frontiers in Immunology

TYPE Original Research
PUBLISHED 03 September 2026
DOI 10.3389/fimmu.2026.1894773

Check for updates

OPEN ACCESS

EDITED BY
Kalpit A. Vora,
Merck, United States

REVIEWED BY
Radha Railkar,
Research Laboratories Merck, United States
Antonios Aliprantis,
Flagship Pioneering, United States

*CORRESPONDENCE
Xiaodong Sun
sunxiaodong@scdc.sh.cn
Jieqiong Hu
joan.x.hu@gsk.com

RECEIVED 29 May 2026
REVISED 17 July 2026
ACCEPTED 17 July 2026
PUBLISHED 03 September 2026

CITATION
Guo X, Ning G, Bi D, Damaso S, Dodet M, Huang F, Zhang X, Genco F, Lu H, Zhao J, Jiang L, Wu X, Li X, Yang L, Dezutter N, Sun X and Hu J on behalf of the RSV-021 Study Group (2026) Immunogenicity and safety of a single dose of adjuvanted RSVPreF3 vaccine in adults ≥60 years of age in China: results from a phase 3 immunobridging trial. *Front. Immunol.* 17:1894773. doi: 10.3389/fimmu.2026.1894773

COPYRIGHT
© 2026 Guo, Ning, Bi, Damaso, Dodet, Huang, Zhang, Genco, Lu, Zhao, Jiang, Wu, Li, Yang, Dezutter, Sun and Hu. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Immunogenicity and safety of a single dose of adjuvanted RSVPreF3 vaccine in adults ≥60 years of age in China: results from a phase 3 immunobridging trial

Xiang Guo[1], Guijun Ning[2], Dan Bi[3], Silvia Damaso[4], Monique Dodet[5], Fang Huang[1], Xinji Zhang[3], Flavio Genco[4], Hongmei Lu[6], Jingjing Zhao[7], Lili Jiang[8], Xiaoting Wu[9], Xiaojun Li[10], Laibao Yang[11], Nancy Dezutter[4], Xiaodong Sun[1]* and Jieqiong Hu[2]* on behalf of the RSV-021 Study Group

[1]Shanghai Municipal Center for Disease Control and Prevention, Shanghai, China, [2]GSK, Beijing, China, [3]GSK, Shanghai, China, [4]GSK, Wavre, Belgium, [5]GSK, Rixensart, Belgium, [6]Songjiang District Center for Disease Control and Prevention (Songjiang District Health Supervision Institute), Shanghai, China, [7]Jiading District Center for Disease Control and Prevention (Jiading District Health Supervision Institute), Shanghai, China, [8]Putuo District Center for Disease Control and Prevention (Putuo District Health Supervision Institute), Shanghai, China, [9]Minhang District Center for Disease Control and Prevention (Minhang District Health Supervision Institute), Shanghai, China, [10]Baoshan District Center for Disease Control and Prevention (Baoshan District Health Supervision Institute), Shanghai, China, [11]Pudong New Area Center for Disease Control and Prevention (Pudong New Area Health Supervision Institute), Shanghai, China

Introduction: Respiratory syncytial virus (RSV) is an important cause of severe respiratory disease, yet no vaccine is available for older adults in China. This phase 3, randomized, partially blind immunobridging study (NCT06551181) compared a single dose of adjuvanted RSVPreF3 vaccine in ≥60-year-old Chinese adults with a non-Chinese population.

Methods: Chinese participants were randomized 2:1 to receive adjuvanted RSVPreF3 (RSVPreF3_China group) or placebo (Placebo_China); participants from six additional countries (RSVPreF3_Overseas) received adjuvanted RSVPreF3. The primary objective was to demonstrate non-inferiority of humoral immune responses (RSV-A/RSV-B neutralizing titers) at 1 month post-vaccination in Chinese versus non-Chinese participants. Non-inferiority was met if the upper limit of the 95% confidence interval (CI) was ≤1.5 for the geometric mean titer (GMT) ratio (RSVPreF3_Overseas over RSVPreF3_China) and ≤10% for the seroresponse rate (SRR) difference (RSVPreF3_Overseas minus RSVPreF3_China). Reactogenicity and safety were also assessed.

Results: Overall, 2620 participants were exposed (RSVPreF3_China: 1199; Placebo_China: 601; RSVPreF3_Overseas: 820); 2522 were included in the per protocol set at 1 month post-vaccination (RSVPreF3_China: 1175; Placebo_China: 590; RSVPreF3_Overseas: 757). Non-inferiority criteria were met for both RSV-A and RSV-B, with 95% CI upper limits of 1.20 and 1.10 for GMT ratios and 3.40% and 4.89% for SRR differences, respectively. Neutralizing titers increased at 1 month in vaccine recipients: RSV-A/RSV-B GMTs were 5523.2/8073.2 ED60 (mean geometric increase [MGI]=7.89/6.40) in the RSVPreF3_China group and

6604.5/8286.2 ED60 (MGI=8.04/6.57) in the RSVPreF3_Overseas group; GMTs remained above baseline at 6 months post-vaccination. Solicited events were more frequent in vaccine- than placebo-Chinese recipients but were mostly mild-to-moderate and transient. Pain (in 41.7% of participants in the RSVPreF3_China group versus 4.2% in the Placebo_China group) and fatigue (13.6% versus 3.2%) were the most frequently reported administration-site and systemic events, respectively. The incidence of unsolicited adverse events (reported in 11.8%–13.8% of participants across Chinese groups), serious adverse events (3.4%–6.5% across all groups), and potential immune-mediated diseases (0.2%–0.3% across all groups) was low and comparable between groups.

Conclusion: A single dose of adjuvanted RSVPreF3 was immunogenic and well tolerated in Chinese adults aged ≥60 years, supporting the extrapolation of global efficacy and a favorable benefit-risk profile in this population.

KEYWORDS

adjuvanted RSVPreF3, Chinese adults, clinical trial, immunogenicity, RSV, safety, aged ≥60 years

1 Introduction

Respiratory syncytial virus (RSV) remains a significant yet often underestimated cause of acute respiratory illness (ARI) and lower respiratory tract disease (LRTD) in young children (1), older adults (2, 3), and individuals with certain underlying conditions (4). Older adults, in particular those with comorbidities, have a higher risk of developing severe RSV-associated illness, leading to high hospitalization and mortality rates.

In China, RSV was identified as a leading cause of ARI between 2009 and 2019, accounting for 16.8% of ARI cases in individuals of all ages and 7.4% of those in adults ≥60 years of age (5). However, most available data on the burden of RSV-associated disease are focused on children <5 years of age, while little information is available on the burden of RSV among older Chinese adults.

