Work accident victims: a comparison between non-standard and standard workers in Belgium

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Background: The fast growth of non-standard employment in developed countries highlights the importance of studying the influence of contract type on worker's safety and health.

Objective: The main purpose of our study is to investigate whether non-standard workers are more injured than standard workers or not. Additionally, other risk factors for occupational accidents are investigated.

Methods: Data from the Belgian surveys on work ability in 2009 and 2011 are used. During their annual occupational health examination, workers were asked to fill in a self-administered questionnaire. In total, 1886 complete responses are collected and analyzed using logistic regression.

Results: Temporary workers did not have higher injury rates than permanent workers [OR 0.5, 95% confidence interval 0.2–1.2]. Low-educated, less-experienced workers and those exposed to dangerous conditions are more frequent victims of occupational accidents.

Conclusion: The present data do not support the hypothesis that non-standard workers have more injuries than standard workers. Our results about occupational accidents derived from a non-representative sample of the Belgian workforce and cannot be generalized due to the heterogeneity in job organization and labor regulations between countries. Further research is needed to extend our findings and to seek other factors that may be associated with work accidents.

Keywords: Work accident, Non-standard work, Belgium, Occupational injuries

Introduction

Work accidents are a significant burden to society.¹ Multiple factors contribute to occupational injuries and most research has focused on identifying individual and workplace contributing factors. Known risk factors include younger age, male gender, and low educational attainment.^{2–4} Furthermore, working long hours and job insecurity are also associated with increased incidence of occupational injuries.^{5,6} Results from a cohort study of manufacturing workers found that workers with health problems, such as chronic heart disease, diabetes, and depression have a higher rate of acute occupational injuries than workers without coexisting conditions.⁷ Lower Work Ability Index scores (a proxy for poor work ability) are also positively associated with work injuries.⁸ Accidents and injuries are more prominent in construction, agriculture, hunting and forestry, and manufacturing.⁹ In addition, some studies found that job stress and demanding physical and mental workloads increase the risk for occupational accidents and injuries.^{10,11} Hazardous worksite conditions

(e.g. loud noise, vibration, extreme temperatures) and a lack of protective equipment and training are other well-documented factors that contribute to injury.^{12,13} Protective factors for occupational injury include implementation of occupational health and safety management system in the workplace and job tenure.^{14–16} Workers with less than six months of experience showed higher relative risks compared with job tenure of more than two years.^{15,16}

However, working conditions continue to change rapidly as a result of factors such as globalization, economic fluctuations, and technology. The number of workers with standard work contracts (permanent or full time workers) has decreased while non-standard work continues to increase.^{17–19} Fixed-term work, temporary employment, part-time employment, self-employment, telecommuting work, home-based work, and on-call work are forms of non-standard work.²⁰ Despite the heterogeneity of the term “non-standard”, these employment arrangements are often characterized by lower income, poor job security, and low knowledge of workplace risks and health hazards. Women are more likely than men to be employed in non-standard work.^{20–22}

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In 2010, 14% of workers in Europe had temporary work contracts, ranging from approximately 65% in Kosovo to 1% in Romania.²³ The growth of non-standard employment highlights the importance of studying how contract type influences occupational health and safety. In the last decade, studies have found that the health of non-standard workers is worse than their standard worker counterparts. Backache, fatigue, muscular pains, mental distress, poor self-rated health, and tobacco use are associated with non-standard work.^{24–26} However, there is less research on the association between non-standard work and occupational injuries. Studies in India, Korea, and Italy found that non-standard temporary workers were more likely to be injured compared to standard workers.^{5,27,28} However, contradictory results were reported in studies from Finland and Spain.^{29,30}

The studies described above investigated the relationship between non-standard work and occupational injuries by analyzing specific or national settings. Our aim is to extend the existing literature on work accidents with Belgian data. We hypothesize that the risk of having a work accident is higher among non-standard workers compared to standard workers. This study also explores the extent to which demographic and work-related factors predict work accidents.

Methodology

Data collection

In Belgium, occupational health care is compulsory. All contract workers (3.7 million), who are exposed to chemical, biological, or physical hazards, benefit from comprehensive occupational health care provided by occupational health services. About half of the Belgian workforce (2 million) undergoes an annual health examination and approximately 750,000 workers complete a health assessment every three to five years.

