

DESCRIPTIVE STUDY ON THE SITUATION OF VITAMIN DEFICIENCY HOSPITALIZATION EPISODES, IN ROMANIA, IN THE LAST DECADE

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INTRODUCTION

The three manifestations of malnutrition are undernutrition, obesity or micronutrient deficiency, which is defined as the lack of essential vitamins or minerals, needed in small amounts in the body for proper development and growth. Micronutrients, although necessary in small quantities, are vital for the harmonious physical and mental development of the individual. The category of micronutrients includes vitamins (water and fat soluble) and minerals. Deficiencies related to the intake of micronutrients are a public health problem, with implications for both the growth and development of the child, and affecting the health of adults by increasing vulnerability to disease, physical and mental impairment, etc. [1]

At least half of children under the age of 5 worldwide suffer from micronutrient deficiencies [2]. It is estimated that over 2 billion people [3] are affected by "hidden hunger", the most exposed of which are children and pregnant women, both due to increased nutritional needs in those stages of life and due to insufficient intake. Some areas, especially underdeveloped countries, are representative of the high prevalence of micronutrient deficiencies, areas such as sub-Saharan Africa and South Asia, reaching prevalence values of 60-70% among children, while in Central Europe and Latin America the prevalence values were between 5-20% of children. [1] Among fat-soluble vitamins, vitamin A deficiency leading to severe visual impairments leading to blindness, being the main cause of preventable blindness, manifests itself in children in the form of night blindness, which in severe cases can become permanent blindness. Also, the deficiency of this vitamin leads to the exacerbation of other diseases, increasing infant mortality, but also maternal mortality. [1] For pregnant women, the areas with the highest prevalence are also found in Africa and Asia, with countries in North Africa and Central and East Asia registering prevalence rates between 20-25% and those in Sub-Saharan Africa and South Asia values between 15-20%. In Central Europe and Latin America, the phenomenon is low. Night blindness is more common in pregnant women in sub-Saharan Africa and South Asia (prevalence between 5-20%). [1]

It is estimated that approximately 190 million preschool children are deficient in vitamin A worldwide. In children under 5 years of age, the prevalence rates for vitamin A

One of the forms of malnutrition is the deficiency of micronutrients, vitamins and minerals, necessary for optimal and harmonious development and functioning of the body. In some parts of the world, there is a high prevalence representing a serious health problem for those populations. Vitamin D deficiency, widespread not only in low-income countries but also in many countries with a developed economy and not only among at-risk population groups but also in the general population, is the best example of "hidden hunger", as this manifestation of malnutrition is also called. In Romania, the real situation is not well known, the studies being few and including especially small population categories, generally considered "at risk". Prevention also focuses on this type of population groups, severe deficiencies being diagnosed late, when they have already led to the installation of chronic diseases whose treatment is obviously much more expensive, with multiple implications on the patient's life. Studies at national level, carried out at regular intervals, have the role of signaling to decision-makers the existence of health problems, which must be resolved before they become real public health problems.

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deficiency are between 60-70%, while in Central Europe and Latin America between 5-20% [1], the deficiency predisposes to blindness but also to immune deficiency, increasing mortality by infectious diseases, diarrhea, etc. [3] Vitamin D deficiency is widespread, with statistical data indicating that about 40% of Europeans have this deficiency (values of 25 (OH) D <50 nmol / L or 20 ng / ml), 13% showing severe deficiency (<30 nmol / L or 12 ng / ml), associated with a significant increase in the risk of excess mortality, infections and multiple other chronic diseases. [4] Based on the literature review, it can be said that the average level of vitamin D in the Central European population is below the 30 ng / ml limit. [5] Other regions also have a high prevalence, 24% in the US with 5.9% severe deficiency, 37% Canada, with 7.4 severe deficiency. Countries such as India, Tunisia, Pakistan, and Afghanistan have significant percentages (> 20%) of the vitamin D deficiency population. Children and the elderly, as well as people with chronic diseases (kidney disease, liver disease, liver failure, kidney or hepatic transplants have a prevalence of deficiency between 85-99%) are more frequently affected by this deficiency. [4] In Romania, statistical data are lacking, however, some studies give indications at the level of small groups of participants, the conclusion being that the suboptimal level for vitamin D characterizes our population (59%), the risk factors being old age, female sex and cold season and the supplement is the annual recommendation from January to April. [5]

Regarding the group of water-soluble vitamins, the category with higher prevalence among the population is that of group B, especially B12 causing the most common megaloblastic anemia. About 40% of the western population has a B12 deficiency, among those at risk are those with a diet low in this vitamin (low intake of animal products, fruits and vegetables, vegetarians), the elderly (about 15% of those over the age of 65) [6], those with gastrointestinal disorders (celiac disease, Crohn's, or

gastrointestinal interventions/resections), etc. [7] Among children under 5, anemia affects 42%, with the highest prevalence in South Asia and sub-Saharan Africa (51.7 and 60.4%, respectively), while in North America the prevalence is around 6.7 %, in Europe 19.8%, East Asia and the Pacific region 23.6%, in 2019, in net decrease compared to 2000. [1] According to the World Health Association (2008) vitamin B12 deficiency associated with folate affects millions of people around the world, leading to the premise that it is a public health problem (WHO, 2008). [8]

