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Short Report

Education level and chronic liver disease by aetiology: A proportional mortality study

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ABSTRACT

Background: Data are lacking on mortality from chronic liver diseases of different aetiology by education level.
Aims: To investigate the association between education level and mortality from alcoholic, viral, and non-viral/non-alcoholic chronic liver disease.
Methods: Proportional mortality was investigated in 2011–2013 in the Veneto Region (Italy). Odds ratios were estimated by conditional logistic regression with deaths from liver cirrhosis, liver cancer, and viral hepatitis as cases, and all other deaths as controls. Disease aetiology was determined from all conditions mentioned in the death certificate.
Results: Overall chronic liver disease proportional mortality was higher in males (OR 1.37, 95% CI 1.18–1.60) and females (OR 1.72, 95% CI 1.29–2.30) with primary education than in subjects with higher educational level. The risk for alcohol-related and non-viral/non-alcohol-related disease significantly increased with lower education in both genders.
Conclusions: Proportional mortality analysis of multiple causes of death records showed an association between education and chronic liver diseases with alcoholic and non-viral/non-alcoholic aetiology.
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1. Introduction

Previous reports from Europe [1–3], North America [4,5], Australia [6], and Asia [7] have shown an association between socio-economic position and liver cirrhosis mortality. Despite an overall decrease observed in many countries in the last decades [8], liver cirrhosis mortality widely varies depending on education level [1,3,6].

Few reports are available from Italy: in the 1980s mortality from gastrointestinal diseases (mainly liver cirrhosis) among males aged 45–59 years was shown to be higher among manual workers than among non-manual workers [9]. In some Italian cities in the late 80s–early 90s, mortality from cirrhosis increased with lower level of education in both genders [10]. A recent study on a representative sample of the Italian population in 1999–2007 did not have enough statistical power to detect an association between education level and mortality from digestive diseases [11].

Whereas liver cirrhosis mortality has been investigated by race/ethnicity according to different aetiologies (alcoholic, viral, or other) in the US [12], to date similar analyses investigating a differential role of education by aetiology of liver diseases have not been carried out.

Furthermore, deaths classified according to international coding rules as due to liver cirrhosis only represent a limited proportion of mortality from chronic liver disease. A surveillance extended to other causes of death, including viral hepatitis and liver cancer, has been advocated as a more appropriate approach [13,14]. It remains to be assessed, though, whether the association with education level holds true also when this more comprehensive definition of liver disease mortality is applied.

The study aims at providing an analysis of the association between education level and liver disease mortality (including liver cirrhosis, viral hepatitis, and liver cancer) in North-eastern Italy, and at disentangling such association by different aetiologies of liver disease, by means of a proportional mortality approach.

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Table 1
Distribution of the number of deaths and proportional mortality due to all liver diseases by education level: males and females of the Veneto Region, 2011–2013.

Underlying cause of death	High school/college	Middle school	Primary/none	Total
Males				
Viral hepatitis (B15–B19)	17	48	52	117
Liver cirrhosis (K70,73,74)	86	247	484	817
Liver cancer (C22)	134	284	671	1089
All liver diseases	237	579	1207	2023
All deaths	3804	6998	16,597	27,399
Proportional mortality	6.2%	8.3%	7.3%	7.4%
Females				
Viral hepatitis (B15–B19)	5	17	69	91
Liver cirrhosis (K70,73,74)	24	61	248	333
Liver cancer (C22)	29	62	253	344
All liver diseases	58	140	570	768
All deaths	1816	3254	11,247	16,317
Proportional mortality	3.2%	4.3%	5.1%	4.7%

