Original Article

Analysis of Workplace Accidents in Automotive Repair Workshops in Spain

Antonio López-Arquillos*, Juan Carlos Rubio-Romero ∗

Cátedra de Prevención y Responsabilidad Social Corporativa, Departamento de Economía y Administración de Empresas, Escuela Técnica Superior de Ingenieros Industriales, Universidad de Málaga, Malaga, Spain

A R T I C L E   I N F O

Article history:
Received 4 December 2015
Received in revised form 17 January 2016
Accepted 28 January 2016
Available online 16 February 2016

Keywords:
accident
automotive maintenance
injury
occupational safety
workshop

A B S T R A C T

Background: To analyze the effects of the factors associated with different types of injury (superficial wounds, dislocations and sprains, bone fractures, concussion and internal injuries, burns scalding and freezing) caused by occupational accidents in automotive repair workshops.

Methods: Study of a sample consisting of 89,954 industry accidents reported from 2003 to 2008. Odds ratios were calculated with a 95% confidence interval.

Results: Belonging to a small company is a risk factor for suffering three of the five types of injury studied. Women are less likely to suffer burns and superficial wounds, and more likely to suffer dislocations or sprains. Foreign workers are more likely to suffer concussion and internal injuries.

Conclusion: Health and safety strategies and accident prevention measures should be individualized and adapted to the type of worker most likely to be injured in each type of accident. Occupational health and safety training courses designed according to worker profile, and improving the participation of the workers in small firms creating regional or roving safety representatives would improve working conditions.

Copyright © 2016, Occupational Safety and Health Research Institute. Published by Elsevier. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Prevention of injuries from occupational accidents is a public priority [1], and accordingly several studies on this issue have been conducted in Spain. These studies have focused on different aspects, such as trends over time for fatal injuries caused by occupational accidents across all sectors [2], or the risk of foreign workers suffering occupational accidents [3].

Much research has been done into occupational accidents in hazardous and economically important sectors such as the construction industry [4–6], but, although vehicle repair is an important global economic activity, this sector has been the target of far fewer studies on workplace health and safety than the aforementioned construction industry.

In the United States, 3.9 out of every 100 full-time workers employed in the automotive repair and maintenance sector in 2011 suffered some kind of nonfatal occupational accident or illness, according to data from the Bureau of Labor and Statistics [7]. The accident rate for this industry was higher than that reported by other, apparently more hazardous, sectors such as support activities for mining or the chemical industry, which had rates of 2.3 and 2.4 per 100 workers, respectively [7].

The sector’s high accident rate is associated with several different variables, and in their day-to-day activity workers from the sector are exposed to many different risk factors such as high noise levels [8–10], asbestos [11–13], or ergonomic conditions [14,15]. Although some of these risks are classified as hygienic risks and they are associated with occupational diseases, previous research [16] demonstrated that there were strong relationships between hygienic conditions and occupational accidents. They showed that poor hygienic conditions duplicate the probability of accident [16]. Majority of the previous scientific researches found about occupational health and Safety in the automotive repair and maintenance sector were located in the United States. In Europe, there is a lack of scientific publications about the topic; however, there are some professional guides about cited risks as the guide

* Corresponding author. C/Doctor Ortiz Ramos, Escuela Técnica Superior de Ingenieros Industriales, Universidad de Málaga, 29071 Malaga, Spain.

E-mail address: investigacioncatedra@gmail.com (A. López-Arquillos).

The authors have made substantial contributions to the study in terms of concept and design, requesting accident data from the Ministry of Employment and Social Security, processing and interpreting these data using SPSS 19, and both writing and conducting critical reviews of the article. They also approved the final version.

2093-7911/5 – see front matter Copyright © 2016, Occupational Safety and Health Research Institute. Published by Elsevier. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

http://dx.doi.org/10.1016/j.shaw.2016.01.004
proposed by the Health and Safety Executive [17], and the training guide for assessing the risk in cars repair workshops [18] proposed in the TRIA project, coordinated by Cyprus Workers’ Confederation. In Spain, there are more examples of risk assessment guides, such as that edited by the Centro de Experimentación y Seguridad Vial MAPFRE (CESVIMAP) [19], or the manual proposed by the Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT) [20].

It is remarkable that the Spanish Ministry of Employment registered 89,954 occupational accidents in the sector over the 2003 to 2008 period, leading to varying degrees of injury. Therefore, accidents in the sector are not a minor problem. Although it was not possible to obtain the disaggregate data of accidents the sector in order to calculate specific incidence rates, only the total number of accidents should be a reason to study and address the problem of the accidents in this sector more deeply.

The aim of this study is to analyze the effects of the factors associated with different types of injury (superficial wounds; dislocations and sprains; bone fractures; concussion and internal injuries; burns, scalding, and freezing) caused by occupational accidents in automotive repair workshops.

2. Materials and methods

2.1. Data collection of accident reports

Since 2003, it has been mandatory in Spain to register online all occupational accidents resulting in sick leave lasting 1 day or more (ORDER TAS/2926/2002, of November 19, establishing the new models for notifying occupational accidents and enabling these to be transmitted electronically). Accidents must be reported over the Delt@ electronic system by filling in an Official Occupational Accident Report. For the purpose of this study, the Ministry of Employment and Social Security provided us with 89,954 occupational accident reports corresponding to all the accidents reported from the automotive repair and maintenance sector (Classification of Economic Activities) between 2003 and 2008. This number represents the total amount of accidents reported in Spain in the cited period. Before 2003, not all accidents were reported digitally using the electronic system Delt@, because it was possible to report the accident alternatively using the official hard copy form. After 2008, Spanish Classification of Economic Activities codes were modified. Although cited codes changed, the majority of maintenance activities are similar in current times, and mechanical configuration of automobiles have not changed substantially. Cars with emergent technologies only represent a small percentage of the total vehicle population in Spain. A proof of that is that only 2% of new cars sold in 2015 in the country were hybrid or electrics [21]. Also, emergent technologies do not affect maintenance of common elements as tires or bodywork. These are the main reasons for the period studied being limited to between 2003 and 2008.

The Ministry removed all personal data from the accident reports. Despite the statutory obligation to report accidents, some might not have been notified as required by prevailing regulations, leaving them with no official record.

2.2. Study variables

We used the injury description code variable, based on the first two digits of the main injury groups listed in accident reports, in order to measure the effect of different variables on different types of injury. The percentages of workers injured based on the description of the injury was as follows: superficial wounds and injuries (41.2%); dislocations, sprains, and strains (38.8%); bone fractures (6.2%); concussion and internal injuries (5.3%); and burns, scalding, and freezing (2.0%). Injuries accounting for less than 2% of the total number of accidents were not analyzed. Overall, the percentage of injury descriptions studied encompassed 93.5% of all accidents.

Once the accidents had been grouped by injury description, different variables were chosen to determine how they affected different types of accident. The selection of the variables was based on the research conducted by Camino López et al [6]. In a preliminary approach we analyzed all variables (n = 57) included in the accidents records elaborating their contingency tables. Variables for which the majority of values in their contingency tables did not reach a statistical significance were rejected for current research. Finally, we chose the 11 variables which were statistically superior.

The variables studied were subdivided into three groups, according to whether they were worker, company, or accident description variables.

- Worker variables: Describe the profile of the injured worker. This group includes the variables sex, nationality, and employment situation (employed by a company vs. others, such as self-employment, or other special regimes).
- Company variables: Describe organizational aspects of the company. This group includes the size of the company (workforce), whether it conducts compulsory general risks assessments, its health and safety organization (outsourced prevention service or other prevention management system), and whether it worker who suffered the accident was recruited through temporary employment agencies.
- Accident description variables: Include variables related to the circumstances under which the accident occurred, such as whether it occurred in the worker’s usual workplace, if more than one worker was affected, if accident occurred on Monday or not, or whether the worker was performing their usual job at the time of the accident.