Recently, several preventive options have become available for RSV-associated illness in older adult populations (6), including 3 vaccines. RSV vaccination has shown effectiveness against RSV-associated hospitalization, with estimates of 75% during the first season after vaccination (7) and 58% across 2 RSV seasons (8) among adults ≥60 years of age (including immunocompromised adults). Two of these vaccines, adjuvanted RSVPreF3 (*Arexvy*, GSK) and RSVpreF (*Abrysvo*, Pfizer), are also approved for use in adults aged ≥60 years in Macau and Hong Kong, but remain unavailable in mainland China (9).

Adjuvanted RSVPreF3 is an $AS01_E$-adjuvanted RSV prefusion F protein–based vaccine that was assessed in a large phase 3 clinical trial (AReSVi-006) in adults ≥60 years of age (10–12). The vaccine was shown to be immunogenic, well tolerated, and efficacious against RSV-LRTD across 3 consecutive RSV seasons. Although conducted in 17 countries across both hemispheres, the trial did not include participants from mainland China.

Here, we report the immunogenicity of adjuvanted RSVPreF3 in the first completed phase 3 clinical trial evaluating the vaccine in adults aged ≥60 years in China. Non-Chinese participants from countries where the global efficacy trial AReSVi-006 was conducted were also enrolled in this study for immunogenicity and safety comparisons, while vaccine reactogenicity and the occurrence of ARI were assessed among Chinese participants. Findings are summarized in plain language in Figure 1.

2 Methods

2.1 Study design and participants

This phase 3, randomized, controlled, partially blind, immunobridging study was conducted in 12 centers in China and 33 centers in 6 other countries (Finland, Japan, Poland, Republic of Korea, Spain, and the United Kingdom), between 5 August 2024 and 27 November 2025.

Adults ≥60 years of age living in community dwellings, who were medically stable as assessed by the investigator, had not previously received any RSV vaccine, and who provided written or witnessed informed consent were enrolled in the study. Individuals with chronic medical conditions, such as diabetes, hypertension, or cardiac disease (treated or untreated), were eligible if the investigator considered the participant's condition to be medically stable. Inclusion and exclusion criteria are detailed in the Supplementary Material, Text S1. Enrolment in the study was

Abbreviations: AE, adverse event; ARI, acute respiratory illness; CI, confidence interval; ED60, estimated dilution 60; GMT, geometric mean titer; IU, International Units; LLOQ, lower limit of quantification; LRTD, lower respiratory tract disease; MGI, mean geometric increase; MPL, 3-*O*-desacyl-4′-monophosphoryl lipid A; NMPA, National Medical Products Administration; PCR, polymerase chain reaction; pIMD, potential immune-mediated disease; QS21, *Quillaja saponaria* Molina, fraction 21; RSV, respiratory syncytial virus; RT-PCR, reverse transcription polymerase chain reaction; SAE, serious adverse event; SRR, seroresponse rate; UL, upper limit; ULOQ, upper limit of quantification.

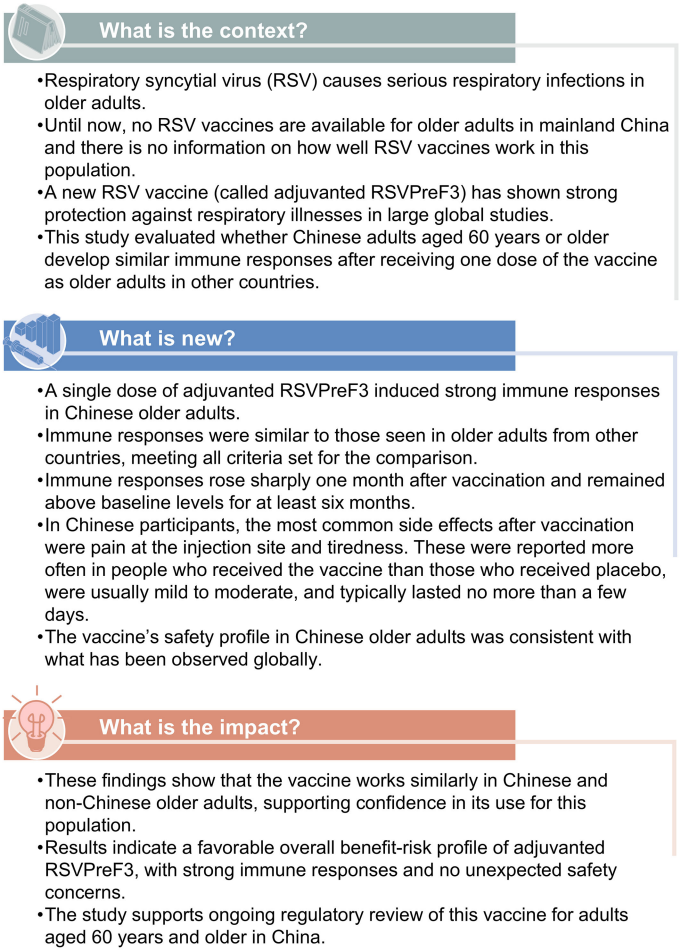


FIGURE 1
Plain language summary.

performed throughout the year and was not restricted to periods corresponding to the RSV season in each country.

Participants from China were randomized 2:1 to receive either 1 dose of adjuvanted RSVPreF3 (RSVPreF3_China group) or placebo (Placebo_China group) on Day 1. Participants from China were randomly allocated to each group using an interactive web response system. Participants from the other countries received 1 dose of adjuvanted RSVPreF3 (RSVPreF3_Overseas group). The study was observer-blind for participants in China, with participants and all personnel involved in clinical evaluation and laboratory testing remaining blinded to treatment assignment. Vaccines were prepared and administered by unblinded staff not involved in assessments or endpoint evaluation. The RSVPreF3_Overseas arm was open-label.

The study documents were approved by institutional review boards/independent ethics committees in each country. The trial was conducted in accordance with Good Clinical Practice and the Declaration of Helsinki and is registered with ClinicalTrials.gov on 9 August 2024 (NCT06551181). The study protocol is available at https://www.gsk-studyregister.com/trials/219815.

2.2 Objectives

The co-primary objectives were to demonstrate the non-inferiority of humoral immune responses (RSV-A/RSV-B neutralization titers) in Chinese adults ≥60 years of age in the RSVPreF3_China group compared to those in the RSVPreF3_Overseas group at 1 month after vaccination with adjuvanted RSVPreF3. Non-inferiority was demonstrated if the upper limit (UL) of the 2-sided 95% confidence interval (CI) for the geometric mean titer (GMT) ratio (RSVPreF3_Overseas group over RSVPreF3_China group) was ≤1.5 and the UL of the 2-sided 95% CI for the seroresponse rate (SRR) difference (RSVPreF3_Overseas group minus RSVPreF3_China group) was ≤10% for both RSV-A and RSV-B.

