**CLINICAL FEATURES**

**Chronic Liver Disease—An Increasing Problem: A Study of Hospital Admission and Mortality Rates in England, 1979–2005, with Particular Reference to Alcoholic Liver Disease**

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**Methods:** Hospital episode statistics for admissions in England were obtained from the Information Center for Health and Social Care and mortality data for England and Wales from the Office for National Statistics. **Results:** Hospital admission rates for chronic liver disease increased by 71% in males and 43% in females over the study period. This increase was largely due to alcoholic liver disease, admission rates for which more than doubled between 1989/1990 and 2002/2003. While there was a smaller rise for chronic viral hepatitis B and C, admission rates declined for hepatitis A, autoimmune hepatitis, and primary biliary cirrhosis. Mortality rates for chronic liver disease more than doubled between 1979 and 2005. Two thirds of these deaths were attributable to alcohol-related liver disease in 2005. The highest rate of alcoholic liver disease mortality was in the 45–64 age group, and the largest percentage increase between 1979 and 2005 occurred in the 25–34 age group. **Conclusions:** Hospital admissions and mortality in England from chronic liver disease are increasing. The underlying reasons are complex, but alcohol-induced liver disease makes a major contribution. There are clear social and health implications if the trend continues and addressing alcohol-related liver disease should be a public health priority.

**INTRODUCTION**

The World Health Organisation reported in 2002 (World Health Report, 2002) that alcohol use was responsible for 4% of the total global disease burden compared with 4.1% (tobacco) and 4.4% (hypertension). In developed countries it was also responsible for 9.2% of all disability-adjusted life years lost. This includes associated neuropsychiatric conditions, suicide, homicide, and physical injuries (road traffic accidents, falls, burns, drowning, etc.). Alcohol intoxication is also implicated in a number of high-risk behaviors (substance abuse and unsafe sex) which themselves have significant social repercussions.

Alcoholic liver disease (ALD) is seen as an increasingly important medical problem and has attracted significant political and media interest in recent years. Deaths from chronic liver disease and cirrhosis have been rising in the UK since 1979 (Plant, 1997). The rise in mortality from alcohol-related causes between 1991 and 1997 was particularly marked in areas where there were higher rates of unemployment, social housing occupancy, and social classes IV/V (Griffiths et al., 2001). In contrast, Leon et al. showed that the sharp increases in mortality from chronic liver disease observed in the UK were not mirrored elsewhere in Europe (Leon and McCambridge, 2006). In fact, most of the countries in southern Europe experienced a decline in mortality rates for ICD 9 571 and ICD 10 K70/73/74 between 1987–1991 and 1997–2001. (See Table 1.)

Although alcohol is the main cause of chronic liver disease (CLD), the reporting of associated data is variable in specificity and emphasis, and causes of liver disease other than ALD are often not described. Indeed, the layperson is often led to believe that alcohol abuse is the only etiological factor in CLD. A gray area also exists between the statistics related to ALD itself and extrahepatic alcohol-related comorbidities such as accidents, suicide, and other solid organ disease.

In this study we describe recent time trends in England for hospital admissions specifically due to ALD compared to other causes of CLD. Mortality data for England and Wales are also reported. Hospital admission statistics draw an interesting parallel to mortality figures and provide useful information for those in charge of healthcare planning.

**METHODS**

**Data sources**

Hospital episode statistics (HES) and national mortality data were used.

**Hospital episode statistics**

The Information Centre for Health and Social Care, a division of the National Health Service (NHS), now administers the HES service. The service has provided information on inpatient care delivered by NHS hospitals in England since April 1987. In the 1999/2000 financial year, the HES system collected nearly 12 million records detailing episodes of inpatient treatment delivered by NHS hospitals in England. Although private hospitals are not covered, the HES database does include private patients treated in NHS hospitals.

The data recorded are consultant episodes, defined as “the period during which an admitted patient is under the care of a particular medical consultant within a hospital provider.” Therefore, should a patient’s care transfer between different consultants during the time spent in hospital, a single admission could actually generate more than one hospital “episode”.

