Prevalence and Factors Associated with Respiratory Symptoms Among Bahir Dar Textile Industry Workers, Amhara Region, Ethiopia

Environmental Health Insights
Volume 14: 1–7
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DOI: 10.1177/1178630220965933

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ABSTRACT

INTRODUCTION: The expansions of labor-intensive investments in a developing countries, especially in textile production create a dusty work environment for workers, and those workers are from the low socio-economic group and need special safety concern.

OBJECTIVE: This study was aimed at assessing the prevalence of respiratory symptoms and associated factors among textile factories workers in Bahir Dar, Amhara region, Ethiopia, 2015.

METHODS: Institutional based cross-sectional study design was employed among randomly selected 384 textile workers using pre-tested interviewer-administered questionnaire. We stratified workers by their working section in the textile industries. Then the proportional numbers of workers were selected from each working section of the factory by using a random number generator. The identification number of workers from each factory was used for selection. The data were checked, coded, and entered to Epi-info Version 7 and exported to the Statistical Package for Social Science Version 20 for further analysis. Both bivariate and multivariate logistic regressions were used to identify associated factors. Variables having a $P \leqslant .2$ were fitted to multivariate logistic regression so as to assess the presence and strength of association with the respiratory symptom. Variables having a $P < .05$ were considered as significant.

RESULTS: Three hundred eighty-three (99.74%) of the study participants responded completely filling the questionnaire. In this study, the prevalence of cough, phlegm, bronchitis, chronic bronchitis, and chest pain among the respondents were 31 (8.1%), 45 (11.7%), 26 (6.8%), 2 (0.5%), and 21 (5.5%), respectively. Generally, 141 (36.81%) of the respondents have either of the above respiratory symptoms in the textile industry. Working in the spinning section (AOR = 3.26, 95% CI: 1.80, 5.89), being in the grade 11 and 12 level and below (AOR = 2.36, 95% CI: 1.50, 3.70) and personal protective equipment (PPE) utilization (AOR = 4.88 95% CI: 1.54-15.45) were significantly associated with respiratory symptoms in the multivariate analysis.

CONCLUSION: The prevalence of respiratory symptoms in Bahir Dar Textile workers was relatively high. Working department, educational status, and PPE use were variables significantly associated with respiratory symptoms in this study. Experience sharing across departments, employing educated workers and provision of personal protective equipment are important tasks to be followed to reduce respiratory symptoms in the industry.

KEYWORDS: Respiratory symptom, textile industry, Ethiopia

RECEIVED: September 16, 2020. **ACCEPTED:** September 21, 2020.

TYPE: Original Research

FUNDING: The author(s) received no financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author(s) declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Introduction

Background

World Health Organization (WHO) 2010, reported that non-communicable diseases (NCD) were the leading cause of death resulting in loss of life of about 57 million people globally each year. From this, 36 million (63%) were due to cardiovascular diseases, cancer, respiratory diseases, and diabetes. Moreover, more than 80% of cardiovascular and diabetes deaths and almost 90% of deaths from chronic obstructive pulmonary disease (COPD) occurred in low- and middle-income countries. According to World Health Organization, it is predicted that chronic obstructive pulmonary disease will become the leading cause of death by 2030 worldwide.[1,2]

Over 60 million people are employed in the textile or clothing industry worldwide. There is a growing interest in the contribution of workplace exposures to obstructive lung disease, given that 25% to 45% of patients with chronic obstructive pulmonary disease (COPD) worldwide have never smoked. Cotton processing is known to produce a respiratory disease known as Byssinosis particularly in the early processes of cotton spinning.[3,4] Long-term exposure to cotton, flax, hemp, or jute fibers/dust may cause permanent scarring of the lungs and airways leading to debilitating lung diseases. Persons with Byssinosis generally experience the following symptoms throughout the workweek, during exposure to such fibers/dust: wheezing, shortness of breath, tightness of chest, and

coughing.[5] It is generally believed that acute airway responses are reversible in the early stage or after short-term exposure. In contrast, chronic airway obstruction may result from continuous and prolonged exposure.[4] It is plausible that chronic airway obstruction observed in cotton textile workers is a result of continuous exposure, repeated acute airway responses, or both, in addition, excess nonspecific respiratory symptoms such as chronic cough, phlegm, and dyspnea were reported in cotton textile workers compared with non-exposed populations.[6]

