

# **BRICK KILN INDUSTRY AND WORKERS' CHRONIC RESPIRATORY HEALTH PROBLEMS IN MIT GHAMR DISTRICT, DAKAHLIA GOVERNORATE**

By

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## **Abstract:**

**Introduction:** Brick manufacturing industry is an old and important industry in Egypt. It involves three main steps: clay shaping with water (molding), drying with solar energy and firing with fuel (baking). **Aim of work:** To study the respiratory health problems among workers engaged in brick kiln industry. **Materials and Methods:** a comparative cross sectional study was conducted among 173 male brick kilns workers in Mit Ghamr District, Dakhlia Governorate. A control group of 170 seller men matched with the exposed brick kilns workers were included for comparison. After dust sampling in the brick kiln factories, the included persons were subjected to: 1-a modified pre-constructed questionnaire inquiring about: socio-demographic data, detailed occupational history, present history of acute and chronic respiratory symptoms and relevant past and smoking history 2-pulmonary function test 3- Environmental assessment of the working place. **Results:** measured mean dust concentration from 10 factories was 31.2 mg/m<sup>3</sup> exceeding the permitted level in the Egyptian work law 2003 (10mg/m<sup>3</sup>). This study showed that brick kilns workers had significant higher frequency of chronic respiratory problems compared to their control group and the most common chronic respiratory symptoms among them were chronic cough followed by dyspnea, chest wheeze chronic bronchitis, and asthma. Moreover, 39.91% of brick kilns workers were complaining of more than one respiratory symptom compared to 11.70% among

their control group. A significant increase of chronic respiratory problems in brick kilns workers  $\geq 10$  years work duration was detected compared to the workers 5-10 years. All ventilatory lung function measurements of brick kilns workers were significantly lower than that of their control group. Regarding the smoking habits, this study showed that there was a significant higher prevalence of chronic respiratory health problems among smoking workers (60.91%). **Conclusion and Recommendations:** A significant high prevalence of respiratory problems was found among brick kiln workers especially the bakers, smokers, and those  $>10$  years work duration. For safe work environment, we recommend for developing the brick kilns sector under supervision of Ministry of Industry and Environment, recent technology transfer, substitution by natural gas and enforcement for using personal protective equipments.

**Keywords:** Brick kiln-Respiratory problems- Smoking-Respiratory functions tests-

Duration of work.

### Introduction

Brick manufacturing involves three main steps: clay shaping with water (molding), drying with solar energy and firing with fuel (baking). Workers at brick kiln may be involved in carrying the clay dust and bricks, molding or baking (Shaikh et al., 2012). Emission from brick kilns comprises of fine dust particles, hydrocarbons, Sulphur Dioxide (SO<sub>2</sub>), Oxides of Nitrogen (NO<sub>x</sub>), Fluoride compounds, Carbon Monoxide (CO) and small amount of carcinogenic dioxins if rubber tyres were used as fuel. Clay dust contains a mixture of inorganic compounds including free silica, iron oxide, lime, magnesium carbonate, alkalis, calcium carbonate, calcium sulfate, and sodium chloride and varying amounts of organic materials (Joshi et al., 2008).

Generally speaking, Myer et al., (1989) found that work conditions in brick kilns were rather dusty with much pollution from coal fires in the kilns and from clay used for bricks making. In addition, they are exposed to high concentration of dust during manual breaking of coal. There is also the risk of exposure to dust (from bottom ash spread on the kiln). They are also exposed to high concentrations of respirable suspended particulate matters (RSPM), during monitoring and regulating the fire, as the furnace chamber is covered with ash (Monga et al., 2012). Also during the kiln unloading and shipping process (Spies and Naicker, 2006).

Inhalation of even relatively low concentrations of fine particles could affect lung function and lead to increases in cardiovascular and

respiratory diseases. Higher amount of CO, which is produced in these kilns due to poor kiln design that results in incomplete combustion of coal, could also increase incidence of heart disease. Epidemiological studies done in different places around the world have found the evidence that increase in rate of bronchitis, asthma, decreased lung function, pharyngitis, cough, eye irritation, fibrosis, emphysema, allergic rhinitis, low birth weight are linked with deteriorating ambient air quality in brick kilns (Joshi et al., 2008).

