Use path analysis method to measure the impact of some factors on the disease of cancer in the governorate of Basrah

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Abstract

Path analysis and multiple regression analysis were used for studying the effect of some factors on patients having tumors in the governorate of Basrah. Sample o f recorded patients in the Center of Tumors in governorate of Basrah for the period from 2007 to 2009 was taken and it was classified into three groups according to the patient's state and best model was determined by using Multiple Regression Analysis method according to the method of Stepwise. After this, path analysis method was applied for studying the relationship in this model .

استخدام أسلوب تحليل المسار لقياس تأثير بعض العوامل على إمراض السرطان في محافظة البصرة

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الملخص :

تم استخدام تحليل المسار و تحليل الانحدار المتعدد لدراسة تأثير بعض العوامل على المصابين بمرض الأورام الخبيث في محافظة البصرة . حيث تم اخذ عينة من المرضى المسجلين في مركز السرطان في محافظة البصرة للفترة من ٢٠٠٧ إلى ٢٠٠٩ و تصنيفهم إلى ثلاثة مجاميع على أساس حالة المريض ثم تحديد النموذج الأفضل باستخدام أسلوب تحليل الانحدار و من ثم تطبيق طريقة تحليل المسار لدراسة العلاقات في هذا الانموذج .

1-<u>Research problem</u>

    The increase in the rate of casualty of cancer in recent years generally in Iraq and particularly in Basrah governorate ,pushes the researcher towards studying the effect of some factors that affecting the situation of a patient having cancer using the method of path analysis

2-<u>Research aim</u>

The proportion of having the diseases increased after wars, as a result of the type of weapons used in these wars. The aim of this study is diagnosis the factors effecting the cancer diseases in governorate of Basrah, using path analysis.

3-<u>Research assumption :</u>

Study is based on assumption which is the patient's condition is affected directly by some variables such as: the duration of treatment, age, sex, social state, number of sons, habitation, profession and type of tumor .But seems to have the biggest impact on tumor is period of treatment.

The path analysis model for having tumors is:

$$y = p_{01}X_1 + p_{02}X_2 + p_{03}X_3 + p_{04}X_4 + p_{05}X_5 + p_{06}X_6 + p_{07}X_7 + e$$

                                          1)

Where p_{0i} is the effect of independent variable (x_i) on depended variable (y).

4-<u>Introduction:</u>

    It is not coincidence or discovery, that Basrah land is focus for cancer diseases caused by radioactive contamination caused by the successive wars on the southern gateway to Iraq. Where the present reports demonstrate that the ratio of pollution caused by hundreds of missiles of depleted uranium which is used in particular in second Gulf War, is still very high until the moment sending its toxicity to the environment and people in Basrah and generally south of Iraq. The radioactive contamination is a factor which was subjected to the southern region through recent war and is the most important factor for high incidence of cancer in the southern region, Basrah in particular. Uranium is considered

as a very dangerous substance on human life, and its mid-period of radiations is between four to five billion years, and it has the ability of decay and interaction with other substances which is harmful to humans by contact with contaminated parts or inhalation of Gases Released from it. the number of contaminated sites in governorate of Basrah, which is known as sites of radioactive is limited by 100 site until the year 2004. This explains the increasing in number of cancer cases in recent years, the number of cancer cases registered in the Cancer Center, was 434 case in 1999,while this number was increased to960 in 2006

This study included analysis of the effect of some factors affecting the situation of people having cancer diseases using two of statistical methods : regression analysis and path analysis to analyze a sample data of people having cancer disease which is recorded in the Cancer Center of Basrah. Correlation coefficients have been calculated among all variables after that path coefficients are calculated .then the most variables affect on patients ' conditions is identified using a regression analysis according to the method of stepwise. some conclusion were obtained by the researcher from the practical side

Path Analysis:

The path analysis is one of statistical methods, which is an extension of multiple regression analysis aiming to estimate the assignment and significant causal relationship among variables. The path analysis is not considered as alternative to Multiple Regression Analysis, but one is complementary to the other so that the use of path analysis and multiple regression for analyzing certain phenomenon having variables affected by other variables, gives deeper understanding to the phenomenon.

Path analysis has great promise for improving our understanding of natural selection but must be used with caution since coefficient estimates depend on the assumed causal structure [1].