Respiratory symptoms and occupational lung diseases are preceded by different symptoms such as shortness of breath, cough, sputum, dyspnea, and wheeze. The existence of respiratory symptoms could indicate that there is a mild cold or a life-threatening condition and show chronic respiratory disorders. The dustier environment is associated with a high prevalence of chronic respiratory symptoms.[7,8] Chronic bronchitis, cough, and dyspnea were more common and persistent in the cotton group than in the silk group.[9] Length of the exposure period, cumulative or mean dust concentration, past exposure levels and grade of cotton, have all been determined to affect functional loss.[10]

Although causes and factors aggravating it are known to some extent, not enough insight is available as far as our country is concerned. By this study, we shall have a snapshot status of the disease in the cotton industry setup of Bahir Dar. Therefore, this study was designed to contribute to the determination of current prevalence of those respiratory symptoms in textile factory workers and assess the associated factors.

Methods and participants

Study area and period

Bahir Dar Textile Share Company was established in 1961 in the town of Bahir Dar, 570 km North West of Addis Ababa. It was a government owned integrated mill manufacturing 100% woven cotton fabric. In 1989, the factory rehabilitated its spinning and weaving section replacing most of the machines and renovating the rest. The finishing was left for the second phase treatment, which however did not materialize as scheduled. As of September 1999 the factory is changed from public enterprise to share company and financially it was restructured. Currently, in the factory spinning has the capacity of producing 15 tons of yarn per day. Weaving department has the capacity of producing 50 000 m fabric and the processing and finishing section can produce 82 000 m^2 of fabric per day. The garment department can also produces 10 000 pairs of bedsheet per day. The study was conducted in textile factories from February to May 2015.

Study design

An institution-based cross-sectional study was conducted.

Source population and study population

All production workers working in the textile factories in Bahir Dar town who had worked for a period of a minimum 2 years were the source population. Randomly selected production workers and sampled individuals who had worked for a period of a minimum of 2 years were the study population.

Inclusion and exclusion criteria

Workers who are working for 2 years and above in the textile factory were included in the study. However, all workers from the textile factories who cannot respond properly or severely ill were excluded in this study.

Sample size determination and sampling technique

In this study, the sample size was determined using a single population proportion formula. Taking prevalence of respiratory symptoms 50.6% of the study population had 1 or more respiratory problems from Ethiopia[11] and assuming a 5% margin of error and significance level of 95%. Therefore, the sample size was determined as follows:

$$n = \frac{(Z\alpha/2)^2 P(1-P)}{d^2} \quad n = \frac{(1.96)^2 0.506(1-0.506)}{(0.05)^2} = 384$$

Study subjects were stratified by their working sections (Garment, Dyeing, Weaving, and Spinning). In the textile industries after obtaining eligible workers form human resource management of all the sections. Then the proportional numbers of workers were selected from each working section of the factory by using a random number generator. The identification number (ID) of workers from each factory was used for selection.

Variables

Dependent variable. Respiratory symptoms.

Independent variables. **Socio-demographic factors:** Age, sex, religion, education status, ethnicity, marital status, income, and BMI.

Behavioral factors: Cigarette smoking, PPE utilization, alcohol drinking, chat chewing, and physical exercise.

Occupation-related factors: Availability of PPE, work shift, training on respiratory health and safety, dust control system in the working section, history of respiratory disease, occupational history of exposure to dust, home used energy source, and service year and working sections.

Operational definitions

Respiratory symptoms: Workers developing 1 or more symptom of cough, phlegm, dyspnea, chest pain, bronchitis, and chronic bronchitis.[12]

Cough: Cough was defined as a cough as much as 4 to 6 times per day occurring for most days of the week ($\geq$4 days) for at least 3 months in a year and for at least 2 consecutive years.[12]

Phlegm: Chronic phlegm was classified as sputum expectoration as much as twice a day for most days of the week (⩾4 days) for at least 3 months in a year and for at least 2 consecutive years.[12]

Chest pain: In the past 2 years chest pain that kept off the work of the workers with phlegm.[9]

Chronic bronchitis: is a common but variable phenomenon in chronic obstructive pulmonary disease.[13]

Cigarette smokers: Worker who has smoked at least 100 cigarettes during the course of his/her life, which includes current smokers and ex-smokers.[12]

Data collection procedure

Data were collected via pre-tested and structured interviewer-administered questionnaire adopted from the American Thoracic Society division of lung disease. The questionnaire contains socio-demographic variables, behavioral and occupational factors, and respiratory symptoms. The questionnaire was translated into Amharic and back-translated into English to verify accuracy. Observational check list was used to assess sanitation conditions and availability and use of personal protective equipment of the working site.[14] Three trained data collectors with 1 supervisor participated in the data collection.

