

## The Trend of Occupational Accidents and Their Under-Reporting Estimations in the Factories of Pakistan; 1993-2009

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**Abstract:** This study aimed to investigate the occupational accidents trends and their under-reporting estimations in Pakistan during 1993-2009. Accident rates and Index value analysis method base on year 1993 used to compare the changing profile of occupational accidents. Occupational accidents underreporting (Ur) in non-reporting factories (NRFs) calculated by considering their proportional accident rate equal to the number of reported occupational accidents by RFs. Total 10330 occupational accidents investigated in RFs. Total 819 fatal accidents found with average fatality rate of 25 fatal accidents per 10<sup>5</sup> workers in RFs. Total 9511 non-fatal accidents found with an accident rate of 271 non-fatal accidents per 10<sup>5</sup> which was high (567 non-fatal accidents per 10<sup>5</sup>) from 1993 to 1996. Occupational accidents Ur (77%) estimated three times higher than reported occupational accidents (23%) in RFs with their continuous increasing trend. This study concludes the weak organizational safety culture in Pakistan. Enforcement at governmental level for safety reporting and labor laws reforms required to reduce the Ur of occupational accidents in the factories of Pakistan.

**Keywords:** Occupational accident analysis; Accident under-reporting; Pakistan

### Introduction

Occupational accidents are a serious threat to the society in the form of direct and indirect costs. According to ILO occupational accidents and diseases entail 4% of gross domestic product (GDP) loss or about US\$ 2.8 trillion about in the form of direct or indirect costs. Estimates show that about 3.2 million People die annually due to occupational accidents and 151 workers have an occupational accident after every 15 seconds (ILO, 2013).

For over 100 years occupational accidents and occupational injuries gained importance due to attention, made by industrialized countries by

making legislation for their prevention. Organizations and different countries have interest to decrease the burden of occupational accidents due to their direct and indirect cost over their progress (Hamalainen et. al., 2009). The analysis of occupational accidents uses to make prevention policies after identifying common contributing factors responsible for the occurrence of occupational accidents (ILO, 2002), and negative impacts found due to occupational accidents over victims, co-workers and their families (Dembe, 2004).

Occupational accident numbers were underestimated in developing countries globally (Hamalainen et al., 2006) these countries don't have reliable occupational data due to lack of

proper safety reporting and notifying culture (Hamalainen et. al., 2009), but this unreliable data is being used as a baseline for making prevention policies in the respective countries (Takala, 1999). Most of existing occupational accidents and injury data is from developed countries and some developing countries are recording this kind of data. According to ILO More than half countries lack occupational accidents and disease data. Just few countries are collecting occupational accidents and disease data gender wise categories. Work related deaths and injuries are high in developing countries due to involvement by their labor force in hazardous jobs in different sectors such as agriculture, fishing and mining. (ILO, 2013).

According to ILO Under-reporting of occupational accidents is difficult to calculate and it's widespread and its scale is alarming. In most of the cases, a narrow range of occupational accidents is being recorded and notified. Due to lack of professional skills and health safety, infrastructure it is difficult for a large number of developing countries to record and publish their national accidents and injury data. The recording and notification of occupational accidents and injuries can be useful for policy making and to establish proper safety reporting culture at national level aiming to reduce occupational accidents and injuries (ILO, 2002).

Probst & Estrada, (2010) defined, under-reporting as the function of both (a) the number of reported accidents to organization by workers and (b) the number of experienced accidents by workers that went unreported to the organization. If the difference of percentages between reported and under-reported accidents increases, then may be under-reporting of occupational accidents will be high. Probst & Graso, (2011) mentioned two levels of under-reporting of occupational accidents such as individual level and

organizational level. At organizational level under-reporting of occupational accidents can be due to its size (Leigh *et al.*, 2004; Oleinick *et al.*, 1995), industrial sector type (Daniels and Marlow, 2005), lack of perceived organizational awareness about occupational accidents (Clarke, 1998) and safety climate at organizational level (Probst *et al.*, 2008; Zohar, 2003). At individual level under-reporting of occupational accidents can be due to attitudes of coworkers, fear of being responsible for occurrence of accident or injury, unemployment rate, loss of work related benefits such as promotions, bonuses (Webb *et al.*, 1989; Pransky *et al.*, 1999). Due to lack of basic infrastructure in Pakistan both organizational and individual factors can be responsible.

