

Analysis of the Factors That Affect Medical Oxygen Demand An Empirical Study at Government Hospitals in Khartoum State

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Abstract: *This study aim to measuring the factors in terms of a number of patients who take oxygen therapy, time spent by patients in treatment and oxygen rate flow that affect medical oxygen demand by the governmental hospitals in Khartoum State. As well as to testing effects type of disease, age groups of patients who need medical oxygen as a treatment and seasonality of the demand of medical oxygen. Survey covered number of (15) governmental hospitals in Khartoum State (9 urban & 6 rural) .Were selected randomly by using the cluster random sampling method .The study found that factors of a number of patients who take oxygen therapy in a month, oxygen transfer rate to patient and the time period which spent by patient in treatment , the deference of diseases are affect monthly average of medical oxygen consumption in hospitals per m3 ($p < 0.05$). Also it detected that the demand of medical oxygen is not affected by the deference of the age groups of patients who need medical oxygen as a treatment. The demand of medical oxygen is not affected by the deference of season of year ($p > 0.05$).*

Key Words: *Factors Analysis, Medical Oxygen demand, Medical Oxygen at hospitals in Khartoum state.*

I. Introduction

The importance of determining the demand of medical oxygen by government hospitals in Khartoum state derives from the importance of medical oxygen as one of the most important medical needs necessary to remedial sections which is used in hospitals, especially in the treatment of acute medical patients in the short term in emergency departments such as respiratory diseases, acute pneumonia, asthma and pulmonary congestion due to heart failure or chronic conditions which are required in some cases. These cases need continuity in the use of oxygen, examples include chronic obstructive pulmonary disease, pulmonary fibrosis, sleep disorders. So the oxygen is a major tool of therapy in hospitals and emergency medical management.

This research follows the observational analytical approach through field study and collection of data in methods that the field survey and personal interview and statistics. To identify the factors affecting on the demand of medical oxygen, namely : distribution refer to the type of disease (respiratory disease, asthma, pneumonia, etc.-Patient arrives at hospital /hour (Flow Chart) , oxygen transfer rate liter/ min , treatment duration. (Hours) .

This research will contribute to provide accurate information for decision-makers which can helps them in the development of policies leading to the solution of the problem. And to know the real amount of medical oxygen for hospitals to avoid a shortage of the oxygen supply in the future. The privacy and the importance of statistical applications in the study of economic, social phenomena and health, so we seek through this research to apply one of these statistical methods in the study of a demand of medical oxygen by government hospitals in Khartoum.

II. Methods

Objectives:

This study aims to measure the factors effect on the demand of medical oxygen, also to provide accurate information about medical oxygen for decision-makers which can helps them in the development of policies leading to the solution of the problem.

Data collection:

The research data was taken by statistical survey conducted by the researcher , to study the government hospitals in Khartoum state, the survey included an investigation made with a number of 15 government hospitals. They were selected randomly by using the cluster random sampling method, because the sampling frame exists. The study covered the governments hospitals in Khartoum state in (urban & rural) .Data was collected through a questionnaire filled up by conducting a personal interview with responders of hospitals. The researcher used a number of statistical methods to test hypotheses and analyze data under study, which was characterized by diversity , nominal and numerical data , variables also include dependent & independent variables classified into two or more than two categories, taking into account how much the suitability of each statistics method with the test required to get the good results.

III. Statistical Methods

To measure the factors affecting the demand of medical oxygen by government hospitals in Khartoum State, the researcher used different kinds of regression models: simple linear regression , binary logistic regression and multinomial logistic regression which are more suitable and advance methods to analyze the data under study.

The researcher also used the chi square test as one of the most important methods and widely used in nonparametric. Researcher used multinomial logistic regression model to test hypothesis of “ Respiratory illness requires more demand of medical oxygen than other”. In this test oxygen consumption represents dependent variable classified into two categories (High / Low) refer to the general average of consumption . While the type of disease represents independent variable classified into more than three categories, Multinomial logistic regression is used to predict categorical placement in or the probability of category membership on a dependent variable based on multiple independent variables. The independent variables can be either dichotomous (i.e., binary) or continuous (i.e., interval or ratio in scale). Multinomial logistic regression is a simple extension of binary logistic regression that allows for more than two categories of the dependent or outcome variable. Like binary logistic regression, multinomial logistic regression uses maximum likelihood estimation to evaluate the probability of categorical membership.(Dr. Jon Starkweather and Dr. Amanda Kay Moske.2011).