Path Analysis depends on existence of causal models, where one of its advantages is partitioning of correlation coefficient between two variables to its components, which can be explained

using figure (1).This figure represents components of Correlation Coefficient, where there are four variables, x_1, x_2, x_3, y. from figure (1) note that :

1 – Path Coefficient is arrowhead on one end only , which represents the direct effect of extraneous variable (j) on endogenous variable (i) also represents the direction from the cause to the effect ;a path from the variable (x_1) to the variable (y) is symbolized by the symbol p_{yx1} and symbolized shortly by p_{01}.Where the depended variable is symbolized by 0

2 - The Correlation Coefficient is arrowhead at both ends and it represents a correlation between the two variables as shown in figure (1) there is a correlation between both variables x_1 and x_2 and that this relationship cannot be analyzed in other words. Any relation between two extraneous variables cannot be analyzed

3 - The variable E is the Random Error or residuals or differences in variable y, and cannot be predicted by the model.

4 - Extraneous variable is intended as a variable which its difference are determined by variables out of the causal mathematical model. While the endogenous variable represents the variable which part of its differences are determined within the causal mathematical model and the remaining part is kept to determine the error.

5- The sum of the direct effect and indirect effect represents the total effect, as the total effect of the variable x_3 on the variable y is the sum of the direct effect of the variable x_3 on the variable y added to the indirect effect through the influence of the variable x_3 on the variable x_1 and influence of x_1 on y.
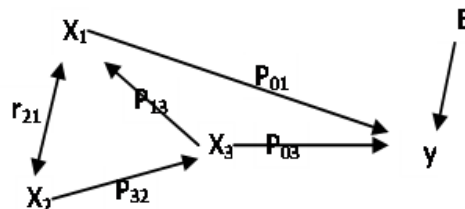
Fig.(1)

Diagram prepared by the Researcher

The Simple correlation coefficient between any two variables r_{ij} is the sum of the values of all paths which associate these two variables. This means that the simple Correlation Coefficient

reflects more than just the total effect, in the whole extraneous variable, part of its association with the endogenous variable may be the result of its association with the whole extraneous variables and other effects. In the case of two endogenous variables; part of the correlation may be a spurious correlation; and The total effect is known as being part of a simple correlation, so that is not the result of the presence of [4]

1. Impact of a set of common external variables that affects endogenous variable (a common cause)
2. The affect of external variable on an endogenous variable across middle variable (the correlation through the causes)
3. Correlation between two variables (Non- correlation analysis)

The determination coefficient of the variable (y) by the causal variables is a product between Path Coefficient Correlation and Correlation Coefficient

$$R^2 = \sum_{i=1}^{n} p_{oi} \, r_{io} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(2)$$

Where i=1 , 2 . . . n   , n=number external variable

Finding the path coefficients is achieved by solving a set of linear equations as follows:

RP=r…………………………..(3)

Where

R: Symmetric matrix of dimension ($n \times n$) where its elements represent correlation coefficients between the independent variables.

p: Vector of dimension (n $\times$ 1) represents the elements of the Path coefficients to be found.

r: Vector of dimension ($n \times 1$)represents the elements of the Correlation coefficients between the dependent variable and the independent variables.

simple correlations coefficients between variables will be partitioned to its components using path analysis and according to the theoretical side of the study

a) calculation simple correlation coefficient (Spearman) according to following relationship:

$$r = 1 - \frac{6 \sum d_i^2}{n(n^2-1)} \quad \dots\dots\dots\dots\dots\dots(4)$$

Where (d) is the difference between the levels rank of the first variable, and levels rank of the second variable.

Is order to calculate the path coefficients ,apply the equation(3) ,we have to calculate simple correlation coefficient

5- Correlation Coefficient

Path analysis depends on the existence of causal models which has existence of a causal linear relationship between cause and effect. The partition of simple correlation coefficient between two variables is one of the advantages of path analysis and it consists of [2]

1. The direct influence of the reason on the effect, represents a direct effect of the extraneous variable on the endogenous variable such as the path p_{01} in figure (1) is represent the direct effect of x_1 on y

2. Indirect I influence of the reason on the effect ,represents an indirect effect of the extraneous variable on the endogenous variable across the middle variables (across other causes) such as the path p_{02} p_{03}.

