Review Paper

Acceptance of Vaccination and Its Global Challenges

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ABSTRACT

Background: Vaccine hesitancy has emerged as a major public health concern. Still, vaccination saves millions of lives each year. The World Health Organization has identified vaccine hesitancy as one of the top 10 threats to global health. This phenomenon varies from outright refusal to accept vaccines to doubts regarding their safety and effectiveness.

Objectives: Understanding and addressing the reasons behind vaccine hesitancy is crucial for maintaining high vaccination rates and preventing disease outbreaks.

Methods: This study was conducted by review of literature published between 2010 and 2025. Data were collected from scientific databases, including PubMed, Scopus, and ScienceDirect. Only English-language articles that examined factors influencing vaccine hesitancy were included in the review.

Results: The history of vaccine opposition dates back to the 18th century when the smallpox vaccine was first introduced. At that time, religious objections were common, with some individuals arguing that vaccination interferes with divine will. In the 19th century, mandatory vaccination laws in Europe and America led to organized anti-vaccine movements. Today, the spread of misinformation through social media has exacerbated vaccine hesitancy. Social and cultural factors also play a significant role. Certain religious groups, such as the Amish, refrain from vaccination due to their beliefs. Historical mistrust of medical institutions, particularly among minority communities, further contributes to hesitancy. Additionally, some political groups oppose vaccine mandates, viewing them as violations of personal freedom. Social media platforms amplify these issues by creating echo chambers where misinformation spreads rapidly.

Conclusions: Addressing vaccine hesitancy necessitates a comprehensive and multifaceted approach. Public health strategies should focus on improving health literacy through community education and engaging, scientifically accurate content. Transparency in vaccine development and the involvement of trusted community leaders can help rebuild public trust. Social media platforms must take responsibility for managing misinformation and promoting reliable sources. Policies should emphasize positive incentives rather than strict mandates to encourage vaccination. Success depends on collaboration across sectors, a thorough understanding of public concerns, and evidence-based solutions. By implementing these strategies, we can increase vaccination rates and establish a model for addressing other public health challenges.

Key Words:

Vaccination, Vaccine hesitancy, Public health, Social media, Public trust

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Review Paper

Vaccination Strategies for Immunodeficient Patients: Challenges and Advancements

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ABSTRACT

Background: Immunization remains one of the most effective strategies for preventing infectious diseases. However, in patients with congenital or acquired immunodeficiencies, vaccine administration requires special caution. In general, live attenuated vaccines (such as Measles, Mumps, Rubella (MMR), Oral Polio Vaccine (OPV), varicella, Bacille Calmette–Guérin (BCG), and live influenza) are contraindicated in cases of severe immunodeficiency, as they may cause serious infections. In contrast, inactivated and conjugate vaccines (such as hepatitis B, pneumococcal conjugate, Haemophilus influenzae type b, and meningococcal conjugate) are usually safe and often essential.

Objectives: The aim of this study was to summarize current evidence and recommendations regarding immunization practices in individuals with congenital or acquired immunodeficiency disorders.

Methods: A comprehensive search was performed using databases, including PubMed, Scopus, and Google Scholar. Keywords used in the search included “immunodeficiency”, “vaccination”, “live attenuated vaccines”, “inactivated vaccines”, “severe combined immunodeficiency (SCID)”, “human immunodeficiency virus (HIV)”, “corticosteroids”, and “vaccine safety”. The search was limited to articles published in English between 2000 and 2024.

Results: In congenital immunodeficiencies such as T-cell defects, SCID, or complement deficiencies, live vaccines pose significant risks. In B-cell defects, all non-live vaccines are safe, though antibody response may be poor due to impaired hormonal immunity. In T-cell defects, all live vaccines are contraindicated. In phagocytic defects, live bacterial vaccines are contraindicated but live viral vaccines seem to be safe. In complement deficiencies, live vaccines generally allowed, but with caution. However, in acquired immunodeficiencies such as HIV infection, organ transplantation, or prolonged immunosuppressive therapy, the degree of immune suppression and disease stage determine vaccine eligibility. In HIV-infected patients with adequate CD4 counts, MMR and varicella vaccines may be considered. Live vaccines are contraindicated in patients who needs corticosteroid therapy with immunosuppressive dosage (≥2 mg/kg/d prednisone or ≥20 mg/d for ≥14 days in patients’ weight ≥10 kg) until 4 weeks after discontinuation of treatment. An important point is that even when vaccines are correctly administered, protective immunity cannot always be ensured in these patients. Antibody responses may be insufficient or short-lived. Therefore, in case of exposure to pathogens such as measles, hepatitis B, or varicella, post-exposure prophylaxis with specific immunoglobulin or booster vaccination is required.

Conclusions: The key principles of vaccination in immunodeficient patients include avoiding live vaccines in severe immunosuppression, prioritizing essential inactivated vaccines, monitoring immune response when possible, and using immunoglobulin or booster doses after exposure.

Key Words:
Immunodeficiency, Vaccination, SCID, Corticosteroid

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Review Paper

Changing Indications for Bronchoalveolar Lavage in Adolescent Pulmonary Disease

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ABSTRACT

Background: Bronchoalveolar lavage (BAL) has been part of respiratory medicine for decades, mainly to investigate persistent infections in the lower airways. Whilst originally performed to investigate persistent infections, BAL is now addressing modern health challenges and disorders involving complicated non-infectious conditions in this age group. This shift reflects both new health challenges in teenagers and a growing confidence in the procedure's value beyond its traditional scope.

Objectives: This study evaluates the evolving diagnostic and therapeutic indications of BAL in adolescent pulmonary disease.

Methods: This research reveals evidence from recent studies (published between 2020 and 2025) that focus on BAL in pediatric and adolescent populations evaluating key outcomes for various conditions. The evidence has been grouped into three main areas: detecting infections in immunocompromised patients, helping to characterize diffuse and interstitial lung diseases, and assessing lung damage caused by toxic inhalation exposures.

Results: Among immunocompromised adolescents, especially those with malignancies, BAL has provided excellent utility, leading to a new diagnosis in 17.2% of cases. Pneumocystis jirovecii pneumonia was one of the more frequent findings. In fact, BAL results directly influenced the choice of antimicrobial therapy in over 87% of immunocompromised children experiencing acute respiratory illness. In the non-infectious group, BAL has become an important part of evaluating E-cigarette or vaping-associated lung injury (EVALI), a growing concern in adolescents. Moreover, in adolescents with chronic conditions, such as refractory small airway disease, BAL offers therapeutic benefits by facilitating clearance of airway secretions. Cellular analysis from BAL continues to be valuable for diagnosing ILDas it can point to specific types of inflammation.

Conclusions: The role of BAL in adolescents has changed to a more focused procedure that assists with diagnosis and treatment. It remains essential for spotting opportunistic infections in immunocompromised patients. BAL has also become essential in the evaluation of EVALI. These arguments suggest that clinicians should seriously consider BAL for adolescents presenting with acute respiratory distress of unclear etiology, particularly in those with a previous history of vaping. Its further diagnostic and therapeutic value in chronic airway diseases also points to its usefulness. These trends show that BAL is not just safe but also an effective procedure, aligning the changing needs of adolescent lung care.

Key Words:
Bronchoalveolar lavage (BAL), Adolescence, Pulmonary disease, Diagnostic indications

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Review Paper

Evolution of Diagnostic Markers in Pediatric Sepsis: A Short Narrative Review

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ABSTRACT

Background: Sepsis diagnosis has evolved dramatically over 5 decades, transitioning from clinical symptom-based approaches to sophisticated multi-parameter systems incorporating biomarkers and genetic markers.

