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Physical Work Environment, Sick Building Syndrome and Mental Health of Factory Workers

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Abstract

The current study is aimed at exploring the relationship between physical work environment, sick building syndrome and mental health of factory workers. Sample of the study consisted of (N =300) men and women factory workers by using purposive sampling technique. It was hypothesized that there will likely to be a relationship between physical work environment, sick building syndrome and mental health of factory workers, Physical work environment will likely to be a predictor of mental health. Further it was hypothesized that Sick building syndrome will be a mediator between physical work environment, and mental health of factory workers. Other hypothesis was that Female will likely to be higher on physical work environment, sick building syndrome and mental health than males. Descriptive statistics were calculated to assess means, standard deviations and frequencies of the variables. Pearson product moment correlation was used to find out relationship among work environment, sick building syndrome and mental health and hierarchical regression was used for prediction. The mediating role of variables was assessing through Process Macro. Independent sample t test was used to analyses the gender differences among study variables. Physical Work Environment Scale (PWES) (Erikson, 1999), Sick building Syndrome Survey Questionnaire (SBSSQ) (Israeli & Pardo, 2011), and Subjective well-being Scale (SWBS) (Stone & Christopher, 2013) were used for assessment. The result indicated that Physical Work environment had a negative relationship with sick building syndrome and mental health of factory workers. Indoor air quality had a negative relationship with mental health of factory workers. All the other dimensions of physical work environment (Lighting, ergonomics and acoustics) had a positive relationship with mental health of factory workers. Physical Work environment

had a positive predictor of mental health of factory workers. Sick building syndrome had a negative predictor of mental health of factory workers. Demographic variables (age, gender, family system, number of children, region) were predictor of mental health. Sick building syndrome had a mediator between physical work environment and mental health of factory workers. Sick building syndrome had a mediator between dimension of physical work environment (indoor air quality, ergonomics and lighting) and mental health of factory workers. Females were high on physical work environment, sick building syndrome and mental health than male. This research can provide help for managers understanding multi dimensions of environment of work and impact of dimensions on employee for job satisfaction. This research can also understand the work environment of employees. It helps organizations to create effective work environment.

Keywords: Physical work environment, sick building syndrome, mental health, factory workers.

1. INTRODUCTION

In the current age, organizations are fronting numerous challenges due to the energetic nature of the environment. One of the several difficulties for a occupational is to loosen up its representatives at work to adjust the constantly shifting and proceeding complaint and to make improvement and stay in competition. To expand ability, competence, productivity and profession duty of representatives, the business must accomplish the requirements of its representatives by charitable countless working circumstances (Raziq, 2015). The environment of indoors should be kept up its quality for inhabitants and occupants' wellbeing. Poor indoor ecological quality (IEQ) is frequently accused for causing wiped out structure disorder. Indoor air quality lessens individual's capacity to react to the requests of the earth, which regularly prompts exhaustion, discomfort, nervousness, cerebral pains, mental perplexity, decreased mental and physical execution or low emotional well-being. Word related pressure has been observed to be associated with side effects of the debilitated structure disorder. Work-related strain has been originated to be associated with indications of the old building disease. Labors account additional symptoms when they also account high occupation strain, low job fulfillment, low satisfaction and deprived mental state with office ecological circumstances (Zweers et al., 1992). Moreover, numerous investigations of the sick building syndrome (SBS) among office specialists and library staff have appeared of non-natural factors on side effect reports. Impacts of individual elements, for example,

laborer's sex, have been found with ladies announcing a larger number of indications of Sick building disorder than men doing practically identical work in a comparable setting (Menzies et al., 1999).

1.1 Physical work environment

The physical work environment can be inclined by a varied variability of elements or foundations of substantial things and stimuli. In the working environment surrounding properties, for example, commotion can emerge from sources, for example, phones, representative discussions or clamors produced by modern hardware (for example building destinations, production lines) (Raffaello and Maass, 2002). Worries with temperature may emerge in office situations yet additionally exist for specialists utilized in outside workplaces who are presented to extraordinary climate conditions (for example angling or assets industry). Indoor air quality is a mind-boggling issue where issues may emerge from poisons or scents (organic, substance or molecule) or imperfections in structure ventilation frameworks (EPA, 1998). In any case, representatives who work in outside modern locales may likewise confront air quality issues from synthetic and residue introduction. According to Secretariat of Public Services (SPS) and Statistics Agency of Labrador and Newfoundland (SANL) (2007), physical work environment comprised of different factors among them, first factor is Inside air excellence (IAE) that has a straight influence on employees' well-being grumbles and on their job routines (Dalbokova and Krzyzanowski, 2002). Second is Lighting at the workplace, third is the factor that determined that in what way to progress the fit among the corporeal stresses of the workplace and the labors who complete that work and fourth factor is the acoustics that determined the noise level in the building(Feare, 2001). Physical work environment includes illumination, temperature, cleanliness, and distance etc. early most of the research work in this domain is done by Hawthrone in 1920s and 30s, at that time it was believed that physical environment produce impact on the productive behaviors of the employees, the results of Hawthorne studies were opposite to this expectation and indicate little of physical environment on employee's productivity (snow, 1999). Therefore, other researcher lost their interest in this domain and their attention diverted to the social factors like relation among supervisor, peers etc (Mayo, 2000).

1.1.1 Dimensions of Physical work environment

1.1.1.1 Indoor air quality. Indoor air quality (IAQ) directly affects laborers' wellbeing grumblings and on their activity exhibitions (Dalbokova and Krzyzanowski, 2002). A decent

IAE improves generation characteristics and expands laborer efficiency by keeping up a stimulating workplace (Martin, 1999). A decent IAE advances advanced fulfillment of inward and outside clients (Perry, 2001). The associations between the site, atmosphere, building framework, development systems, chemical basis and defendants are the elements that influence the nature of indoor air. In 2009, the World Organization Health (WHO) arranged a report on Global Health Risks. This report recommended that indoor air contamination oversees 2.8% of the worldwide weight of ailment. Higher extent of people giving indoor ecologically related indications, (for example, Sick Building Syndrome) are newborn children, the old, individual with ceaseless ailment and most urban inhabitants of all ages.

