

## LONGITUDINAL ANALYSIS OF MATERNAL AND CHILD HEALTH INDICATORS IN BACĂU COUNTY, ROMANIA (2021-2024)

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LONGITUDINAL ANALYSIS OF MATERNAL AND CHILD HEALTH INDICATORS IN BACĂU COUNTY, ROMANIA (2021-2024) (Abstract): This longitudinal observational study assessed the evolution of maternal and child health indicators in Bacău County, Romania, between 2021 and 2024, using annual administrative data collected from hospitals and medical practices involved in maternal and child health services. **Materials and methods:** The analysis focused on service coverage, year-to-year variations, and discontinuities in key program-related interventions. Descriptive statistical analyses were performed using SPSS version 28 and Microsoft Excel. **Results:** During the study period, improvements were observed in several components, particularly neonatal screening activities and nutritional support for low-birth-weight newborns. Coverage of Rh immunological prophylaxis among Rh-negative pregnant women increased alongside better orientation of services toward vulnerable population groups. Nevertheless, persistent challenges were identified in postnatal follow-up of preterm infants and in ensuring equitable access to infant formula. Additionally, a declining birth rate was noted, with potential implications for resource allocation and service planning. Overall, the findings indicate heterogeneous longitudinal trends in maternal and child health indicators, reflecting variable continuity and performance across service components. **Conclusions:** These results underline the need for targeted adjustments to enhance the consistency and quality of maternal and child health interventions at the local level. **Keywords:** MATERNAL HEALTH, CHILD HEALTH, LONGITUDINAL ANALYSIS, HEALTH INDICATORS, ROMANIA.

### INTRODUCTION

The promotion and protection of women's and children's health represent a core public health priority at both national and international levels. These population groups require continuous, targeted interventions to ensure equitable access to healthcare services, prevent disease, and support healthy growth and development. Maternal and child health programmes contribute directly to reducing maternal

and infant mortality, preventing chronic conditions, promoting family planning, and improving overall population health outcomes (1-4).

The COVID-19 pandemic exerted additional pressure on healthcare systems in Romania, revealing pre-existing structural vulnerabilities and emphasizing the importance of realistic assessments of public health programme implementation. In this context, maternal and child health interven-

tions have remained essential for addressing health inequalities and maintaining continuity of preventive and curative services. Such interventions typically follow a hierarchical approach, prioritizing primary prevention and health education, followed by early diagnosis and timely treatment, in line with international maternal and child health frameworks (5-8).

Evidence from the literature indicates that the implementation of maternal and child health programmes is frequently uneven, particularly in rural areas and among vulnerable population groups, where access to healthcare services remains limited (9). In Romania, inconsistencies in neonatal screening coverage and in the application of nutritional and immunological protocols have been reported, resulting in notable gaps when compared with European benchmarks (10-12). Urban-rural disparities, shortages of healthcare professionals, and infrastructural constraints further affect the effectiveness and equity of service delivery (13). These challenges underline the need for coordinated action among family physicians, hospital-based services, public health authorities, and community-level actors to ensure continuity and coherence of care.

At the strategic level, maternal and child health priorities in Romania are aligned with World Health Organization (WHO) recommendations and are embedded in national policy frameworks, including the National Health Strategy, the National Strategy on Equal Opportunities and Treatment between Women and Men (2022-2027), the National Cancer Control Plan, and the National Mental Health Strategy (14,15). Core objectives include reducing maternal and infant mortality, promot-

ing reproductive health and family planning, monitoring child development, and addressing inequalities in access to health services (16-18). Within this framework, longitudinal analyses at the local level are essential for understanding temporal trends and identifying areas requiring improvement.

This study was motivated by the need to assess the performance and continuity of maternal and child health interventions in settings characterized by increased population vulnerability. In the context of disruptions generated by the COVID-19 pandemic and the subsequent recovery of the Romanian healthcare system, evaluating the local implementation of key maternal and child health components provides relevant insight into system resilience and service delivery at the county level.

