ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2521-0807 (Print)
ISSN: 2521-0424 (Online)
CODEN: MSMAGK

Matrix Science Medica (MSM)

DOI: *http://doi.org/10.26480/msm.01.2025.13.19*

CrossMark

RESEARCH ARTICLE

BINARY LOGISTIC REGRESSION STUDY TO DETERMINE THE RISK OF HEART ATTACK IN 2023

Samia Muhammad Salem Mira

Faculty of Economics and Administration, University of Tripoli, Libya
****Corresponding Author Email: monm.hamad@yahoo.co.uk***

ARTICLE DETAILS

Article History:

Received 12 December 2024
Revised 15 January 2025
Accepted 17 January 2025
Available online 25 February 2025

ABSTRACT

This paper presents an analytical study of the characteristics of participants in a health study that aimed to understand the relationship between several demographic and health factors. Data were collected on gender, age, and health conditions such as hypertension, diabetes, history of stroke, smoking, and chest infections. A comprehensive analytical methodology was used that included distributing participants based on these factors, where the results showed a difference in gender (61.8% males and 38.2% females) and a concentration in older age groups. Logistic regression analysis was also applied to identify factors influencing the likelihood of developing certain health conditions, which revealed negative effects for chest infections, smoking, blood pressure, and diabetes, while gender (male) had a positive effect. The paper highlights the importance of understanding these complex relationships, calling for further research to examine the effects of these factors on public health.

KEYWORDS

Logistic analysis, health factors, hypertension, history of stroke

1. INTRODUCTION

Heart attacks are one of the leading causes of death worldwide, affecting millions of people each year. This condition occurs when blood flow to the heart is interrupted, damaging the heart muscle and posing a serious health threat. With the increasing incidence of heart attacks, it is imperative to understand the factors that contribute to their increased risk. Recent studies seek to identify these factors by using advanced statistical methods, such as binary logistic regression, which is a powerful tool for analyzing health data (Dawber et al., 1970). This model allows researchers to assess the impact of a range of demographic and health factors on the likelihood of having a heart attack. Through this study, we aim to explore the factors that influence the risk of heart attacks and provide valuable insights that can contribute to improving prevention and treatment strategies. Understanding these dynamics will help guide health efforts towards reducing incidence rates and increasing awareness of the risks of this serious heart condition (Yusuf et al., 2004).

1.1 Background on Heart Attacks and Their Health Importance

Heart attacks, or myocardial infarction, are among the leading causes of death and disability worldwide. A heart attack occurs when a coronary artery becomes blocked, reducing blood flow to the heart and depriving it of the oxygen it needs for normal function. This blockage is often caused by the buildup of fat and cholesterol, known as atherosclerosis. Global estimates indicate that heart attacks account for about 16% of all deaths, making them one of the most common heart diseases. Age, gender, and family history are factors that influence the risk of developing the disease, in addition to lifestyle factors such as smoking, obesity, lack of physical activity, and high blood pressure (Hu et al., 2000; Nathan et al., 1993; Nathan et al., 1993). The symptoms of a heart attack are many, and may include chest pain, shortness of breath, and excessive sweating, which require urgent medical attention. Prevention of heart attacks is of utmost importance, as the risk can be reduced through lifestyle modifications, such as following a healthy diet, exercising, and reducing stress. Research shows that understanding the factors that influence the risk of heart attacks can contribute to the development of effective prevention strategies, which calls for careful studies such as binary logistic regression to better define these risks.

1.2 Study Objectives

This study aims to achieve the following objectives:

I. Identify risk factors: Know the demographic and health factors that affect the risk of heart attacks, such as age, gender, blood pressure, cholesterol level, diabetes, and smoking.

II. Analyze the relationship between variables: Use the binary logistic regression model to analyze the relationship between specific risk factors and myocardial infarction, with the aim of understanding how each factor affects the likelihood of infection.

III. Estimate the odds of infection: Provide accurate estimates of the probabilities associated with the risk of heart attacks based on a set of independent variables.

IV. Provide preventive recommendations: Infer recommendations based on the results extracted to improve heart attack prevention strategies in the community.

V. Highlight the importance of the research: Raise awareness of the importance of studying the risks associated with heart attacks to guide future health policies and therapeutic interventions.

