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## RESEARCH ARTICLE

### Risk Factors of Acute Coronary Syndrome: The Experience from Iran

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#### Abstract:

#### Aims:

This study was conducted with the aim of identifying the risk factors of coronary artery disease in patients referred to Imam Khomeini Hospital in Jiroft.

#### Background:

Acute coronary syndrome (ACS) is a spectrum of symptoms compatible with acute myocardial ischemia. Understanding these factors can have an effective impact on the prevention, diagnosis, and management of ACS.

#### Methods:

This is a descriptive study. Participants in this study were all patients diagnosed with acute coronary syndrome and acute myocardial infarction in 2020. Data collection was done by reviewing patients' clinical records. Data analysis was performed by SPSS version 21.

#### Results:

Out of a total of 228 patients, 149 (65%) were male and 79 (35%) were female. 88% of patients complained of heart pain upon arrival, 43% had a history of drug abuse, 98.2% had retrosternal pain, 48.1% had an average length of hospitalization of four days, 32% were under ischemic treatment, and 68% were under ischemic treatment. They were on thrombolytic therapy. The majority of patients (65.1%) had an EF greater than 40%. 13.9% mortality, 18.9% discharge with survival and recovery, 62.7% recovery and referral to a higher center to complete treatment and angiography, and 4.5% leaving the hospital with It was personal satisfaction.

#### Conclusion:

The main risk factors related to chest pains in the Jiroft region and the reason for more patients going to the hospital include hypertension, high blood sugar on arrival, low WMR, high BMI, drug abuse, leukocytosis, and non-compliance with post-treatment recommendations.

**Keywords:** Myocardial infarction, Acute coronary syndrome, Hospital, Patient, Disease, Coronary heart disease.

#### Article History

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## 1. INTRODUCTION

Coronary heart diseases are the leading cause of death in most industrialized countries. Currently, in Iran, the first cause of death is cardiovascular disease and coronary artery diseases are among them. These diseases lead to significant morbidity, disability, and reduced productivity, and health care is at the top of the cost-generating causes [1, 2].

Heart attack in the world, with 16 million deaths, is about 29.6% of the total causes of death, so in 2014, in the European

continent, it was the cause of 20% of deaths. In 2013 alone, this complication caused more than 385 thousand deaths in America [3]. According to studies conducted, heart diseases are the first cause of death in Iran with 45% of deaths and 26% of lost years of life, and it is 10.4 of the total burden of diseases [4, 5].

In a large number of cases, there are types of infarction that manifest as anxiety. Since the most important factor in increasing the effectiveness of these drugs is reducing the time interval between the onset of symptoms and their administration, the delay in starting treatment leads to a decrease in their beneficial therapeutic effects and will have a

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very important effect on the prognosis of patients. The development of myocardial damage is directly related to the delay in starting medical care, so time is a decisive factor in the treatment of acute myocardial infarction [6].

With the invention of newer medical treatments as well as observation and surgery, the death rate due to coronary heart disease has gradually decreased over the past few decades. The most common warning sign of almost no benefit in the thrombolytic treatment of myocardium is acute chest pain, which can be in the middle of the chest, epigastrium, in the form of pressure, the feeling of heaviness, and in some cases, in the arms, stomach, back, lower jaw and neck spread [7].

Misdiagnosis cases are when the pain is below the xiphoid and is accompanied by digestive symptoms. The correct identification of the aforementioned pain in the first 24 hours, especially in the first few hours after the onset of acute pain, therapeutic measures, and careful patient care will reduce the extent of the infarcted lesion and its complications [8].

The strategy to shorten the time of cardiac ischemia includes an integrated effort to shorten the delay time in successive stages from the time of patients' decision to contact the triage system to pre-hospital transport and in-hospital management [9]. In order to reduce these complications, notifying the emergency center is one of the most important measures that must be taken by the patient's family immediately, and the most important thing is to have the emergency team ready and arrive on time [10].

Evidence shows that the risk of cardiovascular diseases can be reduced by modifying risk factors, and by considering this point, more than 50% of deaths and disabilities caused by heart diseases can be reduced. The high prevalence of heart disease in recent years in Iran and the decrease in the average age of its onset indicate that, unfortunately, most people, by not observing health behaviors, create the basis for the development of heart diseases [11].