The aim of this research was to conduct a longitudinal analysis of maternal and child health indicators in Bacău County over the period 2021-2024, using administrative data associated with program-related services. The specific objectives were to evaluate temporal changes in service coverage, to identify discontinuities or functional challenges across major intervention components, and to analyze trends in the number of beneficiaries by subcomponent in order to describe population coverage patterns during the study period.

## **MATERIALS AND METHODS**

A longitudinal observational study was conducted to assess maternal and child health indicators associated with the implementation of program-related services in Bacău County, Romania. The analysis covered the period 2021-2024 and included data from three public hospitals-Bacău

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County Emergency Hospital, Moinești Municipal Emergency Hospital, and St. Hierarch Dr. Luca Onești Municipal Hospital—as well as from 11 family medicine practices involved in maternal and child health service delivery at the county level.

All medical units participating in the implementation of maternal and child health interventions during the study period were considered eligible for inclusion. No exclusion criteria were applied, and all validated data available from the participating institutions were included in the analysis.

Data was collected through document review of primary and secondary sources, including official reports and datasets provided by the participating hospitals, maternal and child health statistics obtained from the healthcare units included in the study, legislative acts, national strategic documents, and databases of the National Institute of Public Health (INSP). The main variables of interest included the number of beneficiaries by intervention component, annual variations, coverage rates, and indicators of discontinuity in service provision. Calculated measures comprised absolute numbers of beneficiaries, base indices, and dynamic chain indices expressed as percentages.

Statistical analysis was descriptive reflecting the observational design of the study. Descriptive statistics, including absolute values, means, and frequencies, were generated using IBM *SPSS Statistics version 28* and *Microsoft Excel*. Comparative analyses were performed to describe temporal dynamics over the 2021-2024 period, while qualitative information from official documents was interpreted using thematic analysis. This approach allowed the identification of major longitudinal trends, urban-rural differences, and contex-

tual factors influencing service continuity and performance.

The study was conducted in accordance with applicable legislation and ethical standards, following the Standards of Research Ethics in Medical Sciences (19) and the principles of the Declaration of Helsinki (20). Ethical approval was obtained from the Ethics Committees of Bacău County Emergency Hospital (Decision No. 30695/28.12.2022), Moinești Municipal Emergency Hospital (07.12.2022), and St. Hierarch Dr. Luca Onești Municipal Hospital (Decision No. 21613/23.12.2022), as well as from the Ethics Committee of the Grigore T. Popa University of Medicine and Pharmacy Iași (Decision No. 255/17.01.2023). The study forms part of a doctoral research project conducted at the Doctoral School of the Grigore T. Popa University of Medicine and Pharmacy Iași (Doctoral contract No. 1916 / 29.10.2021),

### RESULTS

The application of maternal and child health program-related services in Bacău County generated relevant findings regarding population coverage and the longitudinal evolution of key maternal and child health indicators. The analysis highlighted heterogeneous temporal trends across intervention components, reflecting both improvements in service delivery and the persistence of discontinuities during the study period. These results provide a descriptive overview of program performance at the county level between 2021 and 2024.

#### Number of newborns

The number of newborns recorded in hospitals across Bacău County showed a continuous decline over the 2021-2024

period. Compared with the baseline year 2021, the total number of live births decreased by approximately 30% by 2024. As shown in (tab. I), the number of newborns declined from 5,961 in 2021 to 5,819 in 2022 (97.6% of the baseline), followed by a marked reduction to 4,466 in 2023 (74.9%) and a further decrease to 4,148 in 2024 (69.6%). The most pronounced decrease occurred between 2022 and 2023, while the reduction observed between 2023 and 2024 was more moderate.

**Preterm births**

The evolution of preterm births recorded in hospitals across Bacău County showed a fluctuating pattern during the 2021-2024 period (fig. 1). Between 2021 and 2023, the number of preterm births decreased by approximately 30%, followed

by an increase of about 13% in 2024 compared with the previous year. Overall, the data indicates a non-linear temporal trend, characterized by a decline during the first part of the study period and a subsequent increase in the final year.

