most deprived group, the "have nots", whilst the lowest incidence rates of around 7 cases per 100,000 population were found in the more affluent group, the "affluent achievers". This trend may be influenced by differences in smoking and dietary patterns between the different socio-economic groups.

3.2. STUDY POPULATION

3.2.1. Exclusions

A total of 3,751 patients were registered with pancreatic tumours over the study period 1986-94. However, as one of the primary aims of this study was to assess variation in management, all groups for which management data were known to be absent or incomplete were excluded from the dataset. A total of 473 patients were, therefore, excluded. These included patients managed outside of the region, patients who were mainly managed by their GP or at GP-run hospitals, and death certificate only (DCO) registrations and patients with rare tumour sub-types. Details of the exclusions are given below.

Extra-Regionally Managed Patients

In districts such as Northallerton, which lay on the border of the study region, some patients would have been diagnosed, referred and managed outside the region. These Yorkshire residents would still have their disease registered in Yorkshire and could therefore be included in the analysis of pancreatic cancer incidence in chapter 3.1. However, since the cancer registration officers only extracted management and treatment information from the case notes of Yorkshire hospitals at that time, the management details of these particular patients were not available for study, if management was at a non-Yorkshire hospital. These cases were excluded from the study

Private Patients

These patients were managed in the private sector where case notes were difficult to review. No further details were available for these patients and they were excluded from the study.

GP Managed Patients

A very small proportion of pancreatic cancer patients may remain solely under the management of their GP or are managed at a GP-run hospital. No further details were available for these patients and they were excluded from the study.

Death Certificate Only Registrations (DCO's)

These are patients for whom the only information registered was that given on their death certificate. No other details were available for these patients and they were excluded from the study.

▼ **Summary of all Exclusions Made from the Analysis Dataset**

Exclusions	Number
Primarily managed extra-regionally	47
Private cases	65
GP/Cottage hospital managed	56
Death certificate only registrations (DCO rate=7.4%)	277
Rarer tumour types (see table to right for details)	28
Total Exclusions	473

Excluded Types	Number
Adenocarcinoma Acinar	3
Adenocarcinoma Islet Cell	8
Adeno Uncertain Primary	1
Carcinoid	2
Squamous Cell	4
Fibrosarcoma	1
Leiomyosarcoma	1
Unknown	5
Mixed Adeno/Sqaumous	3
Total	28

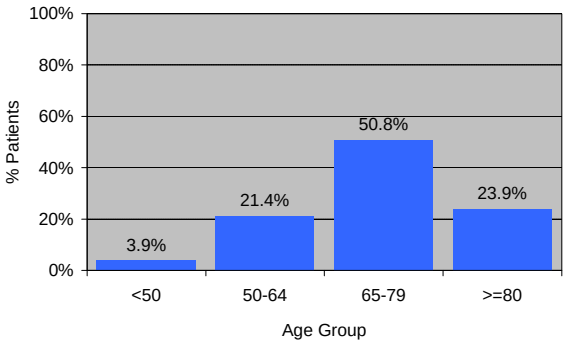
Total number of patients eligible for the study = 3,278

3.2.2. Characteristics of the Study Population

▼ **Patient Characteristics - Pancreas 1986-94**

	Characteristic	N	%
Sex	Male	1546	***47.2%***
	Female	1732	***52.8%***
Site	Head	1699	***51.8%***
	Body	101	***3.1%***
	Tail	70	***2.1%***
	NOS	1408	***43.0%***
Type	Adenocarcinoma	941	***28.7%***
	Other	28	***0.9%***
	NOS	2309	***70.4%***
Age	<50	129	***3.9%***
	50-64	701	***21.4%***
	65-79	1666	***50.8%***
	>=80	782	***23.9%***
Time Period	1986-88	1094	***33.4%***
	1989-91	1109	***33.8%***
	1992-94	1075	***32.8%***

▼ **Proportion of Cases by Age Group**

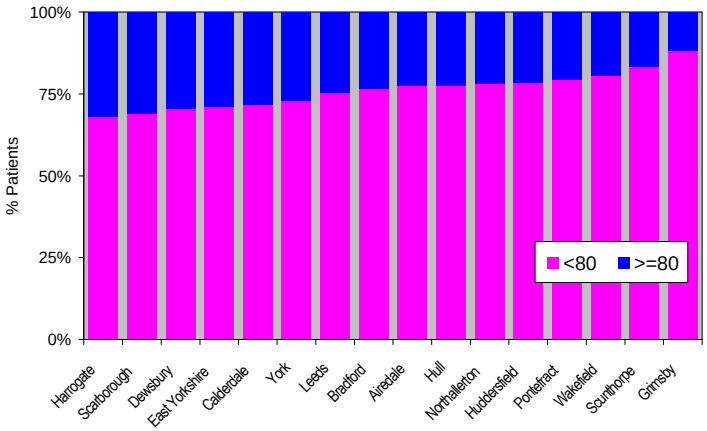


There was a slightly higher proportion of female cases in the study group. Tumours were predominately found in the head of the pancreas and histological type was unspecified in the majority of cases, but where known it was almost always reported as adenocarcinoma. Very few patients were diagnosed with pancreatic cancer under the age of 50, over 50% of patients were aged between 60 and 80 and 20% were over 80 years of age. There does not appear to be any change in the number of cases across the time period which is confirmed by the very slight changes in incidence seen in section 3.1.1

3.2.3. Study Population by District of Residence

▼ **Proportion of Patients over 80 Years of Age by District of Residence – Pancreas 1986-94**

District	N	Proportion >=80	
Harrogate	**107**	34	***31.8%***
Scarborough	**149**	46	***30.9%***
Dewsbury	**146**	43	***29.5%***
East Yorkshire	**191**	55	***28.8%***
Calderdale	**188**	53	***28.2%***
York	**244**	66	***27.0%***
Leeds	**612**	149	***24.3%***
Bradford	**291**	68	***23.4%***
Airedale	**187**	42	***22.5%***
Hull	**295**	66	***22.4%***
Northallerton	**64**	14	***21.9%***
Huddersfield	**191**	41	***21.5%***
Pontefract	**161**	33	***20.5%***
Wakefield	**146**	28	***19.2%***
Scunthorpe	**162**	27	***16.7%***
Grimsby	**144**	17	***11.8%***
Yorkshire Total	**3278**	782	***23.9%***



The proportion of patients over the age of 80 years varied between districts, with the highest proportion of elderly patients in Harrogate (31.8%) and Scarborough (30.9%) and the lowest in Grimsby (11.8%). The variation shown in relation to age may account for differences in histological confirmation rates (4.1.3 below) and treatment rates (4.2.3 below) by district. For example, Harrogate, with the largest proportion of elderly patients (31.8%) has the lowest histological confirmation rate (24.3%) and Dewsbury, with nearly 30% of its population aged over 80, has the highest no treatment rate of 71%.

4. MANAGEMENT & TREATMENT

4

4.1. MANAGEMENT OF PANCREATIC CANCER

Cancer of the pancreas is curable only when it is found in its earliest stages, before it has spread. Otherwise it is almost impossible to cure. It can, however, be treated and the symptoms alleviated with a resulting improvement in the quality of a patient's life.

Potentially curative surgery (pancreaticoduodenectomy or Whipple procedure) is used when imaging studies indicate a high probability that the surgeon will be able to remove all the tumour.

If investigations indicate that the tumour is too widespread to be completely removed, palliative surgery may be performed to relieve symptoms. Cancers in the head of the pancreas usually block the bile duct as it passes through this part of the pancreas. The majority of patients present with jaundice due to the accumulation of certain bile-related chemicals in the bloodstream. Occasionally the obstruction can cause pain or other digestive problems due to a lack of bile reaching the intestine. There are two options for relieving bile duct blockage. The first is an operation which re-routes the flow of bile from the common bile duct into the small intestine directly. This used to require an abdominal surgical incision and resulted in many weeks of post-operative care. The procedure can now be carried out laparoscopically. The second approach is placement of a stent (a soft tube) through an endoscope. The stent helps keep the bile duct open, however it may become clogged and sometimes needs to be replaced. Metallic stents circumvent clogging but are more expensive than plastic alternatives.

In general a surgical operation to relieve biliary obstruction is considered when the cancer is too widespread to be completely removed by surgery, but still localised enough so that the patient has a life expectancy of greater than six months. If the cancer is more widespread and the life expectancy is shorter than six months then endoscopic stent placement is considered.

Radiotherapy can be used postoperatively to eradicate any remaining disease or more commonly, for palliation. Radioactive implants and intraoperative radiation may also be used to deliver high doses of radiation directly to the tumour. A substantial literature exists on post-operative adjuvant radiotherapy or chemotherapy. Some reports indicate benefits but overall the data are inconclusive and very few patients receive either radiotherapy or chemotherapy.

For patients whose tumours cannot be completely removed surgically, the treatments generally focus on the prevention and /or management of symptoms using radiotherapy and /or chemotherapy. Radiotherapy is most often used to relieve painful disease sites, while chemotherapy is used to reduce the rate of tumour growth and thus prolong survival. In some instances radiation and chemotherapy are applied together.

New approaches with new drugs (e.g. gemcitabine and taxol), genetic therapies and new biological therapy are also under study.

4.1.1. NYCRIS Pancreatic Management Data

To aid interpretation and understanding of the following analyses of pancreatic cancer management these guidelines for using NYCRIS data have been developed and should be consulted while reading this chapter.

Managing Hospitals and Consultants

During the study period, up to three managing hospitals could be recorded. The hospital of primary management was available for all patients. The NHS Trust analyses presented in section 4.4 have been based upon this hospital of primary management. Hospitals were not recorded if a patient was referred for example, for a specialist assessment at a teaching hospital, if management of the patient was not formally transferred. This was also true of the recorded managing consultants. A consultant would only be recorded by NYCRIS if management of a patient was actually transferred to that consultant. Therefore consultants offering management opinion only would not be recorded. Again, up to three managing consultants could be recorded by NYCRIS but the referral pathway is not clear from just looking at the data. Consultant 1 is defined as the primary managing clinician - and not necessarily the consultant to whom the patient was first referred. For example, a patient undergoing a resection having first been referred to a general physician would have the surgeon classified as the primary managing consultant.

Treatment

With respect to treatment, it should be noted that, until 1994, only definitive treatment administered within nine weeks of the first episode would have been routinely recorded. This is likely to be sufficient for most patients with pancreatic cancer. For patients where "no treatment" was recorded on the computer, supplementary details of any other procedures performed were obtained from the registration paper records. Additional treatment data (in particular information on the use of stents) were also collected, from original hospital medical records, for patients where no further treatment information was available in-house, however this was limited to the later half of the study period (1990-94). All radiotherapy, whether it be with curative or palliative intent, was recorded. Chemotherapy was also recorded, but details of regimens were not.

Treatment of Patients Residing on the Region Borders

In districts such as Northallerton and Grimsby, which lie on the borders of the study region, some patients would have been diagnosed, referred and managed outside the region. These Yorkshire residents would have their disease registered in Yorkshire. However, the management details of extra-regionally treated patients were not available for study, and these patients were excluded from study. Should patients of relatively good prognosis in a certain district be referred for surgery outside the region, for example, whilst the poorer prognosis cases are treated palliatively within the region, then those treated extra-regionally would have been excluded. It is important that the potential effects of this are kept in mind when drawing conclusions from the treatment rates and outcome data of districts which lie on the border.

The Future

The information contained within this report relates to the period 1986-94. This time period was selected on the basis of the most recent year for which the NYCRIS dataset was available at the outset of the study, and to provide a cohort of patients with sufficient follow-up to enable an analysis of survival. In 1999, NYCRIS implemented a new computer cancer registration system (CCRIS2) which collects and records cancer registration in a fundamentally different way. It allows the recording of more than three hospitals, consultants in order of referral and all treatments. It also, for the first time, allows the linking of a particular treatment or investigation to a particular consultant and to a hospital. Data collected in this way will enable much more detailed referral and treatment analyses to be performed in the future.

4.2. Overview of Histological Confirmation Rates Across Yorkshire

The main reason for the poor prognosis of pancreatic cancer is that very few tumours are found early. Because of the location of the pancreas it is difficult for tumours to be seen or felt during routine physical examinations and there are no effective screening tests that can detect early cancers of the pancreas. Another reason why most cancers are found in an advanced stage is that patients are usually asymptomatic until the cancer has reached a large size or metastasised.

Although investigations such as CT scan, MR imaging, Ultrasound and ERCP (endoscopic retrograde cholangiopancreatography) can be used to diagnose cancer of the pancreas, the only way to confirm this diagnosis is by removing a sample of the tissue for histological examination.

There are several methods for taking a biopsy, but during the time period of this study the most likely method would have been surgical, requiring a laparotomy. The patient undergoes a general anaesthetic and has to remain in hospital for several days for post-operative recovery. It is felt by some clinicians that surgical biopsy should be avoided unless imaging tests indicate that the tumour may be resectable or treatable with chemotherapy. More modern techniques such as laparoscopy, ERCP brushing fine needle aspiration (FNA) biopsy are much less invasive.

