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FINANCIAL BURDEN OF MEASLES HOSPITALIZATION EPISODES IN ROMANIA, 2023-2024

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Between 2020 and 2022, Romania recorded a low number of measles-related hospitalizations, with no deaths reported—an outcome largely influenced by public health measures implemented during the COVID-19 pandemic. Following the lifting of these restrictions in 2023, measles incidence increased significantly, marking a resurgence of a vaccine-preventable disease. This descriptive study uses data from the National DRG database and CNSCBT-INSP reports to analyze the evolution of measles-related hospital admissions between 2023 and 2024, with a focus on the financial burden on the healthcare system. The results show a direct correlation between declining vaccination coverage—below the 95% threshold recommended by WHO—and the rise in measles cases, particularly among children aged 1–5 years. The average reimbursed cost per measles case in 2024 was approximately 2,588 RON, compared to an estimated 100 RON for full vaccination (two doses). These findings underscore the urgent need to strengthen national immunization programs and public health interventions to reduce the clinical and economic burden of measles in Romania.

Keywords: measles, vaccination coverage, hospitalization, reimbursed costs, health management, prevention

INTRODUCTION.

In the pandemic years, the situation of measles-associated hospitalization episodes was as follows: in 2020, 1317 hospitalization episodes were reported, most of which occurred in January-March, before the quarantine period, in 2021 there were 16 hospitalized cases and in 2022 38 measles-associated hospitalization episodes were reported, from the available data provided by the National Institute for Health Services Management (NIHSM). During this period, 2020-2022, no measles-associated hospitalization episode that ended in death was recorded. Starting with 2023, Romania is facing an alarming recrudescence of measles, an infectious disease that seemed to be relatively controlled in previous years. This situation became evident with the lifting of health restrictions imposed during the COVID-19 pandemic. During the pandemic, measures such as physical distancing, wearing masks, limiting social contacts and movement restrictions, established by Decree 195/2020 by the President of Romania, have significantly contributed to the decrease in the number of cases of communicable diseases, including measles. However, with the return to normal social life and the resumption of activities in communities, the conditions favorable to the transmission of this virus have reappeared, starting with June 2023 with the publication of Decision no. 20 of June 27, 2023 on the cessation of the state of epidemiological and biological risk generated by the COVID-19 pandemic and the applicability of art. 1 of Decision of the National Committee for Emergency Situations no. 36 of 21.07.2020. Thus, starting with July 2023, the threshold of 100 cases per month has been exceeded and the number is increasing from one month to the next.

According to data provided by the National Institute of Public Health (INSP), through the National Center for Surveillance and Control of Communicable Diseases (CNSCBT), a significant increase in the incidence of measles has been observed compared to previous years. This increase in the number of cases is not just a regular fluctuation, but a sustained trend, which highlights a worsening public health problem. At the same time, the NIHSM reported a constant increase in the number of measles-related hospitalizations, which indicates not only an expansion of the infection among the population, but also a worsening of the clinical forms of the disease.

This situation raises numerous questions and highlights a series of vulnerabilities in the health system, especially in terms of vaccination coverage. Measles is a vaccine-preventable disease, and immunization remains the most effective method of protection. However, in recent years, the measles vaccination rate in Romania has fallen below the World Health Organization's (WHO) recommended threshold of 95% to ensure herd immunity. This decline is due to several factors, including parental reluctance and misinformation campaigns.

The increase in measles-related morbidity and mortality among hospitalized patients is an important alarm signal. This suggests not only a wider spread of the disease, but also a greater severity of cases reaching health facilities.

MATERIALS AND METHODS

The present study is a descriptive one that aims to verify the evolution of the number of measles hospitalization episodes in previous years.

