

Factors Influencing the Incidence of Sudden Cardiac Death Occurring out of Hospital in Babil Province-Iraq

Aqeel Handil Al Jothery

Department of Physiology and Pharmacology/College of Veterinary Medicine/Kerbala University.

tarishaqeel@yahoo.com

Abstract

The incidence rates of sudden cardiac death occurring out of hospital (OHSCD) in Iraq are not well documented. This study was designed to investigate the incidence rates of OHSCD and potential risk factors affecting the distribution of OHSCD causes among middle aged people in Babil Province/Iraq. Longitudinal study was performed addressing all OHSCD cases in people aged between 35-50 years in Babil Province. All the data regarding to the deceased people were collected from the Department of Forensic Medicine in Babil Province and covering the period from 2010-2015. Only the OHSCD cases subjected to a forensic autopsy were analyzed. From 1980 cases of death occurred out of the hospital, there were 72 cases diagnosed as natural sudden cardiac death (with no history) according to the International Classification of Diseases. Ischemic heart diseases were represented 60% of the cases studied; unspecified disorders of circulatory system (20%), cerebrovascular diseases (10%), and myocardopathy diseases (10%). 53% of ischemic heart diseases (IHD) cases targeted people between (46-50) years. On the other hand, around 55% of cerebrovascular diseases were happening in the individuals ranged from 41 until 45 years old. The percentage of men reached to the highest level in the unspecified disorders of circulatory system (80%) and ischemic heart diseases (77%). OHSCD with different causes was mostly found to attack people at home rather than outside home. Most cases of OHSCD were found among people that had no job at the time of death. Married people were also subjected to more incidences of OHSCD than single people. Therefore, the incidence of OHSCD in Babil Province/Iraq was significantly reduced compared to other countries and the distributions of OHSCD causes are significantly affected by modifiable and non-modifiable risk factors.

Keywords: Sudden cardiac death, Out of hospital, causes, Risk factors, Babil

الخلاصة

يفتقر العراق الى وجود بيانات مثبتة عن معدلات حدوث الموت القلبي المفاجي والذي يحدث خارج المستشفى. صممت هذه الدراسة للتحري عن معدلات حدوث الموت المفاجي/خارج المستشفى والعوامل المؤثرة على تنوع اسبابه للاشخاص المتوسطين في الاعمار والتي تتراوح اعمارهم من (35-50) سنة في محافظة بابل/العراق. الدراسة هذه هي نموذج لدراسة طوليه لكل حالات وفيات الموت القلبي المفاجي/خارج المستشفى للاعمار اعلا. في هذه الدراسة, تم اعتماد المعلومات الصادرة من قسم الطبابة العدليه في محافظه بابل وللاعوام من 2010-2015. تم الاعتماد فقط على وفيات الموت القلبي المفاجي/خارج المستشفى والتي اجري لها تشريح عدلي داخل قسم الطبابه العدليه (لاتملك تاريخ مرضي). تم تسجيل 72 حالة موت قلبي مفاجي طبيعي/خارج المستشفى من اصل 1890 مثبتة لوفيات خارج المستشفى اعتمادا على التصنيف الدولي للامراض. اشارت نتائج الدراسة الى ان امراض نقص الترويه القلبية مثلت 60% من اسباب الموت القلبي المفاجي, يليها امراض الاعتلالات غير المتخصصة في جهاز الدوران بنسبة 20%, امراض اعتلال عضلة القاب 10% واخيرا الامراض الدماغية الوعائية والتي شكلت نسبة 10%. اشارت الدراسة الى ان توزيع الاسباب اعلاه قد تاثر بشكل معنوي بعوامل الخطورة القابلة للتعديل وغير القابلة منها. وجدت الدراسة بانه نسبة 53% من امراض نقص الترويه القلبية اصابت الاشخاص الذين تتراوح اعمارهم من 46-50 سنة بينما نسبة 55% من الامراض الدماغية الوعائية اصابت الاشخاص الذين تتراوح اعمارهم من 41-45 سنة. ووجدت الدراسة ايضا بانه 80% من الاعتلالات غير المتخصصة في جهاز الدوران قد استهدفت الرجال وكذلك ان هناك نسبة 77% من امراض نقص الترويه القلبية قد استهدفت الرجال. وجدت الدراسة ايضا ان اغلب حالات الموت القلبي المفاجي/خارج المستشفى قد اصابت

