

# Causes of death in children of the Kvarner Bay area (western Croatia) in the 19<sup>th</sup> century

## Uzroci smrti djece u Hrvatskom primorju u XIX. stoljeću

Tatjana Čulina<sup>1\*</sup>, Višnja Jovanović<sup>2</sup>

<sup>1</sup> Teaching Institute for Public Health Rijeka, Rijeka

<sup>2</sup> Emergency Center Rijeka, Rijeka

Primljeno: 15. 11. 2014.

Prihvaćeno: 4. 3. 2015.

**Abstract. Aim:** To analyze the rates and causes of death in children in four towns in the Kvarner Bay area (western Croatia) in the 19<sup>th</sup> century. **Materials and sources:** The analysis is based on data collected from the Death Register kept at the State Archives of Rijeka. Death records were translated into English and arranged according to the 10<sup>th</sup> revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10). We analyzed a sample with a total of 5,462 death records, which included six age groups: newborns, infants, toddlers, preschoolers, schoolers, and adolescents. **Results:** In nearly all the age groups the leading causes of death were "Symptoms, signs and abnormal clinical findings, not elsewhere classified", while the second leading cause of death was "Certain infectious and parasitic diseases". Compared to the surrounding towns, Rijeka showed the most favorable trends in the death rate, which seems to reflect improvements in health care. **Conclusion:** Our results represent an original contribution to the historical study of child mortality, with the application of the ICD-10, enabling a more precise insight and comparison between historical and modern epidemiological data.

**Key words:** 19<sup>th</sup> century; child mortality; Croatia; History of medicine

**Sažetak. Cilj:** Analizirati stope i uzroke smrti djece u četiri grada kvarnerske regije u Hrvatskoj u XIX. stoljeću. **Materijali i izvori:** Raščlamba se zasniva na podacima prikupljenim iz matičnih knjiga umrlih iz Državnog arhiva u Rijeci. Podaci o smrti sistematizirani su prema 10. izdanju Međunarodne klasifikacije bolesti (ICD-10). Autori su analizirali ukupan uzorak od 5.462 unosa o smrti koji uključuje šest dobnih skupina: novorođenčad, malu djecu, predškolsku djecu, školsku djecu i adolescente. **Rezultati:** U gotovo svim dobnim skupinama vodećim uzrokom smrti bili su "simptomi, znaci i inače neklasificirani nenormalni klinički nalazi", dok su drugim uzrokom po učestalosti bile "izvjesne zarazne i parazitarne bolesti". U usporedbi s okolnim gradićima, Rijeka pokazuje najpovoljnije trendove u stopi smrtnosti, što vjerojatno odražava poboljšanja u zdravstvenoj skrbi. **Zaključak:** Rezultati ove studije predstavljaju izvorni prinos povijesnom proučavanju dječjeg pomora, uključivši primjenu klasifikacije ICD-10 koja omogućuje precizniji uvid i usporedbu između povijesnih i modernih epidemioloških podataka.

**Ključne riječi:** 19. stoljeće; Hrvatska; povijest medicine; smrtnost djece

**\*Dopisni autor:**

Dr. sc. Tatjana Čulina, dr. med.

Teaching Institute for Public Health in Rijeka

Krešimirova 52a, HR-51 000 Rijeka

e-mail: golubica2@yahoo.com

<http://hrcak.srce.hr/medicina>

## INTRODUCTION

This study continues our long research of demographic changes in the Kvarner Bay area (western Croatia) in the 19<sup>th</sup> century<sup>1-4</sup>. Tradition and our preliminary research suggest that this historical period saw high death rates among children. In fact, of all the deaths we recorded as part of our larger research, nearly 63 % occurred in children. We felt that this outstanding information deserved to be further investigated. Our idea was to analyze and present relevant data related to the rates and causes of death by the age of 19 years.

Several local<sup>5</sup> and national sources<sup>6</sup> published incidental data in the mid and end 19<sup>th</sup> century, but without much of an impact. These were also times that saw the pioneering attempts in social medicine by two physicians of Rijeka, Giovanni Spagnolo and Antonio Felice Giacich. They published two booklets on health education of mothers and children as a way to combat high morbidity and death rates in children.