The study used data from the National DRG Database, data reported by hospitals in Romania in contractual relationship with the National Health Insurance House (NHIH). In accordance with the provisions of the Order. no. 1782/576/2006 regarding the registration and statistical reporting of patients receiving medical services in continuous hospitalization and day hospitalization, with subsequent additions and amendments, the NIHSM collects and processes the minimum set of data at patient level for cases treated in continuous and day hospitalization. The study used data reported in the period 2023-2024, aiming to analyze data on hospitalization episodes in patients with measles in Romania, in the aforementioned hospitals. In accordance with the provisions of Law 190/2018 and Art. 13 of EU Regulation no. 679/2016, personal data are deleted upon transmission to NIHSM, and the identification of persons for the purpose of analysis is based on encrypted numeric personal codes.

The data were selected using the RO DRGv.1 classification, records from observation sheets that had

measles as a main or secondary diagnosis were extracted and analyzed.

Also, the periodic reports of the CNSCBT of the INSP were consulted and the available data were processed so that they could be analyzed in the current context.

The data were processed using the Access and Excel applications from the Microsoft Office 365 package, updated 2019 edition.

The analysis was carried out mainly to highlight the financial burden of measles-associated hospitalization episodes, but also according to a series of demographic variables: age, gender, information included in the minimum data set reported in the DRG system by hospitals. Discharge status and the main associated pathologies were also monitored, taking into account the main and secondary diagnoses, other than measles.

Continuous quantitative data were statistically analyzed: age, lengh of stay, value settled at case level.

Some available data from the 2020-2022 pandemic years were also analyzed, during which the incidence of measles was lower due to preventive measures against the spread of the COVID-19 virus. However, a relatively similar distribution of cases by age group is observed as in the years following the pandemic.

RESULTS

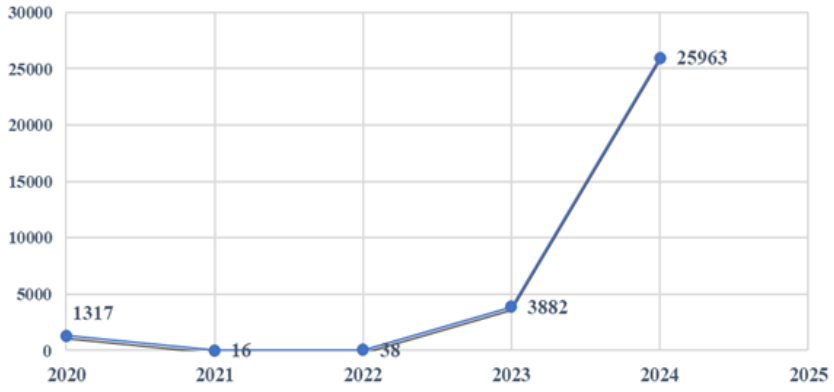
We extracted from the National DRG database the number of absolute hospitalization episodes in the years 2020-2024 to highlight the evolution of hospitalized measles cases in Romania during this period. (Graph 1)

We used the data available from the periodic reports of the INSP for the following analysis. Vaccination coverage [1-8], even with the first dose of MMR vaccine, remains below the 95% threshold recommended by the World Health Organization (WHO) in many counties.

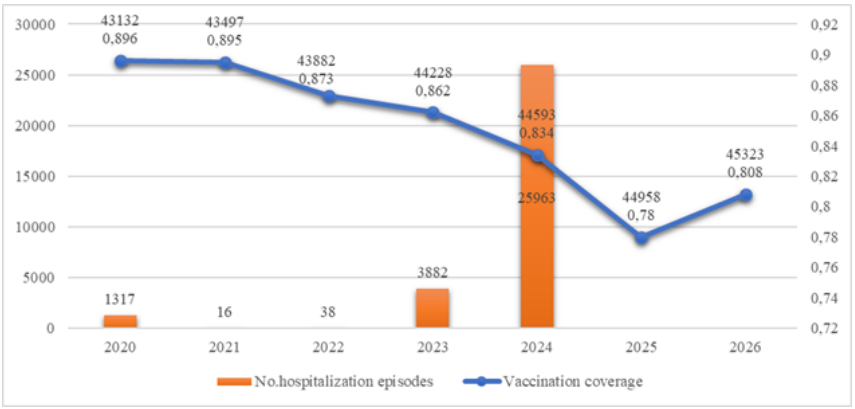
We formulated a projection that suggests that the evolution of the number of hospitalizations today is influenced by the level of vaccination coverage with at least one dose of MMR in 18 -month-old children, recorded two years ago. Thus, a lower vaccination coverage in 2022 correlates with a higher number of cases in 2024, and the current trend indicates the possibility of a continued increase in cases if vaccination coverage does not improve. (Graph 2)

