Category

Best Biotechnology Product

General Information

Company Name *

Pfizer Inc.

Product/Solution Name *

ABRYSVO®

Compound/Tech Name*

Respiratory Syncytial Virus Bivalent Stabilized Prefusion F Subunit Vaccine (RSVpreF)

Trade Name *

ABRYSVO®

Corporate Name *

Date of Approval *

2023-05-31

Indications *

ABRYSVO® is a vaccine indicated for:
• Active immunization of pregnant individuals at 32 through 36 weeks gestational age for the prevention of lower respiratory tract disease (LRTD) and severe LRTD caused by respiratory syncytial virus (RSV) in infants from birth through 6 months of age.
• Active immunization for the prevention of LRTD caused by RSV in individuals 60 years of age and older.

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Therapeutic Areas *

Infectious Disease

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Attached Files:

- PrixGalienUSA 2024_ABRYSVO.docx

Background information and need for drug / device
(please be as specific as possible in your description; limit 500 words)

RSV disease in young infants
Globally, in children <5 years of age, there are an estimated 33 million episodes of respiratory syncytial virus (RSV) associated acute lower respiratory infections annually, resulting in an estimated 3.6 million hospitalizations and an estimated 26,300 in-hospital deaths. A recent global metanalysis attempted to quantify additional RSV deaths occurring outside the hospital setting, resulting in an estimated 101,400 total RSV attributable deaths among children <5 each year (e.g., RSV-attributable deaths in the hospital and in the community).1, The burden of severe RSV among children <5 is concentrated in infancy; globally, 39% of all RSV-associated hospitalizations among children <5 years occur in the first 6 months of life, and within the first 6 months of life, 60% of RSV-associated hospitalizations were among infants 0-3 months old. Among infants <6 months of age, RSV is associated with 1.4 million hospital admissions, and 13,000 in-hospital deaths globally each year. Overall, among infants <6 months of age, RSV-attributable deaths in both the hospital and the community are estimated to be 45,700. More than 97% of RSV-attributable deaths occur in low- and middle-income countries.1

In the US, RSV is the leading cause of infant hospitalization, with approximately 1% to 3% of all children in the first 12 months of life hospitalized due to RSV lower respiratory tract disease. RSV leads to 2.1 million outpatient visits and 58,000 hospitalizations among children younger than 5 years old. , As with the global estimates, hospitalization is concentrated in younger life; a recent study of US hospitalization rates estimated that 50,400 (87%) of hospitalization in children <5 occur in those <2 years old.7 A separate study focusing on hospitalization rates by age estimated that 50% of the hospitalizations among infants <1 year old occurred during the first three months of life, while 75-80% occurred during the first 6 months, and demonstrated that hospitalization rates peaked at 2 months of age. Among infants, RSV-associated hospitalization rates are substantially higher than influenza-associated hospitalization rates.
Several studies have demonstrated links between RSV lower respiratory tract illness (LRTI) (especially if the illness required hospitalization) and subsequent or recurrent non-RSV LRTI in the first two years of life. , Increased risk of bacterial pneumonia (including pneumococcal pneumonia) and acute otitis media have also been documented. , , , , , There is also evidence of a possible association between severe RSV disease in infancy and subsequent wheezing and asthma in later childhood.10, , RSV LRTI in early life increases the risk of asthma not only within the first decade of life but also possibly into adolescence and adulthood. ,
RSV disease in older adults
RSV disease burden reported in 2015 demonstrated there were approximately 1.5 million episodes of acute respiratory illness-RSV (ARI-RSV) in older adults (≥65 years of age) in industrialized countries, with approximately 15% of those being admitted to hospitals.
In the US, RSV is responsible for approximately 177,000 hospitalizations and 14,000 deaths annually in adults 65 years of age and older. RSV disease incidence rates in this population are approximately half those of influenza, with variation year to year.23 However, the burden of adult RSV disease could be underestimated since testing for RSV is less common in older adults than in children. RSV disease in adults is also difficult to diagnose based on clinical signs and symptoms alone, and, before the recent broader use of more sensitive detection methods, laboratory confirmation of RSV in adults was challenging because of low levels of virus shedding.
Adults 60 years of age and older are at increased risk of RSV infection, which can trigger exacerbations of underlying comorbid conditions, such as COPD and CHF.24 RSV infection has been associated with