Secondary objectives included the evaluation of humoral immune responses in Chinese versus non-Chinese participants enrolled in the study up to 6 months post-vaccination. Safety and reactogenicity were also assessed. Throughout the study, the occurrence, duration, symptoms/signs, and severity of polymerase chain reaction (PCR)-confirmed RSV-ARI/LRTD episodes were evaluated in Chinese participants only.

2.3 Study procedures

Adjuvanted RSVPreF3 (0.5 mL) or placebo (at least 0.5 mL; NaCl solution) were administered by intramuscular injection in the deltoid of the nondominant arm. Each dose of reconstituted adjuvanted RSVPreF3 contained 120 µg RSVPreF3 antigen and $AS01_E$ adjuvant. $AS01_E$ is an Adjuvant System containing 3-*O*-desacyl-4′-monophosphoryl lipid A (MPL), *Quillaja saponaria* Molina, fraction 21 (QS-21, licensed by GSK from Antigenics LLC, a wholly owned subsidiary of Agenus Inc., a Delaware, USA corporation), and liposome (25 µg MPL and 25 µg QS-21).

Blood samples (~10 mL each) for immunogenicity assessments were collected from all participants pre-vaccination (Day 1), at 1 month (Day 31), and at 6 months post-vaccination (Month 6) (Figure 2). RSV-A and RSV-B neutralizing titers were assessed as described previously (10), and expressed as estimated dilution 60 (ED60), defined as the inverse of the interpolated serum dilution that yields a 60% reduction in the number of plaques compared to the virus control wells. In addition, ED60 neutralization titers were converted to concentrations in International Units (IU)/mL using secondary standards calibrated against the international reference (13, 14), which were included in each assay run to enable conversion. The SRR was defined as the proportion of participants having ≥4-fold increase in neutralizing titers (1 month post-vaccination over pre-vaccination), in accordance with the clinical development program of adjuvanted RSVPreF3 (15).

Solicited events were assessed in participants from China only, who used paper diary cards to record solicited administration-site and systemic events with onset within 7 days post-vaccination. All solicited events were graded by intensity by the investigator from mild (Grade 1) to severe (Grade 3). Grade 3 events were defined as significant pain at rest, preventing normal everyday activities for pain, a diameter >100 mm for swelling and erythema, an axillary temperature >39°C for fever, and as preventing normal everyday activities for the other events. The grading of solicited events was also done according to the guiding principles for grading criteria for adverse reactions in clinical trials of prophylactic vaccines formulated by the National Medical Products Administration (NMPA) in China (version 2019) (16). According to the Chinese grading scale, Grade 3 erythema or swelling was defined as a diameter ≥100 mm and Grade 3 fever, as an axillary temperature ≥38.5°C; additionally, Grade 4 fever (≥39.5°C lasting more than 3 days) was reported.

Unsolicited adverse events (AEs) were recorded by the investigator for 30 days post-vaccination for participants in China and graded by intensity. Serious AEs (SAEs), potential immune-mediated diseases (pIMDs), SAEs of atrial fibrillation, and (S)AEs leading to withdrawal were reported throughout the study in all groups. Investigators used their clinical judgment to decide whether AEs were related to study interventions.

Surveillance for detection of ARI episodes was carried out throughout the study in China, via spontaneous reporting by the participant (starting on Day 1) and by scheduled site staff contacts (starting from Day 31 onwards) with different frequencies of contact during the RSV season and the interseason periods. All participants reporting ≥2 ARI symptoms/signs meeting the ARI case definition (presence of ≥2 respiratory symptoms/signs for at least 24 hours or ≥1 respiratory symptom/sign and 1 systemic symptom/sign for at least 24 hours, as described in Supplementary Table 1) were followed-up for ARI assessment. Nasal self-swab or nasal and throat swab samples (by study staff) were collected and tested for RSV by reverse transcription PCR (RT-PCR). Case definitions for RSV-ARI/LRTD are detailed in Supplementary Table 1. Each ARI episode was diagnosed and managed according to local standard of care.

2.4 Statistical methods

The study was designed to enroll approximately 2600 participants, including 1800 participants in China, and 800 participants in the RSVPreF3_Overseas group. A sensitivity analysis was performed under multiple plausible immunogenicity scenarios, assuming a 10% attrition rate. The analysis demonstrated that the sample size would yield ≥90% power for evaluating the co-primary non-

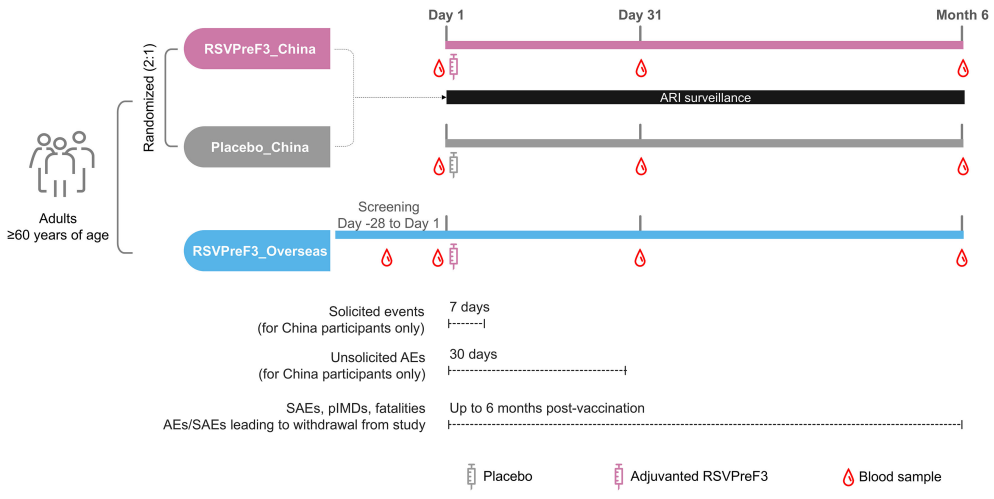


FIGURE 2
Study design. AE, adverse event; ARI, acute respiratory illness; pIMD, potential immune-mediated disease; SAE, serious AE.

inferiority objectives. Power was estimated using a 2-sample t-test for GMT comparisons, and the Miettinen and Nurminen (17) method for SRRs.

Immunogenicity was assessed in the per protocol set that included all eligible participants who received the study intervention as per protocol, had immunogenicity results pre- and post-vaccination, complied with blood draw intervals, had no intercurrent conditions that could interfere with immunogenicity, and no prohibited concomitant medication/vaccination.

