

# DESCRIPTIVE STUDY REGARDING THE SITUATION OF HOSPITALIZATION EPISODES DETERMINED BY MEASLES IN ROMANIA, ANALYSIS OF THE LAST 5 YEARS

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*Measles is still one of the communicable diseases that causes an increasing number of diseases worldwide, being one of the leading causes of mortality, especially among young children. Although measles vaccination has greatly reduced both the frequency of epidemics and mortality, economically underdeveloped countries, with a fragile health system, often lacking sufficient material resources to provide children with an adequate nutritional level and implicitly a proper immune function, faces frequent epidemics and high infant mortality. Although Romania is one of the European countries that continues to fight this disease, the analysis of data on hospitalization of measles cases in the last 5 years indicates a positive trend, both in terms of complicated cases caused by disease, cases requiring hospitalization, their number decreasing constant in recent years, as well as the number of in-hospital deaths which have also decreased in the last period of time*

**Keyword:** hospitalization, measles, Romania

## INTRODUCTION

Measles, a highly transmissible viral disease that is one of the leading causes of high mortality among children, has led to multiple epidemics globally in recent years, with epidemics resulting in a high number of deaths, especially among young children. Thus, worldwide, in 2018 there were over 140,000 deaths, mostly in children under 5 years. The introduction of measles vaccination managed to reduce the number of deaths due to complications of the disease, for example between 2000-2018 the decrease was 73% (from an estimated value of 536,000 in 2000 to 142,000 in 2018), it was estimated that were prevented about 23.2 million deaths [1]. Deaths occur as a result of severe complications that include encephalitis, severe diarrhea with dehydration, severe respiratory infections such as pneumonia, ear infections, blindness, and more commonly affect children under 5 years of age or adults over 30 years of age. However, the forms with severe complications are found especially in the case of malnourished, immunodeficient children, those infected with HIV / AIDS or having other comorbidities. Measles is still common in developing countries, especially in economically underdeveloped areas in Africa or Asia. More than 95% of measles deaths occur in countries with low health infrastructure and low incomes / per capita. Also at risk for dangerous epidemics are areas of conflict or where natural disasters have occurred [1].

The European region reported for 2018 a number of 83540 cases and 73 deaths, compared to a number of 25869 cases and 42 deaths in 2017 and 5273 cases and 13 deaths in 2016. In 2018, several countries (Ukraine, Serbia, France, Italy, Russia, Georgia and Greece) each reported over 2000 cases [2]. According to the latest report from the European Commission for Regional Verification for the Elimination of Measles and Rubella, based on data from 2017 it can be said that in 37 of the 53 countries in the European region measles has been eliminated, the interrupted transmission for at least 3 years being documented, another 5 countries documented the interruption of the transmission for at least 2 years, but less than 3, and one

country for the interruption of the transmission for one year. Ten countries, including Belgium, Bosnia and Herzegovina, France, Georgia, Germany, Italy, Romania, Russia, Serbia and Ukraine, remain endemic areas for measles. The process is resumed annually, with countries reporting reports of discontinuation of disease transmission for 12 months or more providing a detailed epidemiological and molecular analysis (measles virus genotypes and progeny) to document the absence of continuous measles transmission or restored endemic transmission [2].

In Romania, in 2017, 9076 confirmed cases and 26 deaths were registered nationwide. The incidence at national level in 2017 was 46.2% 000 inhabitants, 3.8 times higher than in 2016 (12.2% 000) [3]. According to National Public Health Institute, the counties of Satu Mare (249.3 / 100,000), Caraş-Severin (214.6 / 100,000), Braşov (147.1 / 100,000), Timiş (135.9 / 100,000), Călăraşi (133.5 / 100,000) and Arad (123/100000) recorded the highest incidence rates, and as age groups the most affected were children under 1 year (848.9% 000), group 1- 4 years (419.6% 000) and the age group 5-9 years (168.2% 000). [4] Until 22.03.2019 the number of registered cases was 16211, of which 62 deaths, a much higher number compared to previous years [5]. According to the WHO Europe, almost 2/3 of measles patients (61%) end up in hospital [6]. Taking into account these data, the National School of Public Health, Management and Professional Development in Health, Bucharest (NSPHMPDH) conducted a study on the situation of hospitalization episodes for measles patients hospitalized in public hospitals in Romania, during 2016- 2020, a study whose results will be presented below.

## OBJECTIV

Identification at national, regional and local level of the geographical distribution of hospitalization episodes for measles patients, as well as the temporal evolution of their number, during 2016-2020.

## METHODOLOGY

A descriptive, retrospective study was performed, which used data from the National DRG Database, data reported in a continuous hospitalization regime by Romanian hospitals in a contractual relationship with the National Health Insurance House. In accordance with the provisions of the Order. no. 1782/576/2006 on the registration and statistical reporting of patients receiving medical services in continuous hospitalization and day hospitalization, with subsequent completions and modifications, NSPHMPDH collects and processes the minimum set of patient-level data for cases treated in continuous and day hospitalization.