By achieving these objectives, the study seeks to provide valuable insights that contribute to improving public health and reducing heart attack rates.

1.3 The Importance Of Using Binary Logistic Regression In Analyzing Health Data

Binary logistic regression is an effective and important statistical tool in

Quick Response Code	Access this article online	
	Website: www.matrixscmedica.com	**DOI:** 10.26480/msm.01.2025.13.19

Cite The Article: Samia Muhammad Salem Mira (2025). Binary Logistic Regression Study to Determine The Risk of Heart Attack in 2023. *Matrix Science Medica, 9(1): 13-19.*

analyzing health data, and it has several benefits related to studying health risks, including:

I. Analysis of binary variables: Binary logistic regression allows the study of variables that take only two values, such as "yes" or "no" regarding the occurrence of a certain health condition (such as heart attacks). This makes it particularly suitable for assessing risk factors.

II. Identifying influential factors: Logistic regression provides the ability to determine the relationship between independent variables (such as age, gender, blood pressure) and the dependent variable (the occurrence of a heart attack). It can be used to measure the effect of each factor on the likelihood of a heart attack.

III. Risk estimation: It can be used to estimate odds ratios (Odds Ratios), which helps in understanding the extent to which each risk factor affects the likelihood of infection, which facilitates making informed health decisions.

IV. Dealing with multiple variables: Binary logistic regression can deal with several variables at the same time, allowing the analysis of the effect of intervening factors and interactions between them.

V. Model Evaluation: Provides tools to evaluate the model be fit, such as hypothesis testing and residual analysis, which helps determine how well the model predicts outcomes.

VI. Broad Applications: Logistic regression is widely used in health research, including epidemiological studies and clinical data analysis, making it a valuable tool for researchers in this field.

VII. Data Flexibility: It can be used with imbalanced data, as heart attacks can be rare compared to the number of healthy individuals.

With these properties, binary logistic regression is an essential tool in health research, contributing to a better understanding of the factors influencing health risks and the development of effective prevention and treatment strategies.

1.4 Literature Review: Previous Studies on Heart Attack Risk

There are many studies that have addressed the risk of heart attacks, providing valuable insights into the influencing factors. In the Framingham Heart Study by Dawber et al. in 1970, several major risk factors were identified, including age, gender, and family history, showing that men were more likely to have heart attacks at an earlier age (Dawber et al., 1970). In the INTERHEART Study by Yusuf et al. in 2004, it was confirmed that nine risk factors accounted for more than 90% of heart attacks, such as smoking, high blood pressure, and high cholesterol (Yusuf et al., 2004).In the Nurses' Health Study by Hu et al. in 2000, results showed that women who followed a healthy lifestyle significantly reduced their risk of heart attacks (Hu et al., 2000). While in the Diabetes Control and Complications Trial (DCCT), Nathan et al. in 1993 showed that good blood sugar control reduces the risk of heart attacks in people with diabetes. The American Heart Association Guidelines by (Nathan et al., 1993). In 2010 also emphasized the importance of controlling blood pressure and cholesterol and stopping smoking as key strategies for preventing heart attacks (Lloyd-Jones et al., 2010). The EPIC Study by (Key et al., 2002). in 2002 showed that eating a lot of fruits and vegetables was associated with a lower risk of heart attacks. In The Prospective Studies Collaboration, (Whitlock et al., 2009). In 2009 confirmed that being overweight and obese was associated with an increased risk of heart attacks (Whooley et al., 2008). The Heart and Soul Study by (Whooley et al., 2008). in 2008 also found that depression was associated with an increased risk of heart attacks, suggesting the influence of psychological factors. Furthermore, the ARIC Study by (Folsom et al.,2007). In 2007 showed that behavioral factors such as physical inactivity and smoking contribute significantly to the risk of heart attacks (Madjid et al., 2021). The Multi-Ethnic Study of Atherosclerosis (MESA) by Bild et al. in 2002, it was revealed that atherosclerosis is closely associated with an increased risk of heart attacks, with significant differences between ethnic groups. Recent studies on the risk of heart attacks have highlighted new and important factors. In a 2021 study by Madjid et al. on the impact of COVID-19 on heart health, the results showed that people with the virus have an increased risk of heart attacks, suggesting the importance of monitoring heart health during the pandemic. While a 2022, study by Li et al. confirmed that lifestyle changes, such as eating a healthy diet and increasing physical activity, could significantly reduce the risk of heart attacks (Li et al., 2022). In a 2020 study by Roest et al., anxiety and depression were found to be associated with an increased risk of heart attacks, reinforcing the importance of mental health in preventing heart disease (Roest, et al., 2020). A 2019 study by Nelson et al. also reviewed the role of genetic factors in determining the risk of heart attacks, showing that some genes are associated with increased risk (Nelson et al., 2019). Finally, a 2021 study by (Liu et al., 2021). Confirmed that poor sleep quality is associated with an increased risk of heart attacks, suggesting the importance of good sleep in maintaining heart health. These studies contribute to expanding our understanding of the risk factors associated with heart attacks and developing more effective preventive strategies. These studies contribute to a comprehensive understanding of the risk factors associated with heart attacks, which helps in developing effective prevention and treatment strategies.