TABLE I.  
**Number of newborns in hospitals in Bacău county (2021-2024)**

(Source: Hospital administrative data, National Health Program PN XIII, 2021-2024)

Year	Number of newborns	Dynamic base indices (%)
2021	5.961	100.0
2022	5.819	97.6
2023	4.466	74.9
2024	4.148	69.6

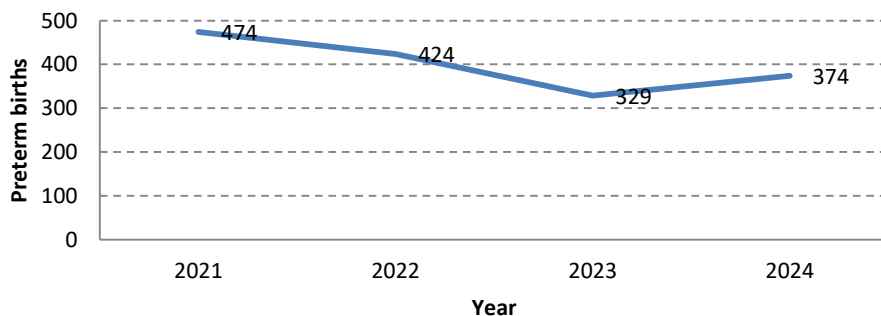


Fig. 1. Preterm births in Bacău County, 2021-2024.

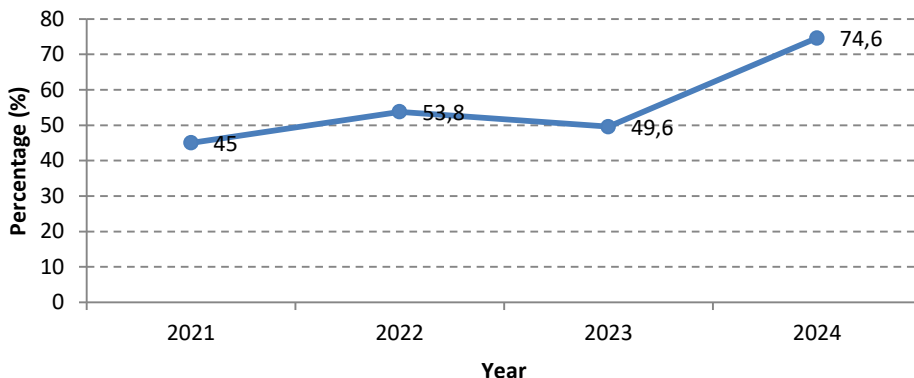
**Prevention of hearing loss through newborn screening**

Coverage of newborn hearing screening increased substantially between 2021 and 2024, rising from 45.03% to 74.61%, which represents a relative increase of 65.7% compared with the baseline year (fig. 2). The upward trend was consistent throughout the study period and was most

pronounced in 2024.

The absolute number of newborns screened for hearing loss varied year to year. In 2022, an increase of 10.39% compared with 2021 was observed, followed by a decrease of 15.22% in 2023. In 2024, the number of screened newborns increased by 39.65% compared with 2023, representing the highest value recorded during the study period.

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**Fig. 2.** Hearing loss screening coverage in Bacău County, 2021-2024.

