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Mathematical Model of the Incidence Prostate Cancer in Mexico

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Abstract: One of the problems of public health in Mexico are the oncological diseases, being one of the main causes of death in the population, according to the Instituto Mexicano del Seguro Social in the year 2015 prostate cancer has a high incidence in mortality from malignant tumors with a rate 16 and data published by the National Institute of Cancerology indicate a mortality rate of 13 deaths per 100,000 men. This paper is a study of transversal qualitative cut, documentary where a mathematical model is developed through the obtained data of various studies. Objecting to the results for models tested, linear, logarithmical, inverse, quadratic, bouillon, polynomial of degree 4, composite, potential, S, growth, exponential and logistic in all cases the R^2 is greater than 0.9, What would implicate that they could adjust to anyone of these, but without prescriptive this is not possible due to the natural processes in the disease, where there is a process of adaptation, growth, base and decline, so that you choose in two models the cubic since this continues processes ciclicos in his behavior, getting the following equation and= -0.0024x3 14.731x2 - 29643X 2E7 with a R^2 0.97
Key words: Model mathematical, cancer of prostate, modeling numerical

Introduction

The Prostate Cancer Action Program of the 2010 establishes that the increase in life expectancy (women 78 and men 72 years) have brought with them the ageing of the population, which in a couple of decade the pyramid population be invested, and therefore the increase of chronic-degenerative diseases; among them stand out by their frequency malignant tumors, that since 2009 occupy in Mexico the second as a cause of death; between the 5 main causes, 90% of lung cancers are attributed to smoking, while cancers of the colon and prostate cancer are related to the degree of development and aging of a country (Urbina, 2010), contrary to the stomach, which is linked to nutritional habits, it is important to point out that Mexico occupies the first place of obesity, the second in diabetes at the international level (PNS, 2010).

Prostate cancer is one of the malignant neoplasm's more frequent in men and is directly proportional according to age, 87.6% of the deaths were recorded in the population older than 65 years (Figueiredo, 2006).
In the early stages of the disease, the cancer is confined to the prostate and not usually fatal; the actions of timely detection make the need to look for a tool that allows you to incorporate the patient to the radical treatment on time and prevent the progression of the disease (Gandur, 2012).

Among the most important is the construction of mathematical models because it is one of the tools used today for the study of problems in medicine, biology, physiology, biochemistry, epidemiology, pharmacokinetics, among other areas of knowledge; its primary objectives are to describe, explain and predict phenomena and processes in those areas. However, its implementation is often constrained by the lack of knowledge and information about the basic principles of mathematical modeling (Rodriguez, 2009).

The relevance of the construction of mathematical models to determine the incidences of prostate alterations is evident: a) model construction sometimes reveals relationships that are not obvious at first sight; b) once the mathematical model has been built it is possible to extract from it properties and characteristics of the relations between the elements that would otherwise remain hidden; c) in most of the problems of prostate incidences in the real world it is not feasible to experiment with reality, because it can be very expensive, dangerous, immoral or even impossible. Therefore, it is natural to try to overcome this difficulty with the construction of a model that adequately describes the basic characteristics of the epidemic and then use the model to predict the consequences of introducing specific changes d) The main function of a model of our model is to provide a means that allows understanding the spread of an infectious disease through a population under different scenarios (Gamar, 2010).

It is important to emphasize that a model is defined by the relationships it incorporates. These relationships are independent of the data to be introduced into the model, since a model can be used for different occasions and in different contexts. It should be noted that mathematical models are used as a tool to make decisions and that they should be valued in their fair measure, because it is difficult to understand a complex problem without a minimal modeling, although it is also necessary to recognize that it is not possible Modeling all of the real situations. In essence, the central function of creating and analyzing mathematical models is to

improve the understanding of a system to prevent future disease situations, to determine the prevalence and incidence and to contribute to make objective decisions to control or eradicate Diseases (Mesa-Mazo, 2010).

Methodology

Is a study of transversal qualitative cutting, documentary where a mathematical model is developed through the obtained data of various studies, using, SPSS to perform the analysis.

Resulted

According to Sánchez-Barriga (2013) and Díaz (2018) The prostate cancer rate data in the Mexican population corresponds to (Table 1):

Year	2000	2005	2010	2015	2020	2030
Rate	7.73	9.01	10.2	16.0	10.08	25.4

Table 1. Table of years against the mortality rate of prostate cancer in Mexico. Sánchez-Barriga (2013) and Díaz (2018)

When performing the mathematical modeling by means of SPSS is obtained (Table 2):

Dependent Variable: Rate								
Equation	Model Summary					Estimates of the parameters		
	R^2	F	gl1	gl2	Sig.	Constant	*b*1	*b*2
Lineal	.964	108.123	1	4	.000	-1222.419	.614	
Logarithmical	.964	106.353	1	4	.000	-9399.570	1237.453	
Inverse	.963	104.605	1	4	.001	1252.483	-2492615.074	
Quadratic	.965	109.913	1	4	.000	-603.691	.000	.000
Polynomial 3	.965	111.723	1	4	.000	$2E^7$	.0024	14.731
Compost	.968	122.579	1	4	.000	2.497E-036	1.043	
Potency	.969	123.215	1	4	.000	3.204E-279	84.631	
S	.969	123.809	1	4	.000	87.284	-170537.981	
Increase	.968	122.579	1	4	.000	-81.978	.042	
Exponential	.968	122.579	1	4	.000	2.497E-036	.042	
Logistical	.968	122.579	1	4	.000	4.05E+35	.959	
The independent variable is year.								

Table 2. Summary of mathematical model of years against mortality rate of prostate cancer in Mexico. Own preparation

In each of the estimators can be seen that the correlation coefficient R^2 is greater than 0.9, so you must determine which is the model that complies with the characteristics of the population according to their growth and the natural state of the pathology.

So it is opted in two models Cubic given that this follows processes cyclic in its behavior, obtaining the following equation $y = -0.0024\ x^3 + 14.731\ x^2 – 29643x + 2E^7$ with an R^2 of 0.97.

Discussion

In this work, was performed an analysis of data reported for the realization of a mathematical model which allowed to obtain a justified projection of the behavior of prostate cancer in Mexico, which allows an evaluation for decision making in Health Programmers in Specifics diseases (Castillo-Riquielme, 2010).

The mathematical model of prostate cancer is in order to make projections and understand the prostate cancer allows an analysis to determine the most sensitive factors of the same, which leads to have arguments for the elaboration of strategies For the control and prevention of pathology (Rodriguez, 2009).

The dynamics of prostate cancer reflects that a behavior probabilistic therefore that the likely that in some years the number of cases found cancer growing the rate through the following decade but the projection allows to have the opportunity to inform and to have actions in our commutation of men with the realization of corresponding studies of according to the stage of his life (Mesa-Mazo, 2010).

It is determined that due to the increase in adult population could be projected to be greater the number of cases of cancer sane to the factor sensitive to study age, so the Modeled polynomial allows to establish the properties Cyclical of the nature of the Diseases with ridges and valleys (Casals, 2012).

In conclusion the mathematical models in study raises a great deal of interest growing that increase more with is study that are being done, also expect new innovations in mathematical models to have new tools that we eyed to detection opportune of cancer of prostate and hold a population healthy before other health problems.

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