BIOLIFE   **RESEARCH ARTICLE**

Qualitative and quantitative overview of victims of work accidents in the province of Kenitra, Morocco

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ABSTRACT

In this work we have contributed to the static assessment of the incidence of Kenitra accidents (Morocco), their causes and their consequences, basing on the reported Victims's data of the Employment Delegation of the City of Kenitra (Morocco) during the period 2011-2015. The results show that the frequency of accidents varies according to the years and the years 2011 and 2015 have the highest number of accidents at work. In contrast, the minimum number of accidents was recorded during the 2001-2005 period. Similarly, this frequency varies according to the months. There is no relationship between the importance of the risk and the sex of the worker. However, the number of victims and the consequences of accidents at work vary from one sector to another. The sectors of activity "Industry" and "Building and Public Works" are high-risk sectors. The climatic conditions of the worker and the many stressors prevailing in these sectors can be the causes.

Key words – Workplace accidents, Accident frequency, Accidents consequences, Morocco- Kenitra

INTRODUCTION

According to the International Labor Organization (ILO), more than 2.34 million people die each year from work-related illnesses, 321,000 (14%) people are injured at work (ILO, 2013). These accidents occur during work and cause physical or mental harm (European Commission, 2011). Developed countries have already taken many precautions and developing countries have become aware of this situation. These types of accidents have attracted the attention of researchers

since early 1980s (Desmarez et al., 2007). So, works that are interested in studying the causes and consequences of work accidents have become

numerous and diverse. We cite those of Martin & Baril (1993); Hertzman McGrail and Hirtle (1999); Dembe (1999); Keller (2001); Boden, Biddle, and Spieler (2001); Weil (2001).

Moreover, for workers, the risk of having an accident at work is not the same according to the country, company or profession. Morocco, for example, it has been classified by the International Labor Office (ILO, 2011) as a country where the risk to workers is high (Hamalainen et al., 2006, El Kholti, 2008). Thus, to reduce this risk, the new laws have been released so that the directors must take care and reorganize the premises and working conditions. (2008), a periodic "barometer" of risk management in Morocco is strongly recommended to the evolution of developments in the matter.

The consequences of accidents at work are social, legal, psychological and economic (Brody et al., 1990). The consequences are serious and diverse, and the solution that we believe is capable of reducing the accidents' number is the prevention of these accidents. Indeed, based on a better knowledge of the worker's environment, this intervention reduces the number of workplace accidents that have to occur (Aubertin et al., 2007, Cambon and Guarnieri, 2008). The prevention of accidents at work is therefore of multiple interests social, human, financial, legal and economic. It should be noted, in order to develop a preventive policy on the risk of accidents at work, it is first and foremost necessary to determine the potential factors that determine this risk.

And, in the first stages of this development, the available data on occupational accidents should be exploited and the degree of danger in the different work areas has to be quantified. So, this is the purpose of this study in the town of Kenitra, a city in full economic and industrial development situated in the northwest of Morocco.

MATERIALS AND METHODS

For the assessment of the frequency and consequences of workplace accidents in the study area, we have statistically analyzed the victim data reported during the 2011-2015 period in the Delegation's Employment of the City of Kenitra.

Note that for a victim of an accident at work, the service concerned notes a set of variables such as the date of the accident, the person or organization that reported, the sex of the victim, the sector of activity of the worker, the degree and type of disability caused By accident, etc. All these data are grouped in an "Excel" table with variables in columns and the list of victims (observation) online. Thus, it is this data matrix, elaborated by the characteristics of the victims of accidents in the area of the city of Kenitra that we statistically analyzed in this study.

RESULTS AND DISCUSSION

Overall, Figure-1 shows that with 452 accidents, or 32.4% of the total number of reported victims, the year 2014 showed a maximum of accidents recorded during the study period, followed by the year 2011 With 394 accidents (28.3% of cases) and the year 2015 with 233 accidents (16.7% of cases). In contrast, the minimum number of accidents was recorded during the period 2001-2005 (5%).

For the monthly change in the number of accidents, Figure-1 shows that March is numerically the catastrophic month (11% of reported cases), followed by January, February, April, May, June (9% of the cases reported for each one), then the months of August, September, October, November and December with 7, 5% per month. Finally, the month of July shows the minimum number of accidents reported (5.7%).

For the sex of the victims, the majority of the victims are men (Fig-2). Among a total of 1393 accidents, 1244 accidents concern men or 89% of the cases. Thus, between the years 2001-2015, women are affected only by 11% of the affected cases.

In addition, 68% of accidents reported by the employer are reported by the employer, 31% by the victim himself and 1% by the beneficiaries.