Pakistan is an agrarian and a semi industrialized country ranked World's 10th largest country by its labor force size (PES, 2013-14). Most of the labor force in Pakistan belong to rural areas and they lack proper medical facilities and compensation against occupational accidents and injuries. Employees social security institutes (ESSI) at the provincial level, providing medical facilities and compensation to the establishments which are registered with them. But still due to lack of proper safety reporting and notifying culture in the country huge number of work related accidents and injury data lost each year. Factories act-1934 is the main occupational health safety law for worker health safety issues. All factories registered under this law and obligatory for reporting. The direct and indirect cost poses by occupational accidents and injuries make a worse situation due they're under-reporting. This study aims to analyze the occupational accident trends and increased number of non-reporting factories which are responsible for occupational accidents data lost in Pakistan. The preliminary results of this study are

important to improve the existing safety reporting and notifying system in the country.

### Materials and Methods

The study population composed of all reporting factories workers between 1993 and 2009 in Pakistan and their information is available in Pakistan Statistical Year Books. Pakistan Bureau of Statistics (PBS) is responsible to keep up and publish labor force data at governmental level in the country. The last four years data from 2010 to 2013 is not available in the reports may be due to a decision made by PBS. Data extracted from reports of industrial accidents faced by workers in the reporting registered factories under the factories act-1934. Microsoft Excel version 2013 used to process the data. According to this act registered industrial establishments has to report all industrial accidents in corresponding labor and human resources department on specified forms. This act consolidates and amends the laws on the regulation of labor in factories in Pakistan. This act deals with health and safety of workers, hygiene conditions at the workplaces, factory inspections, and hygienic conditions precaution in case of fire, machine guarding and pressure vessels.

In this study index value analysis based on year 1993 performed for industrial accident data in reporting factories accidents. This method used by Unsar and Sut (2009) in Turkey and Rhee *et al.* In Korea (2013) for occupational accidents and occupational injury trend analysis. The fatality rate ( $10^5$ ) is calculated by assuming all reporting factories (RFs) workers as the denominator in studying years and fatal accidents in the same studied year as nominator. Industrial accidents were categories by PBS as fatal, serious and minor and total of all these accidents termed as total

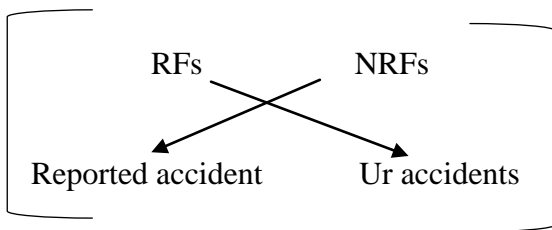
accidents. Nonfatal accidents considered as the total of minor and serious accidents in this study. Nonfatal accident rate ( $10^5$ ) is calculated by assuming all RFs workers as the denominator in studying years and all non-fatal accidents in the same studied year as nominator.

Registered factories means all those factories which were registered under factories act-1934 and working factories means all those factories doing their operations after their registration. RFs are all those factories which are reporting their occupational data to PBS. Non-reporting factories (NRFs) were calculated by subtraction of reporting factories from working factories (assuming total) as equation 1 shows.

$$\text{NRFs} = \text{WFs} - \text{RFs} \dots \dots \dots \text{equation (1)}$$

### Estimations of under-reporting accidents

Under-reporting (Ur) of occupational accidents involves organizational and individual factors as mentioned in the introduction of this study. We made our estimations based on the number of occupational accidents (fatal and non-fatal) reported by RFs to PBS. Mathematical equations developed by assuming that the rates of Ur occupational accidents (fatal and non-fatal) in NRFs were same as the rates of occupational accidents (fatal and non-fatal) in RFs. Our estimations are clearly based on the hypothesis that in each studied years the rates of occupational accidents (fatal and non-fatal) were equal both in RFs and NRFs or we can say that the number of Ur occupational accidents will be proportional to reported occupational accidents by RFs, for that we calculate factor value (FV) of the accidents. The development of mathematical equation are shown below in equation 2 and 3.



It can be as;

Ur accidents =

$$\text{NRFs} \times \text{Reported accidents} / \text{RFs} \dots \text{Equation (2)}$$

So;

$$\text{FV} = \text{NRFs} \times \text{Reported accidents} \dots \text{Equation (3)}$$

Factor values (FV) of fatal and non-fatal accidents calculated based on fatal and non-fatal accidents reported by RFs, such as equations 4 and 5 show the calculation of FV of fatal and non-fatal accidents, as we multiplied the number of NRFs to reported fatal and non-fatal accidents in RFs in each studied year;

$$\text{FV}_{\text{fatal accidents}} =$$

$$\text{NRFs} \times \text{fatal accidents in RFs} \dots \text{equation (4)}$$

$$\text{FV}_{\text{non-fatal accidents}} =$$

$$\text{NRFs} \times \text{non-fatal accidents in RFs} \dots \text{equation (5)}$$