الاشخاص في البيت وليس خارج البيت , كذلك وجد بان اغلب حالات الموت القلبي المفاجي/خارج المستشفى حدثت في الاشخاص الذين لم يمتلكو وظيفه. كذلك اشارت الدراسة الى ان المتزوجين يكون اكثر عرضة للموت المفاجي/خارج المستشفى. لذلك فان الدراسة تؤكد الى ان معدلات حدوث الموت القلبي المفاجي/خارج المستشفى في محافظة بابل/العراق اقل مما يوجد في البلدان الاخرى وكذلك فان اسباب الموت تختلف باختلاف عوامل الخطورة القابلة للتعديل وغير القابلة منه

الكلمات المفتاحية: الموت القلبي المفاجي, خارج المستشفى, الاسباب, عوامل الخطورة, بابل

Introduction

Sudden cardiac death (SCD) is one of big medical challenges that threaten our life and it is left over very tragic memories among family's members (Adabag *et al.*, 2010). Clinically, it is firstly associated with stopping the activity of cardiac muscular tissue, thereafter turning off the blood pump and finally permanent damage of brain tissue (Go *et al.*, 2014). Despite the lack of having a clear definition of SCD, the most acceptable description is that the sudden cardiac death is unexpected death that can be happened within 60 minutes from the symptoms being appeared and approved by witnesses, or it may be occurred during a period of 24 hours in a person who has clearly been found in a healthy condition when the death is not witnessed (Uchmanowicz *et al.*, 2015). According the definition above, around 35-40% of the total cases of SCD are happened out of hospital which is namely known, Out of hospital sudden cardiac death (OHSCD) (Basso *et al.*, 2010). Cardiac arrhythmia resulted from myocardial infarction is classified to be the most important causes leading to the OHSCD. However, other causes like Angina pectoris, unspecified disorders of circulatory system, stroke, and cerebrovascular diseases should also be taken into account (Adabag *et al.*, 2010).

Our knowledge regarding to the prevalence of OHSCD and its causes has been totally depended on the epidemiological studies (Bonow, 2007). However, these studies have been criticized for different premises. Firstly, the majority of these data have not been incorporated into the clinic-based research due to being unexpected happened in the population. Secondly, more information about these studies have been taken from incomplete resources such as a death certificate and deceased's relatives, making the outcomes are equivocal. Lastly, there is paucity in the data relying on the forensic autopsy for classifying the causes of OHSCD (Smith *et al.*, 1998).

Population research comes from the information derived from forensic autopsy could, therefore, provide us with comprehensive picture regarding to the potential causes of OHSCD and other risk factors (modifiable and non-modifiable). This kind of research will also make further step towards our understanding of possible strategies for preventing the incidence of the OHSCD (Morentin and Audicana, 2011).

The prevalence of OHSCD based on the population studies conducted among an European countries indicated that there were huge variations a cross countries. Most of the central and East European countries were faced higher rates of OHSCD compared to other countries in Europe (Lang *et al.*, 1999; Morris *et al.*, 2003; Müller-Nordhorn *et al.*, 2004). Unfortunately, no published data were found regarding the incidence of OHSCD over Arab countries. However, these variations in the incidence of OHSCD can be attributed to the many potential factors. Divergence of the non-modifiable risk factors (sex, age, causes of death, and genetic factors) are seen among populations. Another factor for such variations can be due to the differences in modifiable factors like socio-economic status, residency (urban or rural), smoking, and obesity (Müller-Nordhorn *et al.*, 2008).

The incidence of OHSCD in Iraq is not well understood, particularly those people who were died in middle ages (35-50 years). Therefore, this study was designed to investigate the distribution of OHSCD percentages of a population with age between 35-50 years occurred in Babil Province/Iraq and highlight the role of modifiable and non-modifiable risk factors for the potential differences in the causes of OHSCD percentages.

