



Discrepancy between Admission and Discharge Diagnoses in Central Serbia: Analysis by the Groups of International Classification of Diseases, 10th Revision

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Abstract

Background: Repeated research while using the same methodology can be useful and it can enable relevant conclusions in the same health care system. The aim of our study was to perform comparative analysis of the agreement between admission and discharge diagnostic groups in period 2014-2017 with period 2006-2013 in the Clinical Center of Kragujevac, Serbia.

Methods: The 5% simple, random sample was made from the basic set of all hospital reports from Clinical Centre Kragujevac, Serbia, in the period 01.01. 2014 - 31.12. 2017 (n=10228). The first four digits of ICD-10 codes at admission and discharge were compared for agreement. We used discharge diagnosis as a "golden standard". Statistical analysis was performed using Cohen's Kappa statistic.

Results: In the period 2014-2017, agreement between diagnosis among the most ICD10 groups increased in comparison with the period 2006-2013. Disagreements between diagnosis in the period 2014-2017 in comparison with period 2006-2013 was associated with increased length of stay in the hospital (7.5 vs. 9.1 days, $P<0.01$), patients were younger (54 vs 49.6 yr, $P<0.01$), number of males declined (26.3% vs 16.2%, $P<0.05$), kappa value decreased in XV ICD10 group and XI ICD10 group and kappa value increased in XIV ICD10 group.

Conclusion: Agreement between admission and discharge diagnosis among the most ICD10 diagnostic groups increased. Introduction of a new web application has increased the quality of data, but interpreting it requires the skill of researchers. Further research should identify modifiable causes of discrepancy between admission and discharge diagnoses.

Keywords: Admission diagnosis; Discharge diagnosis; Hospital databases

Introduction

Since the term health care quality was introduced in 1965, its definition has been constantly developing and changing (1). Indicators for a

subjective and objective assessment of the quality of health care starting from Donabedian Avedis are continually improving. In 2002, the European



Commission launched a program called "The Health Care Quality Indicators Project" with the aim of measuring and comparing the quality of health services provided in various European countries (2-4).

The International Classification of Diseases (ICD) as a standard diagnostic classification is used to translate diagnoses of diseases and other health problems from words into an alphanumeric code, which permits easy storage, retrieval and analysis of the data. The Tenth Revision of ICD (ICD-10) as a seven-character, alphanumeric code was endorsed in May 1990 by the WHO (5,6).

Admission diagnosis and discharge diagnosis were recorded as 4-digit numbers. Agreement of diagnoses is defined as the match within the ICD10 groups of the disease (4-digit numbers). In Serbia, until 2014, every institute for public health entered their reports of hospitalization for stationary health institutions from the territories for which it was responsible into the access database. The Public Health Institute of Serbia would merge all access databases into one. Since 2014, a web application has been introduced which enables the centralized collection of data of stationary patients in the health system of the Republic of Serbia, which increases the accuracy of the data, and the data are obtained in a simple, easy and fast manner (7).

Clinical Center of Kragujevac, as one of four clinical centers in Serbia, conducts a highly specialized, consultative and stationary healthcare activity. In this health care institution of tertiary level, the most serious patients are from the territory of Central and Western Serbia, where more than 2 million inhabitants live. In this Clinical Center, more than 60,000 hospitalizations are performed annually and more than 430,000 hospital days are performed, over 7,500 operations are done together with 2,500 births. Clinical Center of Kragujevac is also a medical science research center and a teaching base of the Faculty of Medical Sciences of the University of Kragujevac for undergraduate and postgraduate academic education and professional education for doctors on internships and specialization, as well as an

educational base for students of the Faculty of Medical Sciences (8).

The aim of this study was to do comparative analysis of the agreement between the admission diagnosis and the discharge diagnosis in the period 2014-2017. with the period 2006-2013. in Central Serbia based on the Hospitalization Report.

Materials and Methods

The research was designed as a retrospective cohort study in which the basic set consists of all hospital reports for patients from Clinical Centre of Kragujevac, Serbia who were hospitalized in the period from 01.01. 2014 - 31.12. 2017.