up to 22% of acute COPD exacerbations in prospective cohort studies and 11% of wintertime hospitalizations for COPD exacerbations.24 In industrialized countries, case fatality rate of RSV-ARI was 11.7% for adults with comorbidity, while it was 1.6% for the same general population. , , , This indicates that adults with comorbidities have a higher risk of experiencing ARI-RSV and a poorer outcome.25,26,27,28

Unmet Medical Need in Infants

Prior to ABRYSVO®, there was no approved vaccine to help prevent RSV disease in infants. Treatment of RSV disease consists primarily of supportive care (e.g., nutrition/hydration for infants who cannot maintain hydration, and supplemental oxygen). , The benefit of antiviral therapy (e.g., ribavirin) for RSV is unclear, and therefore, it is rarely used to treat RSV, except in the context of severe immunosuppression, because of inconvenient administration, questionable benefit in immunocompetent patients, teratogenicity concerns based on nonhuman animal data, and high cost.29, , , Paracetamol and OTC cold medications may be used to relieve milder symptoms. Humanized monoclonal antibodies against the RSV F glycoprotein have demonstrated clinical efficacy. Palivizumab has demonstrated safety and efficacy against severe disease in high-risk infants and is currently authorized as immunoprophylaxis therapy for high-risk infants. , Nirsevimab, a next-generation single dose, extended half-life prefusion F-specific monoclonal antibody, demonstrated efficacy against RSV LRTI in Phase 3 studies and was approved by the U.S. FDA in July 2023 for passive immunization to prevent RSV-associated lower respiratory tract disease among infants and young children.

Unmet Medical Need in Older Adults

Prior to ABRYSVO®, there was no approved vaccine to help prevent RSV disease in older adults. Treatment of RSV disease consists primarily of supportive care (eg, fluids, supplemental oxygen, or mechanical ventilation).38 Paracetamol and OTC cold medications may be used to relieve milder symptoms.34 Comprehensive hygiene measures are helpful and cost-effective in limiting the spread of RSV, and should always be advocated as a prophylactic measure, however, they are not sufficiently efficacious to prevent the disease burden.

Conclusions on Unmet Medical Needs

Historically, RSV has primarily been considered a pediatric pathogen, but during the past 30 years it has been increasingly recognized as an important cause of respiratory disease among older adults. Before the approval of ABRYSVO®, no vaccine to help protect against RSV disease in any population had been authorized. Also, there is no currently approved antiviral therapy for RSV, and the only available treatment options include symptomatic treatment and supportive care.38 While authorized for preventative use in children <2 years of age, limitations of palivizumab use include its high cost and requirement for multiple monthly injections, making it impractical for broad use in infants, or use outside of high resource settings.35, , Similarly, although the CDC recommended nirsevimab in August 2023 to protect infants aged <8 months against RSV-associated lower respiratory tract infection in their first RSV season, cost and the logistics of administration may restrict its use to high-income countries.

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History of the development of the solution/product *
(please be as specific as possible in your description; 500 words)

ABRYSVO® is a bivalent RSV stabilized prefusion F subunit vaccine (RSVpreF). The prefusion F protein is a key antigen target for RSV vaccines, as it plays a critical role in viral fusion and entry into host cells. The journey to the RSVpreF vaccine began with the breakthrough determination of the crystal structure of prefusion RSV F in complex with an antibody fragment that prevented rearrangement from the prefusion to the postfusion conformation. This enabled a National Institutes of Health laboratory to engineer an incompletely stabilized RSV prefusion F antigen, termed DS-Cav1. This construct elicited approximately 10-fold higher neutralizing antibody titers than postfusion F in laboratory animals. , , After discovery of the prefusion F crystal structure, Pfizer engineered prefusion RSV F constructs sufficiently stabilized to be practical vaccine antigens. The constructs are RSV F ectodomains "locked" in the prefusion conformation by C-terminal T4 fibritin foldon trimerization domains and internal stabilizing mutations. A stabilized prefusion F subunit construct, designated 847, on which the antigens in RSVpreF are based, elicits >50-fold higher neutralizing titers than a postfusion F antigen in nonhuman primates (rhesus macaques).