Material and Methods

Data collection:

This study was conducted in Babil Province/Iraq, an ancient city of Iraq with total number of estimated population due the latest Population Census done in 2002, was 1,651,565 citizens(Inter-Agency Information and analysis unit/ United Nations, 2010). According to the Iraqi law, all natural (not previously known as ill) and violent sudden deaths happened out of the hospital, were undergoing a forensic autopsy and the cause of death plus other deceased's information were reported on a death certificate. In these cases, the death certificates were issued by the Department of Forensic Medicine and all information included in this study was collected from this Department. Classification of death's causes was identified and coded due to the International Classification of Diseases, 10th Revision (ICD-10)(WHO, 2011). Middle aged people (35-50 years) who lived and died in Babil Province/Iraq were reported in this study. These cases involved the people who were dying for any reasons in and out of hospital. In this current study, only natural sudden cardiac deaths occurred out of hospital was identified accordance with the disease codes (I00 until I99) covering the period from 2010 until 2015. Non-modifiable risk factors (gender, age, cause of death, and place of death) and modifiable factors (place of live, marital status, and socioeconomic status) were analyzed. Ages of deceased people were grouped into three subdivided groups: 35-40 years, 41-45 years, and 46-50 years. Based on the International Classification of Diseases, the causes of death were classified into four groups: People with ischemic heart diseases (I20 until I25), People with cardiomyopathy diseases (I30 until I52), People with different types of cerebrovascular diseases (I60–I69), and People with other and unspecified disorders of circulatory system (I80–I99). Regarding to the place of death, deceased people were ranked into two groups: at home and outside home. Deceased people were also categorized into two marital statuses: married and single (divorced and widowed). Having a job (an indicator for socioeconomic status) at the time of death was also used to compare to those people who were dying with no job.

Statistical Analysis

The Chi-square test was performed to measure the potential variations in the incidence of frequencies in the groups of causes of OHSCD according to gender, age groups, place of death, marital status and socioeconomic status. The data were expressed as percentages. P-values less than 0.05 were significantly accepted. All the analyses were performed using Minitab version 17 (Minitab Inc., State College, PA, USA).

Results

In a period of six years, the study found that there were 4049 cases of death among people with ages (35-50) registered in the department of Babylon forensic medicine. Around half of these cases were reported as out of hospital deaths (49%), while 51% of the cases were happening in the hospital. Out of (1980) cases of death occurred out of the

hospital, there were 352 (around 20 %) cases of cardiac death followed the International Classification of Diseases of the circulatory system (I00-I99). Of these 352 cases, there were 280 (79%) cases ranked as a sudden cardiac death (SCD) with known history of illness and those cases were not subjected to a forensic autopsy. Only 72 (21%) cases out of total cases (352) were undergoing a forensic autopsy at the department of Babylon forensic medicine and these cases were represented as an out of hospital sudden cardiac death (OHSCD) (See Fig1). Based on the total population number of Babil Province (1,651,565 citizens done in 2002), the incidence rate of all OHSCD (with and without history of death) for age groups (35-50) was 22 cases per 100000 citizens (Calculated by dividing the number of SCD to the total population number and then multiplied by 100000), while the incidence rate for only those met criteria for OHSCD with no history of illness was 5 cases per 100000 citizens. There were also differences in the incidence rate of OHSCD with respect to age groups: 0.7 cases per 100000 citizens between 35-40 years old, 1.65 cases per 100000 citizens between 41-45 years old, and 2 cases/100000 citizens between 46-50 years old.