These calculated FV of fatal and non-fatal accidents divided by the number of RFs separately to calculate the number of Ur fatal accidents and Ur non-fatal accidents in NRFs, as equations 6 and 7 show;

$$\text{Ur}_{\text{fatal accidents}} =$$

### Results

The number of RFs workers, fatal accidents, serious accidents and minor accidents with their relative percentages of total accidents are shown in table 1. Total 10330 occupational accidents investigated with the average of 608 occupational accidents annually. Fatal accidents and non-fatal accidents found 48 and 559 annually. The average number of

$$\text{FV}_{\text{fatal accidents}} / \text{RFs} \dots \text{equation (6)}$$

$$\text{Ur}_{\text{non-fatal accidents}} =$$

$$\text{FV}_{\text{non-fatal accidents}} / \text{RFs} \dots \text{equation (7)}$$

Percentage of reported and Ur occupational accidents calculated by taking their yearly average to the total of their numbers at the end to show the percentage of occupational accidents data lost due to NRFs in Pakistan. Factories data for 2009 years not available by PBS so we made our calculations from 1993 to 2008 years only in order to produce smooth results.

This study defined *occupational accident* as an unexpected and unplanned occurrence, including acts of non-consensual violence arising out of or in connection with work which results in personal injury, disease or death and *fatal occupational injury* defined as an occupational injury which leads to death within one year of the day of the occupational accidents causing the injury (PBS, 2013). Pakistan factory act-1934 defined “factory” means any premises, including the precincts thereof, whereon ten or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on or is ordinarily carried on with or without the aid of power, but does not include a mine, subject to the operation of the Mines Act, 1923 (PLO, 2014).

occupational accidents was 1355 from 1993 to 1996 but it reached to the average of 378 occupational accidents from 1997 to 2009 annually. Average 192919 workers were registered under factories act-1934 in Pakistan as table 1 shows. Fatal accidents showed discontinuous trend and non-fatal accidents found high in early four years as compared to the rest of the year.

**Table 1. The number of reporting factories workers, fatal, serious and minor accidents in reporting factories workers registered under Factories act-1934 in Pakistan; 1993-2009.**

Year	RFs workers	Fatal		Serious		Minor		Yearly Total Accidents
		accidents	%	accidents	%	accidents	%	
1993	255943	87	6.3	292	21.3	993	72.4	1372
1994	256620	36	3.2	144	12.6	957	84.2	1137
1995	231745	42	2.5	123	7.3	1530	90.3	1694
1996	188791	40	3.3	172	14.1	1004	82.6	1216
1997	209925	38	8.5	55	12.2	355	79.3	447
1998	196933	33	7.4	79	17.4	341	75.2	453
1999	169083	20	5.8	51	14.4	281	79.8	352
2000	150255	29	15.6	122	66.4	33	18.0	183
2001	167381	57	15.1	80	21.3	239	63.6	377
2002	156416	46	17.4	80	30.3	138	52.3	264
2003	185188	32	9.0	103	29.1	219	61.9	354
2004	181872	34	8.4	68	16.8	302	74.8	404
2005	183807	38	9.2	101	24.3	276	66.5	415
2006	188183	50	11.4	106	24.2	282	64.4	438
2007	187055	85	18.5	130	28.3	245	53.3	460
2008	185207*	108	24.6	92	21.0	239	54.4	439
2009	185211*	45	13.8	62	19.0	219	67.2	326
Total	3279615	819	7.9	1858	18.0	7653	74.1	10330

Figure 1 shows the 1993 year based index value analysis of fatal accidents, serious accidents and minor accidents in reporting factories of Pakistan. When 1993 year taken as base year all three types of occupational accidents show discontinuous patterns, such as fatal accidents decreased to 23% in 1999 but

increased to 124% in 2008, serious occupational accidents were decreased to 19% in 1997 but increased to 42% and 45% in 2000 and 2007 respectively and minor occupational accidents reached to 154% in 1995 and decreased to 3% in 2000.



Fig. 1. Year base index value analysis of fatal, serious and minor accidents in RFs of Pakistan; 1993-2009.

