Occupational Diseases and Environmental Medicine, 2024, 12, 142-159
https://www.scirp.org/journal/odem
ISSN Online: 2333-357X
ISSN Print: 2333-3561

# Work-Related Accidents on a Hospital Construction Site in Benin

**Adjobimey Mênonli[1,2,3,4*], Mikponhoué Rose[1,3], Dégbey Cyriaque[4], Hountohotègbé Esdras[2], Guédou Alexandre[4], Lawani Affousath[2], Ayélo Paul[1,3], Hinson Antoine[1,3]**

[1]Unité de Recherche et d'Enseignement en Santé au Travail et Environnement FSS, Cotonou, Benin
[2]Service de Santé au Travail du Centre National Hospitalier Universitaire de Pneumo-Phtisiologie, Cotonou, Benin
[3]Occupational Health Service at the Referral Hospital Construction Site, Abomey-Calavi, Benin
[4]Inter-Faculty Center for Environmental Training and Research for Sustainable Development (CIFRED), Abomey-Calavi, Benin
Email: *menoladjobi@yahoo.fr

**How to cite this paper:** Mênonli, A., Rose, M., Cyriaque, D., Esdras, H., Alexandre, G., Affousath, L., Paul, A. and Antoine, H. (2024) Work-Related Accidents on a Hospital Construction Site in Benin. *Occupational Diseases and Environmental Medicine*, **12**, 142-159.
https://doi.org/10.4236/odem.2024.122012

**Received:** May 1, 2024
**Accepted:** May 24, 2024
**Published:** May 27, 2024



## Abstract

**Introduction:** Work-related accidents are frequent and serious in the construction sector. The aim of the study was to determine the frequency and factors associated with occupational accidents on the construction site of a referral hospital in Benin. **Methods:** A cross-sectional study was carried out. The sample size was calculated using the Schwartz form adjusted for the number of workers on site and was 129 workers. Random sampling was used. The dependent variable was work-related accidents. The other variables were socio-demographic and occupational characteristics. Data were collected through a questionnaire survey. Medians and proportions were calculated. An association was sought using Chi-square and Fisher tests with a threshold of $p < 0.05$. **Results:** A total of 132 workers were included. Their median age was 30 years with an ITQ of [27 - 38]; men were the most represented 126 (95.45%) with a level of education higher than or equal to high school in 101 (76.52%) and in the majority with a permanent status 85 (64.39%). Seniority of more than 5 years was observed in 92 (69.7%). Workers working more than 8 hours of overtime per week numbered 57 (43.18%). Exposure to vibrating objects was 49 (37.12%). In terms of psychosocial constraints, 82.58% had high psychological demands; 79.53% low decision-making latitude; 50.76% low social support. The frequency of work-related accidents was 6.82%, and the only associated factor was the type of worker ($p = 0.016$). On the other hand, there were 10.2% accidents among workers handling vibrating objects versus 4.98% among those not using them. With regard to psychosocial constraints, the following frequencies were recorded respectively: 6.42% among those with high psychological demand versus 8.7% among those with low psychological demand; 7.62% among those with low decision-making latitude versus 3.7% among those with high decision-making latitude; 8.96% among those with low social support versus 4.62% among those

with high support. **Conclusion:** Work-related accidents on construction sites must be avoided by all possible means including the management of psychosocial constraints.

