

# The Epidemiology of Non-Traumatic Prehospital Sudden Death in Split-Dalmatia County

Jure Aljinović<sup>1</sup>, Katarina Novak<sup>2</sup>, Lina Mirić<sup>3</sup>, Leo Grandić<sup>4</sup>, Nenad Kunac<sup>5</sup> and Valdi Pešutić Pisac<sup>5</sup>

<sup>1</sup> University of Split, University Hospital Centre Split, School of Medicine, Department of Physical Medicine and Rehabilitation, Split, Croatia

<sup>2</sup> University of Split, University Hospital Centre Split, Department of Internal Medicine, Split, Croatia

<sup>3</sup> University of Split, University Hospital Centre Split, Department of Dermatovenerology, Split, Croatia

<sup>4</sup> University of Split, University Hospital Centre Split, Department of Surgery, Split, Croatia

<sup>5</sup> University of Split, University Hospital Centre Split, Department of Pathology, Forensic Medicine and Cytology, Split, Croatia

## ABSTRACT

The aim of this study was to determine epidemiology of non-traumatic prehospital sudden adult deaths in Split-Dalmatia County from 2000. to 2005. The following information were collected from autopsy reports in the archives of University Hospital Split: gender of deceased, birth date, date of death, location of death, immediate cause of death, previously diagnosed diseases that might lead to terminal outcome. There were 160 non-traumatic prehospital sudden adult deaths in the observed period, with 104 (65%) male and 56 (35%) female autopsies performed. Diseases of cardiovascular system were the main cause of death, responsible for 95 (59.37%) sudden deaths, followed by diseases of respiratory system (14.37%) and central nervous system (8.12%). The most frequent cause of non-traumatic sudden death was myocardial infarction, found in 50 cases. July and September were the months of the most frequent occurrence of sudden death. In this study it was confirmed that sudden death incidence increases with age, with almost half of all deaths occurring in people between ages of 61–80. The result that a fifth of all sudden deaths occurred in people aged 51–60 is troubling and potentially preventable. The most frequent location of death was deceased's place of residence (N=29), followed by the ambulance vehicle (N=17). In conclusion, this is the first publication describing the incidence of pre-hospital sudden non-traumatic adult death in Split-Dalmatia County. Causes of sudden death and its incidence are in accordance with World Health Organization's information on general causes of death in Croatia and Western Europe<sup>5</sup>.

**Key words:** non-traumatic prehospital sudden death, sudden cardiac death, epidemiology, Split, Dalmatia

## Introduction

Adult sudden non-traumatic death is defined as a terminal outcome of previously unknown clinical state within 24 hours of appearance of first symptoms<sup>1,2</sup>. It can occur within few seconds or minutes (*mors momentanea*), or within few hours (*mors rapida seu accelerata*). Frequency of sudden non-traumatic deaths varies from 11–50/100000 deaths per year<sup>3,4</sup>.

World Health Organisation (WHO) places diseases of cardiovascular system in the first place among causes of sudden non-traumatic death, followed by diseases of respiratory and central nervous system<sup>5</sup>. Sudden cardiac death constitutes about 60% of all sudden adult deaths<sup>6,7</sup> and its incidence is three to four times higher in men than in women<sup>3,8</sup>. Coronary atherosclerosis was found as

underlying process in 80% of all sudden cardiac deaths<sup>3,8</sup>. In 70% of sudden cardiac deaths a scar tissue from past myocardial infarction was found. Cardiomyopathy is responsible for additional 10–15% of cardiac sudden deaths. Other post-mortem diagnoses that WHO recognized as significant in sudden death are pulmonary emboli, pneumonia, cerebrovascular infarction and subarachnoid or intracerebral haemorrhage<sup>5</sup>.

However, in some cases, despite an expert histopathological examination, cause of death remains unexplained, probably due to the speed of dying process in which patho-anatomical changes could not develop in extent to be recognized by autopsy. According to literature, 4.1% of all sudden deaths remain unexplained<sup>3</sup>.

Croatian law requires a post-mortem examination in cases when the deceased was not under medical care prior to death, when the deceased's medical practitioner does not know the cause of death, or when death might be due to unnatural causes. However, epidemiology of sudden non-traumatic death and autopsy frequency in Croatia has not been described in the literature.

The aim of this study was to determine epidemiology of sudden non-traumatic adult deaths in Split-Dalmatia County. Additional analyses were made in order to determine whether sudden death occurrence differs depending on age and gender of the deceased, month of the year, location of the death and prior health problems. Comparison with international data regarding this subject was made and commented upon.