The data used in this study were reported in the period 2016-2020. The analysis of the data regarding the hospitalization episodes in the case of measles patients in Romania was followed, in the previously mentioned hospitals (hospitalizations in continuous hospitalization regime). The data were selected using the ICD-10-AM classification, the records were extracted and analyzed from the observation sheets which most frequently had as main diagnosis one of the codes: B05.2 (Measles with Complicated pneumonia), B05.8 (Measles with other complications), B05.9 (Measles without complications), B05.4 (Measles with intestinal complications). In addition, a number of other codes of other main diagnoses of infectious or parasitic diseases, malignancies, fractures, surgical conditions, etc. presented by patients with measles, diseases for which they were hospitalized, were included in the analysis.

In accordance with the provisions of Law 190/2018 and of Art. 13 of EU Regulation no. 679/2016, the personal data are deleted at the time of transmission to NSPHMPDH, and the identification of persons for the purpose of analysis is made on the basis of encrypted code of identification. The age of the patients was calculated in months / years of age, as the difference between the date of hospitalization and the date of birth. The data were processed using the SQL Server Management Studio Express 2005 software, further processing and analysis was performed using SPSS and Excel. The analysis was performed according to a series of demographic and socioeconomic variables, such as age, length of hospitalization, state of discharge, etc., information included in the minimum set of data reported in the DRG system by hospitals. The interpretation and presentation were done in the form of tables and graphs.

## RESULTS

Following the processing and analysis of data from the DRG database, their interpretation was performed in

**Table 1. Situation of the number of hospitalization episodes, during the study period, in continuous hospitalization and in the adult and child infectious disease wards**

Year	2016	2017	2018	2019	2020	Total
Total episodes of continuous hospitalization	4089119	4090251	4137191	4150361	2520765	18987687
Episodes of hospitalization in adult infectious disease wards	316	1278	1147	665	215	3621
Episodes of hospitalization in children's infectious disease wards	2873	9866	6884	3285	1102	24010

relation to a series of demographic variables and socioeconomic characteristics (age, length of hospital stay, in-hospital mortality rate, discharge status) following the geographical distribution and temporal evolution of hospitalization episodes of measles patients, from hospitals in our country, in the period 2016-2020.

### 1. Total number of hospitalization episodes in case of measles patients, registered in Romania, in the period 2016-2020

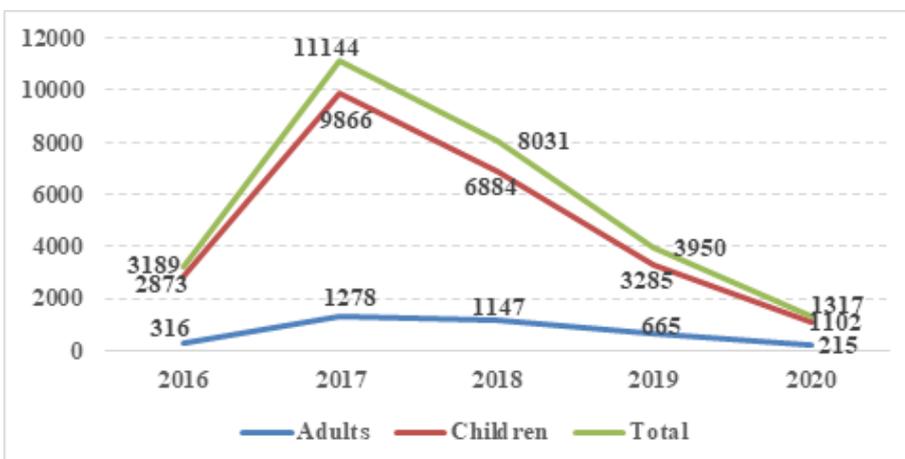
The total number of continuous hospitalization episodes for measles-infected patients registered in Romania in the period 2016-2020 was 27,631 episodes, representing approximately 0.14% of the total number of hospitalization episodes nationwide during this period. Of the total number of episodes of hospitalization in infectious disease departments during this period, the number of episodes due to measles in adults accounted for 13.1% (3621 episodes), while in the case of children accounted for 87% of all hospitalization episodes recorded in children's infectious diseases departments (24010 episodes) - table 1. In 2020, in a pandemic context, the total number of hospitalizations in continuous hospitalization decreased sharply, to 60% compared to the previous year, due to the restrictions imposed, changes in the structure and functioning of health units and even the attitude of the population. Compared to the year with the most episodes of measles hospitalization, in 2017, there is a reduction of almost half in 2019 and 6 times in 2020 in adults, while in children the reduction in the number of episodes was more important, in 2019 the number decreases compared to 2017 three times, and in 2020 almost 9 times.