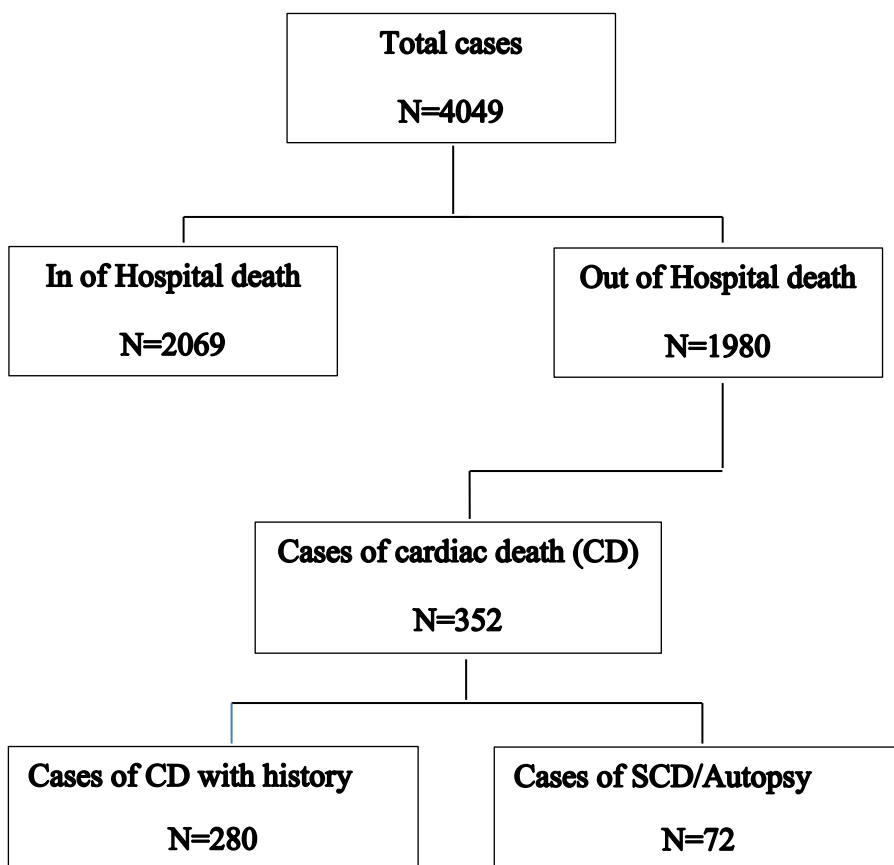


Fig1: Distribution of sudden cardiac death occurred among people in middle aged (35-50) years in Babil Province/Iraq from 2010-2015 investigated by the Department of Babylon Forensic Medicine.

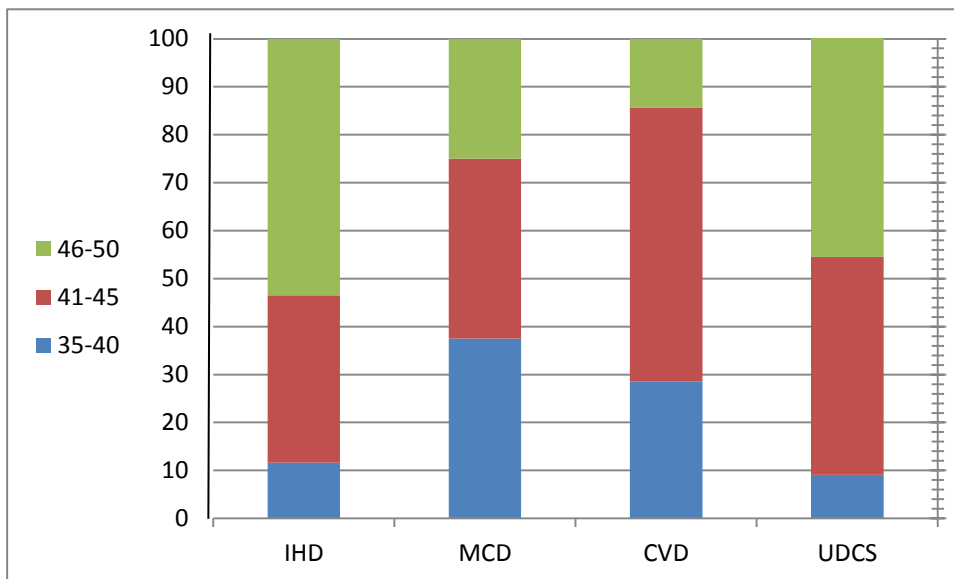
Among causes of OHSCD, ischemic heart disease was found to be the most popular cause of the death seen in this current study. This cause was responsible for around 60% of total OHSCD cases. It involves 40 cases as acute myocardial infarction and 3 cases of Angina pectoris. The second cause for OHSCD was unspecified disorders of circulatory system with 14 cases (around 20%) out of 72 cases. The next cause was cardiomyopathy diseases (10%) with 8 cases, comprising 4 cases of Heart failure, 2 cases of Cardiac arrest, one case of Cardiomyopathy and one case of Nonrheumatic mitral valve disorders. Finally, the last cause for OHSCD was seen to be cerebrovascular diseases (10%), including 4 cases of Cerebral infarction, 2 cases of Stroke, not specified as haemorrhage or infarction, and one of other cerebrovascular diseases. See table1.

