Research Article

Respiratory Syncytial Virus Prevention In Infants: Maternal Vaccination, Long-Acting Monoclonal Antibodies, And Equity Of Access

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Abstract:

Introduction:
RSV is a major cause of acute lower respiratory tract infection, hospitalization, and infant mortality, particularly during the first months of life.
Objectives: To review the current strategies to prevent respiratory syncytial virus (RSV) infection in infants that include maternal vaccination and long-acting monoclonal antibodies with equity of access.
Methodology:
A narrative review of key selected clinical trials was conducted, mostly published in the 2020-2026 range, recommendations by WHO, guidance by the Advisory Committee on Immunization Practices and related public health literature.
Results:
RSV is associated with substantial incidence of ALRI-related hospitalization and death in young infants and is more frequent in low- and middle-income countries. Maternal immunization with perfusion F protein vaccine can confer passive protection, through transplacental transfer of antibody, during the initial months of life. Monoclonal antibodies against RSV, such as nirsevimab and clesrovimab, provide direct passive protection to infants who are at a high risk of developing RSV infection, particularly in cases where their mothers were either unvaccinated, vaccinated too close to delivery, or have had impaired antibody transfer to the infant.
Conclusion:
Recent advancements have changed the RSV prevention strategy for infants from support care into immunization. Today's biggest challenge is not proving scientific feasibility, but ensuring fair and effective delivery. Nations must devise context-specific strategies to integrate maternal vaccination, monoclonal antibodies in infants, surveillance, financing, and equity monitoring to shield all infants, particularly those at highest risk.

Keywords: Respiratory Syncytial Virus Infections; Infant; Pregnancy; Immunization, Passive; Monoclonal Antibodies; Vaccination; Health Equity.

Introduction

RSV, or respiratory syncytial virus, refers to the virus responsible for infection of the respiratory tract. Infections which are not severe are self-limiting whereas severe infections can cause hypoxia, hospitalization ICU admission and death. The responsibility occurs in the first few months of life when infant airways are small, protection is immature and one cannot escape older siblings or crowded household environments[1,2].
Recent global estimates suggest that RSV caused approximately 33 million lower respiratory infection episodes, 3.6 million hospital admissions, and more than 100,000 overall deaths among children younger than five years in 2019. Infants younger than six months accounted for a large proportion of severe outcomes, and most deaths occurred in low- and middle-income countries[1].
The World Health Organization (WHO) has therefore emphasized prevention in early infancy as a global child-health priority[3].
For many years, preventive measures were confined primarily to hygiene, breastfeeding promotion, smoke-exposure reduction and palivizumab for some high-risk infants. Palivizumab prevented severe disease but had to be given monthly and was expensive, thus it could not be utilized for the prevention of disease in all infants[24]. Recent developments of maternal vaccines and long-acting monoclonal antibodies would change this. Devices that can avert a disease before the infection has taken place. But they also create policy questions- which one will be first? Which

one should countries choose between maternal vaccination and infant monoclonal antibodies? How can we ensure that access is provided to low-income families, rural populations, refugees, and infants born outside tertiary hospitals?[8,9]

This review discusses the prevention of RSV in infants through three linked perspectives: maternal vaccination, long-acting monoclonal antibody prophylaxis, and equity of access.

Methodology

In infants, it was prepared from global recommendation statements, prominent randomized trials, real-world effectiveness studies, cost-effectiveness analyses, and implementation literature on RSV prevention. Evidence published over the period 2020 to 2026 was prioritized. This included data on WHO and CDC/ACIP recommendations, reports of clinical trials published in high-impact journals, and to some degree studies on access and affordability. The synthesis concentrated on infants' prevention of RSV rather than treatment of established infection[3-9].

Disease burden and rationale for prevention

Infants are at risk of severe RSV disease even when they have no underlying medical condition. This is important because risk-based programs alone cannot prevent most hospitalizations. In many hospital-based studies, a substantial proportion of infants admitted with RSV were previously healthy. The highest vulnerability is usually observed in the first months of life, especially among premature infants, infants with chronic lung disease, congenital heart disease, neuromuscular disorders, immune compromise, and those living in crowded or disadvantaged environments[1,2,27].

The reasoning behind prevention is based on passive immunity. Many vaccines do not produce an optimal response in young infants, and active infant vaccination against RSV is not yet established for early infancy. By either increasing maternal antibodies during pregnancy and transferring these across the placenta, or by giving a long-acting monoclonal antibody to the infant, protection can be achieved. At the level of health systems, these two strategies are complementary, although most individual mother-infant pairs do not need both[3,5,6].