## Keywords

Occupational Injury, Building and Civil Engineering, Construction, Environment

## 1. Introduction

The building and public works (BTP) sector is a major source of accidents at work (AT), even though the frequency and severity of accidents have declined significantly in developed countries over the last few decades [1]. Statistics on work-related injuries on construction sites show that the building and civil engineering sector is still one of the most critical [1]. In the building and civil engineering sector, accidents are more frequent on building sites than in public works [1] [2]. The frequency of work-related accidents in construction activities was 64.3% in Egypt in 2019 and 74% in Kenya in 2017 [3]. Among all work accidents reported to the Caisse, construction-related work accidents accounted for 22.6% in Senegal and 8.48% in Benin [2] [4]. In terms of lethality, among trauma deaths in Tunisia, construction-related work accidents accounted for 70% [5]. In developing countries, statistics on work-related injuries in the construction sector are patchy and do not reflect reality, due to the highly developed informal activities in this sector. The informal nature of the sector makes it more vulnerable to precarious working conditions. Work accidents do not just happen; they are caused by dangerous acts, unsafe conditions or both [6]. The main causes of work-related injuries in the construction industry are worker negligence, failure to comply with work procedures, working at heights, use of equipment without safety devices, inadequate training, poor site management [7] [8]. However, the contribution of psychosocial constraints to the occurrence of work-related accidents is increasingly mentioned. However, authors remain divided on the question [9] [10]. To prevent work-related injuries, each construction company must implement a prevention policy tailored to its activities and the risks involved. This study was prompted by the lack of data on work-related accidents in the construction sector, and in particular on the association between psychosocial constraints and work-related accidents in our country. The aim was to determine the prevalence and factors associated with work-related injuries, in particular psychosocial constraints, among workers on a hospital construction site in Benin.

## 2. Materials and Methods

### 2.1. Type of Study

This was a descriptive cross-sectional study conducted in April 2023.

## 2.2. Framework of the Study

The study took place on a hospital construction site in southern Benin. The site is run by a multinational group specializing in building and civil engineering.

The Group's strategy is based on a policy of innovation in terms of offerings, work organization, technical solutions, management and site management. The Group's vision is based on "Zero workplace accidents". To achieve this, particular emphasis is placed on work-related accidents, with the adoption of a regularly updated safety policy. The available preventive measures are collective and individual, and apply to all workers.

The hospital construction site has a technical production block with several workshops. Site personnel are divided into two main categories: permanent staff working for the parent company, and occasional staff working for subcontractors. Working hours on the site are from 8 am to 12 pm and from 1 pm to 6 pm for technical staff, with overtime from 6 pm to 10 pm. The site has a functional Occupational Health and Safety Committee (OHSC) and an occupational health department.

## 2.3. Study Population and Sampling

The study population consisted of site workers with at least 1 year's seniority in the production sector who had given informed consent. The sample size, calculated according to the Schwartz formula adjusted ($n1 = Z\alpha^2\ pq/i^2$) to the number of workers on site, was 129 with $\alpha = 5\%$ where $Z\alpha = 1.96$; $p = 0.5\%$ and $q = 1 - p$ (p is the frequency of ailments, we considered 50%, i = 5% (desired precision). Let N be the number of workers on the site in all categories of the production sector with at least one year's seniority on the site. In April 2023, there were a total of 880 workers, including 789 in the production sector, 181 of whom had started work before March 1, 2022; N = 181 then $n2 = [n1*N/(N + n1)] + 5\%$ marge; n2 = 129 workers. The sampling frame consisted of the list of production site workers hired before March 1, 2022. Workers were selected using a simple random sampling technique using Excel 2016 software.

## 2.4. Main Study Variables

The dependent variable was "work-related accident", defined as any accident occurring to a site worker, whatever the cause, as a result of or during work on the site. Only site accidents were taken into account here.

The independent variables relate to socio-demographic factors (age, gender, level of education, seniority, marital status); occupational factors (type of position, seniority in position, seniority in the construction sector, average working hours, number of overtime hours per week, wearing of personal protective equipment (PPE), psychosocial constraints: high psychological demand, decision latitude and social support). With regard to psychosocial constraints, the Karasek questionnaire was used. This questionnaire is divided into three parts, each of which determines three scores. These parts are: decision latitude (LD), psy-

chological demand (PD) and social support at work (SS). Responses from "strongly disagree" to "strongly agree" are transformed into values from 1 to 4. Questions are numbered from K1 to K26. Calculation methods are: LD = 4 * (K4 + (5 − K6) + K8) + 2 * (K1 + (5 − K2) + K3 + K5 + K7 + K9); DP = K10 + K11 + K12 + (5 − K13) + K14 + K15 + K16 + K17 + K18; SS = K19 + K20 + K21 + K22 + K23 + K24 + K25 + K26. Decision latitude is low when the score is below 71, psychological demand is high when the score is above 21 and social support is low when the score obtained is below 24, job stress has been defined as the combination of low decision latitude, high psychological work demands and low social support from colleagues and hierarchy. Iso-strain was defined as the combination of job strain and low social support [11].