Objectives: This review examines diagnostic criteria development in both pediatric and adult populations.

Methods: We conducted a comprehensive narrative review analyzing diagnostic markers from systemic inflammatory response syndrome criteria to contemporary systems like Phoenix sepsis score and PERSEVERE biomarkers. Key sources included studies on cytokines, inflammatory factors, and genetic predictors.

Results: The historical progression reveals significant milestones in sepsis diagnostics. Early SIRS criteria relied on basic clinical signs, while subsequent iterations introduced lactate measurement and organ dysfunction assessment via sequential organ failure assessment (SOFA) score. Contemporary systems demonstrate superior performance through novel approaches. The Phoenix criteria incorporate coagulation markers (D-dimer, fibrinogen) and oxygenation indices (SpO_2/FiO_2), while the pediatric sepsis biomarker risk model (PERSEVERE) biomarkers utilize cytokine profiling (interleukin-8, CCL3) for risk stratification. Genetic markers like HSPA1B variants show promises for personalized approaches but face implementation challenges. The evolution from phenomenological to mechanistic understanding has yielded more precise diagnostic tools but introduced new complexities. While biomarker panels offer improved accuracy, issues of standardization and accessibility persist, particularly in resource-limited settings. The development of pediatric-specific criteria addresses historical gaps but highlights the need for population-specific approaches.

Conclusions: Modern sepsis diagnosis integrates clinical parameters with molecular and genetic markers, representing a paradigm shift in critical care. Future efforts should focus on point-of-care testing platforms, validation across diverse populations, and equitable implementation to realize the full potential of precision medicine in sepsis care.

Key Words:
Sepsis, Biomarkers, Children

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Review Paper

Artificial Intelligence in Anemia Diagnosis

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ABSTRACT

Background: Anemia remains the most prevalent hematological disorder worldwide, characterized by reduced red blood cell count or impaired function, leading to diminished oxygen delivery and significant morbidity. Conventional diagnosis relies on complete blood counts and biochemical assays, which may be time-consuming and require specialized laboratory infrastructure.

Objectives: The aim of this study was to evaluate an alternative approach for the detection of anemia that may overcome the limitations of conventional laboratory-based diagnostic methods

Methods: Artificial intelligence (AI), encompassing machine learning and deep learning techniques such as convolutional neural networks, support vector machines, random forest, and ensemble models, has been increasingly applied to anemia diagnosis. These models utilize multimodal data, including clinical laboratory parameters, peripheral blood smear images, and non-invasive photographs of physical features (conjunctiva, palm, tongue, fingernails) to estimate hemoglobin levels and classify anemia types such as iron deficiency anemia and aplastic anemia.

Results: Studies indicates that AI models achieve diagnostic accuracies ranging from approximately 90% to 96% in detecting anemia and differentiating subtypes. Explainable AI techniques, such as SHAP, LIME, Eli5, Qlattice, and Anchor, have been integrated to enhance interpretability, allowing clinicians to understand key predictive features like hemoglobin, mean corpuscular volume, platelet count, and red cell distribution width. This transparency fosters clinical trust and supports decision-making.

Conclusions: AI-driven diagnostic tools offer rapid, cost-effective, and non-invasive alternatives to traditional methods, potentially enabling early detection, improved patient outcomes, and optimized resource allocation. However, challenges include limited large-scale, diverse datasets, the need for rigorous external validation, and ethical considerations regarding AI integration into clinical workflows.

Key Words:
Artificial intelligence (AI), Children, Anemia, Diagnosis

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Review Paper

Artificial Intelligence in Neonatal Gut Microbiome Analysis for the Prediction of Necrotizing Enterocolitis

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ABSTRACT

Background: Necrotizing enterocolitis (NEC) remains a significant contributor to morbidity and mortality among preterm infants. There is accumulating evidence that alterations in the neonatal gut microbiota play a significant role in NEC pathogenesis, and dysbiosis is a critical risk factor. Recent advances in artificial intelligence (AI) offer promising tools for analyzing complex microbiome datasets, early diagnosis and prevention measures.

Objectives: This review aims to synthesize current literature on the application of AI techniques in identifying gut microbiome patterns associated with NEC development in neonates.

Methods: A comprehensive literature search in PubMed, Scopus, and Web of Science databases was performed for research articles through January 2025. All studies that applied AI algorithms of machine learning and deep learning, exploring neonatal gut microbiome data in NEC were included. Narrative review was done to evaluate the strengths, weaknesses, and clinical applicability of such AI applications.

Results: Methods based on AI have been proven to be extremely accurate in classifying microbiota profiles of NEC and predicting disease onset before clinical symptoms become evident. Classifiers based on machine learning, manifested great accuracy in discriminating between high-risk infants based on microbiota composition and metabolic profiles. Deep learning models, enhanced pattern discovery from complex microbiome datasets. Several researches identified reduced diversity of some microbial signatures and abundance of pathogenic bacteria as predictive markers for NEC. AI algorithms consistently performed better compared to traditional statistical methods for early detection, with some models identifying over 90% sensitivity and specificity. Challenges noted were data heterogeneity, validation in diverse populations, small study sizes, and absence of external validation.

Conclusions: AI technologies hold significant promise to advance neonatal gut microbiome analysis to predict NEC early. Its ability to recognize subtle microbial patterns heralds the possibility of individualized risk assessment and early intervention. However, standardization of microbiome sampling, larger multicenter studies, and integration within clinical workflow remain the key steps for translational application. Optimization of AI models and testing of their utility in diverse neonatal populations should be the focus in the future.

Key Words:

Artificial intelligence (AI), Machine learning, Microbiome, Necrotizing enterocolitis (NEC), Newborn

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Review Paper

Recent Advances in the Role of Inotropes and Novel Hemodynamic Assessment in Shock Management

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ABSTRACT

Background: Cardiogenic shock remains a life-threatening condition with high morbidity and mortality. Recent guidelines emphasize the importance of early and targeted therapy, especially the use of inotropes, to improve cardiac output and tissue perfusion.

Objectives: This review aims to evaluate the role of inotropes in the management of cardiogenic shock, with a focus on their integration with advanced hemodynamic monitoring techniques to optimize therapy, enhance patient outcomes, and minimize complications.

Methods: This review summarizes, including clinical trials, guidelines, and expert consensus, focusing on inotrope use and hemodynamic monitoring in shock patients.

Results: Frontline inotropes, such as dobutamine and norepinephrine are commonly used, with dosing tailored to individual hemodynamic profiles. Newer agents like milrinone and levosimendan have gained attention for their unique inotropic and vasodilatory effects, particularly in refractory cases. Advanced hemodynamic monitoring tools, including ultrasound cardiac output monitor (USCOM), GLS echocardiography (global longitudinal strain), pulse contour analysis, and biomarkers like NT-proBNP, enable more precise assessment and guide therapy adjustments. In patients with persistent shock, mechanical circulatory support devices such as ECMO and Impella are increasingly utilized to stabilize hemodynamics.

Conclusions: Personalized hemodynamic monitoring, using non-invasive technologies like USCOM and GLS echocardiography, has improved the safety and effectiveness of inotrope therapy, reducing complications and optimizing outcomes. The integration of newer inotropes, such as milrinone and levosimendan, guided by advanced monitoring, allows for earlier intervention and better risk stratification.