### 2. The temporal evolution regarding the hospitalization episodes of the measles patients, in Romania, in the period 2016-2020

The temporal evolution of the hospitalization episodes in the case of measles patients during this period can be observed in graph no.1. At the beginning of the period, the trend was increasing, with a maximum recorded in 2017, then there was a steady, sharp decrease in the number of episodes, 1.4 times in 2018 compared to 2017, almost 3 times in 2019, and in 2020 the decrease was 9 times compared to what was recorded in 2017 and more than 2 times compared to the initial year.

### Distribution of hospitalization episodes of measles patients, depending on the discharge department

**Graph no.1. Evolution of the total number of episodes reported in continuous hospitalization, in patients with measles, registered in the period 2016-2020, at national level**



**and discharge diagnosis, in Romania, during 2016-2020**

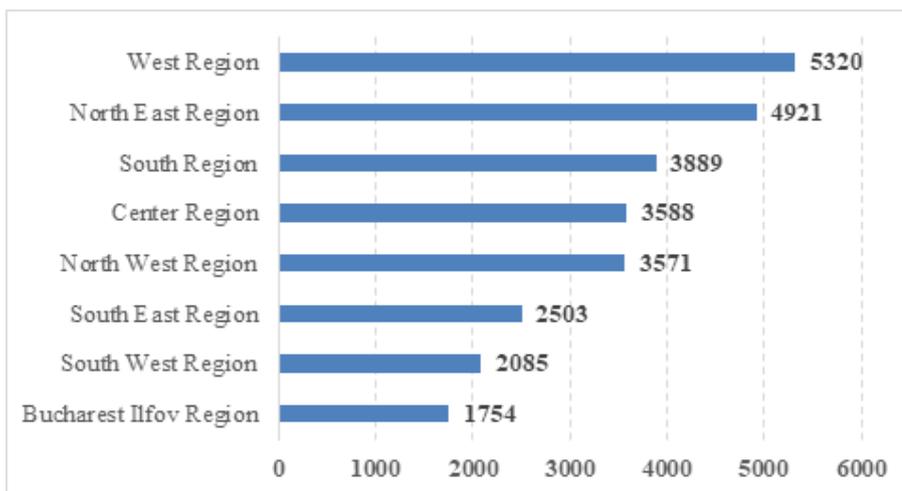
Most episodes of hospitalization for measles patients were recorded in the infectious disease departments, adults or children or pediatric wards (10.8% of all episodes of disease in children), the rest going to the other types of wards, among them the most frequently observed being the departments of HIV / AIDS, pediatric pneumology and pediatric recovery or the departments of internal medicine in the case of adults. As the main diagnosis at discharge, the following were most frequently recorded: Measles complicated with pneumonia (48%), Measles with other complications (12.4%), Measles without complications (11.8%), or Interstitial lung disease, unspecified (5%). As a secondary diagnosis, the most frequently mentioned were: Candida stomatitis, Measles without complications, Probably infectious diarrhea and gastroenteritis, Measles complicated with pneumonia, Measles with other complications, Hypovolemia, dehydration, Other iron deficiency anemias, Anemia iron deficiency, unspecified, Nutritional anemia, unspecified, Other water and electrolyte disturbances, not elsewhere classified, Other viral enteritis, Bacterial intestinal infection, unspecified, Measles with intestinal complications.

**4. Distribution of hospitalization episodes in case of measles patients, at regional and local level, in the period 2016-2020**

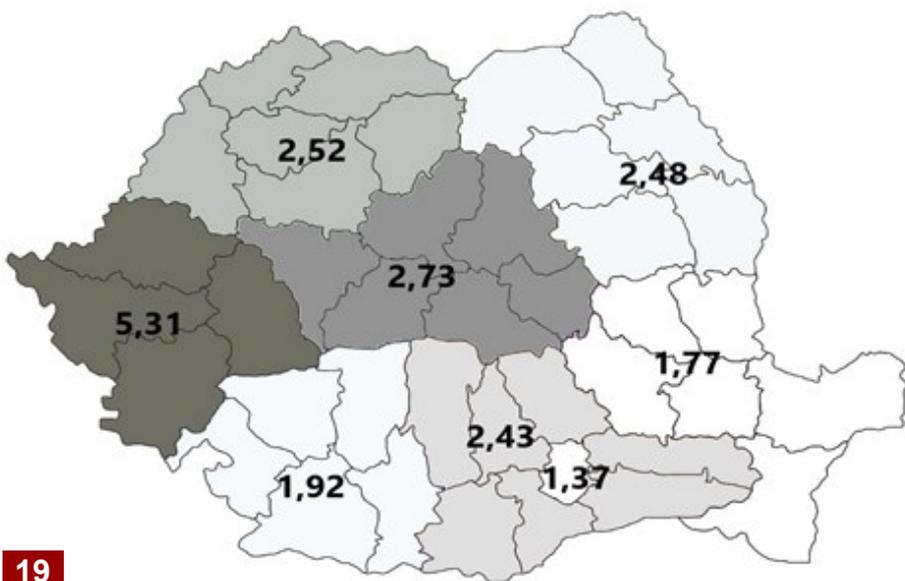
At the regional level, most episodes of hospitalization were recorded during the study period for measles patients in the Western (19% of the national total) and North East (18% of the national total) regions. The regions of Bucharest Ilfov and Sud-Vest recorded the fewest episodes of hospitalization through this main diagnosis, with 6.3 and 7.5% respectively - graph no.2.