In 2009 and 2011, occupational physicians who were members of the Belgian Professional Association of Occupational Physicians recruited a convenience sample undergoing annual medical examinations to complete a voluntary questionnaire on work ability. A total of 1886 individuals completed questionnaires. All participants provided informed consent.

Study questionnaire

The Federal Public Service Employment, Labour and Social Dialogue conducted a series of studies aiming to elaborate the concept of “work ability” in Belgium. A survey referred to as VOW/QFT/QAW (Vragenlijst Over Werkbaarheid/Questionnaire sur les Facultés de Travail/Questionnaire About Workability acronym in Dutch, French and English respectively) was developed. The VOW collects information about how workers perceive the balance between personal characteristics and job requirements. The questionnaire includes six modules: Module 1 measures job demands and psychosocial resources of the

worker; Module 2 assesses occupational physical requirements; Module 3 measures work accidents and safety climate; Module includes questions about health status; Module 5 measures the perceived skills and the capacity; and Model 6 inquires short- and long-term job plans.³¹ Work accidents were determined by the question: “During the past year, have you been involved in a work accident?”

Measured socio-demographic variables were: age, sex, and education level. Education was divided into three categories: low educational attainment (≤ 9 years of education); moderate educational attainment (12 years of education); and high educational attainment (> 12 years of education). Self-rated health was measured using the question “How would you rate your health in general the past two weeks?” Response categories were bad, fair, good, very good, and excellent. This variable was dichotomized (good/very good and fair/bad/very bad). Work ability was assessed with the question: “To what extent do you agree with the following statement? I am well prepared to face the requirements imposed by my job.” Response categories included: strongly disagree, do not agree, partly agree, agree, and strongly agree. Those responding “strongly not agree and not at all agree” were categorized as “not agree”; those responding “partly agree, rather agree and strongly agree” were categorized as “agree.”

Contract type was determined from the question “What type of contract do you have?” Response categories were: statutory (civil servant), permanent contract, fixed-term contract, temporary contract, self-employee (someone performing a professional activity but who is not an employee or civil servant), and other. Workers with statutory and indefinite contracts were classified as standard workers and those with fixed-term, temporary, other, or self-employed contracts were classified as non-standard workers. Occupation type was determined from the question: “Which description best fits your occupation?” Response categories included: blue-collar, white-collar, and mixed occupation. A blue-collar worker primarily carries out manual work, whereas a white-collar worker carries out intellectual work. Work time was assessed by this question: “What is your work time?” There were four possible response categories: full-time, between full-time and part-time, half-time and less than a half. Participants were classified as “full-time” workers if their answer on work time was full-time or between full-time and half-time; and they were classified as working “half-time” if their answer was working half-time or less than half-time. “Full-time” workers work between 36 and 40 h on average (as a result of the Belgian working time regulations, which are far stricter than the EU Directive in this regard).³²

Work experience was based on number of years employed. Participants were classified as having “less experience” if they had worked less than two years or having “more experience” if they had worked two or more years. This cut-off was based on Belgian legislation concerning temporary work, which states if you work for one

employer, temporary work is allowed to be repeated for a maximum period of two years, if the contract period is three months. If contracts are six months in length, then the contract can be repeated for a maximum of three years.³³

Job sector categorization was based on the instruction: "Select the job type in which you work" Answers were divided into: (1) the service sector comprising the whole-sale and retail, hotel/restaurant/cafe, garage, teaching, transport, public transport company, post and telecommunications, banks and insurance, health and well-being, business services (cleaning, consultancy), public administration and other services; (2) the industrial sector consisting of production of textiles, clothing, metallurgy, construction, food industry, chemistry, wood and paper, gas, water, electricity, printing, publishing and other industry, and (3) the agriculture sector including agriculture / horticulture and forestry / fishing.