Data processing and analysis

The data were checked, coded, and entered to Epi-info Version 7 and exported to the Statistical Package for Social Science (SPSS) Version 20 for further analysis. Both bivariate and multivariate logistic regressions were used to identify associated factors. Variables having a $P \leqslant 0.2$ were fitted to multivariate logistic regression so as to assess the presence and strength of association factors associated with the respiratory symptom. Crude (COR) and adjusted (AOR) odds ratio with a 95% confidence interval (CI) were calculated to determine the strength of association between the dependent and independent variables. Variables having a $P < 0.05$ were considered as significant.

Result

Socio-demographic factors of respondents

A total of 384 workers were included in the study and 383 (99.74%) respondents answered the questionnaire completely. The majority of study subjects, 219 (57.2%) were males and the rest 164 (42.8%) were females. Most of the respondents 230 (60.1%) were in the age group of 19 to 29 years, 100 (26.1%) were in the age group of 30 to 40 years, and 53 (13.8%) were in the age group of ⩾40 years. Regarding marital status, 212 (55.4%) were single, 159 (41.5%) were married, 10 (2.6%) were divorced, and 2 (0.5%) were widowed. One hundred forty-nine (38.9%) were grade 9 and 10 and below, 33 (8.6 %) were attained grade 11 and 12 and 201 (52.5%) were vocational and above (Table 1).

Occupation related and behavioral factors of the respondents

In this study, only 115 (30%), 5 (1.3%), and 4 (1%) of the study participants drink alcohol, chew chat, and smoke cigarette, respectively. Regarding the safety training, only 50 (13.1%) workers were trained, and 202 (52.7%) of the respondents use personal protective equipment in the industry (Table 2).

Prevalence of respiratory symptoms

The prevalence of cough, phlegm, bronchitis, chronic bronchitis, and chest pain among the respondents were 34 (8.9%), 48 (12.5%), 29 (7.6%), 6 (1.6%), and 24 (6.21%), respectively. Generally, 141 (36.81%) of the respondents have either of the above respiratory symptoms in the textile industry with 95% CI of 32.1%-41.3% (Table 3).

Factors associated with respiratory symptoms in the industries

In the bivariate logistic regression, sex, age, marital status, educational status, marital status, home energy use, alcohol use, physical exercise, safety training, PPE use, and service year and working department were associated with respiratory symptoms in the bivariate analysis ($P < .2$) and considered as candidate variables to the multivariate analysis. Whereas, in the multivariate analysis, working department, educational status, and personal protective equipment use were variables significantly associated with respiratory symptoms at $P < .05$.

In this study, workers in the spinning department were 3.26 more likely to develop respiratory symptoms than their counter parts **(AOR = 3.26, 95% CI: 1.80, 5.89).**

Workers with educational status of grade 11 and 12 and below were 2.36 more likely to develop respiratory symptom than those with educational status of diploma and above **(AOR = 2.36, 95% CI: 1.50, 3.70).**

Regarding personal protective equipment use, workers who did not utilize their personal protective equipment in the work area were 4.88 times more likely to develop respiratory symptom than those who utilize their PPE in the working area **(AOR = 4.88, 95% CI: 1.54-15.45)** (Table 4).

Discussion

This study indicated that working in the spinning section, educational status, and personal protective equipment utilization were significantly associated with respiratory symptoms in the multivariate analysis in the Bahir Dar Textile factory.

In this study, the prevalence of respiratory symptom among Bahir Dar Textile factory workers were 141 (36.81%) with 95% CI of 32.1% to 41.3%. The finding of this study was much less than a study conducted in Dejen Cement factory workers (62.9%),[15] other cement factory workers (66.2%) in North Shoa,[16] Ethiopia, and a study done in India, 54.4%. Whereas,

Table 1. Socio-demographic factors of Bahir Dar Textile factory workers, Amhara region, Ethiopia, 2015.

