

Influence of Job Stress on Musculoskeletal Disorders Among Employees in Construction Industries in Kerala

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Abstract— The distinct explanation for job stress can be given as the stress related to a work. It occurs when physical and mental health of an employee changes in a positive or negative manner in response to environment which they work. Musculoskeletal Disorders (MSD) describes a complex of conditions that affects muscles, bones and joints. Previous research in this domain has done independently on both these topics from the very beginning. The proposed method is to determine the influence of job stress on work related musculoskeletal disorder among industrial employee in Kerala, India. Researches depicted certain factors which affects both stress and musculoskeletal disorder. In this work, well discussed and arranged Likart scale questionnaire is using for data collection from various construction sectors in Kerala. Multivariate statistical methods such as exploratory factor analysis and confirmatory factor analysis are carried out using statistical softwares such as SPSS and AMOS 20 respectively. The underlying factors obtained shows positive influence of job stress on musculoskeletal disorders among construction workers.

Keywords— job stress, musculoskeletal disorder, multivariate statistical methods

I. INTRODUCTION

There has been many researches about the prevalence of job stress in occupation industry. Job stress can be defined as stress experienced during work. Stress which is found to be associated with any job but the severity varies mainly with the unique features of the job. Governments also started to take measures to provide safety to the health and safety of the employees. The unavoidable relations between job stress and musculoskeletal disorder has been studied by various researchers to draw out the proper remedial measures to ensure safety environment^[1].

India is considered to be as one of the highly developing country among the third world countries in all sectors. Even though the development is in hype, there are no sufficient measures and policies that ensure the safety and health of their employees. The prevalence of job stress in any occupational sector is unavoidable. Hence its impact in construction industries will be large.

Much type of jobs are present in a construction sector which primarily leads to the health problems. Each job is accompanied by mental as well as physical health failure. The reasons include a toxic work environment, negative workload,

isolation, types of hours worked, role conflict, role ambiguity, lack of autonomy, career development barriers, difficult relationships with administrators and/ or coworkers, managerial bullying, harassment, and organizational climate. Should the stressors continue, the employee is at significant risk of developing physiological and psychological disorders that can lead to increased absenteeism, organizational dysfunction, and decreased work productivity^[2].

II. LITERATURE REVIEW

In [1], it shows the impact of overtime work on industrial accident rates. It represents a pathway linking job stress to occupational illness or work related health problems. The variety of individual and environmental factors, including personal characteristics like age, gender, health status, education, experience, and job factors like intensity of work, lack of autonomy, miscommunication between coworkers, job repetition.

In [2], the report considers early and efficient scientific studies depending on the nature of stress at work, on health effects and on the way in which such knowledge is being applied to manage this problem. This report deals with the evidence obtained from research regarding the assessment and management of stress at work. It mainly discusses the various methods in the management of stress at work and in current health and safety policy, focusing on the approaches to solve the problems in the management of stress at work.

In [3], research has shown that there are a number of factors that contribute to workplace stress which include toxic work environment, negative workload, isolation, types of hours worked, role conflict, role ambiguity, lack of autonomy, career development barriers, difficult relationships with administrators and/ or coworkers, managerial bullying, harassment, and organizational climate.

In [4], the study shows the impact of overtime and extended working hours on the risk of occupational injuries and illness among a nationally representative sample of working adults from the United States. The techniques of multivariate analytical techniques were used to calculate the relative risk of long working hours per day, extended hours per week, long commute times, and overtime schedules on reporting a work

related injury or illness, after adjusting for age, gender, occupation, industry and region.

In [5], the study shows the association of mental health with occupational stress, coping styles and their interaction among workers in Chinese offshore oil platform. Multiple regression technique was used to evaluate the main and interactive effects of job stress and coping styles on mental health of the workers.

Authors in [6], introduces a new work stress model by studying the major work stress sources and work stress coping strategies experienced by employees in the Malaysian and Jordanian Customs Department which in turn leads to, and evaluates the relationships between the various stress patterns analyzed. The identified role ambiguity and self-knowledge were found to be the respective main source of work stress and major coping strategy to avoid it, were the results of this study.

In [7], study shows influence of musculoskeletal disorder in industrial workers in Tamil Nadu and the study found that for the optimization of the work system to minimize the risk of injury and to maximize productivity increases with the formidable knowledge of musculoskeletal disorders and its prevalence among industrial workers in various industries can be effectively applied.