Institute of Public Health Kragujevac, as a reference institution, has a database of hospital reports data from Clinical Centre of Kragujevac. Research hospital databases is the obligation of the employees at the Institute for public health. so when it does not contain patient Identification data Ethics approval is not required

From the basic set, we isolated a representative subset in the form of a 5% simple, random sample without repetition, which contained 10228 hospital reports. The complete reports with the admission diagnosis and discharge diagnosis were analyzed, n=9555.

We analyzed dual agreement. First, we performed the analysis of the admission diagnosis with discharge diagnosis and then the agreement of the basic cause of the disease with admission diagnosis. As a "golden standard", a discharge diagnosis was used. To test the robustness of our definition of discrepancy between admitting and discharge diagnoses, we created a second variable that compared the admitting diagnosis ICD10 group with the ICD10 group discharge diagnosis. If the admitting diagnosis code did not match with ICD10 group discharge diagnosis codes, the diagnosis codes were classified as discrepant. Then, the discrepancy between diagnoses in each ICD10 group in period 2014-2017 was compared with discrepancy in period 2006-2013.

We described continuous variables as the mean \pm standard deviation. Comparison between each

group was performed using an independent *t*-test or a Mann-Whitney U test, as appropriate. We described categorical variables as numbers and percentages, and between-group comparisons were performed using a chi-square test. Analysis of the agreement of diagnoses by IDC10 groups was performed by using Cohen's Kappa statistics. SPSS 19.0 software (SPSS Inc., Chicago, IL, USA) was used in this study for statistical analysis. The use of hospital databases without patient identification data by the researchers from the Institute of Public Health does not require the Ethics approval.

Results

Out of a total number of 10,228 hospitalization reports, the admission diagnosis was missing in 673 reports (6.6%). By analyzing the complete reports with the admission diagnosis - 9,555, it was noted that in 17.4% of cases, there was a disagreement of the ICD10 diagnostic groups on admission with diagnostic groups on discharge.

Hospitalization reports with the discrepancy between admission and discharge diagnoses had statistically significantly higher LOS, the patients were older, more often females during the period 2006-2013. It was similar during the period 2014-2017. except for the age, where the patients with the discrepancy between diagnoses were younger (Table 1).

After the period of 2014-2017, patients were mostly referred to stationary treatment due to Neoplasms, Diseases of the circulatory system, Diseases of the digestive system and diseases of the genitourinary system. By 2013, in each ninth, or tenth instruction for hospitalization as admission diagnoses there were diseases of the genitourinary system, Pregnancy, childbirth and the puerperium listed. After 2013, there has been a significant drop in the number of referrals with the mentioned diagnoses, with the simultaneous increase of Neoplasms, diseases of the circulatory system, diseases of the blood and blood-forming organs, endocrine, nutritional and metabolic diseases, mental and behavioral disorders and diseases of the circulatory system.

Table 1: Sample Characteristics, Central Serbia, 2006-2013/2014-2017

Variable	2006.-2013. yr			2014. -2017. yr		
	Agreement	Disagreement	P	Agreement	Disagreement	P
	$\bar{x} \pm SD$	$\bar{x} \pm SD$		$\bar{x} \pm SD$	$\bar{x} \pm SD$	
LOS (d \pm SD)	7.2 \pm 8.8	7.5 \pm 7.8	<0.01	6.7 \pm 9	9.1 \pm 10.5	<0.01
Age (yr \pm SD)	47.4 \pm 22.2	54.0 \pm 21.5	<0.01	51.1 \pm 21.9	49.6 \pm 24.1	<0.05
Female (%)	7927 (81.8)	1758 (18.2)	<0.01	4116 (81.5)	932 (18.5)	<0.05
Male (%)	6257 (73.7)	2231 (26.3)		3779 (83.8)	728 (16.2)	

sd - standard deviation

In the period of 2014-2017, the most consistent agreement of the admission diagnosis and discharge diagnosis was noted in Certain infectious and parasitic diseases (kappa=0.84, 95%CI=0.79-0.89) and Neoplasms (kappa = 0.83, 95%CI=0.81-0.85).