4.2.1. Overall Histological Confirmation Rates

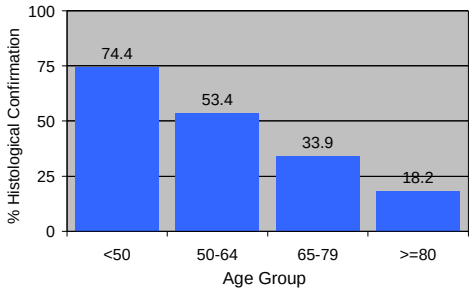
Of the 3,278 patients in this study, 1177 (35.9%) were recorded by NYCRIS as having had their disease histologically confirmed as pancreatic cancer. This is a very low rate of histological confirmation compared with lung cancer (around 70%) and colorectal cancer (>80%) although the technology for obtaining biopsy material was substantially easier for the latter cancers, especially during the time period of the study.

Improvements in diagnosis and assessment can assist in better selection of patients for potentially curative surgery and help reduce the number of inappropriate resections.

4.2.2. Histological Confirmation Rate by Sex, Age, Socio-economic Group & Time

▼ **Histological Confirmation Rates by Sex, Age, Socio-economic Group and Time Period**

Factor		N	*n*	Confirmed
Sex	Male	**1546**	571	***36.9%***
	Female	**1732**	606	***35.0%***
Age	<50	**129**	96	***74.4%***
	50-64	**701**	374	***53.4%***
	65-79	**1666**	565	***33.9%***
	>=80	**782**	142	***18.2%***
Socio-Economic Group	1-3	**643**	240	***37.3%***
	4-7	**1868**	681	***36.5%***
	8-10	**767**	256	***33.4%***
Time Period	1986-88	**1094**	396	***36.2%***
	1989-91	**1109**	394	***35.5%***
	1992-94	**1075**	387	***36.0%***
Total	All Cases	**3278**	1177	***35.9%***

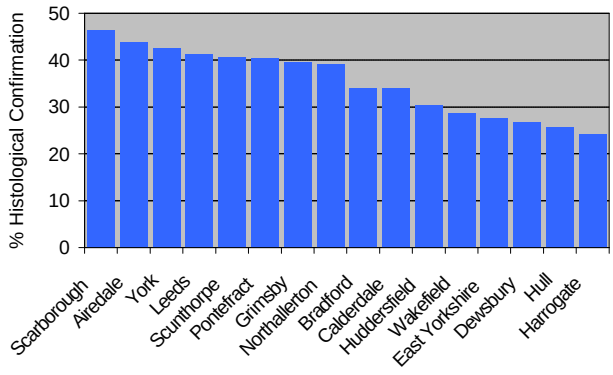


There was little difference in the HCR according to sex but wide variation in relation to age. Almost 75% of the patients aged less than 50 years of age were histologically confirmed. This dropped by nearly 20% in the next age band (50-64) and for the over 80's the rate was just 18.2%. There were slight differences according to socio-economic status. The most affluent social grouping (1-3) showed a rate of 37.3% compared with the least affluent group (8-10) whose rate was 33.4%. The proportion of histologically confirmed cases did not vary across the time period and remained at around 36% for the later years.

4.2.3. Histological Confirmation Rate by District of Residence

▼ **Histological Confirmation Rates by District of Residence 1986-94**

District	N	*n*	Confirmed
Scarborough	**149**	69	***46.3%***
Airedale	**187**	82	***43.9%***
York	**244**	104	***42.6%***
Leeds	**612**	252	***41.2%***
Scunthorpe	**162**	66	***40.7%***
Pontefract	**161**	65	***40.4%***
Grimsby	**144**	57	***39.6%***
Northallerton	**64**	25	***39.1%***
Bradford	**291**	99	***34.0%***
Calderdale	**188**	64	***34.0%***
Huddersfield	**191**	58	***30.4%***
Wakefield	**146**	42	***28.8%***
East Yorkshire	**191**	53	***27.7%***
Dewsbury	**146**	39	***26.7%***
Hull	**295**	76	***25.8%***
Harrogate	**107**	26	***24.3%***
Yorkshire	**3278**	1177	***35.9%***



Histological confirmation rates varied according to a patients district of residence. HCR's were highest in Scarborough, Airedale and York and lowest in Dewsbury, Hull and Harrogate. Section 4.2.2 depicted large variation in HCR with age and this may account for some of the variation by district - with Harrogate, Dewsbury and East Yorkshire having a high proportion of patients aged over 80 (Section 3.2.3). However, this does not explain all the differences in HCR. Scarborough had a high proportion of elderly patients (30.9% aged >=80 years) but also had the highest HCR. Therefore the variation in HCR must also be related to differences in local policy and availability of diagnostic services, perhaps most notably during this time period, CT.

4.3. OVERVIEW OF TREATMENT ACROSS YORKSHIRE

A general overview of treatment options for pancreatic cancer is described at the beginning of this chapter. It should be remembered that during the study period surgery, chemotherapy and radiotherapy was computerised by the Cancer Registry staff. However, a detailed investigation of the paper records identified additional treatment data. This has a significant impact on the treatment analyses for pancreatic cancer in particular due to the nature of the disease where many of the clinical interventions employed aim to palliate symptoms only. Data relating to the use of stents was not routinely collected. This should be kept in mind when looking at the "no treatment" rates, where a relatively high proportion of patients recorded as not having had surgery had actually had a stent. This is addressed in sections 4.3.2 and 4.3.3.

During the study period, only surgery, chemotherapy and radiotherapy were recorded on the NYCRIS database. Data relating to the use of stents was not computerised but, where available in the case notes, it was entered onto the Registry paper records. Since many of the clinical interventions for pancreatic cancer aim to palliate symptoms, these paper records were reviewed and any stenting information noted was used in this study. Stenting information was obtained for the period 1990-94 only.

4.3.1. Overall Treatment Rates

▼ **Frequency of Treatment Modalities 1986-94**

Modality	N	%
Any surgery	**1184**	***36.1%***
Any chemotherapy	**62**	***1.9%***
Any radiotherapy	**34**	***1.0%***
Total	**1280**	***39.0%***

Just over one third of all patients received some type of surgical intervention but very little radiotherapy (1.0%) or chemotherapy (1.9%) was given.

▼ **Surgical Procedures 1986-94**

Surgical Group	Operative Procedure	*n*	%
Resection	Resection	130	***11.0%***
Non-resection surgery (NRS)	Biliary Enteric Bypass	540	***45.6%***
	Biliary Enteric Bypass & Gastroenterostomy	365	***30.8%***
	Bypass Gastroenterostomy	100	***8.4%***
	Biliary Enteric Bypass & Cholecystectomy	26	***2.2%***
	Cholecystectomy	13	***1.1%***
	Biliary Enteric Bypass, Gastroenterostomy And Cholecystectomy	6	***0.5%***
	Cholecystectomy & Gastrojejunostomy	2	***0.2%***
	Other Excision	2	***0.2%***
	Totals	**1184**	***100%***

The overall surgical resection rate for all pancreatic cancer patients was 4.0% which constituted 11.0% of all surgical procedures. The resection rate showed a slight increase across the time period, possibly as a result of recent service re-organisation and improvements in investigative techniques. The resections were carried out at 16 different NHS Trusts, the most active of which performed 39 (30%) resections. The majority of the palliative bypass operative procedures performed were biliary enteric bypasses (45.6%) or biliary enteric bypass and gastroenterostomy (30.8%).

4.3.2. Treatment by Sex, Age, Socio-Economic Profile and Time

▼ **Frequency of Treatment Modalities by Sex, Age, Socio-Economic Profile and Time**

Factor		N	*n*	R	*n*	NRS	*n*	C/RT	*n*	None/Stent
Sex	Male	**1546**	72	***4.7%***	542	***35.1%***	31	***2.0%***	901	***58.3%***
	Female	**1732**	58	***3.3%***	512	***29.6%***	26	***1.5%***	1136	***65.6%***
Age	<50	**129**	17	***13.2%***	44	***34.1%***	14	***10.9%***	54	***41.9%***
	50-64	**701**	58	***8.3%***	261	***37.2%***	23	***3.3%***	359	***51.2%***
	65-79	**1666**	50	***3.0%***	596	***35.8%***	20	***1.2%***	1000	***60.0%***
	>80	**782**	5	***0.6%***	153	***19.6%***	0	***0.0%***	624	***79.8%***
Socio-economic Group	1-3	**643**	19	***3.0%***	218	***33.9%***	13	***2.0%***	393	***61.1%***
	4-7	**1868**	80	***4.3%***	611	***32.7%***	35	***1.9%***	1142	***61.1%***
	8-10	**767**	31	***4.0%***	225	***29.3%***	9	***1.2%***	502	***65.4%***
Time	1986-88	**1094**	41	***3.7%***	417	***38.1%***	13	***1.2%***	623	***56.9%***
	1989-91	**1109**	31	***2.8%***	377	***34.0%***	18	***1.6%***	683	***61.6%***
	1992-94	**1075**	58	***5.4%***	260	***24.2%***	26	***2.4%***	731	***68.0%***
Totals	All Cases	**3278**	130	***4.0%***	1054	***32.2%***	57	***1.7%***	2037	***62.1%***

R=Resection

NRS=Non-Resection Surgery

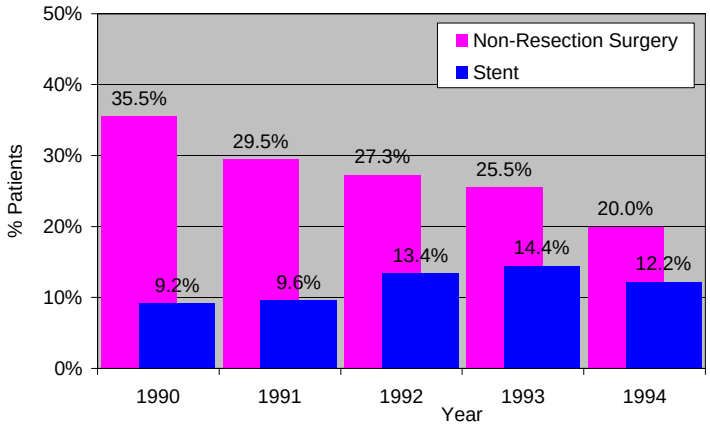
C/RT=Chemo therapy or Radiotherapy

None/Stent = No Treatment (see notes in section 4.3)

As shown in section 3.1.1 there were 6% more females in the study population - but the analysis consistently showed higher treatment rates for males. One reason for this is that 30.6% of the female population was aged >=80 compared to just 16.3% of the males. Age influenced treatment rates, with the proportion of the >=80 year olds receiving no treatment nearly double that of the under 50's (80% and 42% respectively). Just over 15% of patients aged under 65 received radiotherapy or chemotherapy compared to just 1.2% of the over 65's. There was little variation in treatment rates according to socio-economic status. Resection rates over time increased slightly from 3.7 to 5.4%. The rate of NRS fell from 38.1% to 24.2% with a corresponding increase in the proportion of patients receiving stents or no treatment

Stenting Data

▼ **Proportions Receiving Non-Resection Surgery or Stent**



As mentioned in the introduction to this section, data relating to the use of palliative stents was not routinely collected by the Cancer Registry. In the earlier years of the study the use of stents was not particularly widespread and the utilisation of palliative bypass surgery was much higher (38.1% for the years 1986-88). The opposite was found for the latest time period (1992-94) with much lower palliative bypass surgery rates (24.2%) and consequently much higher "no treatment" rates (68.0%). A data collection exercise was undertaken to examine the possible uptake in the use of stents as a palliative treatment for pancreatic cancer. The time period was restricted to the last 5 years of the study (1990-94). Data were extraced from both paper records in the Registry and hospital medical records. Although this exercise was not comprehensive, it did reveal data partly supporting our hypothesis. Between the years 1990-94, the rates of non-resection surgery fell from 35.5% in 1990 to just 20% in 1994 and the uptake of stents showed a reciprocal increase from 9.2% to 12.2% across the same time period.

4.3.3. Treatment by District of Residence

It is important to read the notes relating to the interpretation of treatment data at the beginning of Chapter 4, especially those relating to treatment of patients in districts at the borders of the region.

▼ **Frequency of Treatment Modalities by District of Residence 1986-94**

District	N	*n*	R	*n*	NRS	*n*	C/RT	*n*	None/Stent
Scunthorpe	**162**	7	***4.3%***	68	***42.0%***	7	***4.3%***	80	***49.4%***
Wakefield	**146**	2	***1.4%***	68	***46.6%***	1	***0.7%***	75	***51.4%***
Scarborough	**149**	9	***6.0%***	61	***40.9%***	1	***0.7%***	78	***52.3%***
Airedale	**187**	16	***8.6%***	67	***35.8%***	6	***3.2%***	98	***52.4%***
Grimsby	**144**	4	***2.8%***	56	***38.9%***	4	***2.8%***	80	***55.6%***
Northallerton	**64**	2	***3.1%***	24	***37.5%***	2	***3.1%***	36	***56.3%***
Harrogate	**107**	1	***0.9%***	42	***39.3%***	2	***1.9%***	62	***57.9%***
Bradford	**291**	15	***5.2%***	103	***35.4%***	4	***1.4%***	169	***58.1%***
Huddersfield	**191**	6	***3.1%***	70	***36.6%***	0	***0.0%***	115	***60.2%***
Hull	**295**	5	***1.7%***	100	***33.9%***	1	***0.3%***	189	***64.1%***
Pontefract	**161**	5	***3.1%***	50	***31.1%***	1	***0.6%***	105	***65.2%***
East Yorkshire	**191**	2	***1.0%***	63	***33.0%***	1	***0.5%***	125	***65.4%***
Calderdale	**188**	3	***1.6%***	51	***27.1%***	8	***4.3%***	126	***67.0%***
York	**244**	7	***2.9%***	67	***27.5%***	3	***1.2%***	167	***68.4%***
Leeds	**612**	38	***6.2%***	131	***21.4%***	15	***2.5%***	428	***69.9%***
Dewsbury	**146**	8	***5.5%***	33	***22.6%***	1	***0.7%***	104	***71.2%***

R=Resection

NRS=Non-Resection Surgery

C/RT=Chemo or Radiotherapy

None/Stent = No Treatment* *(see notes in section 4.3)

The overall rates of treatment shown in the above table are ranked in order of the proportion of patients receiving "no treatment" or a stent and highlight much variation according to district of residence. The highest rates of treatment were in Scunthorpe (50.6%) and Wakefield (48.6%) and the lowest rates of 28.8% in Dewsbury and 30.1% in Leeds.