Work hours were divided into "long" (48 + hours/week) vs. "normal" (47 or fewer hours/week) based on the European Working Time Directive.³⁴ Job insecurity was measured with the item: "I think that I am going to lose my job in the future". Response categories were never, sometimes, often and always. The variable was dichotomized into "no": never vs. "yes": sometimes, often and always. Safety climate was measured by asking (1) did you receive good training concerning health and safety and (2) did you receive good personnel protective equipment? Workers who responded "yes" to these questions were categorized as having a good health and safety training and good personnel protective equipment in contrast to workers who responded "no".

Job exposure to hazardous situations or conditions included vibration, noise, extreme temperatures, chemical substances, dangerous conditions, physically demanding tasks, uncomfortable or tiring positions, and repetitive tasks. All work-related exposures were assessed on a four-point response scale (never, sometimes, often, and always) and responses were dichotomized ("no" vs. "yes": never and sometimes; often and always).

Statistical analysis

Descriptive statistics were computed for all variables, including frequencies and proportions for categorical variables and the mean and standard deviation for continuous variables. Chi-square tests were conducted to explore whether potential risk factors were univariately associated with work accidents. A multiple logistic regression analysis investigated whether socio-demographic variables, work-related factors, and job exposures predicted the odds of self-reported occupational injury.

First, socio-demographic items (age, gender, education, self-rated health and work ability) were entered as independent variables with injury status as the outcome. Work-related factors such as occupation type, work time, total work experience, sector of activity, working hours, job insecurity, safety knowledge, availability of personal

protective equipment were entered in a second model. In the final model, job exposures were entered. In all analyses, adjustments were made for confounding variables, regardless of their univariate associations with the outcome. This was to prevent potentially important variables being rejected. All variables were entered in a single step. Data were processed and analyzed using SPSS version 21.0. All models were evaluated at 95% significance level ($p < 0.05$).

In the logistic regression analyses, the following dichotomous categories were created for the variables: (1) contract type (temporary vs. permanent), (2) age groups (younger than 40 years vs. older than 40 years), (3) gender (men vs. women), (4) work experience (≤ 2 years vs. > 2 years), (5) work time (full-time vs. half-time), (6) occupation type (blue-collar vs. mixed and white-collar), (7) education level (low vs. high and medium), (8) self-rated health (bad vs. good), (9) good work ability (not agree vs. agree), (10) sector (industry and agriculture vs. services), (11) working hours (long vs. normal), (12) job insecurity (yes vs. no), (13) safety knowledge (no vs. yes), (14) availability of personal protective equipment (no vs. yes), (15) job exposures (yes vs. no).

Results

Sample characteristics

A total of 1886 workers were included in the analyses including 1055 men (55.9%) and 831 women (44.1%) (Table 1). Average age was 39.8 years (± 11.0 SD) and 26.4% had a low educational attainment. The majority (86.7%) worked full-time and had normal working hours (94.2%). A total of 87.5% of the respondents were permanently employed, whereas 12.5% ($n = 227$) worked with a temporary contract. Of the whole sample, 8.7% ($n = 159$) reported being injured at work during the last year.

More than two-thirds of the workers (79.9%) reported their health as being either (very) good or excellent and they experienced no job insecurity (72.5%). Mean total seniority was 18.5 years (± 11.6 SD) and more than half of the subjects were working in the service sectors (58.0%). The most frequently reported job exposures were uncomfortable or tiring positions (66.3%), exposure to noise (59.7%) or physically demanding tasks (58.9%), and exposure to extreme temperature (53.3%).

Table 2 summarizes the calculated ORs and 95% CIs from the logistic regression analysis for an injury at work.

In the first model with socio-demographic variables, education was the only variable significantly associated with injury (OR 2.71, 95% confidence interval 1.70–4.31). However, the model as a whole significantly predicted the odds of self-reported injury (Model 1: $\chi^2 = 24.16$, $p = 0.001$). In the second model, which included the addition of work-related variables (except job exposure), education and total work experience were significantly associated with injury (OR 1.97, 95% confidence

Table 1 Descriptives of the study population

Variable	Total study sample (n = 1886)	Variable	Total study sample (n = 1886)
Socio-demographic factors		Job insecurity: n (%)^a	
Gender: n (%) ^a n = (1886)		n = (1759)	1276 (72.5)
Male	1055 (55.9)	No	483 (27.5)
Female	831 (44.1)	Yes	
Mean age: year (SD)	39 (11.0)	Safety-climate	
Education level: n (%) ^a n = (1867)		Safety knowledge: n (%) ^a	
Low	493 (26.4)	n = (1786)	
Medium	638 (34.2)	No	492 (27.5)
High	736 (39.4)	Yes	1294 (72.5)
Self-rated health: n (%) ^a = (1855)		Personal protective equipment: n (%) ^a n = (1747)	
Bad	372 (20.1)	No	354 (20.3)
good	1483 (79.9)	Yes	1393 (79.7)
Good work ability: n (%) ^a n = (1807)		Job exposure	
Not agree	91 (5.0)	Vibration: n (%) ^a n = (1833)	
Agree	1716 (95.0)	No	1059 (57.8)
Work-related factors and work accidents victims		Yes	774 (42.2)
Injured: n (%) ^a n = (1818)		Noise: n (%) ^a n = (1842)	
No	1659 (91.3)	No	742 (40.3)
Yes	159 (8.7)	Yes	1100 (59.7)
Contract: n (%) ^a n = (1814)		Extreme temperature: n (%) ^a n = (1840)	
Permanent	1587 (87.5)	No	860 (46.7)
Temporary	227 (12.5)	Yes	980 (53.3)
Occupation type: n (%) ^a n = (1867)		Chemical substances: n (%) ^a n = (1845)	
Blue-collar	700 (37.5)	No	1134 (61.5)
Mixed occupation	635 (34.0)	Yes	711 (38.5)
White-collar	532 (28.5)	Dangerous conditions: n (%) ^a n = (1827)	
Work time: n (%) ^a n = (1832)		No	932 (51.0)
Full-time	1588 (86.7)	Yes	895 (49.0)
Half-time	244 (13.3)	Physically demanding tasks: n (%) ^a n = (1854)	
Total work experience: n (%) ^a n = (1849)		No	762 (41.1)
Experience ≤ 2 year	126 (6.8)	Yes	1092 (58.9)
Experience > 2 year	1723 (93.2)	Uncomfortable or tiring positions: n = (1841)	
Sector: n (%) ^a n = (1811)		No	621 (33.7)
Industry and agriculture	760 (42.0)	Yes	1220 (66.3)
Service	1051 (58.0)	Repetitive tasks: n (%) ^a n = (1845)	
Working hours: n (%) ^a n = (1825)		No	606 (32.8)
Long	106 (5.8)	Yes	1239 (67.2)
Normal	1719 (94.2)		

^aCalculated according to the percentage of the valid count.

interval 1.08–3.60 and OR 2.49, 95% confidence interval 1.33–4.65, respectively). The second model showed that the logistic regression model was significant (Model 2: $\chi^2 = 48.44$, $p < 0.001$). In the third model, eight job exposures variables were separately added (Table 2). Among the exposure variables, injury was associated with exposure to dangerous conditions (OR 1.91, 95% confidence interval 1.08–3.39) and total work experience remained positively associated with injury (OR 2.78, 95% confidence interval 1.46–5.29). Model 3 significantly predicted odds of injury (Model 3: $\chi^2 = 65.99$, $p < 0.001$). Models 1 and 2 accounted for 3.3 and 8.0% respectively (Nagelkerke R^2) of the variance in the injury outcome, and Model 3 predicted 11.3% (Nagelkerke R^2) of the variance in the injury outcome.

Discussion

We surveyed a population of Belgian workers to investigate whether non-standard workers experience more injuries compared to standard workers. The prevalence of non-standard work in our study was 12.5%, comparable with the European statistics, indicating a 8.1% for Belgium

in 2010.²³ However, contrary to our expectations, we did not find that non-standard workers report increased occupational injuries compared to standard workers.

Comparisons between international studies are difficult due to the heterogeneity of job organization, employment arrangements, worker power, and efficacy of government regulation. There are important differences in the definitions of non-standard work. Some authors consider only casual and temporary employment (including agencies leasing workers) as non-standard, whereas others also include self-employment and home-based work.^{21,22} Our sample consisted of four types of non-standard workers: fixed-term contract, temporary contract, another type of contract and self-employed workers, which may have influenced results.

Another possible explanation for our finding is the fact that Belgian non-standard workers are mostly employed in the service sector such as education and socio-cultural work, retail, hotels/restaurants, post company, personnel care services, and cleaning.³³ In this study, the percentage of temporary workers who worked in the service sectors was 13.37%, and 11.81% of the temporary workers were

Table 2 Odds ratios OR and 95% confidence intervals [95% CI] for occupational injury risk factors from multivariate logistic regression model with permanent contract as reference group

Variables		Work accident victims
		Adjusted OR [95%CI]
Contract type	Temporary vs. permanent ^c	0.58 [0.28–1.20]
Gender	Men vs. Women ^c	0.74 [0.41–1.33]
Age group	≤ 40 vs. > 40 ^c	1.15 [0.73–1.81]
Education	Low vs. medium and high ^c	1.97 [1.06–3.67]
Self-rated health	Bad vs. good ^c	1.36 [0.83–2.22]
Good work ability	Not agree vs. agree	1.37 [0.60–3.09]
Occupation type	Blue-collar vs. mixed and white-collar ^c	1.18 [0.49–2.80]
Work time	Full-time vs. half-time ^c	0.99 [0.51–1.94]
Total work experience	≤ 2 years vs. > 2 years ^c	2.78 [1.46–5.29]
Sector	Industry and agriculture vs. services ^c	1.38 [0.78–2.45]
Working hours	Long vs. normal ^c	0.88 [0.35–2.17]
Job insecurity	Yes vs. No ^c	1.55 [0.99–2.41]
Safety knowledge	No vs. yes ^c	0.98 [0.57–1.70]
Personal protective equipment	No vs. yes ^c	0.90 [0.47–1.71]
Vibration	Yes vs. No ^c	0.80 [0.43–1.52]
Noise	Yes vs. No ^c	1.17 [0.63–2.16]
Extreme temperature	Yes vs. No ^c	0.89 [0.54–1.45]
Chemical substances	Yes vs. No ^c	0.73 [0.44–1.21]
Dangerous conditions	Yes vs. No ^c	1.91 [1.08–3.39]
Physically demanding tasks	Yes vs. No ^c	1.29 [0.68–2.46]
Uncomfortable or tiring positions	Yes vs. No ^c	1.54 [0.77–3.11]
Repetitive tasks	Yes vs. No ^c	1.40 [0.78–2.51]

^bAdjusted, in addition, for all work-related factors.

^cReference category.

The proportion of the explained variance of the multivariate model is 11.3% $R^2 = 0.113$ (Nagelkerke R Square) for work injury.

working in the industry and agriculture sectors. Overall, the service sector has better working conditions and less dangerous job conditions compared to industries such as metal and construction.^{35,36} Therefore, the number of observed work accidents may be lower than expected. In this respect, our results are in line with the research of Saloniemi et al., who found that fixed-term workers did not have a higher occupational injury rate than permanent workers.²⁹ The most important explanation for this finding was that, in Finland, fixed-term workers are concentrated in public services such as health care and education which contain a prevalence domination of female workers.

A second possibility to explain our results is the short contract period of many temporary workers (less than one year). Some may have suffered an accident while holding a temporary contract, but were no longer employed at the

time of our survey, resulting in underreporting of work injuries in non-standard workers (healthy worker effect). On the other hand, non-standard workers with three- or six-month temporary contracts were also, likely underrepresented in our study.

A plausible third explanation is the recent efforts and legal initiatives taken by the Belgian government to decrease workplace accidents. The Royal Decree of 15 December 2010 forbids temporary work agencies to offer the following jobs: gassing activities, demolition and removal of asbestos and removal of poisonous waste products.³⁷ Other measures include financial incentives for employers who improved the working conditions and implemented accident prevention strategies, including equipment upgrades. In the latest report of the Fund of Occupational Accidents, there was a 4.2% reduction in

the number of occupational accidents between 2012 and 2013, and the number of accidents was halved between 1985 and 2013.^{36,38}

According to the 2014 annual report of Belgian Safe Work Information Center (BeSWIC), the number of accidents among temporary workers, declined to 8% in 2013.³⁹ Our data included some questions regarding safety climate at work: (1) did you receive a good training concerning health and safety and (2) did you receive good personnel protective equipment? Regarding these questions, the percentage of temporary workers who responded yes was higher than among permanent workers (69.2% vs. 63.2% and 75.8% vs. 74.9%, respectively). This indicates that non-standard workers are well trained and protected, possibly explaining the lower incidence of work-related injuries compared to standard workers in our study.

