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Occupational Health Risks in Savar's BSCIC Zone: The Dark Side of Tannery Industry

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Abstract

The tannery industry in Bangladesh, particularly at the Savar Bangladesh Small & Cottage Industries Corporation (BSCIC) Tannery Estate, presents significant occupational health risks due to hazardous chemicals and outdated processes. Despite relocation from Hazaribagh and efforts to improve occupational health and safety (OHS) standards, compliance remains insufficient, leading to chronic health issues such as respiratory disorders, skin conditions, and increased risk of cancer. This study investigates these health risks, particularly exposure to heavy metals like chromium, as well as biological agents, dust, and high noise levels from machinery. Using a cross-sectional design, data were collected through participatory observation, interviews and questionnaire survey from 205 tannery workers. Descriptive statistics and regression analysis reveal a high prevalence of skin diseases (48.78%) and respiratory problems (44.39%), exacerbated by poor ventilation (66.7%), minimal personal protective equipment (PPE) usage (46.3%), and inadequate healthcare access. Although 85.9% of workers are aware of chemical hazards, only 39.5% received formal training, highlighting gaps in safety education. The regression analysis showed a positive relationship between the number of years worked and the years of health problems, with the equation $y=0.31x+1.38$, indicating that for every additional year worked, health issues increase by 0.31 years. The R^2 value of 0.44 suggests that 44% of the variation in health problems is explained by work duration, with other factors likely contributing. The findings underscore the urgent need for stricter enforcement of national regulations, such as the Bangladesh Labour Act 2006, and international frameworks, including ILO conventions, to improve workplace conditions. Improved environmental management, enhanced safety training, and better healthcare provisions are essential to protect workers' health. The study also stresses aligning tannery practices with the Sustainable Development Goals (SDGs) related to good health, decent work, and responsible production, calling for immediate action from authorities to safeguard worker well-being.

Keywords: Occupational Health Hazards (OHH), Tannery Industry, Hazardous Chemicals, Savar, Bangladesh

Introduction

The tannery industry in Bangladesh is known for its extensive use of hazardous chemicals, putting workers at significant health risks, both short-term and long-term (Dewani et al., 2023). Despite initiatives to enhance occupational health and safety (OHS) standards, compliance remains suboptimal, particularly in the Bangladesh Small and Cottage Industry Corporation (BSCIC) Tannery Estate in Savar (Rahman et al., 2022). The tanning process in these industries remains unsanitary and outdated, intensifying workers' health risks (Rahman et al., 2019). Consequently, many lives are at risk each year due to the lack of effective OHS measures, leading to accidents, chronic illnesses, and fatalities (Chaudhary et al., 2020). This study critically examines the occupational hazards workers face in Savar tanneries and proposes actionable solutions to improve working conditions and health outcomes.

The relocation of the Hazaribagh Tannery Estate to the newly established BSCIC Tannery Estate was meant to

enhance environmental and working conditions, but workers still face exposure to hazardous substances and unsafe environments (Iqbal et al., 2023; Rahman et al., 2021). A key question arises: what are the primary health consequences of exposure to these chemicals in the Savar tanneries? Workers handle around 40 different heavy metals and acids during leather production, including toxic compounds like chromium, copper, arsenic, cadmium, and others, many of which are carcinogenic (Rahman et al., 2019; IARC, 1987). Chronic exposure can result in respiratory disorders, skin diseases, and cancer. In addition to chemical hazards, workers are exposed to biological agents from animal hides, leading to zoonotic diseases and infections (Hamzaoui, 2024; Khambhaty & Samidurai, 2024). Dust and particulate matter, released during leather processing, exacerbate respiratory issues such as asthma, while constant noise from heavy machinery contributes to hearing impairments (Al-Rubaey et al., 2022; Castellanos-Arévalo et al., 2015). These environmental hazards, along with the mental health challenges posed by the stressful work environment, further undermine workers' well-being.

This research also investigates the most common occupational illnesses among tannery workers, such as chronic skin conditions and respiratory problems, linked to their hazardous work conditions (Omor et al., 2022). Poor waste management exacerbates these issues, releasing foul odors and airborne pollutants that worsen respiratory conditions (Islam et al., 2023; Sarwar et al., 2021). Additionally, the psychological strain caused by monotonous tasks and constant health risks contributes to heightened stress and anxiety (Islam et al., 2017). This study aims to provide evidence-based solutions for reducing health risks in Savar's BSCIC Tannery Estate by addressing the critical questions regarding the health impacts of chemical exposure and the most prevalent occupational illnesses. The findings will inform improved OHS practices in the tannery industry.

Literature Review

Economic Contribution of the Tannery Sector

The tannery sector is a crucial part of Bangladesh's economy, significantly contributing to the country's GDP. The industry, which primarily revolves around Hazaribagh in Dhaka, processes various types of leather, including cowhide, buffalo hide, goat skin, and sheepskin (Chowdhury & Hawlader, 2024). The processed leather and finished leather goods are exported to major international markets such as the United States, Germany, Italy, Spain, France, and Japan. The global demand for Bangladeshi leather products ensures a steady flow of foreign exchange, making the sector a vital component of the nation's export economy (Khan, 2014). Despite its economic significance, the industry faces challenges in terms of worker safety and environmental sustainability.

