



Occupational Accidents in Agriculture in a Developing Country: What are the Particularities? Example of the Société de Cultures Légumières (SCL) of Saint-Louis in Senegal between 2017 and 2021

^{*1} SAGNA, A.S., NDOUR, M.D., FALL, M.T.A. & GUEYE, M.M.

^{*1}Société de Cultures Légumières (SCL), km2 Route de Diama, BP1105 Saint-Louis, Sénégal

²Comité international de la croix rouge, Dakar, Sénégal

³West Africa Farm (WAF), Yamane, Louga, Sénégal

⁴Compagnie Sucrière Sénégalaise, Richard Toll, Sénégal

Corresponding Author's E-mail: assega5@yahoo.fr; sagna.assega-sylvain@ugb.edu.sn Phone: +221777213222

ORCID: <https://orcid.org/0000-0002-9191-6502> BP: 1105, SCL, Saint-Louis, Sénégal

ABSTRACT

This study aimed at describing the types of occupational accidents in an agriculture company in Senegal where that field, even on a large scale, has retained a large part of manual activities; it also help to point out the factors involved in order to identify major areas for prevention. We made a retrospective study from January 1st, 2017, to December 31st, 2021, at the SCL, covering all victims of work-related accidents according to the ILO definition. There were 965 occupational accidents, of which 131 (13%) are commuting accidents. Lost-time injuries accounted for 44.4%. Accidents were of low severity in 88.7% of cases, high in 6.8% of cases and very high in 4.5% of cases. The frequency and severity rates were respectively 24.3% and 0.24%. The victims were mainly men (67.8%), aged on average 35.3 years and working in their positions for 3.4 years. The predominant lesion was wound with 46.9% of cases. The severity of the accident was inversely related to seniority. It was also related to gender, with women having more serious accidents than men. Commuting accidents were also 14.2 times more serious than on-site accidents. Occupational accidents in agriculture are more common in developing countries. Unlike developed countries, they are more often of low to very low severity. Hand tools are the mostly incriminated and lack of experience is one of the prominent factors.

Keywords: Accident, Agriculture, Occupational health, Occupational risk, Senegal, Work related accident

LICENSE: This article by African Journal of Health, Safety and Environment (AJHSE) is licensed and published under the Creative Commons Attribution License 4.0 International License, which permits unrestricted use, distribution, and reproduction in any medium, provided this article is duly cited.

COPYRIGHT: The Author(s) completely retain the copyright of this published article.

OPEN ACCESS: The Author(s) approves that this article remains permanently online in the open access (OA) model

QA: This Article is published in line with "COPE (Committee on Publication Ethics) and PIE (Publication Integrity & Ethics)".

INTRODUCTION

The agricultural sector accounts for a large proportion of the world's manpower and is known to be a high-risk sector of activity (Kuye *et al.*, 2006; Douphrate *et al.*, 2013; Das, 2014; Parvez and Shahriar, 2018), with around 170,000 fatalities worldwide each year, as well as serious injuries and occupational illnesses (International Labour Organization, 2009; Douphrate *et al.*, 2013). According to the International Labour Organization, 318 million non-fatal accidents were recorded in the agricultural sector in 2011. In 2013, there were 13,5626 occupational accidents, including 366 fatalities (Merisalu *et al.*, 2019), in Europe. According to several authors, this number is underestimated, with inconsistencies between the number of actual accidents and the number of accidents reported (Merisalu *et al.*, 2019). In the United States, the actual number of work-related accidents was estimated at 413,000 in 2014 (Leigh *et al.*, 2014). In Africa, where the agricultural workforce is very large, data on the scale of the problem of work-related accidents is almost non-existent (Kuye *et al.*, 2006).

Most of these accidents involve hand tools, agricultural machinery, and chemicals (Kuye *et al.*, 2006; Das, 2014; Parvez and Shahriar, 2018). In Africa, and Senegal in particular, few studies have investigated the characteristics of these accidents (Bhattarai *et al.*, 2016). Senegal is an agricultural country, with a large proportion of its population living in rural areas and making up most of the workforce in agricultural farms (Sagna *et al.*, 2022). The northern region of Senegal is one of the major hubs of this activity, with a large-scale agricultural sector that uses innovations in terms of agricultural machinery, but also retains a high level of manual activity, hence the large numbers of workers in the peak season (Parvez and Shahriar, 2018). These large numbers of workers are transported from the surrounding villages to the farms by a mass transport service affiliated to the farming company.

