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Use of Dual – Response Logistics Regression Technology to Study the Most Important Risk Factors For Age-Related Cataract Disease Applied Study on A Random Sample of Patients in Gezira State - Sudan

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Abstract*: This study included the most important risk factors for cataract disease and analyzed from a statistical point of view and identify the most important determinants using logistics regression technology. Objectives: The main of the study is to enhance methodology of cataract disease and add new stock of data . To determine the prevalence and risk factors for age – related cataract in Gezira State . Methods: data were collected by questionnaire of 800 respondent both male and female of ages from age 40 and over years . Analyzed using SPSS program . Results:. The study showed that the use of logistic regression gave logical results. Recommendation: expanding the use of dual – response logistics regression in economic and social studies .*

Keywords: - logistics - factors - Cataract

استخدام تقنية الانحدار اللوجستي تنائي الاستجابة لدراسة أهم عوامل الخطورة لمرض الكتراكت المرتبطة بالعمر

دراسة تطبيقية علي عينة عشوائية من المرضي بولاية الجزيرة – السودان

الملخص :

تضمنت هذه الدراسة أهم عوامل الخطورة لمرض الكتراكت وتحليلها من وجهه نظر احصائية والتعرف علي اهم المحددات المعنوية المؤثرة باستخدام تقنية الانحدار اللوجستي و تم جمع البيانات عن طريق الاستبيان من 800 مستجيب من الذكور والاناث من عمر 40 سنة فاكثر. تم تحليل هذه البيانات إحصائياً بواسطة برنامج الحزم الإحصائية للعلوم الاجتماعية. النتائج : اظهرت الدراسة ان استخدام الانحدار اللوجستي اعطي نتائج منطقية . التوصيات : توسيع استخدام الانحدار اللوجستي ثنائي الاستجابة في الدراسات الاقتصادية والاجتماعية .

الكلمات المفتاحية :

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Introduction

Cataract is defined as opacity within the clear lens inside the eye that reduces the amount of incoming light and results in deterioration of vision . natural lens is crystalline substance and a precise structure of water and protein to create a clear passage for light. Cataract is often described as being similar to looking through a waterfall or waxed paper. (5) also age – related cataract is the opacity of the natural human lens, which may be resulted from congenital, developmental and acquired causes. Cataract is the leading causes of blindness worldwide, which accounts about more than half of 39 million blind people worldwide, and its blindness effect increases particularly in Africa (4,6). Several studies showed that the reasons for delaying from timely treatment are low economic status, lack of transportation, wrong perception, residual vision and poor knowledge (about the risk factors, nature of disease and treatment options) [2,7,3]

Materials and Methods:

Data Sources

The study will depend on primary data about questionnaire from patients' record from age-related cataracts disease of Gezira State

Data Analysis:

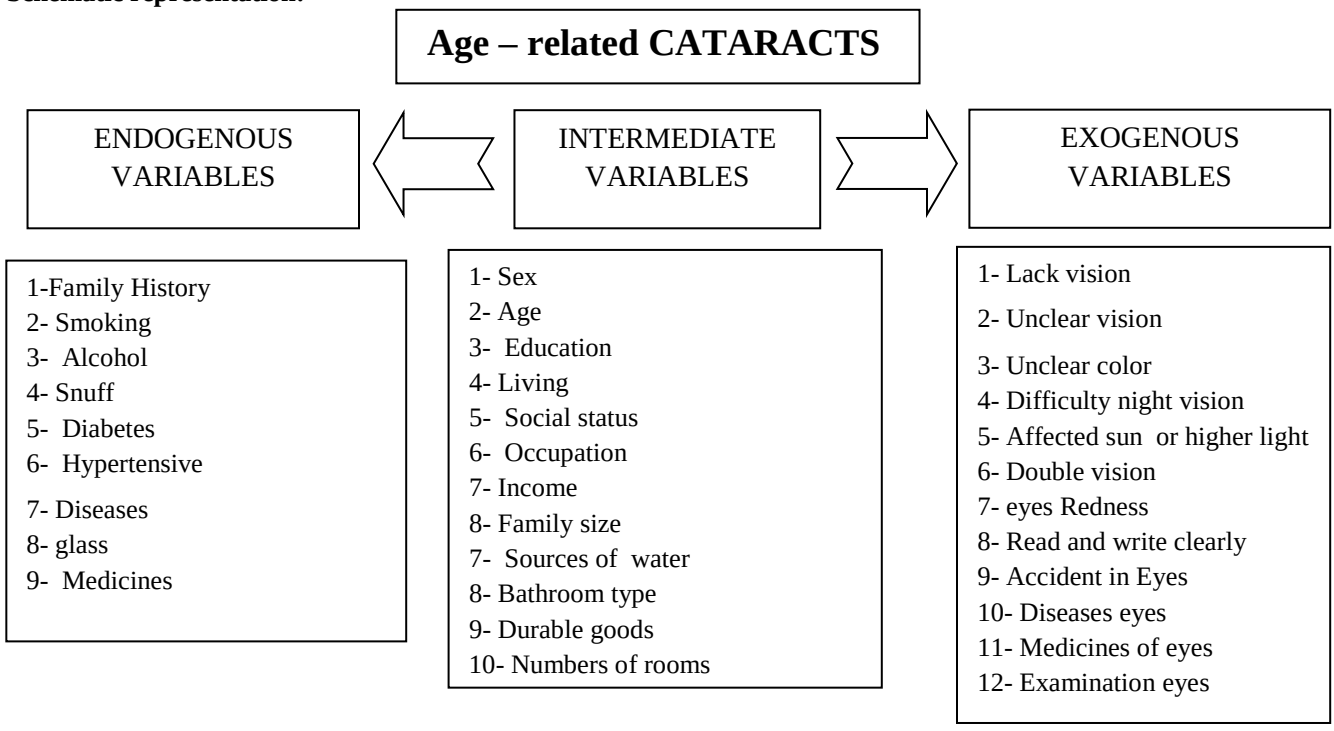
After collecting the data by using questionnaire , the data has been coded and organized and has been analyzed using the Statistical Package for Social Sciences (SPSS). We used binary logistic regression that aims to classify an individual in to one of previously defined groups , based on significant effect on cataract disease.

Methodology

Conceptual framework

Since any pathological process is determined by exposure and susceptibility age – related cataracts prevalence will also be determined by three main categories of independent variables .Any study of cataract prevalence must take into consideration the simultaneous operation of multiple risk factors and multiple processes . For this reason the study develop a schematic representation identifying specific etiologies . The first categories which includes (Family History- Smoking- Alcohol- Snuff- Diabetes…etc). Second exogenous which includes (Lack vision - Unclear vision …. …etc) . Third intermediate which includes (Sex- Age - Education - Occupation – Income …..etc.).

Schematic representation:



Source of researcher design

Fig (1) Schematic representation

Binary logistic Regression Models :

Binary logistic regression model as can be fitted using either the logistic regression procedure or Multinomial Logistic Regression procedure. Each procedure has options not available in the other .An important theoretical distinction is that the logistic regression procedure produces all predictions, residuals, influence statistics, and goodness- of – fit tests using data at the individual case level ,regardless of how the data are entered and whether or not the number of covariate patterns is smaller than the total number of cases , while the Multinomial Logistic Regression procedure internally aggregates cases to form subpopulations with identical covariate patterns for the predictors, producing predictions, residuals, and goodness – of- fit tests based on these subpopulations . If all predictors are categorical or any continuous predictors take on only a limited number of values, so that there are several cases at each distinct covariate pattern , the subpopulation approach can produce valid goodness –of- fit tests and informative residuals , while the individual case level approach cannot (1)

Logistic regression analysis:

Introduction:

This session deal with the collected data (Gezira state data) the sample was 800 members, distributed among the localities of the state According to population census (2008) .The model tries to find the relation between dependent variables (cataract) incidence and socio-economic and demographic variables (independent variables) through the application of binary logistic regression.

The value labels of the dependent variable (cataract) incidence (0 denote negative test and 1 is positive test of result). Conditional logistic regression was used to calculate the matched odds ratio and 95% confidence intervals for a invariable analysis. statistical analysis programs in logistic regression analysis are run in two steps: the first step, called step 0,includes no predictors and just intercept. Often ,this model is not interesting to researchers, the second, step 1 and this is the model with predictors in this case :it is the full model that was specified in the logistic regression command. And we depend on this step in our analysis.

Table(1): The estimated model coefficients

The value of Chi-square was 466.793 with p- value (.000) indicating that , the overall model was significant .

Table(1)Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
Step 1	Step	466.793	50	.000
	Block	466.793	50	.000
	Model	466.793	50	.000

Source: spss output based on data for researchers age related Cataract survey

Goodness of fit

We need to see if the model fits the data or not using two test the first test Hosmer and lemeshow. Second test likelihood ratio .

likelihood ratio test

The Model Summary

The model summary in table 4.34 below provides the -2 Log likelihood , Cox & Snell R Square and Nagelkerke R Square values from the full model . the -2 Log likelihood for the model (642.242) with tell us that there was significant .Here it is indicating that (.442%) of the variation in the dependent variable is explained by logistic model . Nagelkerke R Square is more reliable measure of relationship . it is indicating that (.589%) of variation in the dependent variable is explained by logistic model .

Table(2) Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	642.242	.442	.589

Source: spss output based on data for researchers age related Cataract survey

Hosmer and lemeshow test.

Table (3) shows that the Hosmer and lemeshow test. H-L test of the goodness of fit the model is a good fit to the data . From the table Chi-square with 8 degree of freedom , has a value of (8.882) and probability of P = . .352

Table (3) Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	8.882	8	.352

Source: spss output based on data for researchers age related Cataract survey

Table (4) below that the result of contingency Hosmer and lemeshow test the test divided subjects (those having age related cataract and those have not) divided in to ten groups of equal or nearly equal size ordered with respect to the predicted probability of the target event. for each of these group we ten predicted group memberships . And actual group memberships. This result in a 2 x 10 contingency table , as show (observed and expected). A Chi-square statistic is computed comparing the observed. Frequencies with those expected under the liner model . As in can be clear from the table they were slightly different from observed and expected values.

Table (4) Contingency Table for Hosmer and Lemeshow Test

	having cataract = yes		having cataract = No		Total
	Observed	Expected	Observed	Expected	
1	78	79.861	2	.139	80
2	80	78.840	0	1.160	80
3	75	74.822	5	5.178	80
4	68	65.218	12	14.782	80
5	49	48.132	31	31.868	80
6	21	25.898	59	54.102	80
7	11	11.704	69	68.296	80
8	5	3.228	75	76.772	80
9	1	.747	79	79.253	80
10	0	.106	80	79.894	80

Source: spss output based on data for researchers age related Cataract survey

Classification Table

This Table below shows that the cases where the observed values of the dependent variable cataract disease status . The columns are the two predicted values of the dependent , while the rows are the two observed values of the dependent in a perfect model all cases will be on the diagonal and the overall present correct will be (100%) . in this study (86.9%) were correctly classified as age - related cataract disease and (86.6%) as not having senile cataract .Overall (86.8%) were correctly classified.

Table(5) Classification Table

Observed	Predicted		
	having age related cataract		Percentage Correct
	No	Yes	
Having senile cataract NO	336	52	86.6
Yes	54	358	86.9
Overall Percentage			86.8

Source: spss output based on data for researchers age related Cataract survey

fitting logistic regression

Table below shows that the results of binary logistic regression model for senile cataract disease status as dependent variable and the pathological and socioeconomic and demographic characteristic of respondents as independent variables (coefficient (B) the Wald statistic to test the statistical significance) and all important odds Ratio (Exp(B)for each variable category.

the variable of locality, two categories where show significant correlation with the dependent variable , Almanagil and East Gezira localities **.** for Almanagail locality the Wald statistic= 7.927 with P-value (0.005). Those individuals from Almanagial increase the incidence of cataract by (5) times compared with wad madani locality (reference category) . for East Gezira locality which means that population of East Gezira increase the incidence of cataract by time compared with wad madani, other localities were insignificant with reference to wad madani. The variable of marital status , also two categories where show significant correlation with the dependent variables (married , widow) increase the incidence of cataract by (2) times than people un married . Other divorced was insignificant with reference single. People have (lack in vision, accident in eye, disease in eyes before, disease in eyes, right eye examination, left eye examination) increase the incidence of cataract by (7,2,4,7,8,7) times, the respondent make smoking increase the incidence by (2) times than others . The end variable (medicines) respondent use ,medicines of eyes increase the incidence of cataract by (3) times .