Occupational Health Hazards in the Tannery Industry

Numerous studies have documented the health risks faced by tannery workers in Bangladesh, who are frequently exposed to hazardous chemicals during the leather processing stages. A cross-sectional study conducted with 316 workers in Hazaribagh revealed that 63.3% of the workforce suffered from at least one medical condition, with skin disorders, respiratory issues, gastrointestinal problems, chronic headaches, and cardiovascular diseases being the most prevalent (Islam et al., 2017). Exposure to toxic substances such as chromium and lead has been linked to long-term health complications, including cancer risks. Despite these dangers, only 36.7% of workers reported using personal protective equipment (PPE), underscoring the insufficient safety measures within the sector (Islam et al., 2017)

Environmental Impacts of Tannery Waste

The tannery industry's waste disposal practices, particularly in areas like Hazaribagh and Savar, have been identified as major environmental hazards (Belal et al., 2015). Effluent from tanneries contains harmful chemicals and heavy metals such as chromium,

cadmium, and arsenic, which are often discharged untreated into nearby rivers, severely polluting the local ecosystem (Chowdhury et al., 2015). Studies have shown that communities near tannery estates perceive significant health risks due to exposure to tannery waste, with educated and higher-income residents more likely to acknowledge these hazards (Chowdhury et al., 2015). In the absence of proper waste management systems, the environmental damage not only affects the workers but also poses broader public health risks to surrounding communities, particularly those relying on contaminated water sources (Kumar et al., 2022).

Hematological and Biochemical Health Effects

Exposure to toxic chemicals in the tannery industry has profound effects on workers' hematological and biochemical health. A study comparing the blood profiles of tannery workers with a control group found significant abnormalities among the workers, including lower red blood cell counts, reduced hemoglobin levels, and abnormal hematocrit levels (Islam et al., 2017). These findings indicate a higher prevalence of anemia and related health issues among tannery workers. Furthermore, the study reported elevated liver damage markers, such as alanine transaminase and aspartate transaminase, pointing to the potential for liver dysfunction caused by chemical exposure (Islam et al., 2017). The findings emphasize the urgent need for medical monitoring and intervention to safeguard workers' health in this hazardous work environment.

Gender Differences in Health Risk Sensitivity

Gender disparities in health risk sensitivity have been observed within the tannery workforce, with male workers exhibiting higher susceptibility to certain health issues than their female counterparts. Research conducted in Savar found that men were statistically more likely to report health problems, with a significant p-value of 0.004, indicating heightened vulnerability (Islam et al., 2023). This gender difference could be attributed to varying levels of exposure to hazardous substances, job roles, or the types of tasks performed within the tannery. While both male and female workers face significant risks, the findings suggest the need for more gender-sensitive occupational health policies that address the specific challenges faced by each group.

Physical Health Complications in Other Sectors

Occupational health hazards are not confined to the tannery industry alone. Similar risks are observed in other industrial sectors, such as the garment industry, which also employs a large portion of Bangladesh's workforce. A study on garment workers in Gazipur highlighted common physical health issues, including headaches, eye strain, hand discomfort, and respiratory problems, reflecting similar workplace conditions as those seen in tanneries (Chowdhury et al., 2015). These findings indicate that occupational health risks extend beyond one industry and require a broader, cross-sectoral approach to improve workplace safety in Bangladesh's key industries.

Gaps in Occupational Health and Safety Research

Despite numerous studies highlighting the health risks in Bangladesh's tannery industry, significant gaps remain in occupational health and safety (OHS) research. One major shortcoming is the absence of an effective occupational illness surveillance system, making it difficult to assess the long-term impact of current safety regulations and interventions (Chowdhury et al., 2015). Additionally, there is a notable lack of research on OHS in sectors beyond tanneries and garment factories, such as public health services and smaller industries. More research is needed to develop comprehensive health risk reduction strategies and ensure the enforcement of safety protocols across all industrial sectors. Strengthening OHS research and policies is crucial for protecting the health of workers and improving overall workplace conditions.

Methodology

Study Area

The study was conducted in the BSCIC Tannery Estate at Horindhara, situated on the banks of the Dhaleshwari

River in Hemayetpur, Savar, Dhaka. This 200-acre industrial zone houses several tanneries, including Apex Tannery, Vulua Tannery Limited, and Feni Tannery, which were selected for this study due to their prominence in the leather industry. The geographical coordinates of the study area are from 23° 46' 14.40" N to 23° 47' 16.41" N latitude and from 90° 14' 22.41" E to 90° 14' 59.08" E longitude (Figure 1).

Study Design and Sampling

A cross-sectional study design was employed to capture a snapshot of the occupational health risks faced by tannery workers. The study focused on three prominent tanneries using purposive sampling to select participants who are directly exposed to potential health hazards. This ensured that the sample included individuals with relevant experience and risk exposure.