**Aim of work:** To study the respiratory health problems among workers engaged in brick kiln industry.

Our objectives were 1- to make a field study in this industry searching for risk predictors 2- alert the authorities about extent of adherence to occupational exposure limits of kiln dust and occurrence of some respiratory health problems among these workers 3- to analyze and arrange suspected occupational risk factors for its association with these health hazards.

## **Materials and Methods**

### **I- Study design and time:**

A comparative cross sectional study was conducted among brick

kilns workers in Mit Ghamr district in Dakahlia Governorate during the period from January 2013 to June 2013. The study was conducted in 10 brick kiln factories in Mit Ghamr district which were (Elrashedy, Shadad, Tolba, Elsied, El ettehad, Assad, Osama Rizk, El sorafy, Afify and Keshk).

### **Study population and settings:**

**A) Brick kilns workers (Exposed group):** consists of 173 male brick kilns workers exposed to dust and smoke within their current work.

#### **Inclusion criteria**

1. Exposure to dust and smoke within their current work.
2. Working as molders or bakers in the brick kiln industry for more than 5 years.

#### **Exclusion criteria**

1. History of exposure to dust or smoke due to other cause.
2. Previous history of respiratory diseases (bronchial asthma, chronic bronchitis, pulmonary tuberculosis and pneumonia) before joining the current job.

**b) Control Group (Non -exposed):** Consists of 170 seller men in Mit Ghamr district with no history of

special exposure to dust or smoke. They are matched with the exposed brick kilns workers regarding their socio-demographic characteristics.

### **Sampling Technique:**

#### **Sample size:**

The sample size was calculated using Epi-Info program (Epidemiological information package) software version 6.1, according to the following collected data: the total population of the brick kiln workers in Mit Ghamr district is 669 (1st and 2nd labor Offices in Mit Ghamr District, 2013), mean prevalence of chronic respiratory problems among brick kilns workers in a previous study was 31.8% (Shaikh et al., 2012 the power of precision is 80%, and the confidence interval at 95%. So, the sample was 157 workers. Taking in consideration 10% non response rate, the sample was increased to 173 brick kilns workers.

#### **Sample selection:**

10 brick kiln factories from 23 one in Mit Ghamr district were chosen randomly (Elrashedy, Shadad, Tolba, Elsied , El ettehad, Assad, Osama Rizk, El sorafy, Afify and Keshk). All workers in these factories were invited to fulfill the sample size.

### **Study Methods**

#### **A- Environmental studies and dust sampling:**

1. Making a walk through survey and observe dusty industrial steps, availability and using of PPE, availability of washing facilities and level of mechanization.
2. Measurement of respirable air borne dust in the personal breathing zone P.B.Z. by sampling during the work shift in different work places (loading, molding and firing): using Dust Track Aerosol Monitor 8520 which measures respirable particles suspended in air. The dust track aerosol monitor is portable, battery operated device that gives us real time measurements. It measures a wide range of aerosol concentration. It could be calibrated in the field for the air born contaminants that we measure in the work field under supervision of air pollution department of the National Institute of Researches

Technique: the method used for measurement was to draw a volume of air through a sample inlet nozzle with cut size of 1.0 um after pressure on a sample key to start sampling .During

this; the word sample appears in the upper right corner of the display. Time constant is set to 10 second through time constant key. Flow rate of air was adjusted. The instrument was calibrated to measure kiln dust concentration using track pro soft ware through setting a calibration factor for kiln dust.

### Steps:

1. Air samples were collected during the shift work in 3 different dusty workplaces (loading, molding and firing )
2. Air sample pump drew air at the calibrated flow rate through Gelman Teflon filters in holders. The membrane filter collects particles less than 0.1um in aerodynamic diameter (Warner, 1986)
3. The filters were conditioned in desiccators before and after sample collection for 24 hours then weighted before and after sampling.
4. Suspended particulate matter concentrations were determined by means of gravimetric method.
5. The concentration of particulate matter (10 um) was evacuated through measuring the volume of air samples using calibrated dry gas meter and expressed as mg/m<sup>3</sup>

So, the display shows readings averaged over the previous 10 seconds after that we press the statistics key to view the average readings in mg/m<sup>3</sup> but simply, statistical calculation can be manually done like this :

Dust concentration mg/m<sup>3</sup> = Mass found on the sample filter (mg)/ Volume of air sampled (m<sup>3</sup>):

### a) Mass of particles found on the sample filter:

$M_s = (M_2 - M_1) \text{ mg}$  Where  $M_s$ = mass found on sample filter, mg,  $M_1$ =weight of the clean filter before sampling, mg,  $M_2$ = weight of the sample filter containing dust, mg.