1.1.1.2 Lighting. Although consuming vitality preservation with a reasonable illumination framework, the monetary advantages of the vitality proficient structure, for example, the diminished glare and right enlightenment power might be altogether more prominent than just energy- cost investment funds (Sullivan, 1995). As indicated by the investigation of the Lawrence Berkley Laboratory in California, 30- 50 percent of the vitality expended in the business structures is utilized for illumination. The illumination spending plan is 90 pennies for every square foot, contrasted with $30.00 per square foot for laborer's expense in the places of business. Along these lines, while upgrading the lighting framework; consideration must be paid to the approaches to expand the execution of the representatives. The examinations done by various affiliations show that there is critical relationship be tween's lighting frameworks and laborers' effectiveness (Tatum et al., 1995). Right work environment lighting adds to bring down specialist non-appearance, advanced excellence and wellbeing enhancements (Tooling and Production, 1997; Occupational Hazards, 2000).

1.1.1.3 Ergonomics. The ergonomics in the work environment has been depicted as every single material item and boosts that representatives associate with in their working lives (Elsbach and Pratt, 2007). Material articles can be seen at both the full scale (for example structures) and miniaturized scale levels (for example goods and office courses of action). Improvements incorporate the conditions under which representatives work, for example, the lighting and temperature. Ergonomics builds efficiency and to diminish medical issues of inside clients. On the off chance that you don't give a decent workplace to representatives, the finest may dispensation at the primary chance. Purchasing the best-suitable mechanical assembly, equipment and instruments isn't sufficient; workers

additionally should be prepared on the most proficient method to utilize these merchandise (Sullivan, 1995; Feare, 2001).

1.1.1.4 Acoustics. In spite of there being no measurable information on the distinct connection among commotion level and productivity in the writing, auditory range specialists and some structure administrators demand this subject. Fundamental advances are taken to keep the commotion level surpassing a foreordained an incentive as per the sort of the activity done. In any case, there are conclusions that the endeavors for diminishing the commotion level are a bit much on account of the high ability of individuals to adjust to troublesome conditions (Sullivan, 1995).

1.2 Sick building syndrome

The sick building syndrome (SBS) has been became the issue of thoughtful systematic investigation only in the previous 10 years. It is normally recognized to signify eye, nose, and throat crossness; pains, weariness, trouble directed, and on sometimes shakiness; sickness, chest rigidity; and other indications. Indication proposes that what is called the SBS is at minimum three distinct objects, every of which has minimum one reason (Apter, et al, 1994). 'Old building disease' is the reason of apparently high occurrence of illness in the middle of inhabitants of impenetrable, instinctively publicized office block. On the foundation of conveyed belongings, there seems to be no solitary reason but a chain of causal aspects (Skakon et al., 2010). It is also termed as building related illness, which is related to the man-made eco-system (Menzies & Bourbeau, 1997). The inside hotness disturbs numerous mortal reactions, comprising updraft luxury, apparent air excellence, SBS indications and presentation at exertion. It is summarized that discoveries uncovered that individuals will be people and can respond contrastingly to various ecological conditions especially if they have previous asthma or another medicinal condition or on the off chance that they are only delicate to an indoor poison. The most ordinarily revealed side effects of wiped out building disorder are identified with skin aggravation, eye disturbance, respiratory manifestations, subjective dissensions, queasiness, dormancy and the side effects of presentation to other natural reasons for sick wellbeing. There is a wide assortment of indications of debilitated building disorder because of there being a wide assortment of foundations for workers encountering sick wellbeing when in a structure. Variables that take be situated distinguished to cause debilitated building disorder side effects incorporate the natural components of temperature, dampness, enough airing, audio solace and illumination. The manifestations produced by these natural components are normally eased when the

inhabitant greeneries the structure. Manifestations triggered by structure interrelated substance and natural dangers can source whichever here and now or long-haul wellbeing impacts that don't generally tenacity when the tenant greeneries the building

An examination was directed by Emilia (2017) to manage the affiliation concerning (SBS) and other natural components adding to plausible psychological wellness issues among college lab staffs. Altogether, about 30% of the members revealed having plausible emotional wellness issues. The predominance of SBS was 35.4%. In the wake of controlling for confounders, the critical components for plausible emotional well-being issues were work instability, sluggishness, weariness, work request. Results additionally demonstrated that psychosocial variables and indications of SBS at their workplace add to plausible emotional wellness issues among research facility staffs. The most grounded indicators in this examination were work uncertainty. Another study was accompanied by Wijerathne et al. (2012) to see the sick building syndrome in workplace employees. Outcomes demonstrated that inhabitants in three places of business bore numerous normal manifestations while working in same premises in same planning design. Further, discoveries demonstrated that three places of business that are as of now influenced with wiped out structure characteristics have in certainty conformed to existing Indoor Environment Quality benchmarks. Harrison (1992) conducted a study to see connection between the symptoms of old office block disease and environmental problems. The results indicated that the main symptoms dominant was tiredness (56%), smoky nose (50%), dehydrated gullet (45%), worry (40%), and itching eyes (30%). The most collective external airborne linked indications stated by the certain residents were tiredness (50%), irritating, boiling, or frustration of eyes (45%), pain (40%), as well as throaty or dry gullet (35%). The most collective environmental difficulties reported that had happened throughout previous two weeks remained deprived, air feature (65%), and current distress (40%). This conclusion was originated to be reliable with the outcomes in studies founded on diverse types of samples (Jakkola, 1991).

