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Company size and differences in injury prevalence among apprentices in building and construction in Norway

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ABSTRACT

An increased risk for injuries is found in small enterprises, and is especially evident for the construction industry. Our aim was to study injury risk among apprentices in different sized enterprises within different building and construction trades. The study design was a cross-sectional survey among all apprentices in a county in Western Norway, designed to assess injury involvement during the apprenticeship period. Six-hundred seventy-three ($n = 673$) apprentices completed the questionnaire, giving a response rate of 81%. Overall the prevalence of injuries was higher among apprentices in training companies with 10–19 employees. However, trade-specific analysis for apprentices in building and electrical trades showed *different patterns regarding injury risk across different company sizes,* with increased risk in companies with 10–19 employees for the electrical trade and in companies with 20–49 employees in the building trade. In conclusion, when considering injury risk among young workers, nature of work and associated exposures, as well as other characteristics that may vary by size of the enterprise, should be assessed.

1. Introduction

The construction industry is complex, characterized worldwide by a multitude of trades and occupational groups also with a high share of small businesses (<50 employees). Injury rates are high in the industry (Courtney et al., 2001; Glazner et al., 1998; Kines et al., 2010; Lipscomb et al., 2010; Schoenfisch et al., 2010) despite widespread agreement that underreporting of injuries exists (Dong et al., 2011; Fan et al., 2006; Moore et al., 2013; Samant et al., 2008; Shannon and Lowe, 2002; Welch and Hunting, 2003). Issues of underreporting work injuries may be particularly relevant in small businesses (Sorensen et al., 2007).

Reports suggest that injury risk is greater among workers in small businesses (Fabiano et al., 2004; Hasle and Limborg, 2006) including the construction industry (McVittie et al., 1997). Establishing empirical evidence regarding differences in risk among workers in smaller and larger companies can be challenging (Dong et al., 2011; Sorensen et al., 2007) and establishing clear reasons for excess risk can be even more difficult, as small companies are difficult to reach (Hasle et al., 2010). A number of possible explanations have been suggested for these observations. Small enterprises may lack knowledge regarding risk and safety regulations, and they may be more likely to lack formal systems for OHS management (Hasle and Limborg, 2006; MacEachen et al., 2010). Further, workers in small enterprises have been reported to accept health risks and perceive health as an individual responsibility due to informal social relations in the enterprise, with little or no distance between workers and employers (MacEachen et al., 2010).

Risk differences in construction are also reported relative to characteristics of workers themselves including age, job tenure, and even nationality (Lipscomb et al., 2014 (falls); Schwatka et al., 2013; Spangenberg et al., 2003, 2002). While there may be tendencies to attribute age-related injury risk among young workers to their inexperience, relative lack of training, or even youth itself, there is evidence to suggest that such assumptions should not be made without careful consideration of their actual job exposures (Lykke Nilsen et al., 2013). For example, Lipscomb et al. (2003a) suggested initial attribution of marked increased risk for nail gun injuries among apprentice carpenters to lack of training. Later evidence revealed marked exposure differences based on job tenure with inexperienced carpenters often being assigned

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the use of this easy to operate, but dangerous, tool (Lipscomb et al., 2003a, 2008b). In addition to direct work exposures related to the nature of work, young workers may be particularly vulnerable in small companies, due to needs for being accepted and included socially, or trying to behave in accordance with the accepted norms within the company (Lykke Nilsen, 2012).

Training in the construction industry is highly variable but typically involves less experienced workers working alongside more experienced ones in formal or informal apprenticeship type relationships. In the case of Norway 92% of youth between 16 and 18 years of age participated in upper secondary education and training in 2012 (Statistics Norway, 2013a). Of the 240,000 students in 2012, 39,000 (16%) were apprentices (Statistics Norway, 2013a). Within the group of apprentices 21% were in building and construction, while 20% were in the electrical trade (Statistics Norway, 2013b). Yet another 21% of the apprentices were within "Technical and industrial production" (ibid.), but only a minority of these work in construction (KARRI, 2011).

The norm for vocational studies is attending school for two years, followed by two years of apprenticeship. The years of apprenticeship give the students practical training within companies according to their discipline. They work full-time in the company, during which time they are subject to the responsibility of the Employer Organizations' Offices for Training. There are several discipline-specific training offices belonging to different Employer Organizations. Each office is responsible for all apprentices in training companies that are members of the Employer Organizations. It is the Training Office's responsibility to ensure fulfillment of the apprentices' curriculum. Not all training companies are members in the Employers Organizations. A minority of the apprentices are therefore under the responsibility of the county authority. The apprenticeship is typically the young students' first experience with real life work. It is also an opportunity for a permanent position, potentially adding strain to the apprentice to adapt to the working culture. Although apprentices have a specific training program to be followed during their 2 years of apprenticeship, differences in the reception and OHS training given to apprentices among companies of different sizes have been observed (Holte and Kjestveit, 2012).

