

Evaluating Some of the Risk Factors of Heart Disease at Benghazi Cardiac Center

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**Kasem abdinibi Farag¹, Eman Shuaeib Essa²
Fathia Hussien Mohammed³**

¹Mathematical Department, Faculty of Science
Omar Al-Mukhtar University.

²Pre- economic Department, Faculty of Economy ,
Omar Al-Mukhtar University

³Department of Physiology, Faculty of Medicine
Omar Al-Mukhtar University

kasem.abdinibi@gmail.com

Abstract

Cardiovascular disease, commonly referred to as heart disease, is a well-documented and thoroughly researched medical condition. Epidemiological investigations indicate that the annual mortality rate associated with cardiovascular disease continues to increase. Understanding the intricate interplay of risk factors associated with cardiovascular disease is pivotal in addressing this escalating public health crisis. In this paper, we aimed to explore the use of chi square to identify association between heart disease and some of the important risk factors such as gender, age, diabetes, heart attack before, body mass index (BMI), systolic blood pressure (SBP) and cholesterol level. The dataset was collected from the heart patient's records of Benghazi Cardiac Center – Libya. Among the 136 instances examined, 68 were identified as cases, representing individuals diagnosed with heart disease, while the other 68 served as controls, consisting of individuals without heart disease. Our results shows very interactive and significant pattern. It is found that significant variation between the different risk factors. It is important for both pre and post-heart patients to be increasingly mindful of these risk factors. In addition, this study can contribute

to subsequent research efforts and will raise awareness among individuals about making healthier choices.

Keywords: Heart disease, Risk factor, Chi – Square technique.

تقييم بعض عوامل الخطر لأمراض القلب في مركز بنغازي للقلب

قاسم عبد النبي فرج¹، إيمان شعيب عيسي²، فتحية حسين محمد³

¹ قسم الرياضيات – كلية العلوم – جامعة عمر المختار

² قسم الاتجاه لعام – كلية الاقتصاد – جامعة عمر المختار

³ قسم علم وظائف الاعضاء – كلية الطب – جامعة عمر المختار

kasem.abdinibi@gmail.com

الملخص

أمراض القلب والأوعية الدموية، والتي يشار إليها عادةً بأمراض القلب، هي حالة طبية موثقة جيدًا ومدروسة بدقة. تشير التحقيقات الوبائية إلى أن معدل الوفيات السنوي المرتبط بأمراض القلب والأوعية الدموية مستمر في الارتفاع. يعد فهم التفاعل المعقد لعوامل الخطر المرتبطة بأمراض القلب والأوعية الدموية أمرًا محوريًا في معالجة أزمة الصحة العامة المتصاعدة. هدفنا في هذا البحث إلى استكشاف استخدام مربع تشي لتحديد الارتباط بين أمراض القلب وبعض عوامل الخطر المهمة مثل الجنس والعمر والسكري والنوبات القلبية السابقة ومؤشر كتلة الجسم (BMI) وضغط الدم الانقباضي (SBP) ومستوى الكوليسترول. تم جمع مجموعة البيانات من سجلات مرضى القلب في مركز بنغازي للقلب – ليبيا. من بين الحالات الـ 136 التي تم فحصها، تم تحديد 68 حالة على أنها حالات، تمثل أفرادًا تم تشخيص إصابتهم بأمراض القلب، بينما كانت الحالات الـ 68 الأخرى بمثابة عناصر تحكم، وتتكون من أفراد لا يعانون من أمراض القلب. تظهر نتائجنا نمطًا تفاعليًا وهامًا للغاية. وقد وجد أن هناك اختلاف كبير بين عوامل الخطر المختلفة. من المهم لكل من مرضى القلب وما بعده أن يكونوا أكثر وعياً بعوامل الخطر هذه. بالإضافة

إلى ذلك، يمكن أن تساهم هذه الدراسة في الجهود البحثية اللاحقة وستزيد الوعي بين الأفراد حول اتخاذ خيارات صحية. الكلمات المفتاحية: أمراض القلب، عوامل الخطر، أسلوب مريح كاي.