For the variation in the number of accidents at work according to the place of work (Fig-2), the incidence of accidents is higher in the industrial enterprises (56%) followed by that of the service type companies (23.5%). The rest of the accident workforce is distributed among many other sectors of activity (agriculture, commerce, public, buildings and liberal professions).

The causes of work accidents are various (Fig-3), but those caused by falls are the most frequent accidents (67%), handling accidents, burns, electricity, machinery, engines, tools, traction, and path constitute only 16%. The consequences of these accidents are also varied (Fig-3): 39% partial disability, 43% total disability, 13.9% permanent disability, 2% death and no incidents 0.9%.

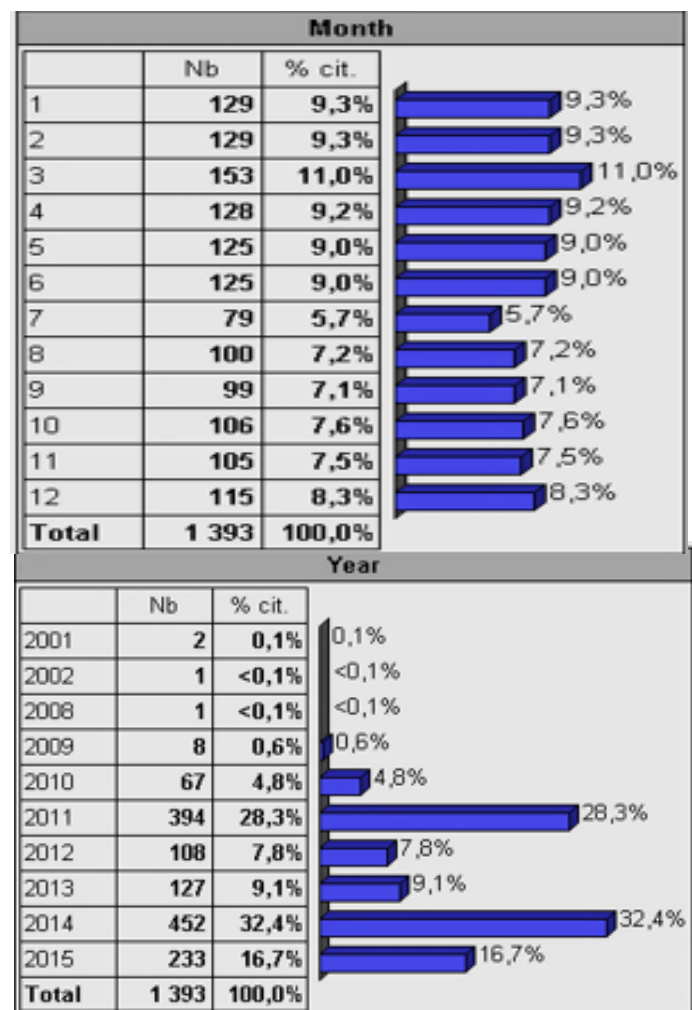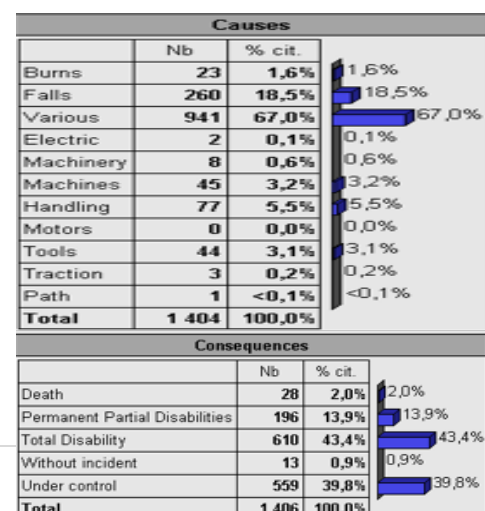**Figure-1. Years and Months of Workplace Accidents**

Month	Nb	% cit.	
1	129	9,3%	9,3%
2	129	9,3%	9,3%
3	153	11,0%	11,0%
4	128	9,2%	9,2%
5	125	9,0%	9,0%
6	125	9,0%	9,0%
7	79	5,7%	5,7%
8	100	7,2%	7,2%
9	99	7,1%	7,1%
10	106	7,6%	7,6%
11	105	7,5%	7,5%
12	115	8,3%	8,3%
Total	**1 393**	**100,0%**	