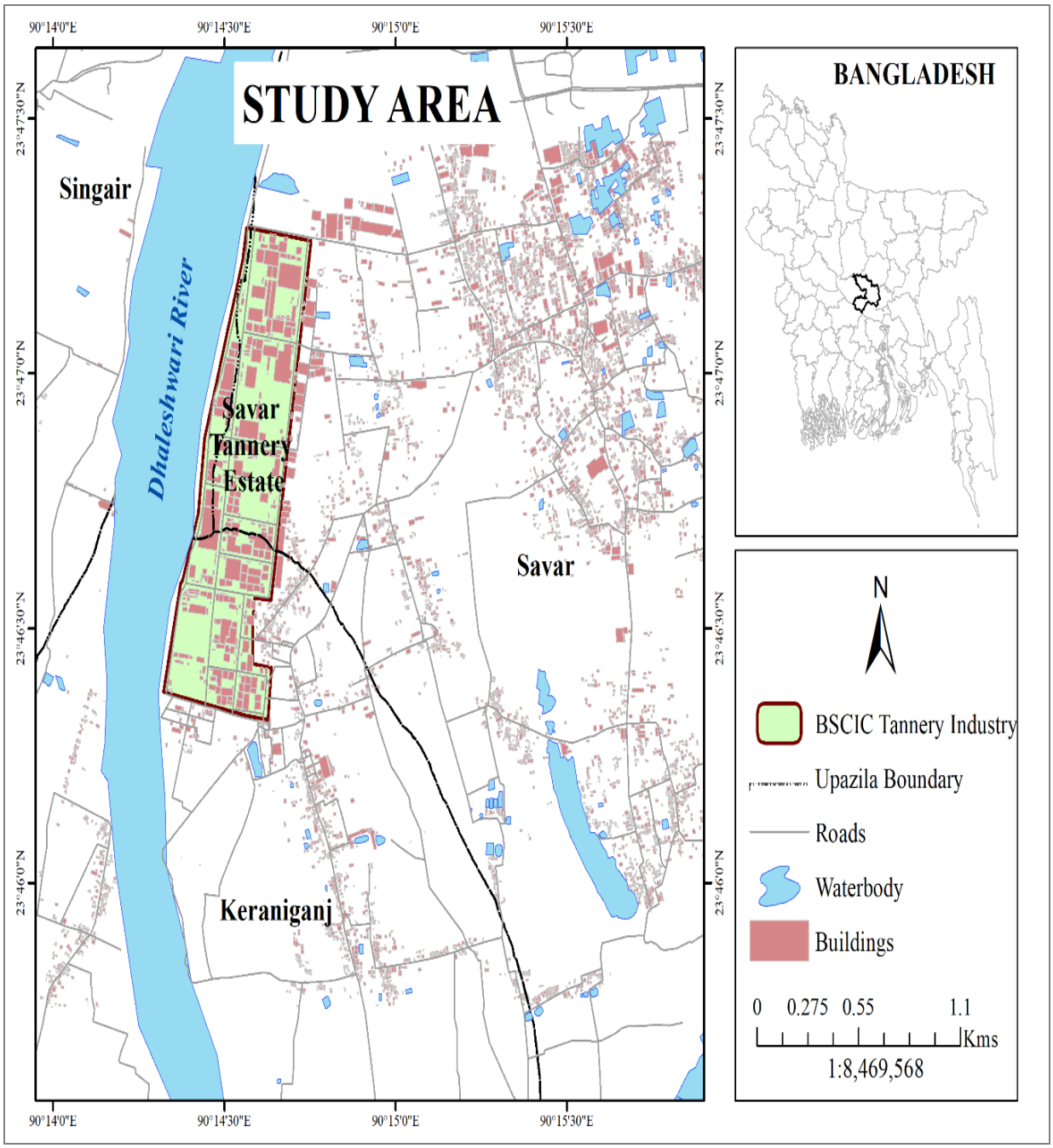

Figure 1: Map of the Study Area

A total sample of 205 participants was determined using the formula for finite population size:

$$\text{Finite Populaion: } n' = \frac{n}{1 + \frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2 N}} \quad \text{…….. (1)}$$

Where,

n' is the required sample size.

n is the initial sample size.

z is the z score (for 95% confidence level it is 1.96).

Ɛ is the marginal error (5%).

$\hat{p}$ is the population proportion (0.5).

N is the total population size (500).

This formula ensured that the sample size was representative of the total worker population in the tanneries, providing robust data for analysis. Mixed-method data collection (both quantitative and qualitative) was employed, using a combination of questionnaires and observational techniques to gather comprehensive data on occupational health risks.

The population targeted for this study included 500 full-time tannery workers of diverse demographics, encompassing both males and females across various age groups. These workers were selected through voluntary participation to ensure a representative sample for analyzing Occupational Health Hazards (OHH) in the tannery industry. To gain a holistic understanding, the study also employed participatory overt observation, allowing researchers to immerse themselves in the work environment and openly observe daily activities, processes, and interactions (Figure 2).

Data Collection

This study utilized a multi-method approach to comprehensively assess occupational health risks among tannery workers in the BSCIC Tannery Zone. From a population of 500 full-time workers, 205 participants were systematically sampled for a questionnaire survey, which provided quantitative data

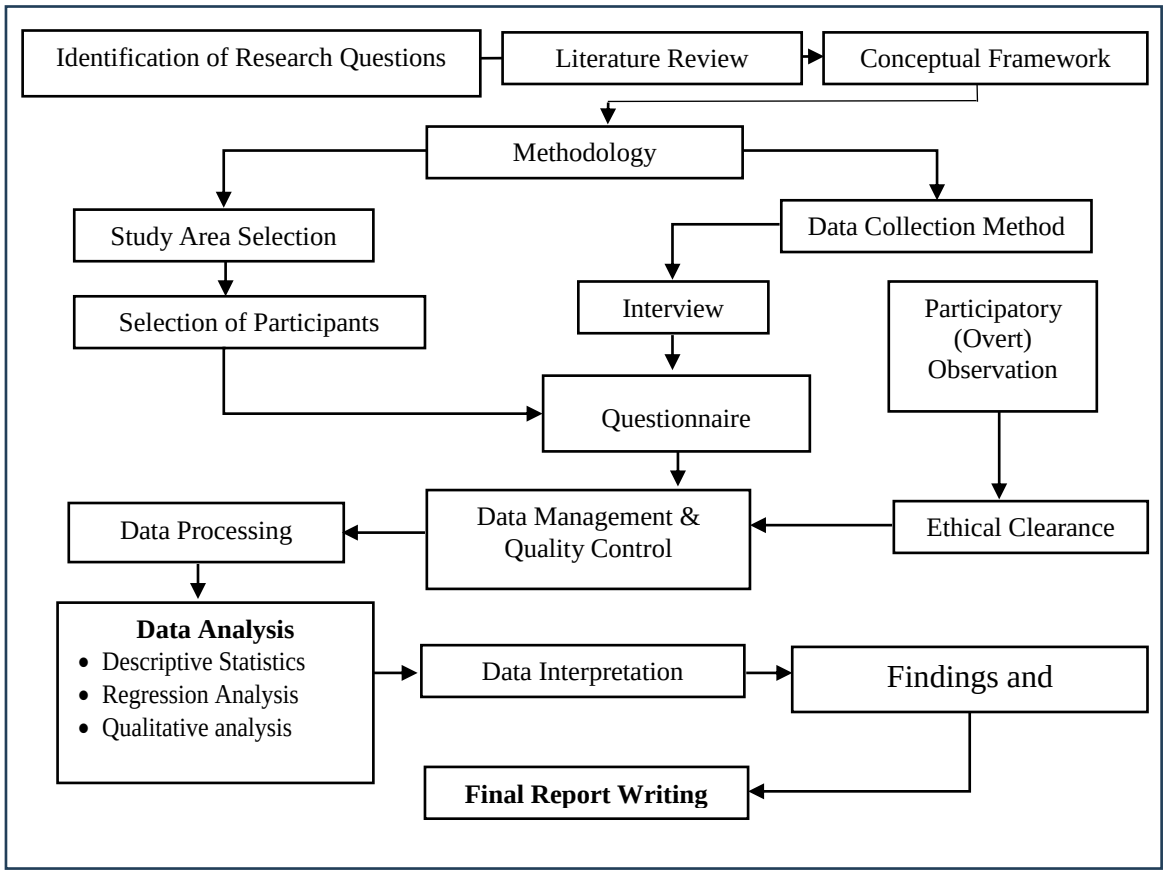

Figure 2: Research Framework

on demographics, health conditions, and workplace risks. A purposively selected subset of these 205 survey participants subsequently participated in semi-structured interviews, offering in-depth qualitative insights into specific workplace hazards, health issues, and safety practices. The integration of survey and interview data enabled both broad and detailed perspectives on the occupational health challenges faced by tannery workers. The questionnaire, administered through Kobo Toolbox, eensured participant anonymity and streamlined response management. It covered a wide range of topics, including socio-demographic details (e.g., age, gender, education level, marital status), financial conditions (income levels), and work-related factors such as job duration, training status, and awareness of safety practices, specifically the use of personal protective equipment (PPE). Additional survey sections evaluated workers' awareness of chemical hazards, assessed workplace environmental conditions (e.g., ventilation, lighting, noise, temperature, waste management), and examined personal habits like smoking, as well as existing health conditions and treatment status.

To complement these methods and gain a deeper understanding of tannery operations, participatory overt observation was employed, allowing researchers to directly observe work practices, interactions, and potential hazards in real-time. This integrated approach—combining survey data, interviews, and observation—offered a comprehensive view of occupational health risks in tannery work.

Data Analysis

Data from interviews, questionnaires, and observations were analyzed through thematic categorization and descriptive statistics to capture key frequencies, proportions, means, and standard deviations. This approach quantified socio-demographic characteristics, work conditions, and health-related outcomes among tannery workers, offering a clear profile of participant backgrounds and highlighting prevalent health risks within the tannery industry. This structured analysis provided a comprehensive overview of the occupational hazards faced by workers and underscored key areas of concern related to workplace safety and health.

Further inferential analysis was conducted through regression analysis to explore the relationships between health problems (such as respiratory issues and skin conditions) and the duration of employment. Chi-square tests were performed to assess the associations between categorical variables, such as the correlation between PPE usage and the incidence of health issues. All findings were interpreted with 95% confidence intervals and p-values, with statistical significance determined at $p < 0.05$. This analytical approach ensured that both quantitative and qualitative data were effectively used to uncover significant patterns and associations, helping to identify key occupational health risks in the tannery sector.

Result and Findings

The socio-demographic data from Table 1 reveal that the workforce in the BSCIC tannery industry is predominantly male, with 62.93% (n = 129) male workers compared to 37.07% (n = 76) female. The majority of workers are middle-aged or older, with 46.83% (n = 96) between 31-40 years, and 29.27% (n = 60) over 41 years of age. Monthly income largely falls within the range of 8,000-12,000 BDT, reported by 56.59% (n = 116) of workers, indicating a generally low-income bracket. Educational levels are also low, as 35.12% (n = 72) of workers have no formal education, and only 4.88% (n = 10) have completed secondary education or higher. Notably, 39.02% (n = 80) of the workforce has been employed in the tannery industry for 6 to 10 years, reflecting both employment stability and prolonged exposure to occupational hazards. A significant portion of these long-term workers reported relocating from Hazaribagh to Hemayetpur in 2018, following the industry's move. In terms of smoking habit, 33.17% (n = 68) of workers are smokers, all of whom are male, introducing an additional health risk within their already hazardous working environment.

Table 1: Socio Demographic Characteristics of the Tannery workers, Hemayetpur, Dhaka, Bangladesh.

Background Characteristics	Percentage	No. of Tannery Workers (N=205)
Sex		
Male	62.93	129
Female	37.07	76
Age (Year)		
<20	2.93	6
21-30	20.98	43
31-40	46.83	96
41+	29.27	60
Education		
No Education	35.12	72
Primary Incomplete	3.41	7
Primary Complete	24.39	50
Secondary Incomplete	32.20	66
Secondary Complete or Higher	4.88	10
Monthly Income (Taka) of the tannery Workers		
Less than 8000	2.93	6
8000-12000	56.59	116
12001-16000	29.76	61
16001-20000	7.80	16
More than 20000	2.93	6
Duration of Job (Year)		
<5	16.59	34
6-10	39.02	80
11-15	21.95	45
16-20	14.63	30
20+	7.80	16
Smoking Habit of the Tannery Workers		
Smoker	33.17	68
Non-Smoker	66.83	137

Source: *Field Survey, 2023*

Table 2 highlights a critical gap in formal training, as only 39.5% (n = 81) of workers reported receiving training on working with tannery machinery and chemicals. This lack of preparation raises concerns about inadequate knowledge of safety protocols and the health risks associated with chemical exposure. However, 72.2% (n = 148) of workers believe that training should be mandatory before starting the job. Encouragingly, 85.9% (n = 176) of workers are aware of the harmful health effects of chemicals used in the tannery, and 75.6% (n = 155) are specifically knowledgeable about the cancer-causing potential of certain chemicals. Despite this awareness, only 46.3% (n = 95) of workers regularly use personal protective equipment (PPE), leaving the majority (53.7%, n = 110) without adequate protection. Of those who do use PPE, 82.4% (n = 169) obtained it from their employer, while 17.6% (n = 36) sourced it independently. These findings indicate a need for improved provision and enforcement of PPE use, ensuring consistent access to high-quality protective gear to safeguard workers' health.

Table 3 outlines significant environmental challenges within the tanneries that directly impact worker health. Alarmingly, 66.7% (n = 135) of workers reported inadequate ventilation, which leads to the buildup of toxic pollutants and chemicals and contributes to the high incidence of health problems, reported by 65.9% (n = 126) of workers. Interviews further underscored this issue, as one worker remarked, "*The fumes make us cough, but there's no way to escape them during work hours.*" Additionally, poor ventilation makes it challenging to keep the air free of toxins, directly impacting respiratory health. Furthermore, 62.96% (n = 127) of workers reported exposure to insufficient

Table 2: Assessment of tannery workers' training status, knowledge, and utilization of Personal Protective Equipment (PPE), Hemayetpur, Bangladesh

Training status, Knowledge, and PPE use	Number of tannery workers (N= 205)	Percentage (%)
Received formal training	81	39.51
Did not receive formal training	124	60.49
Believe in the necessity of training	148	72.20
Do not believe in the necessity of training	57	27.80
Awareness of chemical harmfulness	176	85.85
Not aware of the chemical harmfulness	29	14.15
Perception of cancer risk	155	75.61
Do not share this belief of cancer risk	50	24.39
Knowledge of PPE effectiveness	176	85.85
Do not recognize PPE's effectiveness	29	14.15
PPE Usage	95	46.34
Do not utilize PPE	110	53.66
Source of Protective Equipment (Self)	36	17.56
Obtain their protective equipment from the tannery	169	82.44

Source: *Field Survey, 2023*

lighting, which interferes with precision tasks and increases strain, as evidenced in interviews. One worker explained, "*The lights aren't enough; we sometimes struggle to see what we're working on*," highlighting the potential for accidents and continuous eye strain, which may lead to the reported 21.46% of eye-related health issues. 81.5% (n = 167) of workers reported working in uncomfortable temperature conditions, which interviews revealed to be a major factor affecting safety compliance. "*The masks make it hard to breathe in the heat, so we take them off*," explained one worker, indicating how excessive temperatures discourage the use of personal protective equipment (PPE), despite high awareness (85.9%, n = 176) of chemical dangers.

Although 34.1% (n = 70) of workers reported exposure to chemical fumes, this did not show a statistically significant impact on health problems in the quantitative data. However, interviews provided a qualitative understanding of the perceived risks. As one participant shared, "*We know it's dangerous for our hands and heart, but we have to use bare hands because it's faster.*" Another worker added, "*We don't get paid enough to afford missing work*," highlighting the economic pressures that discourage adequate PPE use and contribute to long-term health risks.

Noise pollution affects 98.4% (n = 201) of workers, and while it did not statistically correlate with specific health conditions, qualitative data indicate that the continuous noise heightens stress levels. "*The machines are so loud we can't hear each other, which makes it stressful*," described one worker, underscoring the indirect impact of noise on mental well-being and work stress. Furthermore, 84.1% (n = 174) of workers endure exposure to unpleasant, corrosive odors, which negatively influence the work environment. One worker commented, "*There's waste everywhere; it feels unsafe to breathe here*," adding a layer of discomfort that, while not statistically linked to immediate health issues, affects overall work conditions and mental health.

