

PSYCHOSOCIAL RISKS AND WORK-RELATED ACCIDENTS: RESEARCH STUDIES AND PRACTICAL IMPLICATIONS

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Work-related accidents are a problem of extreme importance due to their serious consequences. Available data on the level of personal injuries and on the economic cost of work accidents justify their study. However, the amount of variables involved, the difficulty of accessing the data and "experimental mortality", among other reasons, may explain why this field is not a highly attractive one for researchers. Nevertheless, over the last few years, there has been a significant increase in research studies related to this area not only in our country but also in neighbouring countries. The economic crisis has aggravated this problem as employment has become more precarious. This article summarizes the principal results of two research projects carried out by the Social and Organizational Psychology Department of UNED on work-related accidents. The sample of the first study is made up of professional soldiers and the second comprises workers from two especially dangerous sectors, construction and agriculture. Following previous classifications that distinguish between personal, job and organizational variables, we review the main models and data obtained. Several practical recommendations to improve the research in this field as well as the prevention of work-related accidents can be found at the end of this article.

Key words: Work-related accidents, Economic crisis, Military, Construction and agriculture.

Los accidentes de trabajo constituyen un problema importante por sus graves consecuencias. Las cifras sobre los daños personales y los costes económicos justifican su estudio, sin embargo, diferentes razones (múltiples variables implicadas, mortandad experimental, dificultad de acceder a datos, etc.) explican que no sea atractivo para los investigadores. Aún así los estudios han aumentado en los últimos años, tanto en nuestro país como en los de nuestro contexto. La crisis económica ha agravado el problema al aumentar la precariedad del empleo. Este artículo recoge los principales resultados de dos proyectos de investigación llevados a cabo en el Dpto. de Psicología Social y de las Organizaciones de la UNED sobre accidentabilidad laboral. El primero con soldados profesionales, y el segundo en dos sectores de especial peligrosidad, la construcción y la agricultura. Siguiendo clasificaciones previas que distinguen entre variables personales, del puesto de trabajo y de la organización, se revisan los principales modelos explicativos y los datos obtenidos. El artículo finaliza con una serie de recomendaciones prácticas para mejorar la investigación y la praxis en la prevención de accidentes.

Palabras clave: Accidentabilidad laboral, Crisis económica, Militares, Construcción, agricultura.

The Seventh National Survey of Working Conditions of the National Institute of Safety and Health at Work (2011) indicates that 69% of respondents replied that their work presents some risk of accident and the number of accidents in the period between October 2009 and September 2010 was 560,105. Thus, accidents are the main health risk, especially in sectors such as construction and agriculture. Regarding the costs, official figures are hard to find, but if the direct costs are high, the indirect ones are even higher, in a ratio of 1:4 (for a review see Sun, Paez, Lee, Salem & Daraiseh, 2006). Also, at this moment, the economic crisis exacerbates this problem because it represents one more stressor with negative consequences on working conditions in

general and on risk prevention in particular (Bettio, Corsi, Lyberaki, Samek & Verashchagina, 2013). These data justify the importance of studying the work-related accident rates, despite the complexity of the issue (the multiple variables involved, difficulty in accessing the samples and the data, *experimental mortality*, etc.) This article has two objectives. First, it aims to review the literature on this subject, and second it will present the main results of two research projects, from the Department of Social and Organizational Psychology at the UNED, on accidents in professional soldiers and in two particularly dangerous industries: construction and agriculture.

RESEARCH INTO WORK-RELATED ACCIDENTS

Work-related accidents, according to the General Social Security Act (Art. 115, GSSA), are accidents that occur when performing the duties and functions of the job, those that are produced in the journey to the place of work (commuting) and

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occupational diseases that were not previously cataloged as such, but are considered to be a result of work. However, given that research identifies different antecedents for each of these three categories, we must clarify that this review focuses on the first two.

In the field of work and organizational psychology, most of the research has focused on two sets of antecedent variables: those relating to the job and those relating to the organization (see Osca & López-Araujo, 2012, for a review), although there are models that offer more integrative views as we will see. A well-designed job that reduces the physical, ergonomic and psychosocial risks prevents occupational health problems in general and accidents in particular. Work overload and lack of autonomy are the two psychosocial risks that are most studied in this respect, and they are linked in the well-known demands-control theory of Karasek and Theorell (1990). From the point of view of accident rates, the influence of these stressors arises in two ways: directly, as they are two major sources of stress, and indirectly, through third variables. For example, high demands generate fatigue (Strauch, 2010) and cognitive errors (Day, Brasher & Bridger, 2012) which, in turn, are the precursors of accidents.

However, models offering more integrative visions have already been proposed, such as that of Goldenhar, Williams and Swanson (2003) for the construction sector and the one by Håvold (2007) on cultural variables and orientation towards safety.

The model by Goldenhar, Williams and Swanson (2003) explains work-related accidents and incidents considered as antecedents, job and organization variables, and as mediating variables, physical and psychological discomfort. As can be seen (Figure 1), the first category of antecedent variables are the job characteristics, which include aspects such as job demands, autonomy at work, etc. The second refers to organizational variables such as safety climate, training, support, etc. The third comprises the hours of exposure to harmful conditions (noise, temperature, etc.) and the use of protective equipment (masks, etc.). Finally, in the fourth category, there are the control variables, such as the time working in the sector, the age and the sex of the workers. According to these authors, the research shows that the antecedents of their model influence the appearance of physical and psychological symptoms and these symptoms may act as mediators between the antecedents and work-related accidents/incidents. Specifically in the construction industry, it has been found that physical and psychological symptoms may act as mediators between occupational stressors and accidents (Siu, Phillips & Leung, 2004). According to Goldenhar, this could be explained using the *theory of modified stress*, since aspects such as worry or anxiety can make one pay less attention at work, increasing the likelihood of having an accident and/or incidents. In our context, also Oliver, Cheyne, Tomas and Cox (2002) confirm the mediating role of health

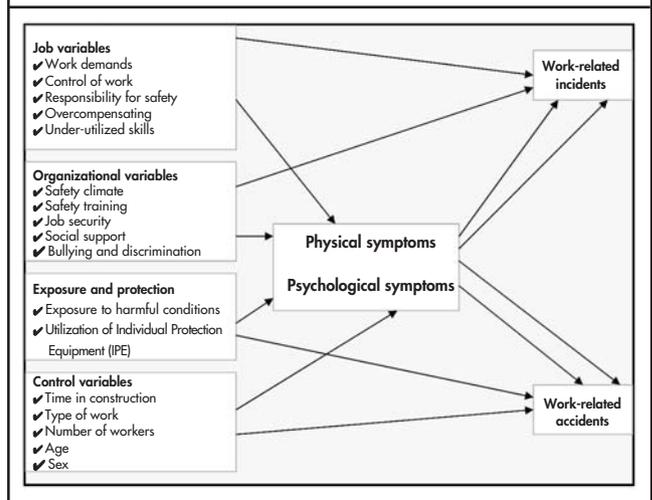
between different organizational aspects, such as social support and safety climate, and accidents.

The Håvold model (2007) studies the role of organizational, cultural and contextual factors in the attitudes and behaviors related to safety. Specifically, Håvold selects the twelve factors most cited in the literature: safety standards, dissemination of safety culture, the learning of this culture, the systems of communication, management commitment, organizational justice, conflict between the demands of the organization and safety, working conditions, satisfaction with safety measures, safety training, job satisfaction and *fatalism* as a cultural measure. Based on a study carried out in 10 countries, Håvold examines the relationship between national culture and employee attitudes to safety. His results show, first, that in all countries the national culture is related to the safety culture of the organization, and that cultural values influence the attitudes of employees, such that it is more common for employees in countries with an increased *power distance and uncertainty avoidance* to follow orders and obey safety procedures than those with different cultural values. Subsequent meta-analyses have confirmed these results (Mearns & Yule, 2009).

ACCIDENT RATES IN PROFESSIONAL SOLDIERS

Being a soldier is considered a profession of risk and a major source of stress (e.g., Harrington, Bean, Pintello & Mathews, 2001) with implications for occupational health and accidents. In addition, the new demands placed on the armies of western countries increase the importance of this issue (Gee, 2007). In this line, in a first investigation (Bardera, Osca & González-Camino, 2002), we analyzed the influence of stress and occupational health, measured by emotional exhaustion and job dissatisfaction, on the rate of accidents (at work and commuting)

**FIGURE 1
MULTI-LEVEL MODEL OF OCCUPATIONAL
STRESS-ACCIDENTS BY GOLDENHAR ET AL. (2003)**



in a sample of 203 Spanish soldiers. According to the results, emotional exhaustion and job dissatisfaction explained 10.3% of the variance in the number of accidents at work; however, these variables are not related to commuting accidents.

In a subsequent study (López-Araujo, Osca & Rodríguez-Muñoz, 2006), analyzing a larger number of variables and contemplating more complex relationships, we studied seven sources of occupational stress and the intervention of job involvement as a moderator variable. These sources of stress were related to accidents and it was established whether these relationships are direct or are moderated by personal variables and, specifically, by the degree of job involvement. The idea was that the more involved soldiers would be more attentive to the rules in general, which would reduce the likelihood of an accident. With a sample of 779 professional soldiers of the Spanish armed forces, the study showed that the stressor that was the most significant predictor of work-related accidents was due to the *organizational structure and climate*. Thus, the stress caused by the characteristics and design of the organization, lack of communication or lack of resources, is linked to a greater number of accidents during the working day. Like the previous study, commuting accidents were related to other antecedents, specifically conflict between work and family life and difficulties progressing in the career.

In addition, and as discussed, job involvement acts directly on the accident rate, and indirectly, as a moderator variable. In Figure 2, we can see that stress due to *factors intrinsic to the job* does not influence work-related accidents if the soldier has a low job involvement. However, when stress is high and employees have less involvement the number of accidents is higher.

Following this same line of argument, Bardera (2010) discusses the role of stress due to job demands (assessed through the demands in physical, mental and social skills, self-control and frustration tolerance), and another personal variable

relevant to psychological research, the perception of professional self-efficacy (assessed through self-efficacy in physical, mental, social skills, and self-control and frustration tolerance). The direct relationships indicate that the most important relationships are with the demands of self-control and frustration tolerance, in a positive sense, and with skills of self-control and frustration tolerance, in the negative sense. With regards to the moderated relations, it was also found that when the demands are low there is no difference between those with high and low perceived self-efficacy, however, when the demands are high, those who perceive themselves as the least self-efficacious have the least accidents.

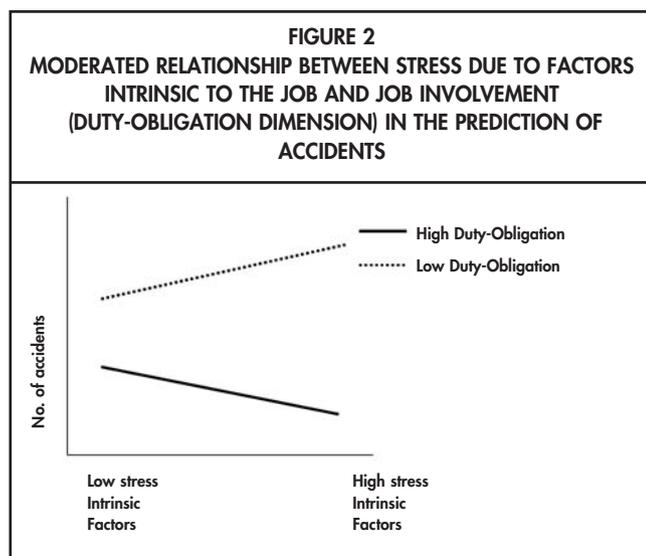
STUDY OF ACCIDENTS IN AGRICULTURE AND CONSTRUCTION

As noted, construction and agriculture are two occupations with high accident rates. Presented below are some of the main results obtained with these samples.

Accidents in a sample of agriculture workers

According to the results of the *Seventh National Working Conditions Survey*, occupational risks are not distributed evenly across the workforce, as there are particularly dangerous areas such as agriculture. Also workers in small and medium businesses and precarious jobs are more exposed, since it is more difficult to have appropriate prevention and protection systems, and more occupational health problems are found. Coinciding with this, the results obtained with a sample of 261 Spanish farm workers across the country, indicate that farm workers who are self-employed have significantly higher scores in control of their work, but they also have more responsibility and, in line with what was outlined above, a greater number of accidents than those who work for others (López-Araujo & Osca, 2009a).

Regarding the study of stressors in the industry, and their impact on psychological and physical discomfort, and accidents, in line with the model of Goldenhar, we analyzed job demands, control over work, responsibility for safety, use of protective equipment and exposure to harmful conditions (López-Araujo & Osca, 2009b). The results of the regression equations conducted show that *exposure to harmful conditions* is the variable that has the most influence in explaining the occurrence of accidents. In addition, there are three significant interactions between stressors and occupational health. The first interaction shows that, when farm workers do not have excessive demands, there is no difference in the accident rates of farm workers with high and low scores in physical discomfort. However, as the demands and physical discomfort increases, the number of accidents also increases. In analyzing the second interaction it can be seen that the lower rate of accidents occurs when farm workers have low exposure to harmful conditions and low physical discomfort but, if they are not in good physical health, even if they have a low



exposure to harmful conditions, their accident rate is higher. The third significant interaction shows that when psychological distress and exposure to harmful conditions are low, there are fewer accidents, but as exposure to harmful conditions increases, the number of accidents also increases, especially when farm workers feel better psychologically, which may be due to overconfidence.

Accident rates in a sample of construction workers

The *Seventh National Working Conditions Survey* highlights the danger of the construction sector, but it also contemplates the differences between laborers, specialists, etc. because their situations are not comparable. López-Araujo and Osca (2009a) analyze the working conditions of these employees. The analyses of variance performed indicate significant differences: job control, responsibility for safety, use of protective equipment, safety climate, safety training, social support, psychological distress and commuting accidents. Accordingly, in general, workers who have a higher status (team managers/site managers) have better working conditions than those in lower levels (laborers, bricklayers and specialists), and they also have better health and a lower rate of accidents.

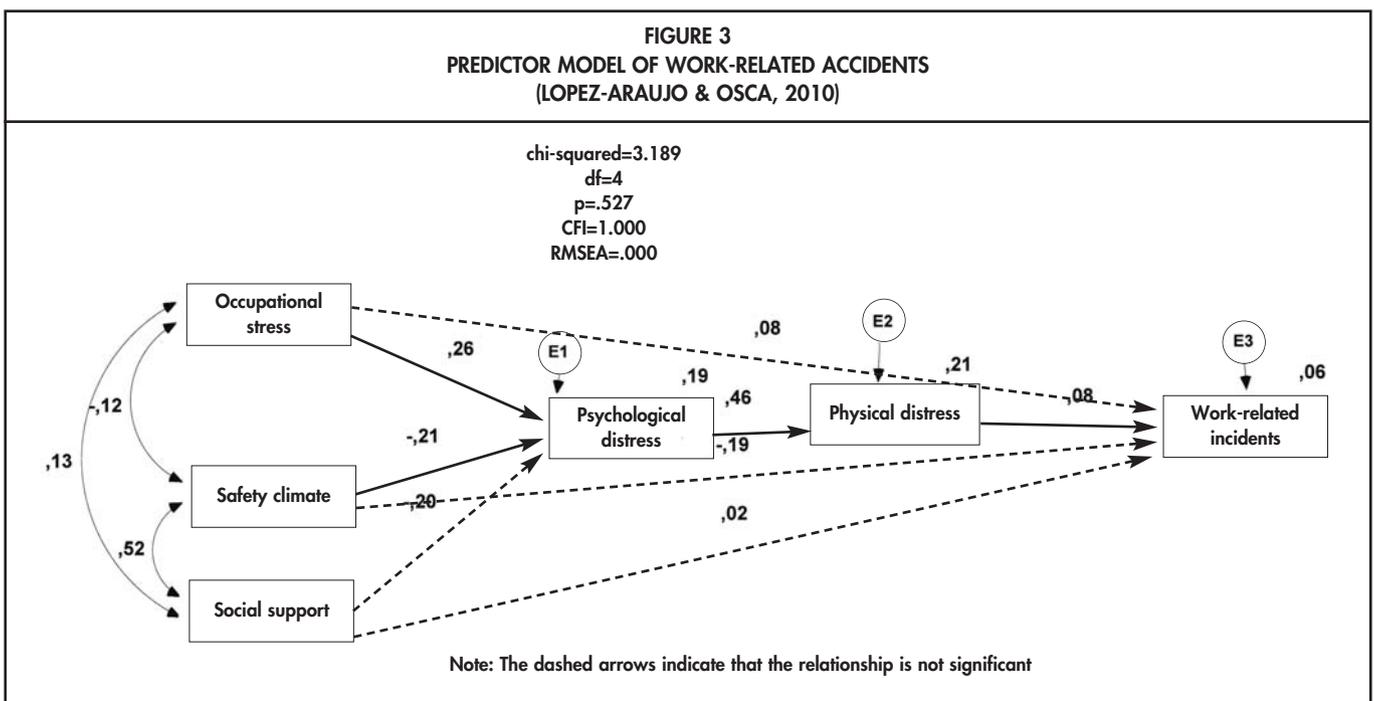
In López-Araujo and Osca (2010), following Goldenhar and her colleagues, three of the five stressors contemplated in their model (safety climate, social support and occupational stress) and two mediating variables (psychological and physical discomfort) were analyzed as predictors of accidents and incidents (Figure 3). So, through structural equation analysis performed with the LISREL program it was found that the model has a good fit, ($\chi^2=12.19$, g.l.=12, $p=.43$, CMIN/DF=1.02,

CFI=1, GFI=.97, AGFI=.93, RMSEA=.01), and all parameters were significant, except the one that reflects the relationship between physical discomfort and occupational incidents (dashed arrow). As shown, occupational stress, safety climate and social support are significantly associated, and in the expected direction, with psychological distress. Furthermore, psychological distress was positively related to physical discomfort and this in turn to accidents. Specifically, occupational stress, safety climate and social support explained 20% of psychological distress. In turn, these four variables explain 22% of the physical discomfort and the model as a whole accounts for 7% of the work-related accidents in this group. As can also be seen, the model does not show significant values for predicting work-related incidents, which was already anticipated by Goldenhar and her team, for whom accidents and incidents do not have similar antecedents, an important aspect which requires further study.