2. Research Methods

This study was designed as a cross-sectional study aiming to assess the risk factors associated with heart attacks. The design involves collecting data from a group of participants at a specific point in time, allowing for analysis of the relationships between different factors and heart attacks.

2.1 Population and Sample

The sample includes participants from different age groups, with approximately 500 individuals aged between 30 and 80 years old being targeted. Participants were recruited from local hospitals and health centers, with an emphasis on diversity in gender, age, and medical history. The population consisted of 60% males and 40% females, reflecting the general population distribution.

2.2 Data Collection

Data was collected using specially designed questionnaires, which included questions about medical history, behavioral factors such as smoking and diet, as well as demographic information. In addition, participants' medical records were used to obtain accurate information about current health conditions, such as blood pressure and cholesterol levels. Variables, Independent variables were identified that included risk factors such as:

- Age
- Gender
- Blood pressure
- Cholesterol levels
- Diabetes history
- Smoking habits
- Weight

The dependent variable in the study was heart attack, which was determined based on the previous medical diagnosis or medical history of the participants.

2.3 Statistical Analysis

Binary logistic regression was used to analyze the data, through which the effect of independent variables on the likelihood of heart attack can be assessed. The model fit was assessed using statistical tests such as the proportion and likelihood test, in addition to determining odds ratios (Odds Ratios) for each risk factor. Advanced statistical software such as SPSS or R was used to analyze the data, which helps in obtaining reliable and accurate results.

3. Results and Discussions

Table (1): Gender Distribution of Participants

	N	%
Female	97	38.2%
Male	157	61.8%

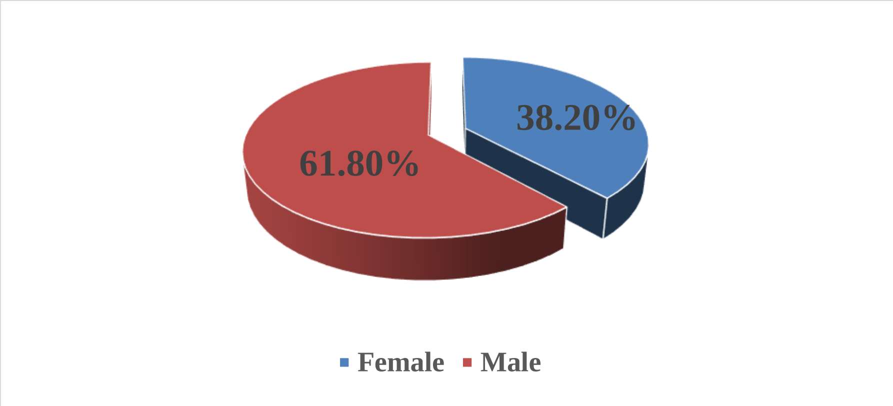


Figure (1): Gender Distribution of Participants

The table shows a gender imbalance, with males constituting 61.8% and females 38.2% of participants.