Thiamine deficiency affects 16-18% of the elderly population, and B2 deficiency 10-15% of the world's population. [8] Deficiencies occur not only in less developed countries, but also in developed countries, as nutritional intake is insufficient, which predisposes to the occurrence of many chronic diseases. [8] Given the high prevalence of these deficiencies in the general population, but especially among certain population groups, such as the elderly, children, pregnant women, but also the economically disadvantaged and the negative impact, with serious future implications on morbidity and mortality, we consider that it is necessary first of all a better knowledge of the nutritional status of the population, by conducting population studies and monitoring the susceptible age groups by the family doctors. This offers the possibility to take preventive measures to correct any deficiencies in time and to prevent the onset of chronic diseases that require further treatment, with high costs from an individual point of view, but also economically and socially. The present study provides a description of hospitalized cases for health problems related to such nutritional deficiencies and was conducted by the National School of Public Health, Management and Professional Development in Health, Bucharest (NSPHMPDHB) for 2009-2019.

OBJECTIV

Identification at national, regional and local level of the geographical distribution of hospitalization episodes in the case of patients diagnosed with vitamin deficiencies, as well as the temporal evolution of their number, between 2009-2019.

METHODOLOGY

A descriptive, retrospective study was performed, which used data from the National DRG Database, data reported in continuous hospitalization 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, SNSPMPDSB collects and processes the minimum set of patient-level data for cases treated in continuous and day hospitalization. The study used data that were reported in the period 2009-2019, following the analysis of data on hospitalization episodes in patients with avitaminosis in Romania, in the hospitals mentioned above (hospitalizations in continuous hospitalization). 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: E50-64, Other nutritional deficiencies, excluding nutritional anemia (D50- D53) and including: E50 avitaminosis A, excludes sequelae of avitaminosis A (E64.1), E50.0-avitaminosis A with conjunctival xerosis, E50.1-avitaminosis A with Bitot spots and conjunctival xerosis, E50.2-avitaminosis A with corneal xerosis, E50.3-avitaminosis A with corneal ulceration and xerosis, E50.4-avitaminosis A with keratomalacia, E50.5-Avitaminosis A with evening hemeralopia, E50.6 Avitaminosis A with xerophthalmic scar of the cornea, E50.7 Other manifestations avitaminosis A ocular Xerophthalmia NOS, E50.8 Other manifestations of avitaminosis A Follicular keratosis due to avitaminosis A † (L86 *), Xeroderma due to avitaminosis A † (L86 *), E50.9 Avitaminosis A, unspecified A, Hipovitaminosis A NOS; E51 Thiamine deficiency, excludes sequelae of thiamine deficiency (E64.8), E51.1 Beri Beri, E51.2 Wernicke encephalopathy, E51.8 Other manifestations of thiamine deficiency, E51.9 Thiamine deficiency, unspecified; E52 Nicotinic acid deficiency (pellagra) Nicotinic acid deficiency and nicotinamide, Pelagra (alcoholic), excludes sequelae of nicotinic acid deficiency E64.8; E53. Other group B avitaminosis excludes sequelae of avitaminosis B (E64.8), B12 deficiency anemia (D51), E53.0 Riboflavin deficiency, ariboflavinosis, E53.1 Pyridoxine deficiency avitaminosis B6, excluding sideroblastic anemia reacting to pyridoxine (D64.3), E53.8 Deficiency of other B vitamins deficiency of biotin, cyanocobalamin, folate, folic acid, pantothenic acid, vitamin B12, E 53.9 Group B avitaminosis, unspecified; E54 Ascorbic acid deficiency, Vitamin C deficiency Scurvy, excludes anemia in scurvy (D53.2), sequelae of avitaminosis C (E64.2); E55 Vitamin D deficiency, excludes: adult osteomalacia (M83), osteoporosis (M80-M81), sequelae of rickets (E64.3); E55.0 Evolutionary rickets Osteomalacia: infantile, juvenile Excludes: rickets: celiac (K90.0), Crohn's (K50), inactive (E64.3), renal (N25.0), resistant to vitamin D (E83.3), E 55.9 Vitamin D deficiency, unspecified avitaminosis D; E56 Other avitaminosis excludes: sequelae of other avitaminosis (E64.8), E56.0 Vitamin E deficiency, E56.1 Vitamin K deficiency, excludes coagulation factor deficiency due to vitamin K deficiency (D68.4), vitamin K deficiency of the newborn (P53), E56.8 Deficiency of other vitamins, E56.9 Unspecified avitaminosis. In accordance with the provisions of Law 190/2018 and of Art. 13 of EU Regulation no. 679/2016, personal data are deleted at the time of transmission to NSPHMPDHB, and the identification of persons for the purpose of analysis is based on encrypted personal identification number. The age of the patients was calculated in 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 accomplished in the form of tables and graphs.

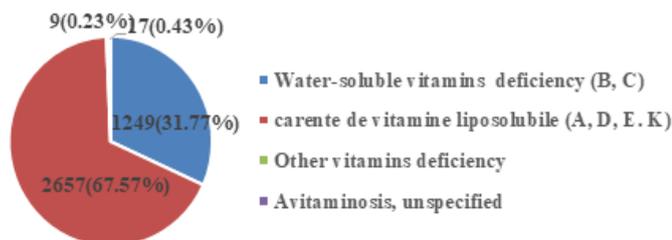
RESULTS

Following the extraction, processing and analysis of data from the national DRG, their interpretation was performed in relation to a series of demographic variables and socioeconomic characteristics (sex, age, area of residence, length of hospitalization, in-hospital mortality rate, discharge status) following the geographical distribution and the temporal evolution of the hospitalization episodes of the patients presenting vitamin deficiencies, from the hospitals in our country, between 2009-2019.