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE (%)
Sex	Male	219	57.2
	Female	164	42.8
Age (in years)	19-29	230	60.1
	30-40	100	26.1
	⩾40	53	13.8
BMI	<18.5	16	4.2
	18.5-24.99	340	88.8
	25-29.99	27	7.0
Ethnicity	Amhara	379	99.0
	Others*	4	1.0
Marital status	Married	159	41.5
	Single	212	55.4
	Divorced	10	2.6
	Widowed	2	0.5
Religion	Orthodox Christian	370	96.6
	Muslim	10	2.6
	Protestant	3	0.8
Educational status	Grade 9-10 and below	149	38.9
	Grade 11-12	33	8.6
	Vocational and above	201	52.5
Home energy source	Electric	51	13.3
	Biomass	332	86.7
Working shift	Day shift	85	22.2
	Evening shift	73	19.1
	All shifts	225	58.7
Service year in the factory	<5 y	154	40.2
	⩾5 y	229	59.8
Working sections	Garment	110	28.7
	Dyeing	50	13.1
	Weaving	122	31.9
	Spinning	101	26.4

*Others: Tigray, Oromo.

the finding of this study was consistent with a the study done in Karachi, Pakistan around (35%) of respondents had complained of having respiratory disorders in the past 6 months.[5]

Table 2. Behavioral factors of Bahir Dar Textile factory workers, Amhara region, Ethiopia, 2015.

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE (%)
Chat chewing	Yes	5	1.3
	No	378	98.7
Cigarette smoking	Yes	4	1
	No	379	99
Alcohol drinking	Yes	115	30
	No	268	70
Alcohol drinking days per week	1-2 d	77	20.1
	3 d	34	8.9
	4-7 d	4	1.0
Physical exercise	Never	305	79.6
	1 per mo	8	2.1
	1 per wk	13	3.4
	2-3 times per wk	40	10.4
	4-5 times per wk	9	2.3
	Daily	8	2.1
Safety training	Yes	50	13.1
	No	333	86.9
Personal protective equipment use	Yes	202	52.7
	No	181	47.3

Table 3. Prevalence of respiratory symptoms in Bahir Dar Textile factory workers, Amhara region, Ethiopia, 2015.

RESPIRATORY SYMPTOMS	FREQUENCY	PERCENTAGE (%)
Cough	34	8.9
Phlegm	48	12.5
Bronchitis	29	7.6
Chronic bronchitis	6	1.6
Chest pain	24	6.21

The discrepancy may be due to better prevention measures done in the factory.

The prevalence of cough, phlegm, bronchitis, chronic bronchitis, and chest pain among the respondents were 34 (8.9%), 48 (12.5%), 29 (7.6%), 6 (1.6%), and 24 (6.21%), respectively. This was slightly higher than a study done in Lancashire Textile weavers which shows that work-related respiratory symptoms (persistent cough 3.9%, chronic production of

Table 4. Bivariate and multivariate logistic regression analysis of factors associated with respiratory symptoms among Bahir Dar Textile factory workers, Amhara region, Ethiopia, 2015 (n = 383).

VARIABLES	CATEGORIES	RESPIRATORY SYMPTOM		COR (95% CI)	AOR (95% CI)
		YES (%)	NO (%)		
Sex	Male	77 (35.2)	142 (64.8)	0.84 (0.56, 1.28)	0.762 (0.42-1.38)
	Female	64 (39.0)	100 (61.0)	1	1
Age (in years)	19-29	69 (30.0)	161 (70.0)	1	1
	30-40	47 (47.0)	53 (53.0)	2.07 (1.28, 3.36)*	1.96 (0.76-3.73)
	⩾40	25 (47.2)	28 (52.8)	2.08 (1.13, 3.83)*	2.17 (0.97-4.85)
Working department	Garment	32 (29.1)	78 (70.9)	1	1
	Dyeing	21 (42.0)	29 (58.0)	1.77 (0.88, 3.54)	1.61 (0.79, 3.27)
	Weaving	35 (28.7)	87 (71.3)	0.98 (0.56, 1.73)	1.104 (0.62, 1.98)
	Spinning	53 (52.5)	48 (47.5)	2.69 (1.53, 4.75)*	3.26 (1.80, 5.89)*
Marital status	Married	68 (42.8)	91 (57.2)	1	1
	Others#	73 (32.6)	151 (67.4)	0.65 (0.43, 0.99)	0.92 (0.52, 0.99)*
Educational status	Grade 11-12 and below	83 (45.6)	99 (54.4)	2.07 (1.36, 3.15)*	2.36 (1.50, 3.70)*
	Vocational and above	58 (28.9)	143 (71.1)	1	1
Home energy source	Electric	21 (41.2)	30 (58.8)	1	1
	Biomass	120 (36.1)	212 (63.9)	0.81 (0.44, 1.48)	1.23 (0.62-2.44)
Alcohol drinking	Yes	46 (40.0)	69 (60.0)	1.21 (0.78, 1.90)	1.57 (0.86-2.84)
	No	95 (35.4)	173 (64.6)	1	1
Physical exercise	Once per wk and below	122 (37.4)	204 (62.6)	1	1
	2-3 times per wk and above	19 (33.3)	38 (66.7)	1.20 (0.66, 2.17)	1.82 (0.89-3.73)
Safety training	Yes	18 (36.0)	32 (64.0)	1	1
	No	123 (36.9)	210 (63.1)	1.04 (0.56, 1.93)	1.19 (0.60-2.36)
PPE use	Yes	72 (35.6)	130 (64.4)	1	1
	No	69 (45.8)	112 (54.2)	1.11 (0.73, 1.69)	4.88 (1.54-15.45)*
Service year in the factory	<5 y	46 (29.9)	108 (70.1)	1	1
	⩾5 y	95 (41.5)	134 (58.5)	1.65 (1.08, 2.57)	0.91 (0.49-1.68)