### b) The sampled volume is:

$$V_s = QT/1000$$

Where  $V_s$ = volume of air sampled, m<sup>3</sup>,  $Q$ =average flow rate of air sampled, L/min,  $T$ = sampling time, min, 1000= conversion from L to m<sup>3</sup> Monga et al., (2012)

### B) Questionnaire:

All subjects were interviewed personally using a pre-constructed questionnaire includes socio-demographic data - occupational history - present history of chronic respiratory symptoms as defined by (ATS, 2014)

relevant past medical history -smoking history.

### **C) Spirometry:**

All subjects in this study were subjected to ventilatory lung function tests by computerized spirometer.

### **D) X-rays**

As a guide in diagnosis of chronic respiratory problems for symptomatizing suspicious workers

### **III- Pilot study:**

A pilot study was conducted on 10 brick kilns workers during February 2014 to test the questionnaire appropriateness and tools validity .No modifications were done.

### **IV- Data management**

Data were computerized and statistically analyzed using Statistical

Package for Special Sciences (SPSS) version 19.00 (IBM, 2010). The significance level was considered at  $p\text{-value} < 0.05$ . Qualitative data were represented as frequencies and percents. Qui square test was used as a significance test of association.

### **Consent:**

An informed consent was taken from all participants after agreement of the factories, managers. Each worker has the right to accept or refuse participation after explaining the objectives.

**Ethical Approval:** Reviewing the proposal was carried out before starting data collection via the Ethical Review Committee of Assiut Faculty of Medicine. The aim of the study was explained to each participant before filling the questionnaire.

## Results

**Table (1): Protective measures, technique and mean dust concentration measured in personal breathing zone (P.B.Z) within selected 10 factories at Mit Ghamr district**

| Klin factories       | Type of sampling | Mean kiln dust concentration (mg/M3) | PPE | Washing facilities | Technique of work (traditional or automized) |
|----------------------|------------------|--------------------------------------|-----|--------------------|--|
| Elrashedy            | P.B.Z            | 32                                   | nil | insufficient       | traditional                                  |
| Shadad               | P.B.Z            | 28                                   | nil | insufficient       | traditional                                  |
| Tolba                | P.B.Z            | 34                                   | nil | insufficient       | traditional                                  |
| Elsied               | P.B.Z            | 27                                   | nil | insufficient       | traditional                                  |
| El ettehad           | P.B.Z            | 26                                   | nil | insufficient       | traditional                                  |
| Osama                | P.B.Z            | 37                                   | nil | insufficient       | traditional                                  |
| Rizk                 | P.B.Z            | 39                                   | nil | insufficient       | traditional                                  |
| El sorafy            | P.B.Z            | 28                                   | nil | insufficient       | traditional                                  |
| Afify                | P.B.Z            | 26                                   | nil | insufficient       | traditional                                  |
| Keshk                | P.B.Z            | 35                                   | nil | insufficient       | traditional                                  |
| Total mean dust con. |                  | 31.2                                 |     |                    |  |

PBZ: personal breathing zone

**Table (2): Frequency of chronic respiratory problems in brick kilns workers compared to the control group.**

| Chronic respiratory problems | Brick kilns workers<br>N=173 |       | Control group<br>N=170 |       | X <sup>2</sup> | P value |
|------------------------------|------------------------------|-------|------------------------|-------|----------------|---------|
|                              | N                            | %     | N                      | %     |                |         |
| Chronic cough                | 60                           | 34.70 | 17                     | 10.00 | 30.01          | 0.000** |
| Chronic phlegm               | 34                           | 19.70 | 11                     | 6.52  | 13.07          | 0.000** |
| Chronic bronchitis           | 34                           | 19.71 | 11                     | 6.52  | 13.07          | 0.000** |
| Dyspnea                      | 37                           | 21.41 | 9                      | 5.32  | 19.12          | 0.000** |
| Chest wheeze                 | 35                           | 20.21 | 15                     | 8.82  | 8.96           | 0.000** |
| Asthma                       | 27                           | 15.63 | 12                     | 7.14  | 6.22           | 0.013*  |
| More than one problem        | 69                           | 39.91 | 20                     | 11.70 | 28.01          | 0.000** |

\*: Significant

\*\*: Highly significant

This table shows that brick kilns workers have a significant higher prevalence of chronic respiratory problems compared with their control group.