As mentioned in section 4.3.2 an additional data collection exercise was undertaken to record the stenting rates in the "untreated" population. This was restricted to the time period 1990-94 due to availability of case notes. The table below includes these additional data but this time the table is ranked in order of stent rate. What becomes clearer from looking at these data is that there was considerable variation in the rate of stenting, possibly due to the availability of stenting service during this time period ranging from 31.5% of patients in Hull to just 1.7% of patients in Harrogate. An inverse relationship to palliative surgery is also seen (as in section 4.3.2).

▼ **Treatment by District of Residence Including Additional Stent Data 1990-94**

District	N	*n*	R	*n*	NRS	*n*	Stent	*n*	C/RT	*n*	None/ Stent
Hull	**162**	2	***1.2%***	38	***23.5%***	51	***31.5%***	1	***0.6%***	70	***43.2%***
East Yorkshire	**117**	1	***0.9%***	26	***22.2%***	23	***19.7%***	1	***0.9%***	66	***56.4%***
Calderdale	**104**	1	***1.0%***	25	***24.0%***	18	***17.3%***	2	***1.9%***	58	***55.8%***
Grimsby	**85**	1	***1.2%***	31	***36.5%***	12	***14.1%***	4	***4.7%***	37	***43.5%***
Leeds	**318**	17	***5.3%***	53	***16.7%***	42	***13.2%***	10	***3.1%***	196	***61.6%***
Wakefield	**78**	2	***2.6%***	33	***42.3%***	9	***11.5%***	1	***1.3%***	33	***42.3%***
Dewsbury	**95**	8	***8.4%***	18	***18.9%***	10	***10.5%***	1	***1.1%***	58	***61.1%***
Scarborough	**76**	5	***6.6%***	24	***31.6%***	7	***9.2%***	1	***1.3%***	39	***51.3%***
York	**146**	5	***3.4%***	30	***20.5%***	13	***8.9%***	3	***2.1%***	95	***65.1%***
Scunthorpe	**100**	5	***5.0%***	47	***47.0%***	6	***6.0%***	5	***5.0%***	37	***37.0%***
Northallerton	**34**	2	***5.9%***	6	***17.6%***	2	***5.9%***	2	***5.9%***	22	***64.7%***
Huddersfield	**108**	4	***3.7%***	36	***33.3%***	6	***5.6%***	0	***0.0%***	62	***57.4%***
Bradford	**143**	8	***5.6%***	60	***42.0%***	7	***4.9%***	4	***2.8%***	64	***44.8%***
Airedale	**104**	9	***8.7%***	31	***29.8%***	3	***2.9%***	3	***2.9%***	58	***55.8%***
Pontefract	**79**	3	***3.8%***	18	***22.8%***	2	***2.5%***	0	***0.0%***	56	***70.9%***
Harrogate	**58**	0	***0.0%***	22	***37.9%***	1	***1.7%***	1	***1.7%***	34	***58.6%***

R=Resection

NRS=Non-Resection Surgery

C/RT=Chemo or Radiotherapy

None/Stent = No Treatment* *(see notes in section 4.3)

4.4. CONSULTANT MANAGEMENT

In the previous two sections (4.2 and 4.3) substantial variation in both histological confirmation and treatment has been demonstrated. This may be attributable to both variations in patient case mix and also in the degree of management of these patients by clinicians with a specialist interest in pancreatic cancer

It is generally accepted that better care is more likely to be given by specialists in a particular field, and specialisation has also been shown to improve outcomes (Selby *et al,* 1996; Stiller, 1988). This chapter investigates variation in the degree of specialist management of pancreatic cancer patients in relation to a number of factors.

Before interpreting the data, it is recommended that the reader refers to the notes at the beginning of Chapter 4 on hospital and consultant data and the notes regarding patients who resided on the border of the region. Although NYCRIS recorded up to three consultants, who may have taken over the management of a patient, it was difficult to determine the exact referral pathway of a patient's management from these data alone. We could not ascertain which patients were referred directly to a specialist or which patients were referred to a specialist for opinion only, without formal transfer of management. In these analyses, therefore, each patient was allocated to one consultant, who was referred to as the "primary managing consultant". In cases where a decision was made not to treat, the individual responsible for that decision was classified as the managing consultant. However, in cases where treatment was given, the individual responsible for administering the first episode of treatment was defined as the managing consultant.

Two variables were calculated to represent specialist management: Hospital Workload and Consultant Workload. The median annual number of cases managed by each Hospital and Consultant was calculated taking into account new consultant posts and retirements within the study period. Once calculated for each hospital and consultant they were then grouped using quartiles as the cut off points resulting in 4 workload groups.

4.4.1. Number of Patients Managed by Hospital Workload Category

▼ **Number of Patients Managed by Hospital Workload Category 1986-94**

Median Annual Workload	N	Patients	*N*	Hospitals
0-12	**721**	***22.0%***	43	***74.1%***
13-16	**1072**	***32.7%***	8	***13.8%***
17-24	**694**	***21.2%***	4	***6.9%***
≥25	**791**	***24.1%***	3	***5.2%***
Total	**3278**	***100.0%***	58	***100.0%***

A total of 58 hospitals managed pancreatic cancer patients. 22% of patients were managed in 43 low workload hospitals seeing <=1 new patient per month. A further 24% were managed in three higher volume hospitals, seeing more than 25 new cases a year. The remaining 50% were managed at 12 hospitals with intermediate workloads.

4.4.2. Number of Patients Managed by Consultant Workload

▼ **Number of Patients Managed by Consultant Workload Category 1986-94**

Median Annual Workload	N	Patients	*N*	Consultants
=1	**745**	***22.7%***	201	***63.2%***
>1 - =3	**982**	***30.0%***	78	***24.5%***
>3 - =5	**733**	***22.4%***	25	***7.9%***
>5	**802**	***24.5%***	14	***4.4%***
Unknown	**16**	***0.5%***	n/a	***n/a***
Total	**3278**	***100.0%***	318	***100.0%***

The 3262 patients for which consultant information was available, were managed by 318 different clinicians, the vast majority of whom (63.2%) saw one case or less per annum and were responsible for managing just under 23% of all patients. At the other end of the scale, just 14 consultants, with a workload in excess of 5 new cases per year, managed 802 (24.5%) patients-the highest individual workload being 15 cases per year.

4.4.3. Number of Patients Managed by Individual Clinical Specialty

▼ **Number of Patients Managed by Individual Clinical Specialty 1986-94**

Specialty	N	Patients	*N*	Consultants
Surgery	**2190**	***66.8%***	106	***33.3%***
Medicine	**565**	***17.2%***	106	***33.3%***
Medicine for the Elderly	**435**	***13.3%***	60	***18.9%***
Oncology	**12**	***0.4%***	5	***1.6%***
Other	**60**	***1.8%***	41	***12.9%***
Unknown	**16**	***0.5%***	n/a	***n/a***
Totals	**3278**	***100.0%***	318	***100.0%***

Pancreatic cancer is a disease which is primarily managed surgically. 66.8% of all patients were recorded as being managed by a total of 106 different surgeons. The same number of general physicians managed just 17.2% of all patients. 60 physicians in medicine for the elderly managed 13.3% of patients and 41 consultants from other specialties managed 60 patients. These included Gastroenterology, Urology, Haematology, Cardiology, Gynaecology, Nephrology, Neurology, ENT, Mental Health, A&E and Orthopaedic Surgery.

4.4.4. Relationship between Consultant Specialty and Workload

▼ **Consultant Specialty by Workload Category**

Specialty	<=1		>1 to <=3		>3 to <=5		>5	
	Cons	Patients	Cons	Patients	Cons	Patients	Cons	Patients
Surgery	27	**119**	43	**672**	24	**728**	12	**671**
Medicine	85	**312**	18	**117**	1	**5**	2	**131**
Medicine for the Elderly	45	**261**	15	**174**	0	**0**	0	**0**
Other	40	**44**	1	**16**	0	**0**	0	**0**
Oncology	4	**9**	1	**3**	0	**0**	0	**0**
Totals	201	**745**	78	**982**	25	**733**	14	**802**

* Excludes 16 patients for whom consultant management data were not available.

In section 4.4.3 the main managing specialties involved in the management of pancreatic cancer were general surgery, general medicine and physicans in medicine for the elderly. Pancreatic cancer is mainly a surgically managed disease and of the 106 surgeons involved in management, 27 (25%) managed on average, one case or less per year. Twelve surgeons and two general physicians with a specialist interest in gastroenterology managed over 5 patients per year. None of the physicians in medicine for the elderly saw more than 3 cases per year.

4.4.5. Histological Confirmation Rates by Hospital & Consultant Workload

▼ **Histological Confirmation by Hospital and Consultant Workload Category 1986-94**

Median Annual Workload		N	*n*	Confirmed
Hospital	0-12	**721**	177	***24.5%***
	13-16	**1072**	411	***38.3%***
	17-24	**694**	290	***41.8%***
	=25	**791**	299	***37.8%***
Consultant*	=1	**745**	191	***25.6%***
	>1 to =3	**982**	314	***32.0%***
	>3 to =5	**733**	318	***43.4%***
	>5	**802**	353	***44.0%***

- Excludes 16 patients for whom consultant management data were not available.

There was a general trend of increased histological confirmation rates with higher consultant workload. There was also a substantial difference in confirmation rates between the lowest workload hospitals and the other three categories.

A general trend is evident of increased histological confirmation rates associated with higher workload, for both hospital and consultant.

4.4.6. Treatment Rates by Hospital & Consultant Workload

▼ **Treatment Rates by Hospital & Consultant Workload Category 1986-94**

Median Annual Workload		N	*n*	R	*n*	NRS	*n*	C/RT	*n*	None/ Stent
Hospital	0-12	**721**	7	***1.0%***	223	***30.9%***		***2.2%***	475	***65.9%***
	13-16	**1072**	48	***4.5%***	370	***34.5%***	19	***1.8%***	635	***59.2%***
	17-24	**694**	24	***3.5%***	268	***38.6%***	7	***1.0%***	395	***56.9%***
	=25	**791**	51	***6.4%***	193	***24.4%***	15	***1.9%***	532	***67.3%***
Consultant*	=1	**745**	2	***0.3%***	54	***7.2%***	15	***2.0%***	674	***90.5%***
	>1 to =3	**982**	30	***3.1%***	307	***31.3%***	18	***1.8%***	627	***63.8%***
	>3 to =5	**733**	29	***4.0%***	353	***48.2%***	15	***2.0%***	336	***45.8%***
	>5	**802**	69	***8.6%***	327	***40.8%***	9	***1.1%***	397	***49.5%***

R= resection

NRS= non-resection surgery

C/RT= chemo or radiotherapy

- Excludes 16 patients for whom Consultant management data were not available.

The greatest proportion of resections were performed by the high workload consultants and in the high workload hospitals, but there was also a significant percentage (24.6% of all resections) performed by consultants seeing three or less cases per year. The only other trend was the highest rate of "no treatment" in the one or less case per year consultant category (90.5%) and a much lower rate (49.5%) in the highest workload category.

▼ **Treatment Rates by Hospital & Consultant Workload Category Including Stents 1990-94**

Median Annual Workload		N	*n*	R	*n*	NRS	*n*	STENT	*n*	C/RT	*n*	None/ Stent
Hospital	0-12	**378**	4	***1.1%***	90	***23.8%***	47	***12.4%***	7	***1.9%***	230	***60.8%***
	13-16	**594**	25	***4.2%***	196	***33.0%***	49	***8.2%***	13	***2.2%***	311	***52.4%***
	17-24	**383**	14	***3.7%***	134	***35.0%***	12	***3.1%***	7	***1.8%***	216	***56.4%***
	=25	**452**	30	***6.6%***	78	***17.3%***	104	***23.0%***	12	***2.7%***	228	***50.4%***
Consultant*	=1	**403**	0	***0.0%***	19	***4.7%***	48	***11.9%***	12	***3.0%***	324	***80.4%***
	>1 to =3	**520**	13	***2.5%***	126	***24.2%***	53	***10.2%***	11	***2.1%***	317	***61.0%***
	>3 to =5	**413**	21	***5.1%***	182	***44.1%***	33	***8.0%***	9	***2.2%***	168	***40.7%***
	>5	**471**	39	***8.3%***	171	***36.3%***	78	***16.6%***	7	***1.5%***	176	***37.4%***

* Excludes 16 patients for whom consultant management data were not available.