The pivotal MATISSE (MATernal Immunization Study for Safety and Efficacy) Phase 3 trial evaluated ABRYSVO® in a maternal immunization setting. The randomized, double-blinded, placebo-controlled study assessed the efficacy, safety, and immunogenicity of ABRYSVO® against medically attended lower respiratory tract disease (MA-LRTD) and severe MA-LRTD in infants born to healthy women vaccinated during pregnancy. The study enrolled approximately 7,400 pregnant individuals, who were randomized in a 1:1 ratio to receive a single dose of either ABRYSVO® or placebo during the late second to third trimester of their pregnancy. One of the key findings was the significant reduction in severe MA-LRTD due to RSV in infants up to 180 days post-birth. This result underscored the potential of maternal vaccination as a strategy to help protect young infants from RSV. Additionally, there were no significant safety concerns identified during the trial.46

The RENOIR (RSV vaccine Efficacy study iN Older adults Immunized against RSV disease) Phase 3 trial focused on the active immunization of older adults, a demographic particularly vulnerable to RSV. The randomized, double-blind, placebo-controlled study was designed to evaluate the efficacy, immunogenicity, and safety of a single dose of ABRYSVO® in adults 60 years of age and older. The trial enrolled approximately 37,000 participants, randomized to receive 120mg ABRYSVO® or placebo in a 1:1 ratio. ABRYSVO® showed strong efficacy in preventing RSV-associated lower respiratory tract disease (LRTD) with three or more symptoms, maintaining this efficacy across two seasons. The vaccine's efficacy was consistent for both RSV A and RSV B subgroups, with high efficacy rates for LRTD with three or more symptoms. It also shows sustained efficacy against less severe LRTD, defined by two or more symptoms, across both seasons. There were no significant safety concerns identified in this study.47

MATISSE and RENOIR, along with the extensive preclinical and early-phase clinical trials, are significant in the development of ABRYSVO®. Despite challenges posed by the COVID-19 pandemic, which impacted RSV transmission patterns and seasonality, both trials yielded compelling evidence supporting the vaccine's efficacy and safety profile. The results from these trials were instrumental in the regulatory approval process and recommendations for the use of ABRYSVO®, for maternal immunization to prevent RSV disease in young infants (representing the first and only U.S. approval of a maternal vaccine to help protect infants at birth through 6 months from LRTD and severe LRTD due to RSV) and active immunization of adults 60 years and older to prevent RSV disease. ABRYSVO® is approved for its maternal and adult indications in several countries including the United States, the European Union, the United Kingdom, Canada, Japan, Argentina, and Brazil.

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Why this drug or device is innovative, the broad implications for future research, and/or how it will improve the human condition *