For the co-primary immunogenicity endpoints, GMT ratios with 2-sided 95% CIs were calculated with an ANCOVA model on log_{10}-transformed titers for each neutralization titer; the model included the group as fixed effect and the baseline log_{10}-transformed titer as covariate. The 2-sided 95% CIs for group SRR difference were derived using the Miettinen-Nurminen method (17). Primary analysis results were reported as ED60.

Within-group mean geometric increases (MGIs), defined as the geometric mean of the within-participant ratios of the post-vaccination over pre-vaccination titer, were also estimated. 95% CIs for GMTs and MGIs were based on a back-transformation of CIs for the mean of log_{10}-transformed values. When computing GMTs, SRRs, MGIs, and between-group differences, titers below the assay cut-off (lower limit of quantification [LLOQ]) were replaced by half the assay cut-off (LLOQ/2) and titers above the upper limit of quantification (ULOQ) were replaced by the ULOQ. All analyses of between-group secondary immunogenicity endpoints were descriptive, with no adjustment for multiplicity.

Safety analyses were conducted in the exposed set, which included all participants receiving study intervention. The percentage of participants reporting AEs was calculated with exact 95% CIs using the Clopper-Pearson method (18).

For ARI surveillance, the number and percentage (with exact 95% CIs) of participants who reported at least 1 RSV-confirmed ARI/adjudicated LRTD episodes were computed.

Analyses were performed using SAS Viya version 4.0. Missing data were not imputed.

3 Results

3.1 Study participants

Overall, 2620 participants were enrolled and received the study intervention: 1199 in the RSVPreF3_China group, 601 in the Placebo_China group, and 820 in the RSVPreF3_Overseas group; 1191, 598, and 816 participants, respectively, were included in the per protocol set at Day 1 (Figure 3). In total, 2577 participants completed the study: 1176 in the RSVPreF3_China group, 589 in the Placebo_China group, and 812 in the RSVPreF3_Overseas group, with the most common reason for not completing being withdrawal by the participant (Figure 3).

In the per protocol set at Day 1, the mean age at vaccination was 70.1 years (varying from 69.8 to 70.5 across the 3 groups) and most participants (50.6% overall, 48.5%–52.3% across groups) were in the 60–69 years of age category. Slightly more than half of participants (52.0% overall, 50.3%–53.6% across groups) were female. Characteristics were balanced between the RSVPreF3_China and Placebo_China groups. Some differences were observed between Chinese and overseas participants for body mass index (≤25.1 versus 27.6 kg/m^2), frailty status (≥49.8% versus 26.1% pre-frail and ≤49.3% versus 73.7% fit participants), and smoking status for tobacco (≥17.6% versus 10.8% current smokers) (Table 1). Baseline characteristics for the exposed set are detailed in Supplementary Table 2.

3.2 Immunogenicity

The per protocol set at Day 31 included 2522 participants: 1175 in the RSVPreF3_China group, 590 in the Placebo_China group, and 757 in the RSVPreF3_Overseas group. The adjusted GMT ratio for neutralizing titers (RSVPreF3_Overseas group over RSVPreF3_China group) was 1.11 (95% CI: 1.04–1.20) for RSV-A and 1.03 (95% CI: 0.95–1.10) for RSV-B. The SRR difference (RSVPreF3_Overseas group minus RSVPreF3_China group) was -0.39 (95% CI: -4.29–3.40) for RSV-A and 0.75 (95% CI: -3.48–4.89) for RSV-B. Non-inferiority was demonstrated for all co-primary objectives: at 1 month post-vaccination, the UL of the 2-sided 95% CI for the adjusted GMT ratio was <1.5, and the UL of the 2-sided 95% CI for the SRR difference was <10% for both RSV-A and RSV-B (Figure 4, Supplementary Table 3). Similar observations were made when neutralizing concentrations (IU/mL) were used (Supplementary Table 4). Analyses performed on the exposed set confirmed the findings of the primary analyses in the per protocol set (Supplementary Table 5).

All participants had detectable RSV-A/RSV-B neutralizing titers at baseline. One month post-vaccination, RSV-A neutralizing antibody titers increased markedly in both the RSVPreF3_China and the RSVPreF3_Overseas groups, while no change was observed in the Placebo_China group. In the RSVPreF3_China group, GMTs increased from 703.3 to 5523.2 ED60, with an MGI of 7.89. In the RSVPreF3_Overseas group, GMTs rose from 825.8 to 6604.5 ED60, with an MGI of 8.04. A ≥4-fold rise at 1 month was observed in 77.3% of participants in the RSVPreF3_China group, 76.9% in the RSVPreF3_Overseas group, and 0.5% in the Placebo_China group. Six months post-vaccination, RSV-A neutralizing antibody titers decreased in both the RSVPreF3_China (2283.4 ED60; MGI of 3.27) and the RSVPreF3_Overseas (2395.6 ED60; MGI of 2.89) groups but remained over the baseline levels. SRRs were 36.7%, 34.0%, and 0.9% in the RSVPreF3_China, RSVPreF3_Overseas, and Placebo_China groups, respectively (Figure 5A, Supplementary Table 6).

One month post-vaccination, RSV-B neutralizing antibody titers increased in both the RSVPreF3_China (from 1264.9 to 8073.2 ED60; MGI of 6.40) and the RSVPreF3_Overseas (from 1274.2 to 8286.2 ED60; MGI of 6.57) groups; no change was observed in the Placebo_China group. SRRs were 69.5%, 70.3%, and 0.5%, respectively. Six months post-vaccination, RSV-B neutralizing antibody titers decreased to 3931.5 ED60 in the RSVPreF3_China group and 3785.0 ED60 in the RSVPreF3_Overseas groups but remained above the baseline levels (MGIs of 3.12 and 2.96, respectively). SRRs were 36.7%, 33.5%, and 1.0% in the RSVPreF3_China, RSVPreF3_Overseas, and Placebo_China groups, respectively (Figure 5B, Supplementary