1.2 Mental health

The work environment is one of the crucial circumstances that effect our psychological success and happiness. There is an assertion and emerging familiarity with the job of effort in proceeding or impeding psychological health and its product – psychological sickness. Even though it is hard to estimate the consequence of work unaccompanied on close to home behavior, self-assurance and social greeting, most psychological wellness

professionals agree that the work atmosphere state can significantly affect a person's psychological prosperity. A few elements at a work environment can advance representatives' psychosocial prosperity and psychological well-being. Particularly critical in this regard is the chance to be incorporated into arranging and completing exercises and occasions in the work environment (for example the chance to choose and act in one's picked way and the possibility to anticipate the outcomes of one's activity). A related element is how much the earth energizes or represses the use or advancement of abilities. Physical security, open door for relational contact, and fair pay are likewise vital (Geneva, 2000). Concentrates from the field of ecological brain research demonstrate that there is potential for the physical workplace to effect on the mental soundness of representatives. For instance, network ponders have demonstrated that issues, for example, commotion and packing consequence in manifestations of deprived mental wellbeing (Taylor and Repetti, 1997) and medicinal examinations have appeared persistent results expand when they consume openings with wildlife acts or presentation to characteristic illumination (Choi et al, 2012). The WHO (2010) exemplifies expressive wellbeing is a state of success in which an person realizes his or her own capacities, can familiarize to the everyday uncertainties of life, can work profitably and can make a obligation to his or her locale. In this optimistic logic, psychological wellness is the establishment for individual prosperity and the successful working of a network (WHO, 2010). There is proof to propose that mental wellbeing ought to be founded on the nearness of positive side effects, for example, prosperity and the nonappearance of negative indications (Boudrias et al., 2011; Masse et al., 1998). Be that as it may, the more generally acknowledged term for ideas connected to mental wellbeing (for example stress, tension, and despondency) is psychological wellness. Mental wellbeing at work is an imperative subject of examination since

Objectives of the study

Specifically, the main objectives of this research are:

1. To explore the relationship between physical work environments, sick building syndrome and mental health.
2. To find out the symptoms of Sick building syndrome (nausea, tiredness, cough, eye and nose irritation, painful throat or headache) in factory workers.
3. To find out mediating role of sick building syndrome between dimensions of physical work environment and mental health.
4. To find out the predictors of mental health.

5. To find out gender differences on physical work environment, sick building syndrome and mental health.

The present research begins with an examination of the literature pertaining to physical work environment. Second, it highlights the conceptual framework which includes the explanation of the conceptual model, determinants and hypotheses. Third, it discusses the methodology adopted. Fourth, it highlights the inferential statistical analyses which include Pearson's correlation, hierarchical and mediated regression analyses and independent sample t test. Finally, conclusions and implications of the study are provided, and a set of future research directions is examined.

2 Literature review

The previous studies on work environment, sick building syndrome and mental health have been summarized in the following literature review.

Ling (2014) directed an examination is to survey emotional well-being of the specialists and to investigate the relationship among physical and psychosocial workplace and laborers' psychological wellness in South China. Around three of every ten specialists (36.2%) in the example had poor mental prosperity. The individuals who were men, more youthful in age, or vagrant specialists had more awful mental result in bivariate investigations. In the wake of controlling for individual factors (sexual orientation, age, conjugal status, and family unit enrollment), we found that more extended week after week work hours more presentation to perilous workplace, higher occupation requests, and lower work independence were critical related with more terrible mental prosperity.

Another study was conducted by Standsfeld (2006) to investigate the relationship between work environments job strain and mental health. A meta-investigation of psychosocial work stressors and regular mental disarranges was embraced utilizing longitudinal examinations distinguished through an efficient writing survey. The outcome uncovered that Job strain, low choice scope, low social help, high mental requests, exertion remunerate lopsidedness, and high occupation uncertainty anticipated normal mental scatters despite the heterogeneity for mental requests and social help among men. The most grounded impacts were secured for position strain and exertion compensate unevenness.

Furthermore, study was conducted by Azmi (2015) to see the relationship between inside air excellence and old building disease between library staffs. This investigation was absorbed to overwhelm the fitness difficulties between residents in a factory that was

pretentious by air excellence structure of the building. Fifty-four staffs of the library had responded to self-administered questionnaire of commonly reported signs of SBS such as irritation in eyes and nose, cough, exhaustion, biliousness, pain and painful gullet. There was prevalence of SBS in the building (72.2%) and of all the reported symptoms, headache, dizzy and heavy headache was the most reported symptoms in this study (59.2%). There were also significant correlations between IAQ parameters and SBS symptoms.

Additionally, an examination contemplates directed by Hedge (1989) demonstrated that the SBS is the result of complex procedures started by a lot of upsetting different dangers which make individual strain. Concentrate on wiped out structure disorder has demonstrated that 80 percent had SBS indications and just 4 percent of individuals in cooled structures feel that they have any command over ventilation and over temperature, contrasted and 33 percent and 17 percent, separately, in normally precisely ventilated structures. Mental factors and identity characteristics may assume a noticeable job in working environment related disarranges like wiped out structure disorder.

Shea et al. (2011) led an examination to explore the effect of the physical workplace on mental wellbeing in representatives. The consequences of this audit uncover that there is just restricted proof of a connection between the physical workplace and mental soundness of representatives. In research where a relationship has been recognized, most connections were frail and for the most part found between composite proportions of the physical workplace (for example temperature, commotion, swarming) and mental factors, for example, stress and tension. The physical workplace was commonly not found to effect on mental wellbeing, when mental wellbeing has been estimated as far as despondency, burnout.

Kogi (1997) found that joined ecological presentation and indoor air quality are one of the top rising issues of word related and natural wellbeing among fifteen Asian-Pacific nations being overviewed. Also, temperature, especially heat, is positioned first as the most vital word related medical issue which is adjusted Hole and Pande's discovering (Hole and Pande, 2009).

To sum up the literature, there are many factors studied relating to mental health such as emotional intelligence, attachment styles, religiosity, communication patterns and conflict resolution skills. Demographic variables were also studied that can effect on work stress and mental health. Some qualitative studies were also conducted. There is a numerous work on work stress and mental health with work environment internationally but no work on sick building syndrome, so a lot of work needs to be done on this issue indigenously. There is a

numerous work on mental health with relation to social adjustment, depression, distress, work stress, organizational commitment and in last few years in Pakistan as well as in western countries. But there is no adequate research done on these variables as a combined entity, that's why the goal of this study is to investigate the relationship between work environment, sick building syndrome and mental health of factory workers.

