Austin Journal of Public Health and Epidemiology

Austin Publishing Group

Open Access Full Text Article

Research Article

Malignant Neoplasms of Urinary Tract (C64-C68) in the Osijek-Baranja County (Croatia) in the Period 2001-2009

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Received: August 20, 2014; **Accepted:** September 15, 2014; **Published:** September 16, 2014

Abstract

Purpose: We investigated the trends of the malignant neoplasms of the urinary tract in the Osijek-Baranya County (Croatia) during the 2001-2009 period.

Methods: Mandatory county hospitals data reports, County bureaus of statistics and the County Register of Deaths of 872 cohort patients (260 females and 612 males) were used in this analysis.

Results: For the both genders, the overall age-adjusted incidence rate was 24.5/100,000 with a weak upward chronological tendency (R^2=0.059); also, the overall age-standardized mortality rate of 12.2/100,000 experienced a moderate upward trend line (R^2=0.350). The age-adjusted 5-year relative survival rate of all patients totalled 51.0% in 2001–2005 period. The survival rate in males (51.1%) resembled the overall survival rate and it was slightly higher than in females (50.6%). An average patient was admitted to hospital 2.7 times during the course of their illness with the average length of stay in hospital of 11.3 days. The number of hospitalizations in years 2001 to 2009 progressively grew, both from the viewpoint of the entire population of patients and seeing genders separately (R^2=0.777).

Conclusion: Although the data on the incidence and mortality rate from this cancer group do not deviate much from the corresponding data on the European and Croatian level, the survival rate is far below the EU average and thus directly suggests that the health care of these cancer patients in the OBC should be substantially improved and put on a much higher level.

Keywords: Neoplasms of urinary tract; Mortality rate; Incidence rate; 5-year relative survival rate; Length of stay in hospital; Croatia

Abbreviations

ICD-10: International Statistical Classification of Diseases and Related Health Problems, 10th Revision; C64-C68: Malignant Neoplasms of the Urinary Tract; C64: Malignant Neoplasm of Kidney, Except Renal Pelvis; C65: Malignant Neoplasm of Renal Pelvis; C66: Malignant Neoplasm of Ureter; C67: Malignant Neoplasm of Bladder; C68: Malignant Neoplasm of Other and Unspecified Urinary Organs; OBC: Osijek-Baranja County; ONKO: Mandatory Statistical Reports on Every Hospitalized Cancer Patients in Croatia; BSL: Mandatory Statistical Report on Every Hospitalized Person, Regardless of the Causes of Hospitalization; CI: Confidence Interval; EU: European Union; MADG: Median Age at Diagnosis; MAD: Median Age at Death; R: Relationship; LOSH: Length of Stay in Hospital; NOAH: Number of Hospital Admissions; IPHO: The Institute of Public Health of the Osijek-Baranja County; USA: United States of America; UW: upward trendline; COD(S): coefficient of determination (strength); N: number of cases; ASR: age-standardized rate (EU); N/A: not available; BG: Both genders; F: Females; M: Males; AA: average admission in hospital per patient

Introduction

Malignant neoplasms of the urinary tract (according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10), group codes C64-C68) belongs to the sixth most common cancers in the OBC [1]. Comparing to the incidence rate of this cancer group in the OBC, higher rates are found in Europe and North America and lower ones are determined in Asia and South America [2]. Exposure to chemicals, cigarette smoke and family history may increase the risk of this cancer group, particular of bladder cancer (C67) [3]. The C64-C68 cancer group accounts for around 8.5% of all cancers in the USA [4]. These cancers affect more often males than females, with a males to females ratio of about 2:1 (11.3% in males and 5.6% in females) [4]. Regarding the USA population, the trends in the incidence of kidney cancer (C64) revealed a statistically significant increase among members of both genders during the 2003–2007 period whereas the trends in the occurrence of urinary bladder cancer demonstrated neither a statistically significant increase nor decrease in males, but it came to a major decrease in females. The trends in the corresponding death rates during the same period revealed a decrease in mortality from kidney cancer in both genders and in the mortality from bladder cancer within the female population. Having regard to the same population, the 5-year relative survival rate from bladder cancer amounted to 72% in males and 67% in females while the 5-year relative survival rate from kidney cancer was 56% in males and 58% in females [5]. Concerning the same cancers, the estimated incidence and mortality rate in the EU were 6.9% and 5.9%, respectively. In males, the incidence and mortality rate

Citation: Milas J, Samardžić S and Milas K. Malignant Neoplasms of Urinary Tract (C64-C68) in the Osijek-Baranja County (Croatia) in the Period 2001-2009. Austin J Public Health Epidemiol. 2014;1(3): 1011.

Table 1: The median age of malignant neoplasms of urinary tract (C64-C68) at diagnosis and at death in the period from 2001 to 2009.

	Table 1A. Median age (in years) at diagnosis - females												
ICD-10	2001	2002	2003	2004	2005	2006	2007	2008	2009	2001-2009	COD(S)	Strength	Trendline
C64	66.0	57.5	67.3	63.4	68.9	64.7	64.2	61.6	61.4	64.2	y=64.22x-0.00 R²=0.003	barely	DW
C65	69.3	68.1	-	31.2	-	78.4	-	72.1	71.7	65.7	y=60.26x0.026 R²=0.004	barely	UW
C66	-	-	-	76.9	-	-	64.4	-	68.6	68.6	y=95.73x-0.17 R²=0.626	strong	DW
C67	71.0	69.5	67.5	68.2	67.9	69.3	69.9	70.7	74.9	69.8	y=68.72x0.011 R²=0.066	weak	UW
C68	-	75.2	-	-	-	-	-	-	-	75.2	-	N/A	-
C64-C68	69.5	65.9	67.4	65.3	68.5	67.1	66.5	66.2	68.8	67.1	y=67.83x-0.00 R²=0.046	weak	DW
	Median age (in years) at diagnosis - males												
C64	58.4	61.4	63.1	61.0	62.6	65.5	65.4	59.6	64.5	62.5	y=59.35x0.034 R²=0.37	moderate	UW
C65	-	63.5	-	-	61.0	46.4	-	-	61.8	59.5	y=64.68x-0.07 R²=0.097	weak	DW
C66	-	73.8	-	-	69.3	58.2	54.6	71.8	69.9	67.0	y=75.16x-0.07 R²=0.113	weak	DW
C67	66.9	66.7	64.7	66.2	68.5	67.1	64.6	68.7	65.7	66.4	y=66.41x0.001 R²=0.002	barely	UW
C68	-	-	-	-	-	-	74.9	-	-	74.9	-	N/A	-
C64-C68	64.7	65.2	64.3	64.1	66.1	66.3	64.8	65.5	65.4	65.2	y=64.57x0.006 R²=0.154	weak	UW
	Median age (in years) at diagnosis - both genders												
C64	60.7	60.2	65.2	61.8	65.0	65.2	64.8	60.3	63.4	63.1	y=61.07x0.020 R²=0.182	moderate	UW
C65	69.3	65.0	-	31.2	61.0	62.4	-	72.1	66.7	62.9	y=59.78x-0.00 R²=0.000	barely	DW
C66	-	73.8	-	76.9	69.3	58.2	61.2	71.8	69.2	67.6	y=78.64x-0.08 R²=0.182	moderate	DW
C67	67.9	67.4	65.3	66.8	68.4	67.5	65.7	69.2	67.7	67.2	y=67.07x0.002 R²=0.009	barely	UW
C68	-	75.2	-	-	-	-	74.9	-	-	75.1	-	N/A	-
C64-C68	66.1	65.4	65.3	64.5	66.8	66.5	65.3	65.7	66.3	65.8	y=65.53x0.002 R²=0.026	barely	UW

COD(S) - Coefficient of determination (strength)
"-" - to small number of cases
DW – downward trendline
UW – upward trendline
N/A – not available
R - relationship