The licensing of a vaccine against RSV that utilizes structure-guided vaccine antigen design marks a huge accomplishment in the field of vaccinology, capping over 60 years of scientific struggle, perseverance, and innovation. Since RSV was identified in 1956, efforts to develop a vaccine faced numerous setbacks, including the infamous 1966 trial where a formalin-inactivated RSV vaccine not only failed to protect but also exacerbated the disease in some children. The breakthrough came with the advent of structural biology techniques, which allowed scientists to understand the precise configuration of the RSV F protein in its prefusion state. The trimeric RSV F surface glycoprotein is the primary target of neutralizing antibodies and is the basis for the engineered antigens in ABRYSVO®. During RSV entry into cells, F rearranges from a prefusion to a postfusion conformation. As it rearranges, F fuses the viral and host cell membranes. Structural data show that the postfusion F conformation targeted by many prior failed vaccine approaches is very different from the predominant prefusion conformation that is present on virions. The structural difference between conformations results in antigenic differences. In contrast to postfusion F, prefusion F is in a metastable conformation that needs to be stabilized to be useful as an improved vaccine antigen.43,44 Based on this new understanding, Pfizer developed 2 structurally engineered, stabilized prefusion F vaccine antigens, 1 for each RSV subgroup (RSV A and RSV B). This innovative antigen design enhances the vaccine's ability to induce robust and durable immune responses, thereby providing superior protection against RSV infection compared to previous vaccine candidates. This milestone not only highlights the triumph over decades of challenges but also heralds a new era in vaccine development, where structure-based design can significantly accelerate the delivery of effective vaccines for other elusive pathogens. Clinical trial data shows that ABRYSVO® provides robust protection against RSV for adults 60 years of age and older, reducing the risk of RSV-associated LRTD and severe complications. Following vaccination, ABRYSVO® offers protection for at least two years, a substantial duration that enhances its practicality and appeal for older adults who may face challenges with more frequent vaccination schedules. This prolonged immunity is particularly important for the elderly who are more susceptible to severe RSV outcomes, including hospitalization and death. By ensuring sustained defence against RSV, ABRYSVO® has the potential to, not only improve individual health outcomes, but also to help alleviate the broader public health burden associated with RSV in this age group. Maternal immunization to help protect infants is anticipated to overcome the barriers to direct infant immunization. One barrier is the very early peak of RSV disease, occurring approximately 1 to 2 months after birth, which affords little time for a neonatal vaccine to elicit a protective immune response. Other barriers include the immaturity of the neonatal immune system and potential suppression of active RSV antibody responses by maternal antibodies. Perhaps the greatest barrier to direct infant immunization is the history of vaccine-mediated RSV disease enhancement following immunization of RSV-naive infants with a formalin-inactivated RSV vaccine. The goal of maternal immunization is to boost preexisting RSV-neutralizing antibody titers in the mother. Maternal antibodies are transferred transplacentally to the fetus and thus protect babies for the first months of life, when they are most vulnerable to severe RSV disease. Maternal immunization with ABRYSVO® is designed to help protect infants through their first 6 months of life when the risk of RSV hospitalization is highest (50% and 75% of hospitalizations during the first year of life occur in the first 3 months and 6 months of life, respectively).8 Importantly, this approach can confer protection that is present at birth, without the logistical challenges that might be involved with direct infant immunization or prophylactic monoclonal antibody administration, such as adding an additional

product into a complex infant immunization schedule and ensuring vaccine administration prior to any opportunities for RSV exposure, the latter of which could require an additional and potentially unanticipated well-child visit if RSV seasonality remains difficult to predict. Maternal immunization has the potential to circumvent the issue of suboptimal immune responses to active immunization in very early infancy that can necessitate administering multiple vaccine doses over several months, leaving the infant unprotected or suboptimally protected in the meantime. It also induces a polyclonal antibody response, and therefore has a low likelihood of applying selective pressure against circulating viruses.
Maternal immunization is a powerful public health approach that has been used across the globe for decades in the prevention of neonatal tetanus, pertussis in early infancy, influenza in pregnant individuals and young infants, and more recently, COVID-19. , , Platforms for vaccine delivery in antenatal care are well-established in many countries, and rates of uptake for vaccines routinely recommended in pregnancy are comparable to and often exceed coverage levels of other vaccines recommended for adults.53,54,55, , , In addition to prevention of illness in infants, additional benefits to the pregnant person, the pregnancy and the fetus have been observed when vaccines are administered in pregnancy, including prevention of severe disease the vaccinated individual. Vaccination in pregnancy also has the potential to provide the infant with an ongoing supply of vaccine-induced maternal antibodies via breastmilk after birth.