The table for 1990-94 contains information on stenting in those patients who were not recorded as having had surgery.

4.5. MANAGEMENT AT INDIVIDUAL TRUSTS

The following section contains analyses which summarise the management of pancreatic cancer patients by individual NHS Trust. For each patient, the managing NHS Trust was defined as that which currently covers the main managing hospital.

The analyses investigate variation in patient age, histological confirmation rate, management by a surgeon and treatments. Chapter 7 contains tables summarising the characteristics of the patients, consultant management, and treatments given for each individual NHS Trust.

4.5.1. Age Variation by NHS Trust

▼ **Proportion of Patients aged under & over 80 years of Age in each Trust 1986-94**

Trust	N	*n*	Age <80	*n*	*Age* =80
Harrogate Health Care NHS Trust	**92**	62	***67.4%***	30	***32.9%***
Calderdale Healthcare NHS Trust	**165**	116	***70.3%***	49	***29.7%***
York Health Services NHS Trust	**222**	158	***71.2%***	64	***28.8%***
Dewsbury Health Care NHS Trust	**140**	100	***71.4%***	40	***28.6%***
East Yorkshire Hospitals NHS Trust	**93**	67	***72.0%***	26	***28.0%***
Scarborough & NE Yorkshire Healthcare NHS Trust	**191**	139	***72.8%***	52	***27.2%***
Pontefract Hospitals NHS Trust	**136**	101	***74.3%***	35	***25.7%***
St James's & Seacroft University Hospitals NHS Trust	**369**	278	***75.3%***	91	***24.7%***
Bradford Hospitals NHS Trust	**302**	230	***76.2%***	72	***23.8%***
Northallerton Health Services NHS Trust	**64**	49	***76.6%***	15	***23.4%***
Royal Hull Hospitals NHS Trust	**340**	261	***76.8%***	79	***23.2%***
Airedale NHS Trust	**145**	114	***78.6%***	31	***21.4%***
United Leeds Teaching Hospitals NHS Trust	**381**	300	***78.7%***	81	***21.3%***
Huddersfield Healthcare NHS Trust	**186**	147	***79.0%***	39	***21.0%***
Scunthorpe & Goole Hospitals NHS Trust	**131**	108	***82.4%***	23	***17.6%***
Pinderfields Hospitals NHS Trust	**152**	126	***82.9%***	26	***17.1%***
North East Lincolnshire NHS Trust	**143**	126	***88.1%***	17	***11.9%***
Others	**19**	11	***57.9%***	8	***42.1%***
Community Trusts	**7**	3	***42.9%***	4	***57.1%***
Totals	**3278**	2496	***76.1%***	782	***23.9%***

The proportion of patients over the age of 80 varied by main managing Trust, with the highest proportion of patients over 80 years of age managed at Harrogate Health Care NHS Trust (32.9%) and the smallest number in the NE Lincolnshire NHS Trust (11.9%). The proportion of elderly patients managed in each Trust would be expected to affect rates of histological confirmation, treatment and managing specialty.

4.5.2. Histological Confirmation Rate by NHS Trust

As described in section 4.2 there was substantial variation in histological confirmation rates by a number of factors, in particular age and district of residence. Histological confirmation rates by NHS Trust shown here exhibit simil ar variations with the highest rate of 51.7% in the Airedale NHS Trust and 45% in the Scarborough & NE Yorkshire NHS Trust compared with just 17.4% in Harrogate Health Care NHS Trust and 23.2% in the Royal Hull Hospitals NHS Trust. The factor causing greatest variation in histological confirmation rate was shown to be age (section 4.2.2) which possibly explains why Harrogate, the trust with the highest proportion of elderly patients, also had the lowest rate of histological confirmation.

▼ **Histological Confirmation Rates by NHS Trust 1986-94**

Trust	N	*n*	Confirmed
Airedale NHS Trust	**145**	75	***51.7%***
Scarborough & NE Yorkshire Healthcare NHS Trust	**191**	86	***45.0%***
York Health Services NHS Trust	**222**	96	***43.2%***
St James's & Seacroft University Hospitals NHS Trust	**369**	155	***42.0%***
Pontefract Hospitals NHS Trust	**136**	54	***39.7%***
Scunthorpe & Goole Hospitals NHS Trust	**131**	52	***39.7%***
Northallerton Health Services NHS Trust	**64**	25	***39.1%***
United Leeds Teaching Hospitals NHS Trust	**381**	147	***38.6%***
North East Lincolnshire NHS Trust	**143**	55	***38.5%***
Bradford Hospitals NHS Trust	**302**	104	***34.4%***
Pinderfields Hospitals NHS Trust	**152**	52	***34.2%***
Calderdale Healthcare NHS Trust	**165**	56	***33.9%***
Huddersfield Healthcare NHS Trust	**186**	57	***30.6%***
East Yorkshire Hospitals NHS Trust	**93**	27	***29.0%***
Dewsbury Health Care NHS Trust	**140**	36	***25.7%***
Royal Hull Hospitals NHS Trust	**340**	79	***23.2%***
Harrogate Health Care NHS Trust	**92**	16	***17.4%***
Community Trusts	**7**	0	***0.0%***
Others	**19**	5	***26.3%***
Totals	**3278**	1177	***35.9%***

4.5.3. Surgeon Management by NHS Trust

▼ **Proportion of Patients Managed by a Surgeon in each Trust 1986-94**

Trust	N	*n*	Surgeon	*n*	Non-Surgeon
Scunthorpe & Goole Hospitals NHS Trust	**131**	106	***80.9%***	24	***18.3%***
Airedale NHS Trust	**145**	115	***79.3%***	30	***20.7%***
Pinderfields Hospitals NHS Trust	**152**	118	***77.6%***	33	***21.7%***
Scarborough & NE Yorkshire Healthcare NHS Trust	**191**	146	***76.4%***	45	***23.6%***
North East Lincolnshire NHS Trust	**143**	108	***75.5%***	35	***24.5%***
Huddersfield Healthcare NHS Trust	**186**	138	***74.2%***	46	***24.7%***
Dewsbury Health Care NHS Trust	**140**	102	***72.9%***	37	***26.4%***
Harrogate Health Care NHS Trust	**92**	64	***69.6%***	26	***28.3%***
Northallerton Health Services NHS Trust	**64**	44	***68.8%***	20	***31.3%***
East Yorkshire Hospitals NHS Trust	**93**	63	***67.7%***	29	***31.2%***
Royal Hull Hospitals NHS Trust	**340**	229	***67.4%***	110	***32.6%***
Pontefract Hospitals NHS Trust	**136**	89	***65.4%***	47	***34.6%***
York Health Services NHS Trust	**222**	140	***63.1%***	81	***36.5%***
United Leeds Teaching Hospitals NHS Trust	**381**	240	***63.0%***	139	***36.5%***
Bradford Hospitals NHS Trust	**302**	184	***60.9%***	115	***38.1%***
St James's & Seacroft University Hospitals NHS Trust	**369**	202	***54.7%***	166	***45.0%***
Calderdale Healthcare NHS Trust	**165**	90	***54.5%***	75	***45.5%***
Community Trusts	**7**	2	***28.6%***	5	***71.4%***
Others	**19**	10	***52.6%***	9	***47.4%***
Totals	**3278**	2190	***66.8%***	1072	***32.7%***

* Excludes those 16 patients for whom Consultant management data were not available.

Scunthorpe & Goole Hospitals NHS Trust had the highest proportion of patients managed by a surgeon at just over 80%, whereas Calderdale Healthcare NHS Trust had just 54.5% of patients managed by a surgeon. This may be explained by the fact that Calderdale also had one of the highest proportions of patients aged over 80 years of age (29.7%) and a higher proportion of it's patients were therefore managed by a physician in medicine for the elderly (24.8%). The two largest Trusts in terms of overall numbers (United Leeds Teaching Hospitals and St James's & Seacroft University Hospital) also had two of the lowest proportions of patients being managed by a Surgeon at 63% and 54.7% which were both below the regional average (66.8%). The availability of other specialties (for example GI specialist physicians) and services, for example a stent clinic, may be responsible for this lower rate of surgeon managed cases in these hospitals.

POST-OPERATIVE MORTALITY 5

The very high operative morbidity and mortality and extremely poor long term survival 20 to 30 years ago led some authors to suggest that the Whipple procedure should not be performed any longer. (Crile, 1970; Shapiro, 1975 and Gudjonsson, 1987).

However the last 10-15 years has seen a vast improvement in operative mortality after resection with a number of centres reporting rates in the range 2-3% (Crist *et al.*, 1987; Grace *et al.*, 1986 and Braasch *et al.*, 1986). A few large centres have reported series in excess of 100 consecutive patients without a single perioperative death. (Trede *et al.,* 1990; Cameron *et al.*, 1993).

Yeo *et al* (1995) published data for a large series of patients undergoing surgical resection for carcinoma of the pancreas at the John Hopkins Hospital in the US. For all 201 patients the in-hospital mortality was just 5% but they reported that for the last 149 patients that figure dropped to 0.7% representing one patient.

A number of reasons have been put forward to explain this improvement. As most of the data originate from large specialist centres, they strongly suggest that pancreaticoduodenectomies should be performed by surgeons experienced in the procedure. These specialist centres also have better facilities for both pre and post-operative care. There have also been improvements in both anaesthetic and nutritional support.

These reports of improvements in post-operative mortality are mainly from the US. The picture is different in the UK.

Neoptolemos *et al* (1997) published results of a UK survey of specialist pancreatic units and reported on a total of 1026 resections from 21 units and 33 surgeons. There were 58 deaths (6%) in hospital. They concluded that the results from specialist units in the UK compared favourably with those from specialist units outside the UK and are better than those from non-specialist units. Mortality was generally lower in units with a higher caseload.

However, in a much larger epidemiological study, Bramhall *et al* (1995) reported on 13,560 patients from the West Midlands. They found much higher rates of post-operative mortality. For the time period 1977-86 the rate after resection was 27.6% and following bypass was 21.6%.

Millson *et al* (1999) reported on the results of 63 patients undergoing pancreatic surgery over 7 years in a district general hospital setting. They reported a 30-day post-operative mortality of 8% and concluded that although most reviews of outcome after pancreatic surgery recommend referral to a specialist centre for pancreatic surgery, it can be safe to perform pancreatic surgery in the DGH setting, provided suitable expertise and facilities are available.

5.1. 30 DAY POST-OPERATIVE MORTALITY

5.1.1. 30 Day Post-Operative Mortality Rates by Surgical Procedure

▼ **30 Day Post-Operative Mortality: Resections and Non-Resection Surgery 1986-94**

Time Period	N	*n*	R	N	*n*	NRS
1986-88	**41**	5	***12.2%***	**417**	78	***18.7%***
1989-91	**31**	6	***19.4%***	**377**	65	***17.2%***
1992-94	**58**	12	***20.7%***	**260**	44	***16.9%***
Total	**130**	23	***17.7%***	**1054**	187	***17.7%***

Death within 30 days from operation was calculated as the measure of post-operative mortality. Place of death was not reliably available for all patients and so it was not possible to calculate in-hospital mortality.

A total of 130 patients underwent resection (4.0% of the total of 3278) and of these 23 (17.7%) died within 30 days of the procedure. Of the 1054 patients undergoing non-resection surgery (32.2% of the total), 187 died within 30 days, resulting in a rate (17.7 %) identical to that for resection patients. The resection post-operative mortality rate showed a sharp increase of 8.5% between the earliest and latest time period while the rate for non-resection surgery remained fairly constant throughout.

5.1.2. Post-Operative Mortality by Sex, Age, Socio-economic Group & Hospital/Consultant Workload

▼ **Variation in Post-Operative Mortality by Sex, Age, Socio-economic Group & Hospital/ Consultant Workload 1986-94**

Factor		N	*n*	R	N	*n*	NRS	N	*n*	All Surgery
Sex	Male	**72**	19	***26.4%***	**542**	103	***19.0%***	**614**	122	***19.9%***
	Female	**58**	4	***6.9%***	**512**	84	***16.4%***	**570**	88	***15.4%***
Age	<50	**17**	1	***5.9%***	**44**	6	***13.6%***	**61**	7	***11.5%***
	50-64	**58**	7	***12.1%***	**261**	36	***13.8%***	**319**	43	***13.5%***
	65-79	**50**	14	***28.0%***	**596**	110	***18.5%***	**646**	124	***19.2%***
	>80	**5**	1	***20.0%***	**153**	35	***22.9%***	**158**	36	***22.8%***
Socio-economic Group	1-3	**19**	3	***15.8%***	**218**	32	***14.7%***	**237**	35	***14.8%***
	4-7	**80**	14	***17.5%***	**611**	116	***19.0%***	**691**	130	***18.8%***
	8-10	**31**	6	***19.4%***	**225**	39	***17.3%***	**256**	45	***17.6%***
Hospital Workload	=12	**7**	2	***28.6%***	**223**	46	***20.6%***	**230**	48	***20.9%***
	13-16	**48**	9	***18.8%***	**370**	71	***19.2%***	**418**	80	***19.1%***
	17-24	**24**	8	***33.3%***	**268**	45	***16.8%***	**292**	53	***18.2%***
	=25	**51**	4	***7.8%***	**193**	25	***13.0%***	**244**	29	***11.9%***
Consultant Workload	=1	**2**	0	***0.0%***	**54**	11	***20.4%***	**56**	11	***19.6%***
	>1 to =3	**30**	6	***20.0%***	**307**	58	***18.9%***	**337**	64	***19.0%***
	>3 to =5	**29**	7	***24.1%***	**353**	65	***18.4%***	**382**	72	***18.8%***
	>5	**69**	10	***14.5%***	**327**	49	***15.0%***	**396**	59	***14.9%***
	n/a	**0**	0	***0.0%***	**13**	4	***30.8%***	**13**	4	***30.8%***

Post-operative mortality for males was worse than that for females. This difference was considerably greater for the resected cases, where the post-operative mortality rates were 26.4% for males and only 6.9% for females. There were, however, more resections performed in males than there were in females (72 males and 58 females).