Dr. Giacich supported his arguments with devastating mortality data for infants of Rijeka, and compared them with several other localities in the region and across the Austrian Empire and other Central and Western European countries. Infant mortality in Rijeka was about 270 ‰ according to Giacich's data, which is very similar to rates in neighbouring countries and major European cities. For example, the infant mortality in Hungary was 282 ‰, in Italy 217 ‰, and the capital Vienna 248 ‰<sup>7,8</sup>.

In the towns of Kvarner, the share of infants in overall mortality was 24 % for Bakar and up to 33 % for Rijeka, and for children under five between 40 % and 56 %, which was also confirmed in this research. However, because of the inconsistencies in registration (under-registration), especially in smaller communities, it should not be taken for granted<sup>6</sup>.

As no other sources speak about child mortality in Rijeka and the Kvarner region of the 19<sup>th</sup> century, or even in a wider area, we felt that our research was justified in filling that gap.

According to a similar, more recent research, generally speaking, child mortality in the general population ranged between 100 – 250 ‰<sup>9-12</sup> in most European cities during the nineteenth cen-

tury, and the situation was similar in USA<sup>13</sup> and Japan<sup>14</sup>. The current studies treat the mortality of children in several ways. They show the circumstances in particular cities<sup>1,15-17</sup>, compare urban with rural regions<sup>18,19</sup>, compare groups of children in different religious communities<sup>20</sup>, and highlight the negative effects of migration on illness and dying of children<sup>21</sup>. However, they also record the preventive attempts to improve health care for children and the positive steps in reducing child mortality<sup>22,23</sup>.

In nearly all the age groups the leading causes of death were "Symptoms, signs and abnormal clinical findings not elsewhere classified", while the second leading cause of death was "Certain infectious and parasitic diseases." Compared to the surrounding towns, Rijeka showed the most favourable trends in the death rate, which seems to reflect improvements in health care.

Today, these and similar researches are justified both from the classical historiographic, as well as the practical and scientific-medical point of view. The new insights of epidemiological and demographic conditions in the 19<sup>th</sup> century encourage to additional possibilities of evaluation of the progress of medicine and health care in the past and oblige to the continuation of search for new opportunities and ways of preservation and improvement of health, in this case, of children and youth.

## MATERIALS AND SOURCES

We used registries of death of four parishes, now kept at the State Archive in Rijeka and Archive of the Parish of the Assumption (of the Virgin Mary), which covered nearly all of the Rijeka population of the time. The parishes include two relatively large harbors: Rijeka<sup>24-34</sup> and Bakar<sup>35-37</sup> and two smaller inland towns: Kastav<sup>38-40</sup> and Grobnik<sup>41-43</sup>. Data were collected for the first years of each decade of the 19<sup>th</sup> century. We relied on literature describing methodological approach to registries and on research covering periods.

The geographic and chronological distribution of data justifies this sampling method, which covers 10 % of the total data.

## RESEARCH METHODS

All registries were kept in Latin, Italian, and occasionally in Croatian. For translation into English we used specialized Latin and Italian medical dictionaries<sup>44-47</sup>.

We identified the sex, age, time, and cause of death for each record. Records that were unintelligible or did not provide data we needed were excluded from analysis. According to the common criteria in neonatology, paediatrics and to-

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day's school medicine we then divided the children into six age groups corresponding to specific physiological periods in the development of children. We selected a total of 5,462 children deaths in Rijeka, Bakar, Kastav and Grobnik for processing. Of this number, 910 were newborns (*age up to 1 month; median 0,15 month*), 1,347 infants (*1-12 months; median 6 month*), 1,977 toddlers (*1-3 years; median 1 year*), 583 pre-schoolers (*4-6 years; median 5 years*), 347 schoolers (*7-12 years; median 8 years*), and 298 adolescents (*13-19 years; median 16 years*) and classified the causes of death according to the current 10<sup>th</sup> revision of the International Statisti-

cal Classification of Diseases and Related Health Problems (ICD-10)<sup>48</sup>.

## RESULTS

To better understand the death rate in four cities during 19<sup>th</sup> century it is important to know the population overall number in the same cities related to the same century. While the population of Rijeka over the century grew from about 6,000 to 39,000<sup>49</sup>, the population in Bakar declined from approximately 7,000 to about 2,000<sup>50</sup>. By contrast, in rural areas there are no significant fluctuations – in Kastav moving around 3,700<sup>51</sup> and around 3,500 in Grobnik<sup>52</sup>. Table 1 shows trends in total mortality in the early years per decade in all four cities. Out of the total 10.168 deaths, 5,462 (53.7 %) were children and adolescents under the age of 19 years. In Rijeka, there were 3,104, Bakar 748, Kastav 1,276 and Grobnik 335.

Table 2 shows the distribution of death causes by age groups and ICD-10 chapters<sup>48</sup>. What strikes immediately is that the leading causes of death in all the age groups, except for schoolers, belong to chapter XVIII "Symptoms, signs and abnormal clinical findings, not elsewhere classified".

In newborns (< 1 month) these mostly refer to the ICD chapter XVIII, block R50-69 "General symptoms and signs"<sup>48</sup>, and are described as *spasmus* (cramp, spasm), *eclampsia*, and *convulsiones*. Surprisingly, "Certain conditions originating in the perinatal period" (ICD-10, Chapter XVI) fall in the second place. The most common descriptions are *imaturitas* and *atrophia* (immaturity and atrophy of the foetus), diagnoses belong-

**Table 1.** Deaths per examined years in Rijeka, Bakar, Kastav and Grobnik

Year	Rijeka	Bakar	Kastav	Grobnik
1800.	212	203	200	69
1810.	598	196	238	62
1820.	260	98	172	31
1830.	357	265	360	130
1840.	416	132	227	50
1850.	399	124	198	48
1860.	500	93	213	77
1870.	841	149	196	73
1880.	728	133	167	58
1890.	1.249	129	460	57
Total	5,560	1,522	2,431	655
Children	3,104	747	1,276	335

ing to the block P07 “Disorders related to short gestation and low birth weight, not elsewhere classified”. Follow diagnoses of the block P95 “Foetal death of unspecified cause”, including *natus mortuus* (stillborn, born dead), *debilitas vitalis congenita* (congenital vital weakness), and *inanitio* (inanition).

Of 1,347 infant deaths, most belong to the block R50-69 “General symptoms and signs”, and the most common descriptions coincide with those for newborns, including *consumptio* (consumption, wasting), *convulsiones*, *eclampsia*, *inanitio*, and *spasmus* (cramps). Follow the causes described in ICD-10 chapter I, including *diphtheria*, *morbilli* (measles), and *pertusis* (whooping cough), then Chapter XI causes including *gastroenteritis*, *enteritis and diarrhoea* as the most common. *Bronchitis* and *pneumonia* (chapter X) were the 4<sup>th</sup> leading cause. *Debilitas vitalis* (vital weakness, chapter XVI) and *hydrocephalus* (chapter XVII) were also reported.

In toddlers (1 to 3-year-olds), the most common descriptions of the cause of death were similar to the previous two age groups and include *spasmus* (cramps), *eclampsia*, *consumptio*, and *tabes* (wasting), accompanied by adjectives such as *infantile*, *intestinalis*, or *mesenterica*. Follow chapter I causes such as *diphtheria*, *morbilli* (measles), *scarlatina* (scarlet fever), *pertussis* (whooping cough), and new diagnoses, including *scrophulosis* (scrofula?) and tuberculosis. The third leading group of causes belong to chapter X and include *bronchitis*, croup, and *pneumonia*. The fourth group (chapter XI) includes *enteritis*, *gastroenteritis*, and *gastromeningitis*. Other relevant causes include “Endocrine, nutritional and metabolic diseases” (chapter IV), the most common of which was *rachitis* (rickets) in 59 cases. Unspecified meningitis was recorded in as many as 53 of the 57 chapter VI diagnoses.