In [8], main objective of this study is to evaluate the relationship of job stress with job attitudes in college lecturers. Purposive sampling technique is used for cross-sectional study design. The negative relationship of job stress with job performance, job satisfaction, and life satisfaction is found out while positively significant relation is found out with turnover intentions, later while considering study variables, significant difference was found among married and unmarried college lecturers.

In [9], this study identified new formidable factors such as management commitment and actions for safety, workers' knowledge and compliance to safety, workers' attitude towards safety, workers' participation and commitment to safety, safeness of work environment, emergency handling preparations in the organization, priority for safety over production and risk justification as the eight safety climate factors, where the work is conducted in the chemical industry in Kerala. Well-designed questionnaire is used for this study to provide benchmark scores for each factors identified with which organizations or even individual departments can be compared based on factor scores obtained by collecting responses and the state of safety in an organization at any point of time and to design safety interventions and management programmes targeting even sub groups based on study variables is carried out to improve the precaution against job stress.

In [10], study is carried out using a well-designed questionnaire to measure the perceptions of workers on six safety management practices and self-reported safety knowledge, safety motivation, safety compliance and safety participation by conducting a random sampling survey. The validity and reliability of the six perceived safety management practices, two determinants and two components of safety

performance were demonstrated in the study. The predictive capacity of the six safety management practices on safety knowledge, safety motivation, safety compliance and safety participation were demonstrated. The demonstration of the perceptions of safety management practices influence safety performance through their effects on safety knowledge and safety motivation which act as mediators were carried out. Direct relationship of four safety management practices on components of safety performance was also identified and it concluded by highlighting the need of safety training of the workforce.

In [11], includes studies of the job-stress intervention evaluation literature shows interventions using high- and moderate rated systems approaches represent a growing proportion. It explains that individual focused, low-rated systems approaches are much effective at the individual level outcomes. The study further explains individual-focused, low-rated systems approach job-stress interventions tend not to have positive influence on the organizational level. Focused high and moderate-rated systems approach job-stress interventions organizationally have positive impacts at both individual and organizational levels.

In [12], study focusing on structural labor factors among hotel workers to identify work-related musculoskeletal symptoms and any associated work-related risk factors. Structural risk factors in the working environment, such as the gender-based division of labor, shift work and labor intensity, were used to demonstrate a statistically significant correlation between the work-related musculoskeletal symptoms among workers. Different departments reported different prevalence rates of musculoskeletal disorder among both men and women. This could indicate that a gender-based division of labor produces different ergonomic risk factors for each gender group. The study comes into the sense that minimizing ergonomic risk factors alone cannot make good prevention effectively musculoskeletal diseases among hotel workers. The study found out that the work assignments given should be based on gender, department, working hours and work intensity should be adjusted to address multi-dimensional musculoskeletal risk factors and it concludes with the suggestion that seeks to minimization of shift work is needed to reduce the incidence of musculoskeletal disorders.

III. METHODOLOGY

To measure the relationships between the variables according to the hypotheses, and the overall relationship between the variables, Pearson's correlation coefficient and path analysis is using. Averages and frequencies are using to rank the sources of work stress and musculoskeletal disorder. These analyzing tools have been used in many previous studies [6].

A mixed type questionnaire was constructed to measure those variables according to hypothesis formulated. Questionnaire consist of four parts- first part includes the demographic characteristics, second part includes the physical illness symptoms the person is affected with, third part

includes the job stress characteristics and fourth part deals with additional details of the employee.

The sampling technique using is stratified random sampling. Likert scale is using to measure the stress related variables and musculoskeletal disorder variables.

The exploratory and confirmatory factor analysis were carried out using SPSS and AMOS 20 statistical software.

A. Sampling Method

The two major methods are probability and non-probability sampling technique. Random sampling is used in this work as it much suited to the objective of the study. Hence the study was dealt with sample random tool, which is one of the most popular methods of sampling.

B. Sources of Data

I have collected the data from two sources. That is primary data and secondary data.

C. Primary Data Collection

Primary data are those, which are collected fresh and for the first time and thus happen to be original in character, questions and interviews methods were used to collect primary data by visiting the factory premises and various departments in it. It was collected from the employees working in the factory by using both the questionnaire method and interview method.

Information from the employees who was not willing or who did not have time for or who was shy about it are taken through interviews.