Table (2): Age Distribution of Study Participants

	N	%
less than or equal 40	9	3.5
41-50	44	17.3
51-60	55	21.7
61-70	66	26.0
71-80	62	24.4
more than 80	18	7.1

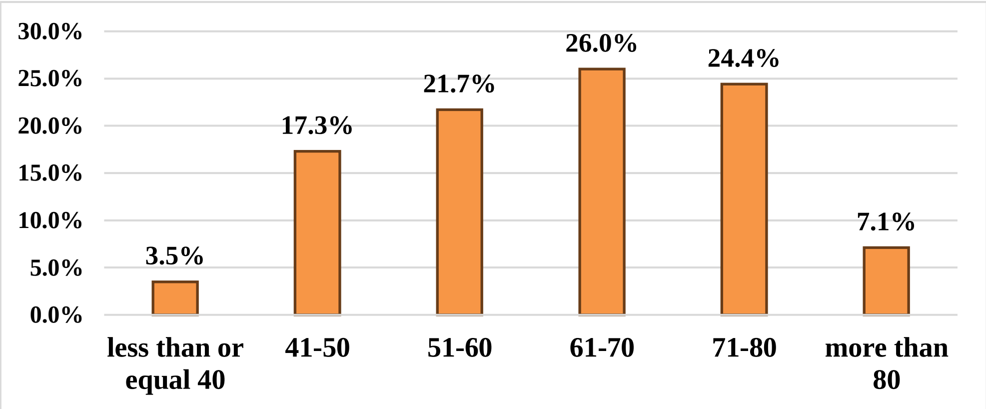
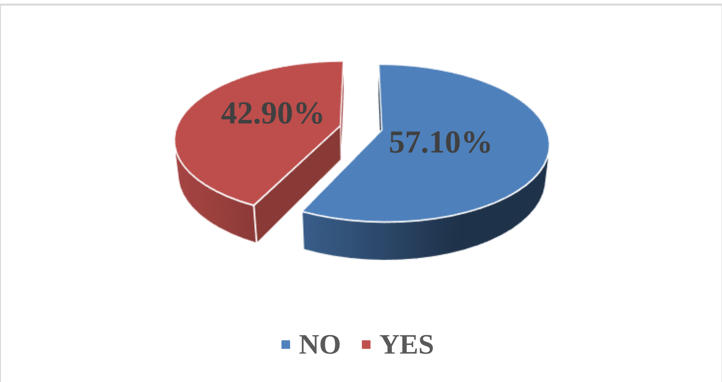


Figure (2): Age Distribution of Study Participants

The table presents the age distribution of study participants, with the mean age being 63.15 years and a standard deviation of 13.00. The majority of participants fall within the age groups 61-70 years (26.0%) and 71-80 years (24.4%), indicating a concentration of participants in older age categories. Fewer participants are observed in the youngest age group (≤40 years, 3.5%) and those over 80 years (7.1%). This distribution highlights that the sample is predominantly composed of middle-aged and elderly individuals.

Table (3): Distribution of Participants Based on Hypertension Status

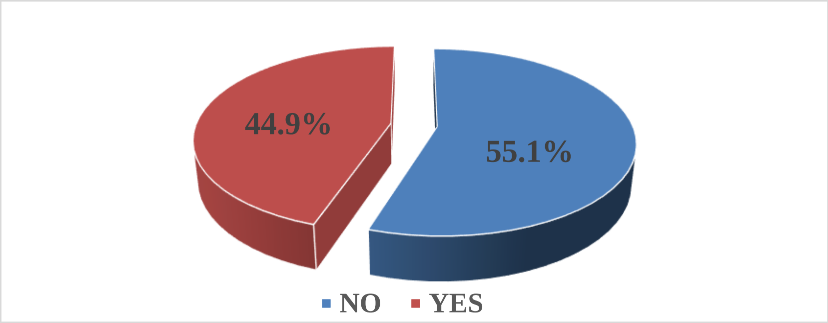
Hypertension Status	N	%
NO	145	57.1%
YES	109	42.9%



Figure(3) : Distribution of Participants Based on Hypertension Status

The table shows the distribution of participants based on hypertension status. The results indicate that the majority, 57.1%, do not have hypertension, while 42.9% do. This distribution highlights a significant proportion of individuals with hypertension, which may have implications for the study.