Given that occupational accidents can be prevented, it is important to understand their characteristics, their consequences, and the populations at risk so that we can develop a prevention strategy. This study aimed at describing the types of occupational accidents in an agriculture company in Senegal where that field, even on a large scale, has retained a large part of manual activities; it also helps to point out the factors involved in order to identify major areas for prevention.

MATERIALS AND METHODS

We conducted a retrospective, descriptive and analytical study over five (5) years from January 1, 2017, to December 31, 2021, at Société de Cultures Légumières (SCL). We collected data from the work accident-monitoring file. Indeed, the SCL has an occupational health service that systematically records and analyse all injuries. Workers and supervisors were required to report any accident (whether they are minor or serious) or near miss that occurred in the workplace. In addition, the occupational health service had a care activity with curative consultations for the benefit of workers and surroundings villages. This is a specificity of occupational health services in developing countries because of the limited availability of healthcare facilities.

The results were analysed using Excel and Epi info 7.1. We carried out various statistical tests, each according to its own validity criteria.

An accident is deemed to be a work-related, regardless of its cause, if it involves an employee as a result of or in the course of work (on-site accident), on the way from his residence to his workplace and vice versa, insofar as the route has not been interrupted or diverted for a reason dictated by personal interest or independent of the job (commuting accident), during travel and journeys for which the expenses are at the charge of the employer (mission trip accident).

If, as a result of an accident falling within this definition, an employee is unable to work for more than 24 hours, it is called a lost time accident, otherwise it is called a non-lost time accident.

An accident severity is determined in terms of the number of days off associated. Thus, an accident resulting in less than 8 days off is considered a low severity accident. If lost time ranges between 8 and 30 days, it is a high severity accident; and over 30 days, it was a very high severity accident.

Results

Between 2017 and 2021, SCL recorded 965 occupational accidents. Commuting accidents accounted for 13.6% (n=131) of all accidents. There were no mission-related accidents. The evolution of the frequency rate of work accidents is shown in Figure 1.

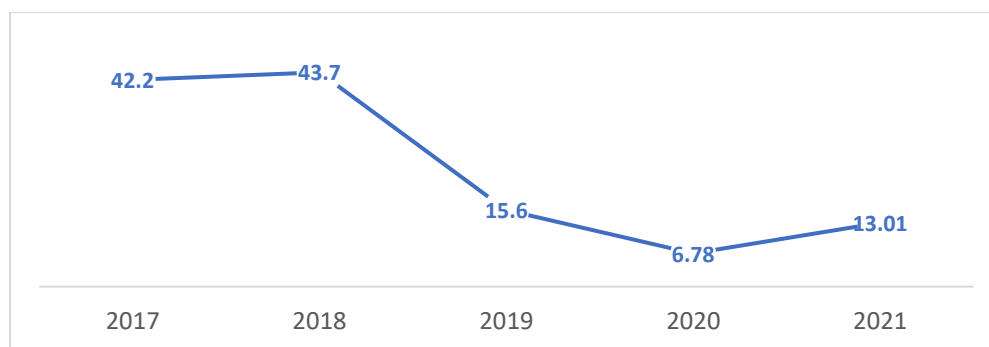


Figure 1: Evolution of the frequency rate of work accidents between 2017 and 2021

The victims were men in 67.8% of cases (sex ratio 2.1).

The average age at the time of the accident was 35.28, with a standard deviation of 9.77 and extremes ranging from 18 to 60.

Accidents resulting in more than 24 hours' lost time accounted for 36.9% (n=356) of all accidents at the SCL. These accidents were very serious, overall, in 4.46% (n=43) of cases, serious in 6.84% of cases and not very serious in 88.70% of cases (n=856).