Maternal vaccination

Maternal vaccination creates a protective immunological window for the newborn during pregnancy. The F protein of RSV is an important antigen because of its high conservation and importance for entry into cells. Receiving a vaccine late in pregnancy increases maternal neutralizing antibodies which by crossing the placenta, offer protection during the first months after birth[10-13]

The bivalent perfusion F protein vaccination during pregnancy was effective against medically attended severe RSV-associated lower respiratory tract illness in infants with a positive safety profile, as shown by the MATISSE trial. Earlier studies of maternal vaccines established important principles of antibody transfer and infant protection while later discussions on safety gave importance to the timing of vaccination and monitoring of pregnancy outcomes[11-14].

In the US, the Advisory Committee on Immunization Practices recommends one dose of Pfizer RSV perfusion F vaccine during 32 to 36 weeks completed of gestation using seasonal administration[5]. WHO has recommended the introduction of infant protection programs using either maternal vaccination or long-acting monoclonal antibodies, with product choice informed by local epidemiology, seasonality, feasibility and cost[3].

Vaccination in the mother has benefits. It protects the newborn immediately after birth and avoid an additional injection for the infant. Where these are already offered, it can be integrated into antenatal care platforms alongside tetanus, influenza, pertussis and coronavirus disease vaccination. It might be particularly useful in settings with relatively strong antenatal care attendance, with access to pregnant women before seasonal peaks[3,5,29].

Despite the benefits of maternal vaccination, their impact is dependent on several factors. When maternal vaccination occurs too close to delivery, in the case of preterm birth prior to adequate antibody transfer, or due to maternal complications that impair placental transport the efficacy may be lower. Due to these limitations, monoclonal antibodies designed for infants are an important alternative or rescue option[3,6,14].

Long-acting monoclonal antibodies

Monoclonal antibodies can act as passive protection against RSV. They do not rely on the infant developing a response, in contrast to traditional vaccines. They are thus ideal for newborns and young infants[15-17,23].

Nirsevimab is a monoclonal antibody licensed for seasonal protection in infants. In studies involving patients, nirsevimab lessened medically necessary RSV low respiratory tract contamination in healthy late-preterm and term babies. Extra pooled and pragmatic proof showed a safeguard against being admitted to hospital and experiencing RSV low respiratory tract disease. Real-world studies have justified the effectiveness versus a stay in hospital and admission into intensive care[19,20].

Clesrovimab is an additional long-acting monoclonal antibody. In a phase 2b-3 trial, one fixed dose protected healthy preterm and full-term infants from RSV disease[21]. In 2025, ACIP recommended clesrovimab to nirsevimab as an alternative for infants less than eight months of age born during or entering their first RSV season and who are not protected through maternal vaccination[7]. This second product may enhance the security of supply and flexibility of programs[22].

Monoclonal antibodies have significant practical advantages because they can be given at birth, prior to hospital discharge and shortly before RSV season. These are especially useful if maternal vaccination was missed, contraindicated, and/or unavailable, given less than two weeks before delivery, or if infants are born prematurely before adequate antibody transfer. The primary drawbacks of these vaccines include the expense, procurement complexity, and cold-chain necessity, besides the need to reach infants promptly[3,6,7,28].

Selecting maternal vaccination or monoclonal antibodies

A guiding principle of policy is that any infant should be protected; however, most do not require both maternal vaccination, followed by monoclonal antibody prophylaxis. A practical strategy is utilizing maternal vaccination when pregnant women present in the recommended gestation for delivery during or close to the RSV season. Monoclonal antibodies may be indicated when maternal vaccination was not received, when vaccination was administered too close to delivery, maternal immune response or antibody transfer may be inadequate, and when the infant has high-risk conditions[3,5-7].

In countries where antenatal care is well-established, maternal vaccination is possibly the most scalable first-line strategy. In counties with high facility-birth coverage and good newborn immunization systems, monoclonal antibody administration may be a possibility before discharge. In several low- and middle-income countries, a multi-pronged approach may be needed vaccination of mothers via antenatal clinics, monoclonal antibodies for missed opportunities and high-risk infants and catch-up before seasonal peaks[3,8,9] (table 1).