### 2.5. Data Collection

We used a standardized questionnaire designed by us based on international questionnaires and tested on another construction site in the same city to make adjustments. The team comprised two interviewers, two nurses and an occupational physician. Data collection was based on a face-to-face interview using a standardized questionnaire digitized on a smartphone using the Kobo Collect application.

### 2.6. Data Analysis

Using R.4.0.4 software, we calculated proportions for qualitative variables and means with standard deviations for quantitative variables. The comparison of two proportions is carried out using the Chi-square test ($Khi^2$) uncorrected if all the numbers are greater than 5. For expected numbers below 2.5, Fisher's exact test was used, and Yates' Chi-square test for numbers between 2.5 and 5. We concluded that there was a statistically significant association between two variables for any probability of less than 5% ($p < 0.05$). Odds ratios and their confidence intervals were calculated as measures of association.

### 2.7. Ethical Considerations

The free and informed consent of each participant has been obtained. Authorization has been obtained from company management. Participants were informed of data confidentiality. Data processing was carried out anonymously. The protocol was approved by the local biomedical research ethics committee of the University of Parakou under number 0577.

## 3. Results

### 3.1. Socio-Demographic Characteristics

A total of 132 workers were included in the study. Their median age was 30, with an inter-quartile range of [27 - 38], a minimum of 19 and a maximum of 71. The most represented age group was 19 to 29 years, with a frequency of 58 (43.94%). The majority of workers were men 126 (95.45%), with 101 (76.52%) having com-

pleted secondary school or higher. Table 1 shows the socio-demographic characteristics of the workers.

### 3.2. Professional Characteristics

Permanent workers were most represented in the sample 85 (64.39%). Seniority of more than 5 years was observed in 92 (69.7%). Workers with more than 8 hours weekly overtime were 57 (43.18%).

Exposure to vibrating objects was 49 (37.12%). With regard to psychosocial constraints, 82.58% of workers had high psychological demands, 79.53% low decision-making latitude and 50.76% low social support. Table 2 summarizes the occupational characteristics of the workers.

### 3.3. Frequency of Work-Related Injuries

In all, of the 132 workers included in the study, 9 (frequency of 6.82% $IC_{95\%}$ [3.364 - 12.92]) had suffered a work-related injury. The circumstances of the accidents were successively related to a part of the limb becoming trapped in a piece of equipment, impact with a piece of equipment or machinery, a fall from a standing position, or a hand slipping in a compressor. Figure 1 shows a finger injury sustained by a flagman.

Table 1. Sociodemographic characteristics of workers on a hospital construction site in 2023 (n = 132).

| | n | % | $[IC]_{95\%}$ |
|---|---|---|---|
| **Age (years)** | | | |
| 19 - 29 | 58 | 43.94 | [35.40 - 52.83] |
| 30 - 40 | 43 | 32.58 | [24.83 - 41.36] |
| >40 | 31 | 23.48 | [16.74 - 31.81] |
| **Gender** | | | |
| Female | 6 | 4.55 | [1.861 - 10.05] |
| Male | 126 | 95.45 | [89.95 - 98.14] |
| **Marital status** | | | |
| Single | 53 | 40.15 | [31.83 - 49.06] |
| Married/Couple | 79 | 59.85 | [50.94 - 68.17] |
| **Education level** | | | |
| Less than secondary | 31 | 23.48 | [1.74 - 31.81] |
| Secondary and higher | 101 | 76.52 | [68.19 - 83.26] |
| **Nationality** | | | |
| Beninese | 124 | 93.94 | [88.02 - 97.15] |
| Foreign | 8 | 6.06 | [2.845 - 11.98] |

Worker Flagman

The worker wanted to tighten a shawl to the gravel bar for its elevation when the ring finger of his right hand got caught between the chain and the bar.

