

doi: 10.3325/cmj.2010.51.259

Retrospective Analysis of Use and Distribution of Resources in Otolaryngology Wards in Romanian Hospitals Between 2003 and 2008 to Improve Provision and Financial Performance of Healthcare Services

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Aim To analyze use and distribution of resources by otolaryngology (ENT) hospital wards in Romania between 2003 and 2008, in order to plan the improvement of patient access to health care services and health care services' financial performance.

Methods Clinical electronic records were searched for all patients discharged from all public hospitals funded on a per-case basis by the government between January 2003 and September 2008. Adult and pediatric ENT wards, as well as ENT wards from different counties, were compared.

Results The number of ENT hospital beds and the number of specialists decreased from 2003 to 2004, the number of specialists declined, and specialists were distributed unevenly among the hospitals and counties. The total number of ENT wards was over 100 for almost the entire study period, but there were only about 15 pediatric ENT wards in all 42 counties. ENT wards recorded more cases and hospitalization days than oral-maxillofacial surgery and neurosurgery wards, but fewer cases than general surgery or obstetrics wards. ENT wards had the lowest mortality rates. Until the second half of 2007, adult ENT wards had a lower surgical index, higher complexity of cases, and longer average length of stay than pediatric ENT wards ($P < 0.001$, t -test). After 2007, pediatric ENT wards treated more complex cases ($P = 0.004$, t -test) that were less surgical in nature; this result was due to the shift from the Health Care Finance Administration classification diagnostic-related group (DRG) system to the Australian Refined DGR system, as well as to improper use of codes. ENT wards in different counties differed in the number of cases, average length of stay, and case mix index.

Conclusion Statistics and case mix clinical data may be a good starting point for informing hospital management to assess ENT service coverage, but they should be supplemented with data on hospitalization costs.

Received: August 22, 2009

Accepted: June 9, 2010

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One of the most common concerns of medical associations of otolaryngology – head and neck surgery (ENT) worldwide is to insure access to care, a good quality of care, and positive health outcomes (1). Any reimbursement system should take into account such objectives. To this end, the American Academy of Otolaryngology – Head and Neck Surgery encourages the ongoing documentation and analysis of patient data, and the use of electronic data and decision support systems to provide best practices (2). The “Pay-for-Performance” (3) reimbursement system, in which physicians are rewarded for improving the quality and safety of their services, is extending from primary care to surgical care, and otolaryngologists should embrace efforts to improve clinical care by practicing evidence-based medicine. The development of clinical guidelines (4) is seen as a tool for increasing the quality of care and reducing variations in medical practice. Hospitals and regions can vary widely in how they treat the same pathology; variation can be seen, for example, in the length of hospitalization, hospital mortality, and frequency of adverse events for a given condition (5). Only a few studies have examined practice variations in Romania but they have not been published (Lazarescu ID, Musat S, Palas C, personal communication), and their conclusion was that practice variations existed among different regions in Romania, mainly concerning surgical practice.

Clinical practice variations are seen as deviations from a scientific standard, while small-area variations (SAV) are large differences in the rate of utilization of health services, for example the number or rate of hospitalization or surgical procedures between geographical regions. The two main effects of SAVs are the use of unnecessary services and the excessive use of resources by the health care system (6). Previous studies performed by National School of Public Health, Management and Continuous Medical Education (NSPHMCME) identified the increase in the use and the reimbursement level of ENT hospital services; thus health care administrators became concerned about the possible effects of SAVs in Romania.

The present study aims to address these questions in the practice of ENT in Romania. It also attempts to compare resource use and distribution in ENT wards with wards of other specialties in Romania. Retrospective patient data were examined for the period 2003-2008. This study used detailed data on hospital activity for an analysis and benchmarking after implementation of the diagnosis-related group (DRG) system in Romania.

METHODS

Data sources

The present study is an observational, retrospective analysis using clinical case mix data collected between January 2003 and September 2008 in the National DRG database, managed by the NSPHMCME, Bucharest, Romania.

Data were obtained from NSPHMCME's Web site (<http://www.drg.ro/index.php?p=indicatori>) (7) and directly from the NSPHMCME after a request from the authors. Other sources of data were the National Center for the Organization and Insurance of the Informational and Informatics System Bucharest (8) and the National Statistical Yearbook (9). Although our study examines patients discharged since 2003, we were able to extend our analysis to December 2002 using the data from the National Center for the Organization and Insurance of the Informational and Informatics System Bucharest (NCOIISB).