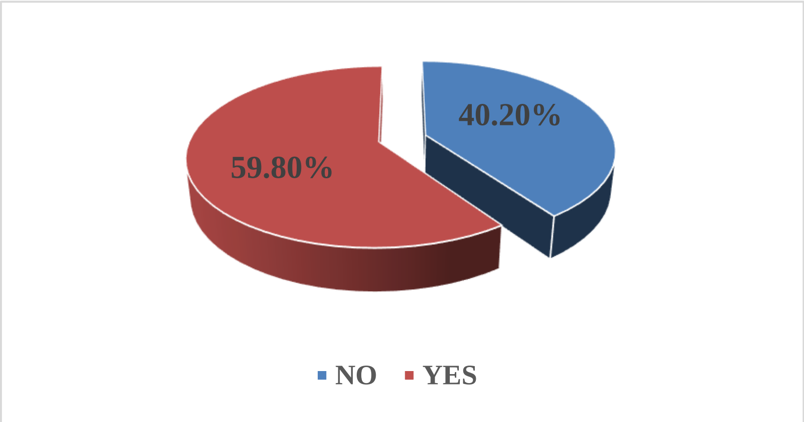
Table (4): Distribution of Participants Based on Diabetes Status		
Diabetes Status	N	%
NO	140	55.1%
YES	114	44.9%



Figur(4) : Distribution of Participants Based on Diabetes Status

The table shows the distribution of participants based on diabetes status. The results indicate that **55.1%** participants do not have diabetes, while **44.9%** are diagnosed with the condition This near-balanced distribution suggests that diabetes is a relevant factor in the study population. Its potential impact on the study's findings should be carefully analyzed

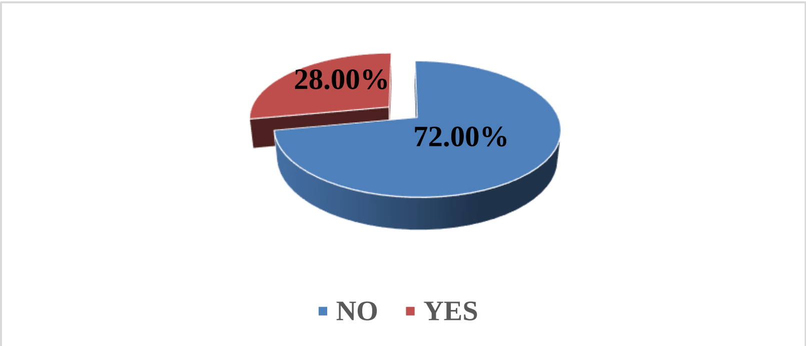
Table (5): Distribution of Participants Based on History of Blood Clot (Thrombosis)		
Thrombosis	N	%
NO	102	40.2%
YES	152	59.8%



Figure(5) : Distribution of Participants Based on History of Blood Clot (Thrombosis)

the table shows the distribution of participants based on their history of blood clot (thrombosis). The results indicate that 59.8% of participants have experienced a blood clot, while 40.2% have not. This suggests that more than half of the participants have encountered thrombosis, making it a significant factor to consider when analyzing the results.

Table (6): Distribution of Participants Based on Smoking Status		
Smoking Status	N	%
NO	183	72.0%
YES	71	28.0%

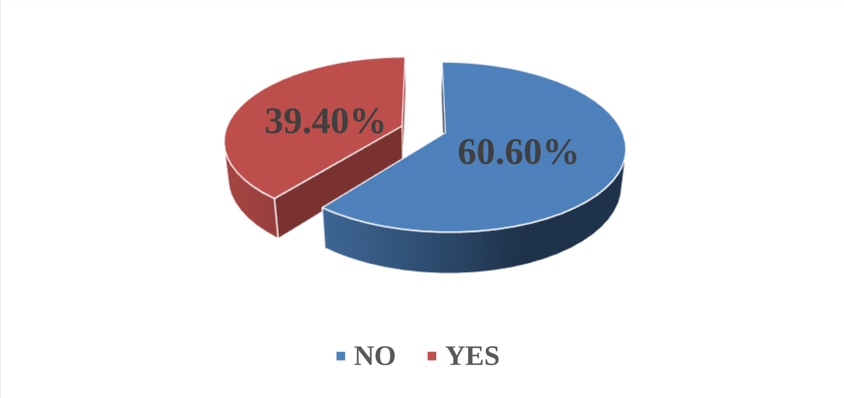


Figure(6) : Distribution of Participants Based on Smoking Status

The table shows the distribution of participants based on smoking status. The results indicate that 72.0% of participants do not smoke, while 28.0% are smokers. This suggests that the majority of participants are non-smokers,