Primary data are collected from:

- Personal investigation
- Observation method
- Information from correspondents
- Information from superiors of the organization

D. Secondary Data Collection

Secondary data provides a better view of the problem by analyzing many magazines, tools and other references related to the study. Sources which used for secondary data collection includes from:

a) It is collected from the internal records of the company such as library records, trade journals, various manuals of the company, various training programs previously conducted and its responds etc. It is also conducted from the officials of the pursued department in the factory.

b) Website and some other sites are also searched to find similar data.

E. Research Approach

It includes, researcher contact the respondents personally with well-prepare sequentially arranged questions. The questionnaire is prepared on the basis of objectives of the study. Direct communication is used for data survey that is contacting employees directly in order to collect data.

The study is conducted in employees of 20 construction industries in Kerala.

The researcher has used probability sampling in which stratified random sampling is used.

The study sample constitutes 836 respondents out of which 150 samples taken for pilot study in order to constitute in the research area.

F. Research Instrument

The researcher has used a structured questionnaire as a research instrument tool which consists of 4 and 5 point Likert scale questions in order to get data. Thus questionnaire is the data collection instrument used in the study. All the questions in the questionnaire are organized in such ways that elicit all the relevant information which are matched to the aim and needed for the study.

G. Analysis Of Data

The data are collected through survey and books, reports, newspapers, internet etc., the survey conducted among the employees among construction industries. The data collected by the researcher are calculated and analyzed in such a way to make interpretations and thus leads to appropriate result.

Various steps, which are required to fulfill the purpose of analysis of data are editing, coding and tabulating. Editing refers to separate, correct and modify the collected data. Coding refers to assigning number or other symbols to each answer for placing them in categories to prepare for calculation. Tabulation refers to bring together the similar data in rows and columns, and totaling them in an accurate and meaningful manner. The collected data are analyzed and interrupted using statistical tools and techniques.

H. Tools And Methods For Data Collection

1) Survey Method

The most widely used technique of gathering primary data is the survey method. The sources interviewed personally at the place of work and also with questionnaires. It is a direct and more flexible form of investigation involving face to face communication and through recorded questionnaires filled in personally. The information is a qualitative, quantitative and accurate. The rate of refusal is low; it offers a sense of participation to the respondents. It usually leads to broader range of data than observation on experimentation methods. The data collected is tabulate and interpreted to draw conclusion.

2) Field Work

It is an important method of data collection. The questionnaire is used for interviewing the respondents. Additional questions that means personal interview can be used to secure more information.

3) Likert Scale

A psychometric response scale primarily used in questionnaires to obtain participant's preferences or degree of agreement with a statement or set of statements. Likert scales are a non - comparative scaling technique and are unidimensional (only measure a single trait) in nature.

Respondents are asked to indicate their level of agreement with a given statement by way of an ordinal scale.

Most commonly seen as a 5-point scale ranging from “Strongly Disagree” on one end to “Strongly Agree” on the other with “Neither Agree nor Disagree” in the middle; however, some practitioners advocate the use of 7 and 9-point scales which add additional granularity. Sometimes a 4-point or 5-point scale is used to produce an impassive (forced choice) measure where no indifferent option is available. Each level on the scale is assigned a numeric value or coding, usually starting at 1 and incremented by one for each level.

4) Reliability Analysis

Reliability refers to the consistency and stability in the results of a test or scale. A test is said to be reliable if it yields similar results in repeated administrations when the attribute being measured is believed not to have changed in the interval between measurements, even though the test may be administered by different people and alternative forms of the test are used. For example, if you weighed yourself twice consecutively and the first time the scale read 130 lbs. And the second time 140 lbs., we would say that the scale was an unreliable measure of weights. In addition, to be reliable, an instrument or test must be confined to measuring a single construct and only one dimension. For example, if a questionnaire designed to measure anxiety simultaneously measured depression, the instrument would not be a reliable measure of anxiety. A reliable instrument or test must meet two conditions: it must have a small random error; and it must measure a single dimension.

5) Factor Analysis

Factor analysis is an important method using abundantly for finding the relevant and appropriate results. Factor analysis is used to find factors among observed variables. In other words, if your data contains many variables, you can use factor analysis to reduce the number of variables. Factor analysis groups variables with similar characteristics together. With factor analysis you can produce a small number of factors from a large number of variables which is capable of explaining the observed variance in the larger number of variables. The reduced factors can also be used for further analysis.

Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were carried out. Exploratory factor analysis is used to is carried out using SPSS statistical software in a reliable way to find out the underlying factors.