1. Total number of hospitalization episodes of patients diagnosed with vitamin deficiencies, registered in Romania, between 2009-2019.

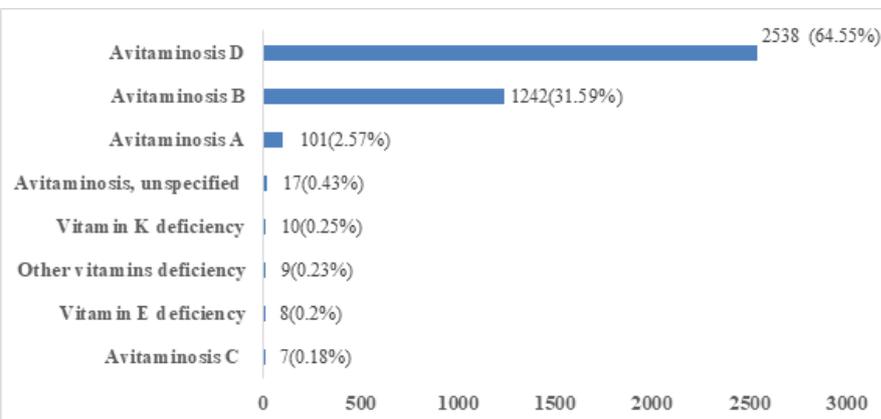
The total number of continuous hospitalization episodes for patients with vitamin deficiencies registered in Romania between 2009-2019 was 3932 episodes, of which more than half (67.6% -2657 episodes) represented the deficiencies of fat-soluble vitamins, the rest being water-soluble vitamin deficiencies, and a very small number, was coded as deficiency of other vitamins or unspecified avitaminosis - graph no. 1.

Graph no.1. Total number of hospitalization episodes reported in continuous hospitalization in patients with vitamin deficiencies, registered in the period 2009-2019, at national level



Differentiated, on each type of deficiency, it is found that the leaders are deficiencies due to vitamin D (64.55%) and avitaminosis in group B (31.6%), the rest of the deficiencies - vitamin A, E, K or C being rare - graph no.2. Within each category, the following are found: in the case of vitamin D, the most common is the absence of an unspecified vitamin D deficiency (77.6%), but also evolutionary rickets. In the case of A vitamin, most hospitalization episodes were diagnosed with avitaminosis A with conjunctival xerosis (30% of all cases), Other manifestations of avitaminosis A (19%), Avitaminosis A with Bitot spots and conjunctival xerosis (16%) or Avitaminosis A with keratomalacia (11%). In the case of water-soluble avitaminosis, group B avitaminosis is most common (31.6%), especially vitamin B1 deficiency - 71% of total cases (Wernicke encephalopathy - 60%, Nicotinic acid deficiency (pellagra) - 18%, Deficiency in thiamine, unspecified - 11%, Deficiency of other B vitamins -9%). In the case of the other vitamins, there were very few cases with the main diagnosis of

Graph no.2. Total number of hospitalization episodes reported in continuous hospitalization in patients with vitamin deficiencies, depending on the main diagnosis at discharge, recorded in the period 2009-2019, at national level



episodes, avitaminosis K -10 episodes, throughout the entire study period.

2. The temporal evolution regarding the hospitalization episodes of the patients with vitamin deficiencies, in Romania, between 2009-2019

The temporal evolution of the hospitalization episodes for the patients with vitamin deficiencies during this period can be observed in graph no.3. It is found that for two of the deficiencies there was an increase in the number of hospitalization episodes over the period, a more significant increase, more than double the episodes from 2009 to 2019, in terms of avitaminosis D and 1.7 times in case of avitaminosis B. The rest of the avitaminosis remain in the same trend throughout the study period, except for avitaminosis A, in which case the number of hospitalizations gradually decreased, decreasing by about 8 times in 2019 compared to 2009.

3. Distribution of hospitalization episodes for patients with vitamin deficiencies, according to the discharge ward

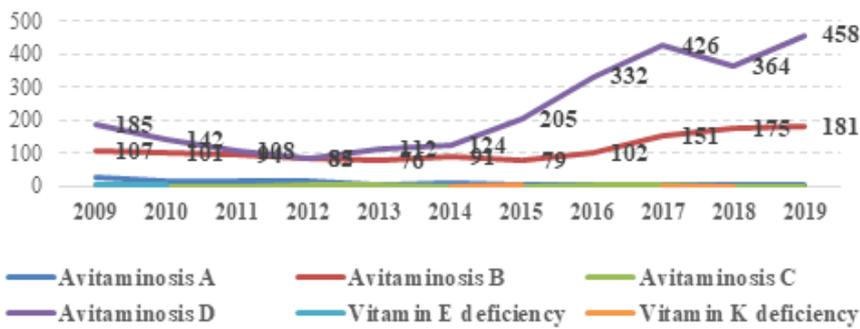
Most episodes of hospitalization for patients with vitamin deficiencies were recorded in the departments of endocrinology (39% of the total), pediatrics (19%) and neurology (11%).

