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Perspective

A Global Perspective on Pediatric Infectious Diseases: Old Threats and New Realities

Livia Mancini*

Department of Pediatrics, Anna Meyer Children's University Hospital, Florence, Italy

INTRODUCTION

Pediatric infectious diseases remain among the leading causes of morbidity and mortality in children worldwide, representing one of the most pressing public health challenges of the 21st century. Despite notable advances in vaccines, antibiotics, and healthcare delivery systems, millions of children continue to suffer from preventable or treatable infections. According to the World Health Organization (WHO), infectious diseases contribute substantially to under-five mortality, with pneumonia, diarrhea, malaria, and neonatal infections being the dominant contributors. However, the epidemiology of pediatric infections is shifting in response to socioeconomic development, global health interventions, antimicrobial resistance, and emerging pathogens [1]. This duality of old and new threats underscores the urgent need for a global perspective that combines region-specific strategies with international collaboration.

This article explores the evolving burden of pediatric infectious diseases, highlighting persisting challenges, emerging risks, and innovative solutions. By examining antimicrobial resistance, vaccine gaps, social determinants of health, and technological advances, it provides an integrated understanding of the complex interplay between biology, society, and environment in shaping pediatric health outcomes [2].

DESCRIPTION

Global Burden and Regional Variation

In low- and middle-income countries (LMICs), infectious diseases remain the dominant cause of child mortality. Pneumonia alone claims more than 700,000 lives annually among children under five, while diarrheal diseases account for over 500,000 deaths. Malaria continues to exact a significant toll, particularly in sub-Saharan Africa, where it disproportionately affects young children due to their limited immunity. Tuberculosis, often overlooked in pediatric populations, also contributes significantly to illness and death, especially among malnourished children and those living with HIV.

In contrast, high-income countries (HICs) have largely curbed mortality from classic infectious killers through widespread vaccination and improved healthcare infrastructure[3]. However, infections remain a major cause of pediatric morbidity, especially respiratory tract infections, viral gastroenteritis, and infections caused by antimicrobial-resistant organisms. Seasonal influenza, respiratory syncytial virus (RSV), and emerging coronaviruses present significant challenges, leading to recurrent hospitalizations and economic burdens.

This disparity highlights the need for tailored approaches that reflect the epidemiology of pediatric infections in different settings. While LMICs require interventions targeting preventable infectious killers, HICs must focus on surveillance, antimicrobial stewardship, and preparedness for novel pathogens.

Antimicrobial Resistance: A Growing Threat

Antimicrobial resistance (AMR) represents one of the most critical threats to pediatric health globally. The misuse and overuse of antibiotics in children, particularly for viral infections such as the common cold or influenza, have accelerated the development of resistant strains. Resistant pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA), multidrug-resistant *Streptococcus pneumoniae*, and gram-negative bacteria including *Escherichia coli* and *Klebsiella pneumoniae* are increasingly reported in pediatric populations.

Children are particularly vulnerable to the consequences of AMR due to limited treatment options, smaller drug safety margins, and dependency on caregivers for healthcare decisions. The spread of resistant pathogens in neonatal intensive care units (NICUs) is especially alarming, as it complicates management of sepsis and meningitis in fragile infants.

Efforts to combat AMR must include pediatric antimicrobial stewardship programs, which emphasize rational prescribing, rapid diagnostics, and physician education. Policymakers should balance the need for access to antibiotics in resource-limited settings with strategies to prevent misuse. Research into child-specific pharmacology and novel antimicrobial agents is also

***Correspondence to:** Livia Mancini, Department of Pediatrics, Anna Meyer Children's University Hospital, Florence, Italy; Email: larkmercy05@gmail.com

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critical to ensure effective treatment in this vulnerable population.

Vaccination: Successes and Setbacks

Vaccines remain the cornerstone of infectious disease prevention in pediatrics. Global immunization programs have drastically reduced deaths from measles, polio, diphtheria, and pertussis. For example, measles-related deaths dropped by more than 80% between 2000 and 2017 due to expanded vaccination coverage. However, vaccination gaps persist due to logistical challenges, vaccine hesitancy, misinformation, and inequities in distribution.

