SUPPORTS THE DECISION OF INSURANCE COMPANY WHILE UNDERWRITING INDIVIDUAL HEALTH RISKS

Emad Abdelgalil Ali Ismail, PH.D

Associate Professor, Department of Insurance, Cairo University,
Currently at Quantitative Analysis Department, King Saud University
emadali@ksu.edu.sa

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Abstract

Policyholder's degree of health risk could be classified as normal as or better than normal or high or bad. This article provides an evaluation of policyholder's degree of risk for the individual health insurance coverage. We examine the relationship between Policyholder's degree of individual health risk and the effect of his demographic factors. A quantitative model is proposed to support decision-underwriting of insurer by segmenting the health insurance underwriting portfolio to four risk groups or clusters which are different and mutually exclusive (low-risk, normal risk, high risk, bad risk) based on some demographic factors affecting the degree of risk which are all internally homogenous and different from the other groups, using cluster analysis. The likelihood of the insured to risk groups has been estimated using polynomial logistic regression analysis, and the degree of risk most likely has been determined in order to take appropriate underwriting decision. This study was based on experience of one insurance company in Saudi Arabia, and ~~gets~~ using a random sample for detailed data on individual health insurance during the period 2013-2015. We found a relationship between the degree of health risk and policyholder's demographic factors. Using this result we were able to calculate the probabilities of affiliation of the insured for various degrees of risk.

Keywords: Health insurance, degree of risk, underwriting, demographic factors.

1. INTRODUCTION

By the end of 2014, the number of insurance and reinsurance companies licensed in the Saudi market totaled 35 companies, 28 of them are qualified by the Cooperative Health Insurance Council to provide medical insurance services. General insurance includes seven sub-activities namely vehicles, marine, aviation, energy, engineering, insurance, accident and liability insurance, as well as insurance on property and against fire. The risks to insurance companies vary according to the risk of major insurance activities, competition and growth rates for each insurance activity. [19]
Medical insurance represented 52% of the insurance market at the end of 2014, and vehicle insurance accounted for 26.5%. So the medical insurance and vehicle insurance represented 78.5% of the size of the insurance market, while protection and savings insurance rep-resented only 2.6%.[13]

On the other hand, total paid claims paid rose by 26% to SAR 20.5 billion in 2014 compared to SAR 16.7 billion in 2013. Net claims incurred for insurance companies amounted to SAR 17.6 billion in 2014 growing 11.2% over the previous year where the figure reached SAR 15.8 billion. The claims of medical insurance accounted for 60% of the total claims incurred during the year.[13]

Table 1 shows the results of net incurred claims for health insurers which displayed a 5.5% increase to SAR 10.4 billion, thus the loss ratio decreased to 79% compared to 94% in 2013.[13]

Table 1. Results of Health insurance Processes

Health insurance (SAR million)	2013	2014	Growth
Gross Written Premium	12778	15750	23%
Net Written Premium	11317	14659	30%
Net Earned Premium	10553	13259	26%
Net Incurred Claims	9900	10448	6%
Retention	89%	93%	
Loss Ratio	94%	79%	

The health insurance underwriting cycle reflects the tendency for health insurance premiums and insurer profitability to systematically fluctuate over time.[1] Underwriting in risks is the process by which the insurer decides whether or not to accept a proposal of insurance, on what conditions, in what proportion, and at what price. [9] This process is most important for the technical operations in the insurance company, it also has an effect on the outcomes of the insurer business and may also lead to the bad effects may not be able to afford the insurance company. Underwriting of individual health risks are those processes relating to the evaluation of individuals dangers and the possibility of coverage, and so by estimating the degree of risk related to these individuals for appropriate underwriting decision. These decisions may be to accept or denying the coverage or acceptance with conditions. Then it is classified risk unit within the appropriate risk group within its risk underwriting insurer portfolio.

In some very exceptional circumstances, an underwriter may have little previous experience to assess potential claims, and he then must base his assessment largely on gut-reaction. But far more commonly an underwriter has the benefit of experience of many similar previous claims, and this can be analyzed and used. He can then determine the major underwriting factors (that is, the characteristics that are most likely to influence annual claims costs under the contract) and then classify contracts according to those factors. Identifying and measuring these factors or characteristics requires detailed statistical analysis.[9]

There are several procedures performed by the underwriter in underwriting health risks, as follows:

(i) Determine major underwriting factors affecting the degree of health risk, which depends on the underwriter experience. According to these factors they are insured and divided into different risk groups from each other, and each risk group of insured is similar in the degree of health risk.