Table 1: Comparison of infant RSV prevention strategies

Strategy	Target recipient	Timing	Main advantage	Main limitation	Equity concern
Maternal perfusion F protein vaccine	Pregnant woman	Third trimester; national guidance may specify exact weeks	Protects infant from birth through maternal antibody transfer	Requires timely antenatal care and adequate placental transfer	Women with late or poor antenatal access may be missed
Nirsevimab	Infant	Birth, before season, or during season if eligible	Single-dose direct infant protection	Cost and supply constraints	Rural and low-income infants may have delayed access
Clesrovimab	Infant	Birth, before season, or during season if eligible	Fixed-dose option may simplify delivery	Newer product with evolving implementation experience	Availability may initially favor high-income settings

Palivizumab	Selected high-risk infants	Monthly during season	Established high-risk prophylaxis	Multiple doses and high cost	Not suitable for universal infant protection

Equity of access

Equity may be the defining issue in RSV prevention. The infants at the highest risk of death are usually found in places with little access to oxygen, PICU, transport, diagnostics, and preventive products. The introduction of maternal vaccines and monoclonal antibodies exclusively to the private market or in tertiary centers may cut disease in more affluent families but will leave the highest-risk infants defenceless[8,9,30].

Inequities will need to be expected. Inequity of antenatal care may limit vaccination for mothers. Women who come from poorer backgrounds, adolescent, displaced, rural, far from clinics, or uninsured may present late, or never. Access inequity to facility births limits delivery of monoclonal antibodies since babies born in homes or small clinics miss birth doses. When products are not publicly financed, there may be cost inequity, and when parents receive poor counseling or misinformation, information inequity may reduce acceptance[3,8,9,30].

A fair program should include public funding and procurement through national immunization markets, integration with maternity and child health, monitoring by region, income, refugee status and place of birth. When resources are limited, the criterion for priority cannot just be ability to pay. The priority groups may consist of premature infants, infants with cardiopulmonary disease, and infants under six months entering the season, as well as communities with a high hospitalization or death rate[3,28-30] (table 2).

Table 2: Equity-oriented implementation framework

Program step	Practical action	Equity indicator
Policy decision	Select maternal vaccine, monoclonal antibody, or mixed strategy based on local seasonality and system capacity	National policy includes publicly funded access
Antenatal delivery	Offer maternal vaccination during eligible gestational window	Coverage by district, maternal age, and socioeconomic group
Birth-dose delivery	Give monoclonal antibody before discharge for eligible infants	Proportion of eligible newborns protected before leaving facility
Catch-up strategy	Use primary care and outreach before or during season	Coverage among rural and home-born infants
Communication	Provide culturally appropriate counseling	Parental acceptance and refusal rates
Surveillance	Monitor hospitalizations, intensive care admissions, and adverse events	Reduction in severe disease across all regions

Proposed clinical-public health algorithm

The core message of the proposed algorithm is that universally every infant needs to be protected before the period of highest RSV risk but duplication of maternal vaccination and monoclonal antibody prophylaxis should be avoided unless national advice stipulates a special indication. The process of documentation in maternal-child records aims to prevent missed opportunities and prevent unnecessary repeat administration[3,5-7] (figure 1).