Year	Nb	% cit.	
2001	2	0,1%	0,1%
2002	1	<0,1%	<0,1%
2008	1	<0,1%	<0,1%
2009	8	0,6%	0,6%
2010	67	4,8%	4,8%
2011	394	28,3%	28,3%
2012	108	7,8%	7,8%
2013	127	9,1%	9,1%
2014	452	32,4%	32,4%
2015	233	16,7%	16,7%
Total	**1 393**	**100,0%**	

Figure-3. Causes and consequences of work acidents

Causes	Nb	% cit.	
Burns	23	1,6%	1,6%
Falls	260	18,5%	18,5%
Various	941	67,0%	67,0%
Electric	2	0,1%	0,1%
Machinery	8	0,6%	0,6%
Machines	45	3,2%	3,2%
Handling	77	5,5%	5,5%
Motors	0	0,0%	0,0%
Tools	44	3,1%	3,1%
Traction	3	0,2%	0,2%
Path	1	<0,1%	<0,1%
Total	**1 404**	**100,0%**	

Consequences	Nb	% cit.	
Death	28	2,0%	2,0%
Permanent Partial Disabilities	196	13,9%	13,9%
Total Disability	610	43,4%	43,4%
Without incident	13	0,9%	0,9%
Under control	559	39,8%	39,8%
Total	**1 406**	**100,0%**	

January, February and March have a high number of victims. Thus, we noted a significant link between the month and the year of the accident ($\chi 2$ = 386.93, DF = 99, P-value = 0.001). It should also be noted that the

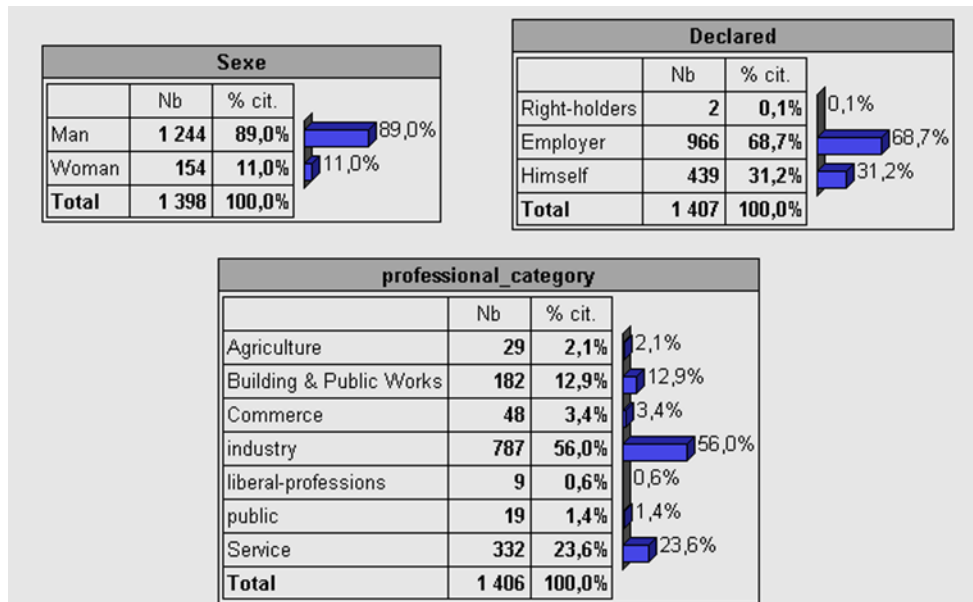## Figure-1. Sexes, accidents declared and profile professionals of workplace accident

Table-1. Distribution of Workplace Accidents by Year x Month

Month/Year	2001	2002	2008	2009	2010	2011	2012	2013	2014	2015	Total
January	0	0	0	0	3	33	23	1	39	30	129
February	0	0	0	1	3	28	26	2	36	33	129
March	0	0	0	1	6	41	24	5	46	30	153
April	0	0	0	1	8	38	9	3	43	26	128
May	1	0	0	0	4	45	11	2	45	17	125
June	0	0	0	0	1	41	6	4	43	30	125
July	0	0	1	3	2	29	1	5	22	16	79
August	0	0	0	1	8	26	0	11	34	20	100
September	1	0	0	0	8	26	2	17	38	7	99
October	0	0	0	1	7	29	1	15	40	13	106
November	0	0	0	0	6	30	1	20	37	11	105
December	0	1	0	0	11	28	4	42	29	0	115
Total	2	1	1	8	67	394	108	127	452	233	1393

A- Dependency between variables:

As the table 1 shows, it is the years 2011 and 2015 that have presented more victims of accidents at work. Similarly, numbers of accidents at work are very low in the period 2001-2010 compared to those of the period 2011-2014. Moreover, within the year, the numerical distribution of accidents according to the months is not always homogeneous. For the year 2015, for example,

high numbers of work accidents reported during certain months of the year could be due to the high numbers of seasonal workers working during these months. Indeed, according to Rahmani et al (2013), it is known that often these seasonal workers lack experience in the work assigned to them, which places them at greater risk.