1. Introduction

Heart disease is increasingly becoming a significant health concern on a global scale. A report from the World Health Organization (WHO) indicates that in 2016, around 17.90 million people lost their lives due to heart disease, which corresponds to roughly 30% of all deaths worldwide [1]. Alarmingly, close to 55% of those diagnosed with heart conditions pass away within the first three years, and the costs associated with treating heart disease account for approximately 4% of annual healthcare expenditures [2]. Various reports indicate that heart disease can be prevented or treated with healthy lifestyle choices [3]. It is imperative to identify and understand the risk factors associated with heart disease to implement effective prevention and treatment strategies. The chi-Square test is a statistical method used to determine whether there is a significant association between variables. In the context of heart disease research, the Chi-Square test can be used to analyze the relationship between various risk factors such as smoking, hypertension, obesity, and diabetes, and the occurrence of heart disease[4][5]. By calculating the Chi-Square statistic, researchers can determine whether there is a significant association between these risk factors and the likelihood of developing heart disease. Several studies have utilized the Chi-Square test to identify risk factors for heart disease and assess their impact on cardiovascular health[6][7][8][9]. For example, a study conducted to examine the relationship between smoking, hypertension, and diabetes and the risk of developing coronary heart disease. The researchers found that individuals who smoked, had hypertension, or diabetes were more likely to develop heart disease. The Chi-Square test confirmed a significant association between these risk factors and the incidence of heart disease [6]. Another study investigated the association between obesity and heart disease. The researchers used the Chi-



Square test to analyze data from a large population-based sample and found a significant relationship between obesity and the risk of developing coronary artery disease. Individuals who were obese were more likely to have heart disease compared to those who were not obese.[7] Overall, the Chi-Square test has proven to be a valuable tool in identifying risk factors for heart disease and assessing their impact on cardiovascular health. By using this statistical technique, researchers can determine which risk factors are most strongly associated with the occurrence of heart disease and develop targeted interventions to reduce the burden of CVDs. Additionally, the Chi-Square test allows for the analysis of multiple risk factors simultaneously, providing a comprehensive understanding of the complex relationship between various factors and heart disease[8][9].

2. Data and Methodology

This research employed a prospective cross-sectional study design. A suitable questionnaire was prepared with the aim to include all the inclusion criteria related to important risk factors of heart disease. A data of the 136 instances were gathered from the reliable source, Benghazi Cardiac Center- Libya. 68 were cases (people who had a heart disease) and the remaining 68 were control (people who only had chest pain). The dataset contained 7 parameters and one target variable. The target variable was the presence of heart disease in the patient, represented by a binary class label, where "1" indicated the presence of heart disease and "0" indicated the absence of heart disease. Moreover, from several parameters, we excluded other parameters except for sex, Age, Diabetes, Heart attack before, Body mass index (BMI), Systolic blood pressure (SBP) and Cholesterol level.

3. Statistical Technique

The results are presented in frequencies and percentages. The Chi – square measure is used for the association between risk factors. The p-value < 0.05 was considered significant. All the analysis was carried out using SPSS 26 version (Chicago, Inc., USA).