3. Un analyzable vehicle represents extraneous variable effect on the endogenous variable a cross correlation extraneous variable with other extraneous variable such as path p_{32} r_{12}.

4. Spurious vehicle which represents the effect of extraneous variable on the endogenous variable a cross variable effect on extraneous variable, such as the path p_{13} p_{03}

6-The practical side:

6-1 Description of the research sample:

I had been collecting data from the records of the Cancer Center in Basrah, which is one of the important centers not only in the governorate of Basrah, but rather at the level of the southern provinces where the center provides its services through the receipt of the file of the patient by the unit of statistics at the center and then the second step comes in which the patient is previewed by the consultant doctor to determine the situation of

his health. The doctor then directs the patient to the third step. This step consists of one or more of the following: if the situation does not need to be followed-up , the patient may leave with or without treatment, the second situation is represented by chemical injecting while the third is represented by surgery to remove the tumor and then having chemotherapy.

A sample consisting of 115 of the cases recorded in this center has been studied and the following variables were collected :

i. Dependent variable (y), represents the patient's condition as follows (1) the patient having treatment and recovering, (2) the patient having chemotherapy after removing the tumor, (3) tumor spread.

ii. The patient's age $(x1)$ which is distributed as the following categories:
   - less than 30 years old 1.
   - 30-40 years old 2.
   - 40-50 years old 3
   - 50-60 years old 4.
   - 60-70 years old 5.

iii. The patients sex (x_2) male symbolized as (1) female symbolizes as (2).

iv. Profession (x_3) which falls in the following categories: fondle house or retired (1),employees(2),non-employees (3).

v. the duration of treatment (x_4) which is distributed as follows:
   - Less than a week 1.
   - Less than a month 2.
   - Less than two months 3.
   - Less than 3 months 4.
   - Less than four months 5.
   - More than four months 6.

vi. the type of tumor (x_5) which falls in the following categories:[7]
   Breast tumor 1, tumors of the digestive system 2, tumors in lungs and bronchus 3, tumors in liver 4, tumors in the bladder 5, others 6

vii. patients habitation (x_6) the sample is classified in to three categories according to living: in the center of Basrah governorate(1),while (2) included living outskirts of Basrah province, and the symbol (3) is given for outside the boundaries of the governorate of Basrah

viii. Patients social state (x_7). (1) points out to male and female unmarried, while (2) points to a married patient.

ix. And variable (x_8) represents the number of sons.

The table below explained the frequency , Percentage, arithmetic mean and Standard deviation to variable study:

Table number (1) : represent frequency ,percentage ,arithmetic mean and stander division.

variable	class	Percentage	mean	s.d
the patients age x1	1	18%	3.49	1.65
	2	12%		
	3	13%		
	4	29%		
	5	28%		
the patients sex x2	1	46%	1.53	0.50
	2	54%		
the patient profession x3	1	54%	1.78	0.90
	2	14%		
	3	32%		
the duration of treatment x4	1	23%	2.66	1.51
	2	39%		
	3	10%		
	4	15%		
	5	6%		
	6	5%		
the type of tumor x5	1	19%	3.47	1.90
	2	17%		
	3	13%		
	4	26%		
	5	7%		
	6	17%		
patient habitation x6	1	35%	1.83	0.71
	2	47%		
	3	18%		
social state x7	1	82%	1.18	0.38
	2	18%		

Table prepared by the researcher

6-2 <u>Path Analysis</u>:

In the context of medical theory and logical relationships, causal relationships among variables of the study are as follows

i. Patient profession (x_3) is affected by patient's sex (x_2) and age (x_4). figure (2) shows the flowing relationship:

Fig (3) :represent relationship between x_1, x_2, and x_3
Which can be represented by the following regression equation :

$X_3 = p_{31}X_1 + p_{32}x_2 + e$ …………………. (5)

ii. Duration of treatment(x4) is affected by sex(x2), age(x1), profession(x3), type of tumor(x5), and habitation(x4) . illustrated by figure (3)

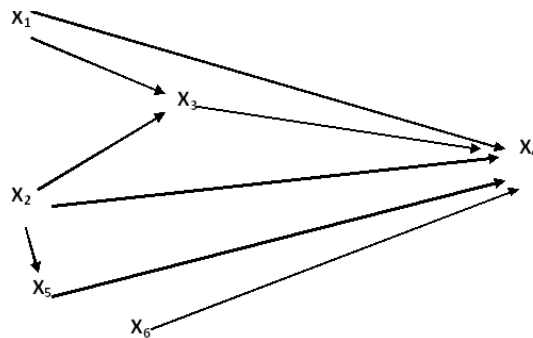Fig (3) :represent relationship between x_1, x_2, x_3, x_4, x_5 and x_6