Confirmatory factor analysis (CFA), on the other hand, is theory- or hypothesis driven. With CFA it is possible to place substantively meaningful constraints on the factor model. Researchers can specify the number of factors or set the effect of one latent variable on observed variables to particular values. CFA allows researchers to test hypotheses about a particular factor structure (e.g., factor loading between the first factor and first observed variable is zero). Unlike EFA,

CFA produces many goodness-of-fit measures to evaluate the model but do not calculate factor scores. CFA requires special purpose software packages such as Mplus, LISREL, Amos, EQS, and SAS/STAT CALIS. CFA is a special case of the structural equation model (SEM)

IBM SPSS Amos implements the general approach to data analysis known as structural equation modeling (SEM), also known as analysis of covariance structures, or causal modeling. SEM consists of two components: a measurement model linking a set of observed variables to a usually smaller set of latent variables and a structural model linking the latent variables through a series of recursive and non-recursive relationships. CFA corresponds to the measurement model of SEM.

A structural equation model is a complex composite statistical hypothesis. It consists of two main parts: The measurement model represents a set of p observable variables as multiple indicators of a smaller set of m latent variables, which are usually common factors. The path model describes relations of dependency—usually accepted to be in some sense causal—between the latent variables. We reserve the term structural model here for the composite SEM, the combined measurement and path models. This avoids the ambiguity that arises when the path model component is also labeled “the” structural model.

In most applications the measurement model is a conventional confirmatory factor model; the latent variables are just common factors and the error or specific terms are uncorrelated. The most common exception concerns longitudinal models with measurements replicated at two or more time points. Longitudinal models usually need specific components that are correlated across replicated measurements. Very commonly, the measurement model is an independent clusters model, that is, a factor model in which no indicator loads on more than one common factor.

It has long been recognized that all SEMs are simplified approximations to reality, not hypotheses that might possibly be true. We may distinguish absolute and relative fit indices: Absolute indices are functions of the discrepancies (and sample size and degrees of freedom); relative indices compare a function of the discrepancies from the fitted model to a function of the discrepancies from a null model. The latter is almost always the hypothesis that all variables are uncorrelated. Some psychometric theorists have prescribed criterion levels of fit indices for a decision to regard the approximation of the model to reality as in some sense “close.”

In reference to model fit, researchers use numerous goodness- of-fit indicators to assess a model. Some common fit indexes are the Normed Fit Index (NFI), Non-Normed Fit Index (NNFI, also known as TLI), Incremental Fit Index (IFI), Comparative Fit Index (CFI), and root mean square error of approximation (RMSEA).

IV. ANALYSIS AND RESULTS

The collected is analyzed in SPSS software by analyzing the Chronbach’s alpha coefficient of internal consistency, Exploratory factor analysis (EFA) , and Confirmatory factor Analysis (CFA) is done by making a structural equation model as follows and following results obtained.

A. Reliability Analysis

Cronbach’s alpha estimates the consistency in the data . this help us finding the consistency the greater alpha value indicates the more its reliable . In the present case the alpha value was 0.758 which is the better case.

Table 1 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.758	.758	14

B. Exploratory Factor Analysis

Responses to the 14-item questionnaire were subjected to a principal component analysis using ones as prior communality estimates. The principal component analysis method was used to extract the components, and this was followed by a varimax (orthogonal) rotation.

As depicted in Figure 1 only the first five components displayed eigenvalues greater than 1, and the results of a scree test also suggested that only the first five components were meaningful. Therefore, only the five components were retained for rotation. Combined, all components 1,2,3,4 and 5 accounted for 71% of the total variance.

Questionnaire items and corresponding factor loadings are presented in Table 2. In interpreting the rotated factor pattern, an item was said to load on a given component if the factor loading was .30 or greater for that component, and was less than .30 for the other. Using these criteria, four items were found to load on the first component, which was subsequently labelled the vocational strain component. Three items also loaded on the second component, which was labelled the work environment component.

Three items also loaded on the third component, which was labelled as self-knowledge component. Two items each loaded on loaded equally on remaining two factors, and were labelled as physical strain and family duty components.

C. Confirmatory Factor Analysis

The structural equation modeling is made using AMOS 20 statistical software to confirm the underlying factors obtained under exploratory factor analysis and are found to be true. The Figure 2 depicts structural equation model obtained shows the five factors vocational strain, work environment, self-knowledge, family duty components and work environment as the hidden factors and hence verified.