Table1: Causes of sudden cardiac death occurred out of hospital among middle aged people (35-50) years subjected to the forensic autopsy in Babil province/Iraq for a period from 2010 until 2015

ICD 10 Code	Cause of death	Number	Percent
I20	Angina pectoris	3	4.1
I21	Acute myocardial infarction	40	55.5
I34	Nonrheumatic mitral valve disorders	1	1.4
I42	Cardiomyopathy	1	1.4
I46	Cardiac arrest	2	2.8
I50	Heart failure	4	5.5
I63	Cerebral infarction	4	5.5
I64	Stroke, not specified as haemorrhage or infarction	2	2.8
I67	Other cerebrovascular diseases	1	1.4
I99	Other and unspecified disorders of circulatory system	14	19.4

The distribution of death's causes was found significantly influenced by age groups (Pearson Chi-Square = 13.622; DF = 6; P-Value = 0.034). 53% of ischemic heart diseases (IHD) cases targeted people between (46-50) years. On the other hand, around 55% of cerebrovascular diseases were happening in the individuals ranged from 41 until 45 years (See Fig2A). Gender also has a significant effect on the variability of the causes (Pearson Chi-Square = 11.699; DF = 3; P-Value = 0.008). The percentage of females reached to the highest level in the cerebrovascular diseases (85%) and the lowest level was observed in the unspecified disorders of circulatory system (21%) (See Fig 2B).

