Analysis of the cause of death established by coroner's inquest

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Abstract

Objectives: To analyze the specific causes of death in the Federation of Bosnia and Herzegovina from 2009 to 2013 based on death certificates.

Methodology: The data source was the Statistical Yearbook issued by Institute of Statistics and Institute for Public Health of the Federation of Bosnia and Herzegovina (FBiH). The research covered the period of 5 years, from 2009 to 2013. We analyzed data on 102,036 deceased.

Results: The leading cause of death in the FBiH during the analyzed period are Circulatory system disorders (53.2%) with highest distribution in age group 75-79 (19.82%). Female slightly prevail in this group of disorders (53.06%). Group "Certain conditions originating in the perinatal period" (P00-P96) prevail in infant age group (0-1 years) with 59.77%. In the group of violent deaths, accidents prevail with 56.89%. The MD with coroner license, up to 76.59%, determined the largest number of deaths. An increase in the number of unidentified causes of death is spotted, which is in direct correlation with the decrease in the number of autopsies.

Conclusion: Causes of death established by coroner's inquest are relevant and reliable only if they were complemented by autopsy. The continued decline in autopsy performance, despite better training of professional staff and an advanced diagnostic procedure leads to an increased number of undetermined deaths.

Key words: Coroner's inquest, vital statistics, ICD classification, Federation of Bosnia and Herzegovina.

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Introduction

Coroner's office was first established in the middle Ages, in England, during the reign of King Richard I. The coroner's inquest was first documented in the Eira's Statutes of 1194 (Ireland), more specifically in the Statute 20, on the Latin Custos Placitorum Coronae [1].

In Federation of Bosnia and Herzegovina (FBIH), time and cause of the death of a person who died outside a health institution of the Canton, is determined by a medical doctor - a coroner appointed by the Cantonal Health Ministry. If person died within a health institution, the same job is done by a medical doctor appointed by a director of the health institution. Coroner is considered to be every medical doctor who has completed coroner's inquest training determined by Institute of Public Health of FBIH in coordination with the organizational units of Forensic Medicine (Faculty of Medicine) and Association of forensic pathologists [2, 3]. Each coroner must be familiar with basics of the International Classification of Diseases and Related Health Problems (ICD). In FBIH, the tenth version of the ICD (4) is currently being implemented. In cases of unclear or suspicious death a coroner can request autopsy to be performed: in cases with suspected natural cause of death pathological autopsy is performed; in cases of suspected violent cause of death forensic autopsy is performed exclusively by forensic-medicine specialist [2, 5, 6]. A coroner keeps the record on the performed examinations of the deceased and produces death certificate. Death certificate data are chronologically entered in the *Book of deceased* from witch *death registry* is produced. Data from death registry are each year presented to public by Institute of Statistics and Institute for Public Health in form *of Statistical Yearbook*. Presented data are the most comprehensive and reliable source of health statistics indicators on which the public health monitoring system is based [7]. The objective of this study was to analyze the specific causes of death in the Federation of Bosnia and Herzegovina

from 2009 to 2013 on the basis of a death certificate, with special reference to the sex and age structure, types of causes of death, and who issued a death certificate.

Methodology

For this study, the data were obtained from of Statistical Yearbook issued by Institute of Statistics and Institute for Public Health of the FBIH, more precisely the data from Demographic Statistics - Health and data from the Populations health condition charts. The research included 5-year period (2009 to 2013) [8, 9] for all ten cantons of the FBiH. Only the deceased persons with permanent residence in FBiH are included in study. Residence is considered to be the municipality or district in which a person resides with the intent to live there permanently. A total of 102,036 deceased were processed of, witch 20,022 were deceased in 2009, 20,482 in 2010, 20,208 in 2011, 20,859 in 2012 and 20,465 respectively in 2013. The deceased persons who have been registered in the FBiH but who died outside the borders of are not included in this study (n = 2,934).