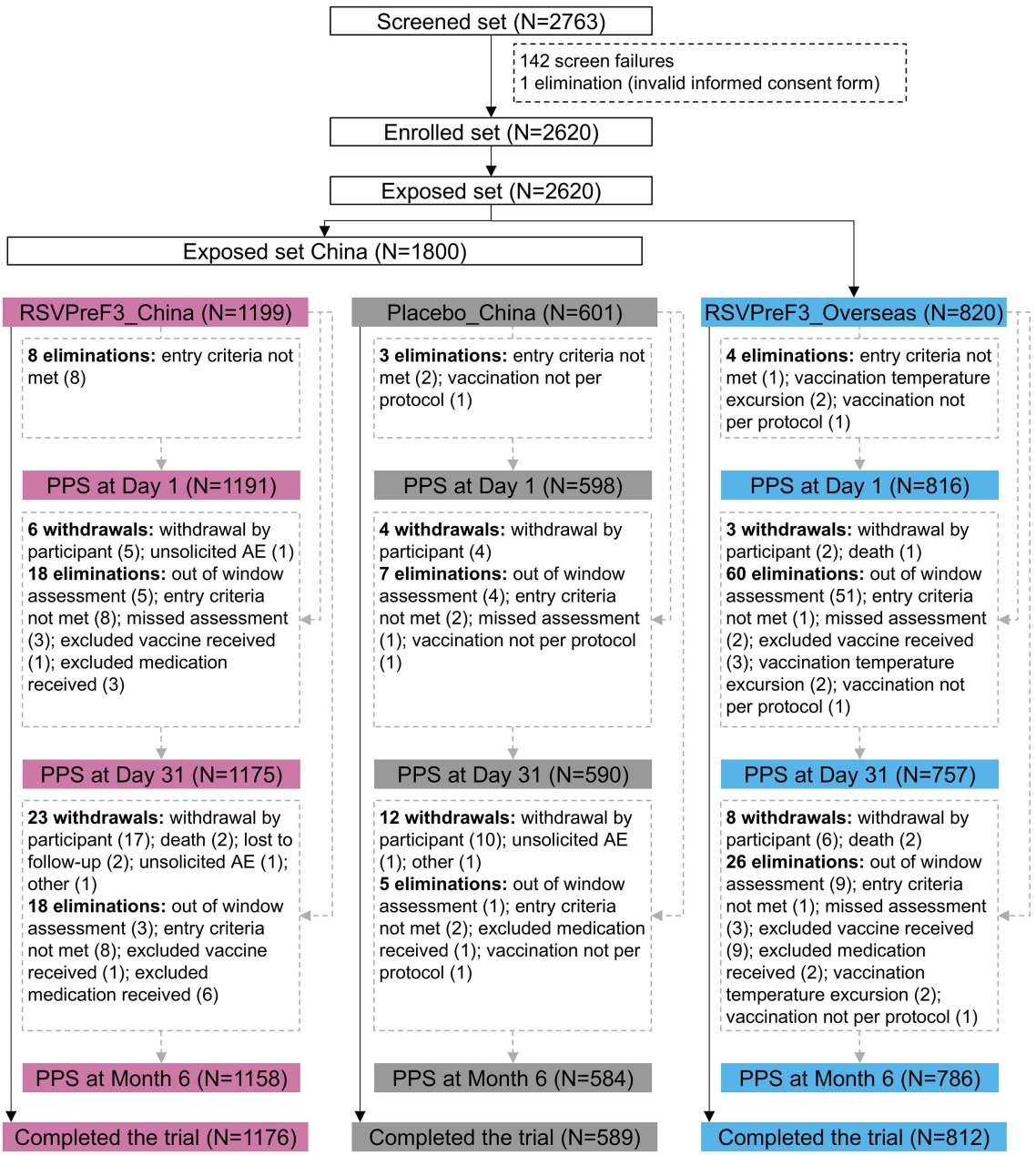


FIGURE 3
Study participant flowchart. AE, adverse event; N, number of participants in each group; PPS, per protocol set.

Table 6). Similar observations were made when neutralizing concentrations (IU/mL) were used (Supplementary Table 6).

3.3 Safety

Among Chinese participants, a higher reporting rate of solicited events was seen in the RSVPreF3_China group as compared with the Placebo_China group. In both groups, the most frequently reported solicited administration-site event was pain, in 41.7% of adjuvanted RSVPreF3-vaccinated participants and 4.2% of placebo recipients. The most frequently reported solicited systemic event was fatigue (13.6% of participants in the RSVPreF3_China group and 3.2% of participants in the Placebo_China group). Grade 3 administration-site events were reported by 0.2% (for swelling) to 0.5% (for pain) of participants in the RSVPreF3_China group and none in the Placebo_China group. Grade 3 systemic events were reported by 0.2% (for fatigue, fever, and headache) to 0.3% (for arthralgia and myalgia) of participants in the RSVPreF3_China group and 0.2% (for fever) of participants in the Placebo_China group (Figure 6, Supplementary Table 7). The median duration of each solicited event was ≤3.0 days for both administration-site and systemic events, regardless of intensity. When classified according to the China NMPA scale, there was no difference in the frequency of Grade 3 solicited erythema or swelling, and Grade 3 fever occurred at similar frequencies; no Grade 4 fever was reported (Supplementary Table 7).

In Chinese participants, within 30 days from vaccination, unsolicited AEs were reported by 13.8% of participants in the

TABLE 1 Participant characteristics at baseline (per protocol set at day 1).

Characteristic	RSVPreF3_China N=1191	Placebo_China N=598	RSVPreF3_Overseas N=816	Total N=2605
Mean age ± SD, years	69.8 ± 6.6	69.9 ± 6.7	70.5 ± 6.8	70.1 ± 6.7
Age category, n (%)				
60–69 years	608 (51.0)	313 (52.3)	396 (48.5)	1317 (50.6)
70–79 years	476 (40.0)	221 (37.0)	322 (39.5)	1019 (39.1)
≥80 years	107 (9.0)	64 (10.7)	98 (12.0)	269 (10.3)
Female, n (%)	616 (51.7)	301 (50.3)	437 (53.6)	1354 (52.0)
Race, n (%)				
Asian - Central/South Asian Heritage	0 (0.0)	0 (0.0)	9 (1.1)	9 (0.3)
Asian - Chinese Heritage	1191 (100)	598 (100)	2 (0.2)	1791 (68.8)
Asian - Korean Heritage	0 (0.0)	0 (0.0)	60 (7.4)	60 (2.3)
Asian - Japanese Heritage	0 (0.0)	0 (0.0)	30 (3.7)	30 (1.2)
White-Caucasian/European Heritage	0 (0.0)	0 (0.0)	704 (86.3)	704 (27.0)
Other	0 (0.0)	0 (0.0)	11 (1.4)	11 (0.4)
Mean BMI (± SD), kg/m²	25.0 ± 3.3	25.1 ± 3.1	27.6 ± 4.8	25.9 ± 3.9
Frailty status, n (%)				
Frail	13 (1.1)	5 (0.8)	2 (0.2)	20 (0.8)
Pre-frail	607 (51.0)	298 (49.8)	213 (26.1)	1118 (42.9)
Fit	571 (47.9)	295 (49.3)	601 (73.7)	1467 (56.3)
Smoker status for tobacco				
Current smoker	210 (17.6)	110 (18.4)	88 (10.8)	408 (15.7)
Former smoker	167 (14.0)	80 (13.4)	316 (38.7)	563 (21.6)
Never smoked	814 (68.3)	408 (68.2)	412 (50.5)	1634 (62.7)
Smoker status for e-cigarettes				
Current smoker	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Former smoker	0 (0.0)	0 (0.0)	5 (0.6)	5 (0.2)
Never smoked	1191 (100)	598 (100)	798 (97.8)	2587 (99.3)
Missing	0 (0.0)	0 (0.0)	13 (1.6)	13 (0.5)

BMI, body mass index; n (%), number (percentage) of participants in each category; N, number of participants in each group; SD, standard deviation.
Other included American Indian or Alaska Native, Asian - South East Asian Heritage, and Black or African American.