Key Words:
Inotropes, Hemodynamic assessment, Shock management

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Review Paper

Formation of Gut Microbiota and Immune Function During the First Three Years of Life

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ABSTRACT

Background: The initial 1000 days, from the conception through a child's second year, are essential for shaping the development of the infant's immune defenses and microbial communities. This highly flexible phase involves important 2-way interactions, and disruptions in the early microbiome can lead to substantial health consequences later in life.

Objectives: This review aimed to summarize current evidence on early-life gut and oral microbiome development and its implications.

Methods: Our review applied a comprehensive literature search of studies indexed in multiple international databases, including PubMed, Scopus, and Google Scholar. We specifically looked at studies published from 2021 to 2025 with the following keywords: "Early life microbiome", "Gut microbiome", "Oral microbiome", "Immunological development", and "Microbiota composition".

Results: Our literature search yielded 14600 reviews and 2600 articles included in our analysis. Prenatal and postnatal periods shape the infant microbiome, which guides immune development. Evidence shows the womb is not sterile; microbes, such as *Staphylococcus*, *Enterobacteriaceae*, *Enterococcus*, *Lactobacillus*, and *Bifidobacterium* appear in meconium, placenta, and amniotic fluid, originating from maternal oral, gut, and vaginal flora. Pregnancy alters these communities, with increases in *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans*, *Candida*, and *Actinomyces*. Maternal health, infections, and antibiotic use affect fetal exposure, reducing Bacteroides and raising *Escherichia* and *Shigella*, which may hinder immune development. Environmental stressors like PM2.5 influence placental function and fetal immune signaling. After birth, vaginal delivery provides *Lactobacillus*, *Prevotella*, and *Bifidobacterium*, while C-section infants more often acquire *Staphylococcus*, *Corynebacterium*, and *Propionibacterium*. Feeding also matters. Breast milk supports *Bifidobacterium*, whereas formula is more associated with *Actinomyces* and *Prevotella*. Early antibiotics and environmental exposures further shape the microbiome, affecting long-term risks such as asthma, allergies, and inflammatory bowel disease.

Conclusions: The development of an infant's microbiome is profoundly influenced by factors, such as maternal health, environmental exposures, the method of delivery, and feeding strategies. These elements work together to establish the foundational microbial communities, which play a crucial role in determining the child's long-term health and well-being.

Key Words:
Microbial community composition,
Oral microbiome,
Immunological development

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Review Paper

Management of Pediatric Acute Respiratory Distress Syndrome

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ABSTRACT

Background: Pediatric acute respiratory distress syndrome (PARDS) is a life-threatening condition in children, defined by acute hypoxemia and pulmonary infiltrates resulting from direct or indirect lung injury. The Pediatric Acute Lung Injury Consensus Conference (PALICC-2) provides standardized criteria for diagnosis and severity classification based on oxygenation indices.

Objectives: This review aimed to provide an updated overview of the definition, epidemiology, pathophysiology, clinical outcomes, and management of pediatric acute respiratory distress syndrome.

Methods: This review summarizes current evidence regarding the definition, epidemiology, histopathology, pathophysiology, etiologies, clinical outcomes, and management strategies of PARDS. Data are derived from PALICC guidelines, epidemiological studies, and recent advances in pediatric critical care.

Results: The incidence of PARDS is estimated at 2/2–5/7 cases per 100000 children annually, representing 3%–10% of pediatric intensive care unit (PICU) admissions. Most cases progress from mild to severe forms, with two-thirds requiring invasive mechanical ventilation. Histological features include diffuse alveolar damage with hyaline membrane formation and interstitial edema. The most common etiologies are viral or bacterial pneumonia, particularly respiratory syncytial virus, rhinovirus, and human metapneumovirus, as well as trauma, inhalational injuries, and vaping-associated lung injury. Mortality has significantly declined from 65% to 80% in the 1980s to approximately 18% after 2010, with higher rates reported in Asia. Mortality is typically related to multiorgan dysfunction rather than persistent hypoxemia.

Conclusions: PARDS is a multifactorial syndrome with heterogeneous clinical outcomes. Early recognition, severity-based stratification, and individualized management, including high-flow nasal cannula, noninvasive and invasive ventilation, and adjunctive therapies such as prone positioning, corticosteroids, and ECMO, are critical to improving survival and long-term outcomes in pediatric patients.

Key Words:

Acute respiratory distress syndrome (ARDS), Respiratory failure, Hypoxemia, Mechanical ventilation, Children

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Review Paper

Morbidity and Mortality in Children With Multisystem Inflammatory Syndrome Hospitalized in Several Iranian Hospitals

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ABSTRACT

Background: Multisystem inflammatory syndrome in children (MIS-C) is a rare but potentially fatal complication of COVID-19 (coronavirus disease 2019) that can involve various organs and systems, including the kidneys, heart, and hematopoietic system.

Objectives: This study aimed to investigate morbidity and mortality in patients with MIS-C hospitalized in several academic centers in Iran during the COVID-19 pandemic.

Methods: This retrospective, multicenter study included all children under 18 years of age who were admitted to 5 selected hospitals with a diagnosis of MIS-C based on CDC (Centers for Disease Control and Prevention) criteria from April 2020 to September 2022. Information on variables including hematuria, proteinuria, anemia, leukopenia, increased ALT (alanine aminotransferase), cardiac involvement, and echocardiographic findings, as well as mortality, was extracted and analyzed.

Results: Out of 205 hospitalized children diagnosed with MIS-C, 88% had at least one of the complications studied. Anemia (72%), proteinuria (58%), and increased alanine aminotransferase (46%) were among the most common manifestations. Abnormal echocardiographic findings such as coronary artery dilation and left ventricular dysfunction were observed in 39% of patients. The mortality rate in MIS-C patients was 5%. The findings showed that the simultaneous presence of several complications (especially cardiac dysfunction and high inflammatory markers) is associated with a longer duration of hospitalization and an increased risk of mortality.

Conclusions: The results of the present study showed that morbidity and mortality in children with MIS-C in Iran are significant. Early detection of complications such as kidney damage, cardiac involvement, and blood disorders can be effective in timely management and improving clinical outcomes. Close monitoring of kidney and heart function in the early stages of the disease and the use of a multidisciplinary approach in the treatment of these patients are recommended.

Key Words:
Multisystem inflammatory syndrome in children (MIS-C), COVID-19, Morbidity, Mortality, Proteinuria, Hematuria, Cardiac disorder, Children

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Review Paper

Approaches to Obesity in Children and Adolescents: A Review of Assessment and Management Strategies

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ABSTRACT

Background: Childhood and adolescent obesity remain pressing global health concerns, with projections indicating a rise to 206 million affected individuals aged 5–19 years by 2025. This condition predisposes young individuals to various comorbidities, including type 2 diabetes, hypertension, and psychological disorders. Early identification and comprehensive management are crucial to mitigate long-term health risks.

Objectives: This review aimed to provide an updated overview of the definition, epidemiology, pathophysiology, clinical outcomes, and management of pediatric acute respiratory distress syndrome.

Methods: A literature review from 2019 to 2025 was performed utilizing PubMed, Scopus, and Web of Science databases. Keywords included “children”, “adolescent”, “obesity”, “BMI”, “laboratory”, and “evaluations”. Peer-reviewed articles discussing obesity assessment methods and management strategies for individuals aged 2–18 years were included.