Researcher also used chi-square test to test the effect of an other factors on oxygen consumption such as; “the average number of hours spent by the patient in treatment by oxygen ” and “ the oxygen transfer rate to patient it would have been a 2×3 table, or a 3×2 table; it doesn't matter which variable is the columns and which is the rows. It is also possible to do a chi-square test of independence with more than two nominal variables. Jackson et al. (2013) . In addition that the researcher used chi-square test to test :

- The demand on medical oxygen is increasing in the winter without the other seasons.
- Most age groups of patients need medical oxygen in hospitals are children under 10 years.

In all statistical testes p - value was considered significant at < 0.05, in all analyses the statistical package for social sciences (SPSS – version 16) was used in the study.

IV. Results

Table (1) shows that the result of measuring the effect of a number of patients who take oxygen therapy, on a monthly average of medical oxygen consumption in hospitals per m3, by referring to the p - value, which is < 0.05 as in table - (1) this means that there is a statistically significant difference . Consequently, the factor of a number of patients who take oxygen therapy in a month affect monthly average of medical oxygen consumption in hospitals per m3 .Hospitals that receive a large number of patients consume more amount of medical oxygen.

Table (1) : Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	1666.113	465.795		3.577	.003
How many number of patients who take oxygen therapy in a month?	3.598	.892	.746	4.034	.001

Table (2): Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.500a	1	.006		
Continuity Correction	4.219	1	.040		
Likelihood Ratio	8.282	1	.004		
Fisher's Exact Test				.022	.022
Linear-by-Linear Association	7.000	1	.008		
N of Valid Cases	15				

Table (2) shows the result of measuring the effect of the Monthly average of medical oxygen consumption in hospital on the oxygen transfer rate to patient, researcher detects that there is a significant difference, since ($p < 0.05$). This means that the factor of oxygen transfer rate to patient affects monthly average of medical oxygen consumption.

	Value	df	Asymp. Sig.(2-sided)	Exact Sig. (2-sided)	Exact Sig (1-sided)
Pearson Chi-Square	8.571 a		.003		
Continuity Correction	5.658		.017		
Likelihood Ratio	10.720		.001		
Fisher's Exact Test				.007	.007
Linear-by-Linear Association	8.000		.005		
N of Valid Cases	15				

Table (3) shows the result of measuring the effect of the monthly average of medical oxygen consumption in hospital on the average number of hours spent by the patient in treatment, researcher detects that there is a significant difference, since ($p < 0.05$), this means that the time period which spent by patient in treatment affects monthly average of medical oxygen consumption. Also the results of testing the main hypotheses of this research are illustrated as follows : Table (4): illustrates the result of multinomial logistic regression model fitting, which is significant, since (P-value < 0.05).

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	9.161			
Final	3.049	6.112	1	.013

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	6.845	3.796	1	.051
Diseases	9.161	6.112	1	.013

Table (5): Shows that the result of Likelihood Ratio Tests, which is significant, since (P-value < 0.05).

Table (6) shows that the result of measuring the hypothesis which is said that “the demand of medical oxygen is affected by the deference of diseases”, so that the researcher detects that the result is a significant, since ($p < 0.05$), this means that the respiratory illness requires more medical oxygen than others.

Table (7) shows that the result of measuring the hypothesis which is said that “the demand of medical oxygen is not affected by the deference of the age groups of patients who need medical oxygen as a treatment”, so that the researcher detects that the result is not significant, since ($p > 0.05$). This means that the children less than 10 years and the adults 30 years or above they are most age groups of patients need medical oxygen therapy equally.(except the age group from 10-30 years).

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig.(1-sided)
Pearson Chi-Square	.536 a	1	.464		
Continuity Correction	.033	1	.855		
Likelihood Ratio	.537	1	.464		
Fisher's Exact Test				.608	.427
Linear-by-Linear Association	.500	1	.480		
N of Valid Cases	15				

Table (8) shows that the result of measuring the hypothesis which is said that “the demand of medical oxygen is not affected by the deference of season of year”, so that researcher detects that the result is not significant, since ($p > 0.05$).

Table (8) : Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.712	2	.700
Likelihood Ratio	.734	2	.693
Linear-by-Linear Association	.658	1	.417
N of Valid Cases	15		

V. Discussion

In this aspect the researcher was also interested in studying a number of factors that might have effect on the demand of oxygen as population sizes , internal migrations rate to Khartoum state, a number of government health facilities, proportion of morbidity and severity of the diseases which needed oxygen therapy and medical oxygen providing sources. According to the latest population census 2008 the population of the Khartoum state is (5,274,321). Central Bureau of Statistics.