(ii) Measuring the average annual claims for each risk group, using the frequency distribution data for each of the number of claims and the size of claims.

(iii) Evaluation of the proposed health risk, through the study of factors affecting the degree of risk, and classification of the proposed health risk within the appropriate risk group.

Underwriting health risks process aims to minimize the adverse effects that may be exposed to the insurance company, as a result of selection against the company through the new insurance applicants. As well as minimizing the degree of inherent risks within heterogeneous groups of danger. Adverse selection plays a prominent role in the insurance literature due to its negative implications for insurer financial performance and stability, adverse selection could be a manageable problem for insurer.[6,7] And therefore it is the insurance companies that must follow strict underwriting, and that each branch of the insurance branches practiced.

This paper concerning the study of underwriting health risks, as the subscription of this type of insurance is especially important, because the factors affecting the degree of health risks are many, such as age, sex, nationality, marital status, occupation, place of residence, etc. Underwriting decision on the health risks in this paper is as follows:

- Acceptance of insurance coverage with a discount price.
- Acceptance of insurance coverage at the normal price.
- Acceptance of insurance coverage with the increase in the price.
- Denial of insurance coverage.

2. LITERATURE REVIEW

Arrow, Mossin, and smith have demonstrated that when insurance is priced at actuarially fair rates insured prefer policies that offer full coverage. Since insurance is not a costless business, insurers sell policies above the actuarially fair premium to cover their expenses. Smith has shown that when health insurance is available at a cost that exceeds the actuarially fair value and the probability of loss is greater than zero, the optimal level of insurance coverage will depend on an individual's degree of risk aversion and the cost of insurance. For a given risk-averse individual, the optimal level of insurance will decrease as the cost of insurance increase. Depending on the shape of the utility function, the optimal level of health insurance may be zero or exceed the value of the asset, human capital, subject to risk.[15] Where the equilibrium underwriting, in which low risks obtain greater coverage than they would without underwriting.[5] Based on the underwriting behavior of insurance companies in 1988, classified medical conditions into three categories: conditions that led to denial of coverage; conditions that led to exclusion restrictions; and, conditions that led to higher premiums.[16]

There is a paucity of empirical evidence consistent with the existence of adverse selection in the U.S. insurance market. Potential reasons for the lack of evidence include: (i) that insurers effectively use underwriting and pricing to counteract adverse selection; or (ii) that consumers either do not have, or fail to take advantage

of, private information. [7] Discussion about several strategies to prevent or to counteract the observed negative spillover effects of supplementary insurance. Health insurers may have become more inclined to calculate risk-rated premiums and to use medical underwriting to prevent high-risk applicants from enrolling.[2] The U.S. health care reform debate and legislation, discussed the potential effects of the mandate that individuals have health insurance in conjunction with proposed premium subsidies and health insurance underwriting and rating restrictions.[3] An indicator of underwriting profitability in property-liability insurance, have changed over time. The findings asserted that underwriting profit has worsened in recent years, and combined ratios are non-stationary. The study affirmed that life style and one's health have an important impact up on the underwriting process in health care field.[10] A number of alternative explanations have been offered for insurance underwriting cycles, but no study to date has empirically evaluated this tendency in the health insurance industry. The study used national data over the period from 1960 to 2004 to test if various theories pertaining to price movements in the property and casualty insurance industry can also explain premium behavior in the health insurance industry. The empirical results provide strong support for the capacity constraint, fluctuation in interest rate and rational expectations with institutional intervention hypotheses.[1] Underwriters considered the following background medical information about four pairs of hypothetical applicants. One member of each pair was described as having positive genetic test information. In seven instances, an adverse underwriting action was taken on applicants based on their genetic test result; in two others, participants indicated uncertainty as to how to underwrite an applicant with genetic test information. In seven of these 92 applications, underwriters said they would deny coverage, place a surcharge on premiums, or limit covered benefits based on an applicant's genetic information.[8]
Jason Brown and Mark Warshawsky use numerous demographic and health characteristics, this allows for analysis of disability and mortality risk across a number of dimension and they find that different risk groups at age 65 have similar projected long-term care expenses, but that the level –periodic – premium structure of most long-term care insurance policies creates incentives for individuals to separate into different risk pools according to observable characteristics, justifying the underwriting observed on the market. [4]

2.1 Objective of the study

The aim of this paper is to evaluate the degree of risk of policyholder for the individual health insurance coverage, by examining the relationship between the degree of individual health risk and demographic factors affecting the insured and then propose a quantitative model to support decision-underwriting of insurer. To achieve this aim reduces the possibility of adverse selection of insurer.

3. METHODOLOGY

This paper is for measuring the risks associated with the process of individual health insurance underwriting. Data of 1658 insured individuals were obtained from one Saudi insurance company and analyzed using Cluster Analysis, One-Way ANOVA and Multinomial Logistic Regression.

3.1 Assumptions of the model

We assume the following:

(i) The degree of individual health risk varies from one person to another depending on policyholder's demographic factors.

(ii) The degree of health risk's policyholder is one out of four mutually alternatives, are: low, normal, high and bad risk.

(iii) Insurer's underwriting decision making for individual health risk's policyholder depending on the category of the degree of risk.

3.2 Mathematical Framework

Cluster Analysis for dividing the data obtained to the risk groups or clusters which are different and mutually exclusive, and each has its own characteristics, which considers all risk groups internally homogeneous and different from the other risks Groups.

One-Way ANOVA: We can perform analysis of variance test in one direction (One-Way ANOVA), to make sure the differences means of various groups of the risks, and testing the following null hypothesis:

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$$

Multinomial or Polytomous Logistic Regression: When the dependent variable is qualitative, Discrete, and has several limits or responses, and independent variables are mixture of quantitative both types of variables (Discrete and continuous) it would be appropriate to use a Multinomial Logistic Regression. This model has many uses in the process of life, especially in the medical field, when a dependent random variable has several responses, such as assessing the prospects for the symptoms of a disease that (No - There is simple - there is an average - there are chronically), or when it comes to choose the way of one of the ways of the diet, and in all the previous cases are estimated probability of each response from the variable responses, and determine the most probable value, so as to support making the right decision.[11]

To calculate the Probability of responses are:

- Model for Probability of Low-risk group

$$\hat{P}(Y = 0/X) = e^{h_0(x)}/[1 + e^{h_0(x)} + e^{h_1(x)} + e^{h_2(x)}]$$

- Model for Probability of Normal risk group

$$\hat{P}(Y = 1/X) = e^{h_1(x)}/[1 + e^{h_0(x)} + e^{h_1(x)} + e^{h_2(x)}]$$

- Model for Probability of High risk group

$$\hat{P}(Y=2/X)=e^{h_2(x)}/[1+e^{h_0(x)}+e^{h_1(x)}+e^{h_2(x)}]$$

- Model for Probability of Bad risk group

$$\hat{P}(Y=3/X)=1/[1+e^{h_0(x)}+e^{h_1(x)}+e^{h_2(x)}]$$

Where:

$$h_0(x)=\hat{\alpha}_0+\sum_{i=1}^{n}\hat{\beta}_{0i}X_i$$

$$h_1(x)=\hat{\alpha}_1+\sum_{i=1}^{n}\hat{\beta}_{1i}X_i$$

$$h_2(x)=\hat{\alpha}_2+\sum_{i=1}^{n}\hat{\beta}_{2i}X_i$$

3.2.1 Estimating model parameters

The likelihood can be generalized to include *G* outcome categories by taking the product of each individual's contribution across the *G* outcome categories. Where: [13, 17]

$$L(Y)=\prod_{j=1}^{n}\prod_{g=0}^{g-1}P(Y=g/X)^{y_{jg}}$$

$$where\ y_{jg}\begin{cases}1\ if\ the\ jth\ subject\ has\ D=g\\ \quad (g=0,1,\dots,G-1)\\ 0\qquad if\ otherwise\end{cases}$$

Estimated $\boldsymbol{\alpha}'\boldsymbol{s}$ and $\boldsymbol{\beta}'\boldsymbol{s}$ are those which maximize likelihood.

3.2.2 Wald Test

To test significance of interaction term at each level, for example:

$$H_0: \beta_{g1}=0\ ;\ g=1,2,\dots g-1$$

$$H_0: \beta_{g2}=0\ ;\ g=1,2,\dots g-1$$

Wald test Statistic:

$$Z=\frac{\hat{\beta}_{gi}}{S_{\hat{\beta}_{gi}}}\sim N(0,1)$$

3.3 Data Description

3.3.1 Dependent Variable is the degree of risk, assuming that the Y has several responses variable (A, B, C, D), where:

- C: Low-risk group (cluster 0)
- A: Normal risk group (cluster 1)
- B: High risk group (cluster 2)
- D: Bad risk group (cluster 3)

$$y = \begin{cases} 0 & if\ y = C \\ 1 & if\ y = A \\ 2 & if\ y = B \\ 3 & if\ otherwise \end{cases}$$

3.3.2 Independent Variables are health insurance underwriting factors (policyholder's demographic factors), as follow:

X_1: Age

Age affects annual claim costs differently, depending on the type of benefit involved, although both frequency and severity generally increase with advancing age for all types of benefits. Most individual medical expense policies are limited as to amount and type of coverage after a certain age, such as 65 or 70, although some companies have made lifetime coverage available.[12] This quantitative variable (continuous).

X_2: Residence

This variable is qualitative, and was regarded as a binary classification (inside the city / other), where:

$$X_2 = \begin{cases} 1 & if\ inside\ the\ city \\ 0 & if\ otherwise \end{cases}$$

X_3: Nationality

This variable is qualitative, and was regarded as a binary classification (Saudi / other), where:

$$X_3 = \begin{cases} 1 & if\ Saudi \\ 0 & if\ otherwise \end{cases}$$

X_4: Marital status:

This qualitative variable, and was considered a three-category (Married / Single / others), Where:

$$X_{41} = \begin{cases} 1 & if\ \text{Married} \\ 0 & if\ otherwise \end{cases}$$

$$X_{42} = \begin{cases} 1 & if\ Single \\ 0 & if\ otherwise \end{cases}$$

X_5: Gender:

As with life insurance, a person's sex is of considerable significance in health insurance underwriting. Females show higher disability rates than males at all but the upper ages in most studies. This is true even for policies that exclude or limit coverage of pregnancy, miscarriage, abortion, and similar occurrence.[12] This variable is qualitative, and was regarded as a binary classification (Male / other), where:

$$X_5 = \begin{cases} 1 & \textit{if}\ \text{Male} \\ 0 & \textit{if otherwise} \end{cases}$$

X_6: Occupation:

Occupational risk has two offsetting effects on the purchase of personal accident, sickness, and health insurance.[9] This variable is qualitative, and was regarded as a binary classification (Employee / other), where:

$$X_6 = \begin{cases} 1 & \textit{if}\ \text{Employee} \\ 0 & \textit{if otherwise} \end{cases}$$

X_7: Family History:

There's not much you can do about your gene pool. However, a family history of stroke, cancer or other serious medical conditions may predispose you to these ailments and lead to higher rates. Carriers are usually interested in any conditions your parents or siblings have experienced, particularly if they contributed to a premature death. Some carriers put more emphasis on your family's health than others, but it's likely to have some impact on your premium. This qualitative variable, and was considered a four-category (Fit / Middle / Not fit /etc.), Where:

$$X_{71} = \begin{cases} 1 & \textit{if fit} \\ 0 & \textit{if otherwise} \end{cases}$$

$$X_{72} = \begin{cases} 1 & \textit{if middle} \\ 0 & \textit{if otherwise} \end{cases}$$

$$X_{73} = \begin{cases} 1 & \textit{if not fit} \\ 0 & \textit{if otherwise} \end{cases}$$

4. DATA ANALYSIS AND FINDINGS OF THE STUDY

The data of individual health insurance claims and policyholder's demographic factors collected were analyzed using IBM SPSS statistics 22.

4.1 Groups of individual health insurance risks

The individual health insurance to four groups or clusters of claims data are divided according to the demographic factors influencing (age, residence, nationality, marital status, gender, occupation and family history). These groups are internally homogeneous and mutually exclusive, using cluster analysis technique. Table 2 provides the number of claims in each risk group. We assume clusters are levels outcome of dependent variable. Table 3 shows Descriptive Statistics of group risks mean of claims, standard deviation, standard error of the estimate, and confidence interval of 95% for each risk group or cluster. Also observed from the table that the cluster 3 is the most dangerous risk groups and cluster 0 is lowest dangerous risk groups. Thus the total numbers of claims have been divided into four graded-risk groups. One way ANOVA testes the differences between the average amount of claims for the risk groups.

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$$

Table 4 provides F value and its level significance *p*-value is zero, so we reject the null hypothesis and accept the alternative that there are differences between the means of amount of claims for the four risk groups.

Table 2. Number of Cases in each Cluster

Cluster	Number of Cases
1	5
2	1523
3	108
4	22
Total	1658

Table 3. Descriptive Statistics of group risks

Cluster	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
0	1523	510.25	1429.613	36.633	438.39	582.10	0	7509
1	108	14196.69	6454.852	621.118	12965.40	15427.99	7588	32581
2	22	54258.59	13488.263	2875.707	48278.23	60238.95	35239	81000
3	5	122310.80	15747.082	7042.309	102758.22	141863.38	105200	148000

Table 4. One way ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.515E11	3	5.051E10	6746.891	.000
Within Groups	1.238E10	1654	7485672.514		
Total	1.639E11	1657			

4.2 Underwriting model in the individual health risks

Multinomial Logistic Regression used to calculate the probabilities of policyholder's affiliation for different groups of risk, to determine the most likely value. Using the following equations:

$$h_0(x) = 61.907 + .413X_1 - 12.053X_2 - 14.212X_3 - 27.868X_{41} - 14.833X_{42} - 11.640X_5 + 17.55X_6 - 0.971X_{71} - 9.615X_{72} - 12.724X_{73}$$

$$h_1(x) = 52.358 + .173X_1 - 9.58X_2 - 12.065X_3 - 12.037X_{41} + 1.552X_{42} - 11.277X_5 + 17.284X_6 - 2.182X_{71} - 12.002X_{72} - 12.154X_{73}$$

$$h_2(x) = 42.589 + .028X_1 + 1.947X_2 - 10.111X_3 - 9.746X_{41} + 1.201X_{42} - 8.003X_5 + 18.486X_6 - 9.629X_{71} - 18.031X_{72} - 17.607X_{73}$$

4.2.1 Goodness of fit

4.2.1.1Likelihood Ratio Test

As with a standard logistic regression, we can use a likelihood ratio test to assess the significance of the independent variable in our model.[14]

In this paper, we have a four-level outcome variable and *p* independent variables for each of the outcome comparison. We are being by fitting a full model (with the exposure variable in it) and then comparing that to a reduced model containing only the intercept. The null hypothesis is that the beta coefficients corresponding to the exposure variable are both equal to zero. The likelihood ratio test is calculated as negative two times the log likelihood (log L) from the reduced model minus negative two times the log likelihood from the full model. The resulting statistic is distributed approximately chi-square, with degree of freedom (df) equal to the number of parameters set equal to zero under the null hypothesis. As follow:

$$H_0: \beta_{gi} = 0 \; ; g = 1,2, \dots g-1, i = 1,2, \dots., p$$

Likelihood ratio test statistic:

$$-2\ log\ L_{reduced} - \left(-2\ log\ L_{full}\right) \sim x^2$$

Table 5 shows negative two times the log likelihood for the reduced model is 1087.161 and for the full model is 259.957. The difference is 827.204. The chi-square *p*-value for this test statistic, with 30 degrees of freedom, is 0 . We conclude that the independent variables (policyholder’s demographic factors) are statistically significant at the 0.01 level.

Table 5. Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1087.161			
Final	259.957	827.204	30	.000

4.2.1.2 McFadden R^2

McFadden in multinomial logistic regression model similar to the coefficient of determination in linear regression, and has the same concept and characteristics. It has been calculated by McFadden in 1974, where:[11,18]

$$McFadden\ R^2 = 1 - \frac{\log L_{full}}{\log L_{reduced}}$$

It also has other measures similar to the measure, such as: R_L^2 ,$R_{Cox\ Snell}^2$

$$R_L^2 = \frac{\log L_{full} - \log L_{reduced}}{\log L_{full} - 1}$$

$$R_{Cox\ Snell}^2 = 1 - \left(\frac{\log L_{reduced}}{\log L_{full}}\right)^{2/n}$$

It also has another measure called Nagelkerke which depends on $R_{Cox\ Snell}^2$ by dividing the largest estimated value. Table 5 according McFadden shows that 75.4% of the variation in the degree of risk to interpret variations policyholder's demographic factors. 39.3%, 81.2% according Cox Snell and Nagelkerke respectively.