By comparing 2006-2013 vs 2014-2017 it was observed that the value of kappa coefficient after 2013 is significantly decreasing in reports where pregnancy, childbirth and the puerperium are in-

dicated as admission diagnoses (from kappa=0.75 (95%CI=0.73-0.77) to kappa=0.43 (95%CI=0.35-0.51). A more detailed analysis showed that in 45.6% of these reports, the admission diagnosis was Supervision of other high-risk pregnancies (Z35.8) and Supervision of high-risk pregnancy (Z35.9), and discharge Single spontaneous delivery (O80) or Single delivery by C-section (O82), which can not be considered a discrepancy. Similarly, kappa value increases with

diseases of the Genitourinary system (from kappa=0.21 to kappa=0.72) due to corrections made in the coding of reports for patients who, due to

Chronic renal disease (N18, XIV ICD10 group) have to undergo care involving dialysis (Z49, XXI ICD10 group) (Table 2).

Table 2: Admission diagnostic groups of ICD10, Kappa statistics and 95% CI, Central Serbia, 2006-2013/2014-2017

Admission diagnoses (ICD 10)	2006 - 2013. yr					2014 - 2017. yr				
	n	Agreement n (%)	Disagreement n (%)	Kappa	95% CI	n	Agreement	Disagreement	Kappa	95% CI
Certain infectious and parasitic diseases	671	639 (95.2)	32 (4.8)	0.84	0.81–0.87	257	238 (92.6)	19 (7.4)	0.84	0.79–0.89
Neoplasms	3426	3351 (97.8)	75 (2.2)	0.94	0.93–0.95	2424	2140 (88.3)	284 (11.7)	0.83	0.81–0.85
Diseases of the blood and blood-forming organs	318	294 (92.5)	24 (7.5)	0.88	0.84–0.92	309	278 (90)	31 (10)	0.78	0.73–0.83
Endocrine, nutritional and metabolic diseases	454	366 (80.6)	88 (19.4)	0.75	0.71–0.79	368	330 (89.7)	38 (10.3)	0.72	0.67–0.77
Mental and behavioural disorders	469	425 (90.6)	44 (9.4)	0.79	0.75–0.83	310	303 (97.7)	7 (2.3)	0.8	0.75–0.84
Diseases of the nervous system	981	748 (76.2)	233 (23.8)	0.67	0.64–0.70	499	431 (86.4)	68 (13.6)	0.77	0.73–0.81
Diseases of the eye and adnexa	409	387 (94.6)	22 (5.4)	0.93	0.85–0.99	213	208 (97.7)	5 (2.3)	0.3	0.21–0.37
Diseases of the ear and mastoid process	59	45 (76.3)	14 (23.7)	0.68	0.56–0.80	33	26 (78.8)	7 (21.2)	0.5	0.33–0.68
Diseases of the circulatory system	1403	1144 (81.5)	259 (18.5)	0.61	0.58–0.64	1039	763 (73.4)	276 (26.6)	0.48	0.45–0.51
Diseases of the respiratory system	1030	876 (85)	154 (15)	0.59	0.56–0.62	529	470 (88.8)	59 (11.2)	0.7	0.66–0.74
Diseases of the digestive system	1192	1092 (91.6)	100 (8.4)	0.77	0.75–0.79	614	537 (87.5)	77 (12.5)	0.62	0.58–0.66
Diseases of the skin and subcutaneous tissue	172	138 (80.2)	34 (19.8)	0.73	0.67–0.79	122	98 (80.3)	24 (19.7)	0.71	0.63–0.8
Diseases of the musculoskeletal system and connective tissue	449	414 (92.2)	35 (7.8)	0.72	0.68–0.76	294	249 (84.7)	45 (15.3)	0.68	0.62–0.73
Diseases of the genitourinary system	2313	634 (27.4)	1679 (72.6)	0.21	0.19–0.23	565	493 (87.3)	72 (12.7)	0.72	0.69–0.76
Pregnancy, childbirth and the puerperium	1696	1677 (98.3)	29 (1.7)	0.75	0.73–0.77	149	132 (88.6)	17 (11.4)	0.43	0.35–0.51
Other subgroups of ICD10	3130	1963 (62.7)	1167 (37.3)	0.48	0.46–0.50	1830	1199 (65.5)	631 (34.5)	0.56	0.53–0.58

95% CI - confidence intervals

By comparing the discharge diagnoses with admission diagnosis in two analyzed periods, it is noted that the value of the kappa coefficient after 2013 is increasing in the most common ICD10 groups. The exceptions are the diseases of the ear and mastoid process where the kappa coefficient

value dropped from 0.6 to 0.4. Further analysis showed that every fourth hospitalization in which the discharge diagnosis was diseases of the ear and mastoid process the admission diagnosis was Certain conditions originating in the perinatal period (Table 3).

Table 3: Discharge diagnoses of ICD10, Kappa statistics and 95% CI, Central Serbia, 2006-2013/2014-2017

Admission diagnoses (ICD 10)	2006 - 2013. yr					2014 - 2017. yr				
	n	Agreement n (%)	Disagreement n (%)	Kappa	95% CI	n	Agreement	Disagreement	Kappa	95% CI
Certain infectious and parasitic diseases	772	639 (82.8)	133 (17.2)	0.63	0.59–0.67	281	238 (84.7)	43 (15.3)	0.77	0.72–0.82
Neoplasms	3602	3351 (93)	251 (7)	0.81	0.80–0.82	2270	2140 (94.3)	130 (5.7)	0.89	0.87–0.9
Diseases of the blood and blood-forming organs	330	294 (89.1)	36 (10.9)	0.66	0.61–0.71	301	278 (92.4)	23 (7.6)	0.81	0.76–0.86
Endocrine, nutritional and metabolic diseases	457	366 (80.1)	92 (19.9)	0.55	0.51–0.59	361	330 (91.4)	31 (8.6)	0.73	0.68–0.78
Mental and behavioural disorders	464	425 (91.6)	39 (8.4)	0.7	0.66–0.74	317	303 (95.6)	14 (4.4)	0.78	0.73–0.83
Diseases of the nervous system	921	748 (81.2)	173 (18.8)	0.7	0.67–0.73	457	431 (94.3)	26 (5.7)	0.87	0.83–0.91
Diseases of the eye and adnexa	391	387 (99)	4 (1)	0.95	0.92–0.98	220	208 (94.5)	12 (5.5)	0.29	0.22–0.35
Diseases of the ear and mastoid process	82	45 (54.9)	37 (45.1)	0.6	0.49–0.71	41	26 (63.4)	15 (36.6)	0.4	0.25–0.55
Diseases of the circulatory system	1640	1144 (69.8)	496 (30.2)	0.38	0.36–0.40	869	763 (87.8)	106 (12.2)	0.58	0.55–0.62
Diseases of the respiratory system	1139	876 (76.9)	263 (23.1)	0.52	0.49–0.55	553	470 (85)	83 (15)	0.67	0.63–0.71
Diseases of the digestive system	1366	1092 (79.9)	275 (20.1)	0.55	0.53–0.57	671	537 (80)	134 (20)	0.57	0.53–0.61
Diseases of the skin and subcutaneous tissue	166	138 (83.1)	28 (16.9)	0.65	0.58–0.72	119	98 (82.4)	21 (17.6)	0.74	0.66–0.82
Diseases of the musculoskeletal system and connective tissue	488	414 (84.8)	74 (15.2)	0.54	0.50–0.58	272	249 (91.5)	23 (8.5)	0.73	0.68–0.78
Diseases of the genitourinary system	768	634 (82.6)	134 (17.4)	0.66	0.63–0.69	550	493 (89.6)	57 (10.4)	0.75	0.71–0.78
Pregnancy, childbirth and the puerperium	1721	1667 (96.9)	54 (3.1)	0.73	0.71–0.75	263	132 (50.2)	131 (49.8)	0.24	0.19–0.29
Other subgroups of ICD10	3865	1967 (50.9)	1905 (49.1)	0.36	0.35–0.37	2010	1199 (59.7)	811 (40.3)	0.51	0.49–0.53

Discussion

The admission diagnosis code reflects the amount of information known at the time of admission but is retrospectively coded. The admission diagnosis code specificity may depend on a variety of patient and physician-related factors, and neither the quality of the information collected at admission nor the specificity of the coded information is externally regulated. The researchers use the discharge diagnosis codes to classify a patient's condition, identify comorbidities, and measure severity of illness (9).

Agreement of the patient's admission diagnosis with the discharge diagnosis, which is determined at the end of hospital treatment is one of the indicators of the quality of the work of doctors in primary health care (10). Agreement of the admission and discharge diagnosis affects not only the possibility of starting the treatment on time (the initial treatment is initiated in relation to the recommended diagnosis) but the outcome of the treatment as well.

