

THE ASSESSMENT OF MORBIDITY AND THE USE OF HOSPITAL SERVICES IN A COUNTY, FOR BETTER PLANNING HOSPITAL INFRASTRUCTURE

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Abstract: Background: The healthcare need and costs are increasing, hospital expenditure having a big impact. New hospital structures need to be projected based on population and morbidity needs, standards and guidelines. Objectives: To assess the discrepancy between the need and the supply of hospital services, to support projects for new hospital infrastructure. Materials and methods: Literature review about hospital planning, design and building, completed with data analysis of demographic, morbidity indicators and hospital utilisation indicators. Results: In spite of lack of harmonization of morbidity coding, and various catalogues used by different institutions, it is possible to use in Romania demographic, morbidity, and hospital utilization data to assess the need of hospital services; there are discrepancies in utilization between similar wards in different hospitals; surgical activity cannot be assessed only based on hospital beds. Conclusions: A unique reporting standard is needed; further analysis is necessary to assess the need for operating theatres and actual plan new hospitals.

INTRODUCTION

Increasing health spending is seen all over the world as an important source of budget deficit. There is an increasing uncertainty if these increased costs lead necessarily to better health. Some studies (Orszag, 2009) from United States – country already famous for the high health spending - have shown that about \$ 800 million / year is spent without a better health outcome. In the United States, health spending has grown steadily, in the last 5 years was constantly above 17% of gross domestic product (GDP) (reaching 18.2% in 2018) (1), becoming thus unsustainable. This triggered action from the US authorities, initiated through the ACA (Affordable Care Act) in 2010. This act extended the coverage to health insurance for patients, but reduced the level of reimbursement for hospitals and health service providers.(2)

Hospital spending represents one of the biggest health costs, including both construction and operating expenses.(3) The efficient management of scarce resources is also an essential issue here, for allowing hospitals to continue the provision of the qualitative services to patients.

The largest share of the hospital costs is due to fixed buildings and expenses, supporting the theory of the economy of scale, according to which large hospitals are the best. However, studies that are more recent have shown that many health decision makers have an opposite view.(4)

The number of beds is a classic indicator of health services, but it has not proved to be a decisive element for the sustainability of hospital services. In many European countries - which have inherited many hospitals older than 20 years - both the renovation and modernization of hospitals and the construction of new ones have led to an increase in the number of hospital beds, in the context of the need of costs decrease. Reduction of hospital beds, although apparently a cost-cutting measure, could cause adverse effects by excessive shortening of hospital stay, premature discharges leading to an increase in

readmission rates in less than 72 hours.(5)

Decisions to invest in hospital building or renovation should start from the assessment of existing structures, taking into account the health needs, the hospital performance, but also future sustainability.

As a result, the urgent challenge faced by both researchers and health authorities is to identify measures to reduce health expenditure or costs without affecting the quality of services.(6)

PURPOSE

This research aims to compare the need for health services in a given area and the supply of hospital services in that area; as basis for the development of a planning model for hospital infrastructure, according to the morbidity and existing hospital facilities in a certain geographic area. This could contribute to better resource utilization and better serve the medical need of the people in that area.

MATERIALS AND METHODS

The first part of the research has sought scientific evidence on modern methods for planning and construction of hospitals based on standards but also on the needs of the population.

The method used was the literature review, as described below: an electronic search was performed on scientific databases and the "grey" literature, widely available on the Internet. The legal provisions and the applicable rules in force in Romania have been reviewed.

They were used the following search terms: international hospital, guidelines, standards, planning, construction, beds. The search in scientific databases such as Google Scholar, Web of Science, Scopus and PubMed, did not return relevant results. In the next step, an exhaustive search was performed with the Google search engine, using the same search

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terms. This new search returned about 12.8 million results, of which were selected the texts published after year 2000, containing both general principles and specific instructions, quantifiable, on sizing, planning, design, adaptation of hospitals based on standards international and population needs.

The online search returned a number of manuals, guidelines and recommendations of the institutions or organizations recognized internationally, as the World Health Organization, Joint Commission Accreditation of Hospitals, Red Cross etc.

In the second part of the research, statistical databases available at national level were used, with the aim to describe the current situation in Romania, regarding the need for hospital services or the features of the services already available, in a county with university center. This type of county was selected, since it has the highest complexity of available hospital services, but also the biggest challenges. There is a large addressability of patients from other counties.

The need assessment for services at the county level was made based on quantitative criteria, such as demographic and socio-epidemiological criteria, on health status indicators (mortality and morbidity) and the use of hospital services (surrogate indicator of the need for health services).

The assessment of the hospital services supply was made based on the analysis of the activity indicators of the hospitals (diagnoses and procedures performed, type of hospitalization and the type of hospital discharge, hospital mortality), some structural indicators (type and size of the hospital, number of beds, types of wards and specialties, number and types of operating rooms) and existing norms.

The study included all types of hospitals in the county, having contracts with the health insurance houses, all the cases discharged from these hospitals (continuous hospitalization) between 2015-2017, corresponding to validated cases (clinically correct and qualifying to be reimbursed by the national health insurance). All the patients reported by the family doctors in the county, during 2014-2017 and the population of the county, reported by the National Institute of Statistics, were included.

They were excluded from the study the cases that have not been validated, under the validation rules applied by NSPHMPDHB (National School of Public Health, Management and Professional Development in Health, Bucharest), in accordance with the legislation in force at the time of the patients discharge (were not properly recorded either sex, date of birth, date of discharge, date of surgery, the principal surgeon, identity data, the length of stay, the status at discharge, principal diagnostic codes, or surgical procedures).

Data collection has been made using available public sources (such as hospital websites, county health insurance websites, www.drg.ro). Data provided by NSPHMPDHB were also used- DRG codes of the discharged cases, the surgical activity and other indicators of hospitals activity, regarding the complexity of the activity, the type of the admission and discharge, the number of the patients resident in the same county as the hospital, the hospital mortality, etc. NIPH (National Institute of Public Health) - provided data on population statistics, the number of the new cases recorded by the family doctor, population mortality, the organization of wards and the number of beds in hospitals, some of the hospital use indicators. Pathologies and morbidity were analyzed according to diagnostic codes - ICD classification with 999 codes used by the family doctors, respectively ICD 10 / RO DRG V1 at the hospital level. Surgical procedures were analyzed according to RO DRG V1 codes.

The catalogues for hospitals and wards from NSPHMPDHB and NIPH were used, mapping their codes where

necessary. Data were processed with Microsoft Excel and Access, databases were inquired with SQL Server. Basic statistics were used for comparison.

RESULTS

The bibliographic sources show that identifying the real need for a new hospital should be based on research, referring to: sociodemographic aspects and the estimation of their future trends, payment modalities, existing expertise, the local community needs and perceptions, competition, evaluation of the existing facilities (structure, dimensions, operation, use), the future needs. This is to enable the operation of the new hospital (including compliance with the dimensions / spaces required for operation), compliance with standards (including earthquake resistance requirements, fire resistance, flood resistance, accessibility, and safety) and with hospital type and classification. All of these are intended to show whether the existing structure meets the present and future needs of hospital services, thus ensuring sustainability.(7)

The principal steps of a typical hospital capacity planning process were described by Neufville R. et al. in 2008:(8) demand projection on hospital level, regional level and local level; demand projection at different healthcare providers (primary, secondary, tertiary care); at individual hospitals; high level capacity design (number of operating theatres, size of departments, number of beds); low level capacity design (e.g. departmental arrangements and more).

The need for minimum standards to ensure the quality of hospital services is recognized at international level, various organizations thus publishing reports or manuals, rules or regulations on these standards (American Hospital Association, Joint Accreditation Commission of International Red Cross).

For example, the Red Cross published in 2006 the "Hospital Building Manual", which contains as main chapters the hospital's general organization, the specialized services (operator sections and blocks), the safety standards (regarding installations etc.).(9)

In Romania, a report prepared in 2009, "Management of Infrastructure Projects for the Hospitals in Romania, Final Report", described the situation of hospital care at the time, provided through 409 hospitals, of which only few benefited from rehabilitation in the last 20 years. The report mentions that the average life span of hospital buildings is 30-40 years; therefore, a correct decision is needed, regarding the upgrading existing buildings or rather building new ones that meet current needs. The literature review shows that the number of acute hospital beds in Europe has the tendency to decrease in recent years from 536.28 beds /100,000 inhabitants in 1996 to 396.43 in 2013. The development of the complementary services for primary, secondary (outpatient, day-care) recovery or home care, accompany the reduction of the hospital beds. The aim was to assist the patient in the most favourable environment, reducing adverse events and increasing safety.

In Romania, the reduction of the number of hospital beds, from 5.85 in 2007 to 4.3 beds / 1000 inhabitants in 2014, was an objective of health policy. However, comparing to the European level, the initial number of beds was not hugely large; this is why more important would have been to analyze the utilization of those beds. This assumed measure, on reducing the number of beds, was likely to generate a major reorganization of the entire health system, including the development of prevention systems. In this context, the government was announcing, in April 2009, the intention to build 15 new hospitals, out of which 7 emergency hospitals and 8 regional hospitals.(10,11)

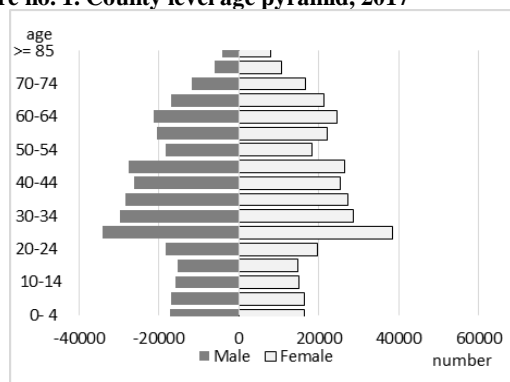
According to the National Institute of Statistics, in

Romania, there were 567 hospitals nationwide in 2016, out of which 366 were in the public network, the rest being private hospitals.

The total number of beds in hospitals countrywide was 132,047, out of which 125,079 were in the public network. In total, the number of beds in hospitals and health centers with hospital beds was 132,277, out of which 7,945 beds for day hospitalization. The highest number of beds were in Psychiatry (16,435), Surgery (13,970) and Internal Medicine (11,809), followed by other specialties.

In 2016, according to INSSE data, 4,186,838 patients were hospitalized, out of which 3,993,209 in public hospitals.(12) In order to assess the need for hospital services in the studied county, the data from NIPH and NSPHMPDHB were analyzed.(13,14) The analysis proves that the population number in the county had a slight increase trend, from 700,090 inhabitants in 2014 to 702,904 inhabitants in 2017, especially in the age group of 0-4 years and 65+ years. These are vulnerable age groups requiring special care. This trend may in the future impose the development of neonatology, pediatrics, gerontology, neurology, recovery / rehabilitation services. However, this has to be considered with caution in the context, as it may include a mechanical effect due to temporary migration from other counties, due to the attractiveness of industrial development in the studied county.

Figure no. 1. County level age pyramid, 2017



Although the largest population share is represented by the adult age group (15-64 years), about 70% of the total population of the county (Chart 1), most of the deaths occur in the 65+ age group, which accounts for about 70% of total deaths.

The analysis of new cases reported by family physicians shows that the newest cases of illness are due to respiratory, digestive, genitourinary, osteoarticular and circulatory diseases. In the same time, most deaths are due to tumours, circulatory and digestive diseases, osteoarticular diseases, but also mental and behavioural disorders. The analysis of the mortality on the ICD 10 codes of death, 20 diagnoses are responsible for 80% of deaths- cardiovascular diseases, lung, stomach, colon and breast cancer.

Overall, the number of the hospital beds in the county decreased from 4.887 in 2014 to 4.803 in 2017, meaning that the coverage with beds decreased from 6,98 beds to 6,83 beds/1000 inhabitants.

During the analyzed period, 19 hospitals reported data, of which 3 private units, for the latest ones only NSPHMPDHB provided data at the hospital level.

Although most new cases are respiratory, digestive and genitourinary diseases, the most numerous beds are for general surgery. The obstetrics gynecology and oncology surgery beds are the most frequent (explicable given the high

frequency of lung, digestive and breast tumours).

The second place in the top of the most frequent bed numbers are internal medicine and paediatrics - nonspecific for a certain pathology. Gastroenterology and psychiatry follow: although the number of new cases of psychiatry is not among the most frequent, yet there are many psychiatric hospitalizations, which could explain the large number of beds allocated to this specialty.

It is worth mentioning that, given the university profile of the county, the hospital beds ensure the care as follows: 60% for the resident population in the county and 40% for the other counties. In this context, the distribution of the beds can be influenced by the morbidity of the patients from other counties, hospitalized in the studied county.

Comparing to the national average of approximately 50% in 2017, the 40% average of the emergency admissions in the studied county is lower (www.drg.ro); in 2015-2017 there is an increase in the number of referrals from the family doctor. Although the proportion of discharges by transfer is small, it has increased during this period with 48% (from 1.37 to 2.30).

The analysis reveals that the county has a proportion of hospital deaths higher than the national average (2.61 versus 1.9 in 2017), but the frequency of discharges on demand is much lower (1.24 versus 2,5).

Regarding surgical activity in surgical departments, the proportion of patients who had surgery is higher than the national average, throughout the study (77.51 versus 66.94 in 2017). The proportion of these patients increased from 74.49% to 77.51% from 2015 in 2017, while at the national level it increased from 66 to 66.94%.

Surgical hospital activity analysis shows the most of the cases having a principal surgical procedure were discharged from Clinical Emergency County Hospital, Institute of Oncology, Institute for Digestive Disorders, Emergency Hospital for Children, Municipal Clinical Hospital.

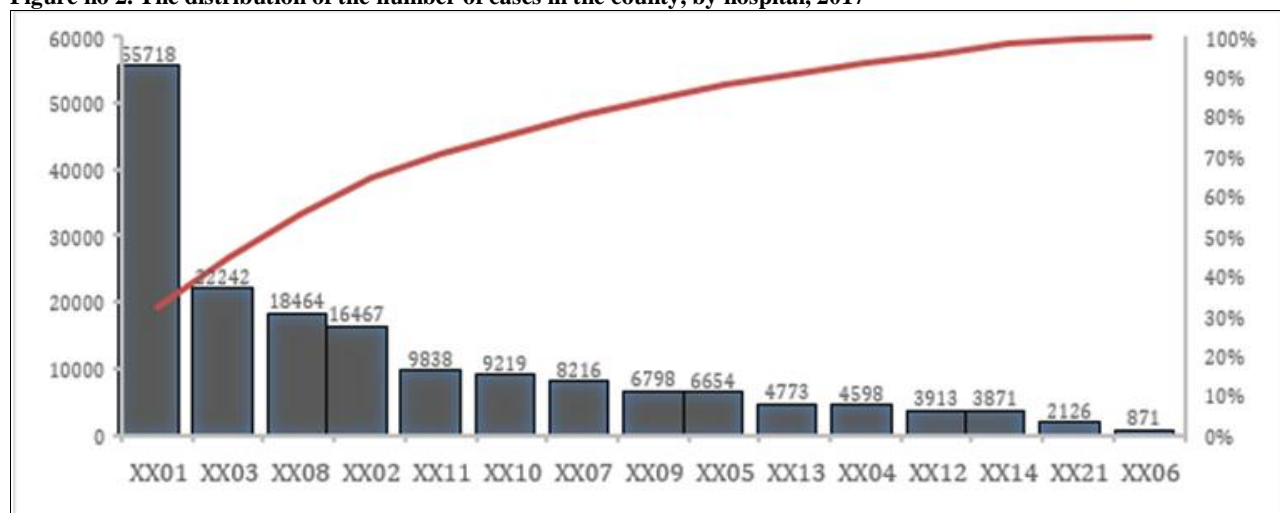
Clinical Emergency County Hospital achieved over 47% of the cases with a principal surgery procedure, the five above mentioned hospitals making together 80% of those cases in the county.

The large addressability to the hospitals listed above, for performing surgical interventions, is also explained by the fact that the county has university activity. This is important for further elaboration of the analysis regarding the optimal resources needed for performing the surgical activity at county and hospital level.

Compared to a national average of approximately 78% throughout the studied period, the proportion of patients resident in the same county as the hospital is slightly over 60% (60.11% in 2017), explained by the large number of specialized institutes for cardiology, digestive disorders, oncology, transplantation), which are reference centres for patients resident in neighbouring counties.

The patients in group U3022, Schizophrenic disorders with no legal status of mental health, accounted the highest number of hospitalization days, 87,131 in 2015, 87,238 in 2016 and 75,708 in 2017.

A first analysis of the case mix index (CMI) for hospital activity in the studied county shows that there is a large variation in the complexity index of the cases between hospitals, calculated on the validated cases discharged from the acute departments, although all the hospitals have a relatively large CMI. The 2017 data analysis shows that CMI variation between hospitals was between 0.8282 and 2.4528, with a median of 1.4231. The number of hospitalized cases ranges between a minimum of 871 cases and a maximum of 55,718 cases per hospital, having in 2017 a median of 6,798 cases (table no.1).

Figure no 2. The distribution of the number of cases in the county, by hospital, 2017

From the total 17 hospitals (15 public and 2 private) that have reported data to NSPHMPDHB and NIPH during the studied period, six discharged between 861 and 5871 cases per year. There are also four hospitals, which discharged more than 10,000 patients per year. Thus, 5 hospitals have discharged over 70% of cases. An adjustment should then be done to the activity indicators (number of cases, number of patients, number of days of hospitalization, number of surgeries), in order to be relevant for the county population and remove the effect of “migration” between counties in order to get better care (figure no.2).

The adjustment factor should be 60%, because, according to the analysis, only 60% of the cases are residents in the studied county.

DISCUSSIONS

The result of the data analysis confirms the possibility to perform the evaluation of the need for hospital services, in Romania, using the socio-demographic data, together with morbidity data of the population from the studied county. The different catalogues for diagnosis, or libraries of hospitals and wards, make difficult the integration of data from different sources. A lot of validation and checks were required to acquire a satisfactory data quality.

The utilization indicators of hospital activity can be used as a proxy for the confirmation of the medical need. For instance, the large number of hospitalization days and cases with psychiatry disorders indicates the need for such services, although the incidence of such diseases- as recorded by the family doctor- is not in the top.

There are big differences between hospitals for the same type of specialty ward, in terms of length of stay, mortality, utilization rates of the beds. These differences need to be further explored, potential causes could be the differences in addressability according to the brand of the hospital.

The number of beds per hospital, as sole indicator, is not enough to assess accurately the activity of the hospital. Further analysis are needed, to integrate the pathologies, the Norms and legal provisions related to the hospital building, with the existing situation of the surgical beds and operating theatres, to provide a relevant landscape of the need of surgical facilities.

In addition, all the utilization indicators need to be adjusted to remove the effect of the population coming from other counties to have hospitalization in the studied county.

Most of the hospitals are old hospitals (more than 35 years), flagging the need of upgrade or building new hospitals-

as described by the literature.

Table no. 1. Comparative description of the structure and activity indicators of the county hospitals studied, for the year 2017

NHIH* code	Hospital name	Number of validated cases	CMI	No. of urban beds	Bed turnover rate
XX01	Clinical Emergency County Hospital	55.718	1.4650	1404	40
XX02	Institute for Digestive Disorders	16.467	2.2116	410	40
XX03	Clinical Emergency Hospital for Children	22.242	1.2333	505	44
XX04	Hospital of Pneumo&TB	4.598	1.7245	170	27
XX05	Clinical Hospital of Infectious Diseases	6.654	1.9612	192	35
XX06	Clinical Recovery Hospital	871	1.8635	385	2
XX07	Municipal Clinical Hospital	8.216	1.4232	282	29
XX08	Oncology Institute	18.464	1.2432	535	35
XX09	Institute for Cardiovascular Diseases	6.798	2.4528	178	38
XX10	Municipal Hospital 01	9.219	1.1158	223	41
XX11	Municipal Hospital 02	9.838	1.1641	230	43
XX12	Municipal Hospital 03	3.913	0.8282	45	87
XX13	City Hospital	4.773	1.0237	109	44
XX14	Municipal Hospital 04	3.871	0.9806	60	65
XX21	Transplant Institute	2.126	1.5310	75	28
	Total county	173.768	1.4751	4.803	36

CONCLUSIONS

There are several challenges related to the aging population, the addressability of complex cases (like tumours, cardiovascular diseases, and psychiatry), the overuse of some services (high utilization rates of the beds) or lack of use of other services. Also, this first analysis identify the potential need

of more beds for chronic diseases, rehabilitation, palliative care, or triggered the recognition of the special situation of some specialties like interventional cardiology - which currently is hidden in the general cardiology wards (non-surgical). The high number of surgical cases comparing to the national average needs to be analysed separately, to correctly identify the exact need of operating theatres per specialty and hospital, together with the complementary services, like imaging.

A unique standard of reporting and coding of the morbidity, hospital activity and hospital structure, to be used by all entities collecting data on routine basis, would be highly recommended, to enable qualitative analysis.

Although putting together in a standardized manner the information obtained from different sources and databases is not an easy task, it can be done as a preliminary step in planning new hospital infrastructure, according to population need.

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