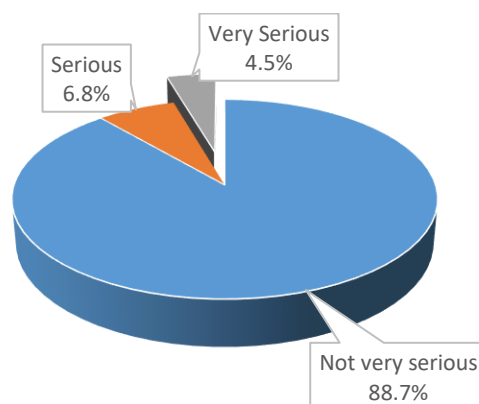


Figure 2: Distribution of accidents by severity

The three most frequently found material factors were hand tools (25.5%), vehicles (24.5%) and objects for manual handling (15%).

The average seniority in position at the time of the accident was 3.4 years, with extremes ranging from 0 to 4.2 years.

Permanent workers were involved in 39.7% (n= 383).

The lesions found were mainly wounds (cuts, punctures, abrasions, other wounds) in 46.9% of cases and contusions in 31.8% of cases. There were 27 fractures (2.93%) see Table 1.

Table 1: Distribution of the accidents according to the nature of the lesion

Nature of the lesions	Prevalence	Percentage
Crushing of a part of the body	1	0.10
Electrification	1	0.10
Amputation	2	0.21
Dislocation	3	0.31
Inhalation of toxic	5	0.52
Bee sting	11	1.15
Burn	12	1.26
Inflammation	25	2.62
Fracture	27	2.93
Lumbago	31	3.25
Sprains	87	9.11
Contusion	307	31.41
Wound (cut, sting, abrasion,other wounds)	453	47.02
Total	965	100.00

Lesions were more frequent in the hands (32.1%), in the lower limbs (17.2% except feet), and in the feet (14.9%) (Figure 3).

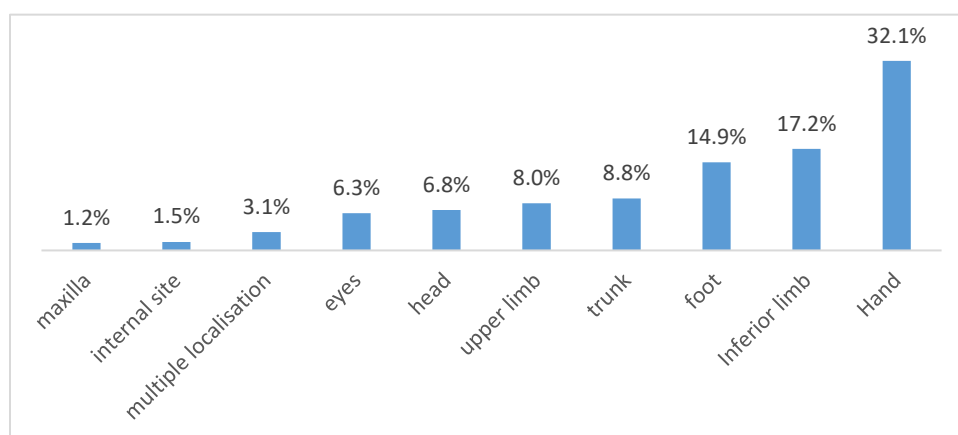


Figure 1: Distribution according the site of injuries

The average lost time duration was 13.2 days, with extremities ranging from 2 to 485 days.

Most serious accidents were mainly fractures, 58.14% (n=25), finger amputation, 2.33% (see Table 2).

Table 2 : Lesion and severity-based accident distribution

Severity	Nature of lesions	Actual	Total
Very high severity	Amputation	1	43
	Burn	1	
	Contusion	5	
	Sprain	3	
	Wound	8	
	Fracture	25	
High severity	Burn	1	66
	Contusion	28	
	Sprain	15	
	Wound	18	
	Fracture	2	
	Luxation	1	
Low severity	Burn	10	856
	Contusion	274	
	Sprain	69	
	Wound	427	
	Crushing	1	
	Luxation	2	
	Electric shock	1	
	Bee sting	11	
	Inflammation	25	
	Inhalation of toxic substance	5	
	Lumbago	2	

The victims' seniority in their positions for very serious incidents was 2.7 years versus 3.6 for low severity accidents (see Table 3).