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Each hospital episode record contains details of clinical, administrative, and demographic information. The data are collected by each hospital before being forwarded on to the national database.

HES were coded using the International Classification of Diseases, Ninth Revision (ICD 9) until March 1995 and ICD 10 thereafter (Appendix A).

Mortality statistics

Mortality statistics were obtained from the Office for National Statistics (ONS). These figures are based upon analysis of the certified cause of death and related to the population of England and Wales. The majority (95%) of these combined data are represented by England. Therefore, the relative influence of Welsh data on the overall figures is negligible and we draw comparisons with the English only HES data.

Mortality data were coded using ICD 9 until 2000 and ICD 10 thereafter. Not only had the ICD codes themselves changed but the rules for selecting the underlying cause of death from those mentioned on the death certificate also changed. The ONS undertook a bridge coding study in 2001 to assess the impact of these changes. By applying both sets of codes to that year’s data, although there was some entrance and exit of data from the alcohol-related group, the actual overall figures changed very little (<1%). ICD 10 alone has continued to be used from this point onwards.

Rates

Rates presented in this paper are either age specific or age standardized. The former are crude rates for different age groups in the same period. The directly age standardized (DAS) rate adjusts these figures using the European standard population to control for differences in the age structure of the population over time to give unbiased comparisons of the “all ages” rate. Rates were constructed using mid-year population estimates. Population estimates from the census are updated each year to produce mid-year population estimates for the years in between censuses (Population Estimates—A Short Guide, 2004).

RESULTS

Hospital admission rates

Between 1989/1990 and 2002/2003, the DAS rates of hospital admission for patients with all liver diseases increased from 24.9 to 42.4 per 100,000 males (71%) and from 19.3 to 27.6 per 100,000 females (43%) (Fig. 1A). The major contributor to this increase was ALD for which admission rates increased by 116% (from 12.6 to 27.3 per 100,000) in males and 106% (from 6.5 to 13.5 per 100,000) in females over this time period (Fig. 1B).

Hospital admission rates also increased for both hepatitis B and hepatitis C. For hepatitis B there was an 18% increase for males and a 55% increase for females (Fig. 1C). Admission rates for hepatitis C increased by 30% for males and 11% for females (Fig. 1D), but it should be noted that separate coding for hepatitis C only began in 1995.

Although the numbers were too low to calculate valid rates, hepatitis A experienced a decline in the number of admissions. There has also been a decline in the DAS rates for autoimmune hepatitis and primary biliary cirrhosis. Overall, hospital admission rates for all diagnoses excluding alcohol-induced liver disease were very low.

For both males and females, the bulk of hospital admissions for ALD (Tables 2 and 3) occurred in patients between 45–54 and 55–64 years old with the younger of these groups taking precedence more recently. The largest percentage change in hospital admission rates between 1989/1990 and 2002/2003 has occurred in the younger age groups. Numbers have doubled in most age groups for both males [25–34 (100%), 35–44 (107%), and 45–54 (146%)] and females [25–34 (82%), 35–44 (114%), and 45–54 (150%)]. The rate of increase between ages 35 and 54 was greater in females than males.

Mortality data

Mortality from all liver diseases (ICD 9 570–573, ICD 10 K70–77) steadily increased between 1979 and 2005. Mortality rates rose from 5.9 to 15.9 per 100,000 among males and from 3.9 to 8.3 per 100,000 among females. The increase was most pronounced within the last decade. The leading cause of liver disease mortality in England and Wales was ALD (ICD 9 5710–5713, ICD 10 K70) for which mortality rates rose from 1.7 to 10.4 per 100,000 among males and from 0.9 to 5.0 per 100,000 among females between 1979 and 2005. These figures make up two thirds of the total liver disease figures for both sexes (Fig. 2A and B). The patterns demonstrated closely mirrored those for hospital admission rates as shown above.

The age group trends observed in the hospital admissions were repeated in the mortality data. Over the past decade, the ALD age-specific mortality rates for the 45–54 age group rose to almost equal to those for the 55–64 age group among males (26.2 versus 28.1 per 100,000 in 2005) and superceded the 55–64 age group among females (13.4 versus 12.4 per 100,000 in 2005). The overall rate of increase between 1979 and 2005 was greatest amongst the 25–34 age group: 713% (0.45–3.63 per 100,000) male and 780% (0.26–2.25 per 100,000) female.