A



B-

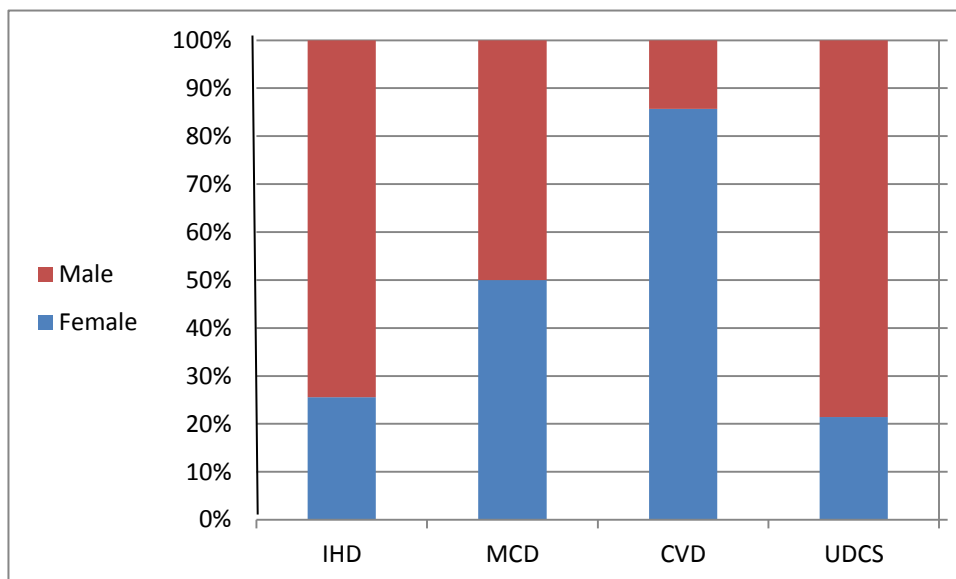
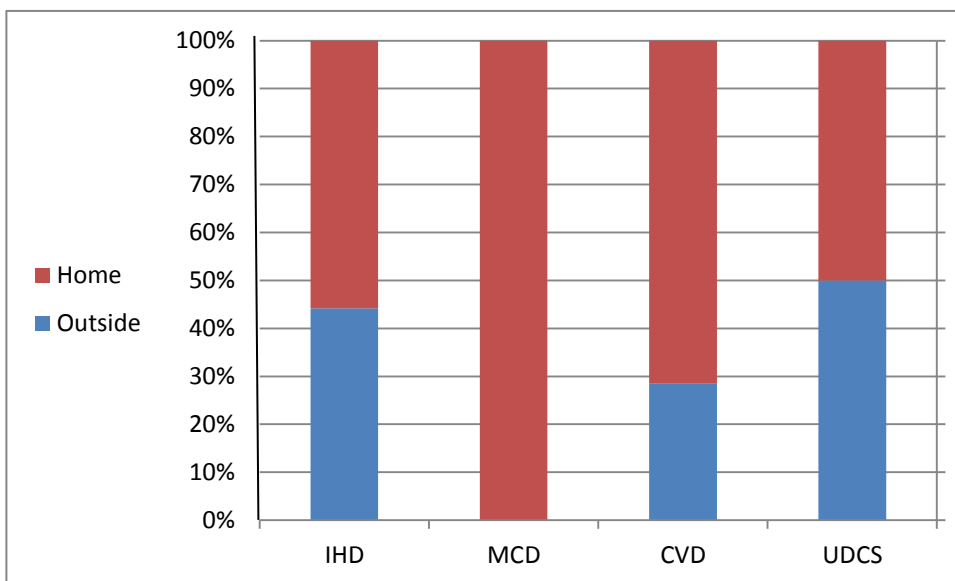


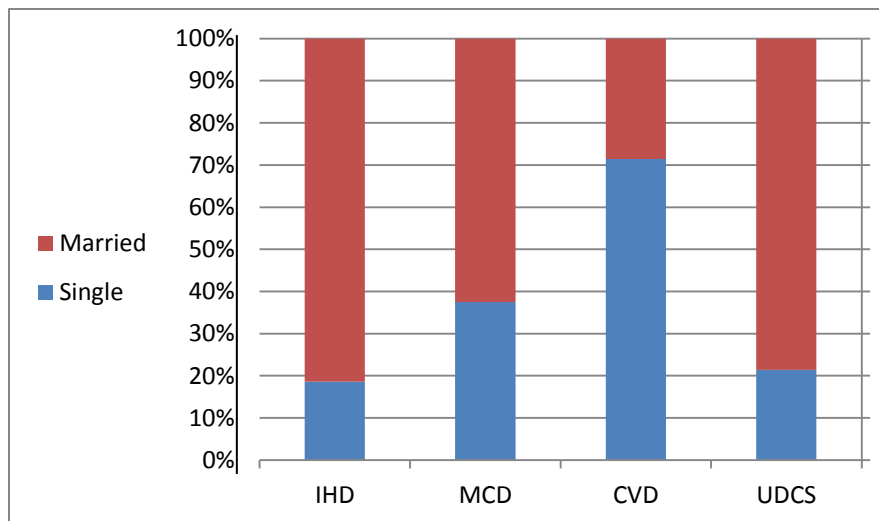
Fig2: The percentage of Sudden Cardiac Death for each group of causes with respect to (A) age group and (B) gender. In A, the blue segment of each bar indicates the percentage of deceased individuals with age group: 35 - 40 years, the red segment indicates for deceased individuals with age group: 41- 45 years and the green bar indicates those ranked in age group: 46-50. In B, the red segment of the bar indicates for the percentage of men's deceased people, while the blue one represents for the women's deceased. IHD: Ischemic heart diseases; MCD: Myocardiopathy diseases; CVD, cerebrovascular diseases; UDCS: Unspecified disorders of circulatory system.

