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Work injury trends during the last three decades in the construction industry

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ABSTRACT

Objectives: The aim was to analyze injury trends according to age, severity, work activity and business cycle in the construction sector.
Methods: From 1980 to 2010 a total of 23.464 work related injuries were treated at the emergency department at Odense University Hospital. The annual incidences were calculated. Employment levels in the construction sector were used as an indicator of fluctuations in the business cycle since 1980.
Results: Through the last three decades the overall trend of work-related injuries was unchanged. For some subgroups of injuries, such as major injuries and injuries due to young workers use of small powered tools significant downward trends were seen, but trends within different age groups of workers were unchanged and young workers have at least twice the risk compared to older workers. The fluctuations in work injury trends among workers under 30 years of age were significantly related to the business cycle, where the risk of injuries was higher during economic booms than during recessions. Further, periods with economic booms are positively related to the rate of minor injuries and injuries due to all other work activities than the use of power tools.
Conclusion: Overall the number of injuries in the construction sector have not changed significantly during the recent three decades, except for minor subgroups related to 'major injuries' and 'injuries due to use of small power tools'. Re-evaluation of safety prevention programs is needed in order to break the high injury level among young workers compared to older workers, especially during economic booms.

1. Introduction

A recent study revealed that the overall trend of work injuries in the Danish construction industry has been unchanged during the last three decades, which stands in contrast to the general downwards trend seen in work injuries in Denmark across all sectors (Nielsen et al., 2015). This long term trend as well as the pattern of annual fluctuations were similar for work injuries treated at a emergency department (ED) and for injuries reported to the Danish Working Environment Authority (Nielsen et al., 2015). This is in spite of a very small individual overlap between these two datasets. In addition, each data set represents to a large extent different injury events and different types of injuries (Lander et al., 2014). Thus, the strong concordance in the time trends and fluctuations indicates that injury frequency is influenced by one or more common underlying factor.

So far, no other European studies or surveillance reports covering work injury rates in the construction industry for this period exist. In a US setting, a significant decline in rates of reported work-related injuries and illnesses has been observed over the preceding 20-year period among union carpenters (McCoy et al., 2013). In particular, a substantial decline was observed for falls from height among these construction workers (Lipscomb et al., 2014). Also, the US Bureau of Labor Statistics observed a downward trend in reported work injuries in the construction industry as a whole (Welch et al., 2007). Inconsistencies in the information suggest that some of the apparent decrease may be due to changes in the ways injuries are treated, misclassification of employees, or underreporting (McCoy et al., 2013; Welch et al., 2007).

Construction has always been regarded as one of the most hazardous industries (Swuste et al., 2012). It is considered as a special case, as the nature of the work entails that automation and many technological improvements that have led to improved safety in other industries has not had the same impact within construction (Swuste et al., 2012). Thus, in this context the European Union (EU)

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since the early 1990s had enacted several directives, guidelines and standard directed toward safety and health at work e.g. Directive 92/57/EEC and the majorities of the member states including Denmark had fully implement specific legislation directed toward occupational safety in the construction sector (osha.europa.eu, 2015). In Denmark, as well as other western countries, much has been done during the last 20–30 years to regulate and improve work environment standards on building sites (Fabiano et al., 2001; Haslam et al., 2005; Danish Labor Inspection, 2015). Many initiatives have repeatedly been introduced, either through legislation or labor market agreements between employers and employees, both in specific industries and at enterprise level e.g. promotion of drug and alcohol-free workplaces, safety training programs, establishing safety groups on work-sites, but unfortunately few formal scientific evaluations have been undertaken measuring the effect on work injuries (Loomis et al., 2004; Fabiano et al., 2001; Wickizer et al., 2004; The Danish Health and Medicines Authority, 2008). Parallel to these initiatives, recurring economic recessions and booms within the construction sector, as well as other industries, continuously alter work conditions e.g. through changes in the number of hours worked, pacing of work, and changes in the level of recruitment of inexperienced labor (Asfaw et al., 2011). As a consequence, a declining number of reported work injuries are observed during recessions while an increase is seen during booms – a trend that the construction industry might be especially sensitive to (Nielsen et al., 2015; Asfaw et al., 2011).