Table 3: Seniority in the position according to incident severity.

	Average	Variation	Standard variation
Low severity	3.6	10.4	3.2
High to Very high severity	2.7	5.8	2.4

$p=0.03$

Lost time average was 10.8 days form female and 2.8 for male. This variation was statistically significant with $p<0.01$.

High to very high severity accidents represented 20.9% of accidents in women and 6.7% in men. This variation was statistically significant with a $p<0.001$. Women were 3.7 more exposed to severe accident risks than men OD [2.4-5.5]. Being a woman was a severe accident risk factor as shown in Table 3.

Table 4: Gender-based severity distribution

	High to very high severity	Low Severity	Total
Women	20.9% (65)	79.1% (246)	100% (311)
Men	6.7% (44)	93.3% (610)	100% (654)

$p<0.001$

Average duration of lost time is 88 days for fracture, 49 days for amputation, and 6 days for wound (see table 4).

Table 5: Average duration according to the injury

Injury nature	Average lost time duration	Variation	Standard variation
Wound	6	115	10.7
Contusion	6.6	78.5	8.8
Sprain	8	81	9
Burn	16.2	433	20.8
Amputation	49	3362	57.9
Fracture	88	10618	103

$P<0.001$

Commuting accidents were 28.6% in women and 6.4% in men. This variation is significative. Women were 5.8 times more exposed to commuting accidents than men.

Serious accidents represented 46.6% of commuting accidents and 5.8% of on-site accidents. This variation is significant Commuting accidents were 14.2 times more serious than on-site accidents (Table 5).

Table 6: Accident type severity

	Low severity	High to very high severity	Total
On-site accidents	786(94.2%)	48(5.8%)	834(100%)
Commuting accidents	70 (53.4%)	61(46.6%)	131(100%)
Total	856 (88.7%)	109(11.3%)	965 (100%)

$p<0.001$

DISCUSSION

Work related accident at SCL are frequent but not particularly serious. Our study shows an average frequency rate of 24.3% of occupational accidents over 5 years. Few studies have considered this parameter. The situation may derive from the failure of occupational accidents notification systems in both developing countries and developed countries (World Health Organization. Regional Office for the Eastern Mediterranean, 2004; Merisalu *et al.*, 2019). However, the frequency rate of farming accidents is estimated at around 12% (Décosse, 2015) in France, and 16.7% (Lee *et al.*, 2012) in South Korea.

Men were more likely to be involved in accidents than women (67.8% for men compared and 32.2% for women). This finding was supported by the literature in both developed countries and developing countries (Kouassi *et al.*, 2013; Pfortmueller *et al.*, 2013; Dia *et al.*, 2018a; Diédhiou *et al.*, 2022;). Diédhiou *et al.* (2022), in Senegal, found a more prevalent male presence than we did (0.4% of women). This variation can be explained by the fact that vegetable harvesting and packaging at SCL is mainly carried out by women, as opposed to the Compagnie Sucrière Sénégalaise, where sugar cane cutting is almost exclusively a male activity.

In other studies, this variation was due to the small number of women in the sectors of activity most prone to accidents (construction, fishing, mining) (Moradinazar *et al.*, 2013; Dia *et al.*, 2018a).

The average age of the accident victims, 35.3 years, was also close to the findings of Diédhiou in Richard Toll (Dia *et al.*, 2018a), and higher than the average age in studies conducted in Côte d'Ivoire and The Congo (Lee *et al.*, 2012; Pfortmueller *et al.*, 2013), which were 27 years in both countries. However, the relatively young age of victims seems to be specific to Africa, where the workforce is young.

In Switzerland, the average age was 47.3 (Pfortmueller *et al.*, 2013), while in South Korea, farming accidents are more common among the population over 60 (Lee *et al.*, 2012; Parvez and Shahriar, 2018).