4. Results and Discussion

Exploratory Data Analysis (EDA) was conducted to obtain a more profound comprehension of the data and its characteristics. The EDA process involved descriptive statistics and the Pearson's chi square test which was used in bivariate analysis to examine the relationship between categorical variables and the presence of the heart disease. A p-value ≤ 0.05 was considered as significant. Table 1 and figures 1 – 6 presents descriptive statistics for various risk factors associated with heart disease. These statistics are based on a sample of individuals and offer insights into the distribution of these factors among those with and without heart disease. The results showed that young people (under 21 years of age) had a lower risk of heart disease than older groups. Cardiovascular disease increases with age and is most commonly seen in the over 50 age group. In addition, people with diabetes have a higher risk of heart disease than people without diabetes. The risk of heart disease was significantly higher among people with diabetes (44.1%) than among those without diabetes (5.9%). In addition, people who have had a heart attack in the past are more likely to have a heart attack than people without a history of heart attack. The risk of heart disease was higher among people with a previous heart attack (36.8%) compared to those without (13.2%). Also, overweight and obese people are more prone to heart disease compared to people with normal body mass index. Cardiovascular disease increases with increasing body mass index, which is the highest observed in any species group. People with high systolic blood pressure have a higher risk of heart disease than people with normal blood pressure. The risk of heart disease was higher in people with high blood pressure (33.1%) compared to people with normal blood pressure (16.9%). Finally, people with high cholesterol levels are more likely to have heart disease than people with normal cholesterol levels. The risk of heart disease is higher among people with high cholesterol levels (36%) compared to people with normal cholesterol levels (14%).

Table 1: The descriptive statistics for the parameters

Risk factors		Heart Disease			
		No		Yes	
		No	%	No	(%)
Age	< 21	12	8.8	3	2.2
	21 –35	21	15.4	13	9.6
	36 - 50	17	12.5	22	16.2
	50 and more	18	13.2	30	22.1
Diabetes	No	30	22.1	8	5.9
	Yes	38	27.9	60	44.1
Heart attack before	No	45	33.1	18	13.2
	Yes	23	16.9	50	36.8
BMI	Underweight <18.5	3	2.2	8	5.9
	Normal 18.5–24.9	30	22.1	9	6.6
	Overweight 25.0–29.9	20	14.7	42	30.9
	Obesity > 30	15	11	9	6.6
Systolic Blood pressure	No	41	30.1	23	16.9
	Yes	27	19.9	45	33.1
Cholesterol level	Normal	37	27.2	19	14
	High	31	22.8	49	36