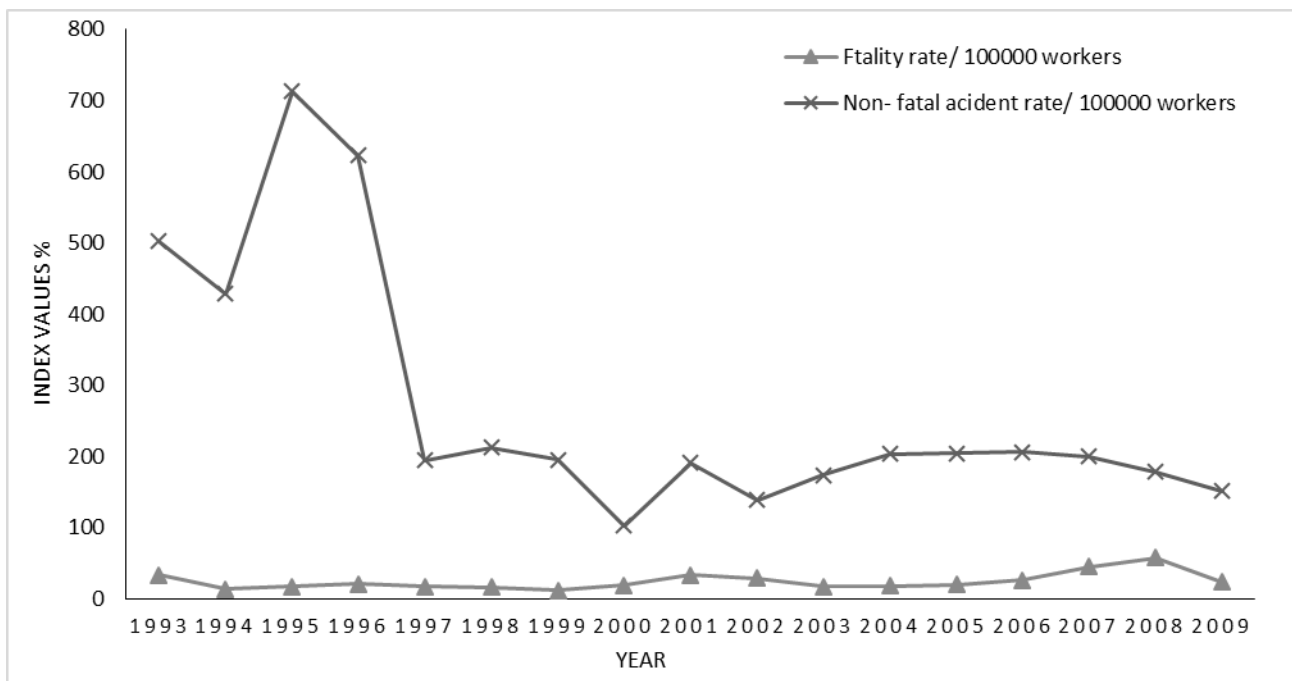


Fig. 2. Fatality rate and non-fatal accident rate among RFs workers of Pakistan; 1993-2009.

Figure 2 shows the fatality rate and non-fatal accident rate among RFs workers of Pakistan.

The average fatality rate found 25 fatal accidents /  $10^5$  RFs workers. Fatality rate

decreased in 1999 with 12 fatal accidents per  $10^5$  workers, but increased to 56 fatal accidents  $10^5$  RfS workers in 2008. Average non-fatal accident rate found 271 non-fatal accidents per  $10^5$  RfS workers in RfS. From 1993 to 1996

non-fatal accident rate was 550 non-fatal accidents per  $10^5$  RfS workers, which decreased to 180 non-fatal accidents per  $10^5$  RfS workers in RfS approximately.

**Table 2. The number of registered factories, working factories, reporting factories and non-reporting factories in Pakistan under factories Act-1934; 1993-2009.**

Year	RgFs	WFs	RfS	NRFs
1993	7727	6621	2363	4258
1994	8720	6946	2306	4640
1995	7955	6856	2139	4717
1996	8360	7025	1866	5159
1997	9267	7948	2205	5743
1998	9283	7832	2780	5052
1999	9847	8543	2195	6348
2000	10282	8875	1781	7094
2001	9749	8220	1770	6450
2002	10518	8785	1680	7105
2003	12326	10601	1828	8773
2004	12834	10620	1856	8764
2005	12725	10705	2021	8684
2006	13133	12969	2078	10891
2007	15789	13882	2248	11634
2008	16787	15902	2181	13721
Total	175302	152330	33297	119033
Average	10956	9521	2081	7440

*Values of RfS, WFs and NRFs of year 2009 are missing*

*RgFs= Registered factories*

*RfS= Reporting factories*

*WFs= Working factories*

*NRFs= Non- reporting factories*

The number of RgFs, WFs, RfS, and NRFs in Pakistan are shown in table 2, as it shows that the number of NRFs was three times higher than RfS number. When we take the year 1993 as a reference, NRFs reached 322% in 2008 as figure 3 shows the continuous increase in non-reporting factories values. RfS decreased 71% in 2002 but increased 95% in 2007 after taking 1993 as reference. The scatter plot between WFs and RfS shows the scattering of data with a narrow R<sup>2</sup> value which indicates there is no correlation between WFs and RfS as figure 4 shows, which show gaps in the recording and

reporting of RfS occupational data to PBS and it also indicate the non-uniformity of the safety reporting behavior by RfS management. In contrast to RfS we see a positive correlation between NRFs and WFs. This positive correlation with high R<sup>2</sup> value shows uniform behavior of non-reporting data to the PBS administration by NRFs management as figure 5 shows, which indicate there is an increase in the number of NRFs as the number of WFs increase, so a lot of data is being under-reporting.