Another point of interest has been put forward in a recent article reporting that in the United States working population, those with non-standard work arrangements tend to work in multiple jobs and that multiple jobs increased the risk of injury.⁴⁰ In our study, we were unable to measure number of jobs and is an area for future research.

Our findings are similar to those reported by Benavides et al., who found that the higher rate of occupational injuries among non-standard workers was attributable to less work experience and poor knowledge of workplace hazards.⁴¹ This finding is consistent with Bena et al., who found that injury rates decrease with increased time spent in the current job and those of Malliarou, which found that less working experience increased the probability of occupational injuries among military personnel.^{16,42} Other risk factors associated with injuries in this study were educational level and job exposure. In agreement with prior studies, higher educated workers reported the lowest accident rate and were the most compliant with the safety process.⁴³

The relationship between exposure to chemicals, physical risk factors, poor ergonomics, and work accidents was of interest in this study. Working conditions addressed the presence of hazards during a usual working day e.g. exposure to noise, vibration, extreme temperatures, chemical substances, handling of heavy loads, uncomfortable or tiring positions, performing repetitive tasks and also dangerous situations. Examples of the latter include working on a slippery or unstable surface, risk of falling, handling dangerous tools and machines, and risk of electrocution. In comparison with other studies, we found that workers were exposed in the same magnitude to all these conditions but dangerous situations were the only statistically significant explanatory variable for having an accident or injury.¹² Previous research has found noise exposure to be a determinant of on-the-job injuries.^{6,12,13} However, adverse effects of occupational noise exposure usually occur in the range 80–85 dBA and > 85 dBA. Noise exposure level data were not available in the present study, but it is possible that the average noise level among this

sample was lower given the fact that many wore personal protective equipment and received occupational training. With regard to other possible causes of accidents e.g. vibration and cold temperature, the same reasoning may also apply: workers who are exposed to these hazards but who receive adequate information and dispose of efficient protective measures (gloves, warm clothing) will exhibit no excess risk in comparison with laborers who are not confronted with these adverse working conditions.

Study strengths and limitations

Given the lack of available data on the relationship between employment type and occupational injuries, this study makes an important contribution to the literature. Furthermore, using self-reported injury as outcome may reduce possible injury underreporting based on data from employers and workers' compensation. This study is the first to investigate the situation of Belgian non-standard workers and the findings could advance worker health and safety. Interventions to enhance the quality and safety of jobs can be organized at several levels e.g. training and education of individuals, redesign of work places, legislation to limit poor working conditions.

However, also some limitations should be mentioned. Participants did not represent the Belgian workforce since physicians recruited workers from a range of companies and occupations to complete the survey at their annual health examinations. Consequently, some industries were underrepresented. Also, the present results cannot be generalized to other countries, since labor regulations and social care system vary widely. Further research should be performed in diverse occupational settings to investigate the external validity of our findings.

In conclusion, the present data do not support the hypothesis that non-standard workers have more occupational injuries than standard workers. However, other characteristics related to non-standard employment such as low experience, educational attainment, and dangerous work sector were positively associated with a higher risk of occupational accidents. Notwithstanding, educational strategies and better employment arrangements are strongly advised to prevent occupational injuries.

At the individual and organizational level, we recommend the implementation of more safety measures and educational programs to improve in particular the knowledge and skills of low-educated and less-experienced workers. At the policy level, Belgian and European strategies should emphasize the importance of the development of more and better jobs: further legislative initiatives should limit exposure to dangerous working conditions.

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Contributors

HA carried out the study design, analyzed the data, interpreted results, and wrote the first draft of the manuscript. TVH was consulted on data analysis, interpretation of results, and reviewed and commented on manuscript drafts. MAW and LB provided advice on the entire work including the data analysis, interpretation of results, reviewed and commented on manuscript drafts. All authors read and approved the final manuscript.

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