The aim of this analysis was to explore injuries among apprentices in small enterprises within different building and construction trades, compared to medium-sized and large enterprises. It specifically examined whether injury risk differed among apprentices in micro (1–9) and small enterprises (10–19, 20–49) versus medium (50–99) and larger-sized enterprises (100+).

2. Materials and methods

2.1. Sample

The study is based on a cross-sectional survey conducted among all apprentices in Rogaland County (Western part of Norway) within the disciplines of building (the raising of buildings), electrical trades, building techniques (indoor, surface and plumbing), and construction (ground work, infrastructure) within the time period from October 2007 until March 2008. Totally, 831 apprentices received the questionnaire. The survey was completed by 673 apprentices (response rate of 81%). It was part of a larger study of young workers (<25 years old) within the building and construction industry (Holte and Kjestveit, 2012; Kjestveit et al., 2011). As there are about 39,000 apprentices in Norway each year of which ~16,000 belong to our disciplines (Statistics Norway, 2013b), our study group constituted between 4% and 5% of the Norwegian population of apprentices.

2.2. Questionnaire

The questionnaire included background questions on age, gender, apprenticeship tenure assessed by number of months in the company in apprenticeship training, weekly working hours, and size of training company by number of employees (categories *1–4, 4–9, 10–19, 20–49, 50–99 and above 100*). The main part of the questionnaire assessed topics addressed in occupational health and safety training at school and the relevance of this training for the practical work in the company (14 items), and items assessing company-specific issues like safety training and safety focus (13 items). The substantive items assessed injuries as well as being involved in incidents, type of injury, consequences and causes for injuries/incidents during the apprenticeship period. The items in the questionnaire were developed for this purpose specifically as part of pilot work for the larger study.

Specific questions assessing injuries were as follows; "During your time of apprenticeship, have you been involved in an accident in which you got injured (*yes, no*)?", "What was the background for the accident (*insufficient protection, wrong use of machinery and tools, wrong placement, wrong lifting, wrong performance, lack of training*)?", "In what type of accident did you get injured (*hit by an object, fall, cut or puncture, crushed, electrical shock, others*)?", "What kind of injury did you get *(bruise/contusion, wound, joint distortion, fracture, others)?",* "Did the injury cause (*yes, no*): first aid?, medical examination?, self-reported sick leave?, medically certified sick leave?, alternative work?" with several causes allowed, and "Was the accident reported to (*yes, no, do not know*): supervisor?, HSE-manager?, safety deputy?, The Labor Inspection?, National authority for work and welfare?, others?" with several causes allowed. Incidents were assessed by similar phrasing, however the questions considering type of injury and consequences were omitted. The 14 questions assessing occupational health and safety training at school and the relevance of this training for the practical work in the company were as follows; "Have you received education within this topic at school *(no, yes, do not know)*": "General introduction to occupational health and safety?", "Introduction to safe use of machinery tools and equipment?", "Introduction to use of protective equipment?", "Introduction to working techniques and working positions (ergonomics)?", "Introduction to dangers by use of different work methods?", "Introduction to dangers of material handling?", "General introduction to the Work Environment Act?", "Introduction to internal control regulations?", and "Introduction to use of equipment (the 555 regulation)?". Further questions on this issue were; "Was theoretical teaching followed by practical work or exercises (*1 = to a very little degree, 5 = to a very high degree*)?", "Did teachers emphasize occupational health and safety education as important (*1 = to a very little degree, 5 = to a very high degree*)?", "By taking your prevailing experience into consideration (*1 = to a very little degree, 5 = to a very high degree*)": "Do you find the occupational health and safety education at school relevant for your work in the company?", "Did school provide enough occupational health and safety education for your recent job?", and "Was the school education in accordance with the way work is performed in the company?". The 13 questions assessing company-specific issues like safety training and safety focus were as follows; "In the company of your apprenticeship, have you received occupational health and safety training within these topics (*no, yes, do not know*)": "General introduction in the company's system and routines for occupational health and safety?", "Introduction to safe use of the company's machinery and tools?", "Introduction to use of protective equipment?", "Introduction to proper working techniques and working positions (ergonomics)?", "Have you participated in the following activities during your period of apprenticeship (*yes, no, not relevant*)": "Meetings having occupational health and safety as a topic?",

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