Hepatology outpatient service provision in secondary care: a study of liver disease incidence and resource costs

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ABSTRACT – This paper discusses the annual incidence of liver disease and resource costs in providing a hepatology service for all new outpatient referrals to a secondary care setting. In a retrospective study, we found that 200 patients (1 in 1,000 of the West Suffolk population) with a mean age of 52 years were referred per year. One-third of patients had cirrhosis (almost half due to alcohol). Annual incidence (per 100,000 population) were as follows: non-alcoholic fatty liver disease (29: of which 23.5 non-cirrhotic and 5.5 cirrhotic), hepatitis C (25), hepatitis B (3), alcohol-related cirrhosis (12.5), primary biliary cirrhosis (3.5), autoimmune hepatitis (3), primary sclerosing cholangitis (2), haemochromatosis (2), hepatocellular carcinoma (1.5) and oesophageal variceal haemorrhage (6.5). Using national indicative tariffs, the total annual hepatology budget was £130K (£58K for resources and £72K for clinic attendances). The greatest resource expenditure was on endoscopy (almost half for oesophageal varices) and radiological imaging (one-third of the total budget). These findings will help inform commissioners in hepatology service funding.

Introduction

Purchasing of NHS secondary healthcare resources was implemented at primary care level through practice-based commissioning at the end of 2006.[1,2] Important issues to be addressed, for provision of secondary care hepatology outpatient services, include identifying the local healthcare demands (based upon the local aetiology and epidemiology of liver disease) and the resources required to meet these demands with their associated cost implications. This paper addresses these issues and provides findings from a retrospective study, over a one year period, in a secondary care setting.

Methods

This study was based on patients attending the outpatient hepatology clinic of the West Suffolk Hospital NHS Trust in Bury St Edmunds, between 1 August 2003 and 31 July 2004. Secondary care referrals were made to a single hepatology team.

Local demographics

The West Suffolk hepatology catchment area serves a population of about 200,000 people, is largely rural with low unemployment rates (about 2%), and 98% of the population is white. The Office for National Statistics (ONS)[3] recently reported that Moreton Hall, a council ward of Bury St Edmunds, has the longest average life expectancy from birth of all council wards in England and Wales – at 93.4 years.

Parameters analysed

Parameters analysed in our study included:

- number of annual new patient referrals and patient demographics
- number of derived follow-ups
- causation, incidence and stage of liver disease
- resources (investigations and procedures) required from support services (including laboratory blood tests, liver imaging, liver biopsy, paracentesis of ascites, and endoscopy for screening or management of oesophageal varices)
- costs of outpatient clinic attendances and resources used.

Inclusion criteria

Indications for referral to the hepatology clinic included patients with decompensated liver disease, alcohol-induced liver disease, viral hepatitis, autoimmune liver disease, haemochromatosis and, more commonly, patients with persistent (more than 3–6 months) elevation of serum liver function tests (LFTs), especially alanine aminotransferase (ALT), despite a low intake of, or abstinence from, alcohol.

Sources of referral included predominately local general practitioners (GPs) but also intra-hospital referrals and community-based nurse specialists from the Blood Borne Virus Unit of the Health Protection Agency (HPA).

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Exclusion criteria

This study does not include analysis of inpatient hepatology activities relating to acute medical or surgical care, patients with obstructive jaundice (eg requiring endoscopic retrograde cholangiopancreatography), or patients referred to tertiary hepatology services at Addenbrooke's Hospital, Cambridge, which are subject to separate funding, for example for liver transplant, management of hepatorenal syndrome, or antiviral therapy for hepatitis B/C.

Investigations used to establish the cause and stage of liver disease

Diagnoses for causation of liver disease were assigned using ICD-10 codes (Table 1).[4] The following investigations were performed to establish the cause and stage of liver disease in patients with a relevant clinical history.

- *Laboratory blood tests.* These included a liver database, comprising: LFTs; serology for hepatitis B and hepatitis C viruses (HBV/HBC) (total anti-HB core antibody for HBV and anti-HCV IgG for HCV); liver autoantibodies (including smooth muscle antibody (SMA) and liver kidney microsomal antibody type 1 (LKM1) for autoimmune hepatitis; antimitochondrial antibody (AMA) for primary biliary cirrhosis); alpha-1 antitrypsin level (phenotypic analysis was only performed if this level was low); serum caeruloplasmin for Wilson's disease (and if low, a 24-hour urine copper assay); iron studies for haemochromatosis (serum iron, total iron binding capacity (TIBC), ferritin and in those patients with high iron

Table 1. Diagnoses found in annual cohort of 200 new patients seen in the hepatology secondary care outpatient clinic. 5% of patients had dual hepatobiliary pathology. DNA = did not attend; NA = not applicable to incidence analysis; ND = not detected.

Diagnosis	ICD-10 code	Number of patients seen	% of total patients	Annual incidence per 100,000 population
Acute hepatitis B	B16	2	1	1
Acute viral hepatitis (other)	B17	1	0.5	0.5
Chronic hepatitis B	B18.1	4	2	2
Chronic hepatitis C	B18.2	35 (plus 15 DNA)	17.5	17.5 (25)
Unspecified hepatitis	B19	15	7.5	7.5
Alcoholic fatty liver	K70.0	5	2.5	2.5
Alcoholic hepatitis	K70.1	5	2.5	2.5
Alcoholic cirrhosis	K70.3	25	12.5	12.5
Drug induced	K71	8	4	NA
Non-alcoholic fatty liver disease	K76	41	20.5	20.5
Non-alcoholic steatohepatitis (with fibrosis)	K74	18	9	9
Auto-immune hepatitis	K75.4	6	3	3
Primary biliary cirrhosis	K74.3	7	3.5	3.5
Primary sclerosing cholangitis	K83.0	4	2	2
Wilson's disease	E83.0	0	0	ND
Haemochromatosis	E83.1	4	2	2
Alpha-1-antitrypsin deficiency		0 homozygous 2 heterozygous MZ phenotype	0	ND
Gilbert's syndrome		5	2.5	NA
Focal nodular hyperplasia	K76.8	1	0.5	NA
Hepatic adenoma	D13.4	1	0.5	0.5
Hepatocellular carcinoma	C22.0	3	1.5	1.5
Cholangiocarcinoma	C22.1	1	0.5	NA
Liver metastases	C78.7	3	1.5	NA
Choledocholithiasis	K80.5	10	5	NA
Liver abscess	K75.0	1	0.5	NA
Pancreatitis	K85.8	3	1.5	NA
Pancreatic cancer	C25	1	0.5	NA
Congestive hepatopathy		1	0.5	NA

saturation HFE gene mutational analysis for C282Y and H63D associated with genetic haemochromatosis; lipid profile, thyroid function tests and glucose for associated non-alcoholic fatty liver disease (NAFLD) or non-alcoholic steatohepatitis (NASH).[5] This liver database was performed in most patients as a battery of tests for the initial consultation, though in some patients a complete database was not performed due to the diagnosis being self-evident and alternative causes of liver disease not being invoked.

- *Ultrasound imaging*. Performed to look for evidence of increased echogenicity of liver compatible with fatty change (to suggest NAFLD/NASH) and to look for features compatible with cirrhosis (including appearance of liver, increased spleen size or visible varices to indicate associated portal hypertension).
- *Liver biopsy*. This was undertaken in keeping with British Society of Gastroenterology guidelines[6] to determine the cause of liver disease and stage of hepatic fibrosis for prognostic value. For patients with probable NAFLD/alcoholic liver disease (ALD) an initial six-month trial of lifestyle changes, including a reduced calorie diet and/or abstinence from alcohol, was recommended. Liver biopsy was subsequently offered to these patients if their serum ALT remained elevated over twice the upper limit of normal (>80 IU/l). A diagnosis of NASH was made if there was either histological evidence of fibrosis and inflammation or ultrasound evidence of cirrhosis with associated metabolic syndrome. Liver biopsy was not performed for those patients with clear evidence, either clinically or on ultrasound, of NASH or alcohol-related cirrhosis.

Surveillance programmes

Patients with cirrhosis determined on either clinical or histological grounds were entered into surveillance programmes: *a)* DEXA scan for osteoporosis, *b)* six-monthly ultrasound for hepatocellular carcinoma/portal hypertension (increased spleen size), and *c)* initial screening endoscopy for oesophageal varices (repeated on a minimum three-yearly basis if varices absent).

Costing of service

Calculation of cost of outpatient hepatology service (specialty code 306) was based upon the national indicative tariffs for 2005–06, quoted by the Department of Health,[7] for Office of Population Censuses and Surveys descriptions and their corresponding Health Care Resource Group codes. We calculated the total costs, over the one year period studied, of all new patients and derived follow-up clinic attendances plus all resources requested and subsequently utilised in managing this annual new patient cohort. Costs of investigations performed in primary care were not included in this analysis.

Results

An annual total of 200 new outpatient hepatology referrals were seen, of which 56% were male and 44% female, with a mean age of 52 years (range 17–86). Diagnoses and the annual incidence per 100,000 population are detailed in Table 1. The proportion of patients with each diagnosis is summarised in Fig 1.

Specific liver conditions

Alcoholic liver disease. The majority (71%) of the 17.5% of patients with ALD had cirrhosis. Variceal haemorrhage occurred in eight alcohol cirrhotic patients, four had ascites and one severe Korsakoff's syndrome.

NAFLD/NASH. The majority of patients referred to the hepatology clinic had NAFLD/NASH, comprising 59 patients (29%). Although most of these patients had mild liver disease, three patients had decompensation with ascites, two had oesophageal variceal haemorrhage, and a further four had histologically confirmed cirrhosis (Child-Pugh class A).[8]

Hepatitis B and hepatitis C. Hepatitis B was relatively uncommon with an incidence of acute infection of 1/100,000 population. In contrast, chronic hepatitis C was more common. During the one year period analysed, a total of 50 patients were referred to the outpatient clinic with a diagnosis of hepatitis C (annual incidence of 25/100,000, though this is probably an

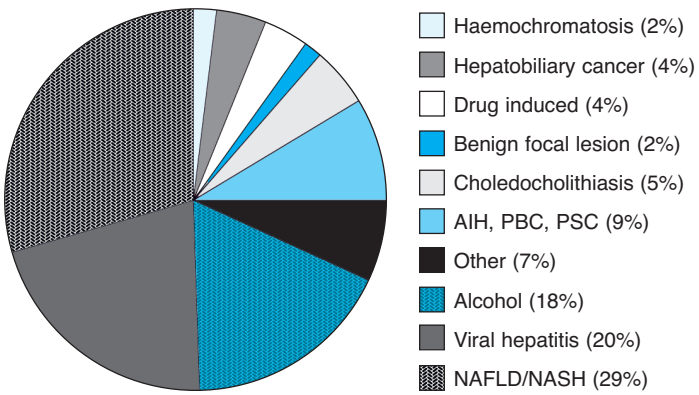


Fig 1. Annual diagnoses and their representing proportion of patients. AIH = autoimmune hepatitis; NAFLD = non-alcoholic fatty liver disease; NASH = non-alcoholic steatohepatitis; PBC = primary biliary cirrhosis; PSC = primary sclerosing cholangitis.

underestimate of the true incidence). Of these, only 35 patients attended clinic (70% attendance rate). Two patients with chronic hepatitis C, both of whom had a history of alcoholism, developed decompensated cirrhosis with ascites and variceal haemorrhage.

Unspecified hepatitis. These patients typically had mild (less than twice the upper limit of normal) or self-limiting elevation of serum ALT with negative liver database tests for causes of chronic liver disease. These patients were discharged for follow-up in primary care.

Autoimmune hepatitis (AIH), primary biliary cirrhosis (PBC), primary sclerosing cholangitis (PSC) and haemochromatosis. These were all identified with an annual incidence of 2–3.5/100,000 population. Autoimmune hepatitis with positive autoimmune markers (IgG, SMA) was histologically confirmed in four patients with cirrhosis while a further two presented with acute icteric hepatitis and had no significant fibrosis.

Cirrhosis. Cirrhosis was identified in a total of 58/200 patients (29%) with varying causes: ALD (25), NASH (11), HCV (4), PBC (7), PSC (4), AIH (4) and haemochromatosis (3).

Focal liver lesions. Focal liver lesions were found in 10/200 patients (5%), though only three had hepatocellular carcinoma (two due to NASH cirrhosis and one due to haemochromatotic cirrhosis) while one had cholangiocarcinoma.

Choledocholithiasis. Five per cent of patients presenting to the hepatology clinic with raised LFTs (non-jaundiced) were found to have choledocholithiasis requiring endoscopic retrograde cholangiopancreatography.

Table 2. Costs for annual hepatology outpatient attendances. Follow-up appointments were for those derived by the annual new patient cohort. Of these, 75* did not attend (DNA rate of 19%).

Hepatology outpatient clinic (specialty code 306)	Number of patients seen	Cost/clinic visit (£)	Total cost (£)
New	200	213	42,600
Follow-up	313/388*	94	29,422
Total	513		72,022

Table 3. Costs for annual outpatient resources utilised for new hepatology patients. Liver database* is defined in methods. Both liver database and biochemistry include liver function tests. Total cost is rounded to the nearest £.
CT = computerised tomography; DEXA = dual energy X-ray absorptiometry; ERCP = endoscopic retrograde cholangiopancreatography; GI = gastrointestinal; HFE = haemochromatosis gene; HRG = human resource group; MRCP = magnetic resonance cholangiopancreatography; US = ultrasonography.

Outpatient resource	HRG code	Number of investigations requested	Cost (£)/ investigation	Total cost (£)
Phlebotomy	839	513	4.99	2,560
Liver database	*	139	29.34	4,078
Virology	840	15	7.39	111
Immunology	830	2	8.40	17
Biochemistry	841	374	1.89	707
Haematology	823	184	2.89	532
Tumour markers	842	5	8.60	43
HFE analysis	842	5	8.60	43
Liver US	RBC2	159	64	10,176
Liver CT	RBD1	16	110	1,760
MRCP	RBF1	10	227	2,270
ERCP	G15	8	424	3,392
DEXA	RBB4	21	33	693
Liver biopsy	G02	45	137	6,165
Histology	824	45	19.51	878
Paracentesis	J12	3	231	693
Endoscopy (upper GI)	F06	35	363	12,705
Endoscopy and banding of oesophageal varices	F63	24	476	11,424
Total				58,246

Annual budget analysis of outpatient hepatology service

Based on the number of investigations requested and knowing the individual price per test, as specified by the national indicative tariff,[7] we calculated that a total expenditure of £130K was required during the period analysed. These costs comprised £72K for outpatient clinic attendances and £58K for outpatient resources as detailed in Tables 2 and 3. The breakdown of resource costs is summarised in Fig 2.

Of these resource costs, the major source of expenditure was for endoscopic work (42% of total budget, £24K). We undertook 35 endoscopic procedures for screening/surveillance of oesophageal varices in patients diagnosed with cirrhosis, while a further 24 endoscopic sessions (in 13 patients) were performed for therapeutic band ligation of oesophageal varices. The aetiology of cirrhosis in the patients with oesophageal variceal haemorrhage was alcohol (8), HCV (2), PBC (1), and NASH (2).

Further evaluation of resource expenditure showed that almost one third was incurred by radiological imaging (£18K)

largely undertaken to screen for evidence of fatty liver, cirrhosis, portal hypertension or hepatocellular carcinoma.

Liver biopsy contributed to 12% (£7K) of resource expenditure. This procedure was undertaken by ultrasound assistance in a selected group of 45 patients of whom five had focal lesion(s) and 40 had diffuse parenchymal liver disease. Of the latter group, 10/40 patients (25%) had an advanced stage of fibrosis (bridging/cirrhosis) which was not apparent on ultrasound imaging leading to their entry into long-term surveillance programmes.

A further 14% (£8K) of resource expenditure was dedicated to laboratory investigations, mainly to perform liver database analysis, and 1% (£0.7K) on paracentesis of ascites.

Discussion

This study was set up to identify the annual demand in a hepatology outpatient service in secondary care and the necessary resources and financial budget required to provide this service.

Liver disease is not uncommon in West Suffolk, a relatively rural corner of England. Indeed, our study demonstrated that 1 in 1,000 of the local population per year were referred to secondary care for outpatient management of liver disease.

Providing this service cost an average of £650 in resources per new patient per year. The total service budget was £130K. This comprised £58K utilised for resource expenditure and £72K allocated to fund outpatient clinic visits. Detailed analysis of resource expenditure revealed that almost half was spent on endoscopic procedures and a third on radiological imaging. A total of £8K (14% of resource expenditure) was spent on laboratory blood tests. About 70% of all patients had a complete liver database performed, in the remainder a diagnosis was made on clinical grounds (eg alcohol) or supported by specific investigations (eg positive viral hepatitis serology – usually tested for in the community by GPs or HPA nurses) without further investigations being indicated.

One limitation of our study was that it did not include the routine follow-up of patients entered into the cirrhosis surveillance programmes from previous years. Of note, however, our study showed that 29% of 200 annual new patient referrals had evidence of cirrhosis necessitating long-term follow-up and entry into surveillance programmes for detection of varices, hepatocellular carcinoma, or hepatic decompensation. The major cause of cirrhosis, in almost half our patients, was alcohol. The annual incidence of hepatocellular carcinoma was 1.5/100,000 population while oesophageal variceal haemorrhage occurred in 6.5/100,000 population. Our surveillance programme (minimum of three-yearly endoscopy, six-monthly liver ultrasound, blood tests and clinic follow-up) budgets at £474 per cirrhosis patient – a further £27K for the following year of follow-up of this annual patient cohort. These costs will have a cumulative impact on the service budget.

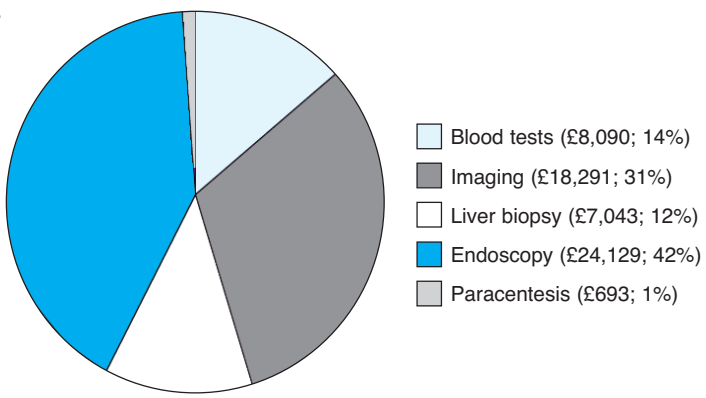
A further limitation of this study was that the budget analysis did not include costs incurred by staff salaries or drug treatment costs (especially anti-viral therapy for hepatitis C – about £10K per patient). Additionally, our study was based upon a local catchment area which, while having a defined population as a source of patient referrals, may have different incidences of hepatological disease and therefore different requirements for health resources compared with, for example, more urban areas. We have, however, defined the local aetiology and epidemiology of hepatological diseases to put into context these healthcare resource requirements. It is interesting to note that even rural areas of relatively high life expectancy, such as West Suffolk, are not spared from the current plight of hepatitis C and alcoholic liver disease. These findings should therefore be of relevance to other hepatological services.

We found that the most common diagnosis was NAFLD/NASH, representing over a quarter of our outpatient practice. This was followed by viral hepatitis (20%) and alcoholic liver disease (18%).

The timing of referral to secondary care showed that patients with alcoholic liver disease were referred mainly when their condition had already progressed to cirrhosis (over two thirds) and indeed an alarming one third of these patients initially presented to emergency medical services with oesophageal variceal haemorrhage. These patients were subsequently referred to our hepatology service. The deepening crisis, regarding alcoholic liver disease in the UK, has recently been reported by ONS[3] in which they note that deaths from alcoholic liver disease rose by 37% in the five years leading to 2004 – our data highlights the gravity of this situation.

In contrast to ALD, patients with NAFLD/NASH were often referred earlier in the natural history of their disease, and often

Fig 2. Total annual costs for resources used by hepatology new outpatient clinic.



for investigation into cause of unexplained elevation of ALT. Evidence is emerging that NASH is an increasingly recognised cause of progressive liver disease.[9] It is likely that secondary care trusts will see increasing numbers of patients with NASH who require healthcare resources. Indeed, in our study one third of all patients with NAFLD/NASH had progressive liver disease.

Chronic hepatitis C is also a growing challenge to resources and it is estimated that by 2010 there will be an increase of more than 50% on the 4,500 people who currently have severe liver disease caused by HCV.[10] In our outpatient clinic, one fifth of patients were infected with HCV, with an annual incidence of 25/100,000 population. This figure is higher than the average UK incidence (15 per 100,000 population). [11] This finding demonstrates that HCV is probably just as much a problem in rural communities as in more urban areas. Patients with HCV had a 30% clinic non-attendance rate, reflecting the poor compliance of this patient group and highlighting the need to coordinate their care with colleagues in primary care, HPA, and prison healthcare services.

The population frequency of genetically defined haemochromatosis (C282Y homozygosity) is approximately one in 200;[12] however, we received comparatively few referrals of patients with liver disease due to haemochromatosis (annual incidence of 2/100,000 population). We identified the annual incidence per 100,000 population to be three and a half for primary biliary cirrhosis (similar to a previous report),[13] three for autoimmune hepatitis (slightly higher than a previous report)[14] and two for primary sclerosing cholangitis.

In conclusion, our study focused on the costs of healthcare resources required to provide outpatient hepatology services in secondary care. This knowledge is pivotal in determining appropriate levels of funding. This analysis offers assistance for commissioners of healthcare in the primary care trusts to develop strategies for providing hepatology services at the secondary interface; bearing in mind that we estimate it costs at least 65 pence (€0.98; $1.28) per capita per year to fund resources required to manage annual new patient referrals to our hepatology service.

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