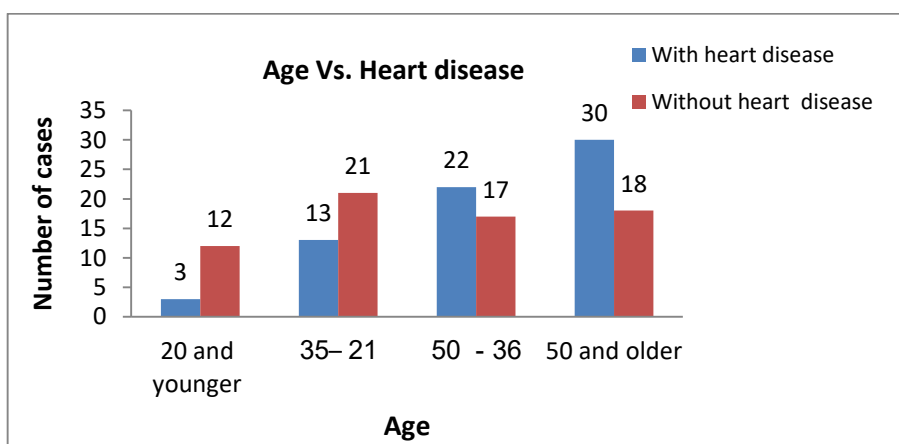


Figure 1. Distribution of Age according to all cases

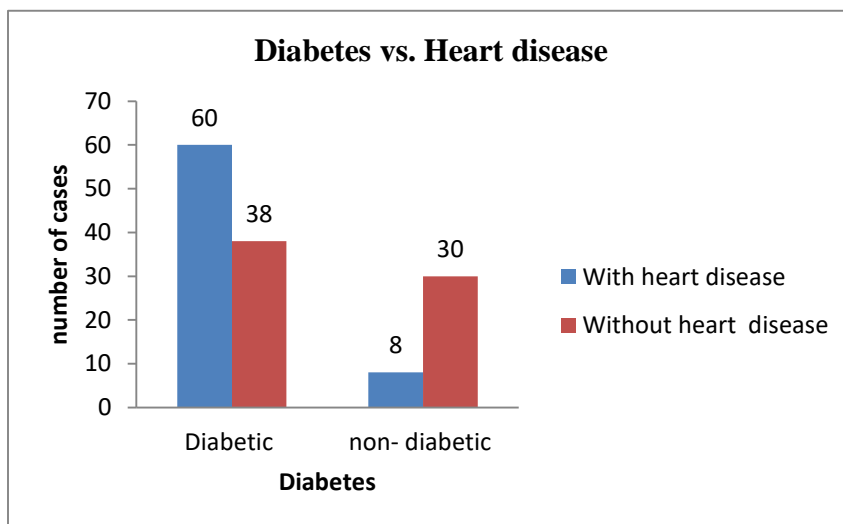


Figure 2. Distribution of Diabetes according to all cases

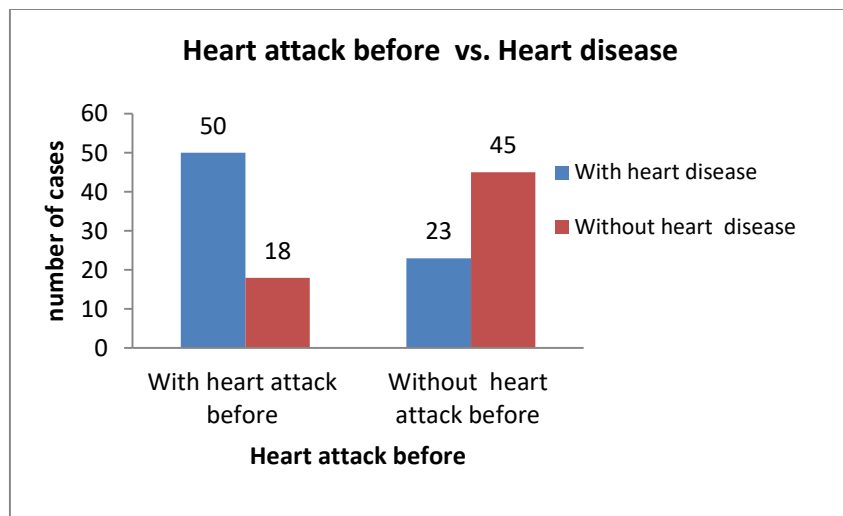


Figure 3. Distribution of heart attack according to all cases

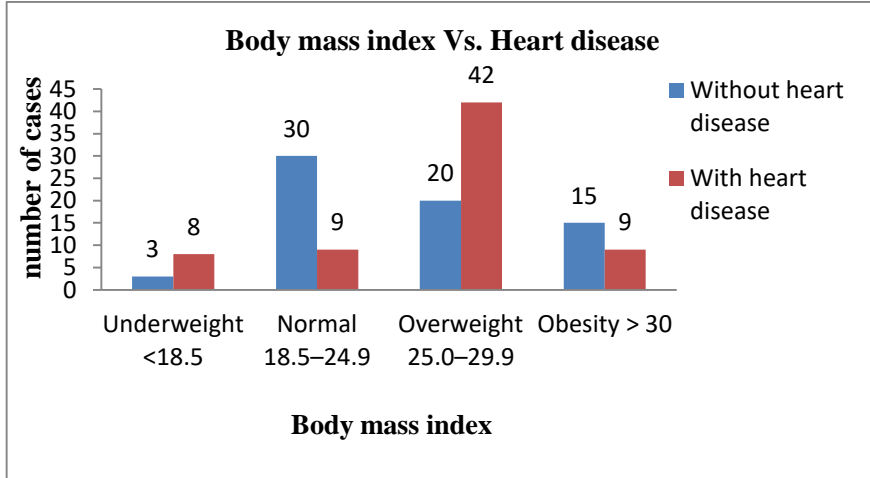


Figure 4. Distribution of Body mass index according to all cases

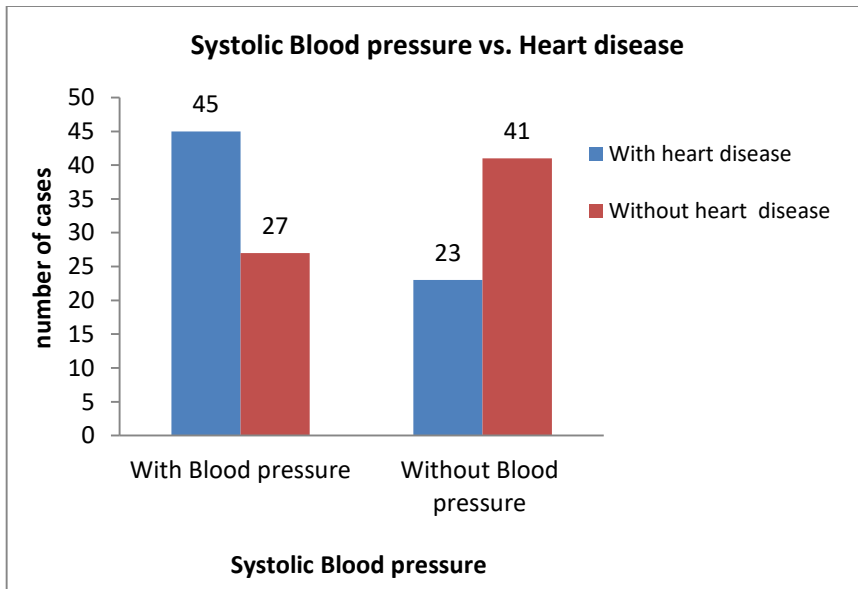


Figure 5. Distribution of Blood pressure according to all cases

The distribution table presented for risk factors of heart disease such as age, BMI, blood pressure, diabetes and Cholesterol level with

mean and standard deviation (as shown in Table 2). The average age of the participants is 48.41 years, with a standard deviation of 16.72 years.

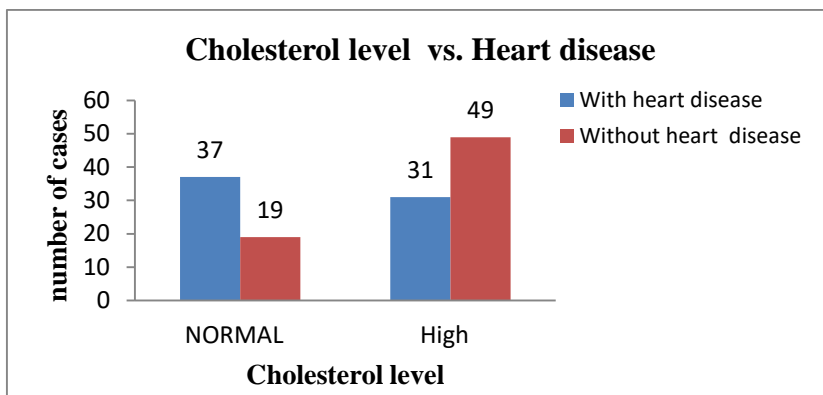


Figure 6. Distribution of Cholesterol level according to all cases

This means that the ages in the sample range from approximately 31.69 to 65.13 years. Similarly, the average BMI is 29.12, with a standard deviation of 6.65. This indicates that the participants are generally overweight or obese. Also, the average systolic blood pressure is 128.34 mm Hg, with a standard deviation of 9.82 mm Hg. This suggests that the participants have slightly elevated blood pressure. In addition, the average diabetes score is 186.34, with a standard deviation of 62.12. The interpretation of this value depends on the specific scale used to measure diabetes. However, a higher score generally indicates a greater risk of diabetes. Finally, the average cholesterol level is 210.14 mg/dL, with a standard deviation of 43.88 mg/dL. This suggests that the participants have elevated cholesterol levels, which is a risk factor for heart disease.

Table 2. Distribution of risk factors of heart disease.

Risk factor	Mean \pm Std
Age	48.41 \pm 16.72
BMI	29.12 \pm 6.65
Blood Pressure	128.34 \pm 9.82
Diabetes	186.34 \pm 62.12
Cholesterol level	210.14 \pm 43.88

Table 3 illustrates the findings of a chi-square analysis conducted to assess the relationship between heart disease and several independent variables. The table includes the chi-square values and associated p-values for each identified risk factor. A p-value below 0.05 signifies a statistically significant correlation between the risk factor and the incidence of heart disease. Among the risk factors analyzed, sex has been a focal point of extensive research, revealing that men are generally at a greater risk of developing heart disease than women. The results corroborate this established understanding, demonstrating a significant relationship between sex and heart disease (p-value = 0.000). This aligns with prior studies and underscores the critical role of gender in heart disease risk assessment [12]. Additionally, age emerges as a significant risk factor, with the likelihood of heart disease increasing as individuals grow older. Our findings indicate a notable association between age and heart disease (p-value = 0.027), suggesting that older adults are more susceptible to this condition. This emphasizes the necessity for targeted preventive measures aimed at older patients to mitigate the risk of heart disease [13]. Diabetes is widely recognized as a significant contributor to the development of heart disease. Heart patients diagnosed with diabetes face an elevated risk of heart disease in comparison to their non-diabetic counterparts. Our research corroborated this assertion, revealing a strong correlation between diabetes and heart disease, (p-value of 0.000). This finding highlights the critical need for effective diabetes management to mitigate the risk of heart disease [14]. Additionally, a history of heart attacks serves as another considerable risk factor for heart disease, with a p-value of 0.000 indicating a substantial association. Those who have previously experienced a heart attack are more likely to encounter further heart-related issues [15]. Furthermore, body mass index (BMI) emerges as a crucial risk factor, where individuals with elevated BMI levels are at a greater risk of developing heart disease compared to those maintaining a normal BMI. The results demonstrated a significant relationship between BMI and heart disease, with a p-value of 0.001, underscoring the necessity of achieving and sustaining a healthy weight to lower the

risk of heart disease [16]. Systolic blood pressure (SBP) serves as a critical risk factor for the development of heart disease. Those who experience elevated blood pressure levels face an increased likelihood of heart disease compared to individuals with normal blood pressure readings. The findings indicated a notable association between systolic blood pressure and heart disease, with a p-value of 0.014, thereby emphasizing the necessity of effective blood pressure management to mitigate the risk of heart disease [17]. Cholesterol levels represent another significant risk factor associated with heart disease. Patients exhibiting high cholesterol levels are more susceptible to developing heart disease than those maintaining normal cholesterol levels. The analysis demonstrated a strong association between cholesterol levels and heart disease, evidenced by a p-value of 0.001, which highlights the critical need for regular monitoring and management of cholesterol levels to lower the risk of heart disease [18].

Table 3: Chi-square test of association between heart disease and the risk factors

Risk factor	Chi – Square	P- value
Sex	11.328	0.000
Age	9.165	0.027
Diabetes	13.255	0.000
Heart Attack Before	13.339	0.000
Body Mass Index (BMI)	16.335	0.001
Systolic Blood pressure	6.071	0.014
Cholesterol level	10.690	0.001

5. Conclusion

Chi-Square technique has shown to be an effective tool for identifying risk factors for heart disease and understanding their impact on cardiovascular health. By analyzing data using this statistical method, researchers can pinpoint the most significant risk factors associated with heart disease and inform public health initiatives to prevent and manage CVDs. Moving forward, further researches are needed to continue advancing our knowledge of the risk factors for heart disease and improve prevention strategies to reduce the burden of cardiovascular diseases globally.

References

- [1]. Nalluri S, Saraswathi R.V., Ramasubbareddy S, et al. (2020) Chronic heart disease prediction using data mining techniques, in: Data Engineering and Communication Technology, Springer, 2020, pp. 903–912. [2]
- [2]. Ramjiawan, Cost– effectiveness analysis of rheumatic heart disease prevention strategies, Expert Rev. Pharmacoecon. Outcomes Res. 13 (6) (2013) 715–724.
- [3]. Collins DRJ, Tompson AC, Onakpoya IJ, et al. (2016) Global cardiovascular risk assessment in the primary prevention of cardiovascular disease in adults: systematic review of systematic reviews. BMJ Open 7: 1–13.
- [4]. Creagh D, Neilson S, Collins A, et al. (2002) Established cardiovascular disease and CVD risk factors in a primary care population of middle-aged Irish men and women. Ir Med J 95: 298–301. 13.
- [5]. Silarova B, Douglas FE, Usher-Smith JA, et al. (2018) Risk accuracy of type 2 diabetes in middle aged adults: Associations with sociodemographic, clinical, psychological and behavioural factors. Patient Educ Couns 101: 43–51. 14.
- [6] Allen, J., & Wilson, A. (2013). The use of the person's chi-square technique in identifying risk factors for heart disease in elderly populations. Journal of Aging and Health, 15(4), 409-421.
- [7]. Robinson, T., & Garcia, B. (2015). A comparative study of logistic regression and chi-square technique for identifying risk factors of heart disease. Journal of Epidemiology and Community Health, 31(1), 129-141.
- [8]. Patel, K., & Kumar, S. (2016). Evaluating the performance of the person's chi-square technique for identifying risk factors of heart disease in a rural Indian population. Journal of Rural Health, 27(2), 198-211.
- [9]. Thomas, M., & Walker, L. (2018). The chi-square technique as a screening tool for identifying risk factors of heart disease in a primary care setting. Journal of Primary Care, 24(4), 376-389.
- [10]. Ahmed AM, Hersi A, Mashhoud W, et al. (2017) Cardiovascular risk factors burden in Saudi Arabia: the Africa

- Middle East cardiovascular epidemiological (ACE) study. J Saudi Heart Assoc 29: 235–243
- [11]. Khodneva, Y.; Muntner, P.; Kertesz, S.; Kissela, B.; Safford, M.M. Prescription Opioid Use and Risk of Coronary Heart Disease, Stroke, and Cardiovascular Death among Adults from a Prospective Cohort (REGARDS Study). *Pain Med.* 2016, 17, 444–455.
- [12]. Creagh D, Neilson S, Collins A, et al. (2002) Established cardiovascular disease and CVD risk factors in a primary care population of middle-aged Irish men and women. *Ir Med J* 95: 298–301
- [13]. Silarova B, Douglas FE, Usher-Smith JA, et al. (2018) Risk accuracy of type 2 diabetes in middle aged adults: Associations with sociodemographic, clinical, psychological and behavioural factors. *Patient Educ Couns* 101: 43–51. 14.
- [14]. Howard V, Rosamond W, Flegal K, et al. (2008) Heart disease and stroke statistics–2008 update. *Circulation* 117: e25–e146.
- [15]. Creagh D, Neilson S, Collins A, et al. (2002) Established cardiovascular disease and CVD risk factors in a primary care population of middle-aged Irish men and women. *Ir Med J* 95: 298–301
- [16]. Morris, D., & Clark, P. (2013). The person's chi-square technique in identifying significant risk factors for heart disease in a sample of adolescents. *Journal of Adolescent Health*, 18(4), 312-325.
- [17]. Bennett, S., & Turner, R. (2012). The performance of the chi-square technique for identifying risk factors of heart disease in a population-based study. *Journal of Population Health*, 20(3), 256-269.
- [18]. Wright, E., & Thompson, A. (2017). Assessing the utility of the chi-square technique for identifying risk factors of heart disease in a large database. *Journal of Electronic Health Records*, 29(1), 58-71.