A retrospective, comparative analysis of death causes data was conducted. The specific causes of death are categorized according to the 10th Revision of the ICD [10], and are divided into 20 categories (Table 1). Data were sorted for each year separately. Violent deaths were analyzed separately. Also insight into demographic structures of deceased population was analyzed on the basis of age and gender structure. The age structure is presented through 19 age groups (period of five years): 1-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49 , 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, and two separate 0-1 (infant group) and 85+.

Causes of infant deaths were analyzed separately. Additional to natural causes of death, special attention is given to the number of violent deaths, in data used they are presented as four categories: *Accident, Suicide, Murder and Unknown.* Coroners (who issued death certificate) based on qualifications were divided into five categories: Medical doctor (MD) with coroner license, Medical doctor (MD) without coroner license, Forensic medicine specialist or pathologist, other health workers, and unidentified.

The results of the analysis are shown by the number of cases and percentages. To test possible differences between the observed groups, the Pearson's chi-squared test was used with a certain level of statistical significance of p <0.05. The analysis was carried out using the Microsoft Excel program and the MedCalc for Windows biomedical research program version 12.5 (MedCalc Software, Ostend, Belgium).

Table 1. Groups of cause of death according to the 10th Revision of the ICD

Certain Infectious and Parasitic Diseases	A00-B99
Neoplasms	C00-C99, D00-D48
Diseases of the blood/blood vessels and disorders of the immune system	D50-D89
Endocrine and metabolic disorders with nutritional disorders	E00-E90
Circulatory system disorders	I00-I99
Eye disorders and adnexa disorders	H00-H59
Mental disorders and behavioral disorders	H00-H59
Nervous system disorders	F00-F99
Diseases of the respiratory system	G00-G99
Diseases of the digestive tract	J00-J99
Skin and subcutaneous tissue disorders	K00-K93
Musculoskeletal and connective tissue disorders	L00-L99
Genitourinary system diseases	M00-M99
Certain conditions of the perinatal period	P00-P96
Pregnancy, childbirth and puerperium	N00-N99
Congenital malformations, deformations and chromosomal abnormalities	P00-P96
Symptoms, signs and abnormal clinical/ laboratory findings	Q00-Q99
Injuries, Poisoning and Other Consequences of External Causes	R00-R99
Factors affecting Health condition and contact with health services	S00-T98
Unknown	Z00-Z99

Results and Discussion

In the observed period from 2009 to 2013, there were a total of 102.036 deaths in the FBiH. The 53.2% (n = 54248) of deaths are caused by diseases of the Circulatory System Disorders (I00-I99) (Figure 1), which is consistent with US reports [20] and regional trends [11, 12, 13, 14, 15].

In this group of diseases the highest number of deaths was found in the age group 75-79 -11,731 persons (21.65%). The data complies with data from the region: in reports from Croatia [11, 12, 13, 14, 15], diseases of this group also dominate in the age group 75-79; data of the US vital statistics for the same period [16] are similar.