The vast majority of tannery workers (92.20%, n = 189) reported experiencing at least one health issue, highlighting the severe occupational health risks present in the tannery industry (Table 4). Skin conditions were prevalent, affecting 48.78% (n = 100) of workers,

Table 3: Workplace environmental conditions within the tannery industry, Hemayetpur, Bangladesh

Environmental Condition in the Tannery Industry		No. of Workers (N=205)	No. of workers suffering from health problems (n=189)	Health Problems of Total Womens (N=205) (%)	Health Problems of sufferer workers (N=189) (%)	OR	CI (95%) Lower	CI (95%) Upper	P-Value
Ventilation	Well Ventilated	70	63	33.33	34.15	0.96	0.63	1.46	0.86
	Poor Ventilated	135	126	66.67	65.85				
Lighting	Adequate Lighting	78	70	37.04	38.05	0.96	0.64	1.44	0.84
	Poor Lighting	127	119	62.96	61.95				
Temperature	Comfortable temperature	38	37	19.58	18.54	1.07	0.65	1.77	0.79
	Not comfortable temperature	167	152	80.42	81.46				
Chemical Fume	No fume	135	124	65.61	65.85	0.99	0.65	1.50	0.96
	With fume	70	65	34.39	34.15				
Noise (mainly machinery	Free from noise	4	3	1.59	1.95	0.81	0.18	3.67	0.79
	Noisy	201	186	98.41	98.05				
Smell	Normal	31	30	15.87	15.12	1.06	0.61	1.83	0.84
	Bad smell	174	159	84.13	84.88				
Effluents and wastes treatment facility of the tannery	Yes	188	172	91.01	91.71	0.91	0.45	1.85	0.80
	No	17	17	8.99	8.29				

OR = Odds ratio, CI = Confidence Interval ***Source:*** *Field Survey, 2023*

largely due to direct chemical exposure. Many workers expressed their frustration with limited medical support, as one noted, "*Proper medical care is needed close to the factory*," emphasizing the need for on-site healthcare to address frequent skin and respiratory issues.

Gastrointestinal problems were reported by 39.02% (n = 80) of workers, likely resulting from chemical exposure and poor hygiene. Chronic headaches, which impacted 41.46% (n = 85) of workers, were attributed to the stressful and physically taxing conditions, with one worker explaining, "*We stand all day, and the pain doesn't go away even after work*," capturing the daily strain faced by workers.

Eye problems affected 21.46% (n = 44) of workers, likely due to exposure to dust particles and chemicals in poorly lit conditions. Allergies, impacting 69.27% (n = 142) of workers, were primarily attributed to chemical exposure. Respiratory ailments were also widespread, with 30.24% (n = 62) of workers experiencing Chronic Obstructive Pulmonary Disease (COPD), while 44.39% (n = 91) suffered from chronic bronchitis and asthma, likely due to continuous exposure to airborne pollutants.

Mental health concerns such as anxiety and depression were reported by 20.98% (n = 43) of workers, likely exacerbated by hazardous working conditions and continuous chemical exposure. Interviews revealed a high level of job-related stress, with one worker stating, "*We work without contracts, so there's always fear of losing the job*," reflecting a sense of insecurity that compounds mental strain. Furthermore, 35.12% (n = 72) of workers reported cardiovascular problems, and a

Table 4: Investigation of the prevalence and patterns of health issues among tannery workers in Hemayetpur, Bangladesh

Health Problem of the Tannery workers	Percentage	Number of Tannery Workers
Suffering from Health Problem		
Yes	92.20	189
No	7.80	16
Disease Specific suffering of the Tannery Workers out of 205		
Skin Problem	48.78	100
Gastrointestinal Problem	39.02	80
Chronic Headache	41.46	85
Eye Problem	21.46	44
Allergies	69.27	142
Diarrhea	2.93	6
Leprosy	0.98	2
Tuberculosis	1.46	3
Respiratory Problem (COPD, Chronic Bronchitis)	30.24	62
Asthma	44.39	91
Fever	12.68	26
Hearing Problem	18.54	38
Cardiovascular Problem (Hypertension, Stroke, Heart Disease)	35.12	72
Musculo- skeletal problem	37.56	77
Neurological disorders	0.49	1
Mental Health Problem (Psychological Problem/Depression/Anxiety)	20.98	43
Renal Problem (Urinary tract Problems)	1.46	3
Trauma/Injury	1.46	3
Loss of Appetite	3.41	7
Sleep Disturbance	15.61	32
Nail Problem	5.37	11
Loss of Smell (Anosmia)	35.12	72

Source: *Field Survey, 2023*

similar percentage (35.12%, n = 72) experienced anosmia (loss of smell), both linked to the inhalation of hazardous substances within the tannery (Table 4).

The risk factors in Table 5 were identified by statistically comparing the likelihood of experiencing health issues across groups of tannery workers with varying characteristics, such as age, sex, and duration of work. This comparison allowed for the identification of specific factors associated with an increased risk of health problems.

Table 6 also reveals a significant disparity in access to medical treatment, as only 47.3% (n = 97) of workers reported receiving medical care, while 52.7% (n = 108) did not, raising serious concerns about the workforce's overall health and well-being. Additionally, only 53.7% (n = 110) had access to on-site healthcare services, leaving 46.3% (n = 95) without any workplace medical facility. Workers expressed frustration over this lack of support, with one stating, "*If we get sick or have an accident, we don't get support—no medical help,"* underscoring the need for improved healthcare access within the tannery environment.