4. Distribution of hospitalization episodes in patients with vitamin deficiencies, at regional and local level, between 2009-2019

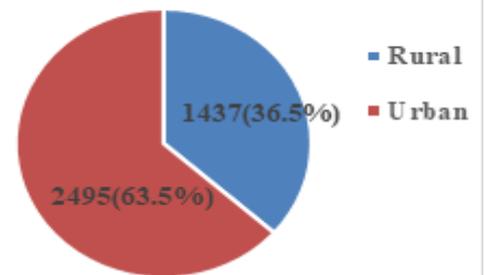
From the point of view of the environment of residence where the patients with this diagnosis come from, it is found that most hospitalization episodes were registered for patients from urban areas (63.5%) - graph no. 4.

At regional level, most hospitalization episodes for patients with avitaminosis were recorded during the study period in the regions of Bucharest-Ilfov (26% of the national total), South-East and South (16, respectively 15%). The West and South-West regions with approximately 5% and 6% had the fewest hospitalizations - graph no.5 →

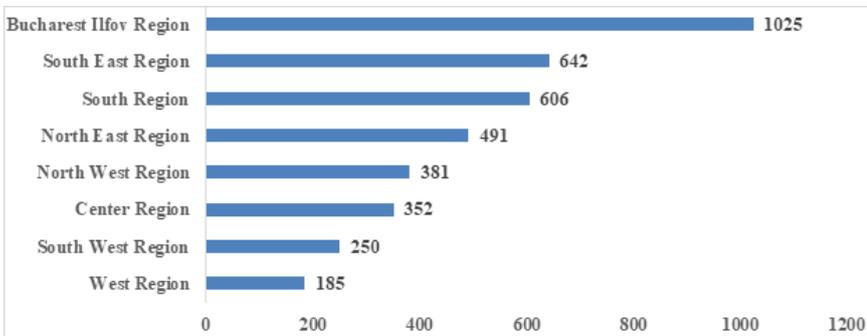
Graph no.3. Evolution of the total number of episodes reported in continuous hospitalization, in patients with vitamin deficiencies, registered in the period 2009-2019, at national level



Graph no. 4. Distribution of hospitalization episodes for patients with vitamin deficiencies, depending on the patient's place of residence, in Romania, 2009-2019



Graph no.5. Distribution of hospitalization episodes for patients with avitaminosis, at regional level in Romania, during 2009-2019

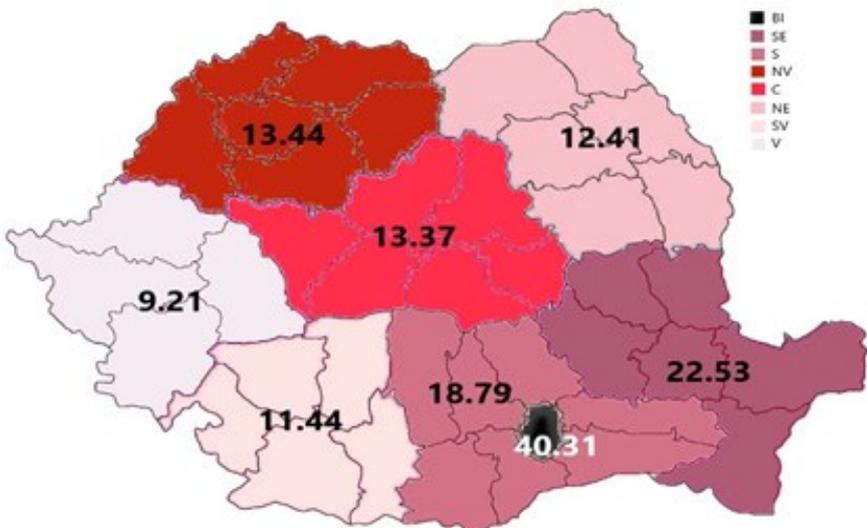


sodes/100,000 inhabitants), South West 11.44 episodes/100,000 inhabitants) and the West region (9.21 episodes/100,000 inhabitants) - graph no.6

At the local level, most hospitalization episodes were registered between 2009-2019 in Bucharest (23% of the total), which has approximately four times more episodes than the following leading counties Iași, Constanța, Harghita and Cluj - graph no.7.

Compared to the population of each county, a change in the ranking can be seen from chart no.8, on the first places being Harghita (49.63 episodes/100000 inhabitants), Bucharest (42.37 episodes/100000 inhabitants) and Ilfov (32.33 episodes/100000 inhabitants) and on the last counties of Bacău and Sibiu, with almost 10 times fewer episodes compared to the leading counties.

Graph no. 6. Distribution of hospitalization episodes for patients with avitaminosis, according to population, reported per 100,000 inhabitants, at regional level, in Romania, 2009-2019



5. Distribution of hospitalization episodes in patients with avitaminosis, according to patient sex

Of the total number of hospitalization episodes with the main diagnosis of avitaminosis recorded during the study period, most belonged to women, approximately 60% - graph no.9.

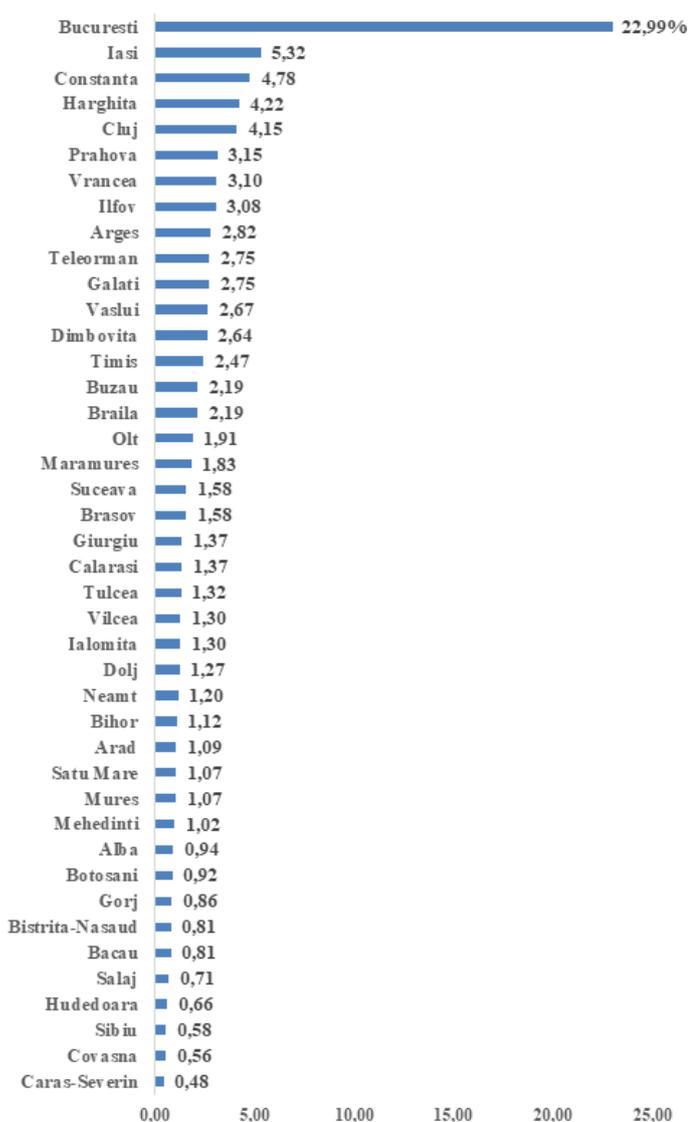
As an evolution over time, there is an increase in the number of hospitalization episodes throughout the study period, for both sexes. Women have recorded several episodes of hospitalization since 2014, reaching an increase of more than 3 times in 2019 compared to the initial year, the increase being continuous, after from 2009 to 2012 there

Compared to the number of inhabitants, the descending order of the regions that recorded hospitalization episodes of patients with avitaminosis was: Bucharest Ilfov region (40.31 episodes/100,000 inhabitants), South East region (22.53 episodes/100,000 inhabitants), South (18.79 episodes/100,000 inhabitants), North West (13.44 episodes/100,000 inhabitants), Center region (13.37 episodes/100,000 inhabitants), North East region (12.41 epi-

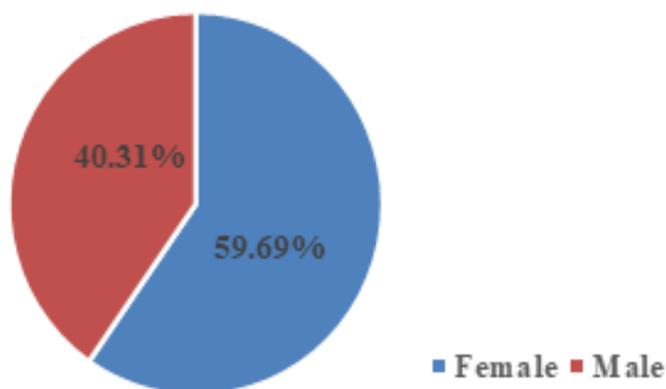
had been a steady decline. In men, too, there is an increase in hospitalizations with this diagnosis, but the evolution of hospitalizations has seen smaller variations than in the case of women, the increase being only 1.7 times compared to the first year of the period studied - graph no. 10.

6. Distribution of hospitalization episodes in patients with avitaminosis, according to patient age

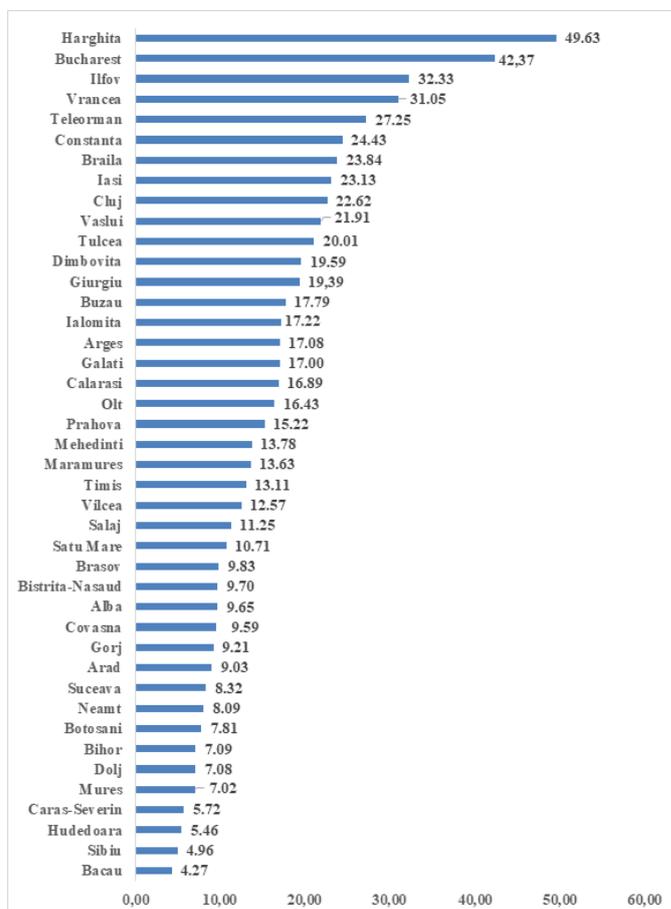
Graph no.7. Distribution of hospitalization episodes for patients with avitaminosis, at local/county level, in Romania, during 2009-2019