Coronary artery disease and ACS combined account for 7 million deaths each year. Statistics related to the United States show that 8-5 million people with chest pain and symptoms of cardiac ischemia visit the emergency room every year, which accounts for 5-10% of all visits. Most of these patients are hospitalized for evaluation in terms of the possibility of ACS, which is an additional cost of 1,000-3,000 dollars for each patient [11, 12].

This syndrome is now the leading cause of death in the Asia-Pacific region, accounting for almost half of the global burden [12]. Coronary artery diseases are one of the most important causes of death; every year it leads to the death of many people worldwide. Today, this disease has become a social problem in Iran, so the mortality due to it is 1.6 deaths per 10 thousand population [13] and includes about 46% of deaths. In addition, acute coronary syndrome causes disability and significant complications in patients, which is the source of many losses for society and the patients' families [14].

Various studies have shown that the symptoms of acute coronary syndrome are different in men and women. Compared to men, women often experience more back pain, sweating, shortness of breath, heartburn, and fatigue following acute

coronary syndrome [15]. Also, some studies indicate that men have more chest pain and sweating compared to women [16]. In young people, the presence of coronary artery anomalies, such as aneurysms, usually increases the risk of thrombosis and high narrowing of the vessels of the acute coronary syndrome and ultimately leads to the occurrence of acute coronary syndrome [17]. This syndrome is usually associated with coronary artery thrombosis and chest pain, which can be aggravated by anemia, bradycardia, or tachycardia and cause the need for essential thrombocytosis/thrombocythaemia [18].

Essential thrombocytosis/thrombocythaemia (ET) has been considered a rare underlying aetiology for acute coronary syndromes (ACS) [19]. However, we recently showed a prevalence of at least 2.1% in a cohort of patients under 40 years who underwent coronary angiography (CAG) in the setting of their first ACS [20]. Despite a lower frequency compared to ischemic neurological events, the thrombotic CV events, associated with the neoplastic disorder per se and with the presence of thrombotic risk factors [21], are reported in over 10% of ET patients [22]. Non-thrombotic CV adverse events (CVAEs) have been reported with different frequencies in ET patients receiving cytoreductive drugs, including interferons alpha (IFN) and anagrelide (ANA) [23, 24].

ANA is a drug that selectively lowers the platelet count. Due to the inhibition of phosphodiesterase III, ANA exerts inotropic, chronotropic, and vasodilator effects; these properties may contribute to CVAEs, which in some cases lead to treatment discontinuation [25].

Acute coronary syndrome usually occurs in people over 40 years of age, but the prevalence of factors such as diabetes, high blood pressure, diabetes, and metabolic syndromes has increased the risk of early cardiovascular diseases in young people [26]. Although the high mortality caused by cardiovascular diseases in developing countries has caused concern, the main reason for concern is the low age of deaths caused by these diseases compared to developed countries [27].

Paying attention to the statistics of deaths caused by coronary artery diseases in Iran shows the need to find a solution to reduce the prevalence of these diseases and the deaths caused by them. There are differences in risk factors such as smoking, diet, lifestyle, and race have different trends. On the other hand, the existence of a large population of young people and their arrival at the age of occurrence of coronary artery diseases indicates an increase in the prevalence of this disease in the future, which requires the necessity of treatment planning. Therefore, the present study was designed and implemented with the aim of identifying the risk factors of coronary artery disease in patients referred to Imam Khomeini Hospital in Jiroft.

## 2. METHODS AND MATERIALS

This descriptive study was conducted on all patients referred to Imam Khomeini (RA) Jiroft Hospital with complaints of chest pain and a final diagnosis of acute coronary syndrome and acute myocardial infarction from the beginning of April 2019 to the end of March 2019. To investigate the characteristics of patients with myocardial infarction and ACS, the clinical records of all patients referred to the emergency