RSVPreF3_China group and 11.8% in the Placebo_China group, with AEs considered related to vaccination for 2.8% and 2.2% of participants, respectively. Grade 3 unsolicited events were reported by 1.1% and 0.8% of participants in the RSVPreF3_China group and Placebo_China group, respectively, and 9.1% and 8.2% of participants, respectively, reported at least 1 medically attended unsolicited AE (Table 2).

One participant in the RSVPreF3_China group discontinued the study due to an AE (inflammation) and 1 participant in the Placebo_China group discontinued the study due to an SAE (cerebral infarction). None of the events were considered as related to study intervention by the investigator.

Two participants in the RSVPreF3_China group and 2 in the RSVPreF3_Overseas group had fatal SAEs (Table 2). In the RSVPreF3_China group, the SAEs were arteriosclerosis coronary artery disease in one participant and bronchitis in another participant with arteriosclerosis coronary artery disease. In the RSVPreF3_Overseas group, SAEs included pneumonia in a participant with hypertensive heart disease and adenocarcinoma of colon in another participant. None of the events were considered related to the study intervention by the investigator.

At least 1 SAE with onset within 6 months from vaccination was reported in 53/1199 (4.4%) participants in the RSVPreF3_China group, 39/601 (6.5%) in the Placebo_China group, and 27/820 (3.3%) in the RSVPreF3_Overseas group; up to study end, an additional SAE occurred in the RSVPreF3_Overseas group (Table 2). Two SAEs were considered related to study intervention by the investigator in the RSVPreF3_China group: arthralgia in an 82-year-old male and segmental glomerulosclerosis in a 70-year-old female; both recovered/resolved by study end. Two other SAEs in participants in the Placebo_China group (gouty arthritis in a 75-year-old male and asthma in a 62-year-old male) were also considered related to study intervention by the investigator. All SAEs considered related to study intervention had onset within 6 months following vaccination.

pIMDs were reported in 0.2%–0.3% of participants across all groups (Table 2). One pIMD was considered related to the study

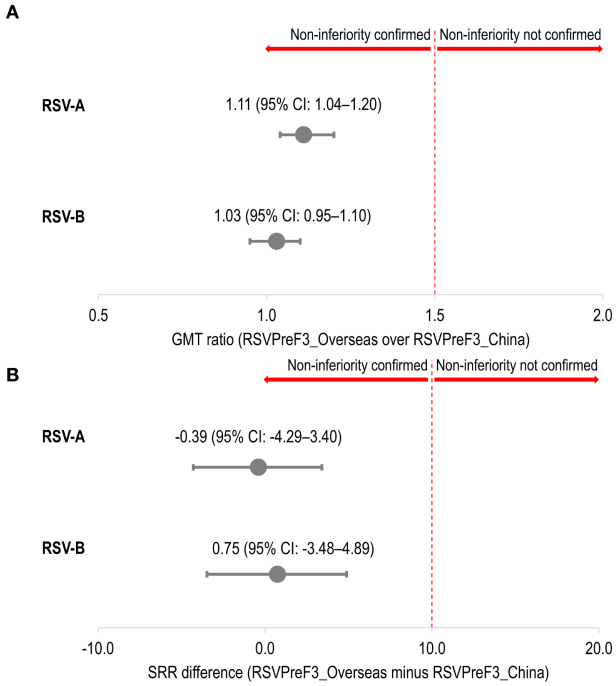


FIGURE 4
Summary of results of non-inferiority objectives for the GMT ratio **(A)** and the SRR difference **(B)** at 1 month post-vaccination (per protocol set). CI, confidence interval; GMT, geometric mean titer; RSV, respiratory syncytial virus; SRR, seroresponse rate. The SRR was defined as the proportion of participants having ≥4-fold increase in neutralizing titers (1 month post-vaccination over pre-vaccination).

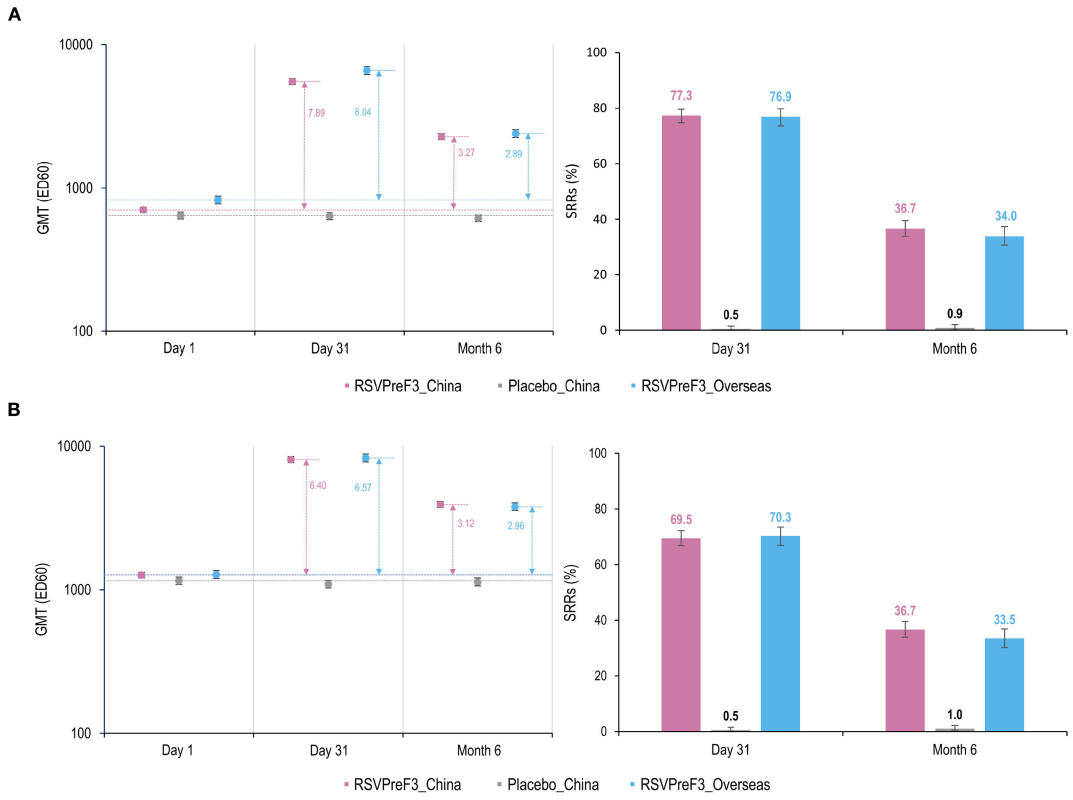


FIGURE 5
Humoral immune responses for RSV-A **(A)** and RSV-B **(B)** in the Chinese and non-Chinese study population (per protocol set). CI, confidence interval; ED60, estimated dilution 60; GMT, geometric mean titer; SRR, seroresponse rate. The SRR was defined as the proportion of participants having ≥4-fold increase in neutralizing titers (1 month post-vaccination over pre-vaccination). In the left panels, values indicate mean geometric increases from pre-vaccination. In the right panels, values show the SRR. Error bars indicate 95% CIs.