Graph no.9. Total number of episodes reported in continuous hospitalization, in patients with avitaminosis, depending on the patient's sex, during 2009-2019



Graph no.8. Distribution of hospitalization episodes for patients with avitaminosis, at local/county level, depending on the population of each county, during 2009-2019



The analysis of data by age shows that most episodes of hospitalization were recorded in adults between 35-65 years (42.2% of the total), the following categories being that of children (29.6%) and the elderly (19.7%). Young people between 19-35 years old recorded the fewest episodes - graph no.11.

By age groups, the most affected were the groups 0-9 years (20.3%), 60-69 years (20%) and 50-59 years (15.5%) - graph no.12.

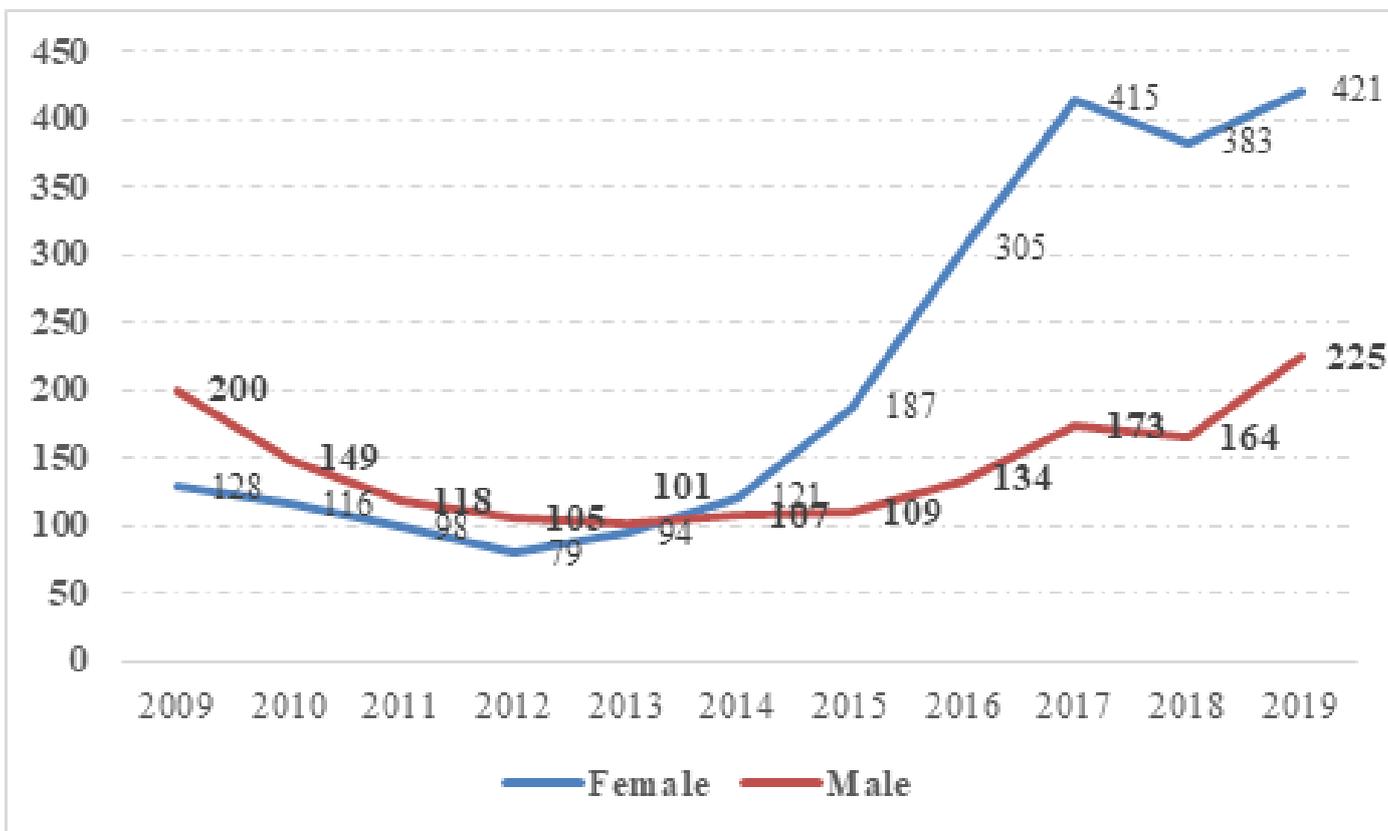
The evolutionary trend of the number of hospitalizations for all age groups was an increasing one, except for the 0-9 years group, where there was a double decrease in the number of episodes in 2019 compared to 2009. The most important increase is found in young age group (20-29 years), where the increase was 9.4 times.