department and finally hospitalized in the cardiac intensive care unit with complaints of chest pain and the final diagnosis of acute coronary syndrome and acute myocardial infarction were examined. Patients who died before entering the emergency department or who left the hospital with personal consent and despite the advice of doctors before completing the diagnostic and treatment procedures were excluded from the study. Collecting the necessary information was conducted by referring to the clinical records of the patients. Data Collection was used by a researcher-made checklist including demographic information (age, gender, education), pain characteristics (location, spread, duration, associated symptoms.), history of heart diseases, and cardiovascular disease risk factors. (hypertension, diabetes, smoking, hypercholesterolemia), treatments performed (thrombolytic therapy, surgical intervention), the time interval from onset of symptoms to referral, history of previous similar complaints, length of hospitalization in the emergency department, location of the stroke, level status Troponin was performed at the beginning of the visit and finally the final outcome (mortality, survival). This checklist was provided to five faculty member experts, and it was determined by the face validity method. In this research, the criteria for the final diagnosis of heart attack and ACS were considered based on the diagnosis by the center's cardiologist and based on a set of clinical, laboratory, and echocardiographic information. In order to consider ethical considerations, the data were collected without the names and characteristics of the patients. All the information of the patients, including the name and national information, remained confidential both during the study and after the completion of the study, and the results were reported in general. Data analysis was performed by using SPSS version 21 statistical software and also by using descriptive statistical indicators, including frequency tables, standard deviation, and mean. Pearson's correlation coefficient was used to test hypotheses, and a t-test was used to compare the average age of deceased and surviving patients.

### 3. RESULTS

Of 228 patients, 149 (65%) men, 9.4% of them were single and 90.6% were married, and the most frequent age was between 60 and 80 years old (42.5%) 40 to 60 years old, with 36.8% and over 80 years old with 15.8%, 50% of them are illiterate, 31.3% of them have a bachelor's degree, 13% of them have a diploma, and only 6% have an education higher than a diploma. The highest BMI corresponds to the ideal weight group (18.5 to 24.9) with 43.4 percent, the overweight group (25-29.9) with 37.7 percent, the obese group ( $\leq 30$ ) with 13.2 percent, and the underweight group ( $>18.5$ ) with 5.7 percent respectively.

Meanwhile, 88.4% of patients were admitted for the first time due to chest pain, 11.6% had a history of hospitalization, 73.9% had no history of surgery, and 26.1% had already undergone surgery. 73.4% of the referred patients had a history of underlying disease, including Diabetes, Hyperlipidemia, Hypertension, Cardiac, and Others, 24.1, 9.5, 54.4, 22, respectively.

43% of patients (104 cases) had unusual habits and risk

factors and abuse of unusual substances (narcotics) and 57% had no use. Almost all of the hospitalized patients did not consume alcohol (more than 99%) and more than 84% were smokers.

The most common complaint of these patients at the time of visit was Chest pain at 88%, followed by Chest pain with dyspnea at 4.6%, Chest pain with Loss of Consciousness at 2.9%, Chest pain and abdominal pain 1.7%, and dyspnea was 1.2%, of which 55.3% were admitted to the emergency room with the primary diagnosis of ACS and 44.7% of them with the primary diagnosis of MI.

These findings showed that the pain in the majority of patients (98.2%) was retrosternal and a significant percentage of the patients had pain intensity. They described themselves as between 4 and 7 and about 54.7% stated that the chest pain spread to the right shoulder and, only 26.7% of the cases reported that the pain spread to the left hand, and the other cases were sporadic. They reported the spread of pain to the neck and back.

Meanwhile, the findings indicate that the duration of pain was intermittent in 65.1% of cases and intermittent in 34.9%, and the nature of pain was pressing in 76.7% of patients and about 23.3%. It was burning and shooting.

About 58% of the above patients were relieved by the TNG method, 15% by the TNG-CBR method, 13.6% by the CBR method, and the rest by the pethidine method or its combination with the above methods.

41% of hospitalized patients were referred between 4 hours and less from the time the pain started, while about 54% had passed between 4 hours and 4 days from the start of the pain to visiting the hospital, while only 39 A percentage of them have previously had a history of similar complaints and were hospitalized for this reason.

Examining the records of the patients in terms of the presence or absence of a history of drug or food allergy showed that the referred patients did not have any specific allergies. Examination of patients hospitalized in CCU showed that the average hospitalization duration in most cases (1/48) was four days, which is an important point in estimating the number of beds and equipment needed in CCU. During this period, 32% of hospitalized patients underwent ischemic therapy, and 68% underwent thrombolytic therapy in addition to ischemic therapy.