In preschoolers (4 to 6-year-olds), again the most common diagnoses were those of chapter XVIII,

**Table 2.** Causes of child death in the 19<sup>th</sup> century according to the 10<sup>th</sup> revision of the International Statistical Classification of Diseases (ICD-10) by age groups

Causes of death according to ICD-10	Age						Total
	< 1 month	1 – 11 months	1 – 3 years	4 – 6 years	7 – 12 years	13 – 19 years	
I.	11	122	381	187	125	102	928
II.	2	3	5	3	2	-	15
III.	4	-	-	1	-	-	5
IV.	-	10	77	17	4	3	113
V.	8	22	19	5	-	-	54
VI.	2	22	57	27	17	11	136
IX.	-	-	3	1	2	-	6
X.	6	110	310	79	42	33	580
XI.	7	120	134	19	18	12	310
XII.	-	-	2	-	1	-	3
XIII.	-	-	-	-	1	2	3
XIV.	1	-	4	4	4	2	15
XV.	-	-	-	-	-	1	1
XVI.	326	16	-	-	1	-	343
XVII.	3	14	31	8	2	2	60
XVIII.	539	905	946	230	121	122	2.866
XIX-XX.	1	3	5	2	5	8	24
Total	910	1.347	1.977	583	347	298	5.462

I. Certain infectious and parasitic diseases; II. Neoplasms; III. Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism; IV. Endocrine, nutritional and metabolic diseases; V. Mental and behavioural disorders; VI. Diseases of the nervous system; IX. Diseases of the circulatory system; X. Diseases of the respiratory system; XI. Diseases of the digestive system; XII. Diseases of the skin and subcutaneous tissue; XIII. Diseases of the musculoskeletal system and connective tissue; XIV. Diseases of the genitourinary system; XV. Pregnancy, childbirth and the puerperium; XVI. Certain conditions originating in the perinatal period; XVII. Congenital malformations, deformations and chromosomal abnormalities; XVIII. Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified; XIX. Injury, poisoning and certain other consequences of external causes; XX. External causes of morbidity and mortality; XXI. Factors influencing health status and contact with health services.

including *consumptio*, *eclampsia*, *spasmus*, and *tabes mesenterica*. Followed chapter I diseases, including *diphtheria*, scarlet fever, measles, and tuberculosis. Of respiratory diseases (chapter X), the leading causes of death were *angina* (quincy, *cynanche tonsillaris*), bronchitis, and croup, and of the “Diseases of the nervous system” (chapter VI) nearly all descriptions fit meningeal syndrome. All 17 chapter IV cases were described as therickets. In schoolers (7 to 12-year-olds), the most common causes of death were infectious (chapter I) diseases such as tuberculosis, diphtheria and scarlet fever followed by *consumptio*, *febris*, *spasmus*, and *eclampsia* (chapter XVIII). Of respiratory (chapter X) diseases, the most common were *bronchitis* and *croup*. These were followed by gastrointestinal and nervous system diseases. In adolescents (13 to 19-year-olds), chapter XVIII diseases resume the leading position with *consumptio*, *spasmus*, *eclampsia* or other febrile conditions, followed by infectious (chapter I) diseases of which tuberculosis accounted for 40 deaths, while other, mostly children’s infections were far less common. The third leading cause of death were respiratory (chapter X) diseases with a similar distribution of bronchitis, pneumonia, and cold. Nervous and gastrointestinal system diseases were less notable but still relevant, while other diseases were rare.

Comparing causes of death in Rijeka and the other three cities we have got the following sequence and ratios: In the first place, equally in all four cities, as the leading causes of death are registered “Symptoms, signs and abnormal clinical findings not elsewhere classified” (between 26,1 %, i 26,4 %). While the second leading cause of death was “Certain infectious and parasitic diseases” (Rijeka 7,5 %, the other three towns 9.5 %). The third group is “Disease of the respiratory system” (Rijeka 7.5 %, the other three towns 3.3 %). These three groups make up 80.3 % of all causes of death, and the remaining 19.7 % of deaths classified as a disease of the remaining 19 ICD-10 chapters.

## DISCUSSION

Before discussion of our results we will discuss the circumstances in the other areas of Croatia and compare them with today’s situation.