**Table (3): Means and standard deviations ( $\bar{X} \pm SD$ ) of ventilatory lung function measurements among brick kilns workers and their control group.**

| Vent. lung function measurements | Brick kilns workers N=173 | Control group N=170 | t-test | P value |
|----------------------------------|---------------------------|---------------------|--------|---------|
|                                  | $\bar{X} \pm SD$          | $\bar{X} \pm SD$    |        |         |
| FVC(L)                           | 3.56 ± 0.96               | 3.91 ± 0.63         | 2.59   | 0.011** |
| FEV1(L)                          | 3.15 ± 0.87               | 3.32 ± 0.54         | 2.21   | 0.021** |
| FEV1/FVC                         | 74.31 ± 8.92              | 88.70 8.10±         | 2.33   | 0.023** |
| FEF25%-75%                       | 2.93 ± 0.92               | 3.31 ± 0.82         | 4.44   | 0.000** |
| FVC% PRED                        | 75.91 ± 6.71              | 80.30 ± 6.13        | 6.33   | 0.000** |
| FEV1% PRED                       | 74.01 ± 7.80              | 81.80 10.11±        | 7.98   | 0.000** |

\*\*: Highly significant

All ventilatory lung function measurements of brick kilns workers are significantly lower than that of their control group.



**Table (4): Relation between the smoking habits in brick kilns workers and chronic respiratory problems.**

| Smoking habits                                 | Chronic respiratory problems |      |                       |      | OR<br>(95% CI)        | P value |
|--|------------------------------|------|-----------------------|------|-----------------------|---------|
|  | N=69<br>(+ve)                |      | N=104<br>(-ve)        |      |                       |         |
|  | N                            | %    | N                     | %    |                       |         |
| <b>Smoking status (cigarettes &amp; goza):</b> |                              |      |                       |      |                       |         |
| Current smoker (no=84)                         | 42                           | 60.9 | 42                    | 40.4 | 2.30<br>(1.18-4.49)   | 0.01*   |
| Non- smoker ( no=89)                           | 27                           | 39.1 | 62                    | 59.6 |                       |         |
| <b>Duration of smoking:</b>                    |                              |      |                       |      | 5.45<br>(1.01-54.32)  | 0.02*   |
|  | <b>(+ve)<br/>N=42</b>        |      | <b>(-ve)<br/>N=42</b> |      |                       |         |
| <15 years (no=73)                              | 40                           | 95.2 | 33                    | 78.6 |                       |         |
| ≥15 years (no=11)                              | 2                            | 4.8  | 9                     | 21.4 |                       |         |
| <b>Number of smoked cigarettes per day:</b>    |                              |      |                       |      | 12.81<br>(1.63-569.3) | 0.004** |
| <10 (no=64)                                    | 41                           | 97.6 | 32                    | 76.2 |                       |         |
| ≥10 (no=20)                                    | 1                            | 2.4  | 10                    | 23.8 |                       |         |

\*: Significant

\*\*: Highly significant

This table shows that there is a significant higher prevalence of chronic respiratory problems among current smokers who smoke for <15 years, and for <10 cigarettes per day.

**Table (5): The relation between Occupational characteristics of brick kilns workers and chronic respiratory problems.**

| Occupational characteristics       | Chronic respiratory problems |       |            |       | X <sup>2</sup> | P value | OR (95% C.I )       |
|------------------------------------|------------------------------|-------|------------|-------|----------------|---------|---------------------|
|                                    | N=69(+ve)                    |       | N=104(-ve) |       |                |         |                     |
|                                    | N                            | %     | N          | %     |                |         |                     |
| <b>Duration of work (y):</b>       |                              |       |            |       |                |         |                     |
| 5-10 years                         | 10                           | 14.49 | 47         | 45.19 | 16.33          | 0.000** | 0.21<br>(0.08-0.47) |
| ≥10 years                          | 59                           | 85.50 | 57         | 54.80 |                |         |                     |
| <b>No of worked hours per day:</b> |                              |       |            |       |                |         |                     |
| <10 hours                          | 31                           | 44.92 | 44         | 42.31 | 4.71           | 0.030*  | 1.11<br>(0.57-2.15) |
| ≥10hours                           | 38                           | 55.07 | 60         | 57.69 |                |         |                     |
| <b>Type of work:</b>               |                              |       |            |       |                |         |                     |
| Brick kiln bakers                  | 42                           | 60.87 | 30         | 28.84 | 18.7           | 0.000** | 0.26<br>(0.13-0.52) |
| Brick kiln molders                 | 27                           | 39.13 | 74         | 71.16 |                |         |                     |