Commuting accidents accounted for a total of 13.6% of accidents at SCL. This rate is higher than the ones found in Richard Toll, Côte d'Ivoire, and Congo (Kouassi *et al.*, 2013; Cléophas *et al.*, 2018). SCL employs many workers who are transported from several villages to its various farms, which increases the risk of commuting accidents. However, this rate remains lower than the one found by Dia in Dakar in his study, which was not specific to the farming sector (Dia *et al.*, 2018a).

The seniority in position of the victims of accidents in our study was 3.4 years. This statistically correlated the occurrence of accidents. The longer the worker had been employed, the less likely he was to have an accident. Lack of experience has been identified in several studies as a risk factor for occupational accidents, in the farming sector as well as in other sectors (Dia *et al.*, 2018b).

The most frequent injury was related to wounds (47% of all injuries), as in several studies (Kouassi *et al.*, 2013; Das, 2014; Cléophas *et al.*, 2018; Dia *et al.*, 2018a) involving the farming sector, whereas in the building and civil engineering sector, the main injuries were fractures and amputations (Moradinazar *et al.*, 2013).

This was mostly caused by hand tools, as described in several African series (Kouassi *et al.*, 2013; Tchicaya *et al.*, 2015; Diédhiou *et al.*, 2022). The hand-injury was the main on-site injury, accounting for 31.1% of injuries. The primary activities at the SCL are harvesting, packaging beans and maize and handling; activities that are almost exclusively carried out manually.

This also explained the same predominance of upper limb injuries described in Senegal, Côte d'Ivoire, and Switzerland (Kouassi *et al.*, 2013; Pfortmueller *et al.*, 2013; Tchicaya *et al.*, 2015; Dia *et al.*, 2018a; Diédhiou *et al.*, 2022).

There were no fatal accidents. Farming in our developing country is still very much a manual activity. Hand tools are used more than machines (Peyron *et al.*, 2018; World Health Organization. Regional Office for the Eastern Mediterranean, 2004).

However, machinery, especially tractors, is the leading cause of work-related fatalities in the farming sector (Arana *et al.*, 2010; Lee *et al.*, 2012; Burlet-Vienney *et al.*, 2016). There is a big variation between developing countries, where the frequency of occupational accidents is high for minor injuries (Kouassi *et al.*, 2013; Diédhiou *et al.*, 2022) and developed countries, where there are fewer accidents with more serious injuries (Arana *et al.*, 2010; Lee *et al.*, 2012; Pfortmueller *et al.*, 2013; Burlet-Vienney *et al.*, 2016; Peyron *et al.*, 2018).

The lost time was higher when it involved a female victim. In fact, women benefit from longer working days-off due to their physical features: lower physical capacity, less muscular strength, pregnancy and maternity, and women's social role explain longer work leave (Mazoyer, 2013; Youssef *et al.*, 2018). Similarly, accidents tended to be more serious in women than in men, probably for the same reasons.

In this study, the lost time was more important when it involved a fracture, because of the longer bones healing process (Meyrueis and Cazenave, 2004; Rousseau, 2011). Commuting accidents were more severe than the workplace accidents. These are violent and frequent accidents involving transport vehicles, which are the third most frequent cause of injury. These accidents are particularly severe, with several victims. They are therefore considered to be the SCL's highest risk. The severity of commuting accidents has been found in several studies (Carre and Paran, 1992; Lompo *et al.*, 2019).

CONCLUSION

Work-related accidents are frequent at SCL reaching a frequency rate of 24%. However, they are not particularly serious (no fatal accident, no total permanent incapacity), and affect men more than women. They are caused by hand tools, resulting in wounds mainly on the upper limb. Lack of experience is a determining factor in the occurrence of these accidents. The large number of workers and the rudimentary state of farming machinery explain these findings. The risk of road accidents remains a threat, because of the seriousness of the injuries that can occur and the number of potential victims. Preventing these accidents must necessarily involve training in the use of manual tools and management the road safety threats, notably by involving service providers in the commuting accidents prevention plans.

ACKNOWLEDGMENT

I appreciate the reviewers for their insightful comments and assistance in constructing this article.

I would like to thank Michael Laurent and his entire medical team for the quality of the data used for this work.