Table 1. Standardized mortality ratesa (per 100,000 per year) for liver cirrhosis (ICD9 571, ICD10 K70/73/74) for southern European countries between 1987–1991 and 1997–2001

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*aRates directly age standardized to the European standard population.


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*Age-specific (crude) rates.

(Fig. 3A and B). This supports the publicized concerns about a growing epidemic of ALD in younger generations. Mortality rates for diseases other than ALD are not shown, as very small numbers are involved.

DISCUSSION

We have described significant increases in both hospital admission and mortality rates for chronic liver disease in England at the turn of the millennium. Two-thirds of deaths from chronic liver disease are due to ALD. The final third represents a combination of other etiologies, which are difficult to precisely define and categorize. Apart from chronic hepatitis B and C, primary biliary cirrhosis, autoimmune hepatitis, and hemochromatosis, there are other less well-defined causes of CLD, such as chronic steatohepatitis or “cryptogenic” cirrhosis. Indeed, nonalcoholic steatohepatitis is a growing phenomenon and one which is widely unrecognized and under recorded. Its more benign precursor, nonalcoholic fatty liver disease, is reported to be present in up to a third of adults in the United States (Wieckowska et al., 2007). There is no definitive classification for nonalcoholic steatohepatitis within the ICD 10 coding system and it is likely that it makes a significant contribution to CLD mortality. Some patients with CLD may also have more than one etiological factor. For example, alcohol misuse is widely recognized as an accelerant factor in the progression of chronic hepatitis C-induced liver disease.
Table 3. Hospital admission rates\(^a\) for alcoholic liver disease 1989/1990 to 2002/2003, England: females

<table>
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<th>Age group</th>
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\(^a\)Age-specific (crude) rates.


Regarding these other causes of liver disease, the observed reduction in hospital admission rates for hepatitis A could either represent improved levels of public health awareness (immunization, better hygiene while abroad) or perhaps, fewer referrals to secondary care. Similarly, the fall in admissions for autoimmune hepatitis and primary biliary cirrhosis is likely to be related to earlier diagnosis, more aggressive treatment, and closer follow up (Lee and Kaplan, 2005). Although the admission rates for hepatitis B and C remain much lower than those for ALD, they are also on the increase. Worldwide, viral hepatitis is the leading cause of chronic liver disease with up to 350 million people chronically infected with hepatitis B (Lavanchy, 2004). With increasing levels of immigration to the UK and the recent government led public health promotion of hepatitis C awareness, we expect viral hepatitis to continue to increase its prevalence and subsequent impact on healthcare services in the UK.

Time trends in hospital admissions for chronic liver disease reflect not only the underlying changes in disease prevalence and management, but are also important markers of service usage and financial cost to the nation (Williams and Mann, 2002).
If our figures are extrapolated to a hypothetical population of 300,000 as the “standard” patient population served by a district general hospital, 210 patients would have been admitted to the hospital in 2002/2003 compared with 132 in 1989/1990. Of these, ALD would account for 122 and 57, respectively. These hospital admissions incur significant costs, as CLD patients frequently require intensive medical input, often in a critical care environment. For example, while liver diseases accounted for only 1.8% of 922,611 hospital admissions in Portugal, the same patients accounted for 2.4% of all hospital healthcare expenses (Cortez-Pinto et al., 2004).

In 2005 Roberts et al. linked hospital admissions for chronic liver disease with subsequent mortality in 8192 patients between 1968 and 1999 (Roberts et al., 2005). Within 1 year of discharge the case fatality rate was 33.6% and the standardized mortality ratio 16.3 (compared to 1 for the normal population). No improvement in either of the statistics was demonstrated over the study period, thus concluding that hepatic cirrhosis no longer has a poor prognosis which has improved little over the last 30 years. Unlike our present study, Roberts et al. included deaths from all causes, including accidents and suicides as well as cirrhosis.