*Significant at $P < .05$.
#Others: Single, divorced, and widowed.

phlegm 3.6%, and chest tightness 4.8%).[3] Whereas, this study was lower than a study done in cement factories in Dejen town,[15] Ethiopia which indicated the respiratory symptoms were cough (24.5%), wheezing (36.9%), chest pain (21%), phlegm (24.5%), and shortness of breath (38.6%), and another study done in Ethiopia which revealed prevalence of respiratory symptoms of cough (73%), phlegm (73.7%), shortness of breath (71.1%), and chest pain (44.7%).[16] This difference may be due to the difference in the machine (the machine in our study are very old), the health, and safety setup in the previous and selection of participants in the study site.

Another study done in China among cotton textile industry workers, the prevalence of respiratory disease were 7.6% which is much more lower than this study.[17]

In this study, the only 3 variables that significantly associated with the respiratory symptom of the respondents were working in the spinning section, educational status of 11th and 12th grade and below, and utilization of personal protective equipments. Similar study on respiratory symptom among male textile workers in Pondicherry: a case–control study showed, working in the spinning and weaving sections, long exposure and heavy smoking have been reported as risk

factors.[18] In other studies in Karachi, Pakistan, respiratory symptom was more prevalent in the spinning section of the textile mill.[19]

Working in the spinning section were about 3.26 times more to report respiratory symptoms in the textile workers than working in the garment section. This may be that the spinning activity by its nature produces more dust than garment industry, and during observation, we had observed that there was dust on the eyebrow, on the hair, and clothes of the workers. And the dust was also observable on the air, on the machines, as well as on the wall.

Being in the grade 11 and 12 and below had a higher chance to develop respiratory symptoms compared with respondents attending vocational and above. Similarly, in a study done in Karachi, Pakistan found that the prevalence of respiratory problems decreased with the increase in educational level.[19] Another study done in Ethiopia also showed that those with low educational status are highly at risk than those with higher educational background.[20] The main reason might be lower grade workers might be assigned in risk working areas, or it might be that they do not understand the risk of work exposure so they might not take necessary precaution measures.

This study also revealed that PPE utilization was statistically significant variable with the development of respiratory symptoms. This finding was in line with studies done in Ethiopia, Tanzania, and Nigeria,[15,21,22] and the difference may be due to the adequacy and quality of personal protective equipments provided, to the varying practice and cleaning of PPE and to adequate supply of PPE in the present study as observed during work place observation.

Limitation

The possible limitation of this study may be, presence of subjectivity because, the study is a cross-sectional type which does not include experimental study to measure the respiratory symptoms of the workers. Another limitation can be lung function test and dust level measurement were not done which make more the explanatory of respiratory symptoms.

Conclusion

The level of respiratory symptoms in the textile workers was relatively high. Working in the spinning section, being in the grade 11 and 12 level and below and PPE use variables were significantly associated with respiratory symptoms. Experience sharing across departments, employing educated workers, and the provision of personal protective of equipment are important tasks to be followed to reduce respiratory symptoms in the industry.

Authors' contributions

MK and BG developed the proposal, analyzed data, and wrote the report and the manuscript. KA and SM organized overall process. MK and BG contributed in proposal writing, data collection and analysis. All authors checked and accepted the final manuscript.

Availability of data and materials

The datasets used/analyzed during the study are available from the corresponding author on reasonable request (**S1 Data**).

Ethical approval and consent to participate

Ethical clearance was obtained from the Ethical review committee of the University of Gondar and permission letter was obtained from the Bahir Dar Textile factory administration. After informing the purpose of the study, the importance of their participation and withdraw at any time, informed and written consent was obtained. Privacy and confidentiality of information given by respondents were kept properly and personal identifiers were removed.

Consent to Publish

Not applicable, no individual detail is presented.

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