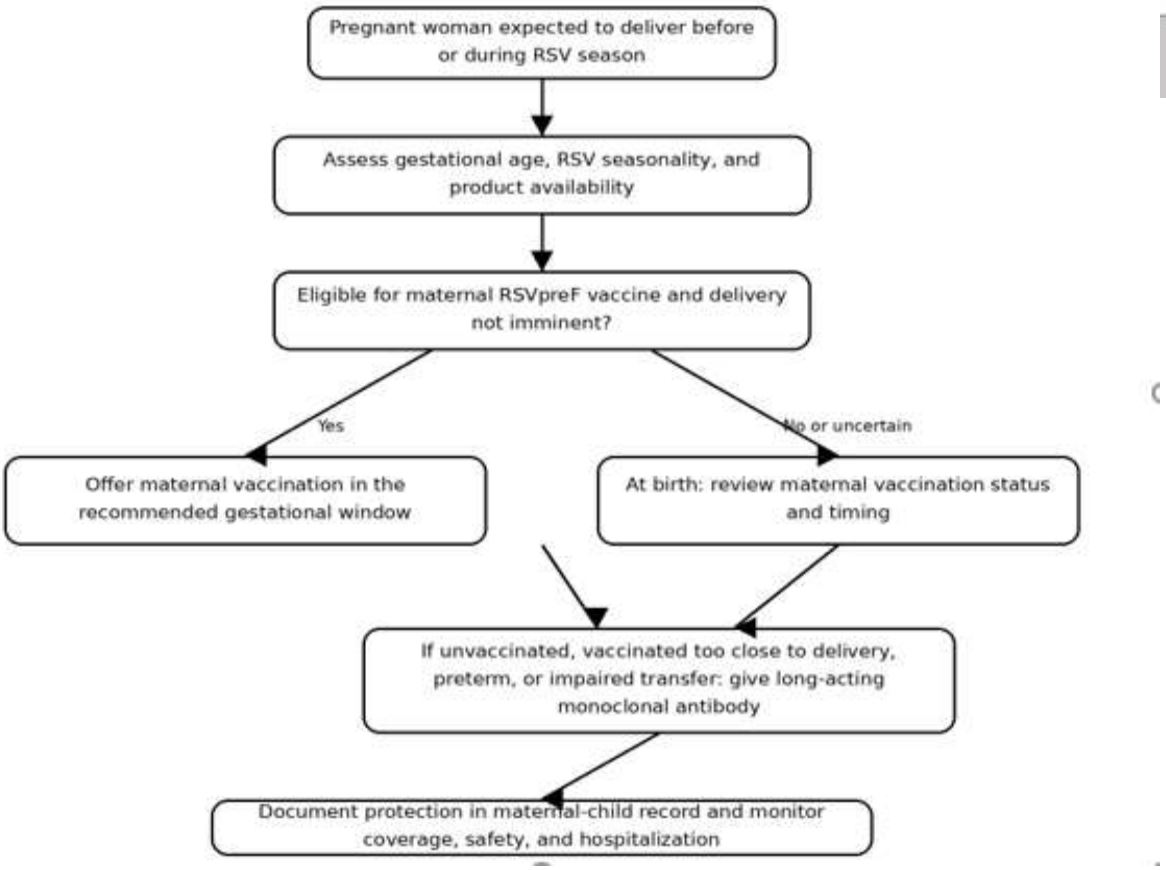

Figure 1: Proposed algorithm for infant respiratory syncytial virus prevention

The policy implications for low- and middle-income nations

For low- and middle-income countries, including many countries in South Asia and the Eastern Mediterranean region, the best strategy may not be a direct copy of high-income country programs. Decision-makers should consider local RSV seasonality, antenatal attendance, facility-birth coverage, cold-chain capacity, health-worker workload, product price, and competing immunization priorities[1,3,8,9].

Maternal vaccination may be more feasible where antenatal-care coverage is high and vaccines can be incorporated into existing maternal immunization visits. Monoclonal antibodies may be more feasible where birth registration, facility delivery, and newborn immunization systems are strong. In countries with year-round RSV circulation, seasonal campaigns may be less effective than continuous eligibility rules. Surveillance is therefore essential[3,4,8].

Financing is central. If products are paid out-of-pocket, the highest-risk infants will often be excluded. Governments and international partners should negotiate affordable pricing, pooled procurement, and donor-supported access. Cost-effectiveness analyses from high-income and low- or middle-income settings suggest that the value of maternal vaccination and monoclonal antibodies depends heavily on disease burden, product price, seasonality, delivery costs, and hospitalization costs[28,29].

Safety and communication

Public confidence requires transparent communication. Maternal vaccination should be explained as a way to protect the infant through transferred antibodies, not as treatment for active infection. Monoclonal antibodies should be explained as passive immunization, not as routine antibiotics or curative therapy. Parents should be told that these interventions reduce the risk of severe disease but do not prevent every respiratory infection[3-7.]

Safety monitoring should include maternal adverse events, pregnancy outcomes, infant adverse events, breakthrough hospitalizations, and rare unexpected events. Health workers should be trained to counsel families

clearly, document product administration, and avoid unnecessary duplication between maternal vaccination and infant monoclonal antibody use[3,5-7,14].

Conclusion

There has been a new era for RSV prevention in infants. Infants are most vulnerable to severe disease during the first six months of life. Maternal vaccination and long-acting monoclonal antibodies in this time frame can substantially reduce severe disease. The scientific evidence is strong, but local epidemiology, health-system capacity, affordability and equity should guide implementation. An effective scheme should not just introduce a product but ensure that all infants, even those born to poor, rural residents, displaced prematurity, or in failing health systems, receive protection. The RSV preventive program should be assessed ethically as whether it narrows or instead, widens the survival gap of the rich and poor.

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