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RESEARCH ARTICLE

Epidemiology and public health challenges of echinococcosis in the Republic of Moldova

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Objective: This study aims to analyze the current epidemiological trends of echinococcosis in the Republic of Moldova and evaluate the effectiveness of existing surveillance and control measures.

Methods: The research is a descriptive observational epidemiological study that involved several steps, which allowed for achieving the initial goal – analyzing the morbidity of echinococcosis globally and in the Republic of Moldova from 2011 to 2024. The steps of the research include: studying the bibliographic literature on the proposed topic and mastering the research methods; collecting data on echinococcosis globally and in the Republic of Moldova; analyzing the obtained data on echinococcosis; establishing effective control and prevention measures.

Results: Between 2011 and 2024, 985 cases of echinococcosis were reported, with a peak incidence in 2012–2013 and a decline until 2020. However, cases increased again from 2022. The disease predominantly affected adults (51–60 years) and was more prevalent in females (53% of cases). Hepatic involvement was the most common localization (79.4%). The southern regions exhibited the highest burden. Control measures, including deworming programs and public health campaigns, contributed to incidence reduction but require further optimization.

Conclusions: Echinococcosis remains a significant public health concern in Moldova, with fluctuating incidence rates and persistent endemicity. Enhanced surveillance, improved diagnostic strategies, and One Health-based preventive interventions are essential for sustainable control.

Keywords: echinococcosis, epidemiology, public health, zoonotic disease

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Introduction

Echinococcosis is a zoonotic disease caused by *Echinococcus* spp., with significant health and economic burdens [1]. The Republic of Moldova is among the most affected countries in Eastern Europe, necessitating continuous epidemiological monitoring and control strategies [2]. The objective of this study is to analyze morbidity trends, demographic characteristics, and the effectiveness of public health interventions to mitigate the disease burden [3]. Additionally, this study explores the socio-economic impact of echinococcosis and the effectiveness of current prevention strategies in reducing transmission [4]. The increasing burden of zoonotic diseases, including echinococcosis, highlights the need for a coordinated One Health approach that integrates veterinary, medical, and environmental sciences [5].

Methods

The research is a descriptive observational epidemiological study. The process of conducting this study involved multiple stages, which allowed for the fulfillment of the primary objective – to analyze the global morbidity of echinococcosis as well as its prevalence within the Republic of Moldova. For this purpose, we gathered the relevant data from the National Agency for Public Health, specifically from the Department of Epidemiological Surveillance of Highly Contagious Diseases, Zoonoses, and Parasitic Infections, covering the period from 2011 to 2024. The data were collected from Form 1 – Statistical Report on Morbidity due to Parasitic Diseases. The following qualitative indicators were analyzed: the distribution of cases by age groups and territories, and quantitative indicators: the dynamics of morbidity over time and the level of morbidity. To assess and evaluate the morbidity caused by echinococcosis, both intensive and extensive indices were calculated.

The intensive index represents the number of new cases recorded in a defined population over a specified period of time. To establish this index, it is necessary to know the population numbers for the relevant years as well as the number of cases of the disease, using the following formula: *Incidence = Number of Cases / Population x 100,000*

The extensive indices are relative measures of the distribution and structure of the phenomenon being analyzed according to specific characteristics. This index shows the ratio between a part and the whole, with the whole always considered to be equal to 100. It is calculated using the following formula: *Extensive Index = Value of the part / Value of the whole x 100*

For the statistical processing of the data, the methods described in the manual "General Epidemiology. Foundations of Evidence-Based Medicine" (2012, V. Prisăcaru) were used. The obtained results were subjected to statistical analysis and calculated using Microsoft Excel, and are presented in tables and graphs.

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Results

Incidence Trends

Between 2011 and 2014, the incidence of echinococcosis increased for both age groups, peaking in 2012-2013 for adults (4.2 cases per 100,000 population) and in 2014 for children (2.6 cases per 100,000 population). After 2014, the incidence progressively decreased, especially among children, reaching zero in 2020 and 2022. In adults, the decrease was less significant, with the lowest level recorded in 2020 (1.54 cases per 100,000 population).

Starting in 2022, adult incidence began to rise again (2.98 cases per 100,000 population in 2022 and 2.99 cases in 2023), while it remained low among children (0.19 cases in 2023 and 0.4 cases in 2024). This suggests that infection hotspots persist among adults. Children had a significantly lower incidence throughout the period, with rates almost half those of adults in 2012-2014, indicating lower exposure (Figure 1).

Sex Distribution

Analyzing the distribution of confirmed echinococcosis cases by sex from 2011 to 2024, it was found that females were more frequently affected, with an average of 53% of the total registered cases, resulting in a female-to-male ratio of 1:0.88. This relatively balanced distribution suggests that the disease affects both sexes similarly. However, the disparity between sexes is more pronounced in years with higher incidence (2012-2014), where the number of cases reported in women was significantly higher than in men (Figure 2).

Geographic Distribution

Analyzing the distribution of echinococcosis morbidity based on the living environment in the Republic of Moldova from 2019 to 2023, it was determined that there is a significant difference between rural and urban areas in terms of echinococcosis morbidity. The findings confirm

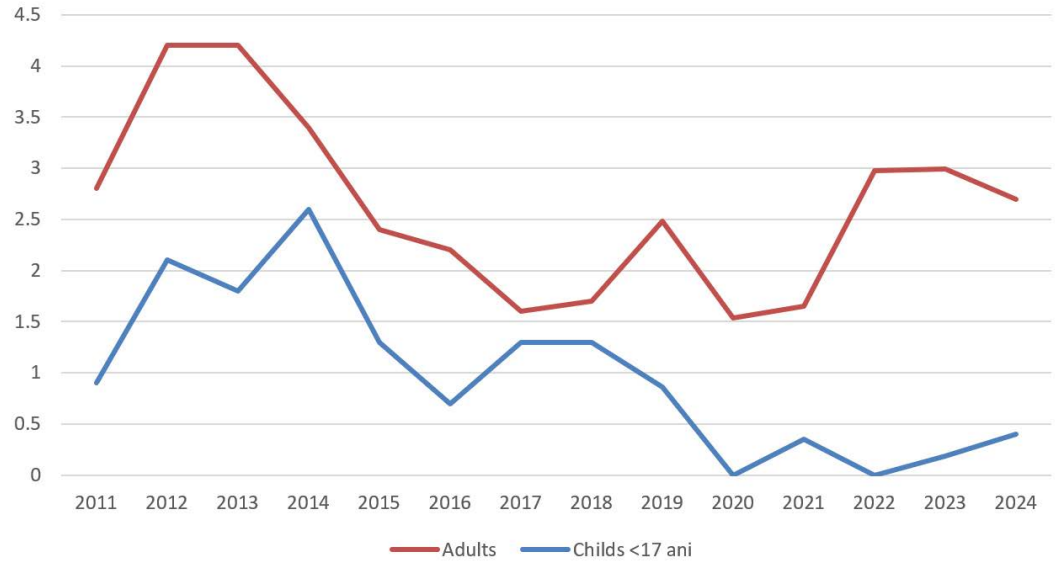

Fig.1. Incidence of echinococcosis in multiannual dynamics in the Republic of Moldova, 2011-2024.

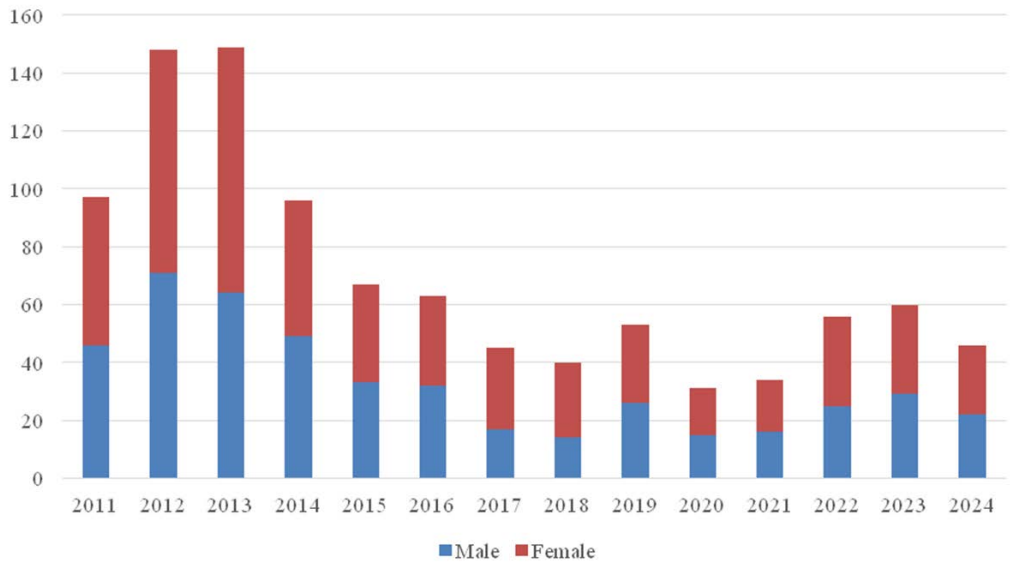

Fig. 2. Gender distribution of echinococcosis cases from 2011 to 2024 in the Republic of Moldova.

that the majority of cases (78%) are registered in rural areas, while only 22% of cases come from urban areas (Figure 3).