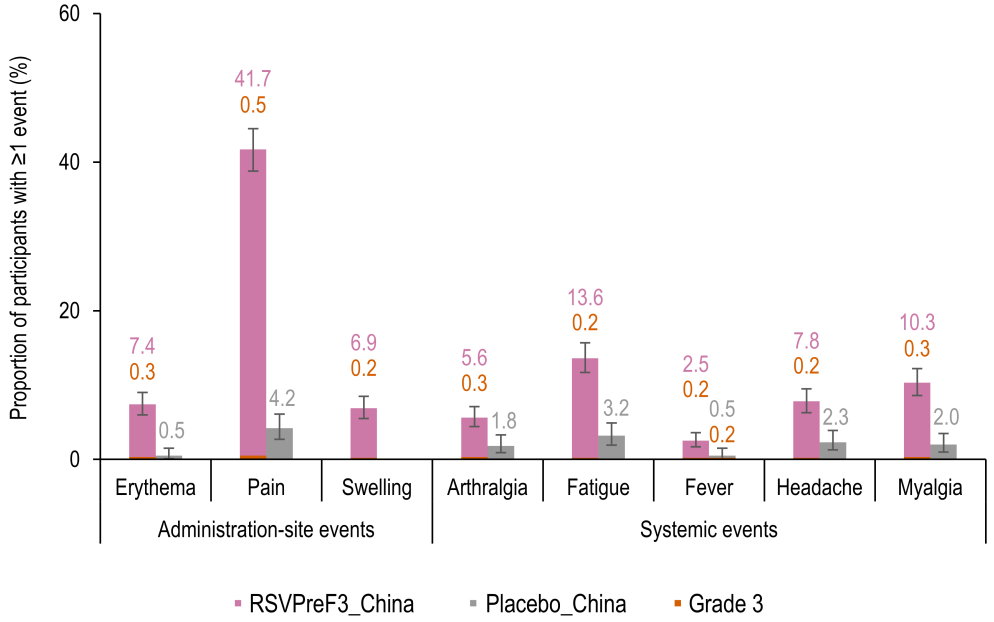


FIGURE 6
Percentages of Chinese participants reporting at least 1 solicited event within 7 days post-vaccination (exposed set). Values above bars show the percentage of participants reporting ≥1 event of any intensity (group color) and of Grade 3 intensity (dark orange color). Fever was defined as an axillary temperature ≥38°C. Grade 3 intensity was defined as diameter >100 mm for erythema and swelling, pain at rest, preventing normal everyday activities for pain, temperature >39°C for fever, and preventing normal everyday activities for all other solicited events. Error bars indicate 95% confidence intervals.

intervention by the investigator, occurring in a participant in the Placebo_China group (gouty arthritis). No events of neurological demyelinating diseases, including Guillain-Barré syndrome and acute disseminated encephalomyelitis, were reported.

Atrial fibrillation was reported as an SAE in 1 participant each in the RSVPreF3_China, Placebo_China, and RSVPreF3_Overseas groups. In addition, 1 participant in the RSVPreF3_China group reported atrial fibrillation as a non-serious unsolicited AE within 30 days from vaccination. None of these events were considered by the investigator as related to the study intervention.

3.4 ARI surveillance

From Day 1 to study end, 173 (14.4%) participants in the RSVPreF3_China group and 76 (12.6%) participants in the Placebo_China group reported at least 1 ARI episode; episodes were

TABLE 2 Safety summary (exposed set).

AE	RSVPreF3_China (N = 1199)		Placebo_China (N = 601)		RSVPreF3_Overseas (N = 820)	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Unsolicited AEs	165	13.8 (11.9–15.8)	71	11.8 (9.3–14.7)		NC
Grade 3	13	1.1 (0.6–1.8)	5	0.8 (0.3–1.9)		NC
Related	34	2.8 (2.0–3.9)	13	2.2 (1.2–3.7)		NC
Grade 3, related to study intervention	1	0.1 (0.0–0.5)	2	0.3 (0.0–1.2)		NC
Medically attended	109	9.1 (7.5–10.9)	49	8.2 (6.1–10.6)		NC
Fatal events	2	0.2 (0.0–0.6)	0	0.0 (0.0–0.6)	2	0.2 (0.0–0.9)
SAEs	53	4.4 (3.3–5.7)	39	6.5 (4.7–8.8)	28	3.4 (2.3–4.9)
Related to study intervention	2	0.2 (0.0–0.6)	2	0.3 (0.0–1.2)	0	0.0 (0.0–0.4)
pIMDs	3	0.3 (0.1–0.7)	1	0.2 (0.0–0.9)	2	0.2 (0.0–0.9)
Related	0	0.0 (0.0–0.3)	1	0.2 (0.0–0.9)	0	0.0 (0.0–0.4)
Atrial fibrillation reported as unsolicited AE	1	0.1 (0.0–0.5)	0	0.0 (0.0–0.6)		NC
Atrial fibrillation reported as SAE	1	0.1 (0.0–0.5)	1	0.2 (0.0–0.9)	1	0.1 (0.0–0.7)

AE, adverse event; CI, confidence interval; n (%), number (percentage) of participants with at least 1 AE; N, total number of participants; NC, not collected; pIMD, potential immune-mediated disease; SAE, serious adverse event.

confirmed as RSV-ARI in only 3 (0.5%) participants, all in the placebo group. At least 1 LRTD episode was reported by 34 (2.8%) participants in the RSVPreF3_China group and 19 (3.2%) participants in the Placebo_China group. Only 1 episode in 1 (0.2%) placebo recipient was confirmed as RSV-LRTD and was not severe.

4 Discussion

In this immunobridging study, a single dose of adjuvanted RSVPreF3 elicited similar humoral immune responses in Chinese adults ≥60 years of age and the global, non-Chinese population enrolled in the same study. Immunogenicity findings were also consistent with those observed in the AReSVi-006 pivotal trial (10), in which vaccine efficacy was demonstrated.