Higher rates of post-operative mortality occurred with increasing age. This is perhaps because the younger patients would generally be fitter and more able to withstand the rigours of major abdominal surgery than more elderly patients.

Post-operative mortality tended to be lower in the more affluent socio-economic groups.

The data for workload (both hospital and consultant) show 30 day post-operative mortality for resections and non-resection surgery to be lowest for these hospitals and

consultants with the highest workload categories. These data are consistent with other published studies that have reported similar findings. Sosa *et al* (1998) demonstrated that increased hospital volume was associated with lower hospital mortality rates for resections, palliative bypass and stent procedures. They concluded that patients with pancreatic cancer undergoing surgery appear to benefit from referral to a high volume provider.

5.1.3. Post-Operative Mortality by NHS Trust

▼ **Variation in Post-Operative Mortality by NHS Trust 1986-94**

Trust	N	*n*	All	LCL	UCL
North East Lincolnshire NHS Trust	**60**	16	***27%***	*17%*	*39%*
Huddersfield Healthcare NHS Trust	**75**	19	***25%***	*17%*	*37%*
Airedale NHS Trust	**64**	16	***25%***	*16%*	*37%*
Dewsbury Health Care NHS Trust	**44**	11	***25%***	*14%*	*40%*
Scunthorpe & Goole Hospitals NHS Trust	**62**	15	***24%***	*15%*	*37%*
Calderdale Healthcare NHS Trust	**50**	12	***24%***	*14%*	*38%*
Northallerton Health Services NHS Trust	**25**	6	***24%***	*11%*	*45%*
Scarborough & NE Yorkshire Healthcare NHS Trust	**86**	20	***23%***	*15%*	*34%*
East Yorkshire Hospitals NHS Trust	**26**	6	***23%***	*11%*	*43%*
Pontefract Hospitals NHS Trust	**46**	8	***17%***	*9%*	*31%*
Harrogate Health Care NHS Trust	**38**	6	***16%***	*7%*	*31%*
York Health Services NHS Trust	**71**	10	***14%***	*8%*	*24%*
United Leeds Teaching Hospitals NHS Trust	**100**	14	***14%***	*8%*	*22%*
Royal Hull Hospitals NHS Trust	**123**	16	***13%***	*8%*	*20%*
St James's & Seacroft University Hospitals NHS Trust	**105**	13	***12%***	*7%*	*20%*
Pinderfields Hospitals NHS Trust	**78**	9	***12%***	*6%*	*21%*
Bradford Hospitals NHS Trust	**123**	11	***9%***	*5%*	*16%*

These results which look at the post-operative mortality rate in all surgical patients (resections and non-resections combined) show no statistically significant difference between any single trust and the Yorkshire average (210/1184=17.7%. 95%CI= 15.6 – 20.1). Nevertheless, there is still a substantial three-fold variation between trusts (9% - 27%).

The lack of statistical significance partly depends on the relatively small numbers of patients treated within any single trust. To detect, as significant, a 5% increase on the average Yorkshire post-operative mortality rate would require a single trust to operate on several hundred patients.

REFERRAL 6

Pancreatic cancer is a disease which is usually asymptomatic until it has metastasised, meaning presentation occurs at a late stage in the disease course. Therefore, there is a great urgency in referring, admitting and managing these patients. The following analyses investigate, as far as possible, the time intervals between GP's referral, the first hospital visit and treatment.

6.1. NYCRIS REFERRAL DATA

▼ **Availability of Referral Data in the Study Population 1986-94**

Date Type	Number Available	% Available
Date of GP Referral	1546	***47.2%***
Date of First Hospital Visit	3257	***99.3%***
Date of Surgery – Resection	130	***100.0%***
Date of Surgery - Non-Resection Surgery	1054	***100.0%***

The date of a GP's referral of a pancreatic cancer patient to hospital was only recorded by NYCRIS if that date was explicitly stated in the hospital notes. This information was available in 47.2% of the patient notes. NYCRIS does not routinely collect data from GP notes. A date of first hospital visit relates to initial attendance at the hospital of primary treatment and may not necessarily relate to the hospital of first presentation, where investigations have been performed. However, over 99% of patients had a date of first hospital visit recorded.

The referral data relate to the time 1986-1994 only. As mentioned earlier in the report, the way in which NYCRIS now collects referral information has since been changed. The new computer system installed at the beginning of 1999 (CCRIS2) links together referral dates, treatments, consultants and their hospitals, thereby making analyses of referral data in the future considerably more comprehensive.

6.2. GP REFERRAL TO FIRST HOSPITAL VISIT

6.2.1. Interval by Age Group and Time Period

▼ **Median Interval between GP Referral and First Hospital Visit by Age Group and Time Period**

		N	*Valid n*	Median (days)	Q1 (25%)	Q3 (75%)
Age Groups	<50	**129**	54	***6***	0	19
	50-64	**701**	368	***5***	0	15
	65-79	**1666**	799	***4***	0	14
	>=80	**782**	319	***1***	0	8
Time Period	1986-88	**1094**	585	***1***	0	8
	1989-91	**1109**	553	***3***	0	13
	1992-94	**1075**	402	***7***	3	17

For all pancreatic cancer patients for whom data were available (47%) the median interval between GP Referral and First Hospital Visit was 3 days (75% being seen at hospital within 13 days). There was considerable variation both according to age and time period. In the <50 year old age group the median interval was 6 days and 75% of all patients seen within 19 days. However in the >=80 year old age group the median interval was just 1 day with 75% of patients being seen within 8 days. Similar variation can be seen for time period. In the earliest time period under investigation the median interval was 1 day whereas in the latest time period (1992-94) the median had risen to 1 week.

6.3. First Hospital Visit to Treatment Interval

6.3.1. Interval by Age Group, Time Period & Type of Surgery

For all pancreatic cancer patients, the median interval from the first hospital visit to the the first of either surgery, radiotherapy or chemotherapy, was 13 days.

▼ **Median Interval between First Hospital Visit and First Treatment by Age Group, Time Period & Type of Surgery 1986-94**

		Valid n	Median (days)	Q1 (25%)	Q3 (75%)
Age	<50	73	***21***	7	44
	50-64	338	***15***	7	29
	65-79	662	***12***	6	22
	>=80	156	***11***	6	18
Time Period	1986-88	462	***11***	6	21
	1989-91	425	***11***	6	21
	1992-94	342	***18***	10	35
Surgery Type	Resection	125	***17***	7	32
	Non-resection surgery	1045	***12***	6	22

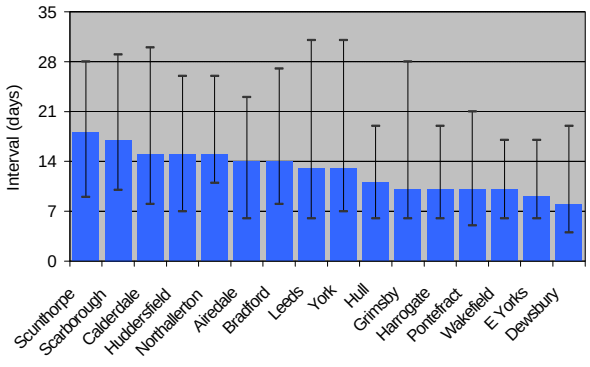
A similar pattern of variation as shown in section 6.2 was also seen for the interval between first hospital visit and treatment. The younger patients (up to 64 years of age) had a much longer median interval than the elderly patients (21 days versus 11 days). A relationship between the interval and type of treatment may be responsible for this variation. In Section 4.3.2 we found much higher rates of treatment, especially resections and non-resection surgery in the younger age group. It is possible that more diagnostic investigations were performed in this group of patients to assess their suitability for surgery, thus increasing the interval between hospital visit and treatment. This is supported by the long median intervals for both resection and non-resection surgery (17 and 12 days to treatment respectively).

6.3.2. Interval by District of Residence

Before interpreting the district data, is it recommended that the reader refers to the paragraph in Chapter 4 regarding patients residing on the border of the region.

▼ **Median & Quartile Intervals (by District of Residence) from First Hospital Visit to Treatment 1986-94**

District	*Valid n*	Median (days)	Q1 25%	Q3 75%
Scunthorpe	81	***18***	9	28
Scarborough	71	***17***	10	29
Calderdale	59	***15***	8	30
Huddersfield	76	***15***	7	26
Northallerton	28	***15***	11	26
Airedale	89	***14***	6	23
Bradford	122	***14***	8	27
Leeds	180	***13***	6	31
York	76	***13***	7	31
Hull	106	***11***	6	19
Grimsby	64	***10***	6	28
Harrogate	44	***10***	6	19
Pontefract	55	***10***	5	21
Wakefield	70	***10***	6	17
East Yorkshire	66	***9***	6	17
Dewsbury	42	***8***	4	19
Totals	1227	***13***	7	25



Median intervals from the first hospital visit date to the date of first treatment ranged from 8 to 18 days between the districts of residence.

7 TRUST SUMMARIES

The following section summarises some of the patient characteristics and policies regarding the management of pancreatic cancer patients by individual NHS Trust. For each patient, the managing NHS Trust was defined as that which currently covers the main managing hospital i.e. where the primary surgical procedure was performed.

The following tables have been included in the report to enable the casemix of patients and their management at each Trust to be summarised and compared.

▼ United Leeds Teaching Hospitals NHS Trust (N=381)

Factor	1986-94	*n*	%
Sex	M	169	***44.4%***
	F	212	***55.6%***
Age	<50	14	***3.7%***
	50-64	98	***25.7%***
	65-79	188	***49.3%***
	>80	81	***21.3%***
Histologically Confirmed		147	***38.6%***
Specialty	Surgeon	240	***63.0%***
	Medicine	107	***28.1%***
	Geriatrics	23	***6.0%***
	Other	11	***2.9%***
Consultant Workload	=1	106	***27.8%***
	>1 to =3	49	***12.9%***
	>3 to =5	86	***22.6%***
	>5	138	***36.2%***
	n/a	2	***0.5%***
Treatment	Resection	19	***5.0%***
	NRS	81	***21.3%***
	C/RT	10	***2.6%***
	None	271	***71.1%***
30 Day Post-Op Mortality	Resection	2/19	***10.5%***
	NRS	12/81	***14.8%***
Referral Interval	Hospital - trt	109	***17 days***

▼ St James's & Seacroft University Hospitals NHS Trust (N=369)

Factor	1986-94	*n*	%
Sex	M	159	***43.1%***
	F	210	***56.9%***
Age	<50	19	***5.1%***
	50-64	83	***22.5%***
	65-79	176	***47.7%***
	>80	91	***24.7%***
Histologically Confirmed		155	***42.0%***
Specialty	Surgeon	202	***54.7%***
	Medicine	118	***32.0%***
	Geriatrics	40	***10.8%***
	Other	9	***2.5%***
Consultant Workload	=1	87	***23.6%***
	>1 to =3	50	***13.6%***
	>3 to =5	51	***13.8%***
	>5	180	***48.8%***
	n/a	1	***0.3%***
Treatment	Resection	39	***10.6%***
	Nrs	66	***17.9%***
	C/RT	9	***2.4%***
	None	255	***69.1%***
30 Day Post-Op Mortality	Resection	3/39	***7.7%***
	NRS	10/66	***15.2%***
Referral Interval	Hospital - trt	109	***13 days***

▼ Royal Hull Hospitals NHS Trust (N=340)

Factor	1986-94	*n*	%
Sex	M	163	***47.9%***
	F	177	***52.1%***
Age	<50	17	***5.0%***
	50-64	64	***18.8%***
	65-79	180	***52.9%***
	>80	79	***23.2%***
Histologically Confirmed		79	***23.2%***
Specialty	Surgeon	229	***67.4%***
	Medicine	59	***17.4%***
	Geriatrics	48	***14.1%***
	Other	4	***1.2%***
Consultant Workload	=1	83	***24.4%***
	>1 to =3	116	***34.1%***
	>3 to =5	9	***2.6%***
	>5	131	***38.5%***
	N/a	1	***0.3%***
Treatment	Resection	4	***1.2%***
	NRS	119	***35.0%***
	C/RT	2	***0.6%***
	None	215	***63.2%***
30 Day Post-Op Mortality	Resection	1/4	***25.0%***
	NRS	15/119	***12.6%***
Referral Interval	Hospital - trt	125	***9 days***

▼ Bradford Hospitals NHS Trust (N=302)