Results: Assessment strategies body mass index (BMI) percentiles remain the primary screening method for obesity among children and adolescents. Nevertheless, BMI does not accurately represent body composition. Recent studies suggest that waist-to-height ratio may serve as a more accurate indicator of adiposity and related health risks. Imaging methods such as dual-energy X-ray absorptiometry (DEXA) and magnetic resonance imaging (MRI) provide accurate fat mass measurements but face limitations in accessibility and cost. Laboratory evaluations play a critical role in identifying obesity-related comorbidities. Common tests include fasting glucose, lipid profiles, liver enzymes, and thyroid function. The American Academy of Pediatrics advises initiating laboratory screenings for children aged 10 years and older with a BMI at or above the 85th percentile, especially if additional risk factors are present. New biomarkers like adipokines and inflammatory indicators are promising for earlier detection of metabolic disorders. Management approaches comprehensive behavioral interventions focusing on diet, exercise, and psychological support, are the cornerstone of obesity management. Family-oriented approaches have shown success in achieving sustained lifestyle modifications. Pharmacologic treatments, such as GLP-1 receptor agonists, have recently demonstrated beneficial outcomes in severely obese adolescents. Their widespread adoption, however, is restricted due to regulatory and safety concerns. Bariatric surgery, particularly sleeve gastrectomy, is effective in severe cases unresponsive to conventional therapies, significantly reducing weight and associated comorbidities.

Conclusions: Addressing obesity in children and adolescents effectively involves early detection using precise evaluation methods and multifaceted management approaches. Enhancing BMI-based assessments with advanced laboratory and imaging evaluations provides more accurate diagnostics. Personalized strategies incorporating behavioral, pharmacological, and surgical treatments show the most promise. Further research is needed to refine assessments and improve treatment accessibility.

Key Words:

Children, Adolescent, Obesity, Body mass index (BMI), Laboratory, Evaluation

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Review Paper

A Decade of Change in Under-5 Mortality in Mazandaran Province, Iran: Insights From 2012 to 2022

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ABSTRACT

Background: Under-5 mortality rate serves as an indicator of the socioeconomic development level of a country. A detailed analysis of changes in mortality due to various causes provides valuable information for identifying healthcare needs and prioritizing resources.

Objectives: This study aimed to analyze shifts in the causes of death among children under five years old in the northern region of Iran.

Methods: This cross-sectional study was conducted using registered mortality data from the Health Deputy of Mazandaran University of Medical Sciences from 2012 to 2022. These data were extracted based on ICD-10 codes. To analyze the under-5 mortality rate, expressed per 1000 live births, the differences in this rate between the 2 mentioned years were examined. The R software version 4.3.1 was employed for analysis.

Results: Based on the data from the period between 2012 and 2022, the largest increases in the share of causes of death under age 5 were observed in perinatal conditions with a growth of +1.58, and diseases of the respiratory system with an increase of +0.40. Neoplasms and endocrine, nutritional and metabolic diseases also contributed more to the mortality pattern, rising by +0.31 and +0.16 respectively. In contrast, transport accidents declined by -0.48. The study findings showed that perinatal conditions and congenital malformations maintained their positions as the first and second leading causes of death in this age group. Over the mentioned period, transport accidents experienced a significant drop, falling from the third to nineth place. Meanwhile, neoplasms rose 5 ranks to reach the fourth place.

Conclusions: The analysis of changes in under-5 child mortality in Iran showed that despite perinatal conditions and congenital malformations maintaining their top positions as the leading causes of death, the relative share of Neoplasms increased significantly. Conversely, the decreased share and considerable drop in ranking of Transport accidents likely reflect the effectiveness of preventive measures and road safety interventions during this period. These changes represent the urgent need to revise child health policies to better align with the evolving mortality profile.

Key Words:
Mortality, Child, Mazandaran

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Review Paper

Artificial Intelligence in Predicting Neonatal Respiratory Distress Syndrome and Bronchopulmonary Dysplasia Outcomes

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ABSTRACT

Background: Artificial intelligence (AI) can analyze large datasets which is very helpful in many fields of health care systems, such as in neonatology in which the risk of neglecting of many important information is high because of the innumerable clinical and paraclinical detailed records in ill neonates. Respiratory distress syndrome (RDS) and bronchopulmonary dysplasia (BPD) are important neonatal lung diseases mostly occur in preterm infants with great risk of morbidity and mortality. So AI and other computational models could be very useful to understand the distinctive condition of every patient and the course of the disease.

Objectives: In this review, we present the current application of AI in the field of neonatology, in prediction of RDS and BPD outcome in neonates.

Methods: We conducted an extensive review of the literature, across the databases. The search was limited to studies published between January 1, 2019, and December 31, 2024. Full text publications on AI applications in RDS and BPD were included in our study.

Results: Studies have revealed the effectiveness of AI in predicting RDS prognosis and the risk of occurrence of BPD. Quantifying biomarkers of RDS and analyzing the correlation between lung ultrasound and the oxygenation status of the patient by AI was successful in determining the RDS prognosis. AI is used to identify risk for BPD occurrence and severity, by evaluating the chest X-ray on the 28th day of oxygen administration, the combination of genetic and clinical factors and also the perinatal factors and the respiratory support used in the first days of life. So, it would be helpful in deciding for beginning of preventive measures.

Conclusions: AI should be regarded as an innovative tool in neonatal care, and is useful in management of neonatal RDS and BPD.

Key Words:
Artificial intelligence (AI), Neonatal medicine, Bronchopulmonary dysplasia (BPD), Respiratory distress syndrome (RDS)

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Review Paper

Vaccinations of the Inborn Error of Immunity (Primary Immune Deficiency Disorders)

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ABSTRACT

Background: Primary immune diseases (PID) are a heterogenous group of disorders with main clinical manifestation of infection. Vaccination is an easily accessible method for preventing infections. Polysaccharide vaccines and protein vaccines required intact B cells and T cells, respectively. Generally, non-lived vaccination has no problem in PID.

Objectives: To review recommended vaccines and contraindications in different types of primary immune diseases.

Methods: Recommended vaccines in less severe antibody immunodeficiencies, such as selective IgA, specific polysaccharide antibody, and IgG subclass deficiencies, are HPV, Zoster, hepatitis B, influenza, pneumococcal, and respiratory syncytial virus (RSV). Live vaccines are generally contraindicated, except MMR and monovalent varicella vaccines. Recommended vaccines in severe antibody immunodeficiencies, such as X-linked agammaglobulinemia and common variable immunodeficiency are COVID-19, HPV, Zoster, hepatitis B, influenza, pneumococcal and RSV. Live vaccines are generally contraindicated.

Results: Recommended vaccines in less severe or partial combined immunodeficiencies (T and B cells), such as incomplete DiGeorge syndrome, Wescott-Aldrich syndrome, ataxia telangiectasia hyper-IgM syndrome, hyper-IgE syndrome and X-linked lymphoproliferative disease are HPV, Zoster, hepatitis B, influenza, pneumococcal and RSV. Live vaccines are generally contraindicated, except MMR and monovalent varicella vaccines, with a CD4+ count > 500 cells/µL and normal mitogen response. Vaccination in severe immunodeficiencies, such as severe combined immunodeficiency and complete DiGeorge syndrome are COVID-19, HPV, Zoster, hepatitis B, influenza, pneumococcal and RSV. All live vaccines are contraindicated. Vaccination in Phagocytic and neutrophil disorders, such as congenital neutropenia, cyclic neutropenia, leukocyte adhesion and migration defects, chronic granulomatous disease (CGD), myeloperoxidase deficiency and Chédiak-Higashi syndrome are HPV, Zoster, hepatitis B, influenza, pneumococcal and RSV. Live bacterial vaccines are contraindicated. Live viral vaccines are generally contraindicated, except for patients with CGD. Vaccination in defects of innate immunity, such as IFNAR defects, IFN-gamma/IL-12 axis defects, defects in cytokine generation Toll-like receptor signaling pathway deficiencies (IRAK4 and MyD88 deficiency) are HPV, Zoster, hepatitis B, influenza, pneumococcal and RSV.

Conclusions: Live vaccines are contraindicated except live viral vaccines in IFN-gamma/IL-12 axis. No vaccines are contraindicated in complement deficiency.

Key Words:
Primary immunodeficiency, Vaccine, Humoral and cellular immunodeficiency

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Review Paper

Rotavirus Infections and Vaccination: A Narrative Review

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ABSTRACT

Background: Despite substantial declines in mortality rates in the last 3 decades, diarrheal diseases remain one of the leading causes of death in the world. Globally, there are nearly 1.7 billion cases of childhood diarrheal disease that kill around 450000 less than 5-years-old children. Additionally, diarrheal disease is a leading cause of malnutrition in this age group. Rotavirus is the global leading cause of diarrhea-associated morbidity and mortality among children younger than 5-years which is preventable by vaccination, and vaccination is a key measure to prevent diarrheal disease.

Objectives: This review aimed to describe the epidemiology of rotavirus-associated diarrhea in children under 5 years and to assess the impact of vaccination on morbidity and mortality.

Methods: This narrative review was conducted to examine the extent of rotavirus infection among children less than 5 years, who presented with diarrheal disease as the out-patients or were hospitalized, and their related mortality in the world and the country. Furthermore, the impact of vaccination on the frequency of rota-related morbidity and mortality also estimated.

Results: Globally, in the era before vaccination, rotavirus infect any child, and was leading cause of severe dehydrating diarrhea in <5-year-old children; resulting in an estimated > 500 thousand childhood deaths, more than 2 million hospitalizations, and 260 million medical visits. Also, the mean proportion of rota positive testing samples among diarrheal-related hospitalized children was 38% in the sentinel hospitals. The global impact of vaccinations against rotavirus is evident by 40% reduction in rotavirus prevalence following vaccination by data gathered from 60 countries as well as from other studies that showed reductions in all cases of acute gastroenteritis, hospitalizations, and diarrheal mortality in a variety of countries. A recent meta-analysis among 47 different with various countries following Rota vaccination, showed 36% reduction in all diarrheal-related, 59% in rotavirus-related hospitalization, and 36% reduction in mortality. Also, the percentage of positive stools for Rota infection decreased from 40% to 20% in children <5 years. To assess the role of rotavirus in causing diarrhea in Iranian children, two systematic review studies were conducted. The pooled estimates were 39.9% in one, and 35% in another study. The pooled estimates for hospitalized children and out-patient subgroups were 0.39% and 0.31%, respectively. Rotavirus vaccines are live attenuated oral strains. The 2-first WHO prequalified vaccines were RotaTeq (Merck; 2008), and Rotarix (GlaxoSmithKline; 2009). In 2018, 2 additional vaccines e.g. Rotavac and Rotasiil (and some others regionally vaccines)

Key Words:

Rotavirus, Diarrheal disease, Children under five, Vaccination, Morbidity, Mortality

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were produced. Rota vaccines have good safety profile. Intussusception has been reported as a serious potentially fatal adverse event. Post-licensure evaluation showed increased risk, but varied by vaccine and location (not reported from Africa and India and no reports for Rotasiil). Over 114 countries introduced vaccine in their National Immunization Program, however, over 81 million of all children globally remain unvaccinated. Vaccines efficacy against severe gastroenteritis is higher (90-95%) in low-mortality countries than countries with higher mortality rates (44-70%). Full protection is provided by full vaccination series.

Conclusions: Vaccination with rotavirus vaccines has led to a significant reduction in the morbidity and mortality from Rotavirus and other causes of diarrhea, worldwide. To achieve better results, full course along with increased vaccination coverage rates at the national and global levels, are important and recommended.

Review Paper

The Role of Peer Interactions in Promoting HPV-related Health Knowledge in School Settings

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ABSTRACT

Background: Human papillomavirus (HPV) remains a major global public health concern, and the dissemination of accurate health information is particularly important for adolescents, who are at a critical stage of sexual and reproductive development. Peer-based interaction has emerged as an effective educational approach in health promotion. This strategy may improve understanding, acceptance, and retention of health information, thereby supporting HPV prevention efforts.

Objectives: This systematic review aimed to evaluate the impact of peer interactions on the dissemination of HPV-related health knowledge in school-based settings.

Methods: A systematic search was conducted in PubMed, Scopus, and Web of Science for studies published between 2010 and 2025. The search strategy included the keywords “peer interactions”, “health knowledge”, “HPV”, and “school settings”. After screening titles, abstracts, and full texts based on predefined inclusion criteria, studies employing experimental or quasi-experimental peer-led educational interventions in school environments were selected. Extracted data included characteristics of educational programs, target populations, implementation methods, and outcomes related to adolescents’ knowledge, attitudes, and behavioral intentions.

Results: Of more than 500 studies initially identified, 57 met the inclusion criteria. Overall, peer-led educational interventions were associated with significant improvements in adolescents’ knowledge of HPV, including its transmission routes, risk factors, prevention strategies, and the importance of vaccination. Several studies reported increased willingness to receive the HPV vaccine following peer-based education. Additional benefits included reduced anxiety toward vaccination, greater confidence in discussing sexual health topics, and increased engagement in health-related decision-making. Group-based and participatory activities such as structured discussions, role-playing, and interactive learning were particularly effective in fostering supportive peer environments and facilitating open dialogue. However, challenges were noted, including limited standardized training resources, cultural and religious sensitivities, and the need for coordination among educators, parents, and school administrators.

Key Words:
Peer influence, Knowledge, Adolescent, Human papillomavirus viruses (HPV), School

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Conclusions: Peer-based educational interventions are effective in enhancing HPV-related knowledge and improving attitudes toward vaccination among adolescents in school settings. By promoting collaborative learning and open communication, these programs support informed decision-making and sustained behavioral change. Integrating structured peer-led education into school curricula, alongside standardized training and stakeholder involvement, may strengthen HPV prevention efforts and improve adolescent sexual health outcomes.

Research Paper

Maternal Risk Factors for Infants With Low Birth Weight: Sari Birth Cohort

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ABSTRACT

Background: Birth weight is one of the most important factors of neonatal survival and is associated with an increased risk of childhood disabilities and diseases. Globally, 15% to 20% of all births are low birth weight (LBW), and most of this occurs in low- and middle-income countries. The World Health Organization aimed to achieve a 30% reduction in the number of LBW infants by the year 2025.

Objectives: This study aimed to investigate the incidence and related factors with LBW among infants in the Sari Birth Cohort Center.

Methods: This study is a cohort study that was initiated in 2017 involving 3000 pregnant women at the Sari Birth Cohort Center, located in Mazandaran Province, Iran. Pregnant information was obtained through interviews by trained personnel. After the birth, mothers visit the birth cohort center to record the characteristics of their newborns. In this study, the infants were divided into two groups: Those with LBW and those without LBW, which was defined as birth weight less than 2500 g, regardless of gestational age. Demographic characteristics and maternal and pregnancy-related variables considered as independent variables. All categorical data were presented as frequencies and percentages and compared using the Chi-square or Fisher exact tests in SPSS version 22.