For both RSV-A and RSV-B, a similar longitudinal profile was observed in participants vaccinated with adjuvanted RSVPreF3, with a sharp increase in GMTs at 1 month post-vaccination, followed by a decline at 6 months post-vaccination. These observations are in line with results obtained for adjuvanted RSVPreF3 in other phase 3 clinical trials (12, 19, 20). At 1 month post-vaccination, humoral immune responses in Chinese participants were non-inferior to those observed in the non-Chinese population for both RSV-A and RSV-B, suggesting that ethnic or regional differences do not impact the vaccine's immunogenicity. RSV-A and RSV-B GMTs and SRRs in Chinese participants were comparable to those observed in the population of the AReSVi-006 trial, in which a single vaccine dose showed an efficacy of 82.6% (96.95% CI: 57.9–94.1) (10), 67.2% (97.5% CI: 48.2–80.0) (11), and 62.9% (97.5% CI: 46.7–74.8) (12) against RSV-LRTD over 1, 2, and 3 consecutive RSV seasons, respectively; in the same trial efficacy was also shown against severe RSV-LRTD and RSV-ARI.

Differences in baseline characteristics, including body mass index, frailty status, and smoking status, were observed between the Chinese and non-Chinese populations, reflecting inherent demographic and lifestyle differences across regions. Although these factors may influence immune responses to vaccination (21, 22), available evidence indicates that the immunogenicity of the adjuvanted RSVPreF3 vaccine is consistent across key subgroups, including frailty and age categories (23). These differences are therefore likely to have a limited impact on the comparability of immune responses observed in this study. Furthermore, the study was designed and conducted in alignment with Chinese regulatory guidance for immunobridging clinical trials which focuses on demonstrating comparability of immune responses between populations rather than complete baseline homogeneity. Therefore, the immunogenicity data support the extrapolation of adjuvanted RSVPreF3 efficacy to Chinese adults aged ≥60 years and support use of the vaccine in this population. The efficacy observed in the AReSVi-006 trial was also confirmed by real-world data, with several studies showing vaccine effectiveness of 1 dose of adjuvanted RSVPreF3 against RSV-associated hospitalizations in older adults, maintained over 2 consecutive RSV seasons (8). In addition, a recent study characterized RSV F amino acid variations (that could potentially impact vaccine efficacy) in RSV isolates from the AReSVi-006 trial and in strains circulating worldwide (including in China) and assessed vaccine efficacy against predominant strains in the trial. The results supported a broad efficacy of adjuvanted RSVPreF3 across globally circulating RSV strains (24). Moreover, none of the few RT-PCR-confirmed RSV-ARI and RSV-LRTD episodes observed during the surveillance period occurred in vaccinated participants during the current study.

In Chinese participants, adjuvanted RSVPreF3 was more reactogenic than placebo; however, most events were of mild-to-moderate intensity and were transient. The frequency, severity, and duration of solicited administration-site and systemic events were consistent with the known reactogenicity profile of the vaccine (10, 19, 20, 25). The most frequently reported solicited administration-site and systemic events were pain and fatigue, respectively, similar to observations from the AReSVi-006 trial (10); however, reporting rates tended to be lower in the Chinese population than in the global population of the phase 3 pivotal trial (41.7% versus 60.9% for pain and 13.6% versus 33.6% for fatigue).

The incidence of unsolicited AEs reported by vaccine and placebo recipients in China was similar, consistent with previously reported safety data in the global population (10, 20). The frequency of SAEs and pIMDs reported up to study end was low and similar between the Chinese and non-Chinese participants receiving adjuvanted RSVPreF3. Events of atrial fibrillation were rare. There were no reported events of Guillain-Barré syndrome or acute disseminated encephalomyelitis.

The results of this study supported submission of the vaccine for regulatory review in China for its intended use in adults ≥60 years of age. Vaccine approval would cover an unmet medical need, as no RSV-prevention products are currently available in mainland China for this age group. China's rapidly aging population further heightens the need for effective RSV prevention. The proportion of adults aged ≥60 years is rising steadily, reaching around 20% of the population in 2022, and is projected to reach 28% by 2040 (26, 27). As the population ages, the burden of chronic conditions also rises (27), including those that increase the risk of severe RSV outcomes, such as chronic obstructive pulmonary disease, congestive heart failure, or diabetes (28–30). Taken together, the demographic shift and high prevalence of comorbidities underscore the substantial risk faced by older adults in China and reinforce the need for an RSV vaccine to protect this growing population segment. Interest in RSV vaccination is also high: a recent cross-sectional survey conducted among adults ≥60 years of age attending community health centers from Shenzhen reported that 60.1% of study participants intended to receive the vaccine if fully subsidized (9).

Our study has several limitations. First, the inclusion criteria focused on medically stable adults, which excluded other groups at increased risk of RSV disease (such as immunocompromised individuals) and may limit the generalizability of the findings. Second, the study was not powered to detect very rare AEs, and this limitation should be considered when interpreting safety findings. Finally, the surveillance period and sample size for ARI monitoring were limited, restricting the ability to fully characterize RSV clinical outcomes over time.

5 Conclusions

Adjuvanted RSVPreF3 elicited humoral immune responses to RSV-A and RSV-B that were similar between the Chinese and overseas participants, meeting all co-primary immunobridging criteria and demonstrating non-inferiority in terms of GMT ratios and SRR differences in the Chinese cohort. Although neutralizing antibody titers declined by 6 months post-vaccination, levels remained above baseline. The vaccine was well tolerated when administered as a single dose in Chinese adults aged ≥60 years, with no safety signals observed and a safety profile aligned with existing data. Taken together, these findings support the generalizability of vaccine immunogenicity and safety and the extrapolation of global efficacy to the Chinese older adult population and indicate a favorable overall benefit–risk profile.

Author's note

Arexvy and AS01 are trademarks owned by or licensed to the GSK group of companies. *Abrysvo* is a trademark of Pfizer.

Data availability statement

GSK makes available anonymized individual participant data and associated documents from interventional clinical studies which evaluate medicines, upon approval of proposals submitted to www.clinicalstudydatarequest.com. To access data for other types of GSK sponsored research, for study documents without patient-level data, and for clinical studies not listed, please submit an enquiry via the website.

Ethics statement

The studies involving humans were approved by Clinical Trial Ethics Review Committee, Shanghai Municipal Center for Disease Control and Prevention. Approval No. LC-2024-6. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

XG: Data curation, Writing – review & editing. GN: Conceptualization, Formal analysis, Writing – original draft. DB: Conceptualization, Writing – review & editing. SD: Conceptualization, Formal analysis, Writing – review & editing. MD: Data curation, Writing – review & editing. FH: Data curation, Writing – review & editing. XