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RESEARCH ARTICLE

USING DISCRIMINATION FUNCTION TO DISCRIMINATE THE DELIVERY IN KING FAHAD HOSPITAL

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ABSTRACT

The discrimination function is a mathematical model can be used to explain the effected factors. In this study the reproduction is very important for life, and it contains a group of sequence events (Delivery and Pregnancy). Event of delivery can be achieved after 270 -280 days and in the case called (Atform), Sometimes the delivery will be between 180-270 days and in this case called (Prematurity). If delivery within less than 180 days in this case called (Abortion). Sometimes delivery will be after 280 days and in this case called (Late delivery). The delivery happens after some events called (Labour), if it is itself called (Spontaus) or inducal and in this case may be normal or artificial. Here in this study we use the analytical methodology. The expected findings, we would like to know the variables that affected and which the first second and third, if there are variables can affect. Lastly we think we can give a good idea for people and also for the economic in the county.

INTRODUCTION

Methodology of the research

Data were collected from King Fahad Hospital at Albaha city (KSA), the data were randomly collected for delivery (20 are Normal and 20 are Cesarean).

Problem of the Study

The problem is how to use statistics for the society to discriminate between two groups or more according to the variables of the observation.

Importance of the Study

To know:

1. Reasons that lead to abnormal deliveries.
2. Discriminate between Normal and Artificial According to the variable that related to the delivery.
3. Test of variables that lead to Cesarean Section or Normal Delivery.
4. Application of Statistics to society or healthy observation.

Goals of Study

a. Medical attention and awareness to clarify the negative effects of circumcision and tumble of the birth.
b. Family awareness of the danger of early marriage and recommended the minimum age of marriage for woman of 25 years.
c. Seeking medical consulting at all stages of pregnancy.

Review of Delivery

Delivery will be after completing the pregnancy (270 - 280) days which lead to (At form), sometimes it takes (180-270) days and in this case called prematurity. If it is less than 180 days called Abortion. Delivery may came after labor and in this case called spontaus and in some cases called inducal. The artificial delivery reduce the higher rate of death for mothers in under develop countries. So this kind of operations are very important in some countries.

The factors effect the delivery

That factors are age, number of delivery cervix, fetus holder form, the size of the fetus, and the contraction of the uters ... and additional to the above the artificial operation have negative effect and of high danger for the new born, also smoking will affect the new born.

Discriminate Analysis

Here discriminate analysis take importance to discriminate between two groups or more for individuals or things like the bank manager may discriminate the debitors to good debitor or not good according to some standards, also in the study we would like to discriminate to normal delivery or artificial delivery according to the weight of the born and the age of the mother.

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Discrimination analysis differ from regression analysis that the dependent variable discriminate is nominal variable from qualitative variables where the dependent variable in case of regression is continuous variable and it is from quantitative variables, but both of them explain the relationship between the dependent variable and independent variable through linear model.

Calculating of the function

1. obtain the mean for each variable and then the difference between the mean in each variable for the two groups

$$\bar{x}_i(j) = \sum_{k=1}^{n_i} x_i k(j)/n_i \quad , \quad j = 1,2 \qquad (1)$$

2. $$d_i = \bar{x}_{i(1)} - \bar{x}_{i(2)} \qquad (2)$$

3. Obtain the sum of squares for each variable within group

$$s_{ii(j)} = \sum x_{i(j)}^2 - \frac{(\sum x_{i(j)})^2}{n_i} \qquad (3)$$

4. Obtain of sum of product for each two variables in the group

$$s_{ik(j)} = \sum x_i x_k - \frac{(\sum x_{i(j)})(\sum x_{k(j)})}{n_i} \qquad (4)$$

5. Obtain the pooled variance between the two groups for each variable

$$v_{ii} = \frac{s_{ii(1)} + s_{ii(2)}}{n_1 + n_2 - 2} \qquad (5)$$

6. Obtain the pooled co-variance for each two variables

$$v_{ik} = \frac{s_{ik(1)} + s_{ik(2)}}{n_1 + n_2 - 2} \qquad (6)$$

7. Obtain the matrix of variance

$$v = \begin{bmatrix} v_{11} & v_{12} & v_{13} \\ v_{21} & v_{22} & v_{23} \\ v_{31} & v_{32} & v_{33} \end{bmatrix} \qquad (7)$$

8. Obtain discriminate function (L)

$$L_{ik(j)} = \alpha_1 x_{ik(j)} + \alpha_2 x_{2k(j)} + \alpha_3 x_{3k(j)} \qquad (8)$$

Where $\alpha_1, \alpha_2, \alpha_3$ selected to give higher discrimination between the two groups and here between group variations greater than within group variation.

9. $$\lambda = \frac{between\_group\ \text{var}iation}{within\_group\ \text{var}iation} \qquad (9)$$

We select $\alpha_1, \alpha_2, \alpha_3$ that λ is more large

10. Then the normal equation to obtain $\alpha_1, \alpha_2, \alpha_3$ is

$$v\alpha = d$$

11. $$\begin{bmatrix} v_{11} & v_{12} & v_{13} \\ v_{21} & v_{22} & v_{23} \\ v_{31} & v_{32} & v_{33} \end{bmatrix} \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} = \begin{bmatrix} d_1 \\ d_2 \\ d_3 \end{bmatrix} \qquad (10)$$

and for obtaining $\alpha_1, \alpha_2, \alpha_3$

11. $$\alpha = v^{-1} d \qquad (11)$$

12. Then we calculate $\alpha_i = \alpha_i \sqrt{v_{ik}} \qquad i = 1,2,3 \qquad (12)$

and by comparing the absolute values for α_i^* so the biggest is value means variable x_i is of high importance and has the ability for discrimination between the two groups ... and so on.