7. Distribution of hospitalization episodes in patients with avitaminosis, according to the average length of hospitalization

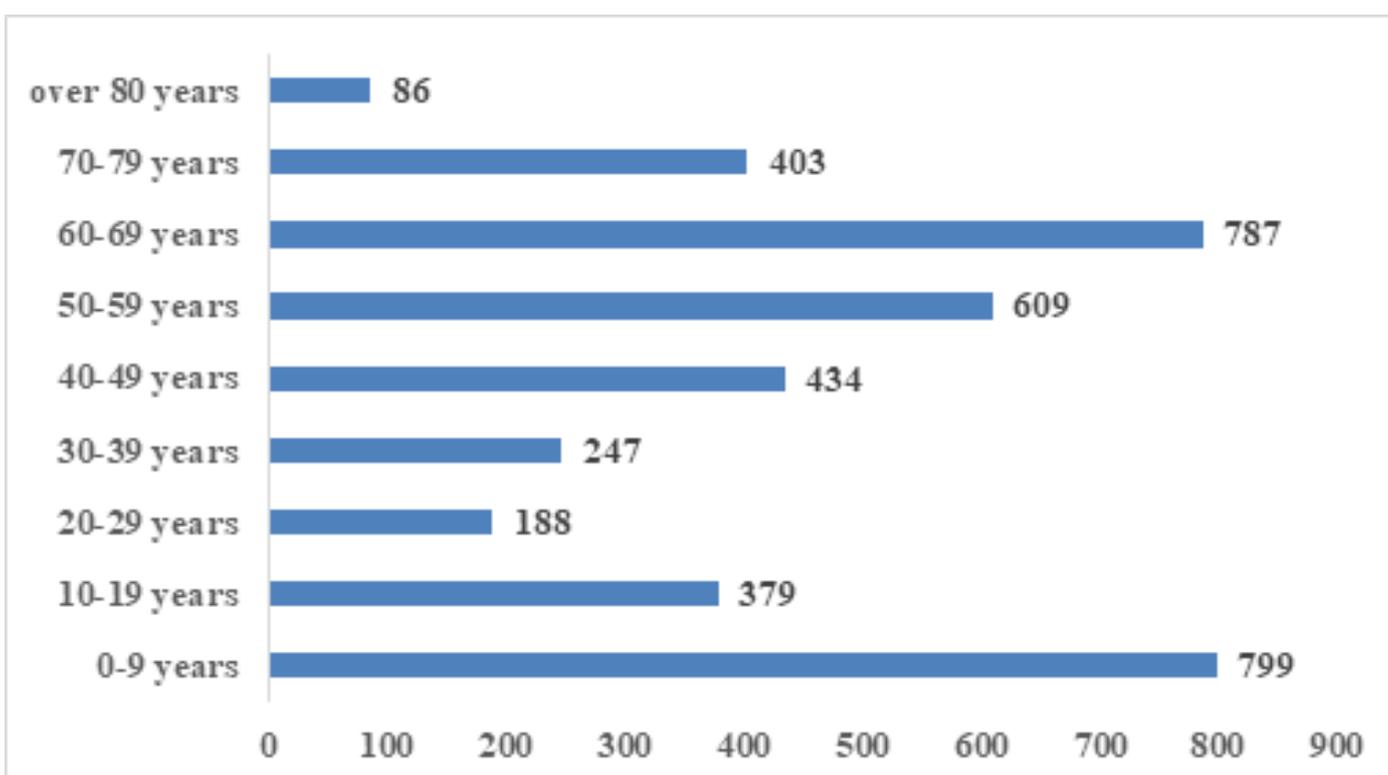
The average length of stay in case of hospitalization episodes for patients with avitaminosis in continuous hospitalization was during 2009-2019 of 5.49 days, varying throughout the study period, the maximum value being observed in the initial years 2013 and 2014 (6.4 days, respectively 6.1 days) it decreased from 2016, in 2019



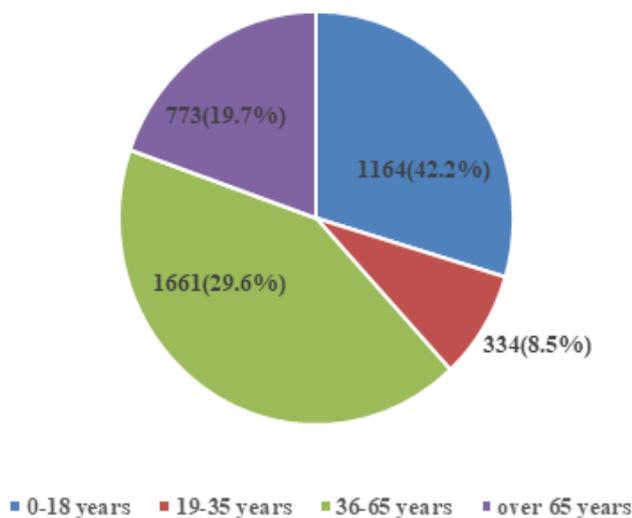
Graph no. 10. Evolution of episodes reported in continuous hospitalization, in patients with avitaminosis, depending on the patient sex, during 2009-2019, at national level