Table-1 shows that there is no statistical difference between the annual numbers according

Table-2: Distribution of accidents at work per year x months

Year/ Sex	Man	Woman	Total	Year/ Sex	Man	Woman	Total
2001	2	0	2	2011	349	39	388
2002	1	0	1	2012	91	17	108
2008	1	0	1	2013	118	9	127
2009	8	0	8	2014	395	57	452
2010	56	9	65	2015	209	23	232
Total	68	9	77	Total	1155	145	1307

Table-3. Distribution of occupational accidents in Morocco by Year x occupational categories

Year/Professional category	Agriculture	Building & Public Works	Commerce	industry	liberal-professions	public	Service	Total
2001	0	0	0	0	0	0	2	2
2002	0	0	0	1	0	0	0	1
2008	0	0	0	0	0	0	1	1
2009	1	0	0	4	0	0	3	8
2010	1	2	5	51	0	1	7	67
2011	9	15	19	266	5	6	73	393
2012	4	9	4	59	0	1	31	108
2013	1	23	7	64	0	6	26	127
2014	8	93	6	228	2	3	112	452
2015	4	39	7	105	2	2	74	233
Total	28	181	48	778	9	19	329	1392

to the sex of the victims. Indeed, the statistical test chi-squared shows that the dependence between these two variables is not significant ($\chi2$ = 8.21, Fd = 9, P-value = 0.05127).

Table 4: Distribution of occupational accidents in Morocco by Year x person who reported

Year/Declared	Right-holders	Employer	Himself	Total
2001	0	0	2	2
2002	0	1	0	1
2008	0	1	0	1
2009	0	1	7	8
2010	0	22	45	67
2011	0	300	94	394
2012	0	89	19	108
2013	0	67	60	127
2014	1	263	188	452
2015	1	211	21	233
Total	2	955	436	1393

For the years 2011 and 2014, for example, the important numerical differences between men and

women victims of work accidents are not related to the sex of the individual; they are linked to differences in the number of men and women who have been active.

Moreover, let us recall that the table-2 Shows that the annual numbers of victims are very high in 2011 and 2014 (452 and 388 respectively). The same table shows that for the two years, according to the occupational category, the "Industry" sector exhibited more accidents, followed by the "Service" sector and the sector of "Building and Public Works". Note that the $\chi2$ test showed us that the two variables "Year and Profession" have a very significant relationship ($\chi2$ = 148,33, FD = 54, P-value = 0,01).

Similarly, the chi-squared test showed a very significant dependence between the two variables "Year" and "person who reported the accident" ($\chi2$ = 170,12, DF = 18, P-value = 0.001). For the years 2011 and 2014, for example, it is the employer who dominates as the person reporting the accident followed by the victim himself.

The direct causes and consequences of these accidents are grouped in the table-5. The chi-squared test showed a very significant dependence between these two variables ($\chi2 = 148.63$, FD= 36, P-value = 0.01). Two-thirds of the deceased (19 out of 28 victims) died as a result of an accident belonging the so-called "varied" category. Footfall falls are also one of the main causes of accidents at work (260 cases for a total of 1404 cases). As a result of 6 deaths, 46 victims have a permanent partial disability, 149 people with permanent disability.

In addition, the chi-squared test showed a very significant dependence ($\chi2 = 92.67$, ddl = 54, P-value = 0.01) between the profession and the cause of the accident (Table-6). For example, for the first important category of so-called "varied", which

groups 940 victims, there are 18 victims in the "Agriculture" sector, 114 in construction sector, 30 in the "Commerce" sector, 555 in Industry, 5 in the "Professional" sector, 13 in the "Public" sector and 205 in the "Services" sector. For the second major category of causes" Plain feet's falls ", which groups 260 victims, 8 accidents occurred in the "Agriculture" sector, 49 in construction, 11 in the "Commerce" sector, 104 in Industry sector, 3 in the Professional sector, 6 in the Public sector and 79 in the Service sector. As the results above show, the three sectors "Industry", "Service" and "BTP" are therefore the most dangerous.

On the other hand, it is interesting to note that these results which we have just mentioned concern only the victims of work accidents registered in the database of the employment delegation of the town

Table-5: Distribution of occupational accidents in Morocco by Causes x consequences

Causes/ Consequences	Death	Permanent Partial Disabilities	Total Disability	Without incident	Under control	Total
Burns	0	1	17	0	5	23
Falls	6	46	159	2	47	260
Various	19	112	339	11	459	940
Electric	1	1	0	0	0	2
Machinery	0	2	4	0	2	8
Machines	1	7	27	0	10	45
Handling	1	19	36	0	21	77
Tools	0	8	24	0	12	44
Traction	0	0	1	0	2	3
Path	0	0	1	0	0	1
Total	28	196	608	13	558	1403

Table-6: Distribution of occupational accidents in Morocco by Causes x professional_category

Causes/ professional_ category	Agriculture	Building & Public Works	Commerce	industry	liberal-professions	Public	Service	Total
Burns	0	3	0	17	0	0	3	23
Falls	8	49	11	104	3	6	79	260
Various	18	114	30	555	5	13	205	940
Electric	0	0	0	2	0	0	0	2
Machinery	0	4	0	3	0	0	1	8
Machines	1	5	0	38	0	0	1	45
Handling	1	2	4	37	1	0	32	77
Tools	1	5	3	26	0	0	9	44
Traction	0	0	0	2	0	0	1	3
Path	0	0	0	0	0	0	1	1
Total	29	182	48	784	9	19	332	1403

of Kenitra for the period 2001-2015, While according to Moroccan media and national newspapers, the number of work accidents exceeds what is recorded and what officially is declared. Indeed, according to Ismaili (2013), 2,000 workers in the "BTP" sector die each year on Moroccan shipyards, equivalent to half the deaths recorded in road accidents. It should also be pointed out that at the global level, this sector accounts for 25 to 30% of accidents at work. According to Ismail (2013), the main cause of these accidents is work at heights, gear use, and handling.

The Moroccan Ministry of Public Health estimates that statistically 48 people out of 100,000 workers suffer fatal occupational injuries whereas in the Mena zone there are only 19 fatal accidents at work Per 100,000 workers. The risk of a fatal work accident in Morocco is thus 2.5 times higher than that of the 'Mena' zone, and according to Mekaoui (2013) and Zerror (2013), 16 times higher than that of Finland.

Furthermore, according to Thiam (2011), the number of annual workplace accidents in Morocco's workplaces is 200,000 accidents, of which 2,000 are fatal. The construction industry is at the top of the most accidents sectors, with more than 60,000 victims, 20% of whom are in the Casablanca region alone. Note that poor climatic conditions favor workers' accidents at work, especially as a worker in this sector often works outside. In other words, in an environment where the worker is more exposed to the climatic elements, in particular, higher ambient heat, intense light or, when the worker is installed on a wet substrate facilitating sliding (Raougui *et al.,* 2012), Risk becomes high. Indeed, all these conditions can create, in addition, a state of stress and a state of fatigue in the worker (Tissot, 2011, Raougui et al., 2012). Similarly, in the "Industry" sector, which is characterized by high rates of industrial accidents, often the working conditions group together a high (natural or artificial) ambient temperature and a metal part or a moving mass. The combination of these environmental factors can be categorized into those causing stress (Matthews and Gump, 2016). Note that the likelihood that a worker in a state of stress suffers an accident at work is important (Ussif, 2004). According to the American Institute of Stress, this psychological state accounts for 60 to 80% of accidents at work (Ussif, 2004) because,

according to Boone (2006), the vigilance of a stressed worker decreases Such that attention to the risk to which the worker is exposed becomes reduced. Thus, stress is among the conditions that are at high risk of work accidents (Sarmiento-Salinas et al., 2004; Raougui et al., 2012).

CONCLUSION

The annual number of the victims of work accidents is very high especially in 2011 and 2014. The frequency of accidents varies from one sector of activity to another and according to the occupation of the worker. Workers of the "Industry", "Service" and "Building and Public Works" sectors are the most exposed to these accidents. The frequency distribution of accidents varies from month to month. Generally, the month of March is the most murderous, followed by the months of January, February, April and May and men and women suffer accidents at work with the same frequency.

The causes of accidents are various: crash accidents, handling accidents, burns, electricity, machinery, engines, tools, traction and path. But, the first cited cause is the most frequent. The consequences of these accidents vary from the death of the victim to varying degrees of disability; the degree of total disability is very common.

On the other hand, the poor climatic conditions surrounding the worker, and other factors leading to stress, could constitute favorable conditions for an accident at work.

It should be noted that these occupational accidents and their consequences can be avoided by developing accident prevention systems that promote these accidents, in particular by developing knowledge of hazards, risks of occupational exposures and by increasing the effectiveness of control working conditions, and by encouraging companies to be involved in occupational health.

Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of this paper.

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