	Table 1B. Median age (in years) at death - females												
ICD-10	2001	2002	2003	2004	2005	2006	2007	2008	2009	2001-2009	COD(S)	Strength	Trendline
C64	62.5	65.0	69.2	71.8	73.8	73.4	73.9	65.8	72.2	69.3	y=63.69x0.062 R²=0.506	strong	UW
C65	69.1	68.1	-	52.1	-	-	-	76.9	-	67.5	y=65.39x0.007 R²=0.001	barely	UW
C66	-	-	-	-	-	-	79.9	-	69.3	74.6	-	N/A	-
C67	71.1	75.7	69.8	78.2	74.2	74.9	77.5	81.7	79.0	75.8	y=70.62x0.048 R²=0.485	strong	UW
C68	-	-	-	-	-	-	-	96.1	-	96.1	-	N/A	-
C64-C68	67.6	70.6	69.5	70.8	74.2	74.2	76.3	72.8	75.6	72.6	y=67.34x0.050 R²=0.784	strong	UW
	Median age (in years) at death - males												
C64	58.0	63.5	67.5	65.6	66.4	67.1	73.2	67.2	62.9	65.7	y=60.38x0.058 R²=0.438	moderate	UW
C65	-	59.5	-	-	50.4	-	-	75.3	68.0	64.3	y=19.35x0.607 R²=0.821	very strong	UW
C66	-	73.8	-	70.5	-	79.6	-	72.3	55.9	70.4	y=81.80x-0.09 R²=0.193	moderate	DW
C67	70.2	69.2	70.9	73.6	72.8	72.9	75.4	75.1	75.4	73.0	y=68.79x0.039 R²=0.789	strong	UW
C68	-	-	-	-	-	-	75.0	-	-	75.0	-	N/A	-
C64-C68	66.0	67.2	69.8	71.4	70.0	71.3	74.8	72.6	70.2	70.5	y=66.64x0.047 R²=0.503	strong	UW
	Median age (in years) at death - both genders												
C64	59.4	64.1	68.2	68.4	67.4	69.3	73.4	66.4	65.5	67.0	y=61.59x0.057 R²=0.492	strong	UW
C65	69.1	63.8	-	52.1	50.4	-	-	76.5	68.0	66.1	y=62.45x0.002 R²=0.000	barely	UW
C66	-	73.8	-	70.5	-	79.6	79.9	72.3	62.6	71.6	y=76.85x-0.03 R²=0.038	weak	DW
C67	70.4	71.1	70.6	74.2	73.2	73.3	76.1	76.5	76.3	73.7	y=69.31x0.041 R²=0.782	strong	UW
C68	-	-	-	-	-	-	75.0	96.1	-	85.5	-	N/A	-
C64-C68	66.5	68.3	69.7	71.3	71.0	72.0	75.3	72.7	71.6	71.2	y=66.49x0.044 R²=0.799	strong	UW

COD(S) - Coefficient of determination (strength)
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ware 10.5% and 7.4%, respectively. What is curious is that in females, either of the parameters did not even reach 1% [6]. Taking account of the whole corpus of patients, the 5-year relative survival rate from kidney cancer in Europe was 57% and if seeing genders separately, this rate was 57% in females and 54% in males. Patients from France, Italy, Austria and Germany are above the European average in terms

Table 2: Historical data on the malignant neoplasms of urinary tract (C64-C68), ASIR and ASMR per 100,000 (using the EU-standard population), covering the period from 2001 to 2009.

	Incidence						Mortality					
C64-C68	Males		Females		Both genders		Males		Females		Both genders	
Year of data collection	N	ASR	N	ASR	N	ASR	N	ASR	N	ASR	N	ASR
2001	55	34.0	22	8.4	77	19.3	32	19.8	13	5.5	45	11.5
2002	79	48.8	32	14.1	111	28.2	28	17.3	14	5.1	42	10.2
2003	69	42.6	32	13.6	101	25.5	28	17.3	12	4.7	40	9.6
2004	63	38.9	31	14.0	94	24.1	38	23.4	14	5.6	52	12.4
2005	67	41.4	27	11.6	94	23.5	50	30.8	15	5.5	65	15.3
2006	85	52.5	32	13.5	117	29.4	42	25.9	14	5.4	56	13.3
2007	69	42.6	32	13.4	101	25.5	37	22.7	19	6.9	56	12.7
2008	58	35.9	26	11.5	84	21.6	39	24.0	25	10.2	64	15.3
2009	67	41.4	26	10.8	93	23.3	38	23.4	13	5.0	51	12.2
COD(S)	R^2=0.041		R^2=0.110		R^2=0.059		R^2=0.360		R^2=0.160		R^2=0.350	
Trendline	UW		UW		UW		UW		UW		UW	
2001-2009	68.0	42.0	28.9	12.3	96.9	24.5	36.9	22.7	15.4	6.0	52.3	12.5

ASIR - age-standardized incidence rate
ASMR - age-standardized mortality rate
COD(S) - Coefficient of determination (strength)
DW – downward trendline
UW – upward trendline
N – number of cases
R - relationship

of the survival from this cancer while patients from eastern European countries, England, Wales, Scotland and Denmark were not even close to the European average in this context. The European 5-year relative survival rate from bladder cancer was 71%. This rate was 70% in males and 67% in females. Bladder cancer is one of the very few cancers from which survival is better in males than in females, although the incidence rate of bladder cancer was higher among males than among females. This is a consequence of the fact females pay less attention to hematuria and other discharges than males do. Survival from both cancers (kidney and bladder) decreases with the age [7]. The median age at diagnosis of bladder cancer within the USA population was 72.9 years (74.1 years for females and 72.5 years for males) [8]. In Denmark, patients were diagnosed with kidney cancer at the average age of 68 years in the 1998–2009 period [9]. In Europe, the median age at diagnosis of kidney cancer was generally around 60 years and the male to female ratio was 3:1 [10]. In Croatia, the kidney cancer incidence rates in males and females were 4% and 3%, respectively, while the bladder cancer incidence rates were 6% and 2%, respectively [11]. In the 1994-1998 period, the 5-year relative survival rate from urinary bladder and kidney cancer in Croatia was 75% and 56%, respectively, in males and 76% and 65%, respectively, in females.

This paper focuses on the demographic (gender, age, median age) and statistical features of C64-C68 cancer patients (incidence and mortality rate, survival rate, length of stay in hospital) and is aimed at obtaining information on the status of this group of cancer in the OBC in relation to the corresponding status in Croatia and Europe in period 2001-2009.

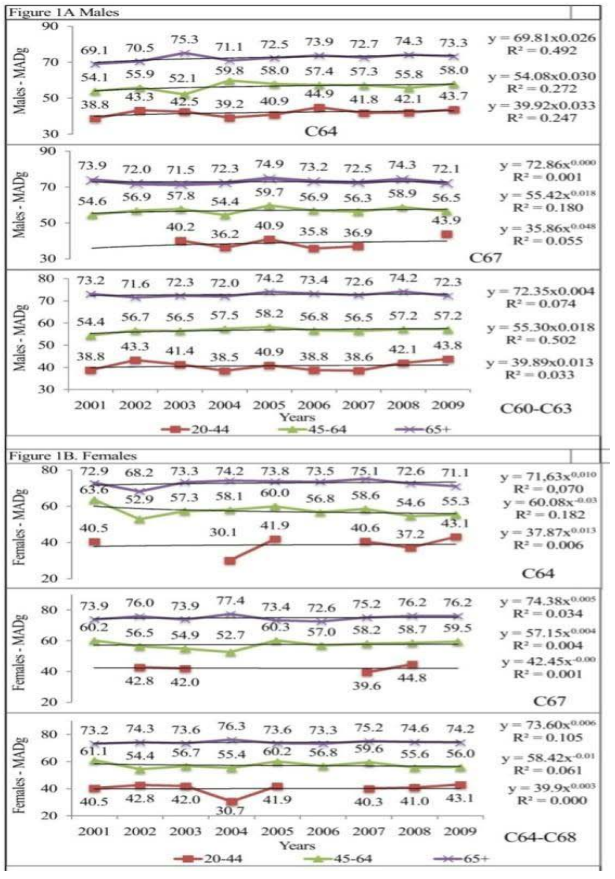

Figure 1: The median by age groups of cancer patients at diagnosis (MADg) by primary cancer site C64-C68 (selected sites) in the OBC, period 2001-2009. The rising trendline suggests that a strong relationship exists in males for C64-C68 (malignant neoplasms of urinary tract) of age 45-64 years and for C64 (malignant neoplasm of kidney, except renal pelvis) between the MADg and years, R^2=0.502 and R^2=0.492, respectively (Figure 1A) (R^2>0.48<0.81). In females moderate downwards trendline exist for cancer site C64 of age 45-64 years (R^2=0.182, Figure 1B).

Materials and Methods

Data source

Although the representativeness of their data might be challenged, mandatory county hospitals data reports, county bureaus of statistics and the County Register of Deaths still represent the only available

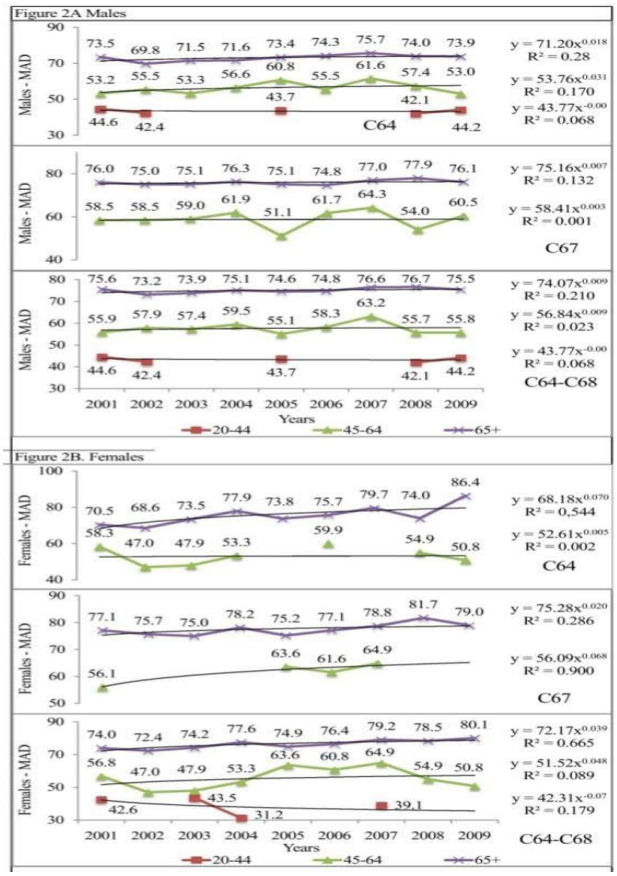

Figure 2. The median by age groups of cancer patients at death (MAD) by primary cancer site C64-C68 (selected sites) in the OBC, period 2001-2009. The rising trendlines suggest that strong relationships exists for C64 of age 65+ years and for whole cancer group C64-C68 of age 65+ years (R^2=0.544 and R^2=0.655, respectively, Figure 2B).

source of information on the profile of cancer in the OBC. All data from the 2001-2009 periods originate from these institutions. The cohort studied in this article included all people with cancer who were registered as the patients in one of two hospitals in the OBC in the time period from 2001 to 2009 (follow up period from 1996 to 2010). Based on these sources, a database of people who were hospitalized in the area of the OBC for any reason whatsoever (including cancer) has been generated [12,13]. The data on each of the hospitalized patients have been supplemented with data obtained from the Register of Deaths.

Data on every person with cancer are accompanied with their chronological order of illness and hospitalization. The database involved all hospitalizations and all data on ONKO or BSL forms (mandatory statistical patterns for all hospitalized patients in Croatia). The ONKO form is a mandatory statistical report on every hospitalized cancer patients in Croatia. The BSL form is a mandatory statistical report on every hospitalized person, regardless of the causes of hospitalization. All cancer patients coming from this area are hospitalized in state-owned (public) hospitals since there are still the only hospitals here.

Statistical analysis

The cancers were classified according to the International Statistical Classification of Diseases and Related Health Problems (ICD-10), codes C64-C68. The cancer incidence and mortality estimates in the period from 2001 to 2009 were prepared for all cancers based on gender and for age groups 0-19, 20-44, 45-64, 65+ by the year at cancer diagnosis. Based on the 2001 census, the analysis covered a total population of 330.506 people in the OBC. The Croatian National Health Insurance is a universal health insurance that covers all or almost all costs (depending on a personal choice of the type of insurance) of treatment of Croatia citizens and provides them with

Table 3: The age-standardized incidence rate (ASIR) in the OBC for malignant neoplasms of urinary tract (C64-C68) per 100,000 using EU standard population, period 2001-2009.

	Females												
ICD-10	2001	2002	2003	2004	2005	2006	2007	2008	2009	2001-2009	Coefficient of determination (strength)	Trendline	Strength
C64	2.6	5.2	7.0	6.0	6.2	7.5	7.6	6.2	5.3	6.0	y=3.542x0.337, R^2=0.548	UW	strong
C65	0.7	0.3	-	0.6	-	0.3	-	0.3	0.3	0.3	y=0.604x-0.25, R^2=0.438	DW	moderate
C66	-	-	-	0.3	-	-	0.7	-	0.3	0.2	y=0.301x0.206, R^2=0.046	UW	weak
C67	5.1	8.2	6.6	7.0	5.4	5.6	5.0	4.9	4.8	5.8	y=6.802x-0.11, R^2=0.205	DW	moderate
C68	-	0.3	-	-	-	-	-	-	-	0.04	-	-	N/A
C64-C68	8.4	14.1	13.6	14.0	11.6	13.5	13.4	11.5	10.8	12.3	y=10.88x0.077, R^2=0.110	UW	weak
	Males												
C64	8.7	13.6	9.9	15.4	15.5	15.5	10.5	13.0	11.7	12.6	y=1.859x-0.47, R^2=0.586	DW	strong
C65	-	1.2	-	-	1.2	0.6	-	-	0.6	0.4	y=0.849x-0.07, R^2=0.009	DW	barely
C66	-	0.6	-	-	1.9	0.6	0.6	0.6	0.6	0.5	y=28.58x-0.01, R^2=0.004	DW	barely
C67	25.3	33.4	32.8	23.4	22.8	35.8	30.9	22.2	28.4	28.3	-	-	N/A
C68	-	-	-	-	-	-	0.6	-	-	0.07	-	-	N/A
C64-C68	34.0	48.8	42.6	38.9	41.4	52.5	42.6	35.9	41.4	42.0	y=39.44x0.038, R^2=0.041	UW	weak
	Both genders												
C64	5.3	8.6	8.2	10.1	10.1	10.8	8.6	9.3	7.8	8.8	y=0.180x0.417, R^2=0.149	UW	weak
C65	0.4	0.7	-	0.3	0.5	0.5	-	0.2	0.5	0.4	y=15.69x-0.04, R^2=0.032	DW	weak
C66	-	0.2	-	0.2	0.7	0.3	0.7	0.2	0.4	0.3	-	-	N/A
C67	13.5	18.3	17.4	13.5	12.2	17.8	15.9	11.9	14.5	15.0	-	-	N/A
C68	-	0.2	-	-	-	-	0.2	-	-	0.05	-	-	N/A
C64-C68	19.3	28.2	25.5	24.1	23.5	29.4	25.5	21.6	23.3	24.5	y=22.84x0.043, R^2=0.059	UW	weak

"-" - to small number of cases
DW – downward
UW – upward
R^2 - relationship
N/A – not available

Table 4: The age-standardized mortality rate (ASMR) in the OBC for malignant neoplasms of urinary tract (C64-C68) per 100,000 using EU standard population, period 2001-2009.

	Females												
ICD-10	2001	2002	2003	2004	2005	2006	2007	2008	2009	2001-2009	Coefficient of determination (strength)	Trendline	Strength
C64	2.2	2.3	2.3	3.3	1.0	2.7	2.7	6.3	2.2	2.8	y=2.032x0.154, R²=0.057	UW	weak
C65	0.3	0.3	-	1.0	-	-	-	1.0	-	0.3	y=0.310x0.620, R²=0.831	UW	very strong
C66	-	-	-	-	-	-	0.3	-	0.3	0.1	-	-	N/A
C67	2.9	2.4	2.4	1.4	4.4	2.7	3.8	2.4	2.4	2.8	y=2.506x0.039, R²=0.007	UW	barely
C68	-	-	-	-	-	-	-	0.3	-	0.04	-	-	N/A
C64-C68	5.5	5.1	4.7	5.6	5.5	5.4	6.9	10.2	5.0	6.0	y=4.841x0.130, R²=0.160	UW	weak
	Males												
C64	6.8	5.5	5.5	6.2	11.1	8.0	6.8	7.4	8.1	7.3	y=5.897x0.131, R²=0.190	UW	moderate
C65	-	0.6	-	-	0.6	-	-	0.6	1.2	0.3	y=0.479x0.263, R²=0.271	UW	moderate
C66	-	0.6	-	0.6	-	0.6	-	0.6	0.6	0.3	y=0.608x0.007, R²=0.270	UW	moderate
C67	13.0	10.5	11.7	16.6	19.1	17.2	15.4	15.4	13.5	14.7	y=11.82x0.141, R²=0.281	UW	moderate
C68	-	-	-	-	-	-	0.6	-	-	0.1	-	-	N/A
C64-C68	19.8	17.3	17.3	23.4	30.8	25.9	22.7	24.0	23.4	22.7	y=17.91x0.156, R²=0.360	UW	moderate
	Both genders												
C64	4.4	3.7	3.6	4.5	5.1	4.9	4.2	6.6	4.7	4.6	y=3.745x0.135, R²=0.281	UW	moderate
C65	0.2	0.5	-	0.5	0.3	-	-	0.9	0.5	0.3	y=0.271x0.386, R²=0.449	UW	moderate
C66	-	0.2	-	0.2	-	0.2	0.2	0.2	0.5	0.2	y=0.160x0.281, R²=0.202	UW	moderate
C67	6.9	5.8	6.0	7.1	9.9	8.1	8.1	7.4	6.5	7.3	y=6.343x0.092, R²=0.163	UW	moderate
C68	-	-	-	-	-	-	0.2	0.2	-	0.05	-	-	N/A
C64-C68	11.5	10.2	9.6	12.4	15.3	13.3	12.7	15.3	12.2	12.5	y=10.27x0.130, R²=0.350	UW	moderate

"-" - to small number of cases
DW – downward trendline
UW – upward trendline
R – relationship
N/A – not available

Table 5: The age-standardized incidence rate (ASIR) and the age-standardized mortality rate (ASMR) in relation with age group of the OBC cancer patients of *malignant neoplasms of* urinary tract (C64-C68), period 2001-2009.

	Overall incidence rate/100,000 EU population				Overall mortality rate/100,000 EU population			
Age group	2001-2009	COD(S)	Trendline	Strength	2001-2009	COD(S)	Trendline	Strength
	Females							
0-19	0.3	N/A	-	-	0.0	N/A	-	N/A
20-44	2.3	y=2.035x0.110, R²=0.034	-	-	0.8	N/A	-	N/A
45-64	18.0	y=10.03x0.346, R²=0.231	UW	Moderate	4.7	y=3.398x0.184, R²=0.047	UW	weak
65+	62.9	y=63.20x-0.00, R²=0.002	DW	Slightly	41.3	y=29.56x0.214, R²=0.371	UW	moderate
	Males							
0-19	0.3	N/A	-	-	0.0	N/A	-	N/A
20-44	3.6	y=2.053x0.313, R²=0.184	UW	Moderate	0.6	N/A	-	N/A
45-64	62.3	y=63.32x-0.01, R²=0.007	DW	Slightly	19.5	y=31.17x-0.4, R²=0.296	DW	moderate
65+	228.1	y=206.4x0.060, R²=0.060	UW	Slightly	160.6	y=94.97x0.341, R²=0.658	UW	strong
	Both genders							
0-19	0.0	N/A	-	-	0.0	N/A	-	N/A
20-44	3.0	y=2.071x0.182, R²=0.077	UW	Slightly	0.7	y=0.861, R²=-8E-1	DW	barely
45-64	39.4	y=37.32x0.030, R²=0.019	UW	Slightly	11.8	y=16.77x-0.32, R²=0.155	DW	weak
65+	122.9	y=115.5x0.036, R²=0.031	UW	Slightly	84.6	y=53.58x0.300, R²=0.687	UW	strong

COD(S) - Coefficient of determination (strength)
DW – downward trendline
UW – upward trendline
"-" - to small number of cases
N/A – not available

the same chances of recovery. Therefore, this article can be said to comprise the entire population of cancer patients treated in the OBC.

Descriptive statistics were used for both age and gender. The survival rates denote the outcome up to 5 years after diagnosis. This applies to cancer patients who were diagnosed with cancer during the 2001-2005 period. All survival estimates were age-adjusted on the basis

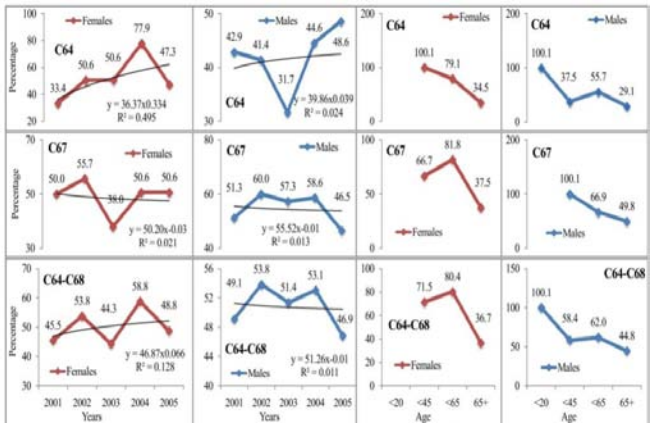

Figure 3: The age-standardized 5-year relative survival rate for cancer group C64-C68 (both genders) combined by age in the OBC in the 2001-2005 period. For cancer site C64 in females, the rising trendline suggest that a strong relationship exists between 5-years survival rate and years, R^2=0.495 (R^2>0.48<0.81).

of four age groups. The analyses were conducted using age-specific rates, the age-standardization-direct method and 95% confidence intervals (95% CI). The standardized incidence and mortality ratios as well as the 95% confidence intervals were computed for C64-C68 pursuant to the year at cancer diagnosis. Also, both ratios were stratified according to the year at cancer diagnosis, age and gender. The median age is the observation ranked in the middle; that is 50% of patients are diagnosed at an older age and 50% are diagnosed at a younger age compared to the median. The EU standard population was used in the analysis [14]. The length of stay was determined according to the date of admission and to the date of discharge with regard to the index admission. The SAS statistical package (version 9.1, SAS Institute INC, Cary, NC, USA) was used for the statistical analysis [15] and Microsoft® Office Excel® 2007.

Results

According to the census in 2001, the analysis covered a total population of 330.506 people in the OBC. From 2001 to 2009, a total of 872 people (260 females and 612 males) were registered with malignant neoplasms of the urinary tract (C64-C68) and treated at the two hospitals in the OBC. Malignant neoplasms of the urinary tract can be said to be cancers typical for males (70.2%) due to their appearance two times more frequent among males than among females (29.8%, Table 2). Out of all cancers in the OBC, C64-C68 cancers accounted for 6.2% of all registered cancer patients. This percentage was 3.7% in females and 8.6% in males.

In the 2001-2009 period, the overall median age at diagnosis (MADg) of C64-C68 cancers was 65.7 years, in males 65.2 years and in females 67.1 years (Table 1A). Females were later diagnosed with this group of cancer then males by 1.9 years. The median age of males was characterized by a time shift at diagnosis to a older age for C64 (malignant neoplasm of kidney, except renal pelvis, a moderate upward trend line, R^2=0.37) as a result of the same changes in all age group for C64 (Figure 1A). The median age of females had a weak opposite (downward) trend (Table 1A) mostly due to the moderate downward trend line for C64 in the age group 45-64 years (R^2=0.182, Figure 1B).

The overall median age at death (MAD) was 71.2 years (Table 1B). It exceeded the median age at diagnosis of C64-C68 cancers by 5.4 years. In both genders seeing as a whole as well as in each gender separately suggest that strong upward trend lines exists between MAD and years (Table 1B, Figure 2). In males, the MAD by cancers

Table 6: Five years relative survival rates (in %) for malignant neoplasms of urinary tract (C64-C68) cancers in the OBC, both genders, period 2001-2005.

	Age group									
ICD-10	0-19		20-44		45-64		65+		All ages	
	Females - % of survival (number of survival cases)									
C64	-	-	100.1	(3)	79.1	(18)	34.5	(11)	54.0	(32)
C65	-	-	0.0	-	-	-	35.5	(1)	25.3	(1)
C66	-	-	-	-	-	-	0.0	-	0.0	-
C67	-	-	66.7	(2)	81.8	(17)	37.5	(19)	49.3	(38)
C68	-	-	-	-	-	-	106.6	(1)	101.3	(1)
C64-C68	-	-	71.5	(5)	80.4	(35)	36.7	(32)	50.6	(72)
	Males - % of survival (number of survival cases)									
C64	100.1	(1)	37.5	(3)	55.7	(27)	29.1	(12)	42.7	(43)
C65	-	-	-	-	0.0	-	53.3	(1)	25.3	(1)
C66	-	-	-	-	101.0	(1)	35.5	(1)	50.6	(2)
C67	-	-	100.1	(4)	66.9	(53)	49.8	(65)	55.4	(122)
C68	-	-	-	-	-	-	-	-	-	-
C64-C68	100.1	(1)	58.4	(7)	62.0	(81)	44.8	(79)	51.1	(168)
	Both genders - % of survival (number of survival cases)									
C64	100.1	(1)	54.6	(6)	63.1	(45)	31.4	(23)	46.9	(75)
C65	-	-	0.0	-	0.0	-	42.6	(2)	25.3	(2)
C66	-	-	-	-	101.0	(1)	26.6	(1)	40.5	(2)
C67	-	-	85.8	(6)	70.0	(70)	46.4	(84)	53.8	(160)
C68	-	-	-	-	-	-	106.6	(1)	101.3	(1)
C64-C68	100.1	(1)	63.2	(12)	66.6	(116)	42.1	(111)	51.0	(240)

"-" - No cases
0.0 - No survival cases

ranged from 64.3 years for patients with malignant neoplasm of renal pelvis (C65) to 73.0 years for malignant neoplasm of bladder (C67). In females, the MAD by cancers ranged from 67.5 to 75.8 years for the same cancer sites, respectively.

The mean incidence of new C64-C68 malignant neoplasms over the 9-year study period was 96.9 (28.9 females and 68 males) cases/year, equating to an OBC population age-adjusted incidence rate of 24.5/100,000 (SD±2.52, CI 19.55-29.43) with a weak upward chronological tendency for both genders (R^2=0.059). The overall age-standardized incidence rate in males (ASIR) (42.0/100 000) was three times higher than in females (12.3/100,000) (Table 2). The ASIR of the malignant neoplasm of kidney, except renal pelvis (C64, overall ASIR was 6.0/100,000) increased strongly in females and males (R^2=0.548 and R^2=0.586, respectively), particularly in the years 2004-2006 (Table 3). These data have directly impact to the whole cancer group. In males, the ASIR moderate increased in age group 20-44 (Table 5, R^2=0.184), while in females in age group 45-64 and 65+ (R^2=0.231).

Every year, an average of 52.3 patients died of C64-C68 cancers in the OBC, which implies the overall age-standardized mortality rate (ASMR) of 12.5/100,000. Both genders seeing as a whole experienced a moderate upward trend line in the mortality rate (R^2=0.350, SD±1.74, CI 9.09-15.91) (Tables 2,4,5). A rise in the mortality rates from the malignant neoplasm of kidney (C64) and bladder (C67) in both genders resulted from an increase in the mortality rates from these cancers in males. The mortality rate from C64-C68 cancers was about eight patients in both genders separately. In males, the ASMR strongly increased in age group 65+ years (R^2=0.658, Table 5), not only to the whole group, but also to the each cancer sites of this cancer group.

Table 7: The age distribution at diagnosis for malignant neoplasms of urinary tract (C64-C68) in the OBC, period 2001-2009.

Table 7.1

ICD-10	Age	Both genders			Males			Females		
		2001-2009 (%)	Trend line	Strength	2001-2009 (%)	Trend line	Strength	2001-2009 (%)	Trend line	Strength
C64	0-19	0,7	N/A	-	0,5	N/A	-	0,8	N/A	-
	20-44	6,3	DW	weak	6,5	DW	moderate	5,9	DW	moderate
	45-64	45,0	DW	barely	48,9	DW	barely	39,0	UW	weak
	65+	48,0	UW	barely	44,0	UW	barely	54,2	DW	barely
C65	20-44	7,7	N/A	-	0,0	N/A	-	14,3	N/A	-
	45-64	30,8	UW	very strong	66,7	N/A	-	0,0	N/A	-
	65+	61,5	DW	moderate	33,3	N/A	-	85,7	N/A	-
C66	45-64	41,7	UW	strong	37,5	N/A	-	50,0	N/A	-
	65+	58,3	DW	barely	62,5	N/A	-	50,0	N/A	-
C67	20-44	2,6	UW	barely	2,2	UW	weak	3,8	UW	weak
	45-64	32,4	DW	weak	35,6	DW	barely	22,3	DW	weak
	65+	65,0	DW	barely	62,2	DW	barely	73,8	UW	barely
C68	65+	0,2	N/A	-	100,0	N/A	-	100,0	N/A	-
C64-C68	0-19	0,2	N/A	-	0,2	N/A	-	0,4	N/A	-
	20-44	3,9	UW	weak	3,4	UW	weak	5,0	UW	weak
	45-64	36,8	UW	barely	39,9	DW	barely	29,6	UW	weak
	65+	59,1	DW	weak	56,5	DW	barely	65,0	DW	weak

Table 7.2

C64	All ages	34,6	UW	moderate	30,1	UW	weak	45,4	UW	strong
C65		1,5	DW	moderate	1,0	DW	moderate	2,7	DW	moderate
C66		1,4	UW	moderate	1,3	UW	barely	1,5	UW	moderate
C67		62,3	DW	moderate	67,5	DW	weak	50,0	DW	strong
C68		0,2	N/A	-	0,2	N/A	-	0,4	N/A	-

Table 7.3

The age proportion of each cancer site

	0-44			45-64			65+			All ages		
	BG	F	M	BG	F	M	BG	F	M	BG	F	M
C64	2,4	3,1	2,1	15,6	17,7	14,7	16,6	24,6	13,2	34,6	45,4	30,1
C65	0,1	0,4	0,0	0,5	0,0	0,7	0,9	2,3	0,3	1,5	2,7	1,0
C66	0,0	0,0	0,0	0,6	0,8	0,5	0,8	0,8	0,8	1,4	1,5	1,3
C67	1,6	1,9	1,5	20,2	11,2	24,0	40,5	36,9	42,0	62,3	50,0	67,5
C68	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,4	0,2	0,2	0,4	0,2
C64-C68	4,1	5,4	3,6	36,8	29,6	39,9	59,1	65,0	56,5	100	100	100

N/A - not available Coefficient of determination (strength) - COD(S)
DW – downward trendline
UW – upward trendline
"-" – to small number of cases

Table 8: The age distribution at death for malignant neoplasms of urinary tract (C64-C68) in the OBC, period 2001-2009.

Table 8.1

ICD-10	Age	Both genders 2001-2009 (%)	Trend line	Strength	Males 2001-2009 (%)	Trend line	Strength	Females 2001-2009 (%)	Trend line	Strength
C64	20-44	6,0	DW	weak	7,5	UW	weak	3,3	N/A	-
	45-64	27,5	DW	weak	30,2	DW	weak	23,0	UW	moderate
	65+	66,5	UW	moderate	62,3	UW	moderate	73,8	UW	barely
C65	20-44	8,3	N/A	-	0,0	N/A	-	14,3	N/A	-
	45-64	25,0	UW	barely	60,0	DW	strong	0,0	N/A	-
	65+	66,7	DW	weak	40,0	N/A	-	85,7	DW	weak
C66	45-64	14,3	N/A	-	20,0	N/A	-	0,0	N/A	-
	65+	85,7	DW	moderate	80,0	N/A	-	100,0	N/A	-
C67	20-44	0,4	N/A	-	0,0	N/A	-	1,5	N/A	-
	45-64	14,8	DW	strong	11,1	DW	strong	7,4	DW	strong
	65+	84,8	UW	very strong	53,6	UW	strong	91,2	UW	moderate
C68	65+	100,0	N/A	-	100,0	N/A	-	100,0	N/A	-
C64-C68	20-44	2,5	DW	weak	2,4	UW	weak	2,9	DW	moderate
	45-64	19,5	DW	strong	22,0	DW	strong	13,7	DW	barely
	65+	77,9	UW	strong	75,6	UW	very strong	83,5	UW	weak

Table 8.2

The proportion trendline of each cancer site in relation to the gender

C64	All ages	35,5	DW	barely	31,9	DW	weak	43,9	UW	barely
C65		2,5	UW	weak	1,5	UW	barely	5,0	UW	strong
C66		1,5	UW	barely	1,5	DW	strong	1,4	N/A	-
C67		60,1	DW	weak	64,8	DW	barely	48,9	DW	barely
C68		0,4	N/A	-	0,3	N/A	-	0,7	N/A	-

Table 8.3

The proportion of each cancer site

	0-44			45-64			65+			All ages		
	BG	F	M	BG	F	M	BG	F	M	BG	F	M
C64	2,1	1,4	2,4	9,8	10,1	9,6	23,6	32,4	19,9	35,5	43,9	31,9
C65	0,2	0,7	0,0	0,6	0,0	0,9	1,7	4,3	0,6	2,5	5,0	1,5
C66	0,0	0,0	0,0	0,2	0,0	0,3	1,3	1,4	1,2	1,5	1,4	1,5
C67	0,2	0,7	0,0	8,9	3,6	11,1	51,0	44,6	53,6	60,1	48,9	64,8
C68	0,0	0,0	0,0	0,0	0,0	0,0	0,4	0,7	0,3	0,4	0,7	0,3
C64-C68	2,5	2,9	2,4	19,5	13,7	22,0	77,9	83,5	75,6	100	100	100

N/A - not available
DW – Coefficient of determination downward
UW – (strength) - COD(S) trendline upward trendline
"-" – to small number of cases

The age-adjusted 5-year relative survival rate of all OBC patients from C64-C68 cancers totalled 51.0% in 2001–2005 period (Table 6, Figure 3). The survival rate in males resembled the overall survival rate and it was slightly higher than in females (51.1% in males and 50.6% in females). Males aged 20-44 had a lower survival rate (58.4%) then males aged 45-64 (62.0%). This difference emerged due to the survival rate from renal pelvis cancer (C64) which amounted to only 37.5% in males aged 20-44. Female patients aged 65+ (36.7%) had two times slimmer chances to survive these cancers than younger females did (71.5% and 80.4%, respectively). Such differences characterize all sites of this cancer group. The survival rate from kidney cancer (C64) was fairly higher in females (54.0%) than in males (42.7%). The situation was different with bladder cancer (C67) since males seemed to be more survival to it (55.4%) than females (49.3%).

The age distribution at diagnosis and at death from C64-C68 cancers is shown in Tables 7,8 and Figure 4. Out of the entire corpus of patients, 59.1% and 77.9% of them were aged 65+ at diagnosis and at death, respectively. Female patients aged 65+ made up 65.0% and 83.5% of all female C64-C68 cancer patients at diagnosis and at death, respectively. This percentage in males was 56.5% and 75.6%, respectively. Patients under 45 years of age constituted only 3.9% and 2.5% of the entire corpus of patients diagnosed with C64-C68 cancers, respectively.

In the 2001-2009 period, a total of 872 people were diagnosed with C64-C68 cancers and they were admitted to the OBC hospitals 2,350 times where they spent a total of 26,649 days. An average patient was admitted to hospital 2.7 times during the course of their illness with the average length of stay in hospital (LOSH) of 11.3 days (Table 9,11). The number of hospitalizations was largest in the 65+ age category (1,443/2,350, 61.4%). Female patients accounted for 25.2% of all hospitalizations and they spent an average of 12.4 days in hospital, which is 1.4 days longer than the average stay in hospital in males (11.0 days). Females aged 65+ (12.4 days) stayed longer in hospital by 1.2 days on average than males of the same age did (11.2 days).

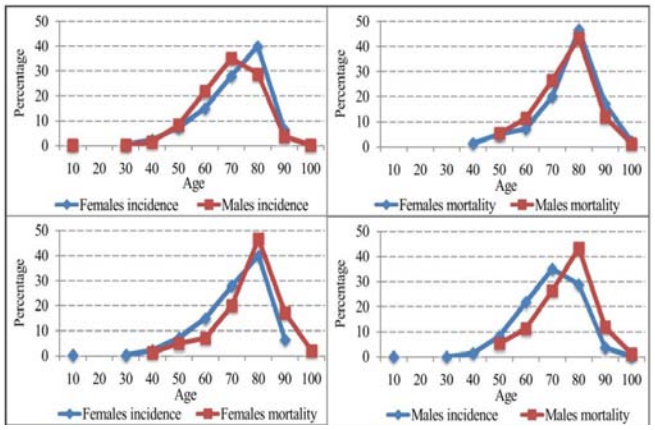

Figure 4: The age distribution for malignant neoplasms of urinary tract (C64-C68) in the period 2001-2009, both genders.

The number of admission in hospital (NOAH) in years 2001 to 2009 progressively grew, both from the viewpoint of the entire population of patients and seeing genders separately (R^2=0.777) (Tables 10,11, Figure 5). Taking account of both genders together and each of them separately, the first three years of the first period (2001-2003) reflected a sharp rise in the LOSH while the second period (2004-2009) was marked by a decline in this parameter (moderate downward trend line, R^2=0.228).

In the period from 2001 to 2009 years slightly increases the incidence rate, and moderate increases mortality rate. In female's slowly rising relative 5-year survival and in males it gently decrease. The number of admission in hospital and the average admission in hospital per patient strongly increased, while in the same period moderately decreased the average length of stay in hospital.

Discussion

Every year during the 2001-2009 periods, an average of around 97 people were diagnosed with C64-C68 cancers in the OBC. In the same period, an annual average of registered deaths from this cancer group numbered around 52. These cancers accounted for around 1 in 16 cancer registrations and 1 in 18 cancer deaths in the OBC [1]. There was a weak increase in the age-standardised incidence rate of C64-C68. The estimated bladder and kidney cancer incidence varied widely throughout Europe in 2008. The average European kidney cancer (C64) incidence rate of 12.1/100,000 and the average incidence rate of this type of cancer at the Croatian level of 13.8/100,000 were higher by 1/3 than this incidence rate in the OBC (8.8/100,000). Unfortunately, the incidence rate of kidney cancer strongly increases in the age group 45-64 years and moderate increases in the age group 65+ years (Table 3). For now there are not available explanations for such changes. The kidney cancer mortality rate in the OBC (4.6/100,000) was lower than the mortality rate from this cancer site in Europe and that at the Croatian level (4.7 and 5.8/100,000, respectively), too [16].

The urinary bladder incidence rate in the OBC (15.0/100,000) was a little higher than the respective incidence rate in Europe but it stayed below the Croatian average (14.4 and 16.2/100,000, respectively) while the mortality rate (7.3/100,000) from this cancer site exceeded the appertaining mortality rates in both Europe and Croatia [16-18].

Despite the fact that the 5-year relative survival rate from urinary bladder cancer (C67) in the OBC was higher in males (55.4%) than in females (49.3%) (The ratio between genders in the OBC resembled the one in Europe), the survival rate in males was still lower than that at

Table 9: The number of cancer hospitalizations and the average length of stay in hospital for malignant neoplasms of urinary tract (C64-C68) in the period 2001-2009.

	Ages									
	0-19	20-44	45-64	65+	All ages	0-19	20-44	45-64	65+	All ages
	Females - NOAH					Females - average LOSH				
C64	5	7	81	83	176	6.6	16.7	17.5	15.7	16.3
C65	-	1	1	8	10	-	12.0	51.0	21.0	23.1
C66	-	-	3	7	10	-	-	8.0	24.3	19.4
C67	-	22	112	260	394	-	9.9	9.0	10.8	10.2
C68	-	1	-	1	2	-	8.0	-	14.0	11.0
C64-C68						6.6	11.5	12.7	12.4	12.4
	Males - NOAH					Males - average LOSH				
C64	1	20	130	112	263	9.0	17.1	17.1	16.6	16.9
C65	-	-	7	4	11	-	-	17.7	32.0	22.9
C66	-	-	5	11	16	-	-	13.2	22.3	19.4
C67	-	35	476	955	1466	-	4.8	8.9	10.3	9.7
C68	-	-	-	2	2	-	-	-	15.0	15.0
C64-C68						9.0	9.3	10.8	11.2	11.0
	Both genders - NOAH					Both genders - average LOSH				
C64	6	27	211	195	439	7.0	17.0	17.2	16.2	16.6
C65	-	1	8	12	21	-	12.0	21.9	24.7	23.0
C66	-	-	8	18	26	-	-	11.3	23.1	19.4
C67	-	57	588	1215	1860	-	6.8	8.9	10.4	9.8
C68	-	1	-	3	4	-	8.0	-	14.7	13.0
C64-C68						7.0	10.1	11.2	11.5	11.3

"-" - No cases
NOAH – number of hospital admissions
LOSH – length of stay in hospital

Table 10: The years of diagnosis and the average length of stay in hospital and number of hospital admissions for malignant neoplasms of urinary tract (C64-C68) in the OBC, period 2001-2009.

Year	Females - NOAH					Females - average LOSH				
	0-19	20-44	45-64	65+	All ages	0-19	20-44	45-64	65+	All ages
2001	-	1	17	25	43	-	7.0	8.8	10.4	9.7
2002	2	2	19	35	58	6.0	9.5	16.7	16.2	15.8
2003	1	12	22	28	63	9.0	5.6	11.5	21.6	14.8
2004	-	6	22	41	69	-	6.2	17.1	14.1	14.4
2005	-	1	24	54	79	-	13.0	11.2	12.1	11.8
2006	2	-	22	51	75	6.0	-	12.5	12.6	12.4
2007	-	3	36	41	80	-	31.3	10.1	8.5	10.1
2008	-	4	21	42	67	-	18.3	15.6	8.7	11.4
2009	-	2	14	42	58	-	22.5	11.4	10.5	11.1
2001-2009						6.6	11.5	12.7	12.4	12.4
COD(S) – R^2=	0.022	0.050	0.061	0.579	0.520	0.022	0.0539	0.033	0.161	0.022
Trendline	UW	UW	UW	UW	UW	DW	UW	UW	DW	DW
Year	Males - NOAH					Males - average LOSH				
	0-19	20-44	45-64	65+	All ages	0-19	20-44	45-64	65+	All ages
2001	-	4	64	71	139	-	7.0	10.1	11.6	10.8
2002	-	7	64	99	170	-	17.6	12.9	15.0	14.3
2003	-	1	51	100	152	-	4.0	15.4	13.1	13.8
2004	-	13	57	109	179	-	9.8	9.6	10.3	10.0
2005	1	5	53	138	197	9.0	8.2	16.1	10.3	11.8
2006	-	3	77	177	257	-	12.7	10.4	11.6	11.3
2007	-	8	75	149	232	-	8.6	7.6	10.3	9.4
2008	-	3	107	94	204	-	10.0	8.2	9.5	8.8
2009	-	11	70	147	228	-	4.5	10.9	10.0	10.0
2001-2009						9.0	9.3	10.8	11.2	11.0
COD(S) – R^2=	N/A	0.038	0.211	0.55	0.740	N/A	0.008	0.088	0.426	0.291
Trendline	-	UW	UW	UW	UW	-	DW	DW	DW	DW
Year	Both genders - NOAH					Both genders - LOSH				
	0-19	20-44	45-64	65+	All ages	0-19	20-44	45-64	65+	All ages
2001	-	5	81	96	182	-	7.0	9.8	11.3	10.5
2002	2	9	83	134	228	6.0	15.8	13.7	15.3	14.7
2003	1	13	73	128	215	9.0	5.5	14.2	15.0	14.1
2004	-	19	79	150	248	-	8.6	11.7	11.3	11.2
2005	1	6	77	192	276	9.0	9.0	14.5	10.8	11.8
2006	2	3	99	228	332	6.0	12.7	10.9	11.8	11.5
2007	-	11	111	190	312	-	14.8	8.4	9.9	9.6
2008	-	7	128	136	271	-	14.7	9.4	9.2	9.4
2009	-	13	84	189	286	-	7.3	11.0	10.1	10.2
2001-2009						7.0	10.1	11.2	11.5	11.3
COD(S) – R^2=	0.016	0.017	0.281	0.606	0.777	0.016	0.088	0.066	0.348	0.228
Trendline	DW	UW	UW	UW	UW	UW	UW	DW	DW	DW

"-" - No cases
NOAH – number of hospital admissions
LOSH – Length of stay in hospital
COD(S) – coefficient of determination
R – relationship
N/A – not available
UW – upward trendline
DW – downward trendline

the European (73% in males and 69% in females) [19], and Croatian level (75% in males and 76% in females) [16,20]. The survival rate from kidney cancer (42.7%) in males was lower in the OBC than in Croatia as a whole by 13.3 percentage points (Croatian average – males 56%) and in females, it was 11 percentage points lower than that in Croatia (65%). Kidney cancer in the OBC was most fatal in the 65+ group (31.4%).