Participants

All patients hospitalized from January 1, 2003 to September 30, 2008 with valid data reported at discharge were included in the study. A valid discharge was considered a case with complete and accurate data reported, from the informational and clinical points of view. Thus, records were excluded if they had empty data fields, incorrect data about age, sex, and insurance, or if they showed erroneous DRG codes or had incomplete clinical data. Patients were admitted to adult and pediatric ENT wards in per-case-funded public hospitals, ie, hospitals operating under the DRG system. All hospitals in our study were public hospitals. In 2008, fewer than 10 private hospitals began reporting data, but they are not DRG-reimbursed and were not included in the study. The number of DRG-system-financed hospitals in 2001 was 23 and it increased to 195 in 2004, and to 279 between 2005 and 2008.

Variables

Study variables describe the amount and type of services, hospital types, and departments (adult ENT and pediatric ENT), average length of stay (ALOS), age groups and sex, hospital mortality, treated morbidity (DRG groups), complexity of treated cases (case mix index, CMI), and the amount of money claimed for reimbursement. ALOS was defined as the ratio between the number of hospital inpatient days and the number of discharges per ward. The

number of hospital days for a certain case was taken to be the difference between the date of discharge and date of admission.

Discharge or case means one episode of in-patient (continuous) care; thus, a patient could have one or more discharges during a year. A patient who was hospitalized and discharged two times in one year would be counted as two different cases. The number of cases was defined as the number of discharges from hospital. This is a good proxy for service volume because it takes into account the fact that one patient can have more than one discharge yearly. Surgical cases were defined as cases classified into a surgical diagnosis group (surgical, "S") according to the Health Care Finance Administration classification (HCFA) or the Australian Refined Diagnosis Related Groups (AR-DRG). The degree of operability indicates what percentage of the total number of discharged patients were surgical cases. Length of stay was defined as the number of days between the admission date and the discharge date. Utilization days were calculated by dividing the number of hospitalization days by the number of beds from the ENT ward(s) during a given period (eg, one year). The number of weighted cases was computed by multiplying CMI by the number of validated cases, which were defined as those having correct and complete data reported.

Case mix index (CMI) at the national level was computed as follows: $\text{sum}(\text{number of valid cases DRG}_i \times \text{cost weight for DRG}_i) / \text{number of valid cases}$, for all adult ENT wards in hospitals financed "per case," where "i" refers to the name of the DRG.

Classifications

Diagnoses and procedures for cases discharged between January 1, 2003 and June 30, 2007 were coded based on the 10th revision of the World Health Organization International Classification of Diseases and Related Health Problems (ICD-10). From July 1, 2007, ICD-10 was used for coding with the 3rd version of the Australian Modifications (ICD-10-AM v.3).

Patients were classified into DRGs, with cases from the same group having similar clinical, demographic, and cost features. A "DRG Grouper" is a software that takes clinical and demographic data as input and gives a corresponding DRG as output. All patients discharged between January 1, 2003 and June 30, 2007 were classified into DRGs (10) using the HCFA-18 grouper. From July 2007, patient classification was

made with the AR-DRG system (version 5.0). Each grouper was used together with its own list of cost weights.

Because the HCFA grouper works with ICD9 diagnosis codes, the WHO ICD10 codes used in hospitals were converted to ICD9 with a mapping table provided by NCOIISB and adjusted with NSPHMCME.

Data analysis and statistics

We performed comparisons between adult and pediatric ENT wards, as well as between ENT wards from different counties. Romania is divided into 41 counties and the capital, Bucharest, which has a stand-alone status.

The results are presented as absolute values, percentages (eg, for surgical cases), or calculated weighted average (eg, for CMI). These calculations were carried out using Microsoft Excel 2003.

Independent two-sample *t*-test for unequal sample size was used to test the differences in mean CMI and ALOS between adult and pediatric ENT wards. The numbers of cases and total hospitalization days were also compared between the two types of ENT wards. Probability values lower than 0.05 were considered significant. Statistical calculations were performed with SPSS 14.0 for Windows 2005 (SPSS Inc., Chicago, IL; USA) (11).

To highlight territorial differences, quartiles were used for CMI and ALOS, and presented in cartograms using EpiInfo/EpiMap 2000 (CDC, Atlanta, GA, USA). For the analysis of changes in the number of beds, bed utilization, and the number of ENT specialists, the option "chart and trend line" from Microsoft Excel was used.

RESULTS

The number of beds in ENT wards in Romanian hospitals constantly decreased, while the number of hospitalization days per bed showed an constantly increased over the entire study period (Figure 1). At the same time, the number of ENT specialists continuously decreased, from 621 specialists in 2006 to 515 specialists in 2007. The coverage with specialists and ENT beds varies widely across regions of Romania (Figure 2). The number of discharges from pediatric ENT wards increased constantly from 2003 to the end of the study period. Adult and pediatric ENT wards handled, respectively, approximately 100 000 and 20 000 cases per year (Table 1).

As far as the type of patient residence (rural or urban) is concerned, most of the hospitalized patients, especially those in the pediatric ENT wards, came from urban areas. During 2006, the urban/rural ratio was significantly higher in pediatric than in adult ENT wards (2.57 vs 1.55, $P < 0.001$).

Hospital mortality for ENT wards (about 0.1%) was lower than that for other surgical departments, like neurosurgery (3.71%), and general surgery (1.54%),

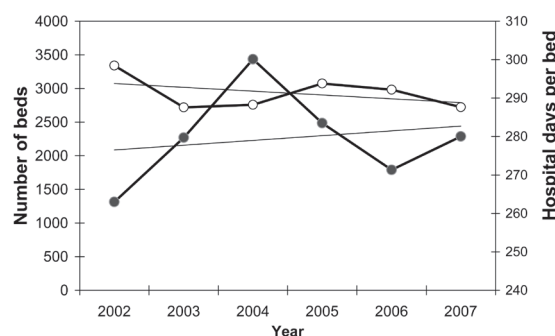
The analysis of the volume of hospital activity shows that in 2004, the number of hospitals that reported ENT data

increased to 81, which may help to explain the fact that 134 318 cases were reported in total that year, compared with only 100 641 in 2003.

In 2005, adult ENT wards had more than 2% of the total number of cases, weighted cases, and days of hospitalization across all specialties, whereas pediatric ENT wards contributed only about 0.4% to these aggregate statistics. In 2006, cases in adult ENT wards accounted for about 2.31% of all cases and 1.82% of all days of hospitalization across all specialties at the national level. These figures are much smaller than the corresponding ones for general surgery or obstetrics (8-9%), but higher than those for oral-maxillofacial surgery (0.5%) and neurosurgery (1%). Pediatric ENT wards treated only 0.4% of cases and accounted for only 0.18% of hospitalization days. ALOS in ENT wards did not change significantly between 2004 and 2008 but it was significantly different during the entire study period between adult and pediatric ENT wards ($P < 0.001$). At the beginning of the study period, adult ENT wards had nearly double the ALOS of pediatric ENT wards, and nearly 5 times more surgical interventions than pediatric ENT wards. In 2004, the number of hospitals that reported ENT data increased to 81 (Table 1) and we noticed a surprising increase in the number of surgical interventions, which grew rapidly for pediatric ENT wards, reaching 76.1% of all discharges from all pediatric ENT wards in 2004. There were geographic differences in ALOS value (Figure 3).

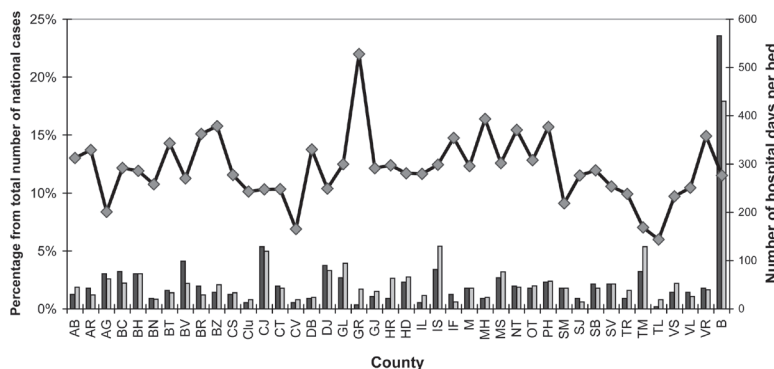
Analyses of data from 2006 show that, before this year, adult ENT wards accounted for a relatively high proportion

Figure 1.



Comparative analysis of number of beds and utilization of beds, Romania, 2002-2007; open circles represent the number of otolaryngology (ENT) ward beds at the national level, and the closed circles represent the value of bed utilization for ENT wards at the national level. The upper line shows the tendency for the number of ENT beds and the lower line the tendency of utilization days. Data source: Center for the Organization and Insurance of the Informational and Informatics System Bucharest.

Figure 2.



Otolaryngology (ENT) ward resources situation across counties, 2007; closed bars represent the percentage of ENT specialists in the total number of ENT specialist physicians in the country; open bars represent the percentage of ENT hospital beds in the total number of ENT hospital beds in the country; the diamond and broken lines represent the ENT bed utilization in different counties. Data source: Center for the Organization and Insurance of the Informational and Informatics System Bucharest. Full names of the counties are available from <http://www.drg.ro/index.php?p=indicatoriperf&s=2007s>.

TABLE 1. The number of cases and the average length of hospital stay in otolaryngology (ENT) wards in per-case-funded hospitals in Romania, 2003-2008

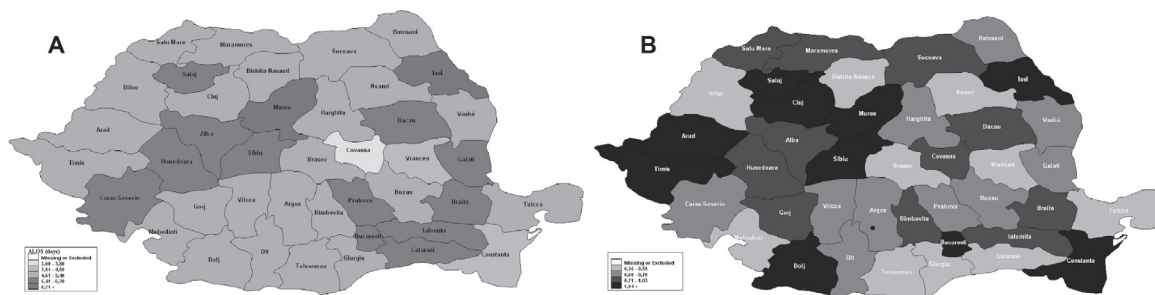
Year	No. of hospitals*		No. of cases†		ALOS (days)‡	
	adult ENT ward	pediatric ENT ward	adult ENT ward	pediatric ENT ward	adult ENT ward	pediatric ENT ward
2003	—	—	84 027	16 614	6.3	3.6
2004	81	—	116 264	18 054	6	3.7
2005	104	17	112 385	19 839	6.1	3.6
2006	107	16	110 455	18 988	6.0	3.4
2007	117	15	97 838	20 141	5.8	3.3
2008	115	15	101 066	23 274	5.7	4

*The total number of hospitals reporting data in diagnosis-related group system was 23 in 2003 and 185 in 2004, but there is no available complete data on the number of hospitals having ENT wards.

†Counted number of discharges. For 2008, the number of cases was estimated based on available data for 9 mo (total number of cases for 9 mo divided by 9 and multiplied by 12).

‡ALOS, average length of stay. For 2008, ALOS was calculated based on data available for only 9 mo. The ALOS for adult ENT was significantly higher than for pediatric ENT every studied year, $P < 0.001$, t -test.

Figure 3.



Territorial variations in (A) average length of stay for adult otolaryngology wards and (B) case mix index for adult otolaryngology wards during the first 9 months of 2008.

of surgical cases discharged from all wards, but in 2006 this percentage decreased. In 2007, the value of this indicator did not change for adult ENT wards. Pediatric ENT wards had a significantly higher percentage of surgical cases (69%) than the national average (48%) during the first half of 2007, but this percentage decreased significantly below the national average during the second half of the year, and the decrease continued in 2008, when only 14.8% (95% CI, 14.2%-15.3%) patients in pediatric ENT wards were surgical patients. This was much lower than the national average for all surgical specialties (51%; Figure 4).

Since 2004, the CMI increased constantly until 2008 (Table 2). These data must be interpreted with caution, since the classification system and the list of cost weights used by hospitals changed in 2007. In 2007, the complexity of cases treated at pediatric ENT wards was very different from those at adult ENT wards: during the first half of 2007, the complexity was significantly higher at adult ENT wards but,

after a switch to the AR-DRG system and cost weights, the CMI for pediatric ENT wards became significantly higher than that for adult wards.

Cases treated in adult ENT wards were classified most frequently in tracheotomy (35% from all the weighted cases for ENT nationwide for the second half of 2007), ENT procedures, respiratory infections, and tonsillectomies. For pediatric ENT wards, although the most frequent cases were tonsillectomies or respiratory infections, the largest number of weighted cases, starting with the second half of 2007, fell under the AR-DRG group "Intubation, age < 16 years." This group accounted for 65% of all weighted cases in pediatric ENT wards.

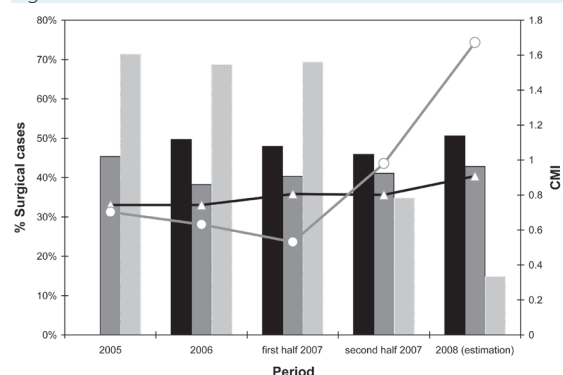
Financial analysis based on the number of cases and CMI of ENT wards showed that by the end of 2007, and in 2008, otolaryngology made a major contribution to the amount of money claimed for the reimbursement

TABLE 2. The evolution of the case mix index (CMI) at the national level for otolaryngology (ENT) wards in Romania, 2004-2008

Year	CMI national average in ENT wards*	
	adult	pediatric
2004	0.6346	0.4900
2005	0.7436	0.7018
2006	0.7428	0.6312
2007 first half	0.8060	0.5311
2007 second half	0.8007	0.9803
2008	0.9076	1.6721

*CMI national average – total number of weighted cases (no DRGi × CW DRGi)/total number of cases, calculated on valid cases only, “i” refers to the name of the DRG.

Figure 4.



Comparative analysis of case mix index (CMI) and surgical cases ratio for adult otolaryngology (ENT) ward vs pediatric ENT in 2005-2008 at the national level; closed bars represent the average percentage of surgical cases in all surgical wards at the national level; medium-gray bars represent the average percentage of surgical cases in adult ENT wards; light-gray bars represent the average percentage of surgical cases in pediatric ENT wards; open circles represent average CMI at the national level for pediatric ENT wards, and open triangles represent average CMI at the national level for adult ENT wards. The complexity of cases for adult ENT wards was significantly higher than for pediatric ENT wards in the first half of 2007 ($P < 0.001$, *t*-test); for the second half of 2007, the complexity for pediatric ENT wards was significantly higher than for adult ENT wards ($P = 0.002$, *t*-test).

by per-case-financed hospitals with ENT departments. For some hospitals, despite the fact they had many specialties, the ENT contributed as much as 25%-33% to the reimbursement claimed by hospitals.

Overall, the amount of money claimed by ENT departments, in per-case-financed hospitals across Romania, increased 1.7-fold from the first half of 2007 (51 million Romanian Lei) to the first half of 2008 (90 million Romanian Lei),

and about 3-fold for pediatric ENT during the same period (from 7.3 million to 27 million Romanian Lei). The analysis of geographical distribution of the activity in ENT departments revealed that the performance was quite different. Thus, counties with large university hospitals, such as Mures, Iasi, and Dolj, shared the same profile of many cases, long ALOS, and high CMI, which is different from the profile of other counties (Figure 3). Counties from the southeastern part of the country (Galati, Bacau) had long ALOS and a low number of cases. These are counties with more beds and ENT specialists than the national average, which was about 13 doctors and 60 beds per county in 2007 (MS, unpublished data). Both Cluj and Bucharest had a slightly shorter ALOS than the country average, whereas CMI and number of cases were very high. In contrast to adult ENT wards, pediatric ENT wards showed poor coverage of the national population: there were only 15 departments nationwide. For adult ENT wards, Cluj, Dolj, and Bucharest discharged most of the patients, but CMI was highest in Mures, Brasov, and Dolj. Cluj, Dolj, and Bucharest had the highest number of beds and physicians, but lower bed utilization as a result of shorter ALOS. Conversely, counties around Bucharest showed poor indicators, probably because their hospitals refer many patients to the capital.

DISCUSSION

This study shows that, similar to other countries, good quality statistical data and routine clinical data can provide a valid baseline for evidence-based patient management in Romania. However, the information system can and must be complemented with the data on actual costs of the ENT departments.

The hospital mortality in ENT wards was lower than in other surgical wards, probably because the procedures are less extensive or the survival after the surgical ENT procedures, even for malignant cases, is longer, so that patients mostly die at home.

Unpublished previous studies in Romania (Palas C and Musat S, personal communication) showed differences in the access to ENT wards, depending on the urban vs rural residence and the age group of the patient, with rural patients and young patients most frequently encountering difficulties in access. It must be mentioned that adult ENT wards even discharge patients younger than 5 years old (about 4% of cases); one explanation may be the absence of pediatric ENT wards in many counties, leading these patients to be treated in adult wards.

Adult ENT wards treated younger patients than wards of other specialties, with 36% of the discharged patients belonging to the 18-44 years age group, followed by 32% of the patients belonging to 45-65 years age group. In both adult and pediatric ENT wards, there were more male than female patients (over 60% for all studied years).

Similar to other countries (6), Romania shows some variations in the number of cases and ALOS among ENT wards, as well as in the geographical distribution of these wards. Having a large number of beds or ENT specialists does not necessarily lead to better outcomes; Galati county, for example, has a high number of specialists and hospital beds, but a long ALOS and low CMI.

Adult and pediatric ENT wards show clear differences in ALOS and degree of operability. A possible explanation is that children have more simple, but frequent, interventions for less complicated diseases (amigalectomies, adenoidectomies), and adults have fewer interventions for more difficult illnesses (tumors, injuries). It appears that a shift in surgical activity occurred in the period from 2006 to 2008 between adult ENT and pediatric ENT wards. The explanation lies in the switch from the HFCA DRG to the AR-DRG system, as a result of which pediatric ENT wards began to classify procedures previously classified as surgical (eg, amigalectomies and adenoidectomies) as non-surgical under the heading "Intubation, age<16 years." This heading carries a high cost weight, which is used to determine reimbursement levels from the state. The use of this heading also distorts our understanding of clinical reality, since the greater the number of cases classified into this DRG group, the lower is the operability (12,13).

As this example illustrates, major statistical changes, such as sudden shifts in morbidity reported by certain specialties or hospitals, should be interpreted in context and with caution by experts. During the decision-making process, managers must use statistical data according to their real meaning. Decision makers should not necessarily consider a decrease in the degree of operability as a true and unjustified reduction of surgical activity, or adopt punishing measures for the affected hospitals.

The changes that occurred together with the introduction of the AR-DRG classification system in the middle of 2007 should be carefully studied, both in terms of hospital management and in terms of accuracy of reporting. Apparently, increased performance, illustrated by CMI growth, can cause collateral losses, such as decrease in the proportion of surgi-

cal patients, as shown in the present study. This could be important, since CMI is used in Romania as an indicator of performance for the evaluation of hospital management. Even though patient miscoding can allow hospitals to receive more money, this "extra" money is capped. According to the Romanian legislation on hospital financing, which defines the framework contract drawn up between the state and DRG-financed hospitals (14,15), hospitals receive an amount based on the contracted CMI, with an overrun of up to 5% in the number of weighted cases per quarter, regardless of the actual CMI or actual reimbursement claimed by the hospital. This is the reason why some hospitals with high-volume pediatric ENT wards, such as clinical pediatric hospitals in Bucharest, reported large discrepancies between amounts claimed and amounts received.

The decline of the number of specialists and their uneven distribution in Romania may lead to serious problems in the access to ENT specialists, in hospital specialty wards and emergency services alike, especially in light of the continuous increase in the number of hospital cases. Regional disparities should be known and managed properly, through a management of the specialty based on objective data at the national level. The number of beds and wards, but also of specialists and on-duty shifts should be adequately planned, both in volume and in complexity, according to the morbidity treated. For instance, in Bucharest, the largest city in the country with a population of more than 2 million, there is only one emergency hospital with ENT wards, although there are 6 emergency hospitals. In other hospitals in Romania, even though they treat emergency cases, there is often only one ENT specialist on duty per shift, and the number of cases he or she must treat is large. In counties without any pediatric ENT ward at all, emergencies are often referred to adult ENT or other surgical wards with experience in treating children. Only 25% of counties have a pediatric ENT ward. Analysis of pediatric ENT indicators indicates that this specialty treats complex cases, so expertise in treating pediatric ENT cases exists in many places that do not have a separate pediatric ENT ward. On the other hand, there are counties such as Bihor, which have many ENT specialists and beds but rank in the penultimate quartile in indicators of performance, such as bed occupancy, CMI, and surgical cases. In these districts, it may be appropriate to reduce the number of beds or to search for appropriate measures to increase the performance of services.

Acknowledgment

The authors thank their colleagues at the NSPHMCME for their help in data collection, and to Marius Ciu-

tan, MD from the Department of Research, NSPHMCME, Bucharest, for assisting in the graphical analysis of the geographical distribution of various indicators.

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