Alarmingly, 27.8% (n = 57) of workers relied on unqualified allopathic providers, such as local drug stores or pharmacies, indicating a lack of standardized medical care. Another 19.5% (n = 40) turned to self-care, family, or neighbors, which may be inadequate for addressing serious health conditions. One worker shared, "*We're left to figure it out ourselves, or ask family and friends*," reflecting the limited options available to many workers. Others sought care from paraprofessionals (15.1%, n = 31), qualified allopathic providers (16.1%, n = 33), and alternative treatments like homeopathy or ayurvedic practices (16.6%, n =

Table 5: Health issues faced by tannery workers and associated risk factors in Hemayetpur, Bangladesh

Factor		Any one health problem frequency (n=189)	No Health problem (n=16)	Percentage (%)	OR	95% CI Lower	95% CI Upper	P-value
Age	<35	68	10	35.98	0.07	0.03	0.16	0.53
	>=35	121	6	64.02	0.07	0.03	0.19	0.62
Sex	Male	116	13	61.38	0.15	0.07	0.33	0.72
	Female	73	3	38.62	0.02	0.01	0.08	0.63
Education	Illiterate	66	6	34.92	0.04	0.02	0.11	0.95
	Literate	123	10	65.08	0.13	0.06	0.29	0.96
Household economic status (year)	Deficient	148	11	78.31	0.22	0.10	0.49	0.87
	Not deficient	41	5	21.69	0.03	0.01	0.08	0.77
Duration of working in the tannery (year)	<7	43	9	22.75	0.05	0.02	0.12	0.33
	>=7	146	7	77.25	0.13	0.05	0.32	0.57
PPE use status of the workers	Yes	162	14	85.71	0.44	0.21	0.94	0.98
	No	27	2	14.29	0.01	0.00	0.05	0.94
Chemicals can cause health problems	Yes	121	14	64.02	0.42	0.21	0.93	0.83
	No	68	2	35.98	0.01	0.00	0.06	0.70
Smoking status	Yes	68	0	35.98	-	-	-	0.36
	No	121	16	64.02	0.21	0.10	0.43	0.52

OR = Odds ratio, CI = Confidence Interval ***Source:*** *Field Survey, 2023*

34). Workers also highlighted the challenges of taking sick leave, with one worker noting, "*If we do take sick leave, our pay for those days is cut*," which discourages workers from seeking proper medical care. These findings reveal a critical gap in healthcare access for tannery workers, with many relying on informal and unqualified healthcare providers due to economic and logistical constraints.

Table 6 further illustrates the health-seeking behavior of tannery workers in Hemayetpur, showing that 52.68% (n = 108) of workers do not seek medical treatment when ill. Only 47.32% (n = 97) reported receiving medical support from their employers, leaving over half without assistance. Even though 53.66% (n = 110) reported the availability of healthcare facilities in their tannery, many workers still resort to informal sources for treatment. One worker shared, *"We rely on friends or family when we can't go to the doctor,"* highlighting the absence of reliable medical support. Specifically, 27.80% (n = 57) rely on local drug stores, while 19.51% (n = 40) turn to family or friends. Only 16.10% (n = 33) receive care from qualified doctors (MBBS), and some workers choose alternative medicine, including homeopathy (16.59%, n = 34) and traditional healers (4.88%, n = 10). A worker noted, *"We can't afford better care, so we go to whoever's nearby,"* underscoring financial and accessibility barriers to formal healthcare. This significant gap in formal healthcare access and reliance on unqualified providers calls for immediate intervention to ensure tannery workers receive proper medical care and protection from occupational hazards. Workers also expressed frustration with the lack of financial support during illness, with one worker stating, *"If I miss work for a health issue, I lose my pay,"* which discourages workers from seeking necessary treatment.

In figure 3, the regression plot illustrates a positive relationship between the duration of working and years

Table 6: Analysis of the health-seeking behavior among tannery workers in Hemayetpur, Bangladesh

Seeking advice or treatment status of the tannery workers		Number of workers (N=205)	Percentage (%)
Receive treatment		97	47.31
Do not receive treatment		108	52.68
Medical treatment supplement to the sick workers by the management	Yes	97	47.32
	No	108	52.68
Availability of health care facility of the tannery	Yes	110	53.66
	No	95	46.34
Health care Provider for the tannery workers	Self-care/Family/relative/Neighbor/friend	40	19.51
	Para-professional	31	15.12
	Qualified allopathic (MBBS)	33	16.10
	Unqualified allopathic (local drug store/ pharmacy)	57	27.80
	Homeopathy/ Ayurvedic / Kabiraj	34	16.59
	Traditional healers (Imam/Ojha etc.)	10	4.88

Source: *Field Survey, 2023*

of health problems. Each blue dot represents an individual observation, showing that as the number of years worked increases, the number of years experiencing health problems also tends to rise. The red regression line, with the equation (y = 0.31x + 1.38), suggests that for every additional year of working, there is an