Clinical Characteristics

Analyzing the distribution of echinococcosis cases based on cyst localization from 2011 to 2024, it was determined that the liver is the most frequently affected organ, involved in 79.4% of cases (Table 1).

Table I. Distribution of echinococcosis cases by cyst location during the period 2011–2024 in the Republic of Moldova

Localization	Nr of cases	%
Liver	783	79,4
Lungs	158	16,0
Liver+Lungs	11	1,1
Liver+Spleen	2	0,2
Spleen	7	0,7
Abdominal cavity	3	0,3
Multiorgan	16	1,6
Axillary fossa	1	0,1
Liver+lungs+spleen	1	0,1
Iliac bone	1	0,1
Pelvic cavity	1	0,1
Muscles	1	0,1
Total	985	100,0

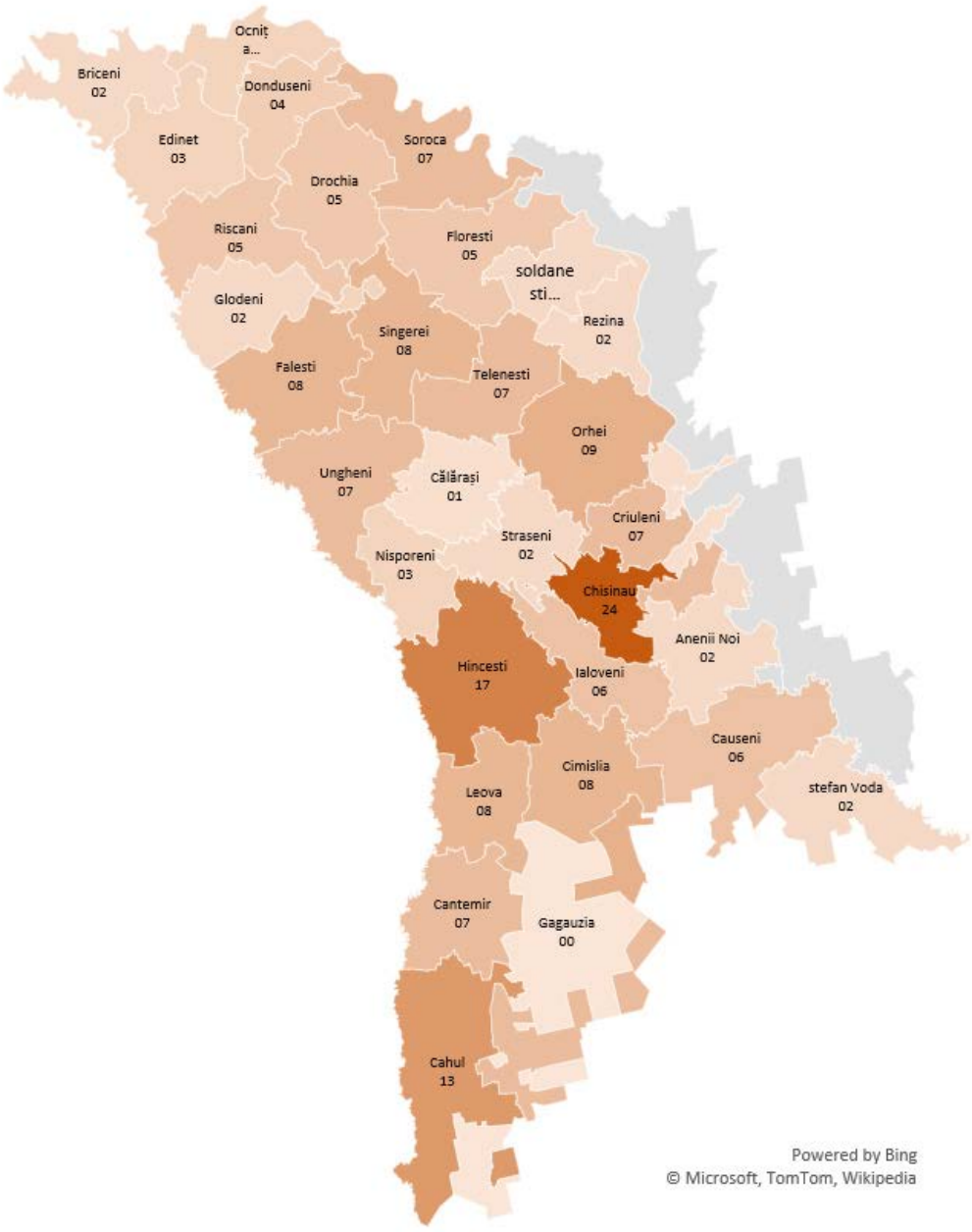

Fig. 3. Geographical distribution of echinococcosis morbidity in the Republic of Moldova, 2019–2023. Light color: low incidence (0–2 cases/100,000 inhabitants); Medium color: moderate incidence (3–9 cases/100,000 inhabitants); Dark color: high incidence (10–17 cases/100,000 inhabitants); **Incidence distribution:** Hîncești: 17.0, Cahul: 13.0, Chișinău: 9.0, Leova: 8.0, Cimișlia: 8.0, Ungheni: 7.0, Florești: 5.0, Glodeni: 5.0, Soroca: 5.0, Căușeni: 6.0, Orhei: 3.0, Telenești: 3.0, Edineț: 3.0, Ștefan Vodă: 3.0, Fălești: 3.0, Cantemir: 7.0, Rezina: 2.0, Nisporeni: 2.0, Râșcani: 5.0, Drochia: 5.0, Briceni: 2.0, Ocnița: 2.0, Șoldănești: 2.0, Strășeni: 2.0, Anenii Noi: 2.0, Criuleni: 2.0, Dubăsari: —, Dondușeni: —, Basarabeasca: —, Taraclia: —, UTA Găgăuzia: 0.0.

Discussions

Echinococcosis remains a major public health challenge, requiring sustained efforts in surveillance, control, and public education [6]. The disease burden in Moldova reflects complex socio-economic and environmental determinants. Comparative analysis with other endemic regions indicates that integrated One Health strategies, involving veterinary and medical collaboration, yield better outcomes [7]. Countries such as Australia and Iceland have successfully implemented control programs that combine rigorous surveillance, systematic deworming of canines, and public education, leading to significant reductions in disease prevalence [8]. In contrast, Moldova still faces persistent transmission cycles, likely due to inconsistent implementation of preventive measures, socio-economic constraints, and gaps in public health infrastructure [9].

One of the critical aspects of disease control is the deworming of stray and domestic dogs, as they serve as the definitive hosts for *Echinococcus* spp. [10]. Studies have shown that periodic deworming campaigns combined with community engagement programs significantly reduce parasite burden in dog populations, thereby lowering the risk of human transmission [11]. However, financial and logistical challenges often hinder the sustainability of such programs in Moldova [12]. Additionally, compliance among dog owners regarding regular deworming remains a challenge, especially in rural communities [13].

Improving diagnostic capacities is another essential strategy to mitigate the disease burden [14]. The early detection of *Echinococcus* infections is critical in preventing severe complications and reducing the need for invasive surgical interventions [15]. However, current diagnostic tools, such as imaging techniques and serological tests, are often limited in accessibility and affordability in rural regions [16]. The introduction of cost-effective point-of-care diagnostic tools could significantly enhance early case detection and prompt treatment initiation [17].

Moreover, public awareness campaigns focusing on personal hygiene, safe handling of animal products, and environmental sanitation are critical in reducing the incidence of echinococcosis [18]. Studies have demonstrated that educational interventions targeting high-risk populations, such as livestock farmers and pet owners, can significantly improve knowledge and preventive practices [19]. In Moldova, community engagement programs should be expanded to cover remote rural areas where knowledge gaps remain substantial [20]. Furthermore, improved waste management and stricter regulations on animal husbandry practices could further enhance control effort [21]. Inadequate disposal of animal remains, particularly in rural slaughterhouses, continues to pose a significant risk for the transmission of *Echinococcus* eggs into the environment [22]. Implementing stricter biosecurity measures and promoting proper carcass disposal methods could help reduce environmental contamination and interrupt the parasite's life cycle [23].

Comparisons with other endemic regions suggest that a multi-faceted approach, integrating veterinary, medical, and environmental interventions, is the most effective strategy for controlling echinococcosis [24]. Future research should focus on evaluating the cost-effectiveness of various interventions to optimize resource allocation for maximum impact [25]. Strengthening collaboration between public health authorities, veterinary services, and community stakeholders will be essential in ensuring sustainable progress toward disease control and eventual elimination [26].

Conclusion

Echinococcosis represents a significant public health concern in the Republic of Moldova, particularly in rural areas where exposure to infected animals is more prevalent. The findings emphasize the importance of preventive strategies, including public health education on hygiene and proper handling of animals, as well as effective control measures for domestic and stray dogs. The establishment of a national surveillance and intervention program is crucial to monitor the spread of the disease, identify high-risk populations, and reduce morbidity rates. Continued research and collaboration between health authorities, veterinarians, and communities are essential for the successful management of this condition

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Authors' contribution

SA (Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Resources; Validation; Visualization; Writing – original draft; Writing – review & editing)

SD (Conceptualization; Formal analysis; Investigation; Methodology; Supervision; Writing – original draft; Writing – review & editing)

Conflict of interest

None to declare.

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