Discrepancy of diagnoses can be expected in situations where the patient is hospitalized due to additional diagnostic procedures, as well as in re-

hospitalizations that are caused not by the main disease, but by the associated diseases (comorbidities) (11).

Indicators for assessing the quality of health care are not synonymous with the set goals of health policy, but they are measures of scope in which the intended goals are achieved. They provide information for both comparison and monitoring, management and policy making within a given health care system (12-14). The agreement of diagnoses in the way shown in this study is a general, objective (measurable) indicator. However, in the research in which the agreement of certain diagnoses is being analyzed, or the diagnosis of certain health disorders or on certain clinics, the indicator is no longer general but specific for a given health disorder or for a given clinic (15,16).

Various factors can cause a discrepancy of the admission and discharge diagnosis: complexity of the medical problem, poor pre-hospital diagnostics, comorbidities, mistakes in the work of doctors in primary health care, coding errors (17-20).

Discrepancy of the diagnosis in admission and discharge is associated with an increase in the morbidity and mortality rate of hospitalized patients, the length of hospitalization, the rate of re-hospitalization and the total increase in treatment costs. Similarly, in a survey conducted in Israel, it has been shown that disagreement between admission diagnosis and hospital discharge diagnosis is associated with increases in morbidity and mortality (21,22).

Diagnosis discrepancy is associated with longer length of stay, which is shown not only in this study but also in a large number of studies conducted across Europe and America (23,24). A higher re-hospitalization rate can also be observed in the disagreement of diagnosis (25). All of the above can cause an increase in total costs of treatment for patients with discrepancy between admission and discharge diagnoses (26).

Guides to good clinical practice and disease registers play a major role in agreement admission and discharge diagnosis, as well as monitoring individual health disorders. Guides to

good clinical practice as guidelines for the treatment of certain clinical conditions reduce the diagnosis and treatment errors and discrepancy among diagnoses (27-29). So far, 20 National Guides for Good Clinical Practice have been developed in Serbia. At the same time, registries of diseases can provide health care professionals and researchers with first-hand information about people with certain conditions, both individually and as a group, and over time, increase our understanding of that condition. Some registries collect information that can be used to track trends about the number of people with diseases, treatments, and more.

Repeated research with using the same methodology, such as this study, provides relevant conclusions in the same health care system in which there are no challenges in terms of defining, coding and interpreting results (30).

The introduction of a portal for centralized data collection of stationary patients in the health system of the Republic of Serbia increased the quality of data. Thus, the lack of admission diagnosis declined from 10.7% to 6.6%. The new data entry system partially eliminated the confusion regarding the possibility of double coding of the same health disorder, which led to an increase in the agreement of the diagnoses in some ICD10 diagnostic groups. Namely, in the previous study it was shown that in 99.3% of hospital reports in whom the admission diagnosis was diseases of the genitourinary system, i.e. Renal failure (N17-N19) the Factors influencing health status and contact with health services, i.e. Care involving dialysis (Z49) was listed as the final diagnosis. In the new web application, all patients who are hospitalized due to dialysis have as discharge diagnosis Z49, and Renal failure is a follow-up diagnosis. However, the system itself requires an upgrade, and as this research showed that, we should be cautious when interpreting the noted discrepancy of the diagnoses in order for the results of the research to be relevant.

The results of the study indicate increased agreement of admission diagnosis with the discharge diagnosis among the most ICD10 groups when the period of 2014-2017 is

compared with the period 2006-2013. Disagreement diagnosis in the period 2014-2017 in comparison with period 2006-2013 was associated with increased length of stay ($P<0.01$), patients were younger and number of males declined. The kappa value decreased in XV group and XI ICD10 group. The kappa value increased in XIV ICD10 group as a result of introduction of a new web application which partially eliminated confusion concerning the possibility of double coding of the same health disorder. However, interpreting diagnosis results for ICD10 groups requires the knowledge and skill of researchers, given the imperfection of the system. Defining the factors which cause the discrepancy of admission and discharge diagnostic groups within ICD 10 diagnostic groups can be the subject of a new research.

Conclusion

Introduction of a new web application has increased the quality of data. There are increased agreement of admission diagnosis with the discharge diagnosis among the most ICD10 groups. Further research should identify modifiable causes of discrepancy between admission and discharge diagnoses

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interest.

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