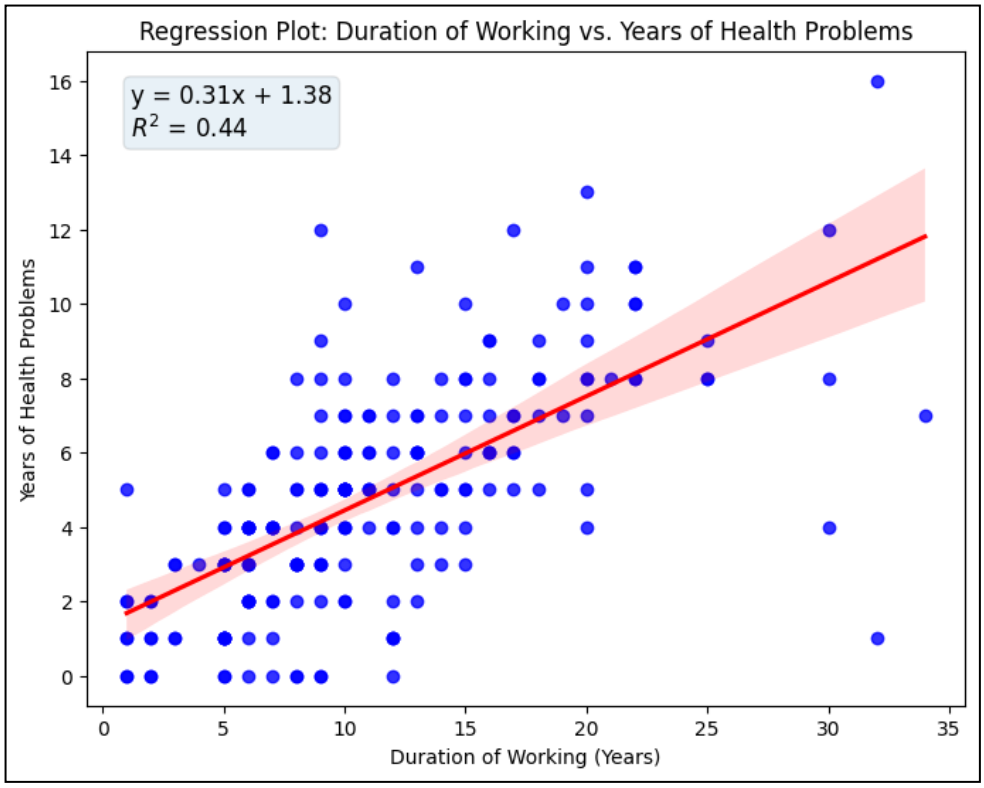

Figure 3: Relationship Between Work Duration and Years of Health Problems

expected increase of 0.31 years of health problems, starting from an estimated 1.38 years of health problems for those with no work experience.

The R^2 value of 0.44 indicates that 44% of the variation in years of health problems is explained by the duration of working, implying a moderate relationship between the two variables. The shaded area around the regression line represents the confidence interval, showing some variability in the data. This suggests that while there is a general trend linking longer work duration to more health issues, other unaccounted factors likely contribute to this relationship.

Discussion

This study underscores the critical occupational health risks in Savar's BSCIC Tannery Zone, with 92.2% (n = 189) of workers reporting at least one health condition, including skin conditions (48.78%, n = 100) and respiratory issues like asthma and chronic bronchitis (44.39%, n = 91). These health concerns are strongly tied to exposure to hazardous chemicals, such as chromium, and inadequate workplace safety measures, such as poor ventilation reported by 66.7% (n = 135) of workers. Despite 85.9% (n = 176) of workers being aware of the dangers of chemical exposure, only 46.3% (n = 95) use personal protective equipment (PPE), highlighting a significant gap between awareness and safety practices. Mental health issues, including anxiety and depression (affecting 20.98%, n = 43), and cardiovascular problems (35.12%, n = 72) further emphasize the toll of this hazardous work environment.

Bangladesh has implemented various policies to address occupational health and safety (OHS), particularly in industries like tanneries. The Bangladesh Labour Act 2006 and its subsequent amendments are pivotal, requiring employers to ensure workplace safety, provide PPE, and maintain a clean, well-ventilated environment. The Bangladesh National Occupational Health and Safety Policy 2013 further mandates health surveillance, risk assessment, and awareness programs. However, this study suggests that these policies are not fully enforced, especially in informal or less-regulated sectors like the tannery industry.

On the international level, Bangladesh is a signatory to the International Labour Organization (ILO) conventions on occupational health and safety, such as ILO Convention No. 155 (Occupational Safety and Health) and No. 170 (Chemicals Convention). These frameworks provide guidelines for managing risks in chemical-intensive industries and ensuring safe working conditions, which are highly relevant to the tannery sector. However, the implementation of these conventions in practice remains weak, as seen in the low PPE usage and inadequate health measures reported by workers.

The findings of this study align with several Sustainable Development Goals (SDGs). SDG 3: Good Health and Well-being highlights the need for improved healthcare, preventive measures, and safer working conditions, given the high rates of occupational diseases among tannery workers. SDG 8: Decent Work and Economic Growth stresses the importance of ensuring safe workplaces and access to protective gear, balancing sustainable economic growth with worker safety and rights. SDG 12: Responsible Consumption and Production is relevant due to the chemical-intensive processes in tanneries, requiring sustainable production practices, proper waste management, and improved worker safety. Additionally, SDG 13: Climate Action is connected to the environmental pollution from tanneries, where better regulatory compliance could reduce the negative impacts on both workers and the environment. Globally, the ILO Conventions and the WHO's Global Plan of Action on Workers' Health (2008-2017) emphasize reducing occupational health risks, which Bangladesh has partially adopted but needs stronger enforcement. The UN Global Compact further promotes corporate responsibility, advocating for the protection of workers' rights and safety, which the tannery industry should align with to meet global ethical standards.

Conclusion

The study's findings reveal significant gaps in enforcing both national policies and international frameworks in the tannery sector of Bangladesh, in particularly considering the workers' health and occupational safety context. While Bangladesh has relevant laws in place, their full implementation is lacking, as evidenced by inadequate PPE usage, poor ventilation, and reliance on informal healthcare providers. To achieve SDG targets and align with ILO standards, stronger enforcement mechanisms, improved worker training, and comprehensive healthcare services are needed. Collaborative efforts between employers, workers, and regulatory bodies will be essential in ensuring safer and healthier working environments for tannery workers in Bangladesh.

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