Suture management

**Figure 1.** Finger injury at a flagmaker's workplace.

**Table 2.** Occupational characteristics of workers on a hospital construction site in Benin in 2023 (n = 132).

| | n | % | $[IC]_{95\%}$ |
|---|---|---|---|
| **Type of worker** | | | |
| Daily | 7 | 5.3 | [2.344 - 11.02] |
| Occasional subcontractor | 40 | 30.3 | [22.77 - 39.00] |
| Permanent | 85 | 64.39 | [55.54 - 72.40] |
| **Length of service (years)** | | | |
| >2 | 107 | 81.06 | [73.12 - 87.15] |
| [1 - 2] | 25 | 18.94 | [12.85 - 26.88] |
| **Length of service in the construction industry (years)** | | | |
| >5 | 92 | 69.7 | [61.00 - 77.23] |
| ≤5 | 40 | 30.3 | [22.77 - 39.00] |
| **Number of overtime hours per week** | | | |
| ≤8 hours | 75 | 56.82 | [47.92 - 65.32] |
| >8 hours | 57 | 43.18 | [34.68 - 52.08] |
| **Vibrating object** | | | |
| No | 83 | 62.88 | [54.00 - 71.00] |
| Yes | 49 | 37.12 | [29.00 - 46.00] |
| **Wearing PPE (gloves + helmets + safety shoes + work clothes)** | | | |
| No | 0 | 0 | |
| Yes | 132 | 100 | - |
| **Psychological demand** | | | |
| High | 109 | 82.58 | [74.79 - 88.41] |
| Low | 23 | 17.42 | [11.59 - 25.21] |
| **Decision-making latitude** | | | |
| High | 27 | 20.45 | [14.13 - 28.54] |
| Low | 105 | 79.55 | [71.46 - 85.87] |
| **Social support** | | | |
| Low | 67 | 50.76 | [41.96 - 59.51] |
| High | 65 | 49.24 | [40.49 - 58.04] |

### 3.4. Associated Factors

The only associated factor found after bivariate analysis was related to the type of worker, in this case permanent workers (p = 0.016). All cases of work-related accidents were recorded among permanent workers, with a frequency of 10.6%.

However, variability in frequency was noted as a function of the other explanatory variables. Indeed, the frequency of work-related accidents increases with age: 3.45% between 19 and 29; 6.98% between 30 and 40; and 12.9% for those over 40. No cases of work-related accidents were recorded among women, compared with 7.14% among men. The frequency of work-related accidents was 7.98% among workers with a high school diploma or higher, versus 3.23% among those with a lower level of education. In terms of seniority, there were 7.61% work-related accidents among workers with over 5 years' seniority, versus 5% among those with seniority ≤ 5 years. There were 10.2% work-related accidents among workers handling vibrating objects, versus 4.98% among those not using vibrating objects. With regard to psychosocial constraints, the following frequencies were recorded respectively: 6.42% among those with high psychological demand versus 8.7% among those with low psychological demand; 7.62% among those with low decision-making latitude versus 3.7% in the case of high decision-making latitude; 8.96% among those with low social support versus 4.62% among those with high support; 7.06% among stresses versus 6.38% among non-stresses. Table 3 presents the results of the search for associated factors.

## 4. Discussion

The aim of this study was to determine the frequency and factors associated with work-related accidents on a construction site. At the end of the study, the frequency of work-related accidents in the sample was 6.82%, and the only associated factor was the type of worker (p = 0.016). Work-related accidents represent a major risk in the building and civil engineering sector [12]. The frequency reported in this study appears to be low compared with that of several other authors in the construction sector. Frequencies of 84.7% in Ethiopia; 64.3% in Egypt; 39% in Ethiopia; 38.3% in Ethiopia were respectively obtained in the construction sector by Hanna *et al.* [13] Sehsah *et al.* [14] Berhanu *et al.* [15]; Tadesse *et al.* [16]. This difference is multifactorial. It may be due to the large size of their sample, to the socio-professional realities and working conditions specific to each country, but above all to the fact that the present study was carried out in a specialized construction company aligned with international standards with a "zero work-related injury on our worksites" vocation. As a result, a number of collective and individual technical preventive measures have been implemented on this site. The only associated factor was the type of worker, in this case the permanent worker is not the usual one, and is linked to the inclusion criteria, in particular seniority on the site. Indeed, the first workers recruited on the site are the permanent ones. Seniority of at least one year limits the number of eligible temporary workers. According to the literature, occupational injuries are more frequent among temporary workers [17] [18].