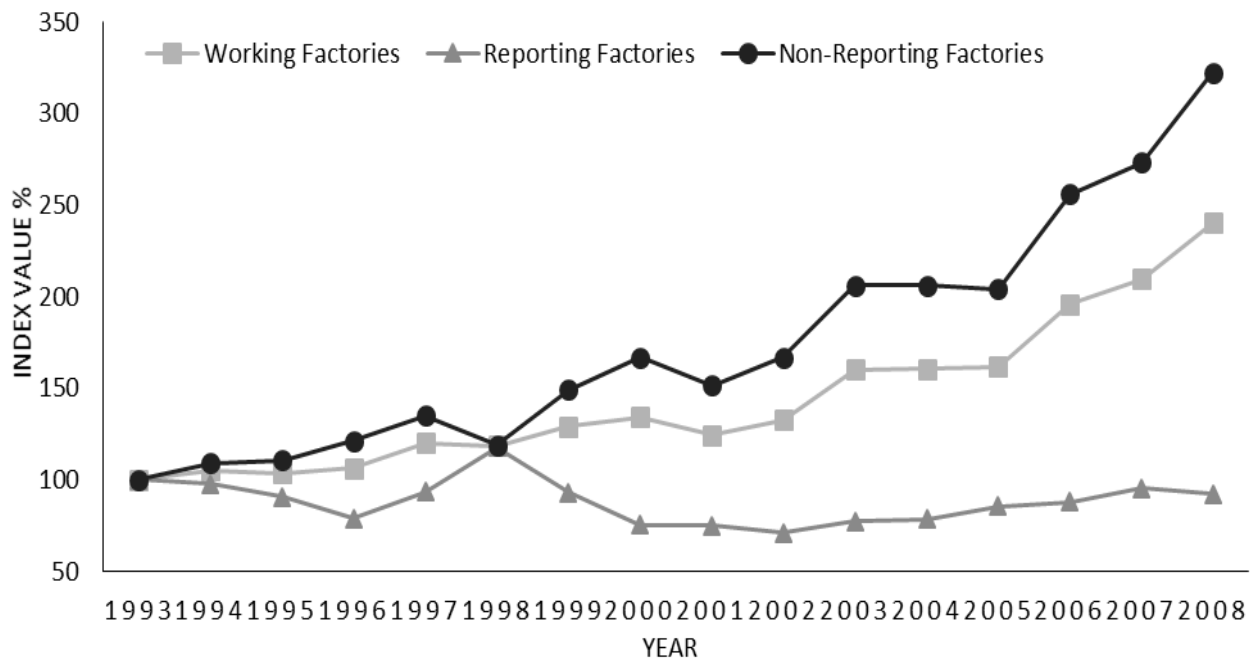


Fig. 3. Year base Index value analysis of registered, working, reporting and non-reporting factories in Pakistan; 1993-2008.

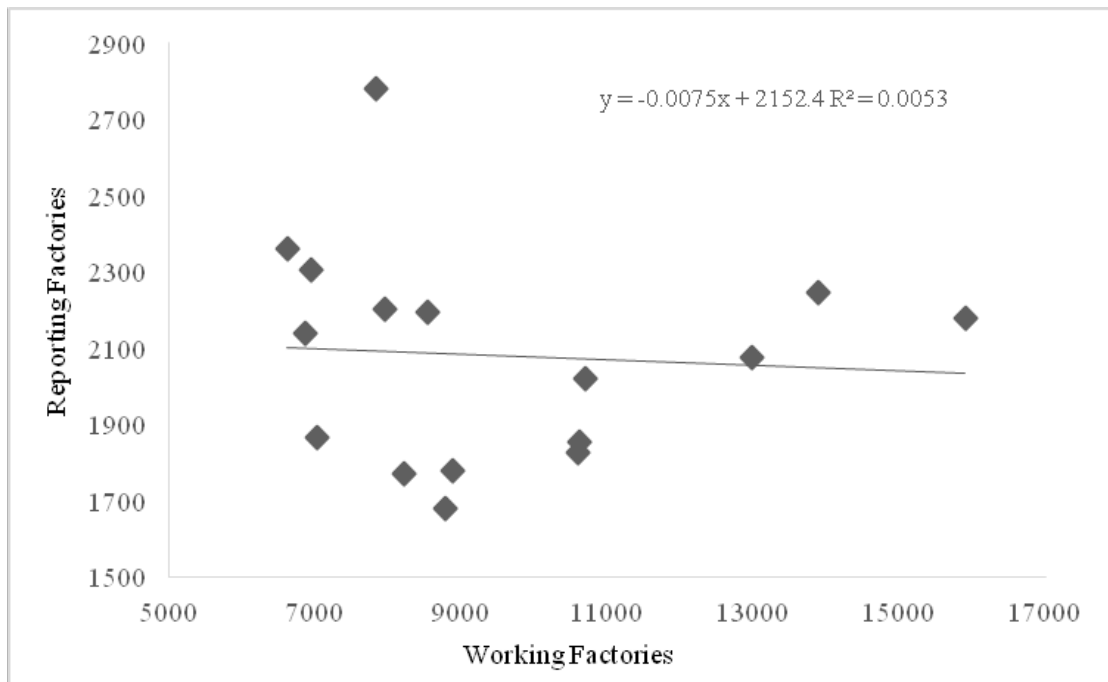


Fig. 4. Scatter plot between reporting factories and working factories.