Increase of number of deaths in age groups 65-69 (8.35%) and 70-74 (16.07%) is noted, indicating that life expectancy is a major risk factor for these diseases. The analysis by each year does not show statistically significant differences in the coverage of Circulatory System Disorders (p> 0.05), however, in every year
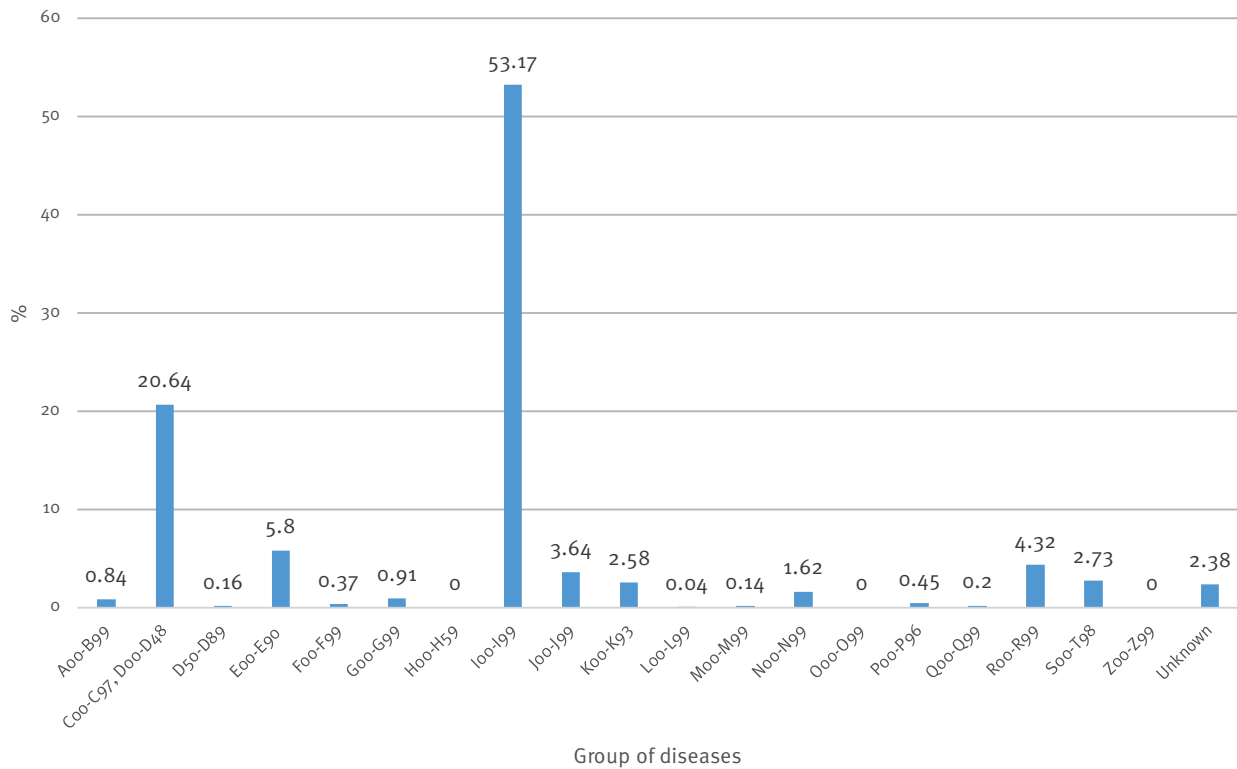
Figure 1. Causes of death (%) in the FBiH for period 2009-2013.

more than 52% of deaths fall into this category, with the largest number of deaths in 2010 represented with 53.88%, which is more than twice the percentage of the second placed group of Neoplasms with 20.13%. For the same period, Croatian reports (Croatian Health and Statistical Yearbooks), placed circulatory system disorders on the first place also, though the percentage was slightly lower (49.20%) [11 - 15]. In the US, percentage representation of this disorders group is a drastically lower [17].

The second most significant cause of death (20.64%) in our study are neoplasms– ICD10 code C00-C99, D00-D48. Within, the largest number of deaths are in age group 70-74 (17.54%). Interestingly, such data are in line with US vital statistics [18], where the same trend was observed. A similar increase in the number of deaths has also been recorded in the Croatian Health and Statistical Yearbooks corresponding to the observed period [11, 12, 13, 14, 15].

With the exception of the first age group, the number of deaths is increasing with age, ending with highest number of deceased persons (19.82%) in the age group of 75-79. The data are consistent with WHO data on the life expectancy [19].

Gender distribution was almost equal: 52.014 (50.98%) were male and 50.022 (49.02%) were females. The leading causes of death (Circulatory System Disorders) was similarly representation for both genders. Second leading cause for both genders were Neoplasm Group of diseases.
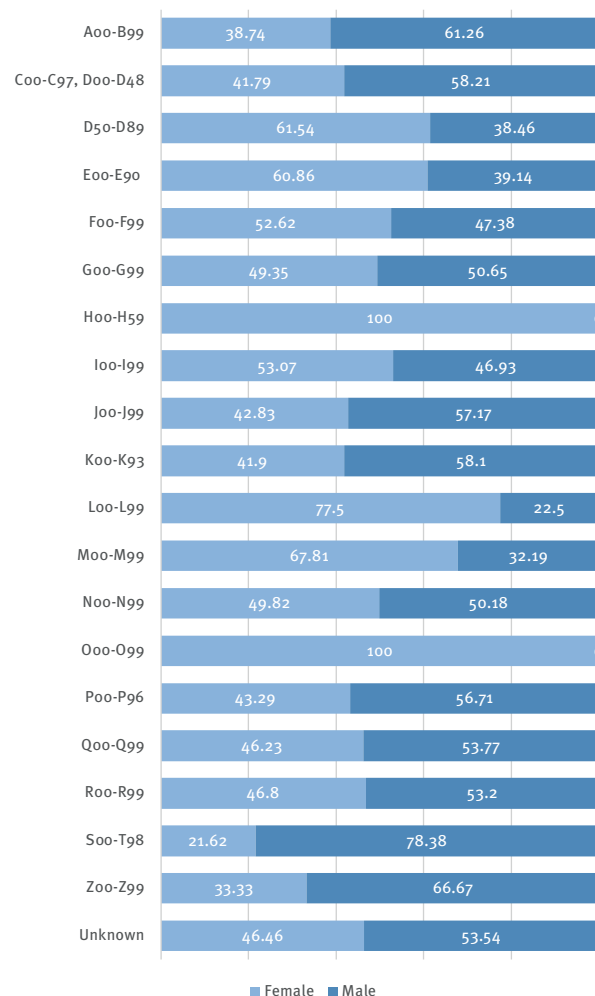

Figure 2. Gender distribution of death causes (%).

Women were slightly more represented in the following disease groups: Blood and Nervous System Diseases and Specific Immune System Disorders (D50-D89) 61.64%, Endocrine and Metabolic Disorders (E00-E90) 60.86%, Diseases of the eye and adnexa (H00-H59) 100%, Circulatory System Disorders (I00-I99) 53.07%, Skin and Subcutaneous Tissue Disorders (L00-L99) 77.5 %, Musculoskeletal and connective tissue disorders (M00-M99) 67.81% (Figure 2). The gender presentation is almost identical in Croatia [11, 12, 13, 14, 15]. On contrary, the US data of vital statistics differ - although the Circulatory System Disorders and Neoplasm's are leading causes of death both genders, they are both more prevalent in male populations.

"External causes of morbidity and mortality" (V01-Y98) is a third placed group among males, and on contrary, it is even not mentioned in reports from regional countries.

Third placed group in the US report in female population is Respiratory System Disorders (J00-J99), which is placed fifth in a female population of FBiH with a total of 1591 deaths.

Group "Certain conditions originating in the perinatal period" (P00-P96) is a group with the highest number of deaths in the infantile period (n = 462; 59.77%). Congenital malformation, deformation and chromosomal abnormalities (Q00-Q99) are the second placed group, representing (n = 139; 17.98%). Third placed group are Circulatory System Disorders (I00-I99) with 60 deaths (7.76%) (Figure 3).

Violent deaths causes were explored separately. No significant statistical difference (p> 0.05) was observed in relation to violent deaths over the observed five-year period. From 2009 to 2012, the total number of deaths has decreased from 173 to 139, however, in 2013, an increase in total number is noted. A similar trend has been observed in Croatia, and US for the observed period. [21, 22, 23, 24, 25]. In the total, violent deaths were represented in 2.65% cases (n = 2,707). There was a slight decrease in the share of violent deaths trough each year: 2.85% (2009 and 2010), 2.7% (2011), 2.44% (2012) and 2.45% (2013) with a statistically significant difference when compared (Table 2).

he highest number of violent deaths was recorded in 2010 (n = 583), placing it in fifth place of total causes of death. In that year, in Croatia, violent deaths was placed third in total [12]. Out of the total number of violent deaths, accidents occupying the highest share (56.89%), which corresponds to the data of Croatian
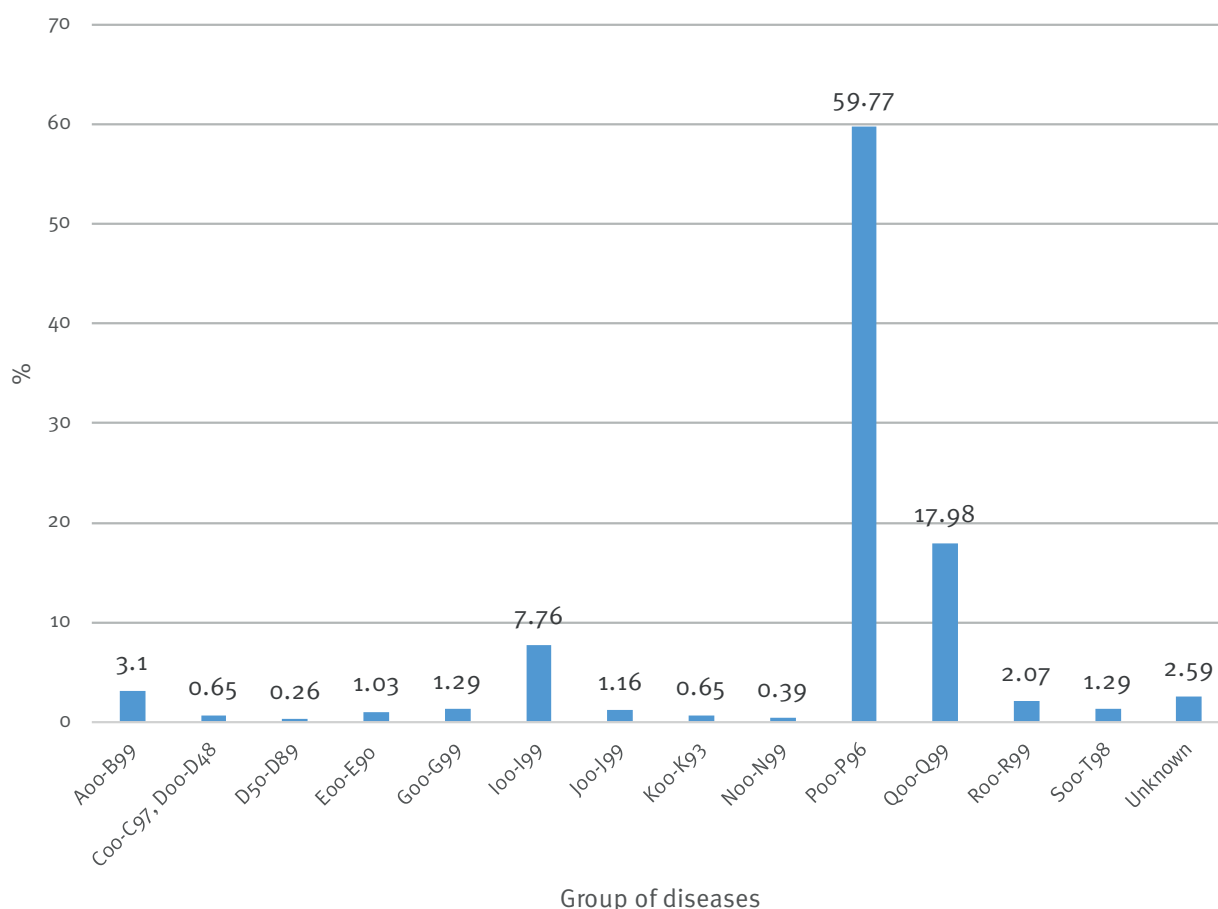

Figure 3. Causes of infant death (%) 2009-2013

Table 2. Four groups of violent deaths for 5 year period

	Year					Total
	2009	2010	2011	2012	2013	
Accident	343	318	312	289	278	1540
Suicide	190	210	174	168	175	917
Homicide	35	30	28	34	21	148
Unknown	2	25	31	17	27	102
Total	570	583	545	508	501	2707

$x^2=3,271$; p=0,611

vital statistics for the same period. The highest number of accidents in FBiH was recorded in 2009 (n=343; 60.18%). It is interesting that the highest number of accidences in Croatia was also recorded in that year [11]. According to the latest data from the WHO in 2014, 9% of the world's total population, or about 5 million a year, dies from violent deaths. In our study placing was same as in our region: an accident first, suicide on the second, and murder on the third place [26].

The worrying fact is that the category "Unknown" records continuous growth over the observed period. Although it was a negligible percentage in 2009 (0.35%), it reaches its peak in 2011 (5.69%). Next two years it falls slightly in 2010 (3.35%), 2013 (5.39%). In the observed period, the percentage representation of this category is 3.77%. In Croatia the highest percentage of unknown deaths was in 2009 (0.43%), to then decrease in 2011 (0.21%) [11, 13].

In the observed period, 102,036 deaths were recorded, and 78,145, respectively, 76.59% of the total number was recorded by the MD with coroner license. The percentage varies through the years: in 2009 coroners determined 13247 deaths (66.16%), then numbers increase to peak in 2013 with 16549 deaths (80.86%). With this growth, there is also a decrease in the number of deaths reported by MDs without coroner license (second placed in this category), with their highest peak in 2009 (n = 5449, 27.21%) and lowest number of deaths in 2013 (n = 2904, 14.19%). Deaths confirmed from other *health workers* and *forensic medicine specialist/pathologist*, are third and fourth place representatives.

In the category of coroners who signed death certificate, *unidentified* has been given if there is no determination who signed death certificate. It is important to note the negative trend in this category, which is the increase in the number of *unidentified* (1.27% at its peak). The increase of this number can be associated with a continuous reduction in the number of deaths confirmed by autopsy each year. This is especially worrying because a number of authors warn that only the coroner or the exterior examination of the deceased is inaccurate in determination of cause of death, even when forensic medicine specialist do it [27, 28]. This can lead to a failure in recognition of violent deaths and increase in subsequent demands for body re-autopsy/exhumations. The above mentioned issues are best explained in a study published by Karger et al. [6]. They have analyzed 155 deaths involving only a coroner's or anterior examination of the corpse, to be suspicious of the cause of death after a while. Postmortem interval ranged from 8 days to 8 years. The evaluation was carried out on the basis of autopsy findings (after exhumation), police reports and death certificates. Histological and toxicological analyzes have been conducted in most cases. The cause of death could be clearly defined in 103 cases (66.5%), and the histological and toxicological analysis was decisive in 40%. There were 57 cases (37%), and most importantly, 22 cases of murder were discovered. There were significant differences of causes of death indicated in the death certificates and the performed after autopsy.

Conclusion

The leading cause of death in the Federation of Bosnia and Herzegovina in the period from 2009 to 2013 was the Circulatory System Disorder (53.2%). In the age group 75-79, the highest number of deaths was 19.82%. Gender distribution was almost equal: 52.014 (50.98%) were male and 50.022 (49.02%) were females. Group Certain conditions originating in the perinatal period (P00-P96) is a group with the highest number of deaths in the infant period of 59.77%. The highest number of deaths was found by the MD with coroner license (76.59%). There was an increase of numbers in category *unidentified* (causes of death), from 65 cases in 2009 to 260 in 2013, which is directly correlated with decreasing number of autopsy, from 295 in 2009 to 171 in 2013. Causes of death established by coroner's inquest are relevant and reliable only if they are complemented by autopsy. The continued decline in autopsy performance, despite better training of professional staff and an advanced diagnostic procedure leads to an increased number of undetermined deaths.

Declaration of Interest:

The authors declare no conflict of interest.

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