The COVID-19 pandemic further disrupted routine immunization services, leading to concerning resurgences of vaccine-preventable diseases. Polio cases, for instance, reappeared in regions that were nearing eradication. Measles outbreaks have surged due to declining coverage, raising fears of losing hard-earned gains.

To strengthen immunization systems, strategies must focus on improving supply chains, addressing vaccine hesitancy through effective communication, and ensuring equitable access. Investment in next-generation vaccines, such as those for RSV, dengue, and malaria, could further reduce pediatric morbidity and mortality.

Emerging and Re-emerging Infections

Emerging and re-emerging infectious diseases continue to shape the pediatric infectious disease landscape. Viruses such as influenza, RSV, and novel coronaviruses demonstrate the unpredictable nature of pediatric infections. The COVID-19 pandemic exemplified this unpredictability, with unique pediatric manifestations such as multisystem inflammatory syndrome in children (MIS-C) drawing global attention.

Vector-borne diseases, including malaria, dengue, chikungunya, and Zika virus, are also expanding into new geographic areas due to climate change, urbanization, and global travel. Pediatric populations are particularly susceptible to these infections, which often present with severe or atypical manifestations.

Continuous pediatric-specific surveillance and clinical research are essential for early detection, rapid response, and the development of age-appropriate therapies. International collaboration in data sharing, vaccine development, and treatment guidelines will strengthen preparedness for future outbreaks.

Social Determinants of Pediatric Infectious Diseases

The risk and severity of pediatric infections are profoundly influenced by social determinants of health. Malnutrition weakens immune responses, increasing susceptibility to infections such as pneumonia, diarrhea, and tuberculosis. Poor sanitation and lack of access to clean water facilitate the transmission of diarrheal diseases, while overcrowded living conditions promote the spread of respiratory infections.

Inequities in healthcare access exacerbate these challenges. Many children in LMICs lack timely access to antibiotics, vaccines, or hospital care, resulting in preventable deaths. Addressing these determinants requires multisectoral approaches that go beyond medicine investments in nutrition, sanitation, housing, and education are critical to reducing the pediatric infectious disease burden.

Climate change further complicates this landscape by altering the ecology of pathogens and vectors. Rising temperatures and shifting rainfall patterns have already expanded the reach of diseases like malaria and dengue into previously unaffected regions, disproportionately affecting children.

Technological Innovations and Future Directions

Recent technological advances hold promise for transforming pediatric infectious disease prevention and management. Point-of-care diagnostic tools allow rapid differentiation between bacterial and viral infections, reducing inappropriate antibiotic use. Genomic sequencing enables real-time tracking of outbreaks and pathogen evolution, while artificial intelligence (AI)-driven predictive models support early identification of epidemic hotspots.

However, equitable access to these innovations remains a challenge. Resource-limited settings, where the burden of infectious diseases is highest, often lack infrastructure to adopt advanced technologies. Global efforts should prioritize capacity building and technology transfer to ensure children everywhere benefit from scientific progress.

Investments in pediatric-focused research are equally important. Children are not merely small adults differences in physiology, immune response, and drug metabolism necessitate child-specific studies to optimize prevention and treatment strategies.

CONCLUSION

Pediatric infectious diseases reflect a complex interplay between microbial biology, human behavior, environment, and societal factors. While enormous progress has been made through vaccines, antibiotics, and public health interventions, persistent threats like antimicrobial resistance, vaccination gaps, and social inequities continue to hinder progress. Emerging pathogens and the growing impact of climate change add further layers of complexity.

The future demands integrated, proactive approaches that move beyond reactive treatment. Strengthening antimicrobial stewardship, expanding immunization programs, addressing social determinants of health, and ensuring equitable access to innovations are essential. Most importantly, global collaboration must remain central, as infectious diseases transcend borders and disproportionately affect the most vulnerable our children.

By adopting a holistic and globally coordinated perspective, we can envision a future where preventable infections no longer define childhood survival. Protecting children from infectious diseases is not only a medical imperative but also a moral responsibility that reflects our collective commitment to safeguarding future generations.

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