Most cases of death with different causes were found to be occurring at home rather than outside home (Pearson Chi-Square = 6.639; DF = 3; P-Value = 0.048). There were no cases of death with Myocardiopathy diseases happened outside the home (See Fig 3A). The distribution of the causes of death in the OHSCD cases was also affected by the marital status of the deceased, in which most cases of death by Ischemic heart diseases (82%) and unspecified disorders of circulatory system (78%) targeted the individuals who were married. In contrast, highest level of percentage of death caused by cerebrovascular diseases (73%) affected single people (Pearson Chi-Square = 9.337; DF = 3; P-Value = 0.025, see Fig3 B). Despite the fact that an individual's socioeconomic status (considered only men cases) had no significant effects on the distribution of the death's causes in this study, the general trend for such effect was highest among jobless deceased for all causes compared to those people who were dying with job (Pearson Chi-Square = 2.890; DF = 3; P-Value = 0.409, see Fig 3C).

A-



B-



C-

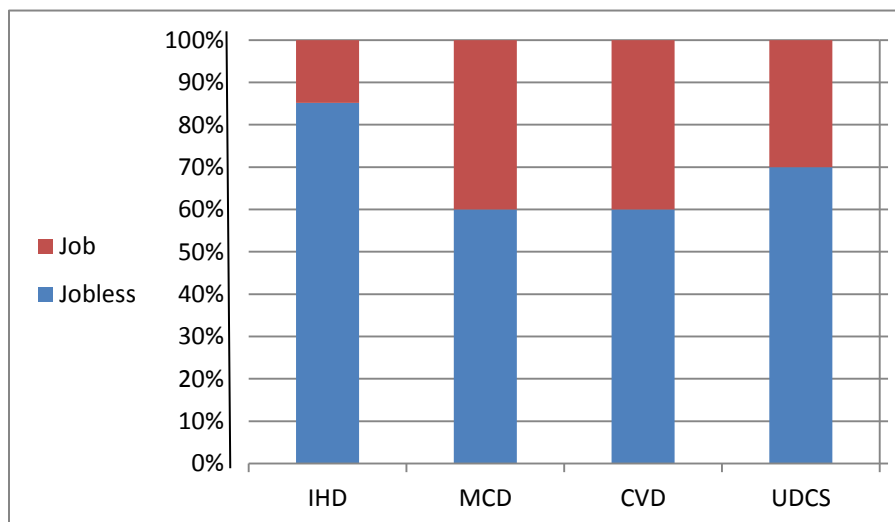


Fig3: The percentage of Sudden Cardiac Death for each group of causes with respect to (A) place of death (B) marital status, (C) socioeconomic status. In A, the red segment of each bar indicates the percentage of deceased individuals that were dying at home, while the blue segment indicates for those dying outside the home. In B, the red segment of each bar indicates the percentage of deceased individuals that were married, while the blue segment indicates those were single. In C, the red segment of the bar indicates the percentage of deceased individuals that had job, while the blue segment of the bar represents for those who had no job. IHD: Ischemic heart diseases; MCD: Myocardiopathy diseases; CVD, cerebrovascular diseases; UDCS: Unspecified disorders of circulatory system.