Diagram prepared by the Researcher
and regression relation is:

$X_4 = p_{41}X_1 + p_{42}X_2 + p_{43}X_3 + p_{45}X_5 + p_{46}X_6 + e$ …………(6)

iii. The relationship among patient's condition(y) , social situation of the patient(x7) ,and number of sons(x8) could be clarified as follows:

$Y = p_{o7}x_7 + p_{o8}x_8 + e$ ……………………………….……(7)

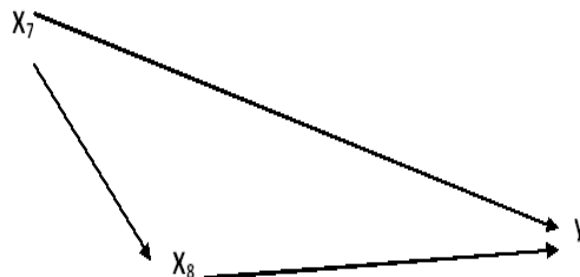Fig (4) :represent relationship between x_7, x_8 and y

Diagram prepared by the Researcher

iv. The relationship among patient's condition, age, sex, profession , duration of treatment, tumor type, social situation and number of sons could be clarified as follows:

$$y = p_{01}X_1 + p_{02}X_2 + p_{03}X_3 + p_{04}X_4 + p_{05}X_5 + p_{06}X_6 + p_{07}X_7 + e \quad (8)$$

Table (2) represents the results of the above relationship after partitioning simple correlation coefficient between any two variables to its components (direct effect, indirect effect, unanalyzed effect,

and spurious effect). According to medical theory and logical relationships, path coefficients among variables is shown in figure(2).

Table (2): The direct effect and 'indirect effect among variables

Variables	Type of effect	Value of effect	
Age X_1	Direction effect	0.01	
	Total	0.072	
	Unanalyzed	sex	-
	Indirect	profession	-
	Unanalyzed	the duration	0.17
	Indirect	Type of	0.011
	Unanalyzed	habitation	0.029
	Indirect	social state	0.017
	Indirect	Number of	0.047
	Total effect	0.263	
Sex x_2	Direction	0.101	
	Total	0.033	
	Unanalyzed	age	0
	Indirect	profession	0.013
	Indirect	the duration	0.02
	Indirect	Type of	-

	Unanalyzed	habitation	0.006
	Indirect	social state	0.01
	Indirect	Number of	0.013
	Total effect	0.14	
patients profession x₃	Direction	-0.016	
	Total	-0.032	
	Spurious	age	0.002
	Spurious	sex	-0.085
	Indirect	the duration	-0.033
	Indirect	Type of	0.024
	Indirect	habitation	-0.012
	Indirect	social state	0.003
	Indirect	Number of	-0.014
	Total effect	-0.131	
the duration of treatment x₄	Direction	0.471	
	Total		
	Spurious	age	0.003
	Spurious	sex	0.004
	Spurious	profession	0.001
	Spurious	Type of	0.006
	Spurious	habitation	0.034
	Spurious	social state	0.005
	Spurious	Number of	0.017
	Total effect	0.541	
Type of tumor X₅	Direction effect	0.096	
	Total Indirect effect	-0.012	
	Unanalyzed effect	age	0.001
	Unanalyzed effect	sex	-0.025
	Spurious effect	profession	-0.004
	Indirect effect	the duration of treatment	0.028

	Spurious effect	habitation	0.017
	Indirect effect	social state	-0.029
	Indirect effect	Number of sons	-0.011
	Total effect	0.073	
patients habitation x_6	Direction effect	-0.197	
	Total Indirect effect	-0.09	
	Unanalyzed effect	age	-0.001
	Unanalyzed effect	sex	-0.003
	Spurious effect	profession	-0.001
	Indirect effect	the duration of treatment	-0.082
	Indirect effect	Type of tumor	-0.008
	Unanalyzed effect	social state	0.006
	Unanalyzed effect	Number of sons	0.004
	Total effect	-0.283	
social state x_7	Direction effect	-0.23	
	Total indirect effect	-0.01	
	Spurious effect	age	-0.001
	Spurious effect	sex	-0.004

Spurious effect	profession	0
Indirect effect	the duration of treatment	-0.01
Spurious effect	Type of tumor	0.012
Unanalyzed effect	habitation	0.005
Unanalyzed effect	Number of sons	-0.012
Total effect	-0.24	
Number of sons X_8	Direction effect	0.107
	Total	0.074
	Spurious	age	0.004
	Spurious	sex	0.013
	Spurious	profession	0.002
	Indirect	the duration	0.074
	Spurious	Type of	-0.01
	Unanalyzed	habitation	-
	Unanalyzed	social state	0.026
	Total effect	0.209

Table prepared by the researcher

While the diagram below illustrates the effect of external variables on the endogenous variable.

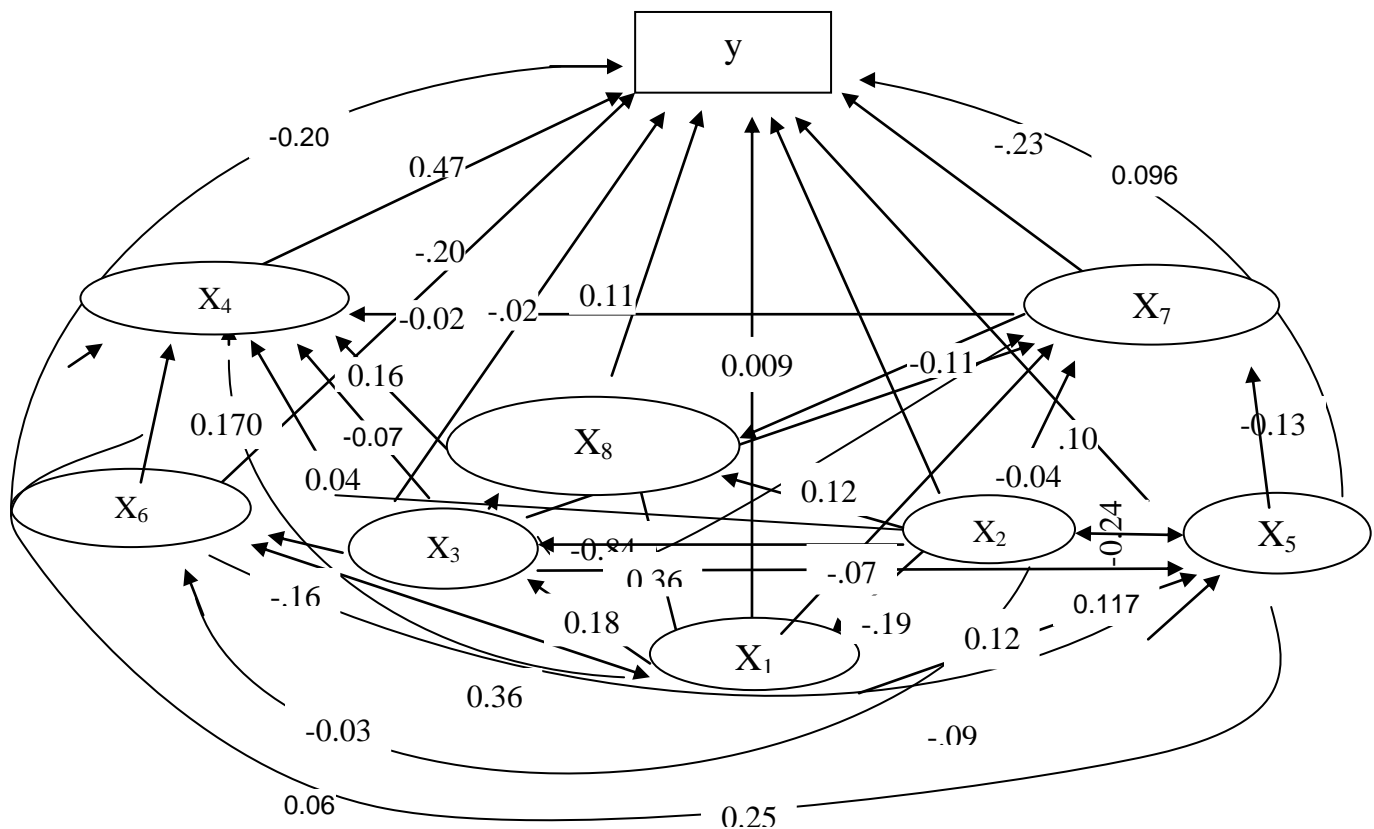Fig (5) represents relationships between variables