Factor	1986-94	*n*	%
Sex	M	149	***49.3%***
	F	153	***50.7%***
Age	<50	8	***2.6%***
	50-64	75	***24.8%***
	65-79	147	***48.7%***
	>80	72	***23.8%***
Histologically Confirmed		104	***34.4%***
Specialty	Surgeon	184	***60.9%***
	Medicine	37	***12.3%***
	Geriatrics	48	***15.9%***
	Other	33	***10.9%***
Consultant Workload	=1	68	***22.5%***
	>1 to =3	82	***27.2%***
	>3 to =5	85	***28.1%***
	>5	64	***21.2%***
	n/a	3	***1.0%***
Treatment	Resection	14	***4.6%***
	NRS	109	***36.1%***
	C/RT	3	***1.0%***
	None	176	***58.3%***
30 Day Post-Op Mortality	Resection	1/14	***7.1%***
	NRS	10/109	***9.2%***
Referral Interval	Hospital - trt	126	***14 days***

▼ York Health Services NHS Trust (N=222)

Factor	1986-94	*n*	%
Sex	M	109	***49.1%***
	F	113	***50.9%***
Age	<50	7	***3.2%***
	50-64	39	***17.6%***
	65-79	112	***50.5%***
	>80	64	***28.8%***
Histologically Confirmed		96	***43.2%***
Specialty	Surgeon	140	***63.1%***
	Medicine	49	***22.1%***
	Geriatrics	30	***13.5%***
	Other	3	***1.4%***
Consultant Workload	=1	34	***15.3%***
	>1 to =3	47	***21.2%***
	>3 to =5	139	***62.6%***
	>5	1	***0.5%***
	n/a	1	***0.5%***
Treatment	Resection	1	***0.5%***
	NRS	70	***31.5%***
	C/RT	3	***1.4%***
	None	148	***66.7%***
30 Day Post-Op Mortality	Resection	1/1	***100.0%***
	NRS	9/70	***12.9%***
Referral Interval	Hospital - trt	73	***11 days***

▼ Scarborough & NE Yorkshire Healthcare NHS Trust (N=191)

Factor	1986-94	*n*	%
Sex	M	91	***47.6%***
	F	100	***52.4%***
Age	<50	4	***2.1%***
	50-64	39	***20.4%***
	65-79	96	***50.3%***
	>80	52	***27.2%***
Histologically Confirmed		86	***45.0%***
Specialty	Surgeon	146	***76.4%***
	Medicine	21	***11.0%***
	Geriatrics	24	***12.6%***
	Other	0	***0.0%***
Consultant Workload	=1	39	***20.4%***
	>1 to =3	40	***20.9%***
	>3 to =5	36	***18.8%***
	>5	76	***39.8%***
	n/a	0	***0.0%***
Treatment	Resection	10	***5.2%***
	NRS	76	***39.8%***
	C/RT	1	***0.5%***
	None	104	***54.5%***
30 Day Post-Op Mortality	Resection	3/10	***30.0%***
	NRS	17/76	***22.4%***
Referral Interval	Hospital - trt	87	***17 days***

▼ Huddersfield Healthcare NHS Trust (N=186)

Factor	1986-94	*n*	%
Sex	M	96	***51.6%***
	F	90	***48.4%***
Age	<50	3	***1.6%***
	50-64	45	***24.2%***
	65-79	99	***53.2%***
	>80	39	***21.0%***
Histologically Confirmed		57	***30.6%***
Specialty	Surgeon	138	***74.2%***
	Medicine	18	***9.7%***
	Geriatrics	27	***14.5%***
	Other	3	***1.6%***
Consultant Workload	=1	28	***15.1%***
	>1 to =3	89	***47.8%***
	>3 to =5	0	***0.0%***
	>5	67	***36.0%***
	n/a	2	***1.1%***
Treatment	Resection	6	***3.2%***
	NRS	69	***37.1%***
	C/RT	0	***0.0%***
	None	111	***59.7%***
30 Day Post-Op Mortality	Resection	3/6	***50.0%***
	NRS	16/69	***23.2%***
Referral Interval	Hospital - trt	75	***14 days***

▼ Calderdale Healthcare NHS Trust (N=165)

Factor	1986-94	*n*	%
Sex	M	64	***38.8%***
	F	101	***61.2%***
Age	<50	7	***4.2%***
	50-64	19	***11.5%***
	65-79	90	***54.5%***
	>80	49	***29.7%***
Histologically Confirmed		56	***33.9%***
Specialty	Surgeon	90	***54.5%***
	Medicine	31	***18.8%***
	Geriatrics	41	***24.8%***
	Other	3	***1.8%***
Consultant Workload	=1	43	***26.1%***
	>1 to =3	78	***47.3%***
	>3 to =5	44	***26.7%***
	>5	0	***0.0%***
	n/a	0	***0.0%***
Treatment	Resection	3	***1.8%***
	Nrs	47	***28.5%***
	C/RT	7	***4.2%***
	None	108	***65.5%***
30 Day Post-Op Mortality	Resection	1/3	***33.3%***
	NRS	11/47	***23.4%***
Referral Interval	Hospital - trt	54	***14 days***

▼ Pinderfields Hospitals NHS Trust (N=152)

Factor	1986-94	*n*	%
Sex	M	81	***53.3%***
	F	71	***46.7%***
Age	<50	8	***5.3%***
	50-64	36	***23.7%***
	65-79	82	***53.9%***
	>80	26	***17.1%***
Histologically Confirmed		52	***34.2%***
Specialty	Surgeon	118	***77.6%***
	Medicine	14	***9.2%***
	Geriatrics	17	***11.2%***
	Other	3	***2.0%***
Consultant Workload	=1	33	***21.7%***
	>1 to =3	29	***19.1%***
	>3 to =5	4	***2.6%***
	>5	85	***55.9%***
	n/a	1	***0.7%***
Treatment	Resection	1	***0.7%***
	NRS	77	***50.7%***
	C/RT	1	***0.7%***
	None	73	***48.0%***
30 Day Post-Op Mortality	Resection	0/1	***0.0%***
	NRS	9/77	***11.7%***
Referral Interval	Hospital - trt	79	***10 days***

▼ Airedale NHS Trust (N=145)

Factor	1986-94	*n*	%
Sex	M	64	***44.1%***
	F	81	***55.9%***
Age	<50	4	***2.8%***
	50-64	28	***19.3%***
	65-79	82	***56.6%***
	>80	31	***21.4%***
Histologically Confirmed		75	***51.7%***
Specialty	Surgeon	115	***79.3%***
	Medicine	14	***9.7%***
	Geriatrics	12	***8.3%***
	Other	4	***2.8%***
Consultant Workload	=1	49	***33.8%***
	>1 to =3	3	***2.1%***
	>3 to =5	42	***29.0%***
	>5	51	***35.2%***
	n/a	0	***0.0%***
Treatment	Resection	15	***10.3%***
	NRS	49	***33.8%***
	C/RT	6	***4.1%***
	None	75	***51.7%***
30 Day Post-Op Mortality	Resection	5/15	***33.3%***
	NRS	11/49	***22.4%***
Referral Interval	Hospital - trt	70	***15 days***

▼ NE Lincolnshire NHS Trust (N=143)

Factor	1986-94	*n*	%
Sex	M	76	***53.1%***
	F	67	***46.9%***
Age	<50	12	***8.4%***
	50-64	39	***27.3%***
	65-79	75	***52.4%***
	>80	17	***11.9%***
Histologically Confirmed		55	***38.5%***
Specialty	Surgeon	108	***75.5%***
	Medicine	17	***11.9%***
	Geriatrics	18	***12.6%***
	Other	0	***0.0%***
Consultant Workload	=1	25	***17.5%***
	>1 to =3	52	***36.4%***
	>3 to =5	66	***46.2%***
	>5	0	***0.0%***
	n/a	0	***0.0%***
Treatment	Resection	3	***2.1%***
	NRS	57	***39.9%***
	C/RT	4	***2.8%***
	None	79	***55.2%***
30 Day Post-Op	Resection	1/3	***33.3%***
Mortality	NRS	15/57	***26.3%***
Referral Interval	Hospital - trt	64	***10 days***

▼ Dewsbury Health Care NHS Trust (N=140)

Factor	1986-94	*n*	%
Sex	M	66	***47.1%***
	F	74	***52.9%***
Age	<50	6	***4.3%***
	50-64	29	***20.7%***
	65-79	65	***46.4%***
	>80	40	***28.6%***
Histologically Confirmed		36	***25.7%***
Specialty	Surgeon	102	***72.9%***
	Medicine	12	***8.6%***
	Geriatrics	24	***17.1%***
	Other	2	***1.4%***
Consultant Workload	=1	39	***27.9%***
	>1 to =3	52	***37.1%***
	>3 to =5	48	***34.3%***
	>5	0	***0.0%***
	n/a	1	***0.7%***
Treatment	Resection	6	***4.3%***
	NRS	38	***27.1%***
	C/RT	0	***0.0%***
	None	96	***68.6%***
30 Day Post-Op	Resection	2/6	***33.3%***
Mortality	NRS	9/38	***23.7%***
Referral Interval	Hospital - trt	44	***8 days***

▼ Pontefract Hospitals NHS Trust (N=136)

Factor	1986-94	*n*	%
Sex	M	63	***46.3%***
	F	73	***53.7%***
Age	<50	5	***3.7%***
	50-64	27	***19.9%***
	65-79	69	***50.7%***
	>80	35	***25.7%***
Histologically Confirmed		54	***39.7%***
Specialty	Surgeon	89	***65.4%***
	Medicine	15	***11.0%***
	Geriatrics	30	***22.1%***
	Other	2	***1.5%***
Consultant Workload	=1	10	***7.4%***
	>1 to =3	93	***68.4%***
	>3 to =5	33	***24.3%***
	>5	0	***0.0%***
	n/a	0	***0.0%***
Treatment	Resection	3	***2.2%***
	NRS	46	***31.6%***
	C/RT	1	***0.7%***
	None	89	***65.4%***
30 Day Post-Op	Resection	0/3	***0.0%***
Mortality	NRS	8/43	***18.6%***
Referral Interval	Hospital - trt	47	***11 days***

▼ Scunthorpe & Goole Hospitals NHS Trust (N=131)

Factor	1986-94	*n*	%
Sex	M	67	***51.1%***
	F	64	***48.9%***
Age	<50	7	***5.3%***
	50-64	39	***29.8%***
	65-79	62	***47.3%***
	>80	23	***17.6%***
Histologically Confirmed		52	***39.7%***
Specialty	Surgeon	106	***80.9%***
	Medicine	7	***5.3%***
	Geriatrics	16	***12.2%***
	Other	2	***1.6%***
Consultant Workload	=1	18	***13.7%***
	>1 to =3	79	***60.3%***
	>3 to =5	33	***25.2%***
	>5	0	***0.0%***
	n/a	1	***0.8%***
Treatment	Resection	3	***2.3%***
	NRS	59	***45.0%***
	C/RT	6	***4.6%***
	None	63	***48.1%***
30 Day Post-Op	Resection	0/3	***0.0%***
Mortality	NRS	15/59	***25.4%***
Referral interval	Hospital - trt	67	***18 days***

▼ East Yorkshire Hospitals NHS Trust (N=93)

Factor	1986-94	*N*	%
Sex	M	43	***46.2%***
	F	50	***53.8%***
Age	<50	3	***3.2%***
	50-64	13	***14.0%***
	65-79	51	***54.8%***
	>80	26	***28.0%***
Histologically Confirmed		27	***29.0%***
Specialty	Surgeon	63	***67.7%***
	Medicine	17	***18.3%***
	Geriatrics	11	***11.8%***
	Other	2	***2.2%***
Consultant Workload	=1	27	***29.0%***
	>1 to =3	40	***43.0%***
	>3 to =5	20	***21.5%***
	>5	5	***5.4%***
	n/a	1	***1.1%***
Treatment	Resection	2	***2.2%***
	NRS	24	***25.8%***
	C/RT	2	***2.2%***
	None	65	***69.9%***
30 Day Post-Op	Resection	0/2	***0.0%***
Mortality	NRS	6/24	***25.0%***
Referral Interval	Hospital - trt	28	***14 days***

▼ Harrogate Health Care NHS Trust (N=92)

Factor	1986-94	*n*	%
Sex	M	42	***45.7%***
	F	50	***54.3%***
Age	<50	1	***1.1%***
	50-64	14	***15.2%***
	65-79	47	***51.1%***
	>80	30	***32.6%***
Histologically Confirmed		16	***17.4%***
Specialty	Surgeon	64	***69.6%***
	Medicine	9	***9.8%***
	Geriatrics	15	***16.3%***
	Other	4	***4.4%***
Consultant Workload	=1	19	***20.7%***
	>1 to =3	42	***45.7%***
	>3 to =5	29	***31.5%***
	>5	0	***0.0%***
	n/a	2	***2.2%***
Treatment	Resection	0	***0.0%***
	NRS	38	***41.3%***
	C/RT	0	***0.0%***
	None	54	***58.7%***
30 day Post-Op	Resection	-	-
Mortality	NRS	6/38	***15.8%***
Referral interval	Hospital - trt	37	***10 days***

▼ **Northallerton Health Services NHS Trust (N=64)**

Factor	**1986-94**	*n*	**%**
Sex	M	34	***53.1%***
	F	30	***46.9%***
Age	<50	3	***4.7%***
	50-64	12	***18.8%***
	65-79	34	***53.1%***
	>80	15	***23.4%***
Histologically Confirmed		25	***39.1%***
Specialty	Surgeon	44	***68.8%***
	Medicine	19	***29.7%***
	Geriatrics	0	***0.0%***
	Other	1	***1.6%***
Consultant Workload	=1	24	***37.5%***
	>1 to =3	39	***60.9%***
	>3 to =5	1	***1.6%***
	>5	0	***0.0%***
	n/a	0	***0.0%***
Treatment	Resection	1	***1.6%***
	NRS	24	***37.5%***
	C/RT	2	***3.1%***
	None	37	***57.8%***
30 Day Post-Op Mortality	Resection	0/1	***0.0%***
	NRS	6/24	***25.0%***
Referral Interval	Hospital - trt	27	***15 days***

8 SURVIVAL

Pancreatic cancer is associated with the worst prognosis of any common tumour. Figures from the Eurocare study, based on diagnoses in the period 1985-89, gave an average observed survival in Europe of 15% at one year and 3% at five years. In England, these figures were 12% and 2% respectively (Berrino *et al*, 1999).