Results: Among 3000 participants enrolled in the birth cohort study, 2962 included in the analysis. The gender of infants was 50.32% boys and 49.68% girls. The incidence of LBW among pregnant mothers attending to birth cohort was 6.29%. The analysis results showed a significant difference between LBW and maternal factors, including age under 18 years (P=0.002), BMI below 18.5 (P=0.032), hypertension (P=0.01), or history of cancer (P=0.021).

Conclusions: The findings showed that maternal factors, including age less than 18 years, BMI below 18.5, hypertension, and a history of cancer, were significantly associated with the incidence of LBW. Therefore, adequate weight gain during pregnancy, as well as control and management of hypertension, and cancer in pregnant women is needed.

Key Words:
Low birth weight (LBW), Birth cohort, Risk factors

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Review Paper

Prevalence and Emerging Trends of Antibiotic Resistance in Gram-negative Bacteria: A Narrative Review

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ABSTRACT

Background: Antibiotic resistance in gram-negative bacteria, such as Enterobacteriaceae and *Pseudomonas aeruginosa*, poses a significant global health threat. The complex structures of these bacteria and their ability to exchange resistance genes make treatment challenging. The rising resistance, particularly to critical antibiotics, is largely attributed to the irrational use of antibiotics and imbalances in the one health approach. Mechanisms such as extended-spectrum β-lactamases (ESBLs), new enzymes like MCR-1, and carbapenemase enzymes make standard treatments and last-line antibiotics ineffective, resulting in higher mortality rates and prolonged hospital stays. Understanding the factors contributing to this crisis is essential.

Objectives: This review highlighted the main contributors to antimicrobial resistance and discuss strategies for prevention.

Methods: This narrative review is based on a systematic search of scientific databases, including PubMed, Scopus, Web of Science, and Google Scholar, from January 2010 to April 2025. Keywords used included “gram-negative bacteria”, “antibiotic resistance”, “β-lactamase”, “efflux pumps”, “horizontal gene transfer”, “carbapenem resistance”, “novel antibiotics”, “MDR”, and “XDR”. The search yielded about 4500 articles, and after removing duplicates and applying strict criteria, 230 relevant articles were selected. Only English articles with experimental or review data were included, while case reports and incomplete studies were excluded.

Results: The results highlight a significant rise in global resistance to major antibiotic classes in gram-negative bacteria, particularly carbapenems, fluoroquinolones, colistin, and aminoglycosides. Resistance to the ceftazidime-avibactam combination is about 6.1% in Enterobacterales and up to 25.8% in non-fermentative bacteria, increasing from 5.6% (2015–2020) to 13.2% (2021–2024). The highest resistance at 19.3% was reported in Asia, followed by Africa and Europe. Factors contributing to the spread of resistance include horizontal gene transfer, irrational use of antibiotics, imbalances in the One Health approach, self-medication in low-income countries, poor hygiene in healthcare facilities, international migration, molecular mechanisms, heteroresistance, and structural changes in bacteria.

Conclusions: Antibiotic resistance in Gram-negative bacteria is caused by various mechanisms, including new enzymes, efflux pumps, permeability changes, and gene transfer. Combating this issue requires a multisectoral approach, focusing on global monitoring, strict stewardship policies, education on antibiotic use, the development of new treatments, and equitable access to care worldwide.

Key Words:

Antibiotic resistance,
Gram-negative bacteria,
Extremely drug-resistant

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Review Paper

Back Pain in Children

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ABSTRACT

Background: Back pain is not uncommon in children. The one-year prevalence of back pain in children has been reported to range from 7% to 58% in different studies. The differential diagnosis of back pain in children is completely different from that in adults.

Objectives: This article aims to explain the various causes of back pain in children.

Methods: A comprehensive search was conducted in Google Scholar, PubMed and Scopus to review articles about back pain and low back pain in children and adolescents in English and Persian.

Results: There are various causes of back pain in children and adolescents. When approaching back pain in children, it is important to consider the patient's age, life threatening differential diagnosis, and the epidemiology and prevalence of diseases in the community. Brucellosis, an endemic infectious disease in our region is one of the most common cause of musculoskeletal pain, both in adults and children. Leukemia and lymphoma are the most malignant diseases that may cause back pain in children. The pain may be generalized or localized and is often accompanied by systemic symptoms. The absence of localized findings and the insidious progression of the disease may delay diagnosis. Other malignancies like Langerhans cell histiocytosis, osteosarcoma, Ewing's sarcoma and metastasis may also present with back pain. Referral pains due to the renal and urogenital condition, pancreatitis, cholecystitis and vascular disease is another possible cause of back pain in children. After the COVID-19 pandemic, there has been an increase in the prevalence of musculoskeletal disorders (neck, back, shoulder, and arm pain) among children, accompanied by increased use of electronic devices. Excessive screen time, heavy school bags, inappropriate posture, and sedentary behaviors are other causes of back and low back pain, especially in adolescents. Metabolic bone diseases, osteopenia, or osteoporosis may also contribute to back pain in children with underlying conditions.

Conclusions: Back and low back pain are important clinical concerns in children. Attention to red flags and a stepwise diagnostic approach can help ensure an accurate diagnosis.

Key Words:

Back pain, Low back pain, Diagnosis

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Research Paper

Evaluation of Knowledge and Performance of Healthcare Professionals in Using Pediatric Inhaler

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ABSTRACT

Background: Respiratory diseases, particularly asthma, are frequently exacerbated by environmental factors such as air pollution and exposure to allergens. Appropriate patient education on the correct use of inhaled medications plays a pivotal role in achieving optimal symptom control. Nevertheless, incorrect use of inhalation devices, including metered-dose inhalers and nebulizers, remains one of the leading causes of poor disease control. The use of adjunctive devices such as inhaler spacers can enhance drug delivery and improve therapeutic effectiveness.

Objectives: This study aimed to evaluate the knowledge and performance of general practitioners, pediatricians, and pharmacists regarding the correct use of inhaler devices.

Methods: This descriptive-analytical study was conducted in 2021 to assess the proper use of inhaler devices. Participants' performance was directly observed by the researcher and evaluated using a standardized 9-step checklist. The collected data were analyzed using SPSS software, version 24.

Results: A total of 200 participants were included in the study, comprising 140 general practitioners, 40 pharmacists, and 20 pediatricians, with a mean age of 37.7±6.6 years. Of the participants, 109(54.5%) were male and 91(45.5%) were female. A statistically significant difference in age and work experience was observed among the professional groups (P<0.05). In terms of knowledge and correct use of inhaler devices, pediatricians achieved significantly higher scores compared with the other two groups, while pharmacists demonstrated better performance than general practitioners (P<0.05). No statistically significant difference was observed between male and female participants regarding awareness levels (P>0.05).

Conclusions: Inhalation therapy represents a complex yet essential component in the management of respiratory diseases and requires effective collaboration among pharmaceutical manufacturers, healthcare providers, and patients to achieve optimal therapeutic outcomes. Inhalation techniques, as fundamental skills for the appropriate use of inhaled medications, should be regularly monitored and evaluated to ensure adequate proficiency and integration into routine clinical practice. Continuous education and periodic assessment of general practitioners, pediatricians, and pharmacists are essential, as these healthcare professionals play a critical role in enhancing patient awareness, improving inhaler technique, increasing treatment adherence, optimizing disease control, and ultimately improving patients' quality of life.