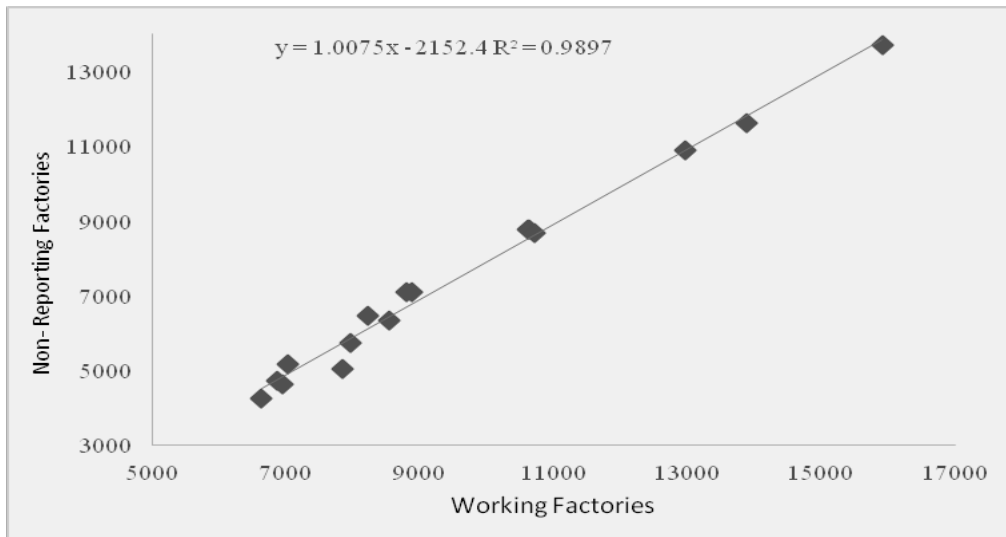


Fig. 5. Scatter plot between Non-reporting factories and working factories.

Table 3 shows the estimated number of fatal and non-fatal accidents and their relevant FV from 1993 to 2008 in Pakistan. Total 3023 fatal accidents estimated at the average of 189

fatal accidents annually. Total 27885 non-fatal accidents estimated at the average of 1743 non-fatal accidents annually.

Table 3. Yearly estimated under-reported fatal and non-fatal accidents with relevant calculated factor values; 1993-2008.

Year	FV fatal accidents	Ur fatal accidents	FV non-fatal accidents	Ur non-fatal accidents
1993	370534	157	5470823	2315
1994	166700	72	5108175	2215
1995	196765	92	7794097	3644
1996	204534	110	6067850	3252
1997	217008	98	2350919	1066
1998	169134	61	2119149	762
1999	128801	59	2103744	958
2000	202523	114	1097886	616
2001	367067	207	2062050	1165
2002	326733	194	1548535	922
2003	280736	154	2824906	1545
2004	297976	161	3242680	1747
2005	329992	163	3273868	1620
2006	544550	262	4225708	2034
2007	988890	440	4362750	1941
2008	1481868	679	4541651	2082

FV= Factor values

Ur= under reporting

Figure 6 shows the yearly percentage distribution of reported accidents by RFs and estimated Ur accidents by NRFs in Pakistan.

Ur occupational accidents estimated 77% annually and just 23% occupational accidents found reported by RFs in the country.

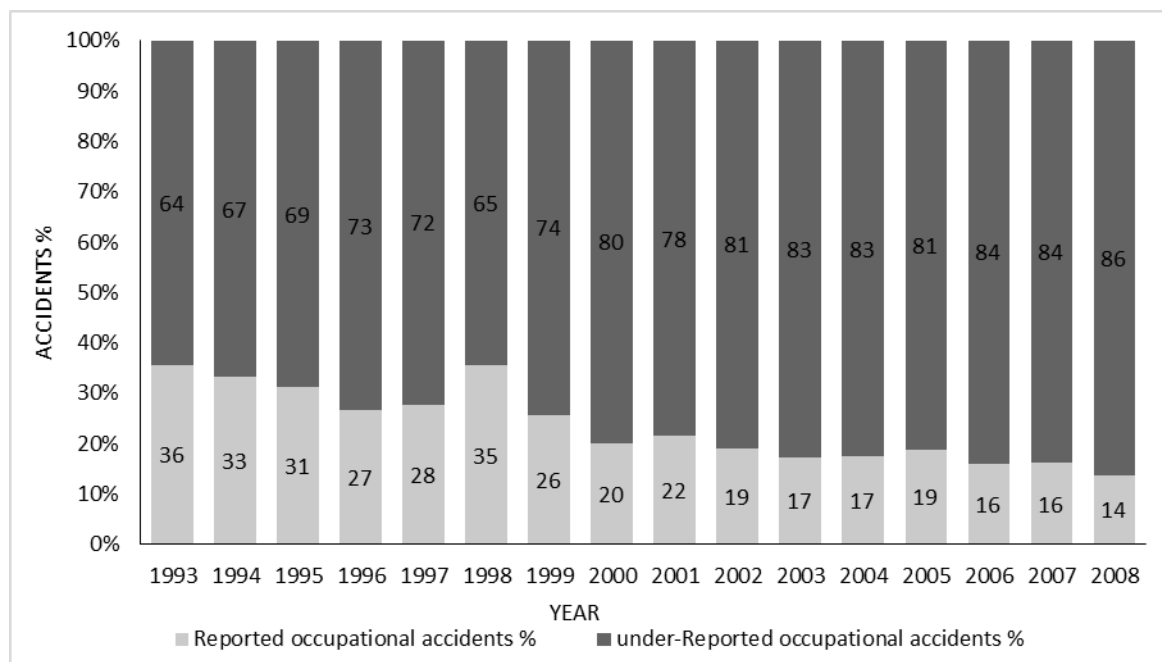


Fig. 6. Reported and estimated under-reported occupational accidents in factories of Pakistan; 1993-2008.

### Discussion

Occupational accidents are the outcomes of poor health, safety status within the country or within an organization. It may be due to less job training or higher production demands pressure over workers to adopt unsafe measures. Occupational accidents analysis and injuries are significant to understand their relative risks and development of prevention strategies. The situations in developing countries are graver than developed countries due to lack of safety resources allocation for improving safety status. This study is about the trend analysis of occupational accidents reported by RFs to PBS and to calculate the Ur occupational accidents due to non-reporting of NRFs in Pakistan. According to our best knowledge, it is the first study in this area of research in Pakistan. We also used Hämäläinen et. al., (2009) study results of Global trend of occupational accidents at country level in order to compare our results to check the occupational accidents status in Pakistan.

In this study average fatality rate found 25 fatal accidents /  $10^5$  RFs workers in RFs with a discontinuous trend of increasing and decreasing but Hämäläinen, et al., (2009) found a decrease in the overall fatality rate in Pakistan from 20.7 fatal accidents per  $10^5$  workers in 1998 to 15.3 fatal accidents in 2003. Increasing fatality rates from 2005 to 2009 show there is a lack of control over fatal accidents in RFs. The nonfatal accident rate in RFs registered under factories act-1934 found high from 1993 to 1996 as compared to the number of occupational accidents (180 non-fatal accidents per  $10^5$  RFs workers) from 1997 to 2009, which means more than 350 times non-fatal accidents decreased after 1996 in Pakistan. Decrease in the accident rate support study made by Hämäläinen et. al., (2009) in which decreased accident rates also estimated from 15809 accidents per  $10^5$  workers to 14382 accidents per  $10^5$  workers in 1998 and 2003 respectively. It may be due to increase in employment both in total employment and economically active population

or our data limitations to just for factories missing data of construction enterprises and agriculture workers' data. It can be due to under-reporting of occupational data to PBS as above discussed.

This study estimated that Ur occupational accidents of NRFs were three times higher than reported occupational accidents of RFs from 1993 to 2008 which express poor safety reporting behaviour in the country. Non-reporting of occupational accidents is obvious in developing countries due to lack of basic infrastructure of occupational health and safety. Poor safety climate in small enterprises which are common in developing countries can also a reason of non-reporting of occupational accidents and injuries. Lack of safety reporting behavior can be found in developed countries in some studies as a study in the United States found between 33% and 69% of all work related injuries, missed due to under-reporting (Leigh, *et al.*, 2004), but after an occupational accidents worker go to work in developing countries but in developed countries they stay at home on medical leave (Hämäläinen, P. *et al.*, 2009).

The high percentage of NRFs can be due to individual level under-reporting by workers in the factories. As most of safety research focused on accidents under-reporting at an organizational level, but it is also due to poor safety behavior at the individual level. Safety climate can trigger individual level under-reporting as (Probst & Estrada, 2010), investigated in their study that at the average of 2.48 unreported accidents to reported accidents to the organizations and 71% of occupational accidents went under-reported due to workers missed to report to their organization, which was mainly due to poor safety climate and inconsistent safety enforcement by supervisor.