It is clear that in spite of formal work standards and legislations work environment practices on construction sites are not fixed, but are altering constantly over time. However, very little is known about the impact of these dynamic processes on injuries in different subgroups of workers or on labor force characteristics. The aim of the current study was to describe long term trends in injury incidence rates in different age-groups, in different type of injuries, and in injuries due to different work activities in the construction sector, and to analyze the impact of the business cycle on work injuries according to these labor force characteristics.

2. Materials and methods

2.1. The observation data

The population base of the study is work sites situated in the catchment area of the Emergency Department (ED) at Odense University Hospital (OUH), which is situated in the city of Odense on the island of Funen, Denmark. The department is the only emergency room in that part of the island and the ED is a free 24-h emergency service. The catchment area for OUH is a well defined mixed rural and urban geographic area with a population of 362,000 inhabitants, which represents approximately 6.7% of the Danish population. The area is demographically and industrially comparable to Denmark as a whole (Statistic Denmark, 2015). Since 1980, the Accident Analysis Group (UAG) at the ED, OUH, has conducted systematic and quality-assured recording of all treated injuries. Each year 35–40.000 injury patients are treated at the ED. About 10% of these injuries occur during paid work and are classified as occupational. In 2010 the UAG ED-database contained information on approx. 160.000 occupational injuries. All injured individuals are indentified by a unique 10-digit personal civil registry number (CRN), and the CRN combined with year of injury was the key for linking to Statistics Denmark's Integrated Database for Labour Market Research, IDA (Statistic Denmark, 2015). IDA contains individual information on industry ties on an annual basis from 1980 to 2010. The IDA 6 digit industry codes were transformed into an overall construction sector code.

A total of 23.464 injuries within the construction industry between 1980 and 2010 were observed. Table 1 shows the dichotomized age distribution of the injuries. Almost half of all injuries involved construction workers below 30 years of age. Clinical information consisted of injury diagnosis based on ICD8 (1980–1992) and ICD10 (1993–2010), which was transformed into main type of injuries and body parts. 'Major injuries' include amputations, bone fractures, joint sprains and strains, all types of soft tissue damage, eye corrosion and burns, and electrical shock. 'Minor injuries' mainly consisted of superficial lacerations and wounds, and being struck by a foreign body (mainly in eyes). The ratio between major and minor injuries was one to two, see Table 1. The ED register also contains individual information on work activity leading to the injury (Table 1). These different types of activities were transformed into three main activities: (1) 'Movement activities', which include slips, trips, falls, striking an object when walking, handling or carrying materials. (2) 'Work with small power tools', e.g. electric or air pressure powered hand tools such as angel grinders, nail guns, drilling machines, as well as machinery in a stationary frame such as smoothing plane or band saw. (3) 'Miscellaneous work activities' include use of non-powered hand tools, various assembly or disassembly work tasks and a heterogeneous number of activities e.g. activities involving big machines such as cranes and trucks, and exposure to chemicals. We assumed that the proportion of workers at risk on the construction sites who perform these three categories of work tasks remains approximately constant from year to year during the observation period.

In the present study, the annual level of employment within the Danish construction sector was used to describe the business cycle from 1980 to 2010, see Fig. 1. Three major economic recessions can be observed with steep falls in employment in the first years of the 1980s, the first years of the 1990s, and the late years of the 2000s. A minor recession is also seen in the mid 2000s. The observed trend corresponds closely to trends in other measures of the business cycle, such as general unemployment, indicating that they measure the same underlying economic phenomenon (Asfaw et al., 2011). The correlation between annual level of employment within construction and the general unemployment level in Denmark was 0.83 ($P < 0.01$). Data was obtained from Bureau of Statistics Denmark.

2.2. Statistics

Total annual employment and age stratified employment in construction in the ED catchment area formed part of the denominator in the equations of the injury incidence rate calculations. Incidence was defined as the number of injuries per 1000 workers employed (Table 2). The table shows the distribution of injured construction workers, and the total number of employed workers in the catchment area of the Emergency Department according to

Table 1
Background indicators.

Indicators	*N*	% (95% CI)
Age (years)		
<30	11,028	47.0 (46.3–47.6)
⩾30	12,436	53.0 (52.0–53.9)
Type of injuries		
Minor injuries	15,972	68.1 (67.0–69.1)
Major injuries	7492	31.9 (31.2–32.7)
Injuries due to		
Movement activities	7893	33.6 (32.9–34.4)
Use of small powered tools	5024	21.4 (20.8–22.0)
Other work activities	10,547	45.0 (44.1–45.8)
Total number of injuries	23,464	