Diagram prepared by the Researcher

6-3 Correlation coefficients:

Statistical program spss was used to calculate the Simple correlation coefficients between variables and to infer its significant Table number (1) represents the Simple Correlation Coefficients between the variables and the value of the p-value of each factor

Table (3) represents the Simple Correlation Coefficients between the variables of the study

variable		y	x1	x2	x3	x4	x5	x6	x7	x8
y	Correlation coefficients	1	0.262**	0.139*	-0.131	0.541**	0.073	-0.283**	-0.239**	0.209**
	p- value	.	0	0.05	0.064	0	0.303	0	0.001	0.003
x1	Correlation Coefficient		1	-0.192**	0.183**	0.362**	0.117	-0.146*	-0.076	0.441**
	p- value			0.006	0.009	0	0.099	0.039	0.285	0
x2	Correlation Coefficient			1	-0.842**	0.042	-0.243**	-0.031	-0.044	0.124
	p- value				0	0.553	0.001	0.663	0.536	0.079
x3	Correlation Coefficient				1	-0.07	0.249**	0.063	-0.014	-0.126
	p- value					0.327	0	0.371	0.839	0.074
x4	Correlation Coefficient					1	0.059	-0.174*	-0.02	0.158*
	p- value						0.406	0.014	0.774	0.025
x5	Correlation Coefficient						1	-0.087	0.128	-0.101
	p- value							0.219	0.071	0.155
x6	Correlation Coefficient							1	-0.025	0.036
	p- value								0.721	0.612
x7	Correlation Coefficient								1	-0.112
	p- value									0.114

Table prepared by the researcher using spss program
Where the ** means significant value at (0.01) , while the * means significant value at (0.05)
according to t-test.

7- <u>Analysis of results:</u>

The above table represents the results of path analysis, from which we note the following

1. The direct effect of age on the patient's statues is (0.009), while the indirect effect was through variables (profession , type of tumor, social state, number of sons) was (0.072) i.e the indirect effect is greater than the direct effect while the total effect of age on the patients case is (0.082), whereas we find that the correlation coefficient between age and patients case was (0.262).

2. The direct effect of sex on the patient's case is (0.101), while the indirect effect was through variables (profession 'type of tumor, social state, number of sons) was(0.033) i.e the indirect effect is less than the direct effect while total effect of sex on the patients case is (0.14), whereas we find that the correlation coefficient between sex and patients case was (0.139).

3. The direct effect of Profession on the patient's case is (-0.016), while the indirect effect was through variables (the duration of treatment, type of tumor, patients habitation,social state, number of sons) was(-0.032)which are the indirect effect is less than the direct effect while total effect of Profession on the patients case is(-0.048),whereas we find that the correlation coefficient between profession and patients case was(-0.131).

4. The direct effect of the duration of treatment on the patient's case is(0.471),whereas we find that the correlation coefficient between the duration of treatment and patients case was (0.541).

5. The direct effect of the type of tumor on the patient's case is (0.096), while the indirect effect was through variables (the duration of treatment, , social state, number of sons) was (-0.012) which are the indirect effect is less than the direct effect while total effect of the type of tumor on the patient s case is (0.084), whereas we find that the correlation coefficient between the type of tumor and patient's case was (0.073).

6. The direct effect of the patient's habitation on the patient's case is (-0.197), while the indirect effect was through variables (the

duration of treatment, the type of tumor) was (-0.09) which are the indirect effect is greater than the direct effect while total effect of the patient's habitation on the patient's case is(-0.287),whereas we find that the correlation coefficient between the patient's habitation and patient's case was(-0.283).

7. The direct effect of patient's social state on the patient's case is (-0.23), while the indirect effect was through variables (the duration of treatment, the type of tumor) was (-0.01) which are the indirect effect is greater than the direct effect while total effect of patients social state on the patient's case is (-0.239), whereas we find that the correlation coefficient between patients social state and patient's case was (-0.239).