Resection provides the only hope of long-term survival even though 5 year survival rates for resected patients with adenocarcinoma in the head of the pancreas managed by pancreaticoduodenectomy have historically rarely exceeded 5% (Herter *et al.,* 1982; van Heerden *et a.l*, 1981 and Warren *et al.*, 1983). As already discussed in Chapter 5, some authors have suggested that the Whipple procedure for pancreatic resection should be abandoned due to the very high post-op mortality and poor survival rate. (Crile, 1970 and Shapiro, 1975).

Some recent studies have, however, suggested an improved survival for patients after pancreaticoduodenectomy. Rates of around 20% have been reported by a number of different groups (Crist *et al.,* 1987; Braasch *et al.*, 1986; and Trede *et al.*, 1990).

Yeo *et al* (1995) published the results from John Hopkins Hospital of 201 patients treated with surgical resection and showed an actuarial 5-year survival rate of 21%, with a median survival of 15.5 months. They also showed improved survival for the later time periods with the 3-year actuarial survival of 14% in the 1970's, 21% in the 1980's and 36% in the 1990's.

It is important to note that the improvements in survival following surgical resection have mainly been reported from large single centre institutions with a specialist interest in pancreatic surgery.

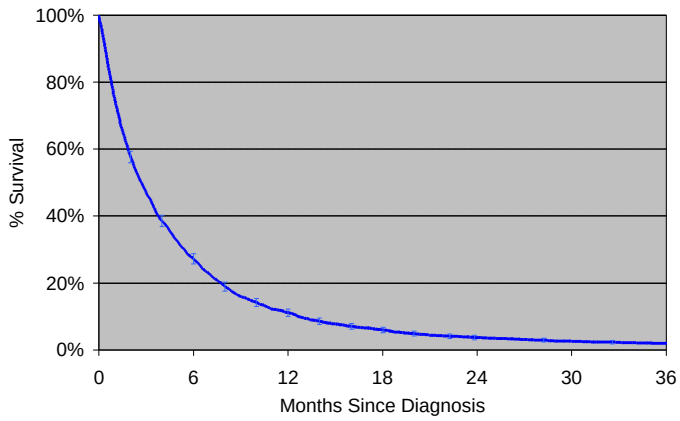
In the UK, the West Midlands epidemiological study (Bramhall *et al.*, 1986) which analysed 13,560 patients across 30 years showed very different results. For the time period 1977-86 the five-year actuarial survival for patients receiving a surgical resection was just 9.6%. This however was a significant improvement for the same treatment modality for the time period 1957-76 which was just 2.6%.

The following analyses look at survival according to single factors. They do not allow for variation in the other casemix factors such as age. Chapter 9 contains a more detailed multivariate survival analysis, with adjustment for all the available casemix and management factors. Statistical methodologies used for the survival analyses in this report are given in the appendix (Chapter 10).

8.1. OVERALL SURVIVAL

Survival from pancreatic cancer was extremely poor, with only 11% of patients alive after one year. This figure declined to 4% at two years and 2% at three years.

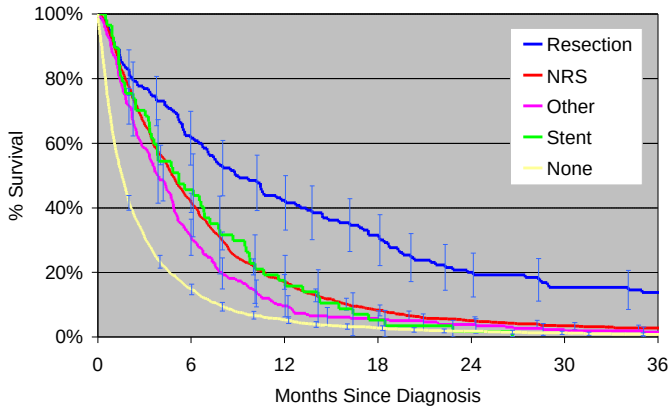
▼ **Overall Survival of Pancreatic Cancer Patients 1986-94**



8.2. SURVIVAL BY INDIVIDUAL FACTORS

8.2.1. Survival by Treatment

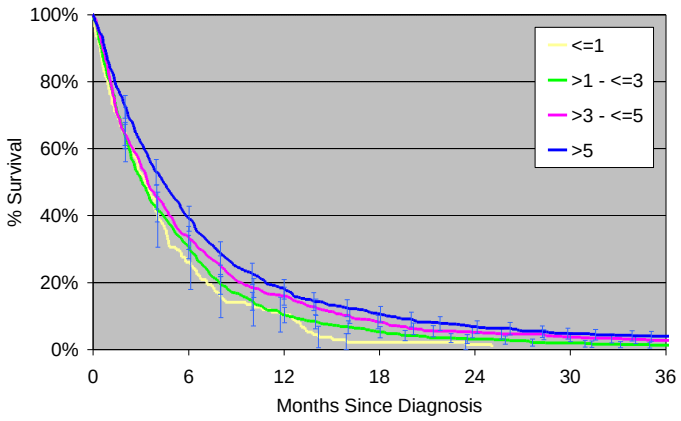
▼ **Survival of Pancreatic Cancer Patients by Treatment Modality 1986-94**



Surgical resection (Whipples operation) remains the only potentially curative treatment for pancreatic cancer. 42% of resected patients were alive at one year and 20% at two years. This compares with 17% of palliative surgical patients at one year. Only 5% of all non-resection patients survived to two years. Only a small minority of patients (4%) are selected for resection and these tend to be the younger and fitter patients with less advanced disease. As far as these data permit, casemix adjustment has been conducted in the multivariate analyses in Section 9.1. Recent trends in anaesthetics, intensive post-operative care and high dependency units mean that increasingly older patients can now be considered for resection in specialist centres.

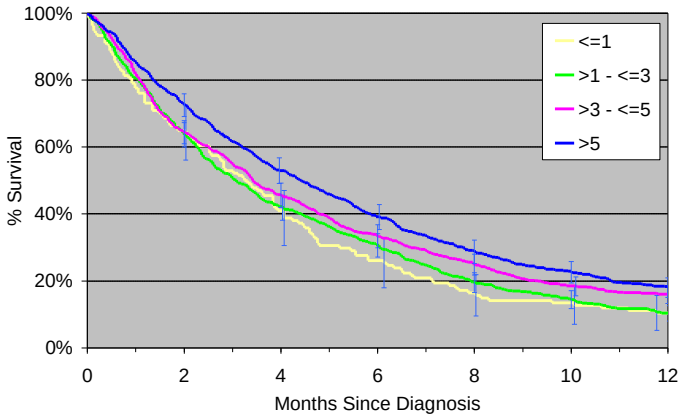
8.2.2. Survival by Consultant Workload

▼ **Survival by Consultant Workload Category (Surgeon managed cases only) 1986-94**



There is a relationship between the workload for pancreatic cancer and survival outcome. Although differences between the workload categories were relatively small, there was a noticeable effect of improved outcomes associated with higher workload surgeons.

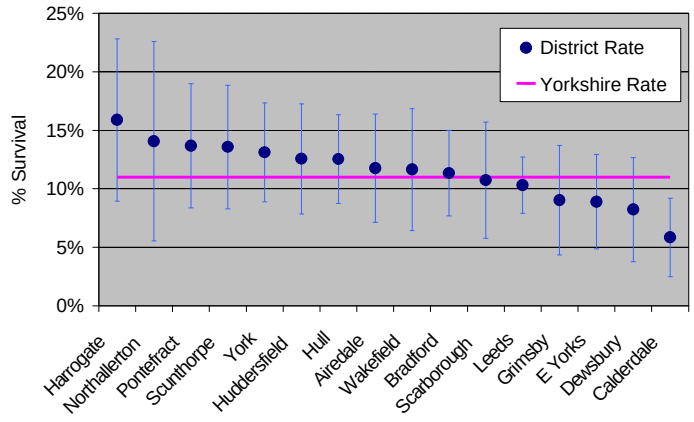
▼ **1-year Survival by Consultant Workload Category (Surgeon managed cases only) 1986-94**



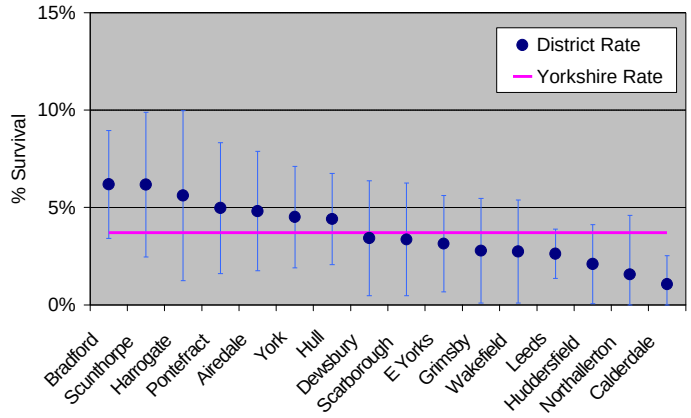
The effect noted above is most marked if particular attention is paid to outcomes in the 12 months after diagnosis. Surgeons managing more than five surgical patients per year showed improved outcomes over the entire 12 month period after diagnosis even in the context of the overall dismal prognosis.

8.2.3. Survival by District of Residence

▼ **1-year Survival by District of Residence 1986-94**



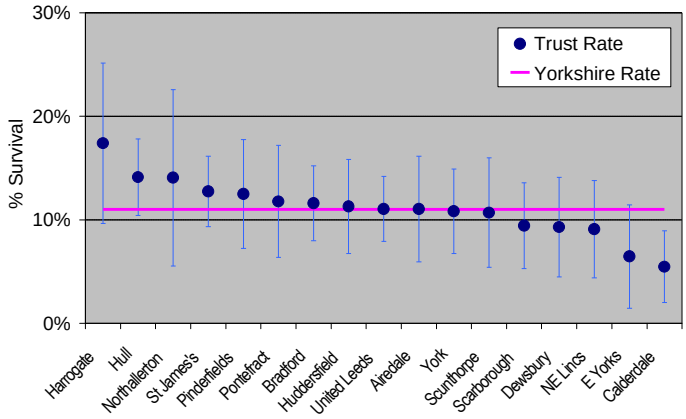
▼ **2-Year Survival by District of Residence 1986-94**



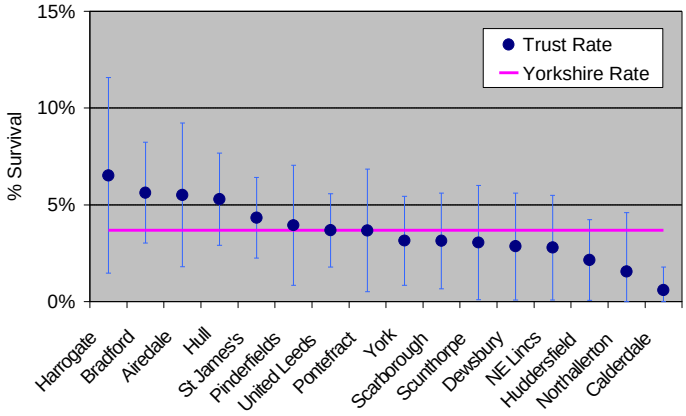
There was relatively little variation in survival between District of Residence although residents of one District (Calderdale) had a significantly worse outcome than the Yorkshire regional rates at both one and two years. In general survival varied by +/- 3% at one year and +/- 2% at two years compared with the Yorkshire rate.

8.2.4. Survival by NHS Trust

▼ **1-Year Survival by NHS Trust 1986-94**



▼ **2-Year Survival by NHS Trust 1986-94**



The patterns of variation in survival by NHS Trust broadly mirrored those by District of Residence shown above. Only one Trust showed significantly worse survival than the Yorkshire Regional rates.