**Table 3.** Factors associated with occupational accidents among workers on a hospital construction site in 2023 (n = 132).

| | | Work-related accident | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | n | Yes | | No | | $OR_b$ | $[IC]_{95\%}$ | p-value |
| | | n | % | n | % | | | |
| **Age** | | | | | | | | 0.258 |
| 19 - 29 years old | 58 | 2 | 3.45 | 56 | 96.55 | 1 | - | |
| 30 - 40 years | 43 | 3 | 6.98 | 40 | 93.02 | 2.10 | 0.33 - 16.5 | |
| >40 years | 31 | 4 | 12.9 | 27 | 87.10 | 4.15 | 0.76 - 31.3 | |
| **Gender** | | | | | | | | 0.352 |
| Female | 6 | 0 | 0.00 | 6 | 100.00 | 1 | - | |
| Male | 126 | 9 | 7.14 | 117 | 92.86 | 3272678 | - | |
| **Education level** | | | | | | | | 0.328 |
| Secondary and higher | 101 | 8 | 7.92 | 93 | 92.08 | 1 | - | |
| Less than secondary | 31 | 1 | 3.23 | 30 | 96.77 | 0.39 | 0.02 - 2.24 | |
| **Marital status** | | | | | | | | 0.662 |
| Single | 53 | 3 | 5.66 | 50 | 94.34 | 1 | - | |
| Married/Couple | 79 | 6 | 7.59 | 73 | 92.41 | 1.37 | 0.34 - 6.73 | |
| **Length of service** | | | | | | | | 0.798 |
| ≤2 years | 25 | 2 | 8 | 23 | 92.00 | 1 | - | |
| >2 years | 107 | 7 | 6.54 | 100 | 93.46 | 0.81 | 0.18 - 5.64 | |
| **Seniority in the construction industry** | | | | | | | | 0.574 |
| ≤5 years | 40 | 2 | 5 | 38 | 95.00 | 1 | - | |
| >5 years | 92 | 7 | 7.61 | 85 | 92.39 | 1.56 | 0.36 - 10.8 | |
| **Type of worker** | | | | | | | | **0.016** |
| Permanent | 85 | 9 | 10.6 | 76 | 89.41 | 1 | - | |
| Daily | | 0 | 0 | 7 | 100.00 | 0 | | |
| Occasional subcontractor | 40 | 0 | 0 | 40 | 100.00 | 0 | | |
| **Overtime** | | | | | | | | 0.937 |
| ≤8/week | 75 | 5 | 6.67 | 70 | 93.33 | 1 | - | |
| >8/week | 57 | 4 | 7.02 | 53 | 92.98 | 1.06 | 0.25 - 4.18 | |
| **Vibrating object** | | | | | | | | 0.245 |
| No | 83 | 4 | 4.82 | 79 | 95.18 | 1 | - | |
| Yes | 49 | 5 | 10.2 | 44 | 89.80 | 2.24 | 0.57 - 9.48 | |

**Continued**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Psychological demand** | | | | | | | | 0.703 |
| Low | 23 | 2 | 8.7 | 21 | 91,30 | 1 | - | |
| High | 109 | 7 | 6.42 | 102 | 93.58 | 0.72 | 0.16 - 5.06 | |
| **Decision-making latitude** | | | | | | | | 0.442 |
| High | 27 | 1 | 3.7 | 26 | 96.30 | 1 | - | |
| Low | 105 | 8 | 7.62 | 97 | 92.38 | 2.14 | 0.37 - 40.7 | |
| **Social support** | | | | | | | | 0.318 |
| High | 65 | 3 | 4.62 | 62 | 95.38 | 1 | - | |
| Low | 67 | 6 | 8.96 | 61 | 91.04 | 2.03 | 0.51 - 9.97 | |
| **Occupational Stress** | | | | | | | | 0.882 |
| Non | 47 | 3 | 6.38 | 44 | 93.62 | 1 | - | |
| Oui | 85 | 6 | 7.06 | 79 | 92.94 | 1.11 | 0.28 - 5.48 | |
| **Iso strain** | | | | | | | | |
| Non | 83 | 6 | 7.23 | 77 | 92.77 | 1 | - | 0.881 |
| Oui | 49 | 3 | 6.12 | 46 | 93.88 | 0.84 | 0.17 - 3.33 | |

Age was not associated with work-related accidents, but an increase in the frequency of accident was observed with age. This result is unusual, as one would expect the risk of occupational injury to be higher in younger workers, due to their lack of experience [19] [20]. However, given the higher workloads and psychosocial stresses of older workers due to their responsibilities, it is possible that the risk of accident is higher.

The exclusively male nature of work-related accidents is typical of the construction sector, where the population is predominantly male [12] and the few women present on site occupy lower-risk positions.

The frequency of work related accidents among workers using vibrating objects was twice as high as among those not using them. This result could be justified by the intrinsically accident-prone nature of these vibrating tools, particularly cutting tools. Further studies will be necessary for a better assessment.

The association sought between psychosocial factors and work related accidents was not found. According to the literature review [9], this association is still debated. However, the prevalence of occupational injuries among workers with low decision latitude was more than twice that of workers with high decision latitude. The same applies to social support. Indeed, psychological constraints are likely to lead to reduced concentration and vigilance, which could be a source of work-related accidents. Further studies are needed to deepen our understanding of this issue.

This study provided information on the frequency and factors associated with occupational accidents among workers on a hospital construction site. The

strong point is the inclusion of psychosocial factors, even though they are not associated with work-related accidents.

This study has a number of limitations linked to the inclusion criterion of at least one year's seniority on the site. While this criterion enabled the inclusion of workers who had been exposed to work on the site for a reasonable period, it led to an overestimation of the number of permanent workers in the sample. Indeed, recruitment on the site began with permanent workers, who therefore have more seniority than other workers. The simple random sample limits this bias, but a non-equipotent stratified sample could correct this distortion.

The present study allows us to suggest that employers in the construction sector should ensure the implementation of collective technical prevention measures, as was the case in the present construction project, in order to achieve low prevalences in terms of occupational accidents. They must also offer permanent workers, those who use vibrating objects and those with more than 5 years' seniority, supervision geared to the prevention of work-related accidents. In addition, they must strive to create a working environment that fosters social support.

## 5. Conclusion

In the construction sector, the low frequency of occupational accidents is linked to improved working conditions, and in particular to a safety policy based on collective and individual measures. Further studies are needed to better assess the contribution of psychosocial constraints to the occurrence of work-related accidents.

## Acknowledgements

Our thanks go to the site managers and workers.

## Conflicts of Interest

The authors declare that there are no conflicts of interest related to this study.

## References

[1] Tissot, C. (2010) Analyse des accidents du répertoriés dans EPICEA. *INRS-Hygiène et sécurité du travail*, **218**, 10-34.

[2] Dia, S., Mohamed, A., Ndoye, E., Agbobli, Y., Jouga, Y., Diaby, A., *et al.* (2018) Caractéristiques des accidents du travail dans une entreprise sénégalaise de bâtiments et travaux publics (BTP). *CAMIP*, **4**, 1-11. https://www.researchgate.net/publication/328307005_Characteristics_of_work-related_accidents_in_a_Senegalese_company_of_Buildings_and_Public_Works_Caracteristiques_des_accidents_du_travail_dans_une_entreprise_senegalaise_de_batiments_et_travaux_public

[3] Raymond, K., Kaluli, J.W. and Kabubo, C. (2017) Common Construction Site Hazards in Nairobi County. *American Journal of Construction and Building Materials*, **1**, 26-33. http://www.sciencepublishinggroup.com/j/ajcbm

[4] Sandrine, Y. (2023) Aspects épidémiologiques des accidents de travail déclarés à la

Caisse nationale de sécurité sociale au Bénin de 2011 à 2020. Cotonou. Mémoire, Bibliothèque de la Faculté des Sciences de la Santé de Cotonou, Université d'Abomey-Calavi, Bénin.

[5] Ben Khelil, M., Harzallah, H., Elmoulehy-Majed, H., Belghith, M. and Hamdoun, M. (2019) Les Morts Traumatiques Accidentelles sur les lieux du travail dans le nord de la Tunisie. *La Tunisie Médicale*, **97**, 918-824. https://www.researchgate.net/publication/338164787

[6] Rahim, A., Hamid, A., Zaimi, M., Majid, A. and Singh, B. (2008) Causes of Accident at Construction Sites. *Malaysian Journal of Civil Engineering*, **20**, 242-259.