3 The Conceptual Framework: The Conceptual Model and Hypotheses

3.1 The conceptual model

This section explores linkages between physical work environment and its dimensions, sick building syndrome and mental health of factory workers. The primary purpose of the research was to measure the working conditions of the workers where they work that can influence mental health. The proposed model, as depicted in Figure 1, is based on three main constructs- (i) physical work environment, (ii) sick building syndrome, (iii) mental health. The physical work environment is the independent variable, sick building syndrome is mediating, and mental health is dependent variable. The conceptual framework shown here highlights the linkages between these main constructs. The framework consists of six important dimensions of work environment, indoor air quality, lighting, ergo nomics and acoustics.

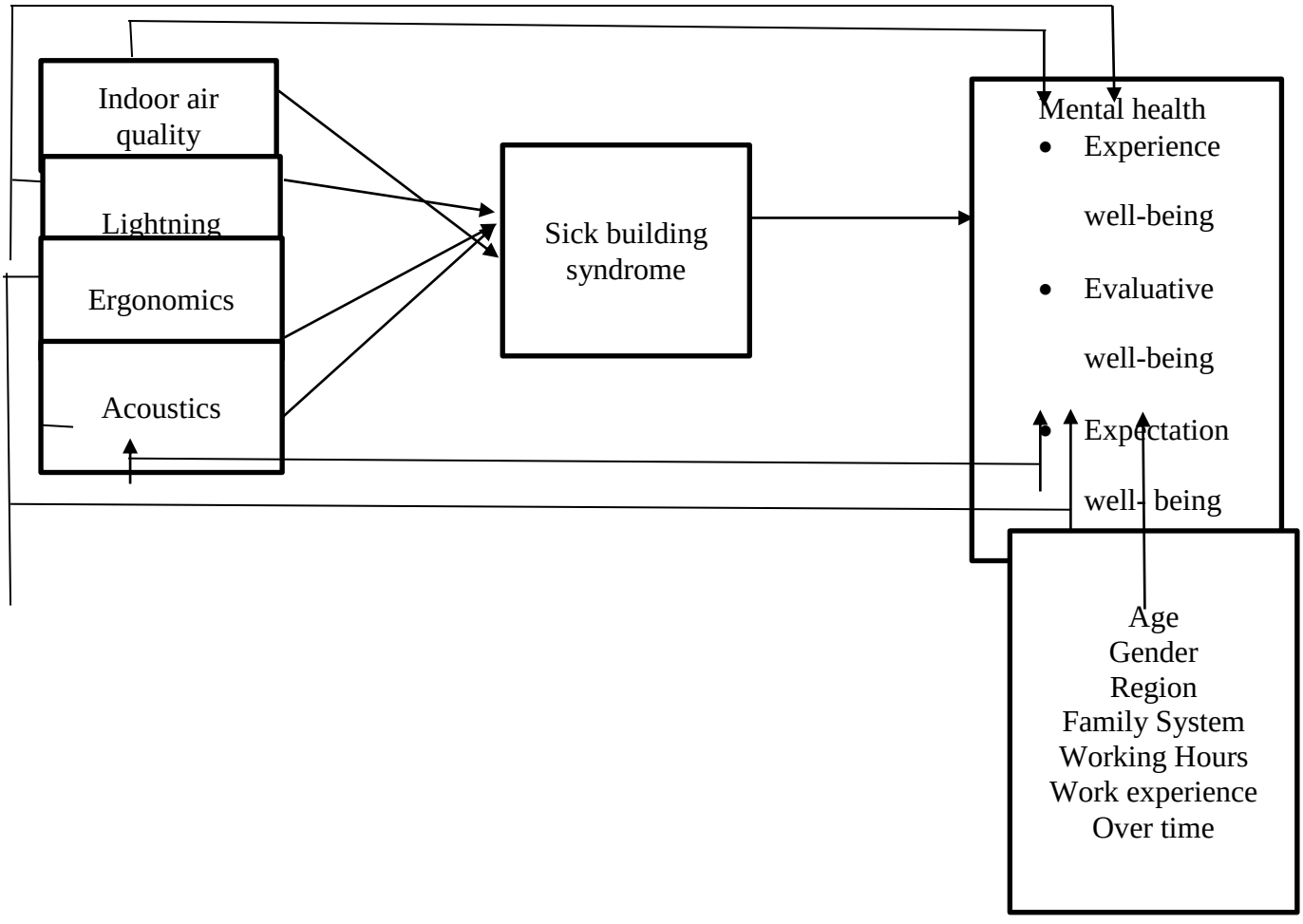

Figure 1. The conceptual model showing the relationship between physical work environment and its dimensions, sick building syndrome and mental health of factory workers.

3.2 Hypotheses

- There will likely to be a negative relationship between physical work environment, sick building syndrome and mental health of factory workers.
- Physical work environment will likely to be a negative predictor of mental health of factory workers.
- Sick building syndrome will be a mediator between physical work environment, and mental health of factory workers.
- Sick building syndrome will be a mediator between dimensions of physical work environment, and dimensions of mental health of factory workers
- Demographic variables (gender, age, marital status, and working hours) will likely to be the predictor of mental health of factory workers.
- Female will likely to be higher on physical work environment, sick building syndrome and mental health than males

4 .RESEARCH METHODOLOGY

This section highlights the research design and research sample.

4.1 Research Design

The study was aimed at assessing the relationship between physical work environment, sick building syndrome and mental health of factory workers. This study focused on how physical work environment and the conditions where the workers where they work lead toward sick building syndrome and how mental health is influenced by these working conditions and sick building syndrome. Correlational between group designs was used in the study. Three questionnaires were administered. Work environment scale was used to assess their work place condition where they work. Work environment scale has 17 items and consists of four subscales that assess indoor air quality, lighting, ergonomic, and acoustics. The items are measured on five-point likert scale 1= completely agree, 2=Agree with, 3=Undecided, 4= don't agree, 5= don't completely agree (Erikson, 1999). The reliability coefficient of this scale is .73. Sick building syndrome questionnaire was used to assess the symptoms and perception of the physical and psychosocial environment, inspection of the building plans and premises, and measurement of temperature, relative humidity, reparable particles, chemicals,

and bio aerosols. It consist on 10 items and these items are measured on 3 point likert scale 0 = no, -never', 1= 'yes, sometimes', and 3='yes, often' (every week). The reliability coefficient of this scale was .79 (Israeli & Pardo, 2011). The subjective well-being scale, SWBS is a 20 items scale and used to measure mental health of occupants. Response categories are 0= did not experience at all, to 6 = the feeling was extremely strong. The reliability coefficient of this scale was .91. The participants were instructed to mark only one option against each item that best reflect their feelings. Tool time or total time to assess the participants was 15 to 20 minutes. Regarding inclusion criteria both male and females were included. Participant with at least one or more than one year of experience were included. Both married and unmarried were also included. Participants diagnosed with psychological or physical illness were excluded because their illness can affect the results.