Discussion

To our knowledge, the study presented here is considered the first longitudinal study examining the incidence of OHSCD and its risk factors among middle aged people (35-50) years done in Iraq. Based on the findings in this study, around 21% of total deaths caused by cardiovascular diseases in the groups studied were reported as a sudden cardiac death. The incidence rate of OHSCD occurred in Babil province/Iraq was 5 cases per 100000 citizens. This rate was similar to the findings observed in some of Europe countries located in south area of the continent (Filippi *et al.*, 2008). However, other parts of the Europe countries as well as North America experienced higher rate of incidence than found in the current study, in which the rate is placed between 10-40 cases per 100000 citizens (Chugh *et al.*, 2004; Müller-Nordhorn *et al.*, 2008; Morentin and Audicana, 2011; Makarov *et al.*, 2015). These variations could be explained by the idea that industrialized countries may have high rate of OHSCD incidence (Morentin and Audicana, 2011). The positive association between the rate of OHSCD incidence and age groups found in this study is in agreement with many previous population-based studies (Morentin and Audicana, 2011; Makarov *et al.*, 2015). In the line with previous research (Chugh *et al.*, 2004; Byrne *et al.*, 2008; Morentin and Audicana, 2011), ischemic heart diseases were found to be responsible for around 60% of OHSCD observed in this study. This percentage was exactly the same one that found in a study conducted in Vizcaya city/Spain targeting same age groups used here (Morentin and Audicana, 2011). The current study also found that most cases of ischemic heart diseases were belonged to acute myocardial infarction (90%). Despite the fact that the mechanism in which an acute myocardial infarction causes sudden cardiac death is not well understood, It is believed that myocardial infarction initiates changes in heart's electricity via a ventricular arrhythmia (UIKURI *et al.*, 2001). Results also indicate that there were other causes for OHSCD such as unspecified disorders of circulatory system, cardiomyopathy diseases, and cerebrovascular diseases. These causes were also found in many of previous studies (Engdahl *et al.*, 2002; Adabag *et al.*, 2010; Deo and Albert, 2013). The current thinking believes that most of OHSCD are genetically controlled and the changes in the heart may be triggered in the channels transporting ions. Previous genetic research demonstrated that some of mutations in genetic code for heart's ion channels may explain some cases of unexplained sudden cardiac. Therefore, a special attention should be paid for the genetic approaches to be applied in the forensic autopsy for detecting the genetic basis in sudden cardiac death (Michaud *et al.*, 2009).

Another interesting data found in this study is that the distributions of the causes of OHSCD are observed to be affected by modifiable and non-modifiable risk factors. 53% of ischemic heart diseases (IHD) cases targeted people between (46-50) years. On the other hand, around 55% of cerebrovascular diseases were found to be responsible for the death among individuals aged between 41 until 45 years. Previous findings indicated that the incidence of OHSCD due to an acute myocardial infarction is significantly increased with personal's age (Chugh *et al.*, 2004; Bonow, 2007; Morentin and Audicana, 2011). Gender also has a significant effect on the variations of the causes. The percentage of men reached to the highest level in the unspecified disorders of circulatory system (80%) and ischemic heart diseases (77%). These results are supported by other studies (Filippi *et al.*, 2008; Morentin and Audicana, 2011; Makarov *et al.*, 2015). Place of death was found to have a significant effect on the variation of OHSCD causes. OHSCD with different

causes was mostly found to attack people at home rather than outside home. This is similar to other studies found that most of OHSCD especially in middle aged people were occurred at home(Drezner *et al.*, 2008; Makarov *et al.*, 2015). It is believed that the rate of SCD occurrence among individuals in middle ages may be related to their physical exercise(Drezner *et al.*, 2008). In the current study, most cases of OHSCD tends to be found among people hat had no job at the time of death. This is confirmed by previous findings. People with low economic status have more chance to be attacked by sudden death compared to those living in good economic situations. The potential mechanism explaining this kind of a link between the incidence of OHSCD and socioeconomic status may be due to the synergetic effects of multi-factors as the same time like: personal's behavior, stress, poverty, coronary risk factors, and low level of heath care(Adabag *et al.*, 2010). The study here also found that married people were subjected more incidence of OHSCD than single people. This result may be partially explained by the thought that married people have more responsibilities in their life compared to the single ones. These responsibilities may ultimately incur more stress and making them more prone to be attacked by OHSCD.

Conclusions

The incidence of OHSCD in Babil Provine/Iraq was significantly lower compared to other countries and the distributions of OHSCD causes are significantly affected by modifiable and non-modifiable risk factors. Aged people are experiencing more chance to get OHSCD. Married Men are also subjected more incidence rates of OHSCD than women. People of low socioeconomic status probably are prone to be attacked by OHSCD.

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