**Prevention of retinopathy of prematurity**

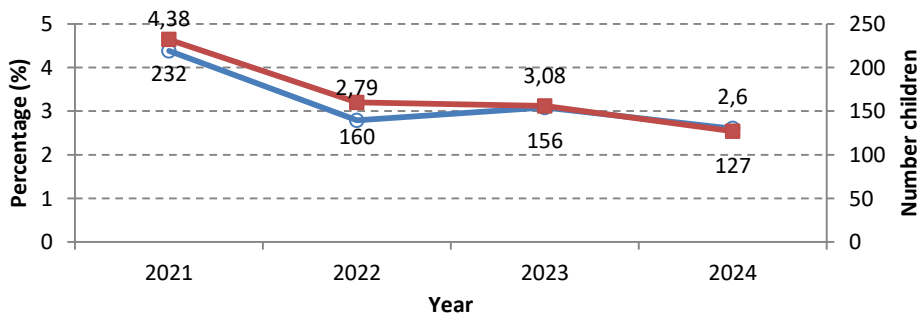
Between 2021 and 2024, the coverage rate of screening for retinopathy of prematurity increased from 86.05% to 100% and remained at this level during the final years of the study period. Over the same interval, the number of preterm newborns eligible for screening increased from 86 cases in 2021 to 127 cases in 2024, with a corresponding increase in the number of beneficiaries, resulting in complete screening coverage during 2022-2024.

In contrast, the proportion of preterm newborns monitored after initial screening decreased progressively over the study period, declining from 93.02% in 2021 to

70.08% in 2024, indicating variability in continuity of post-screening follow-up.

**Malnutrition prophylaxis in infants aged 0-12 months without access to breast milk**

During the 2021-2024 period, the proportion of infants aged 0-12 months benefiting from malnutrition prophylaxis through infant formula decreased from 4.38% to 2.60%. In absolute terms, the number of beneficiaries declined from 232 cases in 2021 to 127 cases in 2024 (fig. 3). This reduction occurred gradually over the study period, in parallel with the decrease in the number of live births.



**Fig. 3.** Number and proportion of infants aged 0-12 months receiving malnutrition prophylaxis with infant formula in Bacău County, 2021-2024.

### **Malnutrition prophylaxis in low-birth-weight infants**

Among low-birth-weight infants, the proportion of beneficiaries receiving nutritional prophylaxis increased from 83.92% in 2021 to 95.89% in 2024, in the context of a relatively stable number of eligible cases. This finding reflects a progressive increase in coverage over the study period.

### **Prophylaxis of Rh isoimmunization syndrome**

Coverage with anti-D immunoglobulin among Rh-negative pregnant women showed moderate variation between 2021 and 2024. Coverage increased to 75.40% in 2023, followed by a decrease to 70.45% in 2024. The absolute number of beneficiaries followed a similar pattern, reaching a peak of 233 cases in 2023 and decreasing to 217 cases in 2024.

## **DISCUSSION**

The findings of this longitudinal analysis indicate a heterogeneous pattern of performance across maternal and child health services at the county level. While several core interventions showed measurable improvement during the study period, persistent discontinuities and inequalities pointed to an ongoing gap between regulatory frameworks and their consistent operationalization. This pattern is consistent with the concept of the “implementation gap” described in public health literature, referring to the discrepancy between formally established policies and their effective translation into routine practice (15).

A clear illustration of this gap is provided by the prophylaxis of Rh isoimmunization through the administration of anti-D immunoglobulin. Although this intervention is well regulated and standardized at

the national level, the observed variability in coverage suggests vulnerabilities in supply chains, reporting mechanisms, and service coordination. Similar challenges have been reported in other European health systems, where regional differences in access to anti-D immunoglobulin persist despite uniform clinical guidelines (16). International evidence further highlights that incomplete documentation and limited traceability of administration episodes continue to constrain effective monitoring of this intervention (17). From a clinical perspective, inadequate prophylaxis exposes Rh-negative pregnant women and their newborns to the risk of hemolytic disease, a preventable condition associated with increased neonatal morbidity (18).

The upward trends observed in newborn hearing screening and retinopathy of prematurity (ROP) screening coverage reflect progressive alignment of local services with European standards and improvements in technical capacity. These findings support the effectiveness of neonatal screening as a public health intervention for early detection of conditions with potentially irreversible consequences. However, the decline identified in post-screening follow-up among preterm infants highlights a critical vulnerability in the continuum of care. The literature consistently emphasizes that screening effectiveness depends not only on early identification but also on functional referral and follow-up pathways that ensure diagnostic confirmation and timely intervention, in accordance with ethical standards for research and clinical practice (19, 20). In the absence of such mechanisms, the overall public health impact of screening programs remains limited. The observed patterns suggest that organizational factors, including fragmented coord-

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dination between maternity services, neonatology units, specialized outpatient care, and primary care, play a central role in loss to follow-up, a phenomenon also reported in other European settings (23).