2.3. Statistical analysis

Logistic regression model is a methodology used frequently in cohort studies and clinical trials. The model provides the odds ratios (ORs) for the disease or injury in those individuals who have suffered exposure to some specific variable with respect to those individuals who have not been exposed [22]. In the current research, the strength of relationship between the variables and the type of injury was measured using adjusted ORs and their 95% confidence intervals (CI). Independency of each variable was tested using Chi-square test. The data were analyzed statistically using SPSS version 19 (SPSS, Chicago, IL, USA).

3. Results

Results obtained are shown in Tables 1 and 2. In the following subsections the most remarkable results are highlighted.

3.1. Superficial wounds

Superficial wounds were significantly and independently associated with male sex (OR = 2.206; 95% CI, 2.02–2.409), with workers employed by companies (OR = 1.306; 95% CI, 1.143–1.491), with companies that used temporary employment agencies (OR = 1.885; 95% CI, 1.113–3.192), with the usual workplace (OR = 2.055; 95% CI, 1.965–2.149), and with the usual job (OR = 1.55; 95% CI, 1.472–1.633). It is also remarkable that accidents with more than one worker affected were significantly and
independently associated with a lower probability to superficial wounds (OR = 0.635; 95% CI, 0.523–0.770).

3.2. Dislocations and sprains

Dislocations and sprains, meanwhile, were statistically significantly and independently associated with Spanish nationality (OR = 1.175; 95% CI 1.121–1.231), with more than one worker injured (OR = 1.272; 95% CI 1.063–1.522), and with the accident occurring on Monday (OR = 1.189; 95% CI, 1.153–1.226). Monday, and not other days of the week, as a risk factor for this type of injury is consistent with the so-called Monday syndrome studied in the scientific literature [23]. In contrast, male sex was reported as a protective factor in this kind of injury (OR = 0.496; 95% CI, 0.456–0.532).

3.3. Bone fractures

Bone fractures are associated significantly and independently to a greater extent with companies with five or fewer workers (OR = 1.289; 95% CI, 1.219–1.362), and with companies that outsource their health and safety organization (OR = 1.114; 95% CI, 1.047–1.186). By contrast, workers employed by a company (OR = 0.492; 95% CI, 0.403–0.599) and workers in their usual workplace (OR = 0.528) have lower probability of suffering bone fractures.

### Table 1

| Variable | Value | Superficial wounds OR | Dislocations and sprains OR | Bone fractures OR | Concussion and internal injuries OR | Burns, scalding and freezing OR |
|----------|-------|------------------------|----------------------------|------------------|-------------------------------------|-------------------------------|
| Sex      | Male  | 2.206                  | 0.493                      | 0.996            | 0.905                               | 2.627                         |
|          | Female| 1                      | 1                          | 1                | 1                                   | 1                             |
| Nationality | Spanish | 0.805                  | 1.175                      | 1.074            | 1.122                               | 0.853                         |
|          | Foreign| 1                      | 1                          | 1                | 1                                   | 1                             |
| Employee or other | Employed by company | 1.306                    | 1.068                      | 0.492            | 1.017                               | 0.663                         |
|          | Others | 1                      | 1                          | 1                | 1                                   | 1                             |
| Workforce | ≤ 5 | 1.117                  | 0.804                      | 1.289            | 0.906                               | 1.376                         |
|          | > 5 | 1                      | 1                          | 1                | 1                                   | 1                             |
| Risk assessment | Yes | 0.892                  | 1.032                      | 1.096            | 1.082                               | 1.032                         |
|          | No   | 1                      | 1                          | 1                | 1                                   | 1                             |
| H&S organization | Outsourced H&S | 0.94                     | 1.054                      | 1.114            | 0.918                               | 1.226                         |
|          | Other H&S system | 1                      | 1                          | 1                | 1                                   | 1                             |
| Temporary employment agencies | Yes | 1.885                  | 0.952                      | 0.703            | 1.889                               | 0.328                         |
|          | No   | 1                      | 1                          | 1                | 1                                   | 1                             |
| Place of accident | Usual workplace | 2.055                    | 0.733                      | 0.528            | 0.939                               | 2.673                         |
|          | Outside usual workplace | 1                      | 1                          | 1                | 1                                   | 1                             |
| Number of workers injured | > 1 | 0.635                  | 1.272                      | 0.963            | 0.894                               | 2.055                         |
|          | 1    | 1                      | 1                          | 1                | 1                                   | 1                             |
| Monday  | Yes  | 0.883                  | 1.189                      | 0.843            | 1.077                               | 0.826                         |
|          | No   | 1                      | 1                          | 1                | 1                                   | 1                             |
| Usual job | Yes | 1.55                   | 0.776                      | 0.702            | 0.926                               | 2.115                         |
|          | No   | 1                      | 1                          | 1                | 1                                   | 1                             |

H&S, health and safety.

### Table 2

Data are presented as n (%).

H&S, health and safety.
3.4. Concussion and internal injuries

The results obtained in the category of concussion and internal injuries were the least conclusive since different variables yielded confidence intervals that include 1, making it impossible to claim that the ORs obtained with these confidence intervals are statistically significant.

3.5. Burns, scalding and freezing

Finally, we found that suffering burns, scalding, or freezing is associated significantly and independently with the male sex (OR = 2.627; 95% CI, 1.706–4.046), with companies with five or fewer workers, (OR = 1.376; CI 95, 1.25–1.514), with outsourced health and safety organization (OR = 1.226; 95% CI, 1.103–1.363), with the usual workplace (OR = 2.673; 95% CI, 2.153–3.19), with more than one worker involved (OR = 2.055; 95% CI, 1.296–3.259), and with the usual job (OR = 2.115; 95% CI, 1.66–2.693). In contrast, workers from temporary employment agencies had the lowest OR value for this kind of injury (OR = 0.328; 95% CI, 0.119–0.901).

4. Discussion

Table 3 summarizes the way in which the study variables affect different types of injury, either as a risk factor or as a protective factor based on the binary value assigned to the variable itself. It is interesting to note that none of the variables contain a value that serves as a protective factor against all types of injury.

Belonging to a small company with five or fewer workers is a risk factor of suffering three of the five types of injuries studied. Several researchers agree that there is evidence to suggest that smaller companies have a higher accident risk [24–26]. Several studies have indicated that the smaller the company, the greater the exposure to physical and chemical agents [27,28]. The reason for this, according to these studies, lies in the difficulty in controlling different risks due to the limited material and human resources of such companies. Frequently, small enterprises are organizations with their resources focused on their survival. The responsible of the company have to handle different issues at the same time, and health and safety is not always a priority [29]. In addition, many owners of small companies consider occupational safety as responsibility of the employees [29], and regulations and demands to improve health and safety standards as a financial burden. Because of their limited resources, many small companies, particularly microcompanies, find it difficult to comply with legal requirements at all.

The findings of this study suggest that in this regard the automotive repair workshop sector is similar to other sectors, where the size of the company is a protective factor against most of the types of injury studied. Larger companies, commonly will have more adequate management of prevention issues, better training activities, and education and information than similar small companies [24].

In terms of where accidents occur, the usual workplace variable yielded similar results to the usual job or usual task variable, both being protective factors against dislocations and sprains, and also against bone fractures. These results are consistent, since it is commonplace in this sector for the usual job to be performed in the usual workplace. Accidents occurring outside the usual workplace are usually associated with driving vehicles either while on a mission, i.e., performing exceptional tasks, or while travelling to and from work. Accordingly, one of the most common injuries from nonfatal traffic accidents is bone fracture [30], making it logical to conclude that extraordinary jobs performed outside the usual workplace involving driving vehicles are a risk factor for this type of injury, an assumption borne out by the findings of this study. In consequence, preventive measures related to prevent traffic accidents of the workers (e.g., courses of anticipatory driving [31]) would reduce this kind of injuries.

With regard to Monday syndrome in which workers claim accidents occurring over the weekend outside usual working hours to be occupational accidents [23], it is interesting to note that Monday is a risk factor for dislocation and sprain injuries, suggesting that these could be associated with this syndrome. However, it is also a risk factor for concussion and internal injuries that are not usually associated with this syndrome, since the seriousness of the injury would prevent the individual involved from delaying medical treatment. It is unsafe, therefore, to conclude that there is enough evidence to suggest that Monday syndrome is found in this sector.

Table 3

| Variable                           | Superficial wounds | Dislocations and sprains | Bone fractures | Concussion and internal injuries | Burns, scalding, and freezing |
|------------------------------------|--------------------|--------------------------|----------------|---------------------------------|-------------------------------|
| Sex                                | Male               | Protective               | Protective     | NS                              | Risk                          |
|                                    | Female             | Protective               | Risk           | NS                              | Protective                    |
| Nationality                        | Spanish            | Protectives              | Protective     | NS                              | Risk                          |
|                                    | Foreign            | Protective               | Protective     | NS                              | Protective                    |
| Employee or other                  | Employee           | Risk                     | Protective     | Protective                      | Risk                          |
|                                    | Other              | Protective               | Protective     | NS                              | Risk                          |
| Workforce                          | ≤ 5                | Protective               | Protective     | Protective                      | Risk                          |
|                                    | > 5                | Protective               | Protective     | Protective                      | Protective                    |
| Risk assessment                    | Yes                | Protective               | Risk           | Protective                      | Protective                    |
|                                    | No                 | Protective               | Risk           | Protective                      | Protective                    |
| Outsourced H&S consultant          | Yes                | Protective               | Protective     | Protective                      | Protective                    |
|                                    | No                 | Protective               | Protective     | Protective                      | Protective                    |
| Temporary employment agencies      | Yes                | Risk                     | NS             | NS                              | NS                            |
|                                    | No                 | Protective               | NS             | NS                              | NS                            |
| Place of accident                  | Usual workplace    | Protective               | Protective     | Protective                      | Risk                          |
|                                    | Outside usual workplace | Protective            | Protective     | Protective                      | Protective                    |
| Number of workers injured          | > 1                | Protective               | Protective     | Protective                      | Risk                          |
|                                    | 1                  | Protective               | Protective     | Protective                      | Risk                          |
| Monday                             | Yes                | Protective               | Protective     | Protective                      | Protective                    |
|                                    | No                 | Protective               | Protective     | Protective                      | Protective                    |
| Usual job                          | Yes                | Risk                     | Protective     | Protective                      | Risk                          |
|                                    | No                 | Protective               | Protective     | Protective                      | Protective                    |

H&S, health and safety; NS, not significant.
Based on the study findings, we can say that the characterization of the worker, company, and accident is not the same for all types of injuries, and the probability of suffering an accident varies for each type of injury. Similar conclusions have been obtained in other sectors as construction [3,5,32,33], coal mining [34], or nursing sector [35], but these results were not focused on the automotive workshop sector.

It is interesting to note that, unlike other sectors such as the construction industry, where the variables male and immigrant are a risk factor for accidents [36], in the automotive repair workshop sector both these and other characteristics of the worker can be either a risk or protective factor, depending on the type of injury caused by the accident.

In conclusion, health and safety strategies and accident prevention measures should be individualized, adapted, and implemented with particular consideration for the type of worker most likely to be injured in each type of accident. Some of these solutions could be: occupational health and safety training courses designed according to worker profile, improving the participation of the workers in small firms creating regional or roving safety representatives [29], or implementing and following some specific interventions on the sector as the experience conducted by Parker et al. [37].

4.1. Limitations of the study

It is important to bear in mind, as a limitation of the study, that variables studied are general variables from accidents registered in the official accident notification system (Delt@). There are some factors contributing in accidents that are not registered in the official form, because there are not fields included about them. In consequence, the findings obtained here are general and can differ in some specific cases. In addition incidents not reported were not considered because of the lack of records about them.

Acknowledgments

Funded directly by Malaga University and the Chair in Health and Safety and Corporate Social Responsibility. This study was made possible by the support given to the Chair in Health and Safety and Corporate Social Responsibility by the Ministry of Economy, Innovation, Science and Employment of the Regional Government of Andalusia and Malaga City Council through the public company LIMASA III, and by the University College of Industrial Engineering.