8. The direct effect of number of sons on the patient's case is (0.107), while the indirect effect was through variables (the duration of treatment) was (0.074) which are the indirect effect is greater than the direct effect while total effect of number of sons on the patient's case is (0.181), whereas we find that the correlation coefficient between number of sons and patient's case was (0.209).

Table (4) shows the order of variables according to the degree of effect on the dependant variable

Variable	Type	effect		
		Direct	Indirect	Total
the duration of treatment	Positive	0.471	0	0.471
patients habitation	Negative	-0.19	-0.09	-0.287
age	Positive	0.262	0.072	0.082
patients social state	Negative	-0.23	-0.01	-0.24
Number of children	Positive	0.107	0.074	0.181
sex	Positive	0.101	0.033	0.134
Profession	Negative	-0.016	-0.032	-0.048
the type of tumor	Positive	0.096	-0.001	0.095

Table prepared by the researcher

From table (3) we find that the variable duration of treatment is the variable of the most effect on the patient's

condition . the total effect of this variable (0.471), we also note that the variable duration of treatment does not affect indirectly on patient's condition. The second variable affecting patients conditions patients is the patient habitation because there are some region affected by radioactive contamination . Total effect of this variable is (-0.287) ,which is partitioned to direct effect (-0.19) and indirect affect (-0.09), and So on for the rest of variables. will we note that the variable type of tumor has the least effect on the patient's condition.

8-Multiple Regression Analysis Table:

Multiple Regression Analysis method was applied according to (stepwise method) to determine the best regression equation and from the results of this method, we find that the following regression model follows is better than one of model (1).

$$y = p_{02}X_2 + p_{04}X_4 + p_{06}X_6 + p_{07}X_7 + e \ldots\ldots\ldots\ldots\ldots(9)$$

Table (5)shows Multiple Regression Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Regression	49.49	4	12.37	39.56	0.00
Residual	61.31	196	0.31		
Total	110.81	200			

From the table above table, we find that the value of test parameter f was 39.56 and this value is significant as the p-value is less than 0.05. This means that model (2) is significant model

9-Path Analysis of model (2):

The table of regression analysis according to the method of stepwise was shown. The model, which represents the variables of sex, duration of treatment, habitation, and social state as independent variables and the variable of the case the patient as a depended variable is than better the model (2) .Therefore the path of this model had been analyzed and the path of this model are shown in diagram (6)
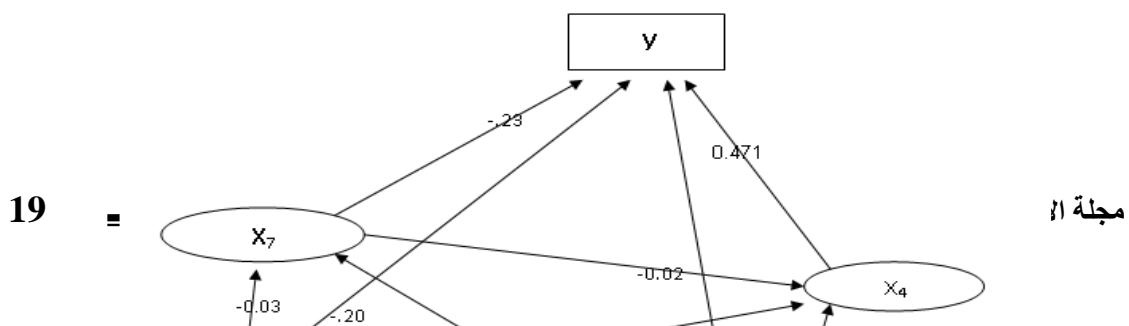
Fig (6) represents relationships between variables

Diagram prepared by the Researcher

9- Conclusions:

From the practical side, the following was obtained

1 -from regression analysis table according to stepwise method we find that sex, duration of treatment, habitation, and social state affect the patient's condition more than the rest of variables.

2 - The duration of treatment have an effect on the patient's case more than the rest of the explanatory variables. the total effect of treatment period on the patient's case had reached up to (0.471). We also note that the effect of the duration of treatment on the patient's case has a direct effect and not cross the mid variables, as shown by diagram (3).

3 - The results show that the variable representing types of tumors have week effect on the patient's case which is concluded from the total effect (0.095).

Foreign References

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