An Investigation of Dynamic Influence to Doctors' Stress in Government Hospitals in Nigeria Using Logistic Regression Approach

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***Abstract*— This study examined some dynamic factors related to doctors' stress in government hospitals in Nigeria using Lagos State as case study. The working hours and the number of patients the professionals attended to showed that they are likely to be stressed. A model was developed to predict the dynamic influence to doctors' stress using logistic regression model. It was discovered that illness, environmental factors, profession and workloads and hours are the variables that highly influenced Doctors' stress.**

***Index Terms*— Dynamic Influence, Doctors, Stress, Logistics Regression, Model fitting.**

I. Introduction

Several authors gave different definitions to stress. A condition in which the resulting tension from workers' feeling as it compares to work demand and resources without a balance [5]. [16] pointed out two major factors which upset human stress as internal and external organisms'. As persons and the environment interact, the resulting effect on workers is stress [7]. Building on Selye assertion it was claimed that there are two major responses which are specific and non-specific stimulating the events that causes stress. Notion of stress from different perspectives could be classified as environmental threatening as external force with several variation based on the society, adaptation to physical and psychological, and the propellant of human organisms as the internal force.

United States of America spends about $300 billion as costs on medical, productivity, workers' turnover in relation to job-related stress as reported by American Institute of Stress, 2001. It was claimed that almost 50% gives benefits to all workers in order to rip off emotional and disability disorder as against the stress encountered on job [6]. A study was carried greatly affected by job stress where mental and greatly affected by job stress where mental and psychological factors account for 88 percent seven years after.

Several schools of thought argued on what mostly predicts stress and agreed that job conditions as well as personality and coping style are important factors in measuring job stress. In addition to the agreement, it was resolved that there are varying degrees of stress which is attributed to persons. Stress originates from the brain which transmits to all other parts of the body [10]. The process of stress as it begins from the brain affects the nervous system and triggers the hormones which shoot up the senses, increases the pulse and respirations while it results in stretching muscles.

Day in day out, there has been more concerns on the conditions at which people work. This conditions ranges from overwork to the insecurity of the job to no self-sufficiency as well as the rank of job satisfaction which leads to stress. Stress at workplace has its own negative effects on health and welfare of employees with downward effects on productivity as well as profits. Many organizations have put in place several measures to minimize or curb or stop the negative effects of stress at workplace by not allowing it to come-up. From the measures, employees were exposed to how they should recognize the signs of stress through their feelings while the employers understand the negative impact of this on productivity and the profits for the company.

It is normal for everyone to respond to stressors based on engaging activities in our environment [12]. Every human being engaged in one or more activities in their daily lives and thereby understands the meaning of stress which is distributable over the types of job. One of the major challenges of employees' health that is globally recognized is stress. It is part of our life. Various discipline ranging from academicians to administrators to practitioners and researchers have been trying to delve to the problems stress caused as it effects affects employees productivity by not been able to yield optimal performance.

In 1992, [14] carried out a research and identified three major origin of stress as it affects life to be job/organizational, social and intrapsychic sectors. The focus of the study examined the misfit of persons' skills and abilities which come as a result of organizational stress, that

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is, a mismatch or job roles. Roles are the expectations form every employee as it is stated in the entrant level which corresponds to position or office in an organization. Not less than ten types of organizational role stress have been indentified in every workplace as both the employees and the organization linked u through roles [9].

As the orgasms engage in work, unfocused response body demands ahead and it is termed Job stress [16]. As people focused on job roles, there are confrontations such as opportunities, constraints or demands either prepared for or not which later result into job stress. Inducement of job stress has been traced back to organisational factors [8]. The factors are the agents that triggers various reactions relating to stress and this is termed as organisational stressors [2].

The fact that Lagos is a fast growing metropolis is a fact well established in literature. The city has since in the 1950s experienced a rapid increase in population, leaping from 230,256 at this time to 1million in 1975. From 1980 to date the growth of Lagos brought the population of the city to an estimated 5.8 million in 1985, 7.7 million in 1999 13.42 million in 2000 and 16.86 million in 2005 [17]. In 2006 it was put at about 17.6 million and 2010 projected population is put at 19.9 million. This trend is not expected to change as it is expected to grow to 22.3million by 2014 and 23million by 2015 becoming the third largest city in the world. This population, in the developing country like Nigeria, Lagos being the base of the study thus revealed that doctors' attendance to patients will be at the high side compared to any other state in Nigeria.