DISCLOSURE

- **Approval of the research protocol:** N/A
- **Informed Consent:** N/A
- **Registry and the Registration No. of the study/trial:** N/A
- **Animal Studies:** N/A
- **Conflict of Interest:** Authors declare no Conflict of Interests for this article.

REFERENCES

- Arana, I., Ederra, J. M., Atarés, P. A., Garín, S. A., López, J. R. A., and Ceballos, M. del C. J. (2010). Evaluation of risk factors in fatal accidents in agriculture. *Spanish Journal of Agricultural Research*, 3, 592-598.
- Bhattarai, D., Singh, S. B., Baral, D., Sah, R. B., Budhathoki, S. S., and Pokharel, P. K. (2016). Work-related injuries among farmers : A cross-sectional study from rural Nepal. *Journal of Occupational Medicine and Toxicology*, 11(1), 48. <https://doi.org/10.1186/s12995-016-0137-2>
- Burlet-Vienney, D., Chinniah, Y., Aucourt, B., and Belmekki, T. (2016). *Maintenance performed on mobile equipment—Review of fatal accident in Quebec*.
- Carre, J. R., and Paran, F. (1992). Commuting to work and abck : Between work ans road risks. *Transport Research Board*, 33, 43-52.
- Cléophas, K. I., Abdon, M. wa M., Baltazar, N. B., Oscar, L. N., and Benjamin, K. I. (2018). Analysis of Work Accidents and Injury Compensation in the Official Sector : Case Study the National Institute of Social Security in the Province of Haut-Katanga in the Democratic Republic of Congo. *International Journal of Innovation and Applied Studies*, 23(2), Article 2.
- Das, B. (2014). Agricultural work related injuries among the farmers of West Bengal, India. *International journal of injury control and safety promotion*, 21(3), 205-215.
- Décosse, F. (2015). Work or heathl ? The dilemma of migrant seasonal agricultural workers. In *Les risques du travail* (p. 88-91). La Découverte. <https://doi.org/10.3917/dec.theba.2015.01.0088>
- Dia, S. A., Mohamed, A. S., Gaye, F. S., Ndoeye, E. H. O., Fall, M. C. G., Soumah, M. N., and Ndiaye, M. (2018a). Characteristics of work-related injuries and the fate of the victims : About 133 cases reported to the Social Security Fund in Dakar, Senegal. *The Pan African medical journal*, 30, 156. <https://doi.org/10.11604/pamj.2018.30.156.10517>
- Dia, S., Mohamed, A., NDOYE, E., Agbobli, Y., JOUGA, Y., Diaby, A., FALL, M., SOUMAH, M., and SOW, M. (2018b). Characteristics of work-related accidents in a Senegalese company of Buildings and Public Works. *Cahiers de médecine inter professionnelle*, 2018.
- Diédhiou, B. B., Diatta, A. E. R., Mbodj, P. M., and Ndiaye, M. (2022). Work-related accidents reported to to the Caisse de Sécurité Sociale (CSS) in RICHARD-TOLL, SÉNÉGAL. *Mali Médical*, 37(4).
- Douphrate, D. I., Stallones, L., Lunner Kolstrup, C., Nonnenmann, M. W., Pinzke, S., Hagevoort, G. R., Lundqvist, P., Jakob, M., Xiang, H., Xue, L., Jarvie, P., McCurdy, S. A., Reed, S., and Lower, T. (2013). Work-Related Injuries and Fatalities on Dairy Farm Operations—A Global Perspective. *Journal of Agromedicine*, 18(3), 256-264. <https://doi.org/10.1080/1059924X.2013.796904>
- International Labour Organization. (2009, juin 15). *Agriculture : A hazardous work* [Document].
- Kouassi, Y. M., Aka, I. N. A., Tchicaya, A. F., N'guessan, L. M. A., Guiégui, C. P., Yao, S., Wognin, S. B., and Bonny, J. S. (2013). *Analysis of occupational accidents among seasonal workers of sugar company in Côte d'Ivoire*. 12(1), 9-15.
- Kuye, R., Donham, K., Marquez, S., Sanderson, W., Fuortes, L., Rautiainen, R., Jones, M. L., and Culp, K. R. (2006). Agricultural health in the Gambia II : A systematic survey of safety and injuries in production agriculture. *Annals of agricultural and environmental medicine*, 13(1), 119-128.
- Lee, S.-J., Kim, I., Ryou, H., Lee, K.-S., and Kwon, Y.-J. (2012). Work-related injuries and fatalities among farmers in South Korea. *American journal of industrial medicine*, 55(1), 76-83.

- Leigh, J. P., Du, J., and McCurdy, S. A. (2014). An estimate of the US government's undercount of nonfatal occupational injuries and illnesses in agriculture. *Annals of epidemiology*, 24(4), 254-259.
- Lompo, M. S. S., Manga, J. L. O., Ayelo, P., Traore, S., Ouedraogo, A. F., Traore, I., and Kabore, S. G. (2019). Epidemiological and clinical aspects of work-related accidents with partial permanent disability : 221 case reports. *Science et Technique, Sciences de La Santé*, 42(1), Article 1.
- Mazoyer, T. (2013). Absenteeism due to illness in 2012. *Aperçus Inspection générale de la sécurité sociale*.
- Merisalu, E., Leppälä, J., Jakob, M., and Rautiainen, R. H. (2019). *Variation in Eurostat and national statistics of accidents in agriculture*. 17(5), 1969-1983. <https://doi.org/10.15159/ar.19.190>
- Meyrueis, J.-P., and Cazenave, A. (2004). Consolidation des fractures. *EMC - Rhumatologie-Orthopédie*, 1(2), 138-162. <https://doi.org/10.1016/j.emcrho.2003.11.003>
- Moradinazar, M., Kurd, N., Farhadi, R., Amee, V., and Najafi, F. (2013). Epidemiology of work-related injuries among construction workers of ilam (Western iran) during 2006—2009. *Iranian Red Crescent Medical Journal*, 15(10), e8011. <https://doi.org/10.5812/ircmj.8011>
- Parvez, M. S., and Shahriar, M. M. (2018). Agricultural farm-related injuries in Bangladesh and convenient design of working hand tools. *Journal of healthcare engineering*, 2018.
- Peyron, P. A., Meusy, A., and Baccino, E. (2018). A case of accidental decapitation in a farm worker. *La Revue de Médecine Légale*, 9(1), 30-34. <https://doi.org/10.1016/j.medleg.2017.08.004>
- Pfortmueller, C. A., Kradolfer, D., Kunz, M., Lehmann, B., Lindner, G., and Exadaktylos, A. K. (2013). Injuries in agriculture-injury severity and mortality. *Swiss Medical Weekly*, 143, w13846.
- Rousseau, B. (2011). *Length of time off work after osteosynthesis of distal radius fracture by anterior plate : Influence of work-related injury* [PhD Thesis].
- Sagna, A. S., Seydi, A. G., Gueye, M. M., Fall, M. T. A., and Mansuy, J. M. (2022). Contribution of COVID Antigenic RDT to the Management Strategy of COVID-19 Pandemic in a Senegalese Company. *Journal of Occupational and Environmental Medicine*, 64(4), e257-e260. <https://doi.org/10.1097/JOM.0000000000002496>
- Tchicaya, A. F., Aka, I. N. A., Kouassi, Y. M., N'guessan, L. M. A., Guiégui, C. P., Wognin, S. B., and Bonny, J. S. (2015). Impact of variations in workers numbers on the annual incidence of occupational injuries of a plantain farm from 2010 to 2012 in Côte d'Ivoire. *Archives des Maladies Professionnelles et de l'Environnement*, 76(6), 585-591.
- World Health Organization. Regional Office for the Eastern Mediterranean. (2004). *Health of workers in agriculture* (25; WHO Regional Publications).
- Youssef, I., Houria, A., Chaouech, N., Bani, M., Ben Charrada, N., Chebbi, C., and Ladhari, N. (2018). Absenteeism and working conditions for women : Cause of absenteeism among female teleconsultantss. *Archives des Maladies Professionnelles et de l'Environnement*, 79(3), 473. <https://doi.org/10.1016/j.admp.2018.03.603>