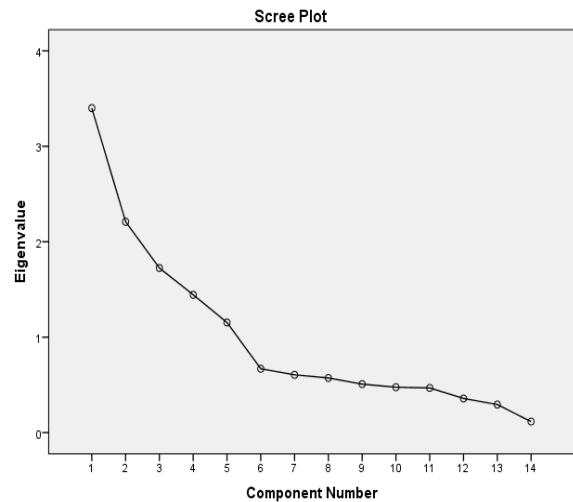


Figure 1 Scree plot

The cut off criteria for several indices are

Normed Fit Index (NFI) > 0.95

Chi-square minimum/Degrees of freedom (CMIN/DF) < 5

Incremental Fit Index (IFI) > 0.95

Tucker Lewis Index (TLI) > 0.95

Comparative Fit Index (CFI) > 0.95

Root Mean Square Error of Approximation (RMSEA) < .08

The table 3 shows the output obtained in AMOS denoting corresponding values of CF/DF RATIO, NFI, RFI, CFI, TLI, IFI, RMSEA values and all falls under acceptance level.

Factor analysis is an important method using abundantly for finding the relevant and appropriate results. Factor analysis is used to find factors among observed variables. In other words, if your data contains many variables, you can use factor analysis to reduce the number of variables. Factor analysis groups variables with similar characteristics together. With factor analysis you can produce a small number of factors from a large number of variables which is capable of explaining the observed variance in the larger number of variables. The reduced factors can also be used for further analysis.

All values are found to fall under acceptable limit. Hence, figure 2 depicting the structural equation model is found to be satisfactory.

The structural equation model shows higher chi-square value in the final output. But as the degrees of freedom are more, it can be neglected as suggested by various researchers. Not all the values in the output need not to be considered when making a model as it gives the researcher the freedom to select only the most appropriate results according to the need. Even so, the values of NFI, RFI, CFI, TLI, IFI and RMSEA must be acceptable.

V. CONCLUSION

The findings of the study has implication for the worker (employee), employer, Trades Union, HR managers, Policy Makers and all parties involved in the industry. Job stress is a very serious menace in the work place that should be tackled

individual’s health, his or her family, work performance and social life in general. Policies that promote good health and enhance work performance should be formulated in the work place. A simple requirement will be for periodic evaluation of stress levels of managerial staff.

Employers should thus put in place policies that reduce the

**TABLE 2
ROTATED COMPONENT MATRIX^a**

	Component				
	1	2	3	4	5
9) I receive incompatible requests from two or more people	.792				
10) receive an assignment without the help i need to complete it	.764				
7) I have to bend or break a rule or policy in order to carry out an assignment	.714				
8) I work with two or more groups who operate quite differently	.691				
13) The level of lighting in the area(s) in which i work is low		.859			
16) The level of noise in the area(s) in which i work is high		.842			
19) The temperature of my work area(s) is high		.760			
1)I know clearly how much authority i have			.816		
3) I know clearly what is expected of me			.786		
2)There are clear, planned goals and objectives for my job			.786		
15) I have to do child care duties apart from my routine job				.954	
20) I have primary responsibility for the care of elderly parents or disabled person on a regular basis				.945	
18) In the past 12 months, my job has been a vector for my disability/disabilities					.894
17) In the past 12 months, i have been restricted from doing my routine job at least once due to some disabilities					.877

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.^a

a. Rotation converged in 5 iterations.

by all stakeholders in the industry. It has sources which are inherent to the work place or organization although the worker also brings into the work place some level of pre-disposed factors to stress. The influence of job stress on musculoskeletal disorder is found successfully by conducting a survey using 4 and 5 point Likart scale questionnaire on 686 employees.

The study focused on factors such as self-knowledge, family responsibilities, work environment, physical strain, and vocational strain that demonstrated a significant influence of job stress on musculoskeletal disorder. These have serious implications for the productivity of the organization, employee and the employer. There is therefore the need to put in place measures to reduce or prevent the occurrence of stress in the work place which have adverse effects on the

stresses encounter so that they will be able to perform their functions assiduously. In particular, HR managers must play key roles in discussing with staff their job descriptions and performance expectations, as well potential dangers or hazards that they will have to cope with.