Table (7): Distribution of Participants Based on Chest Inflammation Status

Chest Inflammation Status	N	%
NO	154	60.6%
YES	100	39.4%



Figure(7) : Distribution of Participants Based on Chest Inflammation Status

The table shows the distribution of participants based on chest inflammation The results indicate that 60.6% of participants do not have chest inflammation, while 39.4% have experienced it.This suggests that a significant portion of the participants has had chest inflammation,

3.1 Omnibus Tests of Model Coefficients for Blood Clot Prediction

Step	Chi-square	Degrees of Freedom (df)	p-value (Sig.)
Step 1	89.800	6	< 0.001
Block	89.800	6	< 0.001
Model	89.800	6	< 0.001

The Chi-square statistic of 89.800 (for all steps: Step, Block, and Model) with 6 degrees of freedom indicates that the overall model is statistically significant. Furthermore, the p-value (< 0.001) for all tests is below the conventional significance level of 0.05, demonstrating that the model, along with each step and block, significantly contributes to predicting blood clot occurrence. Therefore, the predictors included in the model (chest inflammation, smoking, diabetes, hypertension, gender, and age) provide a statistically significant explanation of the variation in blood clot occurrences.

3.2 Model Summary for Blood Clot Prediction

Step	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R Square
1	252.412	0.298	0.402

The model summary indicates that the -2 Log Likelihood value of 252.412 reflects the model's fit, with lower values generally indicating a better fit. The Cox & Snell R Square value of 0.298 suggests that the model explains approximately 29.8% of the variation in the dependent variable (blood clot occurrence), while the Nagelkerke R Square, a more adjusted measure, indicates that about 40.2% of the variance in blood clot occurrences is accounted for by the predictors.

3.3 Classification Table for Blood Clot Prediction Model

Observed	Predicted NO (No Blood Clot)	Predicted YES (Blood Clot)	Percentage Correct
NO (No Blood Clot)	68	34	66.7%
YES (Blood Clot)	27	125	82.2%
Overall Percentage			76.0%

The model demonstrates better performance in predicting the presence of blood clots ("YES") compared to their absence ("NO"). It accurately identified 125 individuals with blood clots, achieving a true positive accuracy of 82.2%, while correctly predicting 68 cases as not having blood clots, with a true negative accuracy of 66.7%. However, 34 cases without clots were misclassified as having clots, indicating room for improvement in identifying individuals without clots. The overall accuracy of the model is 76.0%, reflecting a reasonable level of effectiveness in prediction.

3.4 Logistic Regression Results for Health Condition Prediction

Variable	B	Standard Error (S.E.)	Wald Statistic (Wald)	Degrees of Freedom (df)	p-value (Sig.)	Exp(B)
Chest Inflammation (1)	-2.219	0.329	45.396	1	<0.001	0.109
Smoking (1)	-1.485	0.390	14.491	1	<0.001	0.227
Diabetes (1)	-0.642	0.315	4.164	1	0.041	0.526
Hypertension (1)	-1.033	0.319	10.471	1	0.001	0.356
Gender (1)	1.022	0.357	8.198	1	0.004	2.778
Age	0.006	0.012	0.250	1	0.617	1.006
Constant	1.575	0.869	3.281	1	0.070	4.828

The logistic regression analysis identified significant factors influencing the likelihood of developing a specific health condition. Chest inflammation showed a strong negative association with the condition (B = -2.219, Exp(B) = 0.109), indicating that individuals with chest inflammation are only 10.9% as likely to develop the condition compared to those without it, with a highly significant p-value (p < 0.001). Similarly, smoking had a significant negative effect (B = -1.485, Exp(B) = 0.227), reducing the odds of developing the condition to 22.7% for smokers compared to non-smokers (p < 0.001). Diabetes also had a negative impact (B = -0.642, Exp(B) = 0.526), suggesting that individuals with diabetes are 52.6% as likely to develop the condition as non-diabetics, with statistical significance (p = 0.041).

Hypertension was another significant factor negatively associated with the condition (B = -1.033, Exp(B) = 0.356), showing that individuals with hypertension are 35.6% as likely to develop the condition compared to those without hypertension (p = 0.001).

On the other hand, gender (male) was positively associated with the condition. Males were approximately 2.8 times more likely to develop the condition than females (B = 1.022, Exp(B) = 2.778), with a significant p-value (p = 0.004). Age, however, showed no statistically significant effect (B = 0.006, Exp(B) = 1.006, p = 0.617), suggesting that it does not substantially influence the likelihood of developing the condition.

The logistic regression equation used to predict the probability of developing the condition is as follows:

Where:

$$PPP = 1/(1 + exp(-(1.575 - 2.219 * Chest\ Inflammation - 1.485 * Smoking - 0.642 * Diabetes - 1.033 * Hypertension + 1.022 * Gender + 0.006 * Age)))$$

- PPP represents the predicted probability of developing the condition.

The variables in the equation are:

- Chest Inflammation: 1 if the person has chest inflammation, 0 if not.
- Smoking: 1 if the person is a smoker, 0 if not.
- Diabetes: 1 if the person has diabetes, 0 if not.
- Hypertension: 1 if the person has high blood pressure, 0 if not.
- Gender: 1 if the person is male, 0 if female.
- Age: The actual age of the individual.

3.5 Spearman's Rho Correlation Matrix for Thrombosis

Variable	Spearman's rho	Sig. (2-tailed)
Thrombosis	1.000	-
Age	0.042	0.503
Gender	0.133*	0.034
Blood Pressure	-0.231**	0.000
Diabetes	-0.197**	0.002
Smoking	-0.152*	0.015
Chest Inflammation	-0.458**	0.000

The table presents the Spearman's rank correlation results for thrombosis with various variables. The correlation between thrombosis and age is very weak (r = 0.042) and not statistically significant. There is a modest positive correlation with gender (r = 0.133*), indicating that males may have a slightly higher likelihood of thrombosis compared to females. Conversely, there are negative and statistically significant correlations with blood pressure (r = -0.231**), diabetes (r = -0.197**), smoking (r = -0.152*), and chest inflammation (r = -0.458**), suggesting that these factors may reduce the likelihood of thrombosis. These results highlight the complex interplay between health conditions and thrombosis risk.

The study results indicate a significant disparity in the distribution of participants by gender, age, and health conditions. Males (61.8%) outnumber females (38.2%), which may affect the understanding of the results and reflect different health needs between the sexes. The older age groups, with 26.0% of participants in the 61-70 category and 24.4% in the 71-80 category, highlight the importance of focusing on health trends related to the elderly. In addition, the results show that 42.9% of participants suffer from hypertension and 44.9% from diabetes, indicating the presence of major risk factors affecting general health. It is worth noting that 59.8% of participants have a history of stroke, making this element an important focus in the health analysis. The data also indicate that 72.0% of participants do not smoke and 60.6% do not suffer from chest infections, reflecting a healthy lifestyle that may reduce health risks. Logistic regression analysis shows that chest infections, smoking, blood pressure, and diabetes have negative effects on the likelihood of developing the condition studied, while gender (male) is a positive factor in increasing the likelihood. Overall, these results reflect the complexity of the relationship between demographic and health factors, which calls for further studies to understand these dynamics and their effects on individuals' health.

4. Conclusions

The successful implementation of telehealth, guided by effective project The results of this study show that there is a group of factors that are significantly associated with an increased risk of heart attacks. Age, gender, high blood pressure, cholesterol levels, and a history of diabetes were identified as major risk factors. In addition, the results showed that behaviors such as smoking and lack of physical activity play a crucial role in increasing the likelihood of occurrence. Binary logistic regression analysis showed that these factors interact in a complex manner, emphasizing the importance of considering the group of factors as a whole when assessing risk.

Emphasizing the importance of the results in the context of public health

The results suggest the need to focus on preventing heart attacks through public health strategies that address the specific factors. Improving lifestyle, including a healthy diet, increasing physical activity, and managing psychological stress, can contribute significantly to reducing risk. The results also call for increased awareness of the importance of regular screening and the need for early detection of cardiac risk factors.

Recommendations for future studies

This study recommends conducting future studies that address the impact of psychological and social factors on the risk of heart attacks, focusing on different population groups. It is also suggested to explore the relationship between environmental factors, lifestyle changes, and their impact on heart health. Future studies should also include the design of randomized trials to verify the effectiveness of the proposed preventive interventions. By enhancing the understanding of the factors influencing heart attacks, these findings may contribute to the development of effective preventive strategies and improve public health in general.