[7] Ali, A.S., Kamaruzzaman, S.N. and Sing, G.C. (2010) A Study on Causes of Accident and Prevention in Malaysian Construction Industry. *Journal of Design + Built*, **3**, 95-104.

[8] Ayob, A., Shaari, A.A., Zaki, M.F.M. and Munaaim, M.A.C. (2018) Fatal Occupational Injuries in the Malaysian Construction Sector-Causes and Accidental Agents. *Earth and Environmental Science*, **140**, Article 012095. https://doi.org/10.1088/1755-1315/140/1/012095

[9] Colin, R., Wild, P., Paris, C. and Boini, S. (2022) Psychosocial Factors and Occupational Accidents, What Does the Literature Say? *Archives des Maladies Professionnelles et de l'Environnement*, **83**, 587-605. https://doi.org/10.1016/j.admp.2022.10.002

[10] Bureau International du Travail (2016) Risques psychosociaux, stress et violence dans le monde du travail. *Journal International de Recherche Syndicale*, **8**, 1-146. https://webapps.ilo.org/wcmsp5/groups/public/---ed_dialogue/---actrav/documents/publication/wcms_551814.pdf

[11] Niedhammer, I., Ganem, V., Gendrey, L. and David, S.D.S. (2006) Propriétés psychométriques de la version française des échelles de la demande psychologique, de la latitude décisionnelle et du soutien social du "Job Content Questionnaire" de Karasek: Résultats de l'enquête nationale SUMER. *Sante Publique*, **18**, 413-427. https://doi.org/10.3917/spub.063.0413

[12] Hami, H., Raougui, D., Azzaoui, F.Z., Fadli, M., Mokhtari, A., Soulaymani, A., *et al.* (2018) Les accidents du travail du BTP au Maroc. *Archives des Maladies Professionnelles et de l'Environnement*, **79**, 425. https://doi.org/10.1016/j.admp.2018.03.488

[13] Hanna, M., Seid, T.M. and Lamessa, D. (2017) Prevalence of Occupational Injuries and Associated Factors among Construction Workers in Addis Ababa, Ethiopia. *Journal of Public Health and Epidemiology*, **9**, 1-8. https://doi.org/10.5897/JPHE2016.0883

[14] Sehsah, R., El-Gilany, A.H. and Ibrahim, A.M. (2020) Personal Protective Equipment (PPE) Use and Its Relation to Accidents among Construction Workers. *La Medicina del Lavoro*, **111**, 285-295. https://doi.org/10.23749/mdl.v111i4.9398

[15] Berhanu, F., Gebrehiwot, M. and Gizaw, Z. (2019) Workplace Injury and Associated Factors among Construction Workers in Gondar Town, Northwest Ethiopia. *BMC Musculoskeletal Disorders*, **20**, Article No. 523. https://doi.org/10.1186/s12891-019-2917-1

[16] Tadesse, S. and Israel, D. (2016) Occupational Injuries among Building Construction Workers in Addis Ababa, Ethiopia. *Journal of Occupational Medicine and Toxicology*, **11**, Article No. 16. https://doi.org/10.1186/s12995-016-0107-8

[17] Probst, T.M., Barbaranelli, C. and Petitta, L. (2013) The Relationship between Job Insecurity and Accident Under-Reporting: A Test in Two Countries. *Work & Stress*, **27**, 383-402. https://doi.org/10.1080/02678373.2013.850756

[18] Picchio, M. and van Ours, J.C. (2017) Temporary Jobs and the Severity of Workplace Accidents. *Journal of Safety Research*, **61**, 41-51. https://doi.org/10.1016/j.jsr.2017.02.004

[19] Duguay, P. and Cloutier, E. (2004) Taux d'incidence des accidents du travail et vieillissement: L'importance du type de dénominateur. *Cahiers Québécois de Démographie*, **25**, 279-291. https://doi.org/10.7202/010213ar

[20] Ministère du travail de la République Française D de l'animation de la recherche, des études et des statistiques (DARES) (2022) Quels sont les salariés les plus touchés par les accidents du travail en 2019? https://dares.travail-emploi.gouv.fr/publication/quels-sont-les-salaries-les-plus-touches-par-les-accidents-du-travail-en-2019

## Questionnaire

| Questions | Answers | Code |
|---|---|---|
| Card no. | | /____/ |
| Investigator | | |
| Survey date | | |
| Survey location | | |
| **General Information** | | |
| Last name | | |
| First name | | |
| Address | | |
| **Socio-demographic information** | | |
| Gender | | /____/ |
| How old are you? | In Years | /____/ |
| What nationality are you? | 1 = Beninese<br>2 = Other<br>Specify… | /____/ |
| Education level | 1 = Literacy only<br>2 = Primary<br>3 = Secondary<br>4 = University<br>5 = None | /____/ |
| Profession | 1 = Public servant<br>2 = Dealer<br>3 = Artisan/Worker/Farmers<br>4 = Privately employed<br>5 = Student<br>6 = Other<br>Specify… | /____/ |
| Marital status | 1 = Single<br>2 = Married/couple<br>3 = Divorced/widowed | /____/ |
| **Socio-professional characteristics** | | |
| Type of worker | Daily<br>Occasional subcontractor<br>Permanent BBB | /____/ |

**Continued**

| | | |
|---|---|---|
| Length of service (years) | Years | /____/ |
| Length of service in the construction industry (years) | Years | /____/ |
| Number of overtime hours per week | Hours | /____/ |
| Vibrating object | 0 = No<br>1 = Yes | /____/ |
| Wearing PPE-Helmets | 0 = No<br>1 = Yes | /____/ |
| Wearing PPE-Gloves | 0 = No<br>1 = Yes | /____/ |
| Wearing PPE-Work clothing | 0 = No<br>1 = Yes | /____/ |
| Wearing PPE-Shoes | 0 = No<br>1 = Yes | /____/ |
| **Other PPE according to workstation?** | | |

| **Question Stress KARASEK** | | |
|---|---|---|
| Psychological and organizational constraints (KARASEK questionnaire). For the following questions, please tick the box that best corresponds to your answer) | | |
| In my job, I have to learn new things | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| In my job, I perform repetitive tasks | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My job requires me to be creative | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My job often allows me to make decisions for myself | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |

**Continued**

| | | |
|---|---|---|
| My job requires a high level of skill | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| In my job, I have very little freedom to decide how I do my work | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| In my job, I have a variety of activities | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| I can influence the course of my work | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| I have the opportunity to develop my professional skills | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My job requires me to work very fast | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My job requires intense work | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| I'm asked to do an excessive amount of work | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| I have enough time to complete my work | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |

**Continued**

| | | |
|---|---|---|
| I receive contradictory orders from other people | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My work requires long periods of intense concentration | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My tasks are often interrupted before they are completed, requiring me to resume them later. | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My work is "very hectic". | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| Waiting for colleagues to do their work often slows down my own work. | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My superior is concerned about the well-being of his subordinates | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My superior pays attention to what I say | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My superior helps me get the job done | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My superior easily gets his subordinates to work together | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |

**Continued**

| | | |
|---|---|---|
| The colleagues I work with are professionally competent. | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| The colleagues I work with show interest in me | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| The colleagues I work with are friendly | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| The colleagues I work with help me get the job done. | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| I'm treated unfairly at work | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My job security is threatened | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| My current job corresponds well to my training | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| Given all my efforts, I receive the respect and esteem I deserve | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| Given all my efforts, my promotion prospects are satisfactory | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |

**Continued**

| | | |
|---|---|---|
| Given all my efforts, my salary is satisfactory. | 1-Don't agree at all<br>2-Disagree<br>3-All right<br>4-All in favor | /____/ |
| **Questions about accidents at work** | | |
| Have you had a work-related accident on the site in the last 12 months? If yes, please specify: | 0 = No<br>1 = Yes | /____/ |
| Accident location | | |
| Time of day | | |
| Headquarters | | |
| Nature of lesion | | |
| Causal element | | |
| **Dear participant, we have come to the end of the interview and would like to thank you.** | | |