CONCLUSIONS

Despite the interest of the investigation carried out, we believe that the main limitations should be borne in mind when considering our data. Firstly, the characteristics of the samples analyzed are formed mostly by men with certain profiles. There is a need to address other variables that help to explain a greater percentage of variance in work-related accidents (sociodemographic, personality, etc.), and finally, the use of self-report measures is another limitation, due to the biases that these involve. However, we believe that the data collected can be extrapolated to populations other than those from which they come, groups that have not been sufficiently addressed by

FIGURE 3
PREDICTOR MODEL OF WORK-RELATED ACCIDENTS
(LOPEZ-ARAUJO & OSCA, 2010)



research, and which are therefore of interest. Access to "unskilled workers" requires overcoming some difficulties (the validity of the data provided, workers' reluctance to participate, etc.), but it is essential if this issue is to be investigated.

Finally, and in light of the results presented, we believe that research and practice to reduce accident rates should address the following aspects.

- ✓ Incorporating occupational stress as a psychosocial risk that could cause accidents, directly, but also indirectly through its influence on other variables such as satisfaction or occupational health. The economic crisis and the increase in the associated physical and psychosocial risks (work overload, emotional conflicts, lack of safety, etc.) (Parent-Thirion, Vermeylen, van Houten, Lyly-Yrjänäinen, Biletta, Cabrita, & Niedhammer, 2012), predict an increase in work-related accidents, which may not be reflected in the statistics, given the falling rates of employment, but which much be considered.
- ✓ Given the polycasual nature of accidents and the multiple variables and issues identified by research, integrative approaches should be undertaken that incorporate personal, job and organizational variables. In the field of prevention, programs to reduce the accident rate should control the occupational stressors but also identify the employees who, because of their personal characteristics, are more susceptible to injuries; according to our studies this refers to the people who are less involved, less self-efficacious, less satisfied and have poorer physical and psychological health. In this sense, identifying risk profiles in the selection process and improving training, raising the awareness of the importance of these variables, would be measures to combat this problem.
- ✓ Carrying out longitudinal studies that reveal precisely the antecedents of accidents and the relationships that exist between the variables: reverse relationships, reciprocal relationships, etc. (Rubio & Osca, 2013). Thus, we must address the temporal evolution of the scores, which will facilitate, in the short, medium and long term, the psychological factors involved in the origin of stress, damage to health, and accidents.
- ✓ *Multi-level approximations* will also be necessary, to identify the personal, group or organizational level in which these relationships are produced, an aspect that has not yet been addressed in this field. This, along with a theoretical question, has great applied value (Chen, Bliese, & Mathieu, 2005), because once it is known that a relationship occurs at *group level* intervention programs can be introduced for all members of a unit with greater assurance (e.g., through training programs, awareness, etc.). In contrast, if the relationships only occur at the *individual level*, joint interventions would be meaningless. In our research, the group analyses carried out on job satisfaction in military units (Osca, Bardera & López-Araujo, 2010) indicate that, given the relationship between job satisfaction and accident rates, a multilevel approach for this topic is likely.

Safety programs based on behavioral change have been effective in different contexts such as mining, transport and aviation (for a review, see Grindle, Dickinson & Boettcher, 2000). However, the meta-analysis by Tuncel, Lotlikar, Salem and Daraiseh (2006), based on 10,019 articles, highlights important methodological problems because only 13 met the criteria to confirm that they had been effective in improving safety. Therefore Tuncel et al. recommend that intervention programs: 1) take into account the specific needs of the jobs and workers to which they will be applied; 2) introduce control groups; 3) calculate the validity and reliability of the assessment methods; and, 4) statistically analyze whether the changes *before* and *after* the intervention are significant.

Finally, moving on from the theoretical and applied perspective in this field, the participation is needed of both public and private institutions and agencies. Only through the efforts of all concerned will it be possible to advance in such an important subject as the reduction of working accidents.

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