In 2021, the maximum vaccination coverage was reached in Sălaj County (95.5%) and the minimum in Satu Mare (70.3%). The top 5 counties with the lowest vaccination coverage were Satu Mare, Caraș, Brașov, Vrancea, Mureș counties [4].

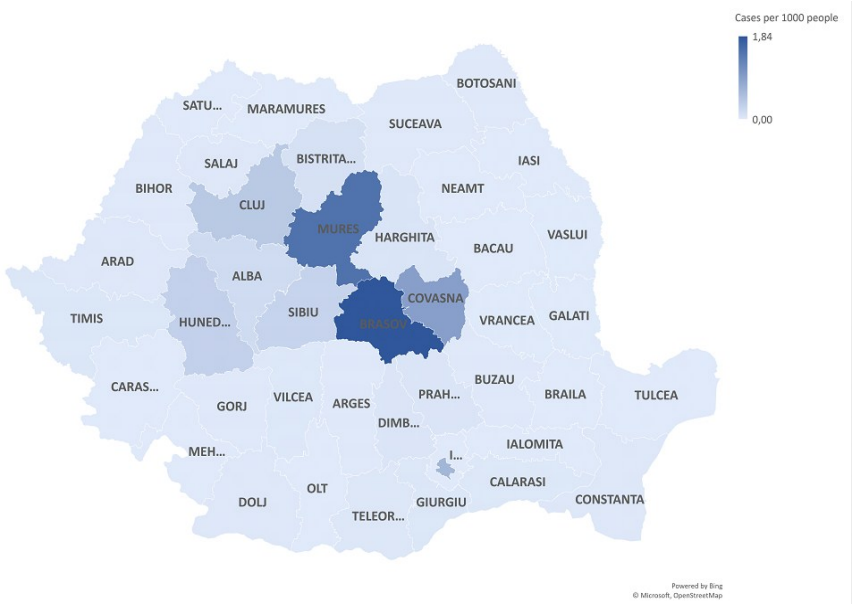
Graph 1. Distribution of total measles cases each year during 2020-2024



Graph 2. Evolution of the number of measles hospitalization episodes, in the period January 2024, in parallel with the vaccination coverage of 18-month-old children reported 2 years previously

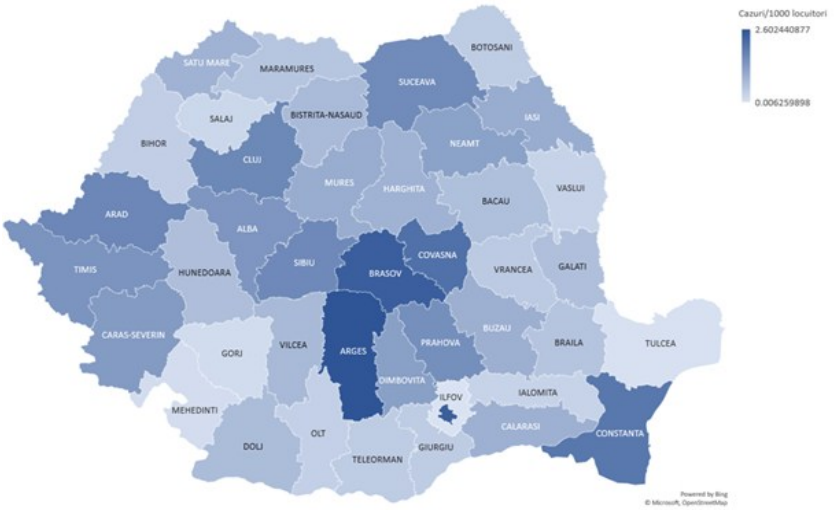


Graph 3. No of hospitalized measles cases raported per 1000 inhabitants, at county level in 2023