In relation to the number of inhabitants, the descending order of the regions that recorded episodes of hospitalization of measles patients was: West region (5.31 episodes/10,000 inhabitants), Center region (2.73 episodes/10,000 inhabitants), North West region (2.52 episodes/10,000 inhabitants), North East region (2.48 episodes/10,000 inhabitants), South region (2.43 episodes/10,000 inhabitants), South West (1.92 episodes/10,000 inhabitants), South East 1.77 episodes/10,000

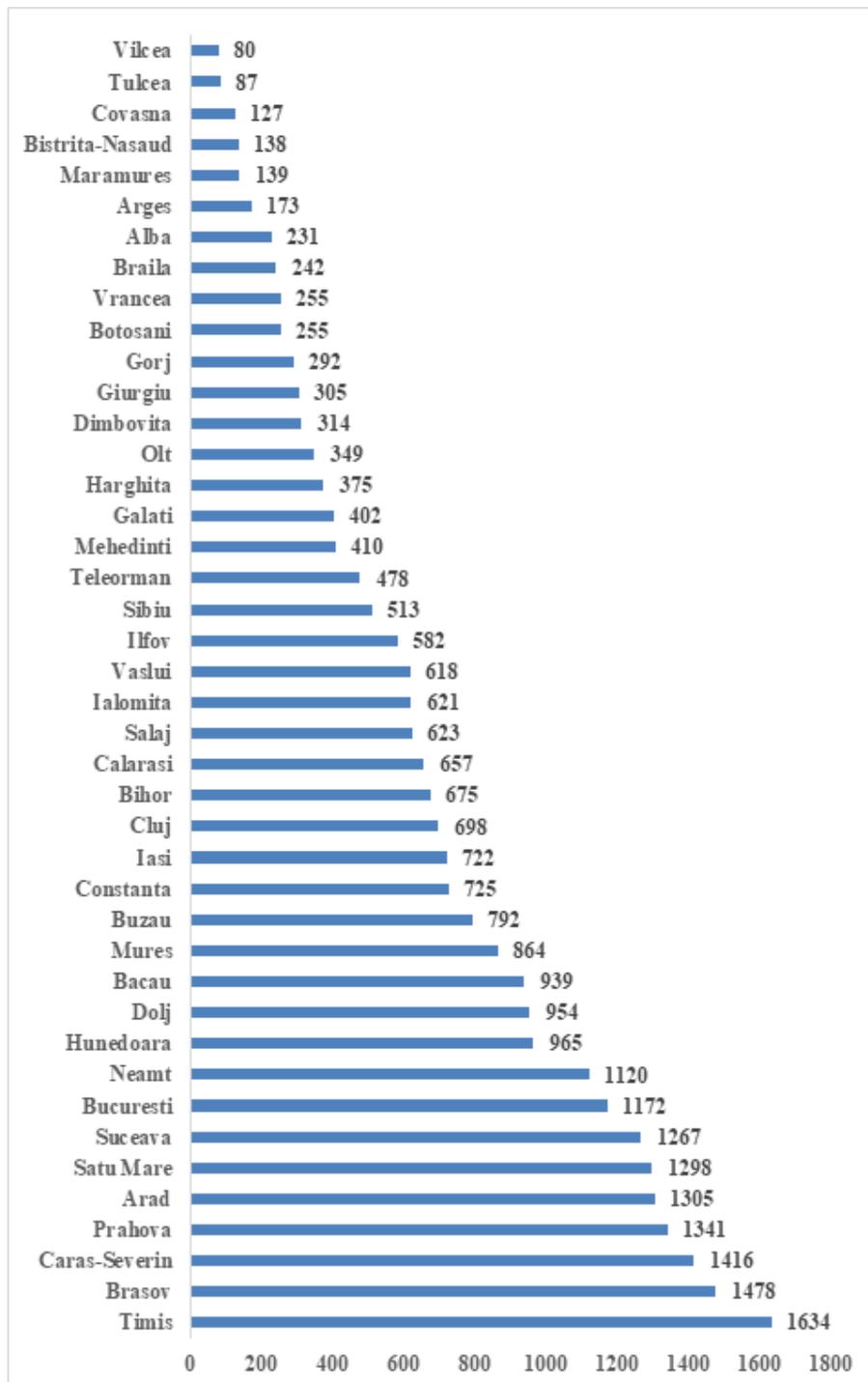
**Graph no. 2. Distribution of hospitalization episodes in case of measles patients, at regional level in Romania, during 2016-2020**



**Graph no. 3. Distribution of hospitalization episodes in the case of measles patients, according to population, in Romania, between 2016-2020**



**Graph no. 4. Distribution of hospitalization episodes in case of measles patients, at local / county level, in Romania, during 2016-2020**



inhabitants) and Bucharest Ilfov (1.37 episodes/10,000 inhabitants) - graph no.3.

At the local level, most hospitalization episodes were registered between 2016-2020 in the counties of Timiș, Brașov, Caraș Severin and Prahova, at the opposite pole being the counties of Tulcea and Vilcea, with less than 100 episodes of hospitalization (graph no. 4)

Compared to the population of each county, a change in the ranking can be seen from graph no. 5, with the first places being the counties of Satu Mare (6.69 epi-

sodes/10,000 inhabitants), Ialomita (6.68 episodes/10,000 inhabitants) and Covasna (6.39 episodes/10,000 inhabitants), and on the last counties Vaslui, Dâmbovița, Argeș, Tulcea, Bistrița Năsăud, Dolj and Mehedinți, as well as the city of Bucharest, with less than one episode/10,000 inhabitants.

**5. Distribution of hospitalization episodes in the case of measles patients, according to patient age**

The analysis of data by age groups indicates that at the national level, for the entire study period, most hospitalization episodes were recorded in the younger age groups, 50% of hospitalization episodes being recorded in children under 4 years - graph no.6.

The analysis of the data in the case of adults notes that most hospitalization episodes also belong to young age groups, under 40 years (84.5% of the total number of hospitalization episodes recorded among adults) - chart no. 7.

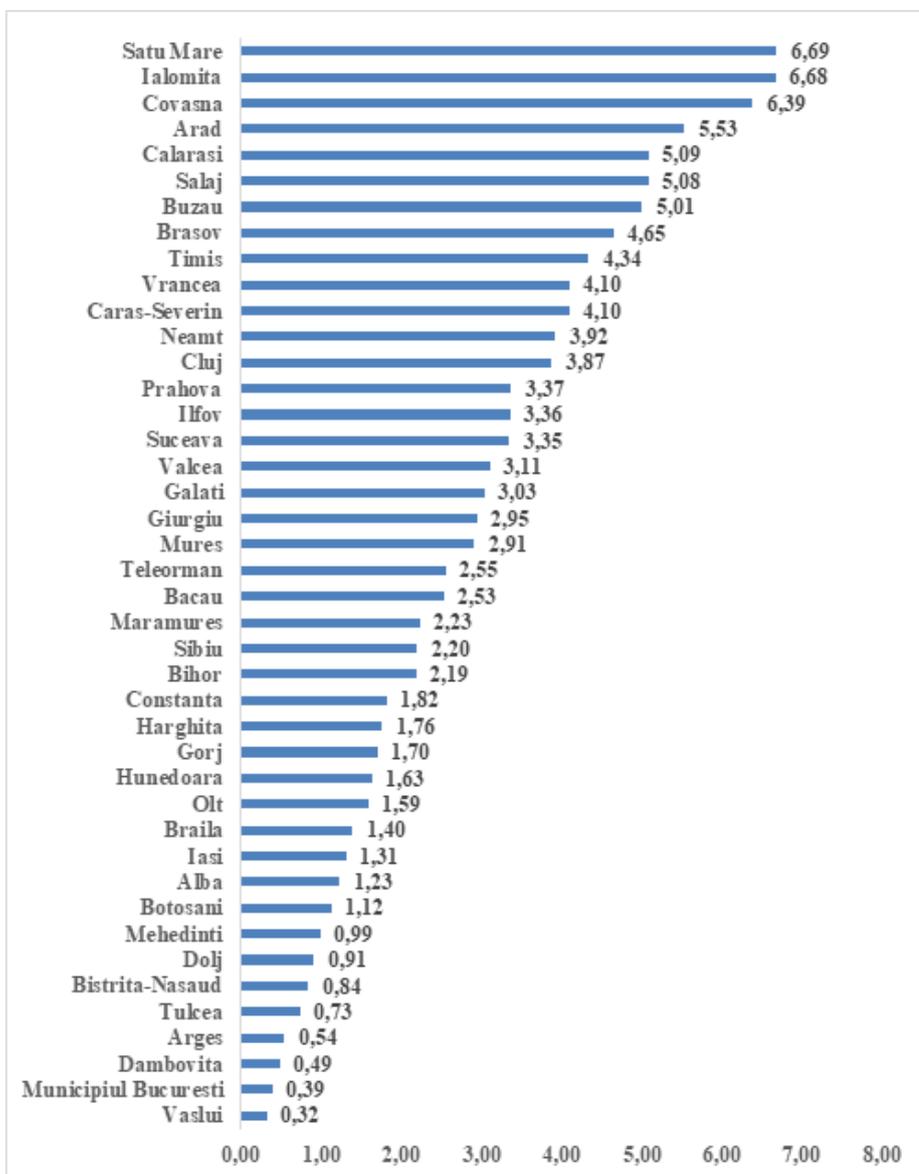
From the point of view of the evolution of the number of hospitalization episodes, it is found that, after a significant increase, 3-4 times the number of cases in 2017 compared to the previous year, in the following years the decrease is continuous and more important for children, in the following years there are also 9-10 times reductions for children under 5 years old, between 5-10 years old and those in the 15-18 years old group - graph no.8.

In the case of adults, there is also an increase in the number of hospitalization episodes in 2017 compared to the previous year, even 3-4-5 times in younger groups, up to 50 years, followed by a reduction in hospitalizations, less accentuated than the one observed in the case of children - graph no.9.

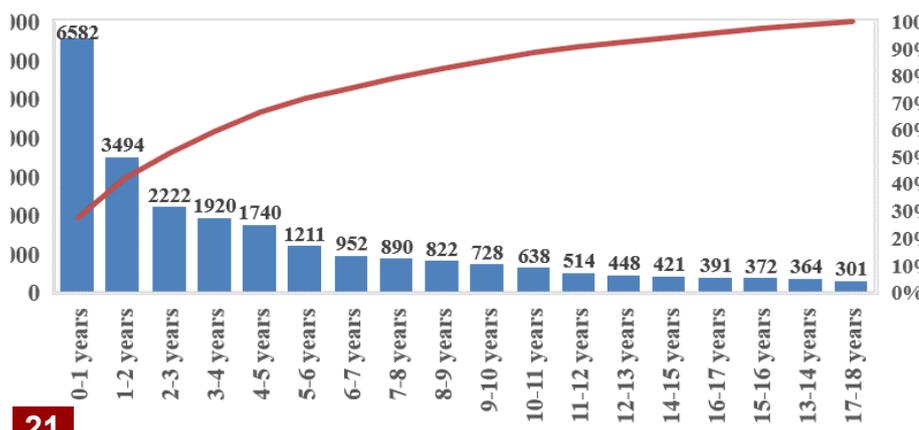
**6. Distribution of hospitalization episodes in patients with measles, according to average length of hospital stay**

The average length of stay in the case of hospitalization episodes for measles patients in continuous hospitalization was in the period 2016-2020 of 5.94 days, varying over the study period, the maximum value was recorded in 2016 (6.19 days), it decreased in 2019 to 5.44 days, the rest of the years it varied around 6 days. The highest average values of hospitalization were recorded in the case of measles patients admitted to chronic psychiatric wards (long duration), palliative care (44.6 days), pneumoftiziology (38.6 days), pediatrics (pediatric recovery) - 32.3 days, but also child endocrinology (23 days), medical oncology

Graph no. 5. Distribution of hospitalization episodes in the case of measles patients, at local/county level, depending on the population of each county, during 2016-2020



Graph no. 6. Distribution of number of hospitalization episodes in the case of children with measles, by the age of the patients, in Romania, during 2016-2020



(22.2 days), recovery neuro-psycho-motor (20.8 days), pediatric orthopedics (20.3 days) and pediatric surgery (19.8 days). The hospitals that registered the highest values of hospitalization duration were those in the counties of Vrancea (9.51 days), Caraş Severin (7.28 days), Constanţa (7.2 days), Timiş (7 days). As type of pathology in general subsequent septic complications (eg Sepsis due to pseudomonas - 61 days, Klebsiella pneumoniae [K. pneumoniae], the cause of diseases classified in other chapters - 41.3 days, Sepsis due to other staphylococci, specify -35 days) or cases in which the patient has tumor-like comorbidities (eg malignant tumor of the peripheral nerves of the abdomen - 31 days, benign spinal tumor - 30 days) have the highest values of length of hospital stay.

**7. Distribution of hospitalization episodes in the case of measles patients, depending on the patient's discharge status and in-hospital mortality rate**

Depending on the patient's discharge status, the data analysis indicates that of the total number of episodes reported in continuous hospitalization in the case of measles patients, most patients were discharged in a better, improved condition (74% of the total) or cured (17.5%). Approximately 6% of patients were discharged as stationary, and small percentages, 2% had an aggravated condition at discharge or died (0.2%) - graph no. 10.