II. METHODOLOGY

This study covered three government hospitals in Lagos state where doctors from different professions were observed such as nursing, dentistry, optician, surgeon, etc. 100 registered medical practitioners both male and female were randomly sampled for questioning. The method of data collection was by using questionnaire that contained all relevant questions for this research. SPSS was used to analyze this study and in addition, STATA package.

The modelling framework was adopted in the investigation using Regression Analysis methodology that utilizes the relationship between two or more variables so that a response or outcome variable can be predicted from the other, or others. More specifically, regression analysis helps us to understand how the typical value of the dependent variable changes when any one of the independent variables varied, while the other independent variables are held fixed. Most commonly, regression analysis estimates the conditional expectation of the dependent variable given the independent variables — that is, the average value of the dependent variable when the independent variables are held fixed. Less commonly, the focus is on a quartile, or other location parameter of the conditional distribution of the dependent variable given the independent variables. In all cases, the estimation target is a function of the independent variables called the regression function. In regression analysis, it is also of interest to characterize the variation of the dependent variable around the regression function, which can be described by a probability distribution. The limitation of linear regression to deal with nominal variables leads to logistic method of regression. Logistic regression determines the impact of multiple independent variables presented simultaneously to predict membership of one or the other level of the dependent variable that is dichotomous and categorical where it employs binomial probability theory in which there are only two values to predict. Logistic regression forms a best fitting equation or function using the maximum likelihood method, which maximizes the probability of classifying the observed data into the appropriate category given the regression coefficients.

III. LOGISTIC REGRESSION EQUATIONS

A log transformation is needed to normalize the distribution, where log transformation and square root transformation moved skewed distributions closer to normality.

This log transformation of the *p* values to a log distribution enables us to create a link with the normal regression equation. The log distribution (or *logistic transformation of p)* is also called the *logit of p or logit(p). Logit*(*p*) is the log (to base *e*) of the *odds ratio or likelihood ratio* that the dependent variable is 1. It is defined as:

$$\log it(p) = \log[p/(1-\mathrm{p})] = \ln[p/(1-p)] \qquad (1)$$

Whereas *p* can only range from 0 to 1, *logit*(*p*) scale ranges from negative infinity to positive infinity and is symmetrical around the *logit* of 0.5 (which is zero). Equation 1.0 shows the relationship between the usual regression equation which is a straight line formula, and the logistic regression equation.

The form of the logistic regression equation is:

$$\log it[p(x_0)] = \log\left[\frac{p(x)}{1-p(x)}\right] \qquad (2)$$

$$\log\left[\frac{p(x)}{1-p(x)}\right] = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots \qquad (3)$$

Instead of using a *least-squared deviations* criterion for the best fit, it uses a *maximum likelihood* method, which maximizes the probability of getting the observed results given the fitted regression coefficients. A consequence of this is that the goodness of fit and overall significance statistics used in logistic regression is different from those used in linear regression. The probability *p* can be calculated with the following formula.

$$p = \frac{\exp^{a+b_1x_1+b_2x_2+b_3x_3+\ldots}}{1+\exp^{a+b_1x_1+b_2x_2+b_3x_3+\ldots}} \qquad (4)$$

Logistic regression involves fitting an equation of the form to the data:

$$\log it(p) = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots \qquad (5)$$

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IV. DATA ANALYSIS AND RESULT

Table I: Respondents' Medical Professional Practice

PROFESSION	FREQUENCY	PERCENT
Nursing	19	19.0
Surgeon/Medicine	20	20.0
Optician	17	17.0
Dentistry	12	12.0
Physician	15	15.0
Others	17	17.0
No Response	3	3.0
Total	100	100.0

Table I showed that, 19% of the respondents were nurse 20% surgeon/medicine, 17% Optician, 12% Dentist, 15% Physician and 17% other medical professionals.

Table II: Respondent's Work Experience

Years of Experience	Frequency	Percent
0 - 9	32	32.0
10 - 19	30	30.0
20 - 29	23	23.0
30 Above	15	15.0
Total	100	100.0

The result in table 2 showed that 32% of the respondents had between 0 – 9 years experience, 30% (10 – 19years), 23% (20 – 29years) and 15% were 30years and above.

V. LOGISTIC REGRESSION ANALYSIS

Hypothesis testing:

H_o: The model fits or accurate to predict job stress
H_a: The model does not fit or not accurate to predict job stress

Dependent variable (Stress: Yes/No) and other variables are: age, experience, job type, profession, income, work hours, average patients attended to per day, duties, other income stress, workload, environmental factors, body part stressed, workplace closeness, average distance, feeling when stressed, illness caused and pressure from workplace**.**

Table III: Variables in the Equation

		B	S.E.	Sig.	Exp(B)	95.0%C.I.for EXP(B)	
						Lower	Upper
Step 1(a)	Age	-0.947	0.544	0.082	0.388	0.133	1.127
	experience	0.625	0.515	0.225	1.868	0.681	5.127
	(Job Type)	0.196	0.290	0.499	1.217	0.689	2.148
	profession	0.041	0.158	0.793	1.042	0.765	1.419
	Income	0.420	0.241	0.082	1.522	0.949	2.442
	Work Hours	-0.435	0.578	0.452	0.647	0.208	2.011
	patients	0.332	0.187	0.076	1.394	0.966	2.013
	duties	-0.500	0.558	0.370	0.606	0.203	1.809
	(Other Income Stress)	0.680	0.575	0.237	1.974	0.640	6.092
	workload	1.358	0.734	0.064	3.887	0.923	16.377
	environment	0.184	0.614	0.765	1.201	0.361	4.003
	(Body Part Stressed)	0.028	0.571	0.962	1.028	0.335	3.150
	workplace	-1.845	1.094	0.092	0.158	0.019	1.348
	Distance	0.304	0.384	0.429	1.355	0.638	2.877
	(Feelings when Stressed)	-0.305	0.212	0.151	0.737	0.486	1.118
	Illness	21.652	22487.009	0.999	2532472003.401	0.000	.
	pressure	-0.266	0.301	0.378	0.767	0.425	1.383
	Constant	-21.546	22487.009	0.999	0.000		

a. Variable(s) entered on step 1: Age, experience, ethnicity, (Job Type), profession, Income, Work Hours, patients, duties, (Other Income Stress), workload, environment factors, (Body Part Stressed), workplace, Distance, (Feelings when Stressed), Illness, pressure.

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VI. THE MODEL EQUATION

$$pr(stress) = -21.546 - 0.947(age) + 0.625(\text{exp}) + 0.196(\text{jtype}) + 0.041(\text{prof}) + 0.420(\text{income})$$
$$-0.435(wh) + 0.332(\text{avep}) - 0.5(\text{duties}) + 0.680(\text{others}) + 1.358(\text{workl}) + 0.184(\text{envfac})$$
$$+ 0.322(\text{effef}) + 0.028(\text{bodyps}) - 1.845(\text{workpc}) + 0.304(\text{distance}) - 0.0305(\text{feelingws})$$
$$+ 21.652(\text{ill}) - 0.266(\text{pressurefw})$$

Table IV: Model selection [Forward Stepwise (Conditional)]

Variables in the Equation		B	S.E.	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
						Lower	Upper
Step 15(a)	environment	.140	.494	.776	1.151	.437	3.030
	Work hour	-.154	.519	.767	.857	.310	2.372
	(Body Part Stressed)	.442	.449	.325	1.555	.645	3.751
	Illness	21.144	23090.349	.999	1523536671.017	.000	.
	Constant	-21.796	23090.349	.999	.000		

Table IV presents the variable selection procedure using forward stepwise conditional. It is noted here that since each of the coefficients are not going to be rejected using the decision that (reject H_o if p-value is less than level of significant otherwise do not reject Ho). This showed that each of these variable coefficients contribute to the prediction of the job stress model after which the model is been selected at step 15(a). Therefore, environmental factor, body-part-stressed and illness are the major variables that are significant in the prediction of the job stress model

VII. CONCLUSION

From the above, it is discovered that not all the variables in the model have effect in the prediction of doctors' stress. When the variables were selected using variable selection method to know which of the variables are to be included in the model, we achieved the following model:

$$pr(stress) = -21.796 - 0.140 - 0.435 + 0.442 + 21.144 \quad (31)$$

Conclusively, doctors' stress was majorly caused by the illness involved which increases by 21.144 with a unit increase in the illness after the work day and the body part affected would be influenced by 44.2%. Therefore, doctors' stress could be predicted by the factors that affect such as illness, environmental factors, work hours and body part stressed

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