Log (odds) = -5.8 +.778 x_{21} + .987x_{22} + .178x_7 + .139x_{81} + .154x_{82} - 1.1x_{11} - 1.015x_{12} -.902x_4 -.469x_5 -.497x_6 - .210x_9 -.258x_{10}.

x_{21} married , x_{22} widow , x_7 eyes diseases , x_{81} right eye examination , x_{82}left eye examination , x_{11} Al managil , x_{12} East Gezira , x_4 Lack in vision , x_5 accident in eye , x_6 Disease in eye before , x_9 Smoking , x_{10} Medicines of eyes.

Table (6) : Results fitting logistic regression model

Variables	B	S.E.	Wald	Df	Sig.	Exp(B)	Odds
40-45 (Age)			4.296	4	.367		
46-50	.249	.400	.386	1	.534	1.282	4.546
51-55	.023	.372	.004	1	.950	1.023	1.880
56-60	.434	.366	1.407	1	.236	1.544	2.838
60+	.589	.347	2.887	1	.089	1.803	2.245
South Gezira	.419	.384	1.191	1	.275	1.521	2.919
Al kamleen	-.160	.427	.140	1	.708	.852	5.756
Al hassaheesa	-.557	.375	2.211	1	.137	.573	1.341
Al managil	-1.10	.391	7.927	1	.005**	.333	0.499
East Gezira	-1.01	.446	5.183	1	.023**	.362	0.567
Oum Al Goraa	-.245	.537	.207	1	.649	.783	3.608
Illiterate			5.598	6	.470		
Khalawi	.290	.345	.709	1	.400	1.336	3.976
Primary	.125	.294	.182	1	.670	1.134	8.462
Intermediate	-.167	.336	.248	1	.619	.846	5.493
Secondary	.200	.480	.174	1	.676	1.222	5.504
University	.748	.725	1.066	1	.302	2.113	1.8984
Higher education	2.442	1.448	2.842	1	.092	11.493	1.095
Single			10.21	3	.017**		
Married	.778	.312	6.210	1	.013**	2.178	1.848
Divorced	-.047	.529	.008	1	.930	.954	20.73
Widow	.987	.403	5.990	1	.014**	2.683	1.594
House wife			3.172	5	.674		
Employer	-.906	.696	1.693	1	.193	.404	0.677
Worker	-.073	.521	.020	1	.889	.930	13.28
Farmer	-.388	.665	.341	1	.559	.678	2.105
without work	-.203	.380	.284	1	.594	.817	4.464
Free job	-.462	.684	.455	1	.500	.630	1.702
Lack in vision	-.902	.362	6.198	1	.013**	.406	0.683

Unclear vision	-.054	.327	.027	1	.869	.948	18.23
Unclear color	.001	.311	.000	1	.996	1.001	1001
Difficulty night vision	-.309	.263	1.385	1	.239	.734	2.7593
Affected sun	-.118	.273	.187	1	.665	.889	8.009
Double vision	.376	.262	2.065	1	.151	1.456	3.1929
Redness eyes	-.118	.244	.233	1	.630	.889	8.009
Affected by accident in eye	-.469	.247	3.614	1	.057**	.626	1.673
Disease in eye before	-.497	.222	5.008	1	.025**	.608	1.551
Snuff	.339	.313	1.171	1	.279	1.743	3.481
Diabetics	.226	.255	.789	1	.374	1.403	4.937
General diseases	.043	.048	.822	1	.364	1.254	23.72
eyes diseases	.178	.056	10.17	1	.001**	1.195	6.128
Disease in eye before	-.242	.039	39.35	1	.000**	.785	3.651
Smoking	-.210	.041	26.37	1	.000**	.811	4.291
examination right eye	.139	.036	15.06	1	.000**	1.149	7.711
examination left eye	.154	.039	15.59	1	.000**	1.167	6.988
Medicines	.147	.107	1.895	1	.169	1.158	7.329
Medicines of eyes	-.258	.056	21.24	1	.000**	.773	3.405

*Source: spss output based on data for researchers age related Cataract survey **sig 5%*

Conclusions: Incident cataracts are common age – related problems and incidence increases with increasing age at baseline . these data will help planning for future care (eg, cataract surgery and change in spectacle correction) and in investigating the importance of risk factors.

Recommendation: expanding the use of dual – response logistics regression in economic and social studies . make regular eye test and wearing sunglass.

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