\*: Significant

\*\*: Highly significant

This table shows that, the prevalence of chronic respiratory problems increase significantly among brick kilns bakers who work in brick kilns for ≥ 15 years and for ≥ 10 hours per day.

**Table (6): Logistic regression analysis for significant predictors of respiratory health problems among the studied brick kilns workers.**

| Independent factors                  | B    | S.E  | Wald  | OR (95% C.I )         | P-value |
|--------------------------------------|------|------|-------|-----------------------|---------|
| <b>Chronic respiratory symptoms:</b> |      |      |       |                       |         |
| <b>Type of work:</b>                 | 1.35 | 0.34 | 15.89 | 3.84<br>(1.980-7.381) | 0.000** |
| <b>Duration of work(y):</b>          | 0.65 | 0.35 | 3.49  | 1.91<br>(0.969-3.769) | 0.062   |
| <b>Smoking status:</b>               | 0.70 | 0.34 | 4.21  | 2.02<br>(1.032-3.937) | 0.040*  |

\*: Significant

\*\*: Highly significant

This table shows that the most significant predictors of chronic respiratory problems among the studied brick kilns workers are, the type of work followed by smoking status but working in brick kilns ≥ 10 years was of non-significant role (p>0.05).

## Discussion

kiln workers form an important industrial work force in Egypt which progressively increases with development of both horizontal and vertical widening in old and new cities of Egypt. Workers at brick kilns are involved in carrying clay and bricks, molding and baking exposing them to smoke and dust which is an important cause of air pollution and respiratory illness among these workers (Shaikh et al., 2012). So, Brick kiln, ceramic and many other industries are banned in most of the developed countries which import such products from developing countries because of its environmental pollution effect that endanger its workers and the general population as a whole.

Within this working environment, this study detected a high dust concentration (Table 1) mean= 31,2 mg/m<sup>3</sup> which exceeded the permitted value for kiln dust concentration (10 mg/m<sup>3</sup> according to the Egyptian law 2003). Other studies as that of Monga et al., (2012) also recorded high dust levels especially in the firing section with respirable dust level up to (19.51 mg/m<sup>3</sup>).

The study detected also significant higher prevalence of chronic respiratory problems in kiln workers than their control group (Table 2). The most common chronic respiratory problems among them were: chronic cough (34.70%), followed by dyspnea (21.4%), chest wheeze (20.2%), chronic bronchitis (19.7%), then asthma (15.63%). Moreover, 39.91% of brick kilns workers were complaining of more than one respiratory problem compared to 11.70% among their control group. These high frequencies were quiet similar to those of Monga et al., (2012), whose results were 32%, 24%, 15%, 28%, and 11% for chronic cough, chronic phlegm, chest wheeze, dyspnea and asthma respectively, also David et al., (2006), showed that there was a significant prevalence of chronic cough (31.8%), chronic phlegm (26.2%), and chest tightness (24.0%) in brick kilns workers, compared with control workers (20.1%, 18.1% and 1% respectively).

Lower frequencies were recorded by Shaikh et al., (2012), where 22.4% had chronic cough, 21.2% had chronic phlegm and 19.4% reported wheeze. Srivastava and Mathur, (2007), showed also that prevalence of respiratory

diseases in exposed brick kilns was (12.1%). Shewale et al., (2013), showed also 11% prevalence rate of chronic respiratory symptoms among Indian brick kilns workers.

Moreover, along many years before, asthma was reported among brick kilns workers with variable prevalence that ranged generally between 6% and 14% in those studies : Myers et al., 1989; Friis et al., 1999; Mustajbegovic et al., 2003; Mwaiselage et al., 2005; Ugheoke et al., 2006; Dehghan et al., 2009; and Singh et al., 2011).