Conflicts of interest

The authors have no conflicts of interest to declare.

References

[1] Benavides FG, Delclos J, Benach J, Serra C. Lesiones por accidente de trabajo, una prioridad en salud pública. Rev Esp Salud Publica 2006;80:553–65. [in Spanish].

[2] Santamaría N, Catot N, Benavides FG. Tendencias temporales de las lesiones mortales (traumáticas) por accidente de trabajo en España (1992–2002). Gac Sanit 2006;20:280–6. [in Spanish].

[3] Benavides FG, Giráldez MT, Castejón E, Catot N, Zaplana M, Delclos J, Benach J, Gimeno D. Análisis de los mecanismos de producción de las lesiones leves por accidentes de trabajo en la construcción en España. Gac Sanit 2003;17:353–9. [in Spanish].

[4] Benavides FG, Ahonen EQ, Bosch C. Riesgo de lesión por accidente laboral en trabajadores extranjeros [España, 2003 and 2004]. Gac Sanit 2008;22:44–7. [in Spanish].

[5] López Arquillos A, Rubio Romero JC, Gibb A. Analysis of construction accidents in Spain, 2003–2008. J Saf Res 2012;43:381–8.

[6] Camino López MA, Ritzel DO, Fontaneda L, González Alcantara QJ. Construction industry accidents in Spain. J Saf Res 2008;39:497–507.

[7] Bureau of Labor Statistics. Occupational injuries and illnesses—2011 [Internet]. 2011 [cited 2014 Oct 12]. Available from: http://www.bls.gov/news.release/archives/osh_10252012.pdf.

[8] Bejan A, Brosseau LM, Parker DL. Exposure assessment in auto collision repair shops. J Occup Environ Hyg 2011;8:401–8.

[9] Dembke AE, Erickson JB, Delbos RC, Banks SM. The impact of overtime and long work hours on occupational injuries and illnesses: new evidence from the United States. Occup Environ Med 2005;62:588–97.

[10] Sorock G, Lombardi D, Hauer R, Eisen E, Herrick R, Mittleman M. A case-crossover study of transient risk factors for occupational acute hand injury. Occup Environ Med 2004;61:305–11.

[11] Dotson GS. Characterization of asbestos exposure among automotive mechanics servicing and handling asbestos-containing materials. In: Graduate School Theses and Dissertations [Internet]. Tampa (FL): University of South Florida; 2006 [cited 2014 Oct 14]. Available from: http://scholarcommons.usf.edu/etd/2506.

[12] Cohen HJ, Van Orden DR. Asbestos exposures of mechanics performing clutch service on motor vehicles. J Occup Environ Hyg 2008;5:148–56.

[13] Blake CL, Dotson GS, Harbison RD. Evaluation of asbestos exposure within the automotive repair industry: a study involving removal of asbestos-containing body sealants and drive clutch replacement. Regul Toxicol Pharmacol 2008;52:324–31.

[14] Fredriksen K, Bøldt C, Høgg G, Kilbom Å. The impact on musculoskeletal disorders of changing physical and psychosocial work environment conditions in the automotive industry. Int J Ind Ergon 2001;28:31–45.

[15] Vandergriff JL, Gold JE, Hanlon A, Punnett L. Physical and psychosocial ergonomic risk factors for low back pain in automobile manufacturing workers. Occup Environ Med 2012;69:29–34.

[16] García-Herrero S, Mariscal MA, García-Rodríguez J, Ritzel DO. Working conditions, psychological/physical symptoms and occupational accidents. Bayesian network model. Saf Sci 2012;50:1760–74.

[17] Health and Safety Executive (HSE). Example risk assessment for a motor vehicle mechanical repair workshop [Internet]. HSE; 2013 [cited 2016 Jan 14]. Available from: http://www.hse.gov.uk/risk/casestudies/pdf/mvr.pdf.