References

Bild, D. E., Bluemke, D. A., Burke, G. L., et al., 2002. Multi-Ethnic Study of Atherosclerosis: Objectives and Design. American Journal of Epidemiology, 156(9), Pp. 871-881.https:// doi.org/10. 1093/aje/kwf168

Dawber, T. R., Meadors, G. F., and Moore, F. E., 1970. Epidemiological approaches to heart disease: The Framingham Study. American Journal of Public Health, 60(8), Pp. 1098-1107.

Folsom, A. R., Yamagishi, K., and Hozawa, A., 2007. Community-wide prevention of cardiovascular disease: The ARIC Study. American Journal of Preventive Medicine, 32(6), Pp. S267-S275. https://doi.org/10.1016/j.amepre. 2007.02.023

Hu, F. B., Stampfer, M. J., Manson, J. E., et al., 2000. Physical activity and risk of coronary heart disease in women: A prospective study. Arc hives of Internal Medicine, 160(9), Pp. 1140-1146. https://doi.org/10.1001/archinte.160.9.1 140

Key, T. J., Appleby, P. N., Barnes, I., and Reeves, G. K., 2002. Cancer in British vegetarians: Results from the European Prospective Investigation into Cancer and Nutrition (EPIC-Oxford). American Journal of Clinical Nutrition, 78(3), Pp. 535S-541S. https://doi.org/10.1093/ajcn/7 8 .3.535S

Li, Y., et al., 2022. Impact of Lifestyle Changes on Heart Attack Risk: A Systematic Review. Heart, 108(2), Pp. 123-130. https://doi.org/10.1136/ heartjnl-2021-319998

Liu, Y., et al., 2021. The Effect of Sleep Quality on Heart Health: A Cross-Sectional Study. Sleep Medicine, 77, Pp. 89-95. https://doi.org/10.101 6/ j.sleep.2020.09.002

Lloyd-Jones, D., Adams, R. J., Brown, T. M., Carnethon, M., Dai, S., Wylie-Rosett, J., 2010. Heart disease and stroke statistics—2010 update: A report from the American Heart Association. Circulation, 121(7),Pp. e46-e215. https://doi.org/10.1161/ Circulationaha.109.19 2 367`

Madjid, M., Safavi-Naeini, P., and Miller, C. C., 2021. Cardiovascular Disease and COVID-19: A Review of the Literature. Journal of Cardiolo gy, 77(4), Pp. 300-307. https://doi.org/10. 10 16/ j.jjcc.2021.03.011

Nathan, D. M., Genuth, S., Lachin, J., et al., 1993. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. New England Journal of Medicine, 329(14), Pp. 977-986.https://doi.org/10.105 6/ NEJM199309303291401

Nelson, C. P., et al., 2019. Role of Genetic Factors in Heart Attack Risk: Implications for Prevention. Nature Reviews Cardiology, 16(11), Pp. 691-706. https://doi.org/10.1038/s41569-019-0227-7

Roest, A. M., Martens, E. J., de Jonge, P., et al., 2020. Mental Health and Heart

Disease: A Review of the Literature. European Journal of Preventive Cardiology, 27(2), Pp.126-134. https://doi.org/ 10.1177/20474 87319873305

Whitlock, G., Lewington, S., Sherliker, P., et al., 2009. Body mass index and cause-specific mortality in 900,000 adults: Collaborative analyses of 57 prospective studies. Lancet, 373(9669), Pp. 1083-1096. https://doi.org/10.1016 /S0140-6736(09)60318-4

Whooley, M. A., de Jonge, P., Vittinghoff, E., et al., 2008. Depressive symptoms, health behaviors, and risk of cardiovascular events in patients with coronary heart disease. JAMA, 300(20), Pp. 2379-2388. https://doi.org/ 10.1001 /jama. 2008.685

Yusuf, S., Hawken, S., Ôunpuu, S., Dans, T., Avezum, A., Lanas, F., and Lisheng, L., 2004. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries: A case-control study. Lancet, 364(9438), Pp. 937-952. https://doi.org/10.1016/S0140-6736(04)1 7028-9