This huge percentage difference between NRFs to FRs indicates a serious problem of deprivation of workers registered under the factory act-1934 in the country. As according to Pakistan Factories Act, 1934 any accident which causes death or injury to the worker's body due to which worker is unable to resume his work in the factory during the 48 hours after the accident occurred it is the responsibility of factory manager to report the accident to assigned authorities. This act makes assure the reporting of occupational accidents in Pakistan, but least amount of penalties for not reporting of occupational accidents to the factory manager as according to this act, a factory manager who will not report the accident as happened under 33-N to the assigned authorities will punish with fine may extend to 20,000 Pakistani Rupees equal to 195.37 USD (PLO, 2014).

Lack of enforcement at government level and a low cost of penalty to the factory manager in case of Ur of occupational accident to the assigned authorities can also be reasons for this huge percentage of NRFs and Ur occupational accidents in the country. Its may be insufficient enforcement by assigned authorities that RFs don't have any relationship with WFs due to poor safety reporting behavior outcomes. ILO started the National Plans of Action for Decent Work and Decent Work Country Programs (NPADW, 2010 - 2015) according to this program the labor law reform is the top priority area in Pakistan (ILO, 2014). Effective measures can adopt to cut occupational accidents by collaboration of workers by raising safety awareness among workers and social responsibility among employers. A safety culture shared and constituted by workers can decrease occupational accidents (Unsar & Sut, 2009).

## Conclusions

The numbers of occupational accidents were high between 1993 and 1996 in Pakistan RFs. Due to poor safety reporting behavior in the country the percentage of Ur occupational accidents of NRFs is three times higher to the percentage of reported occupational accidents by RFs to PBS. The results of this study cannot express the actual status of occupational accidents in the country and it's difficult to predict the future trends of occupational accidents. Occupational accidents reported by RFs management shows the gaps and Ur in the occupational accidents recording system in the country mainly due to lack of governmental enforcement for it. Enforcement of safety reporting at government level should make possible so that victims can gain compensation under the regulations and future safety plans can formulate. This study has limitations regarding accidents distribution by industry types, accidents causes, age and sex groups of workers due to lack of epidemiological data of occupational accidents.

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## اتجاه الحوادث المهنية وتقديراتها المبلغة في مصانع باكستان خلال الفترة من ١٩٩٣-٢٠٠٩م

محسن عباس ومنصور أحمد بالخيور

قسم العلوم البيئية، كلية العلوم، جامعة جوجارات، جوجارات، باكستان

قسم العلوم البيئية، كلية الأرصاد والبيئة وزراعة المناطق الجافة، جدة، المملكة العربية السعودية

المستخلص. هدفت هذه الدراسة إلى التحقيق في اتجاهات الحوادث المهنية وعلى تقديراتها المبلغة في مصانع باكستان خلال الفترة من ١٩٩٣-٢٠٠٩م. طريقة تحليل معدلات الحوادث وقيمة مؤشر قاعدة تعتمد على عام ١٩٩٣م، والتي استخدمت لمقارنة تغيير ملامح الحوادث المهنية. الحوادث المهنية ناقصة التبليغ (Ur)، في مصانع عدم الإبلاغ (NRFs)، تحسب من خلال مراعاة أن معدل الحوادث النسبي بها يكون مساوياً لعدد من الحوادث المهنية التي أبلغ عنها في مصانع الإبلاغ (RFs). تم دراسة عدد (١٠٣٣٠) حادثة مهنية في مصانع الإبلاغ. وجدت (٨١٩) حادثة مميتة بمعدل وفيات (٢٥) حادثة مميتة لكل (٥١٠) عامل في مصانع الإبلاغ. وجد أن إجمالي الحوادث غير المميتة كان (٩٥١١) بمعدل حوادث (٢٧١) حادثة غير مميتة لكل (٥١٠) الذي كان مرتفعاً (٥٦٧) الحوادث غير المميتة في (٥١٠) من عام ١٩٩٣ إلى ١٩٩٦م. نسبة النقص في إبلاغ الحوادث المهنية (٧٧٪) يقدر بثلاث مرات أعلى من المهنية المبلغة (٢٣٪) في مصانع الإبلاغ مع اتجاه تزايد متواصل. وتخلص هذه الدراسة إلى ضعف ثقافة السلامة التنظيمية في باكستان. ومن الضروري الإنفاذ على المستوى الحكومي فيما يتعلق بتقارير السلامة وإصلاحات قوانين العمل من أجل الحد من نقص الإبلاغ عن الحوادث المهنية في باكستان.

الكلمات الدالة: الحوادث المهنية - معدلات الحوادث - باكستان.