Monga et al., (2012), clarified that the increased prevalence of respiratory complaints like cough, phlegm, wheezing, breathlessness and asthma among brick kiln workers were due to exposure to respirable dust levels which exceed the respirable dust limit of 5.0 mg/m<sup>3</sup> as given by OSHA and the Indian Union Ministry of Labour in absence of proper protective equipments causing serious health problems.

All ventilatory lung function measurements of exposed brick kilns workers were significantly lower than that of their control workers (Table 3). Regarding smoking habits, (Table 4) shows that there is a significant higher prevalence of chronic respiratory

problems among current smokers ( $P < 0.01$ ), who smoke for  $< 15$  years ( $P < 0.01$ ), and for  $< 10$  cigarettes per day ( $P < 0.001$ ). These results agree with those of Xiao and David, (2000), in their study which was done among workers exposed to silica dust in a brick manufacturing factory, and found that workers who smoked had more prevalent respiratory symptoms than those who never smoked. Also Salvi and Barnes, (2009), found that 57.1% of the workers who reported suffering from chronic bronchitis were smokers. So smoking can be considered a triggering factor for chronic respiratory symptoms in brick kilns workers. Beside those Aziz et al., (2010), revealed that, smokers and ex-smoker workers showed more frequent respiratory symptoms than those who never smoked. Forey et al, 2011 considered that, smoking is a proven risk factor in developing of chronic respiratory illnesses.

From another side, Shaikh et al., (2012) had done a separate analysis on non-smokers brick kiln workers to prove the pure occupational role in occurrence of chronic bronchitis .He found that about 24.0% of chronic bronchitis in all the workers was detected in non-smoking workers which was an

evidence of the occupational effect on the respiratory illness. This condition could be explained by Aziz et al., (2010) who assumed that smoking relationship is complex but it may has a synergistic but not causative effect together with dust exposure on the respiratory health problems.

In this study, the prevalence of chronic respiratory problems increases significantly among brick kilns bakers, who work in brick kilns for  $\geq 10$  years and for  $\geq 10$  hours per day (Table 5). This agrees with Shaikh et al., (2012), who reported that the incidence of the respiratory tract symptoms were more frequent with increasing the duration of employment among brick kilns workers exposed to dust (more than 10 years).

Logistic Regression analysis in this study shows that the most significant predictors of chronic respiratory problems among the studied brick kilns workers were, the type of work (bakers  $P < 0.001$ ) followed by smoking status ( $P < 0.05$ ), where smoking brick kilns bakers are predicted to have chronic respiratory problems more than non-smoking molders. (Table 6), this is concomitant with the results of Shaikh et al., (2012) whose Logistic

Regression analysis confirmed the impact of brick baking on chronic bronchitis (OR= 3.7, 95% CI 1.1-11.6,  $p \leq 0.05$ ) and asthma (OR= 3.9, 95% CI 1.01-15.5,  $p \leq 0.05$ ), but years of work  $> 10$  years did not show any significant association with both outcomes. This is apparently illogic that duration of work showed insignificant correlation but actually, our study showed near significant correlation ( $p = 0.06$ ) and multiple factors may be involved at the scene like that, being actively involved in dusty operations for long hours is less common in older workers .On the other side Ayoub et al (2013) proved the adverse respiratory effect on prolonged dust exposure.

#### **Conclusion and Recommendations:**

A significant high prevalence of respiratory problems was found among brick kiln workers especially those of  $\geq 10$  years work duration, bakers and smoking workers. For safe work we recommend for development of brick kilns sector under supervision of Ministry of Industry and Environment to be responsible for monitoring of brick kilns workers (Pre-placement, Periodic medical examination and health education) & strategies for cleaner

brick production, recent technology transfer, field testing of mechanized and cleaner firing technology packages (fulfillment of standards of fuel quality standards). Enforcement for using personal protective equipments to all workers (respirators – masks) plus distributing washing facilities at the work place. Alternate brick making technologies such as vertical shaft kilns (Indian model) which are more efficient with less emissions.

#### **Limitations of the study:**

Some owners of these factories were uncooperative for fear of the higher authorities to take unwanted measure; decreased education of majority of workers caused some difficulties in filling questionnaires and in availability of studies interested in occupational health and safety awareness in Egypt.

#### **Conflict of interests:**

The authors declare that there are no conflict of interests. This research paper was financed totally by the authors of the study.

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