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Burn related mortality in Greater Manchester: 11-year review of Regional Coronial Department Data

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ABSTRACT

Introduction: The Coroners Department (CD) records hold important demographic, injury and death details for victims of burn injuries derived from various sources yet this rich source of data has been infrequently utilised previously in describing the epidemiology of burn related mortality. The aim of this study was to use CD data to comprehensively investigate burn related mortality in the Greater Manchester region of United Kingdom.

Materials and methods: A retrospective study design was used to collect data for deceased demographics, injury details, site of death and cause of death from four CD offices in GM over an 11-year period (2000–2010 inclusive). Office of National Statistics (ONS) population metrics were used to calculate age- and gender-specific population denominators and mortality rates. Index of Multiple Deprivation (IMD) was used to correlate mortality with deprivation. Linear regression and Pearson's/Spearman's rank correlation were used to calculate trends and correlations. Poisson regression was used to calculate relative risk (IRR) between age- and gender groups.

Results: There were 314 recorded deaths in the region over the study period and thermal injury was 3-times less likely to result in death in 2010 compared to 2000. The largest proportion of these deaths (24.8%) was comprised of individuals ≥75 years in age. The relative risk of mortality in males was nearly 1.5-times higher and a significant majority of victims (77%) sustained their burn injury at their own home/residence. Inhalation injury without cutaneous burns was the most frequent type of injury (33%) and accidental house fires caused nearly half (49%) the injuries resulting in death. Sixty-five percent of deaths during this period were recorded to have occurred outside of regional burn service (RBS) hospitals and the commonest cause of immediate death on the death certificates was ''inhalation of products of combustion'' (32.1%). Within the >75 years age group the risk of death significantly increased with every quintile reduction in deprivation.

Conclusion: Our data shows that despite reducing overall mortality, certain age groups and causation patterns are associated with significantly higher risks of mortality in our region. Further reduction in burn mortality should focus on the use of prevention efforts with established effectiveness in these high-risk groups. In addition, as a significant proportion of deaths occur outside a burn service environment hence epidemiology data based solely on mortality statistics from burn services will underestimate true burn related mortality.

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1. Introduction

In the United Kingdom (UK) major traumatic injury is the leading cause of death in individuals under the age of 40 years with burn injury accounting for 1 in every 7 serious traumatic injuries sustained [1,2]. In the elderly age group (>65 years) burns are the third most frequent cause of accidental mortality, with only falls and road traffic accidents being more frequent [3]. A considerable body of evidence currently exists showing that effective multimodal prevention strategies employing public education, enforcement through legislation and technical advances in product design can reduce the morbidity and mortality associated with burns among all age groups [4–9]. These strategies however need to be targeted towards high-risk population groups to realise maximum impact, which in turn requires accurate, up-to-date and population specific health information [10]. Mortality associated with burns is important as it represents the tip of the burn injury ''pyramid'' reflecting the most severe end of the spectrum of injury. There are few reports in the literature of recent mortality data from the UK. The reports that do exist represent the survival statistics of individual burn services [11–15]. These descriptions have been important in documenting the improved survival associated with burns presenting to specialised services but have failed to look at the totality of burn mortality, i.e. pre-hospital mortality and deaths in non-burn service hospitals, with the resulting analysis excluding these deaths. This under reporting of the burn related mortality has major implications for planning, implementation and monitoring of prevention programmes. The descriptions in literature have also failed to present population-based mortality statistics limiting their usefulness to either monitor temporal changes in mortality in response to prevention programmes or to compare mortality across different geographic regions [16–20]. On the other hand studies that do report population-based statistics have suffered from a lack of consistency in presenting patient demographics, injury characteristics as well as age- and gender-specific injury rates [17,21–23].

Coroners' services in England and Wales form a statutory service that inquires into the circumstances of death of all unexpected, unexplained, suspicious, violent and work-related/industrial deaths. These include not only deaths at the scenes of accidents but also all hospital deaths and peri-operative deaths, which are reported to the 112 Coroners' Departments (CDs) in England and Wales. The geographical jurisdictions of these CDs are determined by Local Authority (LA) boundaries of which there are 433 in England (average population 121,000) and 22 in Wales (average population 136,000). Coroners investigate the reported deaths and request a post-mortem or hold an inquest (judicial inquiry into death) when the cause of death is unclear. The coroners' records hence hold important demographic, injury and death details for victims of burn injuries derived from various sources, e.g. fire service and pathologists in the forms of fire incident reports and post-mortem reports respectively. This rich source of data has previously been infrequently utilised in describing the epidemiology of burn related mortality both in the UK and globally [24,25].

Greater Manchester (GM) is a county in the North West of England, which comprises 10 LAs: Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford and Wigan. The population of the region is mainly urban but has a mix of high-density urban, suburban, semirural and rural distributions. The census in 2001 showed the total population of the region was approximately 2.5 million about 20% (527,193) of which were <16 years of age. The region is one of the most deprived in England with one in every 5 residents living in the 10% most deprived areas nationally [26]. Metropolitan Fire and Rescue Service statistics also show GM to have one of the highest fire incident casualty rates in the UK in the years 2009–2010 and 2010–2011 [27]. The regional burn service (RBS) in GM is comprised of an adult burn centre (University Hospital South Manchester) and a Paediatric burn centre (Royal Manchester Children's Hospital). The region is also served by 10 general hospitals (GHs) each one housing an Emergency Department catering to their local catchment population.

2. Aims

Using Office of National Statistics (ONS) census records, Department of Local Communities and Local Government (DCLG) deprivation metrics and data from the CD in GM the aims of this study were to:

i. comprehensively define burn related mortality in GM
ii. identify age- and gender-specific population-based burn related mortality rates
iii. investigate trends and age-/gender-specific risks of injury
iv. investigate the relationship between socioeconomic status (SES) and mortality associated with burns

3. Methods

A retrospective observational study design was used to investigate deaths attributed to burns that were reported to the CD offices within the GM region. An 11-year retrospective period between 1st January 2000 and 31st December 2010 was identified for data collection. The institutional Research Ethics Department provided ethical approval for the data collection.

3.1. *Coroner's data*

Each referral to the Coroner in GM generates a unique record for the individual with an identification number for the deceased. The CD staff enters data for the deceased from the time of referral through to when the inquest verdict is known and the case is closed. Four CD offices located in Bolton, Manchester City, Stockport and Rochdale serve GM (Fig. 1). The outcomes of Coroners' hearings are stored at each of the four coroner's offices on an electronic database.

A search was conducted of each of the four CD office databases using the terms ''burn'', ''explosion'', ''smoke inhalation'', ''carbon monoxide poisoning'', ''inhalation injury'', ''inhalation of products of combustion'' ''chemical