## Materials and Methods

We retrospectively analyzed the data from autopsy reports of non-traumatic sudden adult deaths. All of the deceased were residents of Split-Dalmatia County, southern region of Croatia, with total population of 463,676 in 2001<sup>9</sup>. Only the deceased that died outside of the hospital were included in this study. Information from a five-year period from January 2000 until January 2005 was collected from the archives of University Hospital Split and data on 160 autopsies that were in accordance with above mentioned terms were included. All autopsies were performed at Department of Pathology, cytology and forensic medicine in University Hospital Split. The following information were collected from autopsy reports: gender of deceased, birth date, date of death, location of death, immediate cause of death, previously diagnosed diseases that might lead to terminal outcome. For statistical comparison we used *t*-test (GraphPad Software, La Jolla, CA, USA) after we have confirmed normal distribution of the data. Data were presented as means±standard deviation ( $X \pm SD$ ). A value of  $p < 0.05$  was considered significant.

## Results

During the observed five-year period there were 104 male and 56 female autopsies performed, with a men to women ratio of 65%:35%. Age of men was  $62.86 \pm 13.66$ , while the age of women was  $67.45 \pm 14.64$ ; there was no statistically significant difference between the age of deceased men and women ( $p=0.063$ ).

Number of autopsies varied from 25 in 2001 to 43 in 2003 (Figure 1). The youngest deceased was 17 while the oldest was 98 years old; we did not find any records about sudden death in children in the observed period. Results showed that two thirds of sudden deaths (66.25%) occurred in people aged 51–80 years, while almost one quarter of all autopsies were performed on deceased aged 61–70 years (23.75%) (Figure 2). There were 15 deceased whose identity and age was unknown at the time of autopsy. By analysing the month of year when the death occurred we have determined a higher frequency of sudden death in July (14.37%) and September (13.12%),

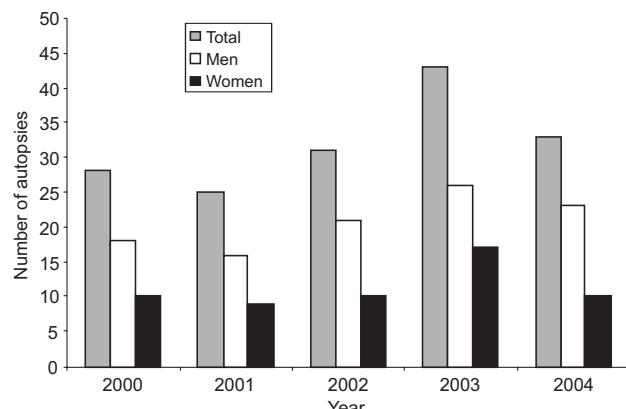


Fig. 1. The number of autopsies in each year due to the non-traumatic prehospital sudden death.

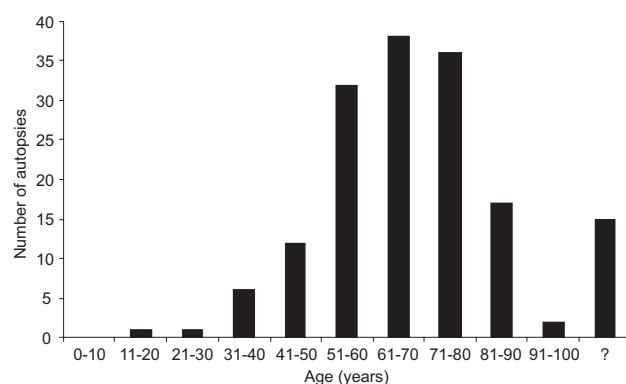


Fig. 2. Age distribution of 160 non-traumatic prehospital sudden deaths. ?- age unknown.

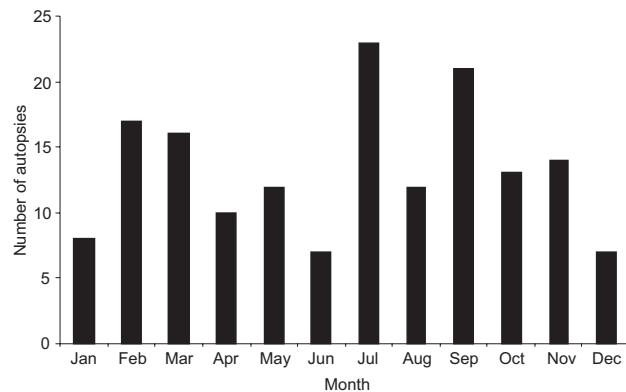


Fig. 3. The total number of non-traumatic prehospital sudden death autopsies in each month during observed five-year period.

while in June and December it was the lowest (4.37% each) (Figure 3).