Although the data sets cannot be directly compared, there appears to be a correlation between the southern European reduction in ALD mortality (Leon and McCambridge, 2006) and a fall in average alcohol consumption per capita over the same time period (Ramstedt, 2001). For example, WHO figures (European Health for All Databases, 2006) have shown that alcohol consumption fell in France from 23.2 to 10.9 and in Spain from 16.1 to 9.6 liters per person per year between 1970 and 2002. This contrasts with the UK where figures have risen slightly (8.5–9.1). Ramstedt confirmed this by showing the patterns and made statistical connections to rising cirrhosis mortality data in both northern (Ramstedt, 2001) and more recently eastern Europe (Ramstedt, 2007).

The most recent information available about drinking patterns in Great Britain can be found in the General Household Survey last reported for 2005 (Goddard, 2006). Of particular concern is the finding that, compared to people over 65, younger males and females aged between 16 and 24 were significantly more likely to have exceeded the recommended daily limits for alcohol consumption in the previous week (M 42% versus 16% and F 36% versus 4%), and were also more likely to have drank heavily (>8 units) on at least 1 day in the previous week (M 30% versus 4%, F 22% versus 1%). Considering that there is a latent period between excessive alcohol consumption and chronic liver disease, these data are consistent with our findings that people aged between 45 and 54 have the highest hospital admission and mortality rates compared to other age groups, and that the 25–34 age group had the highest overall rate of increase over the study period.

The General Household Survey also revealed that ethnic minorities are less likely to drink alcohol than people of white British origin. Although this might seem to support the assumption that ALD is a problem of whites, data from the United States suggest that Hispanic and black ethnic groups are more susceptible to ALD despite the comparable levels of alcohol intake (Stinson et al., 2001). This data could feasibly be biased by factors such as socioeconomic class and access to medical care, but given the increasing levels of comorbid viral liver disease the message that CLD can affect all ethnic groups remains an important one.

The underlying reasons behind the increase in alcohol consumption in the UK are complex. Increased numbers of licensed premises and broader licensing laws allowing sale of alcohol in supermarkets have seen a surge in the availability of alcohol. The cost of alcohol relative to income has fallen and between 1989 and 2000 expenditure on alcohol advertising rose from £150 to £250 million per year (Calling Time, 2004). The media driven portrayal of binge drinking in popular celebrity culture must have an encouraging influence on the minds of young people, and in addition, the drinks industry continues to target younger drinkers with its support of “Alcopop” style drinks and heavily discounted promotions during “happy hour” periods.

It is this cohort which is perhaps at most risk of developing complications through public health ignorance. Many will perceive cirrhosis as a disease of people with uncontrolled, erratic lifestyles focused around an addiction. This is typical of the behavioral phenotype associated with a dependence syndrome. Interestingly, however, data exist which suggest that patients with chronic liver disease scored lower on the Severity of Alcohol Dependence Questionnaire, drank less alcohol and were more likely to be in a stable relationship and in employment, than those exhibiting classical uncontrolled dependence behavior (Smith et al., 2006). They were also more likely to drink for “social” reasons than as a coping mechanism when dealing with relationship or money problems. This is to say that people who believe that despite their steady excessive alcohol intake they are in some way protected from liver disease, because they do not fit the stereotype of addiction, are in fact at higher risk of developing cirrhosis. This is an important point that should be reinforced to the younger “binge drinking” generations.

Having said this, we should not discount the very real effects of “modern” stress. Society is busier and more stressful than ever before and despite claims that the British economy has experienced its longest period of sustained growth for more than 200 years (Chancellor of the Exchequer, 2004); personal financial debt and insolvency is at record levels (Insolvency Service, 2007). Despite advances in communication technology people are living increasingly insular lives and communities are becoming more fragmented. Rates of psychological illness are also increasing with one in six adults suffering with symptoms of anxiety, depression, phobia, and panic disorders (Better or Worse, 2006).

All of these factors in combination are likely to contribute to the ever increasing alcohol-related morbidity and mortality demonstrated in this study. Numerous public policy documents have reviewed these issues over the last decade (NHS Plan, 2000; Annual Report of the Chief Medical Officer, 2001; Health Development Agency, 2002; Prime Ministers Strategy Unit, 2004). In 2005 controversial 24-hour licensing laws were introduced in the UK. It was proposed that restricted licensing hours encouraged binge drinking and subsequent violence. Liberalization of drinking hours was intended to create a more relaxed approach to social drinking in line with that observed in southern European “caf´e culture.” It is still too early to observe the effects of this legislation, but following concerns expressed by leading medical figures within the field (Moriarty and Gilmore, 2006), the changes are currently under review.
Problems associated with the use of HES data have recently been highlighted (Williams and Mann, 2002). The coding process itself relies on nonmedical staff interpreting medical notes, which may not be clear in summary or indeed legible. There is also a potential for duplication of individual patient data, as one hospital admission can sometimes account for multiple “consultant episodes.” As these potential problems have not changed over the study period, the time trends we describe should remain valid. The introduction of electronic hospital discharge summaries and a stronger emphasis on documentation and clinician involvement should make hospital admission data more robust for future assessment (Williams and Mann, 2002).

There are also concerns regarding the validity of mortality data. Although the death certificate is in itself a legal document, there is still room for subjectivity when recording the cause of death. Traditionally there has been a social stigma attached to documenting ALD as a cause of death and this could have led to an under recording of this diagnosis. Until 1984, deaths from alcohol-related disease were considered by the law as “unnatural poisoning” and had to be reported to the coroner for formal inquest. Before the legislative change, patients with an unequivocal clinical and histological diagnosis of ALD were more likely to undergo forensic postmortem and coroners’ inquest than those with nonalcoholic liver disease (Maxwell and Knapman, 1985). The information entered on the final death certificate was also more likely to be incomplete or misleading (Maxwell and Knapman, 1985). Mortality from ALD over this period should therefore be interpreted with caution since an apparent rise in rates may be due to under reporting prior to 1984. Indeed, the fivefold increase in mortality that we have demonstrated in this study does appear to be out of proportion with clinical experience and is much larger than the “doubling” observed in admission rates. However, our results did show consistent time trends for both mortality and hospital admissions even though the rates of increase differed.

It is also important to note that the data described in this paper refer only to patients who are presenting to secondary care. There is evidence to suggest that this cohort is actually only the tip of the iceberg. Up to two thirds of patients with alcoholic cirrhosis do not come into contact with secondary care services before their diagnosis is made (Verrill et al., 2006), suggesting that the main opportunity for screening lies with primary care services.

In conclusion, we have demonstrated a continuing increase in hospital admissions and mortality due to chronic liver disease, especially ALD. The increases observed were particularly marked among younger age groups. The underlying reasons for these trends are complex and it is difficult to envisage a clear resolution to this growing problem. Draconian legislative attempts such as prohibition are not appropriate and have failed in the past. Raising alcohol taxation, improving primary care screening, and reassessment of current licensing laws are all ideas recently proposed by the institute for alcohol studies and clinician involvement should make hospital admission data more robust for future assessment (Williams and Mann, 2002).

APPENDIX A

ICD codes

The ICD categories used in this paper are listed below:

- ICD 9: 570–573, 70.0–70.3
  - 570 acute and subacute necrosis of the liver
  - 571 chronic liver disease and cirrhosis
  - 572 liver abscess and sequelae of CLD
  - 573 other disorders of liver
  - 70.0–70.1 hepatitis A
  - 70.2–70.3 hepatitis B
- K70–K77 “diseases of the liver”
  - K70 alcoholic liver disease
  - K71 toxic liver disease (drug induced)
  - K72 hepatic failure, not elsewhere classified
  - K73 chronic hepatitis, not elsewhere classified
  - K74 fibrosis and cirrhosis of the liver (inc PBC K74.4)
  - K75 other inflammatory liver diseases (abscess, granulomatous)
  - K76 other diseases of the liver (infarction, veno occlusive disease)
  - K77 liver disorders in diseases classified elsewhere
    (CMV, herpes)
  - B15 hepatitis A
  - B16/17/18/18.1 hepatitis B
  - B17.1/18.2 hepatitis C

REFERENCES