4.1 Research Sample

The sample was comprised of (N=300) including males (N=150) and females (N=150) factory workers. The study was a quantitative research utilizing primary data collection. Due to the limitation of the non-existent sampling frame for this type of research, the study adopted a purposive sampling technique. The sample unit of analysis in this study was individual and data were collected from factory workers of different factories of Lahore. Data of three hundred individuals were collected through structured questionnaire by using five point likerst scales and the associations were analyzed through statistical methods such as Descriptive statistics were taken to estimate mean and standard deviation of demographics (age (in years), gender (male, female), Marital status (Married, Unmarried), family system (joint, nuclear), nature of work, monthly income overall work experience, work experience in this factory, working hours, and over time. Pearson product moment correlation was used to find relationship between physical work environment, sick building syndrome and mental health of factory workers. Hierarchical regression, analysis was used for prediction and Independent, sample, t test was used to analyse the difference in male and female factory workers.

5 . ANALYSIS AND RESULTS

The findings of the present research are presented for physical Work environment, sick building syndrome and mental health of factory workers. For this purpose, quantitative data was collected through survey method. After data collection, data was analyzed through SPSS 21. v to reveal the results. The data was evaluated in six key steps. In the first step, Descriptive statistics were taken to estimate mean and standard deviation of demographics

(age (in years), gender (male, female), Marital status (Married, Unmarried), family system (joint, nuclear), nature of work, monthly income overall work experience, work experience in this factory, working hours, and over time. In the second step reliability analysis was conducted to assess the consistency for each scale and Cronbach's alpha for the scales were reported. In the third step, Pearson product moment correlation was applied to assess the relationships among variables and study variables. In the fourth step, mediation analysis was conducted to see the sick building syndrome as a mediator between physical work environment and mental health. In the fifth step, hierarchical regression analysis was conducted to find out the predictors of mental health. In the sixth step independent sample t-test was used to assess the differences among study variables in males and females.

5.1 Descriptive statistics

Table 1 Descriptive statistics of demographic characteristics of study sample (N=300).

Characteristics	*f (%)*	*M*
Age		37.98
Monthly income		23276.33
Work experience in this factory		21.63.23
Overall work experience		3.50
Working hours per day		2.14
Over time		2.39
Gender		
Male	151 (50)	
Female	149(49.3)	
Family system		
Joint	245 (81.1)	
Nuclear	55 (18.2)	
Marital status		

Married	162(53.6)
Unmarried	138(45.7)
Region	
City	155(51.3)
Village	145 (48.0)

Note. Gender (female=1, male=2), Marital status (married=1, unmarried=2) , Family system (joint=1, nuclear=2), Region (city= 1, village=2).

The results of mean and standard deviation revealed that the mean and standard deviation of age was 37.98 (5.10), monthly income 23276.33 (6514.03), work experience 9.23 (2.42), working hours per day 2.14 (1.08), over time 2.39 (1.07), 50% individuals were male, and 50% participant were females. 81% persons were in joint family system and, 19% were in nuclear family system. 53% participants were married and 47% were unmarried, 51% were belong to city and 49 were from village.

5.2 Reliability Coefficients of the scales used in the study.

Table 2: Results of *Reliability Analysis of the Scales (N=300).*

Note. *k = No of items, α = Cronbach's alpha. M = Mean, SD = Standard deviation*

					Scoring Range	
Variables	***K***	***a***	***M***	***SD***	**Potential**	**Actual**
Physical Work environment	17	.70	47.99	21.47	5-85	14-112
Indoor air quality	5	.63	14.31	3.15	5-25	6-24
Ergonomics	6	.77	15.79	5.23	5-30	1-15
Acoustics	6	.70	17.89	17.94	5-30	1-15
Sick building syndrome	10	.72	19.43	4.65	3-30	3-27
Mental health	20	.73	67.28	12.72	7-140	30-67

The result of reliability shown mean and standard deviation of the present study. It also depicted internal consistency index (alpha coefficient) for all scales used in this study. The

results showed that all scales of the present study are internally consistent as alpha coefficient of all scales are above .70.

5.3 Correlation Analyses

Table: 3 Pearson's Correlations among demographics variables in factory workers (N=300)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	-	-.00	.07	-.18**	.00	.14*	.32**	.00	.03	.05	-.15**	.03	.23**
2. Gender		-	-.00	-.02	-.16*	.02	-.10	-.05	-.14*	-.20**	-.21**	-.37**	-.19**
3. Marital status			-	-.00	.000	-.010	.53	-.07	.02	.01	-.08	-.16**	-.15**
4.Family system				-	-.08	-.03	-.05	.01	.16**	-.03	.14*	-.02	.00
5. Region						-	.03	-.01	.06	.02	-.10	-.04	.21**
6. Work experience							-	.07	.13*	.-00	.13*	.21**	.14**
7. Monthly income								-	.06	.05	.04	-.01	.60
8. Working hours per day									-	.21**	.01	.00	-.19**
9. Over time										-	.06	.09	.04

10. Work environment								- .52*	- .14**	-
11.Sick building syndrome									- .29**	
12. Mental health										-

Note: *p<.05, **p<.01, ***p<.001. Gender (female=1, male=2), Marital status (married=1, unmarried=2), Family system (joint=1, nuclear=2), Region (city= 1, village=2)

Correlation matrixes showed that among demographics age, gender, marital status, was negatively correlated with physical work environment and family system, and work experience are positively correlated with physical work environment whereas region, work experience, monthly income, over time, working per hour was not related to physical work environment. Gender, marital status, was negatively correlated with sick building syndrome and number of children, and work experience are positively correlated with sick building syndrome whereas age, family system, monthly income, working hour per day, region was showing no correlation with sick building syndrome. Age, region and work experience are positively correlated with mental health and gender marital status, number of children and working hours are negatively correlated with mental health whereas, family system, monthly income and over time are not correlated with mental health. Physical Work environment are negatively correlated with sick building syndrome and mental health. Sick building syndrome also negatively correlated with mental health.

Table 4 Correlations among physical work environment it's dimensions, sick building syndrome and mental health of factory workers (N=300)

Variables	1	2	3	4	5	6	7	8	9	10
1.Physical Work	-	.18**	.70**	.63**	.92**	- .52**	-.14**	.39**	.04	- .25**

environment									
2. Indoor air quality	-	.02	-.05	-.06	.16**	-.15**	.03	-.14*	-.19*
3. lightning		-	.39**	.53**	.47**	.21**	.42**	.92	-.19**
4.Ergonomics			-	.46**	.53**	.20**	.53**	.14**	-.40**
5. Acoustics				-	.36**	.12*	.24**	.03	-.97
6. Sick building syndrome					-	- .29**	- .62**	-.20*	- .39**
7.Mental health						-	.71**	.83**	.35**
8.Experience							-	.56**	.38**
9. Evaluated									.03
10. Expected									-

Note: *p<.05, **p<.01, ***p<.001.

Correlation matrixes showed that physical work environment negatively correlated with sick building syndrome and mental health. Results also showed that dimensions of physical work environment (indoor air quality, lightning, ergonomics and acoustics) have a positive relationship sick building syndrome. Dimension of physical work environment (indoor air quality is negatively correlate with mental health where as other dimensions of physical work environment (lightning, ergonomics and acoustics) have are correlation with mental health. Results also showed that dimensions of physical work environment (lighting, ergonomics and acoustics are positively correlated with experiential well-being and indoor air quality have no

relationship with experiential well-being. Indoor air quality is negatively correlated with evaluated well-being and ergonomics have a positive correlation with evaluated well-being whereas lightning and acoustics have no correlation with evaluated well-being. The results also showed that all the dimensions of physical work environment (indoor air quality, lightning, ergonomics and acoustics have negative correlation with all the dimensions of mental health (experiential, evaluated and expected). Sick building syndrome is negatively correlated with physical work environment and mental health. Sick building syndrome also negatively correlated with all the dimension of mental health (experiential well-being, expected well-being and evaluated well-being).

5.4 Hierarchical Regression Analysis Predicting Mental health from Demographic variables and physical Work environment and sick building syndrome in factory workers

Table 5. Results of hierarchical regression analysis predicting mental health from demographics variables and physical Work environment and sick building syndrome in factory workers (N = 300)

		Mental Health
Variable	ΔR^2	β
Step I	.26***	
Control variables		
Age		.45***
Gender		-3.5*
Family system		3.2*
Region		4.5*
Monthly income		-5.5
Work experience		1.01*

		Mental Health
Variable	ΔR^2	β
Working hours		-2.71***
Over time		.63
Step II	.28**	
Physical Work environment		.10**
Step III	.31***	
Sick building syndrome		-.55***
Total R^2	.85***	

Note.**p*<.05,***p*<.01,****p*<.001.

The outcome was showed that psychological health was regressed on demographic variables of age, gender, household system, number of children, region, monthly income, work experience, working hours, over time in first step, and physical work environment was added in second step as independent variables. Sick building syndrome was added in the third step. In the first step, demographics of age, household system, region and work experience were significant and was positive predictor of mental health. Gender, number of children, working hours, was significant and negative predictor of mental health. Monthly income and over time did no significant and not predicts mental health and this model succeeded in explaining significant variance of 26% in mental health with F (9, 225), p<.001. In second step, age, family system, region, work experience, was significant positive predictor of mental health and gender; number of children, monthly income and working hours per day are negative predictor of mental health. In this step monthly income and over time was not predictor of mental health. Physical work environment was significant and positively predicts mental health and this step succeeded in explaining significant variance of 28% in mental health with

F (10, 224), P<.001. In third step age, family system, region, was positively predict mental health whereas gender, number of children, working hours and sick building syndrome was negative predictor of mental health. Monthly income, work experience, over time and work environment was not predict psychological health and the model was succeeded in illuminating significant variance of .31% in mental health with F (11, 223), p<.001.

5.5 Investigating the Mediating Effect of Sick building syndrome In the Linkage Between work environment and mental health: A Regression-Based Mediation Analysis

Table 6 Result Direct and Indirect Effect of physical work environment through sick building syndrome on mental health (N = 300*)*

Outcome	Predictors	Direct Effect				Indirect effect			
				95% CI				95% CI	
		β	SE	LL	UL	*β*	SE	LL	UL
SBS	PWE	.17***	.02	.15	.21				
MH	SBS	.58***	.13	.33	.83	.10***	.03	.05	.18
	PWE	-.01	.04	.09	.08				
	Total effect	.09**							

Note: PWE = *physical Work Environment; SBS =Sick Building Syndrome; MH =Mental health*

Sobel's Z test = 4.18

***p<.001

Physical work environment (independent variable) predicted mental health (dependent variable, *ß =.09, p<.001)* which is total effect. Physical Work environment predicted sick building syndrome (mediator, *ß=.17, p<.001).* Physical Work environment and sick building syndrome predicted mental health *(ß=-.0, p >.001)* and (ß=.60, p<.001) connectively. This suggests that sick building syndrome significantly mediated the relationship between physical work environment and mental health. Further the effect mediation was determined as the indirect effect of physical work environment on mental health through sick building

syndrome was noteworthy *(Sobel's Z=4.18, p<.001)* and its 95% confidence interval did not contain zero.