Diseases of cardiovascular system were the main cause of death, responsible for 95 (59.37%) sudden deaths, followed by diseases of respiratory system (14.37%) and CNS (8.12%) (Table 1). In 10 (6.25%) deceased the cause of death could not be determined and thus remained

**TABLE 1**  
THE EPIDEMIOLOGY OF NON-TRAUMATIC PREHOSPITAL SUDDEN DEATH

System	Diagnosis	2000	2001	2002	2003	2004	N	%
Cardiovascular	Myocardial infarction	8	6	10	15	11	50	31.25
	Acute heart failure	6	9	6	9	7	37	23.13
	Aneurysm rupture	3	2	2	0	1	8	5
Respiratory	Pulmonary embolism	1	2	2	4	4	11	6.88
	Bronchopneumonia	4	2	0	3	0	9	5.63
	Lung haemorrhage	1	0	1	1	0	3	1.88
CNS ha	Cerebrovascular insult	2	2	3	0	1	8	5
	Intracerebral haemorrhage	0	0	2	2	0	4	2.5
	Subarachnoidal haemorrhage	0	0	0	1	0	1	0.63
Unexplained	Unexplained cause	3	1	2	1	3	10	6.25
Malignomas	Malignant tumours	1	1	1	1	2	6	3.75
Gastrointestinal	Intestinal haemorrhage	0	0	0	2	1	3	1.88
	Intestinal infarction	0	0	1	1	1	3	1.88
Other	Liver failure	0	0	0	3	1	4	2.5
	Kidney failure	0	0	0	2	0	2	1.25
	Pancreatic necrosis	0	0	1	0	0	1	0.63

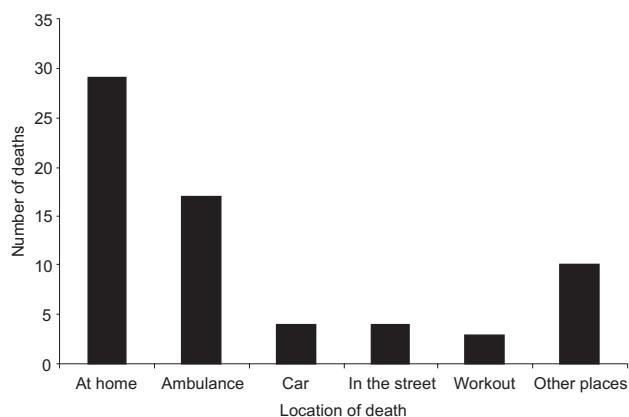


Fig. 4. Locations of non-traumatic prehospital sudden deaths occurrence.

unknown. Diseases that led to terminal outcome from above mentioned systems were further analyzed and the most frequent cause of sudden natural deaths, detected in 50 cases, was myocardial infarction (Table 1). Acute heart failure due to non ischemic heart disease was found in 37 deceased, while bursting of aortal aneurysm (thoracic or abdominal part of aorta) was found in 8 cases (Table 1). Respiratory system failure caused by emboli of pulmonary artery resulted in terminal outcome in 11 deceased. Massive pneumonia was the cause of death in 9 cases and haemorrhage inside lungs was found in 3 deceased (Table 1). As for central nervous system diseases cerebrovascular insult was the most frequent cause of death followed by intracerebral haemorrhage (Table 1). Different diagnoses that were not mentioned above were

found in only few cases, varying from malignant tumours of different sites to liver cirrhosis.

Information about where the body was found was available in autopsy reports of only 67 deceased. In 29 occasions body was located at deceased's apartment or house, while 17 died on their way to hospital inside ambulance vehicle (Figure 4). In 41 cases information autopsy report contained information on prior diseases; hypertension was diagnosed in nine cases, diabetes mellitus in five and malignant disease and recently suffered myocardial infarction in four cases each, the rest of diagnosis were mentioned only once.

## Discussion

This study gives the basic epidemiological data on sudden death incidence in area of Split-Dalmatia County in Croatia. Time periods from 15 minutes up to 24 hours have all been used to define sudden death and we used the latter in this research<sup>7</sup>. Studies in Western Europe and North America showed that cardiac sudden death is by far leading cause of death and that cardiovascular risk factors like bad diet, stressful way of life, lack of physical exercise and smoking may contribute to increased incidence of sudden cardiac death<sup>7,8,10,11</sup>. In contrast, studies in Japan showed that CVI (cerebrovascular insult) was the cause of death in more than 50% of cases but with constantly increasing incidence of ischemic heart disease due to more »westernized« way of life<sup>12</sup>. In this study we found that 60% of all deaths belonged to sudden cardiac death, which places Croatia in group with countries of Western Europe. We confirmed that sudden death incidence increases with age, with almost half of all deaths