Key Words:
Asthma, Awareness, Performance, Children, Spacer

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Review Paper

Prebiotics, Probiotics, and Symbiotic in Childhood Obesity

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ABSTRACT

Background: Childhood obesity is a real pandemic and a major global public health problem with an increasing trend in recent decades. Obesity is associated with short- and long-term complications, both psychosocial and physical. Factors involved in obesity include genetic background, maternal and obesogenic factors such as maternal nutrition, dietary habits, urbanization or sedentary lifestyle. Colonization of the fetal gut can begin in utero, end at 3 to 5 years of age, and acquire an adult pattern. Several external factors play a fundamental role in the maturation of the gut microbial composition, including maternal nutrition, mode of delivery, child nutrition and early antibiotic use.

Objectives: To provide a scientific overview of childhood obesity as a rising global public health pandemic, with a focus on its complications and risk factors (genetic, maternal, environmental).

Methods: Narrative review of literature from PubMed, Scopus, and Google Scholar (2000–2025) using keywords “childhood obesity”, “gut microbiota”, “prebiotics”, “probiotics”, and “symbiotic”. Studies on trends, risk factors, and interventions were synthesized.

Results: In the new classification, there are two types of healthy and unhealthy obesity. Based on the dominance of gut microbial types, they may have positive or negative effects on the occurrence of obesity. Nutritional interventions including prebiotics, probiotics, and symbiotic can have positive effects on improving the gut microbial structure and reduce cardiometabolic risk factors such as obesity.

Conclusions: Prescribing probiotics to pregnant women may act as targeted gene therapy, as it can reduce DNA methylation in specific obesity-promoting genes in mothers and their children, thereby decreasing the risk of weight gain. Therefore, intake of multi-strain symbiotic along with exercise and diet can be an effective strategy for weight reduction in obese children.

Key Words:
Prebiotics, Probiotics, Symbiotic, Obesity, Children

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Review Paper

Advances in Pediatric Migraine Management: A Narrative Review (2020–2025)

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ABSTRACT

Background: Pediatric migraine is a common and disabling condition, affecting 8–12% of children and adolescents globally. It impairs school performance, social functioning, and quality of life. Historically, treatment has been extrapolated from adult studies, but recent years have seen increased research focusing on pediatric-specific approaches.

Objectives: This review synthesizes evidence from randomized controlled trials and pharmacokinetic studies published between 2020 and 2025. It evaluates both pharmacological and non-pharmacological interventions for migraine in children and adolescents, aiming to guide evidence-based clinical practice.

Methods: A narrative search was conducted in PubMed, Scopus, and Google Scholar using relevant keywords. Included were studies on patients aged 6–18 years, written in English, with controlled trial or pharmacokinetic designs. Reviews, case reports, and non-English articles were excluded. Twenty studies met the inclusion criteria and were analyzed for efficacy, safety, and clinical relevance.

Results: Pharmacologically, calcitonin gene-related peptide (CGRP) monoclonal antibodies (e.g. eptinezumab, fremanezumab) show promising safety and pharmacokinetics in adolescents. Melatonin is effective for prevention with few side effects. Traditional preventives like amitriptyline remain common, though cinnarizine offers a safer alternative. For acute treatment, zolmitriptan nasal spray provides significant pain relief within two hours. Non-pharmacologically, remote electrical neuromodulation is beneficial in acute and preventive settings. Exercise therapy, particularly aerobic and neck exercises, reduces headache frequency and severity. Cognitive-behavioral therapy improves adherence and outcomes, while educational interventions enhance self-management and reduce migraine days.

Conclusions: Recent advances provide a broader, more personalized toolkit for pediatric migraine management. A multimodal approach combining newer drugs, neuromodulation, exercise, and behavioral strategies is recommended for best results. However, many studies are limited by small samples and short follow-up. Future research should prioritize large, long-term, real-world trials to optimize treatment protocols and improve the quality of life for young patients.

Key Words:

Pediatric migraine, calcitonin gene-related peptide (CGRP), Melatonin, Cinnarizine, Nerve stimulation

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Review Paper

Comorbidities Associated With Obesity in Children and Treatment Approaches

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ABSTRACT

Background: Childhood obesity is recognized as one of the most important public health challenges worldwide, with its prevalence steadily increasing in both developed and developing countries. This condition, besides apparent overweight, is associated with a range of comorbidities that affect nearly all body systems and may persist into adulthood.

Objectives: To review global childhood obesity prevalence, comorbidities, and long-term risks for public health strategies.

Methods: In this descriptive review, using up-to-date scientific sources and reputable articles, the most common comorbidities of childhood obesity, including metabolic, cardiovascular, respiratory, musculoskeletal, and psychological disorders, have been examined. The focus was on clinical and epidemiological findings related to the occurrence and consequences of these comorbidities.

Results: Insulin resistance is one of the most important metabolic complications of obesity, which can lead to type 2 diabetes. Additionally, high blood lipids and hypertension increase the risk of future cardiovascular diseases. On the other hand, respiratory problems, such as obstructive sleep apnea are common in obese children that often are undiagnosed. Excessive weight pressure on bones and joints can lead to musculoskeletal discomforts. Moreover, obese children are more prone to psychological disorders such as depression, anxiety, and low self-esteem.

Conclusions: Childhood obesity is not a simple or temporary condition, but a chronic and multifactorial disease that can severely impact the child's physical and mental health. Early intervention, including lifestyle changes, psychological support, and pharmacological treatment in specific cases, can prevent the occurrence or progression of comorbidities. Preventive measures at family, school, and community levels play a key role in controlling this crisis.

Key Words:
Childhood obesity, Comorbidities, Insulin resistance, Type 2 diabetes, Mental health, Prevention

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Review Paper

The Role of Artificial Intelligence in the Early Diagnosis of Neonatal Sepsis

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ABSTRACT

Background: Neonatal sepsis is one of the leading causes of neonatal mortality worldwide, particularly among preterm and low-birth-weight infants admitted to neonatal intensive care units. Early diagnosis of this condition is crucial in preventing progression to multi-organ failure and death. However, nonspecific clinical signs and delays in laboratory results often lead to postponed treatment and, in some cases, unnecessary use of antibiotics. In recent years, the application of artificial intelligence (AI) and machine learning (ML) algorithms has attracted considerable attention as a novel approach for the prediction and early diagnosis of neonatal sepsis.

Objectives: This review aimed to summarize recent advances in the use of artificial intelligence and machine learning for early detection of neonatal sepsis.

Methods: In the present study, experimental and review articles indexed in PubMed, Scopus, ScienceDirect, and Google Scholar were reviewed. The inclusion criteria consisted of studies that used ML models for the prediction, diagnosis, or classification of neonatal sepsis. Key findings were extracted from selected articles, including model performance outcomes, types of data used (vital signs, laboratory results, electronic health records), and implementation challenges.

Results: Various studies have employed models such as random forest, bagging, support vector machines, and artificial neural networks to predict neonatal sepsis. Some models, particularly bagging, achieved accuracy rates above 98% and an area under the curve greater than 0.98. Time-to-event analyses demonstrated that these models were capable of predicting sepsis up to 12–24 hours before the onset of clinical symptoms. Combining structured data (such as C-reactive protein levels and white blood cell counts) with unstructured data (such as clinical notes) improved predictive accuracy. Nevertheless, challenges including limited generalizability, lack of a standardized definition for neonatal sepsis, and difficulty in interpreting model outputs by clinical staff were reported.

Conclusions: Artificial intelligence can play a key role in the early diagnosis of neonatal sepsis, leading to timely interventions, reduced mortality, and improved efficiency in antibiotic use. However, for widespread and effective clinical implementation, the development of generalizable models, validation in diverse clinical settings, and the design of interpretable tools for healthcare providers are essential.