Although they were mandatory, the data on the length of stay in hospital (LOSH) and number of hospital admissions (NOAH) per C64-C68 cancer patient cannot be related and compared with performed medical treatments during the hospital care. The data suggest that the NOAH strongly increased from 2001 to 2009. A rapid rise in the length of stay in hospital was registered in 2005 and 2007 when this figure jumped with respect to the previous and following

Table 11: The years of diagnosis and trendlines of the average admission in hospital, the average length of stay in hospital and the number of admission in hospital per patient for selected malignant neoplasms of urinary tract (C64-C68) in the OBC, period 2001-2009.

Females	C64				C67				C64-C68			
Year	NOAH	N	AAH	LOSH	NOAH	N	AAH	LOSH	NOAH	N	AAH	LOSH
2001	6	6	1.0	10.0	34	14	2.4	8.7	43	22	2.0	9.7
2002	18	10	1.8	24.6	38	20	1.9	11.1	58	32	1.8	15.8
2003	17	16	1.1	16.4	46	16	2.9	14.2	63	32	2.0	14.8
2004	20	13	1.5	17.4	45	16	2.8	12.2	69	31	2.2	14.4
2005	18	15	1.2	13.4	58	12	4.8	10.3	79	27	2.9	11.8
2006	31	17	1.8	15.7	43	14	3.1	9.9	75	32	2.3	12.4
2007	25	17	1.5	15.8	52	13	4.0	7.5	80	32	2.5	10.1
2008	23	13	1.8	16.5	41	12	3.4	8.6	67	26	2.6	11.4
2009	18	11	1.6	13.2	37	13	2.8	9.2	58	26	2.2	11.1
2001-2009	176	118	1.5	16.3	394	130	3.0	10.2	592	260	2.3	12.4
COD(S) - R^2=	0.639	0.502	0.318	0.015	0.177	0.316	0.364	0.077	0.520	0.069	0.476	0.022
Trendline	UW	UW	UW	UW	UW	DW	UW	DW	UW	UW	UW	DW
Males	C64				C67				C64-C68			
Year	NOAH	N	AAH	LOSH	NOAH	N	AAH	LOSH	NOAH	N	AAH	LOSH
2001	18	14	1.3	11.7	120	41	2.9	10.5	139	55	2.5	10.8
2002	29	22	1.3	18.7	137	54	2.5	12.8	170	79	2.2	14.3
2003	19	16	1.2	19.1	132	53	2.5	13.1	152	69	2.2	13.8
2004	32	25	1.3	16.8	146	38	3.8	8.5	179	63	2.8	10.0
2005	36	25	1.4	20.7	156	37	4.2	9.3	197	67	2.9	11.8
2006	39	25	1.6	16.0	211	58	3.6	10.0	257	85	3.0	11.3
2007	24	17	1.4	16.6	205	50	4.1	8.5	232	69	3.4	9.4
2008	32	21	1.5	15.3	170	36	4.7	7.6	204	58	3.5	8.8
2009	34	19	1.8	15.4	189	46	4.1	9.0	228	67	3.4	10.0
2001-2009	263	184	1.4	16.9	1466	413	3.5	9.7	1758	612	2.9	11.0
COD(S) - R^2=	0.432	0.187	0.515	0.088	0.726	0.003	0.610	0.415	0.740	0.042	0.652	0.291
Trendline	UW	UW	UW	UW	UW	DW	UW	DW	UW	UW	UW	DW
Both genders	C64				C67				C64-C68			
Year	NOAH	N	AAH	LOSH	NOAH	N	AAH	LOSH	NOAH	N	AAH	LOSH
2001	24	20	1.2	11.3	154	55	2.8	10.1	182	77	2.4	10.5
2002	47	32	1.5	21.0	175	74	2.4	12.4	228	111	2.1	14.7
2003	36	32	1.1	17.8	178	69	2.6	13.4	215	101	2.1	14.1
2004	52	38	1.4	17.0	191	54	3.5	9.4	248	94	2.6	11.2
2005	54	40	1.4	18.3	214	49	4.4	9.6	276	94	2.9	11.8
2006	70	42	1.7	15.9	254	72	3.5	10.0	332	117	2.8	11.5
2007	49	34	1.4	16.2	257	63	4.1	8.3	312	101	3.1	9.6
2008	55	34	1.6	15.8	211	48	4.4	7.8	271	84	3.2	9.4
2009	52	30	1.7	14.7	226	59	3.8	9.1	286	93	3.1	10.2
2001-2009	439	302	1.5	16.6	1860	543	3.4	9.8	2350	872	2.7	11.3
COD(S) - R^2=	0.647	0.435	0.493	0.048	0.760	0.035	0.662	0.368	0.777	0.055	0.668	0.228
Trendline	UW	UW	UW	UW	UW	DW	UW	DW	UW	UW	UW	DW

NOAH - number of hospital admissions
N – number of cases
AAH - average admission in hospital per patient
LOSH - length of stay in hospital
DW - downward trendline
UW - upward trendline
COD(S) - R - coefficient of determination (strength) – Relationship

year despite no bigger change in the number of newly registered cases of C64-C68 cancers in the same years and thus this increase remains unclear. Moreover, the data on the average LOSH (moderate downward) and NOHA (strongly upward) cannot be connected with the rise in the mortality rate from this cancer group either because trend line was moderate upward (in both genders).

Conclusion

Although the data on the incidence and mortality rate from this cancer group do not deviate much from the corresponding data on the European and Croatian level, the relative 5-years survival rate, as a direct indicator of the quality of the health, is far below the EU

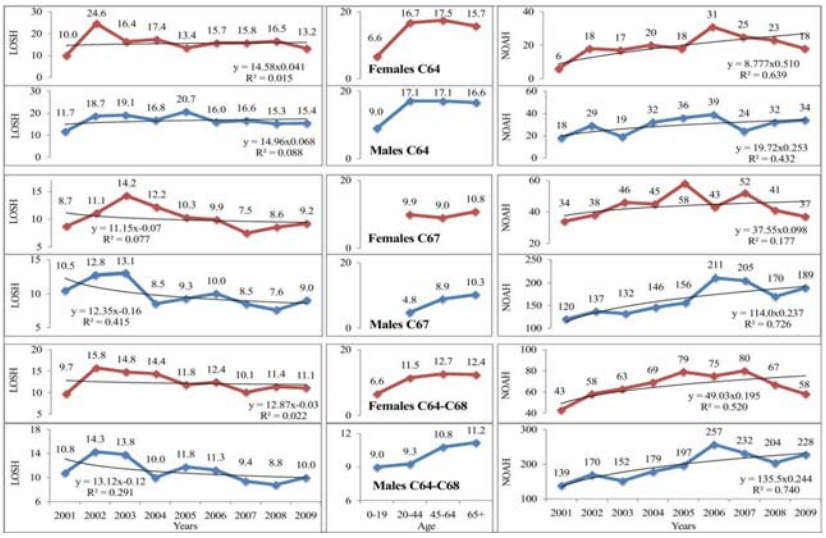

Figure 5: Length of stay in hospital (LOSH) (in days) for cancer group C64-C68 (both genders, selected sites) in the OBC in the 2001-2009 period (NOAH – number of hospital admissions). The rising trendlines in both genders for whole cancer group suggests that very strong relationships exist between the NOAH and years (R^2=0.520 and R^2=0.740, respectively (R^2>0.48<0.81) and moderate downward trendline exist in males between the LOSH and years, R^2=0.291. NOAH - number of hospital admissions, LOSH - length of stay in hospital.

average and thus directly suggests that the health care of these cancer patients in the OBC should be substantially improved and put on a much higher level. Due to the lack of data on the stage of the cancer, about the treatment of cancer and about other indicators related with the cancer, at this time it is not possible to explain (without speculation) why that difference exist.

Limitation

Patients who were treated outside the two state-owned (public) hospitals in the OBC are not registered with the IPHO. Despite the efforts to obtain this information (they exist at the national level) in their original form, the authors were unable to obtain that data for unknown reasons. Therefore, these data on cancer in the OBC may differ from the official state data on cancer in the OBC.

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