13. Obtaining the average for the values of discrimination for each group

$$L_{(1)} = \sum L_{i(1)} / n_1$$

$$L_{(2)} = \sum L_{i(2)} / n_2 \qquad (13)$$

14. Then we use t test to the difference between the two averages (1)

$$t = \frac{L_{(1)} - L_{(2)}}{\sqrt{s_p^2 (\frac{1}{n_1} + \frac{1}{n_2})}} \qquad (14)$$

Where s_p^2 is the pooled variance;

$$s_p^2 = \frac{ssl_{(1)} + ssl_{(2)}}{n_1 + n_2 - 2} \qquad (15)$$

15. Then we compare the calculated (t) with the tabulated (t)

16. We can test by another method for effects of independent variable (x_1, x_2, x_3) for function (1)

$$H_0 : \alpha_1 = \alpha_2 = \alpha_3 = 0$$

and in this case we use F test

$$F = \frac{(n_1 + n_2 - m - 1)}{(n_1 + n_2 - 2)} T^2 \qquad (16)$$

Where $T^2 = t^2, (m)$ is the number of variables then comparing the calculated F with the tabulated F (degrees of freedom (m) as numerator and ($(n_1 + n_2 - m - 1)$ for the denominator.

The value of (F) in equation (16) can be obtained by using $D^2 (Mahalanobis)$

Where D^2 is the square of distance between the two groups

$$(D^2 = \alpha_1 d_1 + \alpha_2 d_2 + \alpha_3 d_3)$$

$$F = \frac{n_1 n_2 (n_1 + n_2 - m - 1)}{(n_1 + n_2)(n_1 + n_2 - 2)m} . D^2 \qquad ((16)$$

Then we construct the ANOVA table

S.O.V	d.f	S.S.	M.S.	F
Between X's	M	SSB	MSB	MSB/MSW
Within X's	n_1+n_2-m-1	SSW	MSW	
Total	n_1+n_2 -1	SST		

$$SSB = \frac{n_1 n_2}{(n_1 + n_2)(n_1 + n_2 - 2)} \left\| D^2 \right\|^2 \qquad (17)$$

$$SSW = D^2 \qquad (18)$$

Calculating of discrimination function

1- by using equation (1) and (2) we get the mean of each variable

Normal	Abnormal	
Group(1)	Group(2)	**Difference** d_i
$\bar{x}_1(1)$ **=26.9**	$\bar{x}_1(2)$ =30.8	d_1 **=-3.9**
$\bar{x}_2(1)$ **=1.7**	$\bar{x}_2(2)$ =2.75	d_2 **=-1.05**
$\bar{x}_3(1)$ **=2.77**	$\bar{x}_3(2)$ =2.91	d_3 **=-0.14**

2- By using equation (3) and (4) we get sum of squares for each variable and to each two variables in the group

Group(1)	Group(2)	
$S_{11}(1) = 432$	$S_{11}(2) = 625$	27.8
$S_{22}(1) = 72.2$	$S_{22}(2) = 109.7$	4.8
$S_{33}(1) = 2.9$	$S_{33}(2) = 27.2$	0.8
$S_{12}(1) = 79.4$	$S_{12}(2) = 241$	8.43
$S_{13}(1) = -1.2$	$S_{13}(2) = 19.2$	0.5
$S_{23}(1) = 0.3$	$S_{23}(2) = 6.5$	0.2

3- using equation (5) and (6) for pooled variances and pooled covariance for each variable and each two variables in groups we get the below matrix using equation (7)

$$v = \begin{bmatrix} v_{11} & v_{12} & v_{13} \\ v_{21} & v_{22} & v_{23} \\ v_{31} & v_{32} & v_{33} \end{bmatrix} = \begin{bmatrix} 27.8 & 8.43 & 0.5 \\ 8.43 & 4.8 & 0.2 \\ 0.5 & 0.2 & 0.8 \end{bmatrix}$$

To find the discrimination function (8) we calculate $\alpha_1, \alpha_2, \alpha_3$ depending on equation (10) as below

$$\backslash \begin{bmatrix} v_{11} & v_{12} & v_{13} \\ v_{21} & v_{22} & v_{23} \\ v_{31} & v_{32} & v_{33} \end{bmatrix} \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} = \begin{bmatrix} d_1 \\ d_2 \\ d_3 \end{bmatrix}$$

$$\backslash \begin{bmatrix} 27.8 & 8.43 & 0.5 \\ 8.43 & 4.8 & 0.2 \\ 0.5 & 0.2 & 0.8 \end{bmatrix} \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} = \begin{bmatrix} -3.9 \\ -1.5 \\ -0.14 \end{bmatrix}$$

Then

$$\alpha_1 = -0.096482$$
$$\alpha_2 = -0.139731$$
$$\alpha_3 = -0.079766$$

Then the discrimination function

$$\alpha_i^* = \alpha_i \sqrt{v_{ii}}$$
$$\alpha_1^* = -0.096482\sqrt{27.8} = -0.508$$
$$\alpha_2^* = -0.139731\sqrt{4.8} = -0.306$$
$$\alpha_3^* = -0.079766\sqrt{0.8} = -0.070$$

From these results we can say the age of the woman is the first variable that affects the sort of delivery, then the number of previous delivers, lastly the weight of the born.

Conclusion and Recommendation

Although specialized physician confirm that the variables undertaken in the study have an impact on the type of birth, but the result turned out the deficiency of the calculated function whether the discriminatory or the regression analysis to distinguish the new births. Based on the opinions of experts, we recommend increasing the sample size in order to get the discriminatory ability of the function, but if their opinions were based only on previous experience, we recommend implementing subsequent research to identify the related impact o the delivery type variables.

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