Paraclinical diagnostic findings showed that 7.5% of patients' troponin levels were less than 1.5 (negative), 34.3% were between 1.5 and 100, 31.5% were between 100 and 1000, 14.6% were between 1000 and 10000, and 12.2% were more than 10000. while in the findings of the second round, the majority of patients (68.8%) had levels higher than 1000 (Table 1).

Paraclinical diagnostic findings showed that in 54.4% of cases, the ST segment was normal, 40.7% of cases had ST elevation, and 5% of cases had ST depression, and in relation to T-wave, 66.4% had normal T-wave, 33.2% had inverted T-wave and 0.4% had a tall T-wave (Table 2).

**Table 1. Investigation of troponin level of referring patients upon arrival.**

Troponin Level on Admission	Frequency	Frequency Percent
<1.5	16	7.5
1.5-100	73	34.3
100-1000	67	31-May
1000-10000	31	14-Jun
10000>	26	12.2
Troponin level on follow up	Frequency	Frequency Percent
<1.5	6	3
1.5-100	10	5
100-1000	46	23.1
1000-10000	55	27.6
10000>	82	41.2

**Table 2. ST electrocardiogram findings of referring patients.**

Electrocardiogram Findings	Frequency	Frequency Percent
ST elevation	98	40.7
ST depration	12	5
ST normal	131	54.4
T invert	80	33.2
T normal	160	66.4
T tall	1	0.4

**Table 3. Findings of EF echocardiography and Valve echocardiogram in referred patients.**

Age	Frequency	Frequency Percent
≤50	65	31.1
40-49	71	34
30-39	42	20.1
20-29	21	10
19-Oct	10	4.8
Echocardiogram Valve	Frequency	Frequency Percent
MR	38	24.4
TR	20	12.8
AI	4	2.6
MR+TR	66	42.3
MR+AI	4	2.6
MR+AI+PI	2	1.3
MR+TR+AI	19	12.2
TR+AI	2	1.3
MR+PI	1	0.6

In the echocardiography findings of hospitalized patients in this study, the majority of patients (65.1%) had an EF greater than 40%. Also, in the echocardiography of many patients, heart valve disorders, especially mitral regurgitation, were found individually (24.4%) or in combination with Other valves (59%) have been reported and are briefly listed in Table 3.

In addition to the above findings, 17 hospitalized patients

also had other cases, 3 had LVH, 8 had Calcified Aortic Valve, 1 had Dilated Aortic Valve, 1 had LV dysfunction, 1 had Medical Prostatic Valve, and 2 had RV dysfunction, and one had LV apex aneurysm.

Paraclinical diagnostic findings showed that 2.1% of hypoglycemic patients, 12.2% of normal blood sugar patients, 30.6% of impaired blood sugar patients, and 55.1% of levels had diabetes. (Table 4)

**Table 4. Examination of the blood sugar level of referring patients upon arrival.**

-	Frequency	Frequency
Hypoglycemic	4	1.2
Normal	23	12.2
Impaired	58	30.6
Diabetic	105	55

**Table 5. Examination of the number of white blood cells and blood platelets in hospitalized patients.**

White Blood Cells	Frequency	Frequency
Leukopenia (4000>)	3	1.3
Normal (4000-10000)	125	53.7
Leukocytosis (>10000)	94	43
Platelet	Frequency	Frequency Percent
Thrombocytopenia (150000>)	19	9.3
Normal (150000-450000)	201	90.2
Thrombocytosis (450000<)	1	0.5

**Table 6. Investigation of the average number of basic white blood cells in relation to the average volume of platelets and blood cholesterol levels in hospitalized patients.**

WMR	Frequency	Frequency Percent
<0.05	144	65.1
0.05-0.1	64	29
0.1-0.2	4	1.8
>0.2	9	1.4
Blood Cholesterol Levels	Frequency	Frequency Percent
<200	87	80.3
200-240	11	10.4
>240	8	9.3

Paraclinical diagnostic findings showed that 1.3% of leukopenia patients, 53.7% of patients had normal WBC levels and 43% of patients had leukocytosis. 9.3% of patients had thrombocytopenia, 90.2% had normal platelet count and 0.5% had thrombocytosis. (Table 5)

In the findings examined in CCU patients diagnosed with ACS and MI, 65.1% of patients have WMR (average baseline white blood cell count compared to average platelet volume) below 0.05, 29% between 0.05 and 0.1, 1.8% between 0.1 Up to 0.2 and 1.4 percent were higher than 0.2. The findings showed that 80.3% of the studied patients had cholesterol with a normal level, while 10.4% of them showed between 200 and 240 or borderline levels, and only 9.3% of them had high cholesterol in connection with diseases. Cardiovascular patients were hospitalized. (Table 6)

The final outcomes of the patients investigated in this study include 13.9% mortality, 18.9% discharge with survival and recovery, 62.7% recovery and referral to a higher center to complete treatment and angiography, and 4.5% leaving the hospital with. It was personal satisfaction.

#### 4. DISCUSSION

ACS is a common cardiovascular disease worldwide and

can lead to serious and even fatal complications. Improving awareness of these factors and taking necessary preventative measures can help reduce the risk of developing ACS and improve heart and vascular health. The present study was designed and implemented with the aim of identifying the risk factors of coronary artery disease in patients referred to Imam Khomeini Hospital in Jiroft.

The findings of the present study showed that 88.4% of patients were admitted for the first time due to chest pain, 11.6% of them had a history of hospitalization, 73.9% of them had no history of surgery, and 26.1% of them had already undergone surgery. 73.4% of the referring patients had a history of diseases, respectively, the most including HTN with 54.4%, history of heart disease with 28.2%, diabetes mellitus with 24.1%, 22% of other diseases, and 9.5% of hyperlipidemia. These findings are contrary to the results of the study of Hosseinzadeh Shanjani *et al.* [28] regarding blood pressure in the same direction and regarding diabetes. Studies by Huxley *et al.* [29], Smith *et al.* [30] have also reported results similar to this study.

More than 93% of hospitalized patients (226 people) had no history of transfusion of blood and its products, and only about 6% had used blood products before. 43% of patients (104

people) had unusual habits and risk factors and abuse of unusual substances (narcotics) and 57% of the rest had no use. Almost all of the admitted patients mentioned not drinking alcohol (more than 99%) and more than 84% of them also smoked. These findings are consistent with the results of Hosseinzadeh Shanjani *et al.*'s study [28].

The most common complaint of these patients at the time of visit was Chest pain at 88%, followed by Chest pain with dyspnea at 4.6%, Chest pain with Loss of Consciousness at 2.9%, Chest pain and abdominal pain at 1.7%, and Dyspnea with It was 1.2%, of which 55.3% were admitted to the emergency room with the primary diagnosis of ACS and 44.7% of them with the primary diagnosis of MI.

Examining the pain status and its severity in the patients referred to the emergency room has been determined by the examinations performed in the following tables. These findings showed that the pain in the majority of patients (98.2%) was retrosternal and a significant percentage of the patients had severe pain. They described themselves as between 4 and 7 and about 54.7% stated that the chest pain spread to the right shoulder and shoulder and only 26.7% of the cases reported that the pain spread to the left hand and the other cases were sporadic. They reported spreading pain to the neck and back.

Meanwhile, the findings indicate that the duration of pain was intermittent in 65.1% of cases and intermittent in 34.9%, and the nature of pain was pressing in 76.7% of patients and about 23.3%. It was burning and shooting. About 58% of the above patients were relieved by the TNG method, 15% by the TNG-CBR method, 13.6% by the CBR method, and the rest by the pethidine method or its combination with the above methods.

41% of hospitalized patients were referred between 4 hours and less from the time the pain started, while about 54% had passed between 4 hours and 4 days from the start of the pain to visiting the hospital, while only 39 A percentage of them have previously had a history of similar complaints and have been hospitalized for this reason

This study and examination of patients hospitalized in CCU showed that the average duration of hospitalization in the majority of cases (1/48) was four days, which is an important point in estimating the number of beds and equipment needed in CCU.

During this period, 32% of hospitalized patients underwent ischemic therapy, and 68% underwent thrombolytic therapy in addition to ischemic therapy.

In this study, we found that 7.5% of patients' troponin levels were less than 1.5 (negative), 34.3% were between 1.5 and 100, 31.5% were between 100 and 1000, 14.6% were between 1000 and 10000, and 12.2% were more than 10000. While in the findings of the second round, the majority of patients (68.8%) had levels higher than 1000. These findings are in line with the findings of studies by Gardner *et al.* [31], and Mokhtari Khot *et al.* [30].

In this study, the findings showed that 54.4% of cases had normal ST segment, 40.7% of cases had ST elevation and 5% of cases had ST depression, and in relation to T-wave, 66.4%

had normal T-wave, 33.2 percent had invert T-wave and 0.4% had tall T-wave.

In the echocardiography findings of hospitalized patients in this study, the majority of patients (65.1%) had an EF greater than 40%. Also, in the echocardiography of many patients, heart valve disorders, especially mitral regurgitation, were found individually (24.4%) or in combination with Other valves (59%) have been reported.

Among the patients examined in this study, 2.1% of the patients were hypoglycemic, 12.2% had normal blood sugar, 30.6% had impaired blood sugar, and 55.1% had diabetic levels. These findings are in line with the findings of the studies of Moghadam *et al.* [32] and Timmer *et al.* [33].

Dongbao *et al.* [34] proved a significant relationship between glucose on admission and in-hospital mortality in AMI patients, which means that hypoglycemic and hyperglycemic patients were at high risk, which is consistent with the findings of the present study.

In this study, 1.3% of leukopenic patients, 53.7% of patients with normal WBC levels, and 43% of patients with leukocytosis were found. These results are consistent with the findings of Connell Kannel *et al.* [35] and the study by Huang *et al.* [36].

During the examination of platelet index in hospitalized patients, 9.3% of patients had thrombocytopenia, 90.2% had normal platelet count and 0.5% had thrombocytosis. These findings are consistent with the results of the study by Davi *et al.* [37] and the study by Chu *et al.* [38].

The WMR index is the ratio of the average number of basic white blood cells to the average platelet volume. In the findings examined in CCU patients diagnosed with ACS and MI, 65.1% of patients have WMR below 0.05, and 29% between 0.05 and 0.1. 1.8 percent were between 0.1 and 0.2, and 1.4 percent were above 0.2. These results are in line with the findings of Chu *et al.*'s [38] and Dehghani *et al.*'s [39] studies.

Our findings regarding the level of blood cholesterol showed that 80.3% of the studied patients had cholesterol with a normal level, while 10.4% of them showed between 200 and 240 or the borderline level, and only 9.3% of them with high cholesterol was associated with cardiovascular diseases.

The final outcomes of the patients investigated in this study include 13.9% mortality, 18.9% discharge with survival and recovery, 62.7% recovery and referral to a higher center to complete treatment and angiography, and 4.5% leaving the hospital with It was personal satisfaction.

## CONCLUSION

According to the findings of this research, it seems that blood cholesterol levels, blood transfusion, EF, EKG changes, and diabetes did not have a high percentage in the studied patients. The main risk factors related to chest pains in the Jiroft area and causing more patients to go to the hospital include hypertension, high blood sugar on arrival, low WMR, high BMI, drug abuse, leukocytosis, and non-compliance with treatment recommendations after hospitalization.

## LIMITATIONS OF THE STUDY

Among the limitations of the present study, we can point out the type of study (cross-sectional), the small number of samples, and its implementation at the level of the affiliated a hospital of Jiroft University of Medical Sciences. Therefore, due to the fact that this study was conducted at the level of one hospital, it is necessary to be cautious about generalizing the findings. To solve the mentioned limitations, it is recommended to conduct similar research at the national.

## LIST OF ABBREVIATIONS

ACS	=	Acute coronary syndrome
ET	=	Essential thrombocytosis/thrombocythaemia
CAG	=	Coronary angiography
CVAEs	=	CV adverse events
IFN	=	Interferons alpha

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This article reports the results of a research project approved by Jiroft University of Medical Sciences with the code of ethics (IR.JMU.REC.1399.069).

## HUMAN AND ANIMAL RIGHTS

No animals were used for studies that are the basis of this research. All human procedures followed were per the guidelines of the Helsinki Declaration of 1975.

## CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

## STANDARDS OF REPORTING

STROBE guideline has been followed.

## AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article is available in the Zenodo Repository at <https://openpublichealthjournal.com/availability-of-data-materials.php>.

## FUNDING

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## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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