[18] Turning Risk Into Action (TRA) Project. Training material for assessing the risks in car repair workshops [Internet]. 2010 [cited Jan 14]. Available from: http://www.aubremen.de/triaustria/en/en_modules/en_m06/en_module_06_00.pdf.

[19] Centro de Experimentación y Seguridad Vial MAPPRE (CESVIMAP). Manual de Prevención de riesgos en talleres de automóviles. 3rd ed. Avila (Spain): CESVIMAP; 2003. [in Spanish].

[20] Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT). Guías para la acción preventiva. Taller de reparación de vehículos. 3rd ed. Avila (Spain): INSHT; 1995. [in Spanish].

[21] Asociación Española de Fabricantes de Automóviles y Camiones [Internet]. 2016 [cited 2016 Jan 16]. Available from: http://www.anfac.es/estadisticas.accion?accion=estad_turismos. [in Spanish].

[22] Schaffino A, Rodríguez M, Pasarini M, Regidor E, Borrell C, Fernández E. ¿Odds ratio o razón de proporciones? Su utilización en estudios transversales. Gac Sanit 2003;17:70–4. [in Spanish].

[23] Campolieti M, Hyatt DE. Further evidence on the Monday effect in workers and employers. Indus Lab Rev 2006;59:438–50.

[24] Fabiano B, Curró F, Pastorino R. A study of the relationship between occupational injuries and firm size and type in the Italian industry. Saf Sci 2004;42:587–600.

[25] Stevens G. Workplace injuries in small and large manufacturing workplaces. Labour Market Trends 1999;107:19–26.

[26] Hasle P, Kines P, Andersen LP. Small enterprise owners’ accident causation attribution and prevention. Saf Sci 2009;47:9–19.

[27] Lammi F. Occupational health and safety in Queensland and New Zealand small businesses: influential factors that lead to occupational health and safety compliance and practice. Doctoral dissertation. Sydney (Australia): University of New South Wales; 2000.

[28] Eakin JM, Lammi F, Limborg HJ. International perspective on the promotion of health and safety in small workplaces. In: Frick K, Jensen PL, Quinlan M, Willthagen T, editors. Systematic occupational health and safety management: perspectives on an international development. Amsterdam (Netherlands): Pergamon; 2000. p. 227–47.

[29] Hasle P, Limborg HJ. A review of the literature on preventive occupational health and safety activities in small enterprises. Ind Health 2006;44:6–12.

[30] Ganveer GB, Tiwari RR. Injury pattern among non-fatal road traffic accident cases: a cross-sectional study in Central India. Indian J Med Sci 2006;50:347–50.

[31] Salminen S. Two interventions for the prevention of work-related road accidents in Finland. Taller de reparación del automóvil: consejos para el profesorado. Madrid (Spain): INSHT; 2003. [in Spanish].

[32] García-Herrero S, Mariscal MA, García-Rodríguez J, Ritzel DO. Accidentes de trabajo: su incidencia y la actividad educativa en las companyías LIMASA III. In: Guías para la acción preventiva. Taller de reparación de vehículos. Madrid (Spain): INSHT; 2003. [in Spanish].

[33] Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT). Guías para la acción preventiva. Taller de reparación de vehículos. Madrid (Spain): INSHT; 1995. [in Spanish].

[34] A. López-Arquillos and J.C. Rubio-Romero / Workplace Accidents in Automotive Repair 235
[34] Ghosh AK, Bhattacherjee A, Chau N. Relationships of working conditions and individual characteristics to occupational injuries: a case-control study in coal miners. J Occup Health 2004;46:470–80.

[35] Venning PJ, Walter SD, Stitt LW. Personal and job-related factors as determinants of incidence of back injuries among nursing personnel. J Occup Med 1987;29:820–5.

[36] Guldenmund F, Cleal B, Mearns K. An exploratory study of migrant workers and safety in three European countries. Saf Sci 2013;52:92–9.

[37] Parker DL, Bejan A, Brosseau LM, Skan M, Xi M. The collision auto repair safety study (CARSS): a health and safety intervention. Am J Ind Med 2015;58:88–100.