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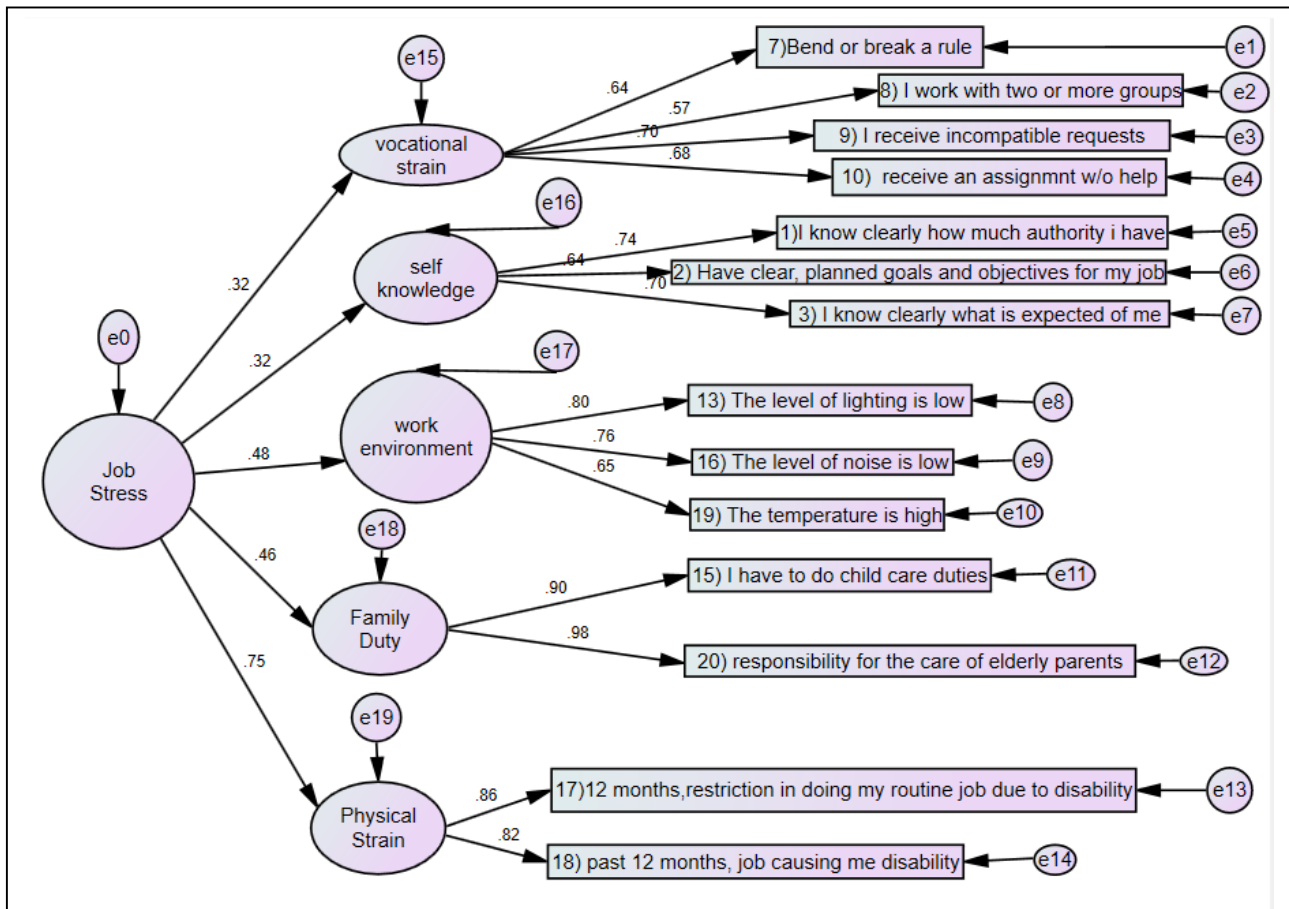


Figure 2 Structural Equation Modelling

**TABLE 3
OUTPUT**

Indexes	Comparison to a baseline (independence) or other model
NFI	0.959
CMIN/DF	1.965
IFL	0.979
TLI	0.974
CFI	0.979
RMSEA	0.038

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