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Please provide appropriate references (PubMed, Abstract, Website) *

1. Li Y, Wang X, Blau DM, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in children younger than 5 years in 2019: a systematic analysis. Lancet. 2022;399(10340):2047-64.
2. Shi T, McAllister DA, O'Brien KL, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015: a systematic review and modelling study. Lancet. 2017;390(10098):946-58.
3. Jepsen MT, Trebbien R, Emborg HD, et al. Incidence and seasonality of respiratory syncytial virus hospitalisations in young children in Denmark, 2010 to 2015. Euro Surveill. 2018;23(3).
4. Taylor S, Taylor RJ, Lustig RL, et al. Modelling estimates of the burden of respiratory syncytial virus infection in children in the UK. BMJ Open. 2016;6(6):e009337.
5. Kimberlin DW, Brady MT, Jackson MA, et al. Respiratory Syncytial Virus. Red Book: 2015 Report of the Committee on Infectious Diseases 30th Ed. 2015. 667-76 p.
6. Hall CB, Weinberg GA, Iwane MK, et al. The burden of respiratory syncytial virus infection in young children. N Engl J Med. 2009;360(6):588-98.
7. Rha B, Curns AT, Lively JY, et al. Respiratory Syncytial Virus-Associated Hospitalizations Among Young Children: 2015-2016. Pediatrics. 2020;146(1):S459-S60.
8. Parikh RC, McLaurin KK, Margulis AV, et al. Chronologic Age at Hospitalization for Respiratory Syncytial Virus Among Preterm and Term Infants in the United States. Infect Dis Ther. 2017;6(4):477-86.
9. Zhou H, Thompson WW, Viboud CG, et al. Hospitalizations associated with influenza and respiratory syncytial virus in the United States, 1993-2008. Clin Infect Dis. 2012;54(10):1427-36.
10. Zar HJ, Nduru P, Stadler JAM, et al. Early-life respiratory syncytial virus lower respiratory tract infection in a South African birth cohort: epidemiology and effect on lung health. Lancet Glob Health.

2020;8(10):e1316-e25.
11. Weber MW, Milligan P, Giadom B, et al. Respiratory illness after severe respiratory syncytial virus disease in infancy in The Gambia. J Pediatr. 1999;135(6):683-8.
12. Heikkinen T, Ojala E, Waris M. Clinical and Socioeconomic Burden of Respiratory Syncytial Virus Infection in Children. J Infect Dis. 2017;215(1):17-23.
13. Shazberg G, Revel-Vilk S, Shoseyov D, et al. The clinical course of bronchiolitis associated with acute otitis media. Arch Dis Child. 2000;83(4):317-9.
14. Smith DK, Seales S, Budzik C. Respiratory Syncytial Virus Bronchiolitis in Children. Am Fam Physician. 2017;95(2):94-99.
15. Weinberger DM, Klugman KP, Steiner CA, et al. Association between respiratory syncytial virus activity and pneumococcal disease in infants: a time series analysis of US hospitalization data. PLoS Med. 2015;12(1):e1001776.
16. Stensballe LG, Hjuler T, Andersen A, et al. Hospitalization for respiratory syncytial virus infection and invasive pneumococcal disease in Danish children aged <2 years: a population-based cohort study. Clin Infect Dis. 2008;46(8):1165-71.
17. Hendaus MA, Jomha FA, Alhammadi AH. Virus-induced secondary bacterial infection: a concise review. Ther Clin Risk Manag. 2015;11:1265-71.
18. Driscoll AJ, Arshad SH, Bont L, et al. Does respiratory syncytial virus lower respiratory illness in early life cause recurrent wheeze of early childhood and asthma? Critical review of the evidence and guidance for future studies from a World Health Organization-sponsored meeting. Vaccine. 2020;38(11):2435-48.
19. Brunwasser SM, Snyder BM, Driscoll AJ, et al. Assessing the strength of evidence for a causal effect of respiratory syncytial virus lower respiratory tract infections on subsequent wheezing illness: a systematic review and meta-analysis. Lancet Respir Med. 2020;8(8):795-806.
20. Wu P, Hartert TV. Evidence for a causal relationship between respiratory syncytial virus infection and asthma. Expert Rev Anti Infect Ther. 2011;9(9):731-45.
21. Fauroux B, Simoes EAF, Checchia PA, et al. The Burden and Long-term Respiratory Morbidity Associated with Respiratory Syncytial Virus Infection in Early Childhood. Infect Dis Ther. 2017;6(2):173-97.
22. Hall CB, Walsh EE, Schnabel KC, et al. Occurrence of groups A and B of respiratory syncytial virus over 15 years: associated epidemiologic and clinical characteristics in hospitalized and ambulatory children. J Infect Dis. 1990;162(6):1283-90.
23. Centers for Disease Control and Prevention. (2020). Respiratory syncytial virus infections (RSV) trends and surveillance. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Reviewed: July 17, 2023. Available from: https://www.cdc.gov/rsv/research/index.html. Accessed on: 14 May 2024.
24. Murata Y, Falsey AR. Respiratory syncytial virus infection in adults. Antivir Ther. 2007;12(4 Pt B):659-70.
25. Branche AR, Walsh EE, Formica MA, et al. Detection of respiratory viruses in sputum from adults by use of automated multiplex PCR. J Clin Microbiol. 2014;52(10):3590-6.
26. Jeong JH, Kim KH, Jeong SH, et al. Comparison of sputum and nasopharyngeal swabs for detection of respiratory viruses. J Med Virol. 2014;86(12):2122-7.
27. Meerhoff TJ, Houben ML, Coenjaerts FE, et al. Detection of multiple respiratory pathogens during primary respiratory infection: nasal swab versus nasopharyngeal aspirate using real-time polymerase chain reaction. Eur J Clin Microbiol Infect Dis. 2010;29(4):365-71.
28. Spyridaki IS, Christodoulou I, de Beer L, et al. Comparison of four nasal sampling methods for the detection of viral pathogens by RT-PCR-A GA(2)LEN project. J Virol Methods. 2009;156(1-2):102-6.