In 2012 National Population Council in collaboration with the United Nations Population Fund conducted a study about the number of internally immigrants. The study revealed that the number of internally immigrants increased during the period of the study in Khartoum state. Thus, the upward trend of internal migration to Khartoum State continued and reached about 2.0 million persons or 49% of all migrants by the time of 2008 census. All of these numbers of the population meet 35 governmental hospitals, and 13 terminal hospitals in Khartoum state. In addition to that there are 183 governmental health center classified into three sections .The demand for medical oxygen is urgent to the asthma and pneumonia diseases which are the most spreaded diseases in the population of the Khartoum State. The medical research results have shown high rates of asthma in Sudan as general about (10%) of injury in Khartoum State (12.5%), mostly among children, the annual reports of school health program in Khartoum State for two years 2013, 2014 ago which are indicated the number of children who have an asthma disease have increased from 803 to 954 cases. In first conference of medical and health research, which was held in Khartoum 2012, experts attributed the high incidence of asthma in Khartoum according to pollution of fumes of cars and factories. Different health reports confirmed that the increasing of infection rates of severe acute respiratory disease in Sudan is increased up to 2 million per year, 500 thousand of them under the age of five, while the disease reaping the life of 8.3 thousand Sudanese children and causes the detention of 86 thousand hospitals to occupy the second disease which causes deaths among children under the five years old. (Beverly & et .al .2014) “Oxygen demand estimates based on annual average values of demand factors can often severely underestimate actual demand” .

Mohamed, Mohamed Gomaa / University of Khartoum, 1997) conducted research about "Evaluation of asthma severity in school aged children". They mentioned in their paper that an asthma is the commonest cause of chronic ill health in childhood. Two third of the asthmatic school children were found to have mild asthma, 16 percent were moderately asthmatic, and 16 percent were children with severe asthma. One - third of the patients have their first attack during infancy. Over half of the patients experienced the first attack of asthma after the age of four years. The annual health report in 2013 which was conducted by the Federal Ministry of Health on the health situation in Sudan. The report revealed that the Pneumonia diseases came in second cause among the 10 leading diseases treated in health units, the number of patients attending hospitals for Pneumonia is 976 520 (27%),in comparison to the number of patients attending hospitals for other diseases of respiratory system is 347009(10%), the report also mentioned that the Pneumonia came in first cause among the 10 leading diseases treated in health units for children age (0-4) years, where the number of children attending hospitals are 430813 child (19%).Concerning Khartoum State also the Pneumonia came in second cause among the 10 leading diseases treated in health units, where the number of patients attending hospitals 35443 (14.5%), the report mentioned that the prevalence of Pneumonia in Khartoum State is 65.7 Pre 1000 Pop Pneumonia disease came in second cause in the list of 10 diseases caused death in Sudanese hospitals. The number of deaths due to pneumonia is 1137 (5%), the report showed that the number of deaths due to pneumonia in Khartoum State hospitals are 505 (4.1%). Researcher discusses severe asthma and pneumonia because they are the most serious diseases that required medical oxygen in their treatment. Nachhattar Singh et al.(2001).They mentioned in their study that the oxygen therapy is required for respiratory failure in many conditions like severe asthma, chronic bronchitis, pneumonia.

VI. Conclusion

From the results of the study the researcher believes that it had achieved its objective, because it proved to us that the factor of a number of patients who take oxygen therapy in a month affect a monthly average of medical oxygen consumption in hospitals per m³, it also proved to us that the factor of oxygen transfer rate to patient affects monthly average of medical oxygen consumption. As well as through the search results we reached that the time period which spent by patient in treatment affects monthly average of medical oxygen consumption. So that the respiratory illness requires more demand of medical oxygen than others. Also through the results of research we know that the asthma and pneumonia diseases which are the most

spreaded diseases in the people of Khartoum State. that the children less than 10 years and adults 30 years or above they are most age groups of patients need medical oxygen therapy equally (except the age group from 10-30 years), as well as the demand of medical oxygen is not affected by the deference of season of year. The results of the study were identical to the terms of the logic ,Finally the vision is intended to the importance of the awareness issues of medical oxygen especially in governmental hospital in Khartoum state. And the researcher hopes that the study will add a real value to the statistical, societal and medical fields.

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