Individual cases of recording causes of death in certain parishes in Croatia started at the turn of the 18<sup>th</sup> into the 19<sup>th</sup> century, coinciding with the rest of the Austrian Empire. Parish death entries were at first based on the accounts given by people who shared the household with the deceased and far less often by a physician who treated the deceased. As time went by, parish priests who took these records broadened their knowledge and adopted the instructions issued by Church and secular authorities as well as the experiences of their predecessors. Their diagnostic scope would then include dozens of descriptions, mostly of symptoms and undefined conditions, which they use as they saw fit. Therefore, from these descriptions is very difficult, almost impossible to identify and describe the causes of the different diseases – problems in ambiance, quality of water, lack of food, congenial previous records, epidemic infections, etc which are certainly played a significant role in the overall morbidity and mortality. Given the historical context, this is not surprising<sup>53-54</sup>.

Due to these and similar shortcomings, the analysis of causes of death, especially in the early nineteenth century is still not possible from modern medical aspects. Therefore, this analysis should be accepted only as an effort to gain insight into the structure of dying.

Since 1815 the recording of infant mortality has gradually introduced in all parishes, and the official statistical data for Croatia are available since the 1874. During this period of time, a tremendous decline was recorded from 295.2 ‰ live births in 1874 to 7.0 ‰ live births in period from 2002 to 2012<sup>55,56</sup>. All of this was achieved by long-lasting and successful implementation of appropriate prevention programs as part of a well-organized public health service<sup>57</sup>.

Among the latest researches in which are the deaths of children and youth especially treated, in the context of demographic transition in Croatia in the second half of the 19<sup>th</sup> century, most comprehensive project was conducted as part of doctoral study “Population History” at the University of Dubrovnik, from 2006 to 2008. The study was conducted on a sample of 12 selected parishes from all Croatian historical lands. By analysis of total mortality by age group and sex, and percent mortality of some groups in overall mortality in the

parishes it is found that traditionalism, isolation and varying degrees of involvement in the new development trends has significantly influenced mortality trends, most destructive in infant and child age, in the second half of the 19<sup>th</sup> century<sup>58</sup>.

There are very few contemporary studies of birth and death registries of the 19<sup>th</sup> century in western Croatia. One that stands out is by Avelin Baretić<sup>4</sup>, who investigated records of baptism and death of the Mošćenice parish. However, his detailed analysis of the causes of death sticks to the nomenclature of those times. There are several differences between his study and our own. The most common cause of death in the Mošćenice parish (27 %) in Baretić's study is described as *ordinaria*, a natural cause. This description has not been recorded in any of the records of the four towns in our study. Another striking difference is that as many as 17 % of the death cases in Mošćenice, and in the nearby Klana<sup>59</sup> for that matter, is accounted for by *vermes* (worms). In our records this description is purely incidental.

The situation in the first half of the 19<sup>th</sup> century seems to coincide between Klana<sup>57</sup>, the island of Krk<sup>60</sup> and Rijeka<sup>1,2</sup>. Rather soon however, Rijeka saw a great advancement, as it quickly developed into a strong regional center with accompanying healthcare services. The town boasted prominent physicians<sup>61</sup> and licensed midwives<sup>62</sup>, whose number grew by the year. With a new hospital in 1823, the town saw the beginning of an extraordinary clinical practice<sup>63</sup>.

These advancements are reflected in the description of specific causes of death observed in our study, such as Bright's disease, *nephritis*, *uraemia*, *angina pectoris*, *pericarditis*, *endocarditis*, *insufficiencia valvulae mitralis*, *haemorrhagia cerebri*, or *aneurisma*, which were made by professional coroners, but more importantly in reduced rates of specific diseases such as complications in pregnancy, childbirth and the puerperium, that were four times less common in Rijeka than in the remaining three towns, or in maternal death rates, which were 1.5 times less common.

It may therefore surprise that Rijeka recorded 21 times more deaths in newborns due to congenital malformations and deformations than the remaining three towns, but this reflects the difference in who made the diagnosis.

## CONCLUSION

Despite difficulties encountered while collecting, systematizing and evaluating primary data, we consider the presented results an original contribution to the study of local and general history of public health. Moreover, the application of ICD-10 has given a far more precise insight into the real causes of infant death and has made it possible to compare historical and modern epidemiological data. This may shed some light on the links between economic, social, and public health development on one side, and general demographic parameters on the other side.

**Conflicts of interest statement:** The authors report no conflicts of interest.

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