29. Florin TA, Plint AC, Zorc JJ. Viral bronchiolitis. Lancet. 2017;389(10065):211-24.
30. Ralston SL, Lieberthal AS, Meissner HC, et al. Clinical practice guideline: the diagnosis, management, and prevention of bronchiolitis. Pediatrics. 2014;134(5):e1474-502.
31. Sinclair SM, Jones JK, Miller RK, et al. The Ribavirin Pregnancy Registry: An Interim Analysis of Potential Teratogenicity at the Mid-Point of Enrollment. Drug Saf. 2017;40(12):1205-18.
32. Simoes EA, DeVincenzo JP, Boeckh M, et al. Challenges and opportunities in developing respiratory syncytial virus therapeutics. J Infect Dis. 2015;211 Suppl 1:S1-S20.
33. Turner TL, Kopp BT, Paul G, et al. Respiratory syncytial virus: current and emerging treatment options. Clinicoecon Outcomes Res. 2014;6:217-25.
34. Hall CB, Simoes EA, Anderson LJ. Clinical and epidemiologic features of respiratory syncytial virus. Curr Top Microbiol Immunol. 2013;372:39-57.
35. Prescott WA, Jr., Doloresco F, Brown J, et al. Cost effectiveness of respiratory syncytial virus prophylaxis: a critical and systematic review. Pharmacoeconomics. 2010;28(4):279-93.
36. IMpact-RSV Study Group. Palivizumab, a humanized respiratory syncytial virus monoclonal antibody, reduces hospitalization from respiratory syncytial virus infection in high-risk infants. The IMpact-RSV Study Group. Pediatrics. 1998;102(3 Pt 1):531-7.
37. United States Food and Drug Administration. Beyfortus United States Prescribing Information (USPI). Available from: https://www.accessdata.fda.gov/drugsatfda_docs/label/2023/761328s000lbl.pdf. Accessed: 28 May 2024.
38. Colosia AD, Yang J, Hillson E, et al. The epidemiology of medically attended respiratory syncytial virus in older adults in the United States: A systematic review. PLoS One. 2017;12(8):e0182321.
39. Boyoglu-Barnum S, Chirkova T, Anderson LJ. Biology of Infection and Disease Pathogenesis to Guide RSV Vaccine Development. Front Immunol. 2019;10:1675.
40. Synagis® (palivizumab). US Prescribing Information. Revised: November 2020.; 2020. Available from: https://synagishcp.com/synagis.pdf. Accessed on: 14 May 2024.
41. Synagis (palivizumab). EPAR Product Information; 2021. Available from: https://www.ema.europa.eu/en/documents/overview/synagis-epar-summary-public_en.pdf. Accessed on: 14 May 2024.
42. Jones JM. Use of nirsevimab for the prevention of respiratory syncytial virus disease among infants and young children: recommendations of the Advisory Committee on Immunization Practices-United States, 2023. MMWR. Morbidity and mortality weekly report. 2023;72.
43. McLellan JS, Chen M, Leung S, et al. Structure of RSV fusion glycoprotein trimer bound to a prefusion-specific neutralizing antibody. Science. 2013;340(6136):1113-7.
44. Liljeroos L, Krzyzaniak MA, Helenius A, et al. Architecture of respiratory syncytial virus revealed by electron cryotomography. Proc Natl Acad Sci U S A. 2013;110(27):11133-8.
45. Flynn JA, Durr E, Swoyer R, et al. Stability Characterization of a Vaccine Antigen Based on the Respiratory Syncytial Virus Fusion Glycoprotein. PLoS One. 2016;11(10):e0164789.
46. United States Food and Drug Administration. FDA Approves First Vaccine for Pregnant Individuals to Prevent RSV in Infants. Available from: https://www.fda.gov/news-events/press-announcements/fda-approves-first-vaccine-pregnant-individuals-prevent-rsv-infants. Accessed: 28 May 2024
47. Pfizer. U.S. FDA Approves ABRYSVO™, Pfizer's Vaccine for the Prevention of Respiratory Syncytial Virus (RSV) in Older Adults. Available from: https://www.pfizer.com/news/press-release/press-release-detail/us-fda-approves-abrysvotm-pfizers-vaccine-prevention. Accessed: 22 May 2024
48. Graham BS. The journey to RSV vaccines-heralding an era of structure-based design. New England Journal of Medicine. 2023 Feb 16;388(7):579-81.
49. Pfizer. Pfizer Announces Positive Top-Line Data for Full Season Two Efficacy of ABRYSVO® for RSV in Older Adults. Available from: https://www.pfizer.com/news/press-release/press-release-detail/pfizer-