Table 5. Pseudo R-Square

Cox and Snell	.393
Nagelkerke	.812
McFadden	.754

MathCAD version 3.1 was applied for obtaining multiple logistic regression model, attachment 6 applications, which describes the different degree of risk depending on the policyholder's demographic characteristics.

5. Conclusion

We examined the relationship between Policyholder's degree of individual health risk and the effect of demographic factors. Data of 1658 insured were obtained from one Saudi insurance company, and got a detailed data about individual health insurance during the period 2013-2015. We estimated the policyholders' probabilities to risk groups and determined the degree of most likely risk. This supports the insurer in making underwriting decisions in individual health risks.

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Case_1

Risk factors		Age	Residence		Nationality		Marital status		Gender		Occupation		Medical History		
			Inside	Outside	Saudi	Non	Married	Single	male	female	Employee	non	Fit	Middle	Non
		30	√		√		√		√		√			√	
$h_0(x)$	*16.459*	Probabilities Degree of Risks			Low-risk		0.104		Degree of Risk				( ) Low-risk		
$h_1(x)$	*17.871*				Normal risk		0.426						( ) Normal risk		
$h_2(x)$	*17.971*				High risk		0.471						(√) High risk		
					Bad risk		7.377E-9						( ) Bad risk		
					Sum		1								

Case_2

Risk factors		Age	Residence		Nationality		Marital status		Gender		Occupation		Medical History		
			Inside	Outside	Saudi	Non	Married	Single	male	female	Employee	non	Fit	Middle	Non
		40	√		√		√			√	√		√		
$h_0(x)$	*40.873*	Probabilities Degree of Risks			Low risk		0.543		Degree of Risk				(√) Low risk		
$h_1(x)$	*40.698*				Normal risk		0.456						( ) Normal risk		
$h_2(x)$	*34.656*				High risk		0.001084						( ) High risk		
					Bad risk		0						( ) Bad risk		
					Sum		1								

Case_3

Risk factors		Age	Residence		Nationality		Marital status		Gender		Occupation		Medical History		
			Inside	Outside	Saudi	Non	Married	Single	male	female	Employee	non	Fit	Middle	Non
		35		√	√			√		√	√		√		
$h_0(x)$	*63.896*	Probabilities Degree of Risks			Low-risk		0.71		Degree of Risk				(√) Low risk		
$h_1(x)$	*63.002*				Normal risk		0.29						( ) Normal risk		
$h_2(x)$	*43.516*				High risk		1E-9						( ) High risk		
					Bad risk		0						( ) Bad risk		
					Sum		1								

Case_4

Risk factors		age	Residence		Nationality		Marital status		Gender		Occupation		Medical History		
			Inside	Outside	Saudi	Non	Married	Single	male	female	Employee	non	Fit	Middle	Non
		22	√		√		√		√			√			√
$h_0(x)$	*-7.504*	Probabilities Degree of Risks			Low-risk		2.602E-4		Degree of Risk				( ) Low risk		
$h_1(x)$	*-0.949*				Normal risk		0.183						( ) Normal risk		
$h_2(x)$	*0.315*				High risk		0.345						( ) High risk		
					Bad risk		0.472						(√) Bad risk		
					Sum		1								

Case_5

Risk factors		age	Residence		Nationality		Marital status		Gender		Occupation		Medical History		
			Inside	Outside	Saudi	Non	Married	Single	male	female	Employee	non	Fit	Middle	Non
		33	√		√		√		√		√				√
$h_0(x)$	*14.589*	Probabilities Degree of Risks			Low-risk		0.011		Degree of Risk				( ) Low risk		
$h_1(x)$	*18.238*				Normal risk		0.435						( ) Normal risk		
$h_2(x)$	*18.479*				High risk		0.554						(√) High risk		
					Bad risk		5.223E-9						( ) Bad risk		

	Sum	1	

Case_6

Risk factors		age	Residence		Nationality		Marital status		Gender		Occupation		Medical History		
			Inside	Outside	Saudi	Non	Married	Single	male	female	Employee	non	Fit	Middle	Non
		33	√		√		√		√		√			√	
$h_0(x)$	17.698	Probabilities Degree of Risks			Low-risk		0.226		Degree of Risk				**( )** Low risk		
$h_1(x)$	18.39				Normal risk		0.451						**(√)** Normal risk		
$h_2(x)$	18.055				High risk		0.323						**( )** High risk		
					Bad risk		4.653E-9						**( )** Bad risk		
					Sum		1								