occurring in people between the ages of 61-80 (Figure 2). The result that a fifth of all sudden deaths occurred in people aged 51-60 is troubling and potential preventive actions, like screening for risk factors, should focus on this group. Examination of family members of above mentioned group for cardiac disease is also a necessity<sup>3</sup>. Furthermore, male patients died more frequently than female patients and were significantly younger which is in agreement with other studies<sup>3,4,13</sup>. A monthly variation of sudden death was also noticed with the highest incidence in July and September and the lowest in June and December. After reviewing the literature we have confirmed that in countries with Mediterranean climate July has highest percentage of cardiac death due to the atmospheric changes which are considered to be one of the risk factors<sup>14</sup>. Although December is considered to have very high incidence of sudden death<sup>4,11,13</sup>, in this study it was the month with lowest incidence probably due to mild winters of middle Dalmatia.

During post-mortem examination, high grade atherosclerosis was discovered in one quarter of sudden death victims, proving it to be number one risk factor<sup>6</sup>. Other risk factors already described in literature that are associated with sudden death like hypertension<sup>4</sup>, diabetes mellitus or previous ischemic cardiac episodes<sup>6,13</sup> were found in less than a quarter of deceased's medical records in this study. This opens a question whether earlier detection of above mentioned risk factors could prevent or postpone sudden death occurrence.

From the available information on location of the body we confirmed that the most deaths occur at home<sup>8,15</sup> while a significant percentage of deaths happen in ambu-

lance vehicles. The emergency medical service can presume that most of the sudden adult deaths are of cardiac origin and equipping of ambulance vehicles with defibrillator showed increase in »near miss« sudden deaths<sup>7</sup>. Education of patients, especially those with risk factors, about the need to call for medical help in time when they feel first symptoms is extremely important because survival is dependent on pain-to-door time interval<sup>16</sup>. From the rest of non-cardiac diagnoses found in sudden adult death only pneumonia and emboli of pulmonary artery were found in higher frequency, mostly in older people with limited movement who often live alone. Since those two causes of death are preventable, family physicians and social services are encouraged to make regular visits of these people.

In conclusion, this is the first publication describing the incidence of non-traumatic prehospital sudden death in Split-Dalmatia County. Causes of sudden death and its incidence are in accordance with WHO information on general causes of death in Croatia and Western Europe<sup>5</sup>.

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J. Aljinović

University of Split, University Hospital Centre Split, School of Medicine, Šoltanska 2, 21000 Split, Croatia  
e-mail: jure.aljinovic@mefst.hr

## **EPIDEMIOLOGIJA NETRAUMATSKE IZVANBOLNIČKE NAGLE SMRTI NA PODRUČJU SPLITSKO-DALMATINSKE ŽUPANIJE**

### **S A Ž E T A K**

Cilj ovog rada bilo je utvrđivanje epidemioloških osobina izvanbolničke nagle netraumatske smrti na području Splitsko-dalmatinske županije. Za razdoblje od 2000. do 2005. godine iz arhive KBC-a Split analizirani su podaci o spolu i dobi preminulih, mjestu i uzroku smrti te anamnestički podatci o kroničnim oboljenjima. U navedenom razdoblju napravljeno je 160 obdukcija izvanbolničkih smrти, od čega 104 muškarca (65%) i 56 žena (35%). Bolesti kardiovaskularnog sustava najčešći su uzroci izvanbolničke nagle smrti, odgovorne su za 95 (59,37%) naglih smrти, slijede ih bolesti dišnog sustava (14,37%) i bolesti centralnog živčanog sustava (8,12%). Najčešći pojedinačni uzrok smrti bio je infarkt miokarda koji je naden u 50 preminulih. U srpnju i rujnu bilo je najviše naglih smrти. Ovaj rad je potvrdio da se učestalost nagle izvanbolničke smrti povećava s dobi, tako da se skoro polovica svih smrти dogodila u ljudi između 61. i 80-te godine života.(46,25%). Zabrinjavajući je podatak da se petina izvanbolničkih naglih smrти dogodila kod ljudi između 51. i 60-te godine života. Prema dostupnim podacima nagla smrt se najčešće događala u kući ili stanu preminulih (N=29), potom u kolima Hitne pomoći (N=17). Ovo je prva studija koja opisuje incidenciju izvanbolničke nagle smrti na području Splitsko-dalmatinske županije. Uzroci nagle smrti i njena incidencija podudaraju se sa statističkim podacima Svjetske zdravstvene organizacije o općim uzrocima smrti u Hrvatskoj i zapadnoj Europi<sup>5</sup>.