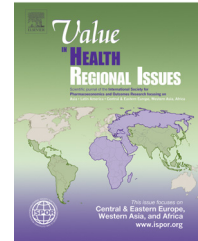




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Radiology Services Costs and Utilization Patterns Estimates in Southeastern Europe—A Retrospective Analysis from Serbia

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ABSTRACT

Objective: Assessment of costs matrix and patterns of prescribing of radiology diagnostic, radiation therapy, nuclear medicine, and interventional radiology services. Another aim of the study was insight into drivers of inappropriate resource allocation. **Methods:** An in-depth, retrospective bottom-up trend analysis of services consumption patterns and expenses was conducted from the perspective of third-party payer, for 205,576 inpatients of a large tertiary care university hospital in Serbia (1,293 beds) from 2007 to 2010. **Results:** A total of 20,117 patients in 2007, 17,436 in 2008, 19,996 in 2009, and 17,579 in 2010 were radiologically examined, who consumed services valued at €2,713,573.99 in 2007, €4,529,387.36 in 2008, €5,388,585.15 in 2009, and €5,556,341.35 in 2010. **Conclusions:** The macroeconomic crisis worldwide and consecutive health policy measures caused a drop in health care services diversity offered in some areas in the period 2008 to 2009. In spite of this, in total it

increased during the time span observed. The total cost of services increased because of a rise in overall consumption and population morbidity. An average radiologically examined patient got one frontal chest graph, each 7th patient got an abdomen ultrasound examination, each 19th patient got a computed tomography endocranium check, and each 25th patient got a head nuclear magnetic resonance. Findings confirm irrational prescribing of diagnostic procedures and necessities of cutting costs. The consumption patterns noticed should provide an important momentum for policymakers to intervene and ensure higher adherence to guidelines by clinicians. **Keywords:** costs, interventional radiology, nuclear medicine, radiation therapy, radiology diagnostics, utilization patterns.

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Introduction

Our time witnesses unseen contemporary advances in medical technology and development of modern equipment in all branches of medicine. A great number of new diagnostic and therapeutic methods have come up in radiology as well. They are very powerful, but their purchase price (which often amounts to a few million euros, for, for example, computed tomography [CT] and nuclear magnetic resonance [NMR]) limits broader usage and replacement of existing appliances. Apart from diagnostic appliances, there has been a technological revolution in radiological methods of intervention radiology and radiotherapy, the development and application of which have prospered in the last 10 years. Parallel to the invention of such appliances and their procurement, a problem has been noted because their services are very expensive and keep a constant burden on health funds [1–8]. These appliances represent mass consumers of health care budgets worldwide. This is particularly the case when considering

secondary and tertiary care hospitals. Health economic estimates of radiation-mediated diagnostic and treatment procedures are seldom reported in the literature. Of those that are available, most deal with imaging diagnostics or radiotherapy in oncology on a separate basis. This would be the first study to compare all these examinations and interventions in a large-scale trial.

In Serbia, as a typical upper-middle income southeastern European country, expensive high-tech services were centralized to several tertiary facilities, the third largest of them being the Clinical Center in Kragujevac. For this reason, we chose this particular university clinic with approximately 1,300 beds, more than 50,000 hospital admissions, and 400,000 outpatient examinations per year. Another problem lies in the fact that these expensive high-tech services are nonrationally prescribed, which also contributes to excessive consumption and spending from the modest health budget. By analyzing the 3-year-long trend in the consumption of services (the volume, i.e., the number of, the frequency, or expenses), we are of the opinion that the key

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weakness of clinical practice is the lack of consistency in following guidelines for good clinical practice.

Based on these above-mentioned facts, interventions could be made in the future aimed toward more rational prescription, especially diagnostic methods, which would redistribute the limited resources to the cases in which these are necessary for proper treatment. Similar to our postulates, numerous studies have shown an increasing trend of the unrealistic use/consumption of radiologic diagnostic methods [9–13], and it is specially the case with new radiologic methods. The downside of these studies, and thus of ours too, is the short time during which the study was carried out (3–6 years), which will be annulated by the future prolonging of the study time of this study. We consider it necessary to establish a special organization whose purpose would be to monitor the prescription of radiologic measures and mark the cumulative annual accepted dosage of radiation given to patients, as was the case with patients who took medicines in some countries, the Czech Republic for instance [14].

The aim of this article was to establish whether radiologic methods in diagnostics and therapy have been used rationally during the last 4 years and to substantiate the need for making a guideline for the application of radiologic methods in clinical practice.

Methods

The 4-year-long retrospective analysis of total expenditure trends of radiologic services from the spheres of the classical radiographic, high-tech imaging diagnostics, interventional radiology, radiation therapy, and procedures of nuclear medicine during the years 2007, 2008, 2009, and 2010 was provided by the database of the Clinical Center in Kragujevac (Figs. 1 and 2). The regular invoicing of services provided in the daycare service and to hospitalized patients according to *International Statistical Classification of Diseases, 10th Revision* code of illnesses and the name/surname/personal identification number resulted in a large administrative database, which is regularly updated. By the cooperation of the clinics and departments in charge, the preview of the database was obtained.

Authors analyzed services that were used the most frequently during the above-mentioned years (top 10 of the expenditure volume) and the most expensive services (top 10 of the total value of services), that is, those that by themselves take up 67% to

95% (arithmetic mean \pm 1 or 2 SD) of the total value of services. The population included in this research amounts to 600,000 inhabitants and is situated in central Serbia, in Sumadija, and the clinical center in charge is the one in Kragujevac.

Results

More than 17,000 radiologically examined inpatients per year have been noted in the clinical center in Kragujevac (Table 1). During 2007, most of the services were provided to outpatients; during 2008 and 2009, most of the services were provided to inpatients; and in 2010, all the radiological diagnostic and therapy services in nuclear medicine and interventional radiology were provided to inpatients exclusively. Total expenses constantly increased during the 4-year period analyzed (Table 1).

Nine percent of total 4-year expenses belong to nuclear medicine, 16% to radiotherapy, while the radiodiagnostic service including interventional radiology spends 75% of the budget intended for radiological services. The number of inpatients constantly increased from 2007 to 2010 (Table 1), but the ratio of patients who received one of the radiological services was relatively reduced with periodic oscillations (44.04% in 2007, 34.55% in 2008, 35.55% in 2009, and 31.39% in 2010). In 2007, on average every second patient hospitalized received one of the radiological services, while in 2010, every third patient received one of the radiological services.

The average price of radiological services per patient constantly increased during this 4-year period analyzed—in 2007, 10,658.97 RSD (€134.89); in 2008, 20,516.81 RSD (€259.77); in 2009, 26,506.07 RSD (€283.67); and in 2010, 33,045.99 RSD (€316.08) (Fig. 3).

The total number of hospital admissions with radiologically examined patients slightly reduced from 2007 to 2010 (Table 1). Eighty-three percent of all the first hospitalizations at the Department of Radiology and Nuclear Medicine belong to radiodiagnosics with interventional radiology.

The number of patients examined and nuclear medicine services provided in this period decreased (Table 1). Costs, however, increased significantly although the number of patients examined or services provided reduced, from 32,272,107.84 RSD (€408,404.30) to 50,264,302.32 RSD (€481,597.20) in 2010, with a slight decline in 2008 (Table 1).

The number of patients who received some of the radiodiagnostic services remained at about 15,000 during the 4-year period (range of 17,000–19,000). The expenses of these services, however, constantly increased, tripling from 2007 to 2010 (Table 1).

The number of patients who received some of the radiotherapy services, and the number of services provided as well, had a slight increase (Table 1). This slight rise in the obtained services volume follows the increase in cost (Table 1).

The services of nuclear medicine lowered their expenses from 15% in 2007 to 8.6% in 2010 per year. A similar fall was noticed in radiotherapy, from 23% in 2007 to 12% in 2010. However, radiodiagnostic services mark a constant increase in the percentage share from 62% in 2007 to 79.55% in 2010.

The total number of services given, including the repetitive one, constantly increased (Table 1). With 81% of the services provided belonging to the field of radiotherapy, 18% belonging to radiology diagnostic services with interventional radiology, and only 1% belonging to nuclear medicine. The total number of nuclear medicine services provided was doubled in 2010 compared with that in 2007 (Table 1). In contrast to nuclear medicine, the total number of radiology diagnostic services and radiotherapeutic services provided constantly grew (Table 1). The trend of increase in the total number of radiology diagnostic services provided from 2007 to 2010 was 30 times bigger (Table 1).

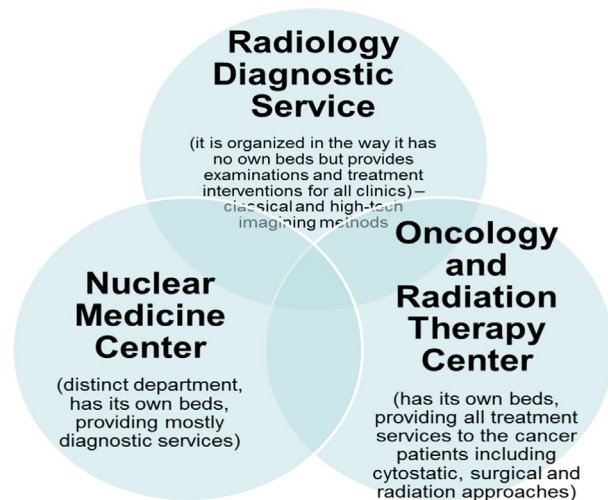


Fig. 1 – Division of core services.

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