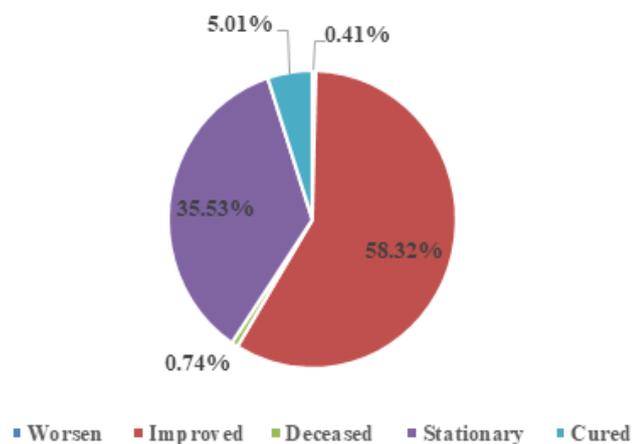
Graph no.12. Number of episodes reported in continuous hospitalization, in patients with avitaminosis, by age groups, in the period 2009-2019, at national level



Graph no. 11. Number of episodes reported in continuous hospitalization, in patients with avitaminosis, depending on the patient's age, during 2009-2019, at na-



Graph no.13. Number of hospitalization episodes for patients with avitaminosis, depending on the state of discharge of patients in Romania, during 2009-2019



reaching the lowest value of 4.72 days. The highest average values of the duration of hospitalization were registered in the case of patients with avitaminosis hospitalized in the acute psychiatric wards (16.3 days), children's hematology (14 days), obstetrics (12.5 days) or infectious diseases children (12 days). As a type of pathology, the forms of avitaminosis A with corneal xerosis and vitamin B1 deficiency-Beri Beri disease and Wernicke encephalopathy record the highest values of hospitalization time (17.67 days, respectively 11 and 10.86 days).

8. Distribution of hospitalization episodes in patients with avitaminosis, 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 patients with avitaminosis,

most patients were discharged in an improved state (58.3% of the total) or discharge status was stationary (35.5%). Approximately 5% of patients were discharged as cured, and extremely small percentages, 0.41% had an aggravated condition at discharge or died (0.74%) - graph no. 13.

The calculated rate of in-hospital mortality was for the entire study period of 0.74%, its values ranging between 0.34% in 2015 and 1.63 in 2012. The pathology of all those who died was Wernicke's encephalopathy.

CONCLUSIONS

In conclusion, from the analysis and interpretation of data on continuous hospitalization of patients with avitaminosis, in the period 2009-2019 the following can be deduced:

- a total number of 3932 episodes of hospitalization with main diagnosis at discharge *avitaminosis* was recorded during the 10 years studied in Romania; most were deficiencies of fat-soluble vitamins (68%), the rest being water-soluble avitaminosis. The most common of the fat-soluble vitamins is vitamin D deficiency (65%), and of the water-soluble vitamins, vitamin B1 (32%). Specifically, as vitamin D deficiency is found in three quarters of hospitalization
- episodes the unspecified vitamin D deficiency, but also the evolutionary rickets, while the most common avitaminosis A was avitaminosis A with conjunctival xerosis.
- in terms of evolution over the period, there is a more significant increase in the number of hospitalization episodes for two of the deficiencies, more than double the number of episodes in 2019 compared to the initial year for avitaminosis D and 1, 7 times for avitaminosis B. The rest of the avitaminosis remain at the same level, except for avitaminosis A, in which case the number of hospitalizations has gradually decreased, about 8 times.
- the endocrinology, pediatrics and neurology departments are the ones in which the most hospitalization episodes with the main diagnosis of avitaminosis were registered.
- most patients came from urban areas, from the regions of Bucharest Ilfov, South-East and South, the leading counties being the city of Bucharest with approximately four times more episodes than the following leading counties Iași, Constanța, Harghita and Cluj. Compare to population, the same regions remain on the leading places, the counties on the first places being the municipality of Bucharest and Ilfov county.
- women accounted for most of the patients hospitalized with avitaminosis, the evolution over time of the number of hospitalization episodes throughout the study period, being an increasing one, for both sexes. The increase was more important for women, more than 3 times in 2019 compared to the initial year, while for men the increase was only 1.7 times →

- in terms of age, the most frequently hospitalized patients with this diagnosis were adults, followed by children and the elderly, by age groups the most affected being the category 0-9 years, 60-69 years and 50-59 years; the evolutionary trend of the number of hospitalizations for all age groups was an increasing one, the most important increase in the 20-29 age group was 9.4 times except for the 0-9 age group where the decrease was twice compared to 2009.
- the average length of stay in the case of hospitalization episodes for patients with avitaminosis was 5.49 days, ranging from a maximum of 6.4 days in 2013 to 4.72 days in 2019. The highest average values of the duration of hospitalization were recorded in the departments of acute psychiatry (16.3 days), hematology children (14 days), obstetrics (12.5 days) or infectious diseases children (12 days), and forms of avitaminosis A with corneal xerosis and vitamin B1 deficiency - Beri Beri disease and Wernicke's encephalopathy recorded the highest values of hospital stay (17.67 days, respectively 11 and 10.86 days).
- more than half of the patients were discharged in an improved state or the condition at discharge was stationary (over a third), and extremely small percentages, less than 1%, had an aggravated condition at discharge or died. The calculated in-hospital mortality rate was 0.74% for the entire study period, ranging between 0.34% in 2015 and 1.63% in 2012, and the pathology in all deaths was Wernicke's encephalopathy.
- Although the analysis of national data on hospitalization of patients with this diagnosis (avitaminosis) does not indicate excessive values of morbidity and mortality

caused by this form of malnutrition, there is still a need for better monitoring of the situation in order to prevent and / or establish early treatment of diagnosed disease to avoid the transformation of these deficits into chronic, serious diseases, with subsequent repercussions on the health of the population.

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