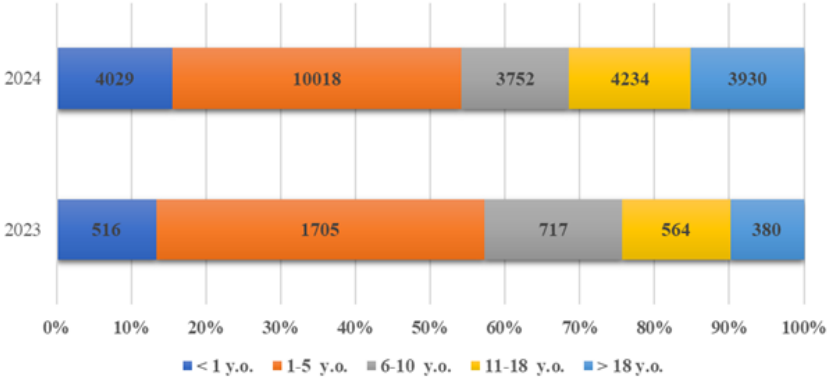


The territorial distribution of measles cases reported per 1000 inhabitants, in 2023, by the county of the hospital that reported the data, is shown in the graph below.

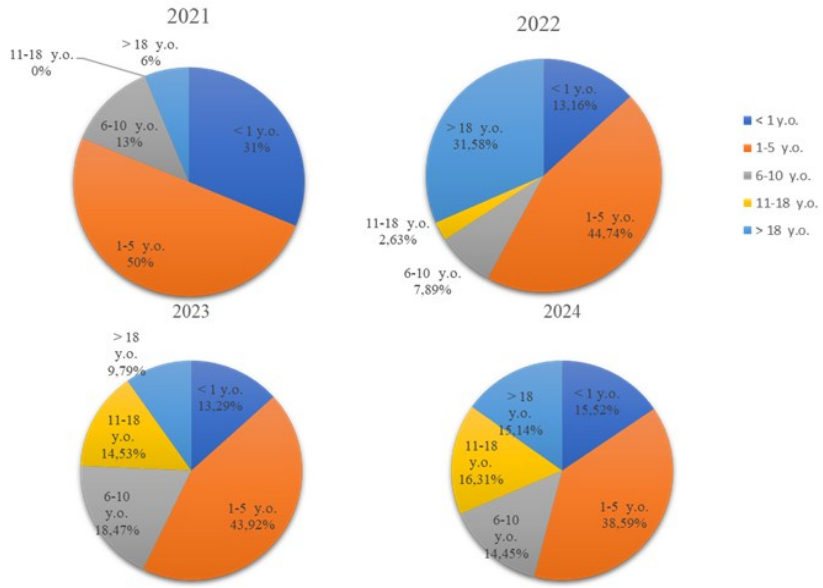
Graph 4. Number of measles hospitalization cases reported per 1000 inhabitants, at county level in 2024



Graph 5. Evolution of the number of hospitalization episodes for measles in Romania, by age group, 2023-2024



Graph 6. Distribution of measles hospitalization episodes by age group in the following years



There are quite large variations between the rates of measles hospitalizations, from 0‰ in some counties such as Ilfov, Brăila, Ialomița and Tulcea, to 1.5‰ in Mureș and 1.84‰ in Brașov. (Graph 3)

In 2022, the maximum vaccination coverage was reached in Covasna County (98.7%) and the minimum in Arad (68.1%). The top 5 counties with the lowest vaccination coverage were Arad, Caraș-Severin, Alba, Suceava, Mureș [5].

The territorial distribution of measles cases reported per 1000 inhabitants, in 2024, by the county of the hospital that reported the data, is shown in the graph below. There are quite large variations between the rates of measles hospitalizations, from 0.006‰ in Ilfov, to 2.41‰ in Brașov.

Graph 4. No. of measles hospitalization cases reported per 1000 inhabitants, at county level in 2024

In percentage terms, the distribution by age group during the period 2021-2024 had the following evolution (Graph 5):

Graph. 6 Distribution of measles hospitalization episodes by age group in the following years:

Table 1. Average length of stay for measles cases and, respectively, in infectious disease wards (including Adult Infectious Diseases, Pediatric Infectious Diseases, and HIV/AIDS wards) in 2023–2024

Table 2. Average length of stay by age group for measles cases in 2023–2024

Table 3. Average reimbursed tariffs for measles cases, for admissions in infectious disease wards, and national average per case in 2023–2024 (in RON)

The following shows the evolution of the average and total number of measles hospitalization episodes in 2023-2024 and specifically by age group 1-5 years, the most affected in absolute terms and percentage. Patients admitted to chronic wards/compartments for which contracting is based on the daily hospitalization rate were excluded from the calculation.(Graph 7) (Graph 8)

The reimbursement made for all cases in the age group 1-5 years represents percentages in the years 2023 and 2024: 42.72% and 37.99% respectively and a relatively proportional evolution can be observed with the percentages that this age group represented in the respective years. In these years, the average settlement made for a case in the age group 1-5 years represented 98.42% in 2023 and 99.50% in 2024.

Related to the periodicity of this pathology, the graph below (graph 9.) does not

Table 1. Average length of stay for measles cases and, respectively, in infectious disease wards (including Adult Infectious Diseases, Pediatric Infectious Diseases, and HIV/AIDS wards) in 2023–2024

Year	Average Length of Stay – Measles Cases (days)	Average Length of Stay – Total Infectious Disease Wards (days)
2023	4.92	4.97
2024	4.96	4.93

Table 2. Average length of stay by age group for measles cases in 2023–2024

Year	< 1 year	1–5 years	6–10 years	11–18 years	> 18 years
2023	5.13	4.87	4.89	4.78	5.07
2024	5.44	4.92	4.65	4.73	5.00

Note: Values are expressed in average number of days per admission

Table 3. Average reimbursed tariffs for measles cases, for admissions in infectious disease wards, and national average per case in 2023–2024 (in RON)

Year	Avg. Reimbursed Tariff – Measles Case	Avg. Reimbursed Tariff – Infectious Disease Wards	National Avg. Reimbursed Tariff per Case
2023	2,489.996	2,803.35	2,660.94
2024	2,587.928	3,114.80	3,011.19
Tarif mediu decontat/caz național (lei)	2660.94	3011.19	

necessarily reflect a higher frequency of cases in spring and autumn (in accordance with data from the specialized literature [9,10]), but rather, the particular situation of the lifting of restrictions generated by the COVID pandemic, corroborated with the accumulation of a receptive mass of individuals, (re)entering the community. (Graph 9)

The discharge status reported and collected at the NIHMS level for the years 2023-2024 is represented in the graph below. A relatively small number represented aggravated cases or deceased patients. (Graph 10)

We analyzed the evolution of hospitalization episodes ending in death during the period 2020-2024 and observed that during the years of the COVID pandemic there were no such cases.(Graph 11)

DISCUSSION

The results of this study are consistent with the results of other studies published in the literature regarding the population determined to be at risk [11-13]. The association between the decrease in vaccination coverage, at least with the first dose of MMR, and the increase in measles incidence is evident and consistent with other data in the literature.

The maximum frequency of measles occurrence in the 1-5 year age group [11-13] can be explained as a consequence of the increased contagiousness, in the context of the entry into the community of unvaccinated or incompletely vaccinated children, while for the age group under 1 year, the frequency is lower, these children being on the one hand more protected within the families, and on the other hand some of them receive a level of vertically transmitted immunity.

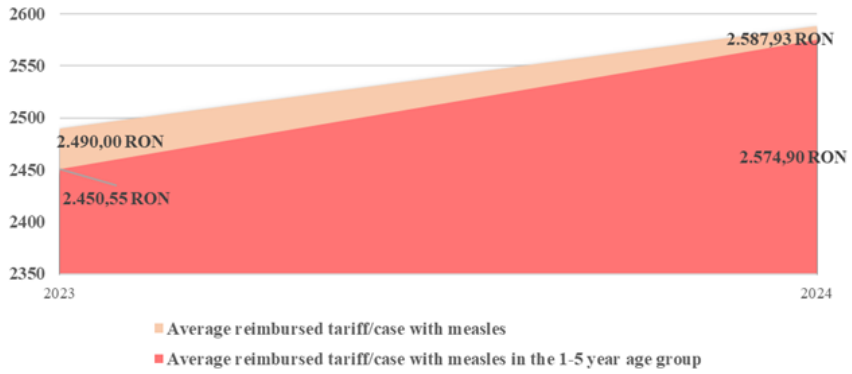
Beyond the impact that measles has on the health status of patients, the burden borne by the health care system is also noteworthy. The average length of hospitalization of measles patients for the two years analyzed did not vary much, not even by age group, however requiring a longer hospitalization period for patients under 1 year or over 18 years.

Analyzing the financial resources mobilized for hospitalized measles patients (even if these represent estimates based on existing public data), it can be concluded that their treatment is expensive, the average fee paid for such a case being approx. 85-94% of the average fee paid per case at national level (including patients discharged from surgical wards), and the share of total amounts paid for these patients out of total amounts paid for hospitalization continues. Also, the burden imposed by cases in the 1-5 age group was considerable, representing 42.72% and 37.99% of the total burden of hospitalized measles cases in 2023 and 2024, respectively, and the average reimbursement for a case in the 1-5 age group represented 98.42% in 2023 and 99.50% in 2024 of the average reimbursement granted for a measles case.

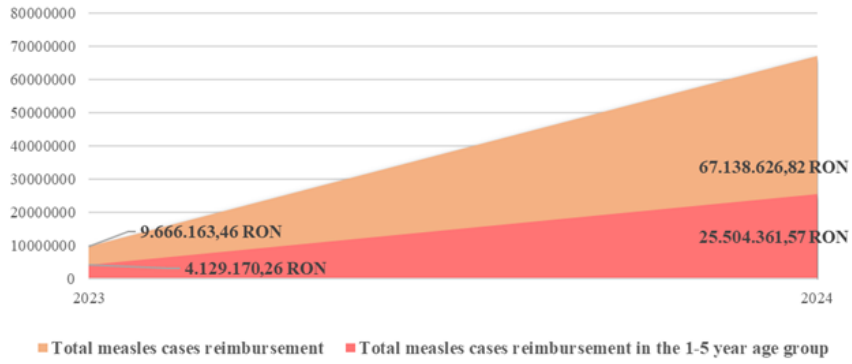
Also, according to available data, the purchase price by the Ministry of Health of a dose of measles-mumps-rubella (MMR) vaccine in 2021, 2022, 2023 and 2024 was: 41.59 RON excluding VAT. Thus, the purchase price with VAT can be estimated at 50 RON, an investment from the state budget [14]. Thus, we can estimate the cost of the 2-dose vaccination intervention at the individual level as being approximately 100 RON, well below the average reimbursement for a measles case hospitalized in previous years and even more so below the reimbursement granted for a measles case that became complicated. It should be noted that these represent the financial estimates for uncomplicated hospitalized cases or those with immediate complications. Measles can have as a rare late complication of measles cases early in life subacute sclerosing panencephalitis, fatal to the central nervous system [15].

Measles-related in-hospital mortality has been significant for a vaccine-preventable disease in the post-pandemic years. In 2023, there were 2 deaths in the under-1 age group and 1 death in the 1-5 age group (out of a total of 5 measles patients who died), and in 2024, there were 7 deaths in the under-1 age group and 7 deaths in the 1-5 age group (out of a total of 31 measles patients who died). Taking these figures into account, a large number of Years of Life Lost (YLL) for a vaccine-preventable childhood

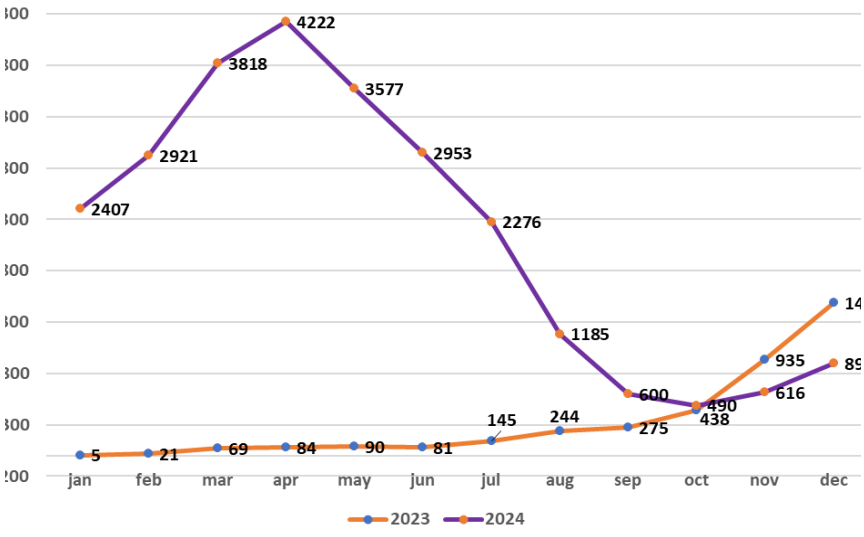
Graph7. Total burden of hospitalization episodes of patients with measles and in the age group 1-5 years in the period 2023-2024, in Romania



Graph 8. Evolution of the average bill per hospitalization episode for measles in Romania, 2023-2024, overall and for the age group 1-5 years



Graph 9. Monthly evolution of the number of hospitalization episodes in 2023-2024



disease for which the vaccine is included in the national vaccination schedule.

We identified 2 studies that estimated the burden of measles in terms of disability-adjusted life years (DALYs). In both cases, DALY has YLL and Years Lived with Disability (YLD) as its component. The first study was conducted in Germany between 2005 and 2007 and calculated DALY/year for several pathogens including measles. The result was 740 DALY/year [16]. This study mentions that an average of 1217 cases per year were reported, but the real estimate of the number of cases is 2840 cases per year[16]. The study attempted to estimate long-term complications and anticipated, on average, the occurrence of one case of persistent encephalitis, one case of post-infectious encephalomyelitis and, less frequently, isolated cases of deafness or subacute sclerosing panencephalitis. The greatest burden was given by the age group 0-19 years and the main component was YLL[16].

The second study was conducted in the Umbria region of Italy between 2013 and 2018. The values obtained are reported in DALYs, expressed annually, per case and per 100,000 inhabitants, to reflect the impact of both the acute manifestation and the sequelae of the disease [17]. DALY was also composed of YLL and YLD. The estimated average incidence for the entire period was 52.50 cases per year of which 58% were children under 5 years of age, resulting in an average annual loss of 3.10 DALYs [17]. In this case, it was not a projection, but strictly the reported cases of measles, without including the possibility of late complications.

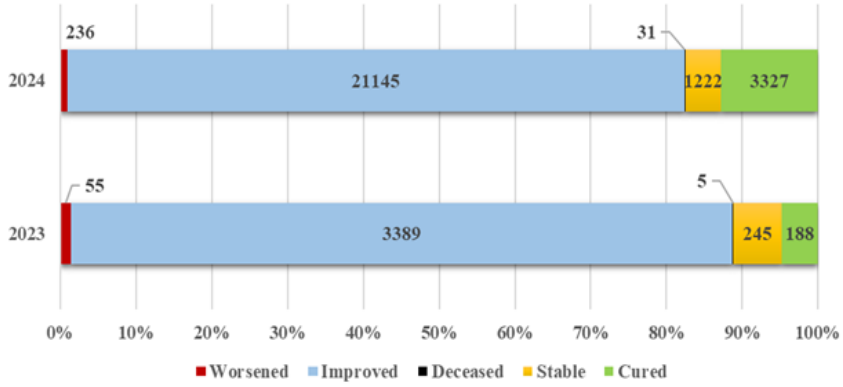
The differences between the two studies relate to the methodology chosen for the research and calculation of the results, but in both it is emphasized that YLL represents a majority proportion of DALYs (75% in the case of the Umbria study [17]) and that most of the patients are children, as in the present study. This fact is explained by the particularity of measles not being frequently associated with serious complications, but having a high fatality in situations where the association occurs in a vulnerable/debilitated patient [17].

CONCLUSIONS

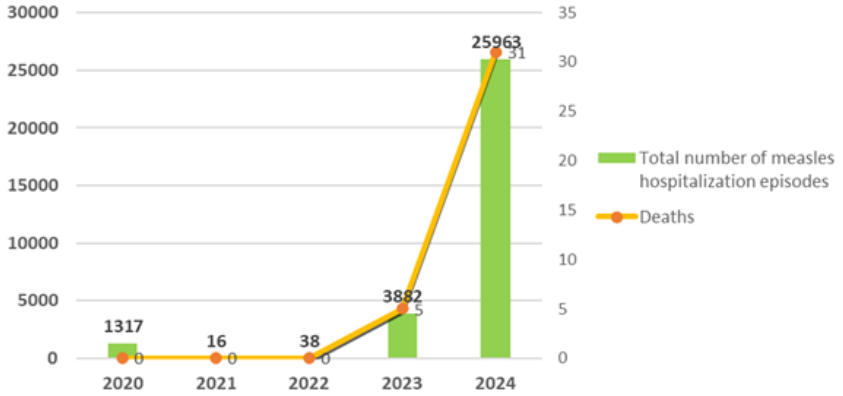
The results of this study confirm the trends observed in other research [12,13,18] on measles, highlighting a relationship, which has not been statistically confirmed, between the decrease in vaccination coverage and the increase in the incidence of the disease. Unvaccinated or incompletely vaccinated children, especially those between 1 and 5 years of age, represent the major risk group, frequently affected due to the increased contagiousness of the virus and collective exposure in educational institutions.

Measles is an acute pathology with severe evolutionary potential, frequently associated with a wide range of complications, from relatively common conditions, such as pneumonia and anemia secondary to nutritional

Graph 10. Discharge status of patients hospitalized with measles in 2023-2024, in Romania



Graph 11. Evolution of the number of deaths among patients hospitalized for measles in parallel with the evolution of the number of hospitalization episodes, in 2020-2024, in Romania



eficiencies, to serious forms of neurological damage, such as viral encephalitis. The risk of complicated evolution is significantly increased among children with congenital malformations or with deficient nutritional status. Beyond the individual impact, measles generates a considerable burden on the healthcare system, expressed in average hospital stays of approximately five days and in substantial costs related to treatment and medical care in continuous hospitalization. The high frequency of complications and the need for hospitalization contribute to the overload of hospital units, especially infectious diseases departments, while also implying a significant consumption of human and material resources.

The geographical distribution of measles cases that required hospitalization indicates a concentration of them in counties characterized by a considerable degree of urbanization, a higher share of children aged 0 to 9 years [19] and/or low vaccination coverage rates. The worrying escalation of measles-associated mortality among children under 5 years of age – reflected in the increased number of potential years of life lost – emphasizes both the severity and the preventable nature of this condition, underlining the importance of public health interventions focused on increasing vaccination coverage.

In this context, it becomes essential to strengthen vaccination campaigns to reduce the number of children not adequately immunized [20] and to strengthen prevention measures, along with the active involvement of medical personnel, to reduce the impact of measles on public health and the consumption of health system resources.

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