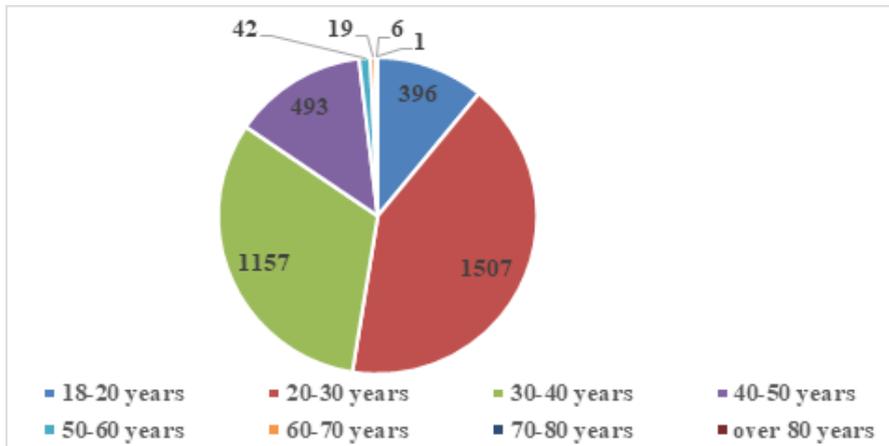
The calculated in-hospital mortality rate was for the entire study period of 0.22%, with a slow decreasing trend in 2016, from a value of 0.31% to a value of 0.15% in 2019, in 2020 not being declared no in-hospital death. Most deaths were recorded in children under 1 year, and hospitals in Timiş County, Bucharest and Iaşi and Dolj counties reported the most deaths due to this.

**CONCLUSIONS**

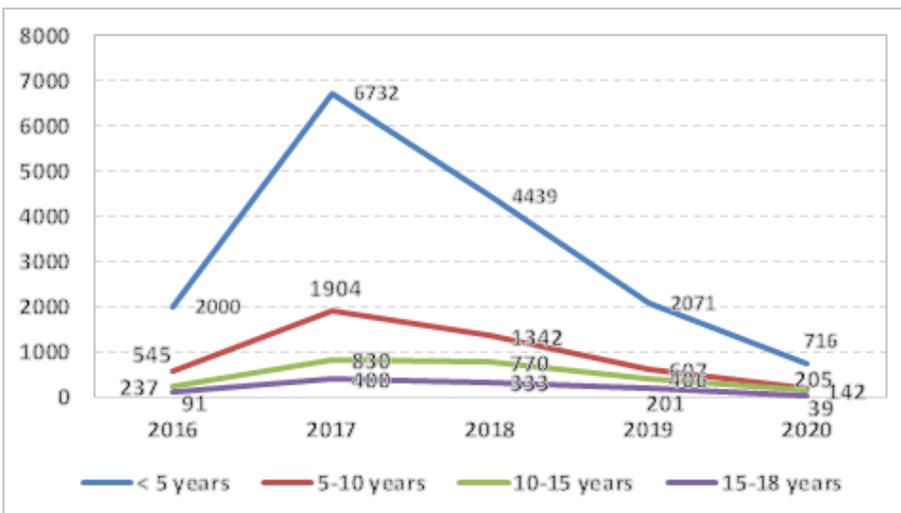
During the last 5 years, 2016-2020, in Romanian hospitals a percentage of 0.14% of the total episodes of hospitalization in continuous hospitalization was recorded by measles patients. The number of hospitalization episodes during this period, due to complications caused by measles was 27631, most affecting children. Compared to the number of hospitalization episodes due to infectious diseases, in children 87% were caused by



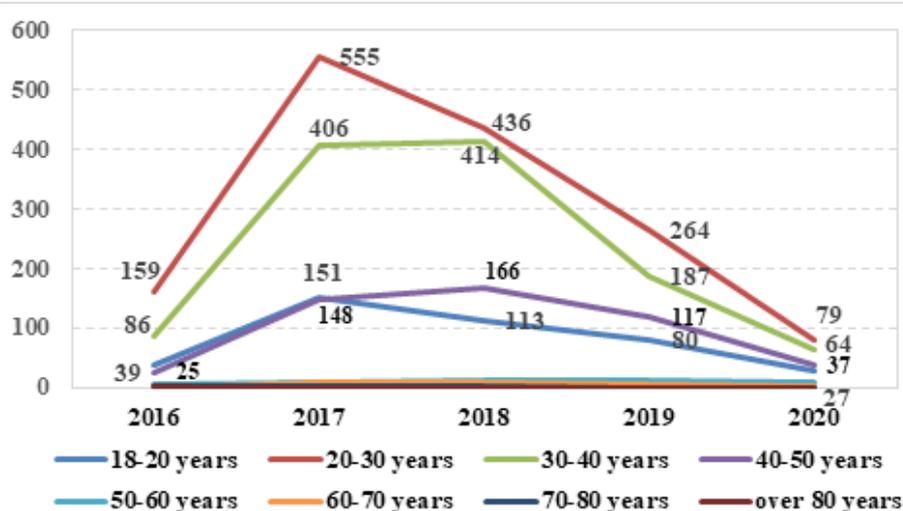
**Graph no. 7. Number of hospitalization episodes in the case of adults with measles, by the age of the patients, in Romania, during 2016-2020**