announces-positive-top-line-data-full-season-two. Accessed: 28 May 2024
50. Parrott RH, Kim HW, Arrobio JO, et al. Epidemiology of respiratory syncytial virus infection in Washington, D.C. II. Infection and disease with respect to age, immunologic status, race and sex. Am J Epidemiol. 1973;98(4):289-300.
51. Crowe JE, Jr. Influence of maternal antibodies on neonatal immunization against respiratory viruses. Clin Infect Dis. 2001;33(10):1720-7.
52. Kim HW, Canchola JG, Brandt CD, et al. Respiratory syncytial virus disease in infants despite prior administration of antigenic inactivated vaccine. Am J Epidemiol. 1969;89(4):422-34.
53. Chu HY, Englund JA. Maternal immunization. Birth Defects Res. 2017;109(5):379-86.
54. Munoz FM, Jamieson DJ. Maternal Immunization. Obstet Gynecol. 2019;133(4):739-53.
55. Safadi MAP, Spinardi J, Swerdlow D, et al. COVID-19 disease and vaccination in pregnant and lactating women. Am J Reprod Immunol. 2022;88(1):e13550.
56. Sebghati M, Khalil A. Uptake of vaccination in pregnancy. Best Pract Res Clin Obstet Gynaecol. 2021;76:53-65.
57. Ghaswalla P, Poirrier JE, Packnett ER, et al. Maternal Immunization in the U.S.: A Nationwide Retrospective Cohort Study. Am J Prev Med. 2019;57(3):e87-e93.
58. Lu PJ, Hung MC, Srivastav A, et al. Surveillance of Vaccination Coverage Among Adult Populations - United States, 2018. MMWR Surveill Summ. 2021;70(3):1-26.

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