Key Words:

Neonatal sepsis, Artificial intelligence AI), Machine learning (ML), Early diagnosis, Clinical monitoring

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Review Paper

Cardiogenic Shock in Pediatrics

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ABSTRACT

Background: Pediatric cardiogenic shock (PCS) represents a critical state of circulatory failure with mortality rates exceeding 50% in certain cohorts. Unlike adult cardiogenic shock, which is primarily caused by acute myocardial infarction, PCS has distinct etiologies, including congenital heart disease, myocarditis, and cardiomyopathies. The immature myocardium possesses unique physiological properties that create challenges in diagnosis and management, compounded by a critical gap in pediatric-specific evidence and validated biomarkers.

Objectives: This review aimed to evaluate current diagnostic approaches, including clinical assessment, biomarkers, and imaging modalities, in children with cardiogenic shock.

Methods: A systematic literature search was performed across multiple databases, including ScienceDirect, Springer, ProQuest, PubMed, SID, Google Scholar, Scopus, and Embase for articles published between January 2019 and December 2025. The search strategy employed MeSH terms and keywords, including “cardiogenic shock”, “pediatrics”, “child”, “infant”, “neonate”, “cardiac shock”, and “low cardiac output syndrome”. Studies focusing on pediatric patients with cardiogenic shock were included, with limited exceptions for foundational adult papers. The selection process followed PRISMA 2020 guidelines.

Results: Recent advances include the development and validation of a modified SCAI (Society for Cardiovascular Angiography and Interventions) classification specifically for children, which provides a standardized framework for risk stratification with a graded association with outcomes. The pathophysiology of PCS involves a vicious cycle of myocardial injury, inflammation, and end-organ hypoperfusion, with etiology-specific pathways including post-cardiotomy low cardiac output syndrome, immune-mediated myocardial dysfunction, and right ventricular failure. Diagnostic approaches rely on clinical assessment, biomarkers (lactate, troponins, natriuretic peptides), and multimodality imaging, particularly echocardiography. Management strategies involve physiology-based pharmacological support with vasoactive agents and timely escalation to mechanical circulatory support for refractory cases.

Conclusions: The field of pediatric cardiogenic shock has evolved significantly with the introduction of pediatric-specific classification systems and refined understanding of pathophysiological mechanisms. However, critical gaps remain in evidence-based management, particularly regarding validated biomarkers and standardized therapeutic protocols. Future research should focus on multicenter studies to establish age-specific diagnostic thresholds, develop etiology-specific management algorithms, and conduct robust clinical trials to optimize outcomes for this vulnerable patient population.

Key Words:

Cardiogenic shock, Pediatric, Heart failure, Extracorporeal membrane oxygenation, Myocarditis

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Journal of Pediatrics Review

Review Paper

Pediatric Idiopathic Intracranial Hypertension

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ABSTRACT

Background: Idiopathic intracranial hypertension in children is a rare condition affecting about 1 in every 100000 to 150000 kids, emerging as a key consideration when evaluating cases with optic disc swelling. It features elevated pressure within the skull without tumors, brain or vascular anomalies, or issues related to hormones, blood, or metabolism.

Objectives: Treatment prioritizes preventing optic nerve damage from disk swelling to protect visual acuity, while also reducing the burden of associated symptoms like prolonged headaches, highlighting the need for early detection.

Methods: This narrative review emphasizes updated diagnostic standards, including cerebrospinal fluid pressure exceeding 28 cm of water (or 25 cm in slim, alert children), supported by brain imaging and spinal fluid sampling to exclude other causes.

Results: Detecting the condition in children is challenging due to poor exam cooperation, inconsistent symptoms, and sedation needs; recovery typically occurs within 4 to 5 months for mild cases, yet relapse affects 6% to 22% (especially teens with weight changes), with permanent vision loss in 10% for acuity and 17% for visual fields.

Conclusions: Comprehensive assessment, confirmation, therapy, and ongoing monitoring are vital to prevent irreversible vision impairment (particularly in severe or prolonged cases), persistent headaches, and psychological stress from repeated care.

Key Words:

Pediatric idiopathic intracranial hypertension, Optic disk swelling, Elevated intracranial pressure, Spinal pressure threshold, Optic nerve damage, Visual field defects, Obesity, Disease recurrence

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Review Paper

Cardiotoxicity in Patients Treated for Childhood Cancer

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ABSTRACT

Background: Pediatric malignancies constitute a significant cause of morbidity among children. While chemotherapeutic regimens are essential for treating pediatric cancers, they may cause significant cardiovascular complications. Therefore, familiarity with the recognition and management of cancer-related cardiovascular complications are needed for enhancing long-term outcomes in these patients.

Objectives: This narrative systematic review aims to summarize the current evidence about cardiotoxicity in patients treated for childhood cancer.

Methods: A comprehensive search of PubMed, Scopus, and Web of Science databases were conducted for articles published between 2010 and 2025 using keywords, such as pediatric cancer, chemotherapy, and cardiac complications.

Results: Among the most commonly used chemotherapeutic agents are anthracyclines, which are strongly associated with cardiotoxicity. Studies have shown that childhood cancer survivors treated with anthracyclines are 15 times more likely to develop late-onset heart failure related to cancer treatment and have a five-fold increased risk of death from cardiovascular disease compared to the general population. Recent advances such as small-molecule inhibitors, antibody-based cytotoxic therapies, and immunotherapies have improved treatment options for challenging pediatric cancers, though they are associated with new patterns of cardiotoxicity. Genetic variations, particularly single nucleotide polymorphisms (SNPs), may influence the degree of cardiotoxicity experienced by individual patients.

Conclusions: linicians should identify the cardiotoxic side effects associated with pediatric cancer treatments, understand available alternative therapies, and employ effective methods for early detection until these toxicities can be fully prevented.

Key Words:
Cardiotoxicity, Patients treated, Childhood cancer, Childhood

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Review Paper

Secondary Hematological Malignancies in Pediatric Patients Undergoing Hematopoietic Stem Cell Transplantation: A Systematic Review and Meta-analysis

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ABSTRACT

Background: Hematopoietic stem cell transplantation (HSCT) is a treatment modality for many hematological diseases and pediatric cancers. However, the occurrence of malignancies, including secondary hematological malignancies (SHM), is a late complication in these patients. **Objectives:** Given that there is no comprehensive data on its incidence in the pediatric population, this study was designed to determine the incidence of SHM in patients under 18 years of age after HSCT.

Methods: This study was conducted as a systematic review and meta-analysis based on the PRISMA guidelines. A comprehensive search of articles published from 2000 to 2025 was performed in PubMed, Scopus, ISI, and Web of Science databases with relevant keywords. The inclusion criteria included cohort studies and case series that reported SHM in pediatric patients after HSCT. After screening the titles and abstracts, eligible articles were selected to extract data on the incidence of SHM.

Results: The present systematic review included 6 studies with a total of 2577 patients who met the inclusion criteria. The results of data analysis showed that the cumulative incidence of secondary hematological malignancies in the population of children receiving hematopoietic stem cell transplantation ranged from 0% to 5.7% 4 to 16 years after transplantation. With an I2 index of 63.2, the incidence was 1.2% (95% CI, 0.5%, 3%).

Conclusions: Although the risk of secondary cancers in HSCT recipients is significant compared to the general population with matched age and sex, the incidence of hematological malignancies in these patients is not high. However, prospective studies with longer follow-up are needed.

Key Words:

Incidence, Hematologic neoplasms, Child, Hematopoietic stem cell transplantation

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