**Graph no. 8. Evolution of the number of hospitalization episodes in the case of children with measles, by age groups of the patients, in Romania, between 2016-2020**



**Graph no. 9. Evolution of the number of hospitalization episodes in the case of adults with measles, depending on the age groups of patients, in Romania, during 2016-2020**



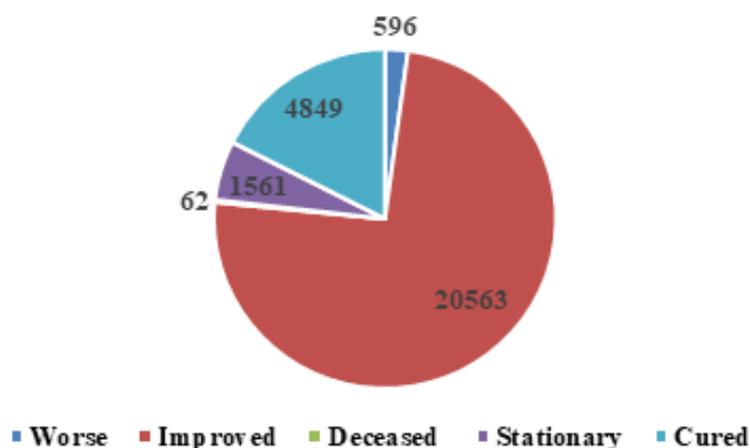
measles, while in adults only 13%. It should be noted that, in the current context marked by the coronavirus pandemic, the number of hospitalization episodes has been greatly reduced, by over 60%, which is also found in the case of hospitalizations caused by measles, which have also been greatly reduced, reaching values 9 times lower than in 2017, when the highest number of the entire study period was observed. Most of the hospitalization episodes belonged to the infectious adult and child or pediatric wards, with the rest of the patients being admitted to other types of wards (especially HIV/AIDS, pediatric pneumology and pediatric recovery or the internal medicine wards for adults, and as the main diagnosis at discharge, the most common were observed Measles complicated with pneumonia, Measles with other complications, Measles without complications, or Interstitial lung disease, unspecified.

As a spatial distribution, most of the hospitalized patients came from the West and North-East regions, as an absolute number, while compared to the number of inhabitants were the West, Center, North-West regions, and the counties best represented from this point of view being Timiș, Brașov, Caraș Severin and Prahova. Compared to the number of inhabitants in each county, the order was: Satu Mare, Ialomița and Covasna.

From the point of view of the patients' age, most episodes of hospitalization were registered in the young age categories, 50% of the hospitalization episodes being registered in children under 4 years, and in the adult population, young ages predominate, until 40 years (over 80% of hospitalization episodes). As an evolution, the number of hospitalization episodes, after a significant increase, 3-4 times in 2017, in the following years there is a continuous and more important decrease in the case of children. In the following years there are reductions of 9-10 times for children under 5 years, between 5-10 years and those in the group 15-18 years. In the adult category, the increase in 2017 was similar, but the reduction in the number of hospitalization episodes during the following years was slightly smaller.

The average duration of hospitalization at national level for the entire study period was 5.94 days, varying throughout the study period, from a maximum value of 6.19 days in 2016 to 5.44 days in the year 2019, the rest of the years

**Graph no. 10. Number of hospitalization episodes in case of measles patients, by the state of patients discharge, in Romania, during 2016-2020**



varying around 6 days. The highest average values of hospitalization were observed in the case of measles patients admitted to the departments of chronic, psychiatry (long-term), palliative care, pneumophysiology or pediatrics (pediatric recovery). The hospitals with the highest values of hospitalization duration were those in the counties of Vrancea, Caraş Severin, Constanta, Timiş (over 7 days). As a type of pathology, in general the septic complications that occurred later or the cases in which the patient presents tumor-type comorbidities recorded the highest values of the hospital stay. The state of discharge of measles pa-

tients was good, with three-quarters of them improved (74% of the total) or almost a fifth cured. A small percentage of episodes resulted in the discharge of the aggravated patient, and less than 1% died. The calculated rate of in-hospital mortality was for the entire study period of 0.22%, varying slightly between 0.31% in 2016 and 0.15% in 2019, in 2020 no in-hospital death was declared due to this condition. Most deaths were recorded in children under 1 year, and hospitals in Timiş County, Bucharest and Iaşi and Dolj counties reported the most deaths due to this.

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