9 MULTI-VARIATE ANALYSIS

9.1. RELATIVE RISK

The survival analyses shown in Chapter 8 did not account for any differences in patient casemix. Limited casemix information was available within the NYCRIS dataset and it was not, therefore, possible to allow for certain known prognostic factors, such as performance status and stage, within the multivariate analysis of survival presented in this chapter. It is recognised that studies such as this can never fully account for differences in the distribution of unknown casemix factors. Despite this we have adjusted for important factors such as sex, age, socio-economic status and management variation. The results show interesting survival trends which are worthy of discussion. A brief outline of the statistical methodologies employed in this section and how the relative risk tables are interpreted, is given in the appendix (Chapter 10).

Factors			Relative Risk					
	N = 3278	N	Factors Alone		Casemix Adjusted		All Factors Together	
Casemix								
Sex	Male	**1546**	*1.00*		*1.00*		*1.00*	
	Female	**1732**	1.03	(0.96 - 1.11)	0.98	(0.91 - 1.05)	0.94	(0.88 - 1.01)
Age (yrs)	<60	**516**	*1.00*		*1.00*		*1.00*	
	60-75	**1525**	1.13	(1.02 - 1.26)	1.13	(1.02 - 1.26)	1.07	(0.96 - 1.19)
	75+	**1237**	1.60	(1.43 - 1.78)	1.61	(1.45 - 1.79)	1.27	(1.13 - 1.42)
Socio-economic Profile	1 - 3	**643**	*1.00*		*1.00*		*1.00*	
	4 - 7	**1868**	1.04	(0.95 - 1.14)	1.05	(0.96 - 1.15)	1.05	(0.96 - 1.15)
	8 - 10	**767**	1.13	(1.02 - 1.26)	1.17	(1.05 - 1.30)	1.12	(1.00 - 1.24)
Period	1986-88	**1094**	*1.00*		*1.00*		*1.00*	
	1989-91	**1109**	0.98	(0.90 - 1.07)	0.97	(0.90 - 1.06)	0.96	(0.88 - 1.05)
	1992-94	**1075**	0.96	(0.88 - 1.05)	0.96	(0.88 - 1.05)	0.91	(0.83 - 0.99)
Hospital Factors								
Treatment	Resection	**130**	0.29	(0.24-0.35)	0.33	(0.27 - 0.40)	0.37	(0.31 - 0.46)
	Non-resection	**1054**	0.50	(0.46-0.54)	0.51	(0.47 - 0.55)	0.57	(0.53 - 0.63)
	Stent	**259**	0.61	(0.54-0.70)	0.62	(0.55 - 0.71)	0.66	(0.58 - 0.76)
	Other	**57**	0.52	(0.40-0.67)	0.59	(0.45 - 0.77)	0.60	(0.46 - 0.78)
	None	**1778**	*1.00*		*1.00*		*1.00*	
Workload Factors								
Hospital Workload	0-12	**721**	*1.00*		*1.00*		*1.00*	
	13-16	**1072**	0.94	(0.86 - 1.04)	0.98	(0.89 - 1.08)	1.07	(0.97 - 1.18)
	17-24	**694**	0.87	(0.79 - 0.97)	0.93	(0.84 - 1.04)	1.04	(0.93 - 1.16)
	=25	**791**	0.82	(0.74 - 0.91)	0.87	(0.78 - 0.96)	0.97	(0.87 - 1.08)
Consultant Workload	=1	**745**	*1.00*		*1.00*		*1.00*	
	>1-=3	**982**	0.72	(0.66 - 0.79)	0.74	(0.67 - 0.81)	0.87	(0.79 - 0.97)
	>3-=5	**733**	0.56	(0.51 - 0.62)	0.59	(0.53 - 0.65)	0.79	(0.69 - 0.90)
	>5	**802**	0.52	(0.47 - 0.57)	0.55	(0.50 - 0.61)	0.74	(0.66 - 0.84)
Specialty	Surgeon	**2190**	*1.00*		*1.00*		*1.00*	
	Physician	**565**	1.66	(1.51 - 1.83)	1.66	(1.51 - 1.82)	1.14	(1.02 - 1.28)
	Medicine for the Elderly	**435**	2.25	(2.02 - 2.49)	1.97	(1.76 - 2.21)	1.24	(1.08 - 1.43)
	Other	**72**	1.43	(1.13 - 1.79)	1.39	(1.10 - 1.74)	0.88	(0.69 - 1.12)

Univariate analyses (shown in the first results column, headed "Factors Alone") shows that, whereas neither sex or time period influenced survival, there was a significant effect of socio-economic profile and age, with an improved outcome in the more affluent groups and the under 60's. Not surprisingly, survival was also significantly improved among the resected patients (in comparison with other treated groups or with untreated patients) and among patients treated by surgeons (in comparison with those managed by physicians or other specialties). There were also significant workload effects with a benefit among patients managed by high volume consultants & in high volume hospitals.

Adjustment of these analyses for the four "casemix" variables (sex, age, socio-economic profile and time period) did not substantively modify any of the above findings (shown in second results column, headed "Casemix Adjusted") although there was now a significant adverse effect on survival for patients from less affluent backgrounds. Mutual

adjustment for all of the considered factors (in third results column, headed "All Factors Together") did not have any additional impact on the results except that the hospital volume effect became negligible. It would thus seem that the hospital workload effect, seen in univariate analyses, is largely explained by a combination of casemix, differences in treatment received, and a consultant workload effect. The latter remained significant in the fully adjusted model and showed an incremental improvement in survival with each workload category, patients being managed by consultants treating five or more pancreatic cancer patients a year having a relative risk of 0.74 (0.66-0.84).

Restriction of the above analyses to consider only patients managed by surgeons or only treated patients or only treated patients managed by surgeons showed essentially the same results (results not shown). In particular, there remained a significant benefit of increased consultant workload with treated patients being managed by surgeons treating five or more pancreatic patients a year having a relative risk of 0.76 (0.59-0.98).

APPENDIX 10

10.1. REFERENCES

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10.2. DATA AND METHODS

10.2.1. Data Quality

A substantial part of this project was concerned with the measurement and improvement of NYCRIS data quality. This work consisted of two main strands - systematic data cleaning and a quality assurance exercise.

Data cleaning involved systematically checking all the pancreatic data against pre-defined rules, to identify records that fail. Cases that failed these pre-defined checks were reviewed and resolved appropriately by experienced registration personnel. The checks were wide ranging and tested for example, for any inappropriate values and non-sensible combinations of hospital, consultant, tumour, treatment and referral data.

10.2.2. Overview of Study Dataset

Data held by the Northern and Yorkshire Cancer Registry and Information Service (NYCRIS) relate to the population of the former Yorkshire Regional Health Authority, a socially diverse yet relatively stable population of 3.6 million. In total, approximately 17,500 new malignant cancer patients are registered annually within this region, the details being extracted from hospital clinical notes by trained cancer registration staff.

▼ **Availability of Relevant Data Items**

Data Type	Available	Not Available
Patient	Age	Symptoms
	Sex	
	District of residence	
	Socio-economic status	
	Year of diagnosis	
	Date of birth & death	
Tumour	Site of Tumour	TNM Staging
	Histology of tumour	
	Grade of tumour	
	Lymph node involvement & metastases	
Management	Managing consultant & speciality	Consultants providing opinion only
	Managing hospital & trust	Investigations
	Radiotherapy hospital	
	Date of first hospital visit	
Treatment	Definitive surgical procedures	Use of Stents (but obtained from paper records)
	Radiotherapy (both radical & palliative)	Radiotherapy intent
	Chemotherapy (both radical & palliative)	Drugs used & dosage
	Dates of treatment	Other palliative care
Referral	Date of first hospital visit	Presentation Pathway- GP/Acute/Other
	Dates of Surgery, RT, Chemotherapy	Chronological referral pathway
Outcome	Survival	Palliation
	Post-operative mortality	Quality of Life

Extra-regional Management : Information was collected on all patients managed within the Yorkshire region, regardless of the place of treatment. For cases managed outside of the region, however, details of treatment were not generally available and consequently such patients were excluded, having a particular effect on the results presented for districts close to the border of the region (for example, Northallerton).

Managing Hospital/Consultant : The hospital of primary management (whether this be a teaching hospital or a district general hospital) was available for all patients, as was information about attendance at a radiotherapy centre. Details were not, however, recorded of referral for a specialist assessment at a centre, where management of the patient was not formally transferred.

Nature of Surgery : For the period covered by this study (1986-94), only definitive surgery given within nine weeks of the first treatment episode was routinely recorded. The use of palliative stents was not routinely recorded.

Chemotherapy : The use of chemotherapy within the first nine weeks of treatment was routinely recorded. Details or drugs used and dosage were not available.

Radiotherapy: The use of radiotherapy within the first nine weeks of treatment was routinely recorded. The intent, whether it was to treat the tumour radically or to palliate the patient was not available.

10.2.3. Statistical Methods

Definitions

For the purposes of this report, the region studied was that covered by the former Yorkshire Regional Health Authority, and District refers to the district of residence, and corresponds to the District Health Authority of the period. Statistics are provided for patients who were resident within the Yorkshire Health region at the time of diagnosis and treated within the region.

All populations referred to in the methodology are the ONS mid-year population estimates based on the 1981 or 1991 censuses.

Registrations and Deaths

A registration is any new case of primary invasive cancer, identified by the Northern and Yorkshire Cancer Registry, arising in the population under study. The incidence rate gives the annual number of new patients registered with an invasive tumour per 100,000 population.

Age-Standardised Rate

Age-standardised registration rates (ASRs) have been computed where the comparison of incidence between groups was of interest. This rate enables such comparisons to be made allowing for differences in their population structures, and is equivalent to the rate that would be seen if the standard population were subject to the same rates as that of the group. ASRs have been standardised against the European standard population.

To obtain the observed annual rate by five-year age groups for each area, the total number of registrations in the time period was divided by the area population for that period.

The ASR was then calculated by multiplying the Standard population for the five-year period by the observed rate, within each age group.

The result was summed to give a rate per 100,000 population. This is known as the direct method of age standardisation.

The charts show the ASR as a dot, with the 95% Confidence Interval for the ASR as an error line around it. The Yorkshire rate is shown as a double line, the middle representing the rate and the line thickness depicting the confidence interval.

Survival

Survival times were calculated from date of diagnosis (taken as date of first hospital visit) to date of death or censoring. Death certificate only registrations were excluded, as their survival times were unknown, so they could not contribute to any survival analysis. Patients were deemed to be alive if no death certificate had been received by the time the analysis was undertaken. They were censored at the 1st January 1999.

Survival distributions were estimated for each variable separately using the Kaplan-Meier method. These have been presented as curves.

Multivariate Relative Risk Analysis

Multivariate survival comparisons were made by Cox's Proportional Hazards regression. The following factors were entered into the model: Casemix (sex, age, socio-economic profile, time period of diagnosis): Management (treatment, hospital workload, consultant workload, specialty). The results are presented as relative risk estimates compared to a

base category (value 1.00). Estimates are given for each factor allowing for the four casemix factors, and for all factors entered into the model together.

Socio-Economic Profile Classification

This is based on an analysis of 120 original census variables, at Enumeration District (ED) level, many of which are highly correlated. A transformation is applied to these variables by Principal Components Analysis to create uncorrelated derived variables. The ED's are then grouped together using Cluster Analysis based on the new derived variables or principal component scores.

Initially there are 160 relatively homogenous profile groups. These have been further aggregated by cluster analysis into 40 groups and then into 10 groups, or 'Super Profiles'. The names attached to the different Super Profiles are an attempt to capture the wider characteristics of the groups in a name that can be easily referred to.

A summary and characteristic description of the 10 Super Profile groups and the 40 groups contained within them is given below.

▼ **Socio-Economic Profile Classification**

Super Profile Group		Description
I	'Affluent Achievers'	Very high income professionals in exclusive areas. Mature families with large detached properties in 'stockbroker belts'. Mature families in select suburban properties.
II	'Country Life'	Prosperous and farming communities. Small holders and rural workers (mainly Scotland)
III	'Thriving Greys'	High income households in genteel neighbourhoods. Affluent ageing couples, many in purchase property. Older professionals in retirement areas. Comfortably well off older owner occupiers. Affluent ageing couples in rural areas.
IV	'Settled Suburbans'	White collar families in owner occupied suburban semis. Mature white collar couples in established suburban semis. White collar couples in mixed suburban housing.
V	'Nest Builders'	Mortgaged commuting professionals with children in detached properties. Double income young families in select properties. Military families. Young white collar families in small semis and terraces. Young white collar families in smaller semis. Young blue and white collar families in semis and terraces. Young families in terraces, mainly council.
VI	'Producers'	Older blue collar owner occupiers in semis. Older workers established in semis and terraces. Older and retired blue collar workers in small council properties.
VII	'Senior Citizens'	Retired white collar workers in owner occupied flats. Older residents and young transient singles many in seaside towns. Old and young buying terraces and flats. Retired blue collar workers in council flats, mainly in Scotland.
VIII	'Urban Venturers'	High income young professionals mainly renting (mainly Greater London). Young white collar workers in multi racial areas (mainly London). Young professionals buying property. Young families buying terraces in multi racial areas. Young families renting basic accommodation. Young white collar singles sharing city centre accommodation.
IX	'Hard Pressed Families'	Blue collar families in council properties. Young blue collar families in council terraces. Manufacturing workers in terraced housing.
X	'Have Nots'	Families in council flats in multiracial areas with high unemployment. Blue collar young families in council properties with high unemployment. Young families, many single parent, with high unemployment. Young singles and pensioners in council flats with high unemployment.