2. Methods

The Veneto Region has about 4,900,000 inhabitants. A copy of all death certificates is sent to the regional epidemiological department for coding of the underlying cause according to the International Classification of Diseases, 10th Edition (ICD-10). The underlying cause is the single condition usually reported in mortality statistics, identified from all diseases mentioned in the certificate according to internationally adopted rules. The regional mortality archive is not limited to the underlying cause, but includes all diseases mentioned in the death certificate (multiple causes of death). The following underlying causes of death were extracted for subjects aged 40–79 years, who were resident of the Veneto Region and died in the period 2011–2013: liver cirrhosis (ICD-10 K70, K73, K74), liver cancer (C22), and viral hepatitis (B15–B19). These three disease categories were merged as "all liver diseases". Multiple causes of death ICD-10 codes were then used to classify all liver diseases in the following etiologic groups: alcoholic diseases (alcoholic liver diseases and mental and behavioural disorders due to use of alcohol, K70 and F10); acute, chronic or unspecified viral hepatitis infections (B15–B19); the remaining deaths were classified as liver diseases with non-viral/non-alcohol (NVNA) related aetiology.

In Italian death certificates, causes of death are recorded by a physician, whereas an officer from the municipality adds socio-demographic data, including education level. Attained education is coded as: none/primary, middle school, high school, lower university education, higher university education. Due to low numbers, the latter three categories were grouped together. As education level is more consistently registered among subjects with Italian citizenship, our analysis was limited to this population. For each education level, the proportional mortality was defined as the percentage of liver disease deaths out of all registered deaths. To assess the association between education and liver diseases, odds ratios (OR) with 95% confidence intervals (CI) were estimated separately by gender by means of conditional logistic regression models (stratified by age) carried out with liver disease deaths as cases (all, alcohol-related, virus-related, NVNA), and all deaths with an underlying cause different from liver disease as controls.

3. Results

Out of 47,034 decedents aged 40–79 years residing in the Veneto Region, 46,315 had Italian citizenship. Education was missing in 5.6% of death certificates, leaving 43,716 records for analysis. Liver cirrhosis codes allowed the identification of less than half of deaths from all liver diseases (Table 1). All liver diseases combined accounted for a substantial proportion of overall mortality, especially among males; such proportion was lower in subjects with a high school diploma/college education.

Table 2 shows how an alcoholic/viral aetiology was mentioned in about 40% of liver disease deaths, being alcohol and viral infection the main causes in males and females, respectively (reported together in less than 2% of deaths). Among virus-related liver diseases, the following aetiologies were reported: 85% hepatitis C virus (HCV), 10% hepatitis B virus (HBV), 2% HCV–HBV co-infection, 3% unspecified viral hepatitis. At logistic regression a significant association was found between education level and proportional mortality from all liver diseases, and specifically for those alcohol-related and NVNA-related in both genders. By contrast, for the viral aetiology estimated ORs were close to the unit.

A parallel analysis was carried out with education classified in four levels: primary/none, middle school, high school, college. The association between overall liver disease mortality and education level was even more pronounced (Fig. 1). Trends by specific aetiology were confirmed, but numbers were small, especially in the female gender (data not shown).

4. Discussion

The study demonstrates an association between education level and chronic liver disease mortality in Italy in recent years for both genders. Such an association was stronger for alcohol-related and for NVNA-related liver diseases than for those with a viral aetiology (if any).

To properly interpret results, drawbacks due to the study design must be highlighted. Updated information on education is often not available to municipal officers; furthermore education in death certificates is registered according to a slightly different classification with respect to census data. These problems have prevented to date the adoption of a cross-sectional design (education of decedents retrieved by mortality records) in investigating the influence of socio-economic status on mortality rates. Therefore the present approach was not to compute mortality rates, but to use only numerator data, and to investigate the different distribution of causes of death by education level; misclassification of education in mortality records was assumed to be non-differential by cause of death. When using proportional mortality designs, results are often difficult to interpret [15], since an increase in the proportion represented by a disease could be due to variations in mortality rates from all other causes of death. In the present study, ORs obtained by conditional logistic regression were estimates of proportionate mortality ratios (PMR) adjusted by age. Such estimates can be interpreted as cause-specific multiplicative factors to be applied to the overall mortality rate ratio, when comparing subjects with low vs. those with high education.

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