Table 7: Results of Direct and Indirect Effect of indoor air quality through sick building syndrome on mental health (N = 300)

Outcome	Predictors	Direct Effect				Indirect effect			
				95% CI				95% CI	
		β	SE	LL	UL	*β*	SE	LL	UL
SBS	IAQ	.24**	.08	.07	.40				
MH	SBS	.64**	.10	.42	.84	.15***	.06	.04	.28
	IAQ	-.59**	.16	-.90	-.28				
	Total effect	-.43**							

Note: IAQ= *Indoor Air Quality; SBS =Sick Building Syndrome; MH =Mental health*
Sobel's Z test = 2.54
***p<.001

Indoor air quality (independent variable) predicted mental health (dependent variable, *ß =-.43, p<.001)* which is total effect. Indoor air quality predicted sick building syndrome (mediator, *ß=.24, p<.001).* Indoor air quality and sick building syndrome predicted mental health *(ß=-.59, p >.001)* and (ß=.46, p<.001) connectively. This suggests that sick building syndrome significantly mediated the association between indoor air quality and mental health. Further the effect mediation was determined as the indirect effect of indoor air quality on mental health through sick building syndrome was noteworthy *(Sobel's Z=2, 54, p<.001)*

Table 8: Results of Direct and Indirect Effect of lightning through sick building syndrome on mental health (N = 300).

Outcome	Predictors	Direct Effect		Indirect effect	
		95% CI		95% CI	

		β	SE	LL	*β*	SE	LL	UL
		UL						
SBS	Lightning	.72**	.09	.53				
		.91						
MH	SBS	.47**	.12	.22	.34**	.11	.15	.59
		.72						
	Lightning	.31**	.20	.09				
		.72						
	Total effect	.65**						

Note: L= *Lightning; SBS =Sick Building Syndrome; MH =Mental health*

Sobel's Z test = 3.33

***p<.001

Lightning (independent variable) predicted mental health (dependent variable, *ß =.65, p<.001)* which is total effect. Lightning predicted sick building syndrome (mediator, *ß=.72, p<.001).* Lightning and sick building syndrome predicted mental health *(ß=.31, p >.001)* and (ß=.47, p<.001) connectively. This suggests that sick building syndrome significantly mediated the association between lightning and mental health. Further the effect mediation was determined as the indirect effect lightning of on mental health through sick building syndrome was noteworthy *(Sobel's Z=3.33, p<.001).*

Table 9: Results of Direct and Indirect Effect of ergonomics through sick building syndrome on mental health (N = 300)

Outcome	Predictors	Direct Effect				Indirect effect		
				95% CI			95% CI	
		β	SE	LL	*β*	SE	LL	UL
		UL						
SBS	Ergonomics	.77***	.08	.61				
		.93						
MH	SBS	.50**	.13	.23	.39***	.04	.18	.64
		.77						
	Ergonomics	.17	.18	-.18				
		.52						

	Total effect	.56**							

Note: E= *Ergonomics; SBS =Sick Building Syndrome; MH =Mental health*

Sobel's Z test = 3.43

***p<.001

Ergonomics (independent variable) predicted mental health (dependent variable, *ß =-.56, p<.001)* which is total effect. Indoor air quality predicted sick building syndrome (mediator, *ß=.77, p<.001).* Ergonomics and sick building syndrome predicted mental health *(ß=-.17, p >.001)* and (ß=.50, p<.001) connectively. This suggests that sick building syndrome significantly mediated the association in ergonomics and mental health. Further the effect mediation was determined as the indirect effect of ergonomics on mental health through sick building syndrome was noteworthy *(Sobel's Z=3.43, p<.001).*

Table 10: Results of Direct and Indirect Effect of acoustics through sick building syndrome on mental health (N = 300)

Outcome	Predictors	Direct Effect				Indirect effect			
				95% CI				95% CI	
		B	SE	LL	UL	*B*	SE	LL	UL
SBS	Acoustics	.17***	.03	.09	.25				
MH	SBS	.56***	.10	.42	.84	.98***	.03	.04	.17
	Acoustic	.02	.04	-.60	.09				
	Total effect	.11*							

Note: A= *Acoustics; SBS =Sick Building Syndrome; MH =Mental health*

Sobel's Z test = 3.36

***p<.001

Acoustics (independent variable) predicted mental health (dependent variable, *ß =-,.11 p<.001)* which is total effect. Acoustics predicted sick building syndrome (mediator, *ß=, .17 p<.001).* Acoustics not predict mental health and sick building syndrome predicted mental health *(ß=-.02, p >.001)* and (ß=.56, p<.001) connectively. This suggests that sick building syndrome significantly mediated the association between acoustics and mental health. Further the effect mediation was determined as the indirect effect of acoustic on mental health through sick building syndrome was noteworthy *(Sobel's Z=3.36, p<.001).*

5.5 Independent Samples t-test

Table 11: Results of Independent Samples t-test Comparing physical work environment, sick building syndrome and mental health of males and females (N=300)

Variables	Females (n=150)	Males (n=150)			95% CI		
	M SD	M SD	t (137)	p	LL UL		Cohen's d
PWE	44.24 11.22	38.29 15.22	3.85(272.8)	.000	2.90 8.99		.45
SBS	21.17 2.37	17.65 5.63	7.03(198.3)	.000	2.53 4.50		.81
MH	48.76 8.87	45.29 9.02	3.35(297.7)	.001	1.43 5.50		.38

Note. *p<.5; **p<.01; ***p<.001;

Table 11 showed that there were differences exist between work environment, sick building syndrome and mental health of males and females. The result showed that the females were higher on work environment sick building syndrome and mental health than males.

Table 12: Results of Independent Samples t-test Comparing physical work environment, sick building syndrome and mental health of married and unmarried workers (N=300)

Variables	Married (n=162)	Unmarried (n=138)				95% CI		
	M SD	M	SD	t (137)	p	LL	UL	Cohen's d
PWE	41.82 14.30	38.29 10.15		1.75(108.1)	.008	-.37 6.15		.23

SBS	19.79 4.54	17.80 4.84	2.79(76.7)	.001	.57 3.41		.55
MH	47.73 9.26	43.96 7.68	3.15(92.7)	.002	1.39 3	6.1	.44

Note. *p<.5; **p<.01; ***p<.001.

Table 12 showed that there were differences exist between work environment, sick building syndrome and mental health of married and unmarried. The result showed that the married were higher on work environment sick building syndrome and mental health than unmarried.

6 Discussion

The aim of the present investigation was to find out the association between physical work environment, sick building syndrome and mental health of factory workers. The findings suggested that there was a significant negative association among physical work environment, sick structure syndrome and mental health. Dimension of physical work environment (indoor air quality) had a noteworthy adverse relationship with sick building syndrome and mental health. Other dimensions of physical work environment (lighting, ergonomics, and acoustics) had positive relationship with sick building syndrome and mental health of factory workers. Physical Work environment had a positive predictor of mental health of factory workers. Sick building syndrome had a mediator among physical work environment and mental health of factory workers. Sick building syndrome had a mediator between dimension of physical work environment (indoor air quality, ergonomics and lighting) and mental health of factory workers. Demographic variables (age, gender, family system, number of children, region) were predictor of mental health. There was a different exist between physical work environments, sick building syndrome and mental health in males and females.

Pearson product moment correlation was directed to evaluate the association among study variables. First hypothesis was that physical work environment will be negatively associated with sick building syndrome and mental health. Our results exposed that here is a significant negative association among physical work environment and sick building syndrome and mental health. Our results were in accord with findings of various other researchers who observed that physical work environment has a significant negative correlation with sick building syndrome and mental health (Azmi, 2015; Marmot et al., 2006; Harrison, 1992; Jakkola, 1991; Shea et al., 2011; Standsfeld, 2006; & Goetzel et al., 2018)

It was hypothesized that dimension of work environment (indoor air quality) will be negatively correlated with sick building syndrome and mental health of factory workers. Our findings revealed that there is a negative relationship among inside air feature and sick building syndrome in factory workers. The results were accord with the previous literature as found that indoor air quality is very prescient of SBS and building general adequacy level and poor ventilation and high temperature are prescient of SBS among office specialists. Expanding the ventilation rates, ventilation adequacy and decreasing indoor air poison could lessen SBS even though hazard components of SBS were distinctive amongst old and new building. In all structures the inside construction condition is influenced by the midair excellence, illumination, construction openings, auditory solace, and radioactivity, format of the structure lodgings and gear and by ergonomic variables. Indoor air quality is vital to the tenants all things considered. So, our hypothesis approved, and findings are consistent with previous literature. Tarcan & Varol, 2004; Hamid, 2013; Zamani et al., 2013 & Hedge et al.,1995; (Khan et al. 2020; Iftikhar, et al. 2020; Ibrahim, et al. 2019; Rashid, et al. 2019; Bhatti et al. 2018; Khan et al. 2015; Qureshi et al. 2014; Rasli et al. 2015).

Further findings were obtained by mediation analysis. It was hypothesized that sick building syndrome will be a mediator between work environment and mental health of factory workers. Our findings revealed that sick building syndrome was a significant mediator between work environment and mental health of factory worker. Previous literature exhibited that features and indications of SBS at at work setting donate to credible psychological well-being glitches amid research laboratory staffs, structure, and apparatus can disturb the performance of the workers. SBS is the result of multifaceted practices originated by a traditional of traumatic numerous threats which produce individual tension (Hedge, 2006 & Zuliza et al., 2017)

Moreover, it was hypothesized that Demographic variables (gender, age, marital status, and working hours) will likely to be the predictor of mental health of factory workers. Our findings revealed that demographic variables (age, gender, family system, number of children, region) were predictor of mental health. The result of previous literature was accord with our findings that females, married works, income, working hours, and work experience were significantly associated with higher score (poorer mental health and well-being) of respondents (Li Lin, 2014; Sung, 2008 & Kaneko et al., 2004).

To find out gender differences, independent sample t test was conducted. It was theorized that here is probable to be variations in work environment, sick building syndrome and mental health of males and females or females will be high on work environment, sick building syndrome and mental health than males. This hypothesis is approved as the findings suggested that the females were high on work environment, sick building syndrome and mental health than males. Previous research showed that female was additional probable to show a propensity for worse mental health. Although the inclination among females are higher than males yet everybody in any case their sexual orientation, age and common situation met psychological health glitches. Women are more probable to higher on work environment, sick building syndrome and mental health than men. Properties of individual aspects, such as employee's gender, have stayed originate with females writing more indications than males undertaking similar work in a comparable situation (Shoham & Brencic, 2003; Menzies et al., 1993; Carpenter,Wayne & Connolly, 2005; Nelson & McLeod, 2005; Taleghani et al, 2012; Irniza, 2017; Taleghani et al., 2012; Filip et al., 2018 & Ashwini et al., 2017).

6.1 Implications

Some implications of present research are given below:

- This research can provide help for further research in future about physical work environment, sick building syndrome, and mental health.

  The permissible consequences of sick structure syndrome for building constructers, artefact providers, managers, assurance corporations, actual estate representatives, free-lancers, structure designers and building proprietors have been well-thought-out.
- The information that is related to sick building syndrome also can helpful for structure to identify the incidences of old building, the signs and symptoms and causes of the building syndrome. This examine also help the manufacturer to search the different

ways to prevent these incidences and ways to enhance people's mental health when they are the occupant of the building.

- It helps managers understanding multi proportions of work situation and influence of these proportions on workers for profession fulfillment.
- This study also helpful to recognize the labor atmosphere or working conditions where they work. It helps organizations to create effective work environment.
- The manufacturing social workers must advocate in stimulating for virtuous lighting at the office because speculation in illumination is to improve protection. Accident rates are significantly falling imbursement of subordinate assurance bonuses, nonattendance condensed because of less accidents. This is nothing but enhancement of worker's welfare.
- This examination subsidizes on the way to the welfare of civilization as the consequences generate consciousness about the position of respectable working atmosphere for worker job fulfillment and mental health.
- The investigation influences on the upcoming presentation of industries by captivating occupied atmosphere more extremely inside their organizations to upsurge the inspiration and assurance level of their workers.

6.2 Limitations

Several limitations have been noted in the present research:

- Sample was small and it was only taken from Lahore. Thus, the results of the present research cannot be generalized.
- The tools used in this research were not indigenous.
- One more limitation was face in data collection was that the data were collected from various organizations. The evidence collected from workers was hard to attain in the meantime the workers of some officialdoms were uncertain to stake their accurate feelings.

6.3 Recommendations

Following are recommendations of the present research:

- Sample size should be large enough to generalize the results.
- Sample should be taken from different cities.
- There should be indigenous tools and should be translated in Urdu.

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