Nutritional interventions display differentiated trends. The increasing coverage of nutritional prophylaxis among low-birth-weight infants indicates effective identification and enrollment of a high-risk population group, demonstrating that targeted interventions can achieve high coverage when supported by clear eligibility criteria and coordinated delivery. In contrast, the declining proportion of infants receiving formula milk in the absence of breastfeeding presents a more complex interpretation. While this trend may be consistent with successful promotion of breastfeeding practices in line with international recommendations, it may also reflect persistent access barriers for families unable to breastfeed, particularly in socioeconomically disadvantaged or rural contexts. International evidence underscores the importance of maintaining regulated and equitable access to safe breast milk substitutes to avoid reinforcing nutritional inequalities (15). These findings highlight the need to interpret infant nutrition indicators within a broader equity-oriented framework.

The variability observed across service components and population groups reflects broader territorial inequalities in healthcare delivery. International studies consistently report lower coverage and reduced continuity of care in rural or underserved areas, even in the presence of centralized national policies (21,22). The results from Bacău County suggest that insufficient coordination structures and limited integration between institutional levels may fragment care pathways, reducing overall program

effectiveness. Evidence from Southeastern Europe supports the relevance of adaptive governance approaches that emphasize coordination across national, county, and community levels in addressing local barriers to implementation and follow-up (23).

The sustained decline in the number of live births observed during the study period must be interpreted within a broader demographic context. Eurostat data document a long-term decrease in fertility rates and a rise in maternal age across Romania and the European Union (24). These demographic shifts create a dual challenge for maternal and child health services, combining reduced case volumes with increased clinical complexity associated with higher-risk pregnancies. The European Health Report emphasizes the necessity for health systems to integrate demographic realities into service planning and risk management frameworks (25).

This study has several limitations. It relies on administrative data, which may be affected by reporting inconsistencies or incomplete documentation, and it does not capture qualitative dimensions such as provider perspectives or organizational culture. The analysis reflects the specific context of Bacău County and may not be fully generalizable to other regions. In addition, the four-year observation period limits long-term inference, and external legislative, financial, or epidemiological factors may have influenced the observed trends.

### **CONCLUSIONS**

The longitudinal evaluation of maternal and child health services in Bacău County over the 2021-2024 period indicates a heterogeneous pattern of performance across program components. Notable progress was observed in neonatal screening activities,

particularly in hearing screening and retinopathy of prematurity prevention, reflecting improved coverage and consolidation of early detection mechanisms with potential long-term clinical benefit.

Nutritional interventions demonstrated differentiated trends. Coverage among low-birth-weight infants increased steadily, indicating effective identification and inclusion of a high-risk group, whereas the declining proportion of infants receiving formula in the absence of breastfeeding highlights the importance of continuous monitoring to ensure that nutritional vulnerabilities are not overlooked.

Immunoprophylaxis against Rh isoimmunization showed variable coverage over time, suggesting that, despite functional implementation, full and stable protection of the target population has not yet been achieved. In addition, the decreasing continuity of post-screening follow-up among preterm infants represents a critical limitation, emphasizing that improvements in screening coverage must be accompanied by sustained monitoring to achieve their intended health impact.

The persistent decline in the number of live births observed during the study period further underscores the need for adaptive service planning in the context of demographic change, characterized by reduced

case volumes and increased clinical complexity. Overall, the findings highlight both the consolidation of key preventive interventions and the persistence of organizational and continuity-related challenges, shaping a nuanced picture of maternal and child health service performance at the county level.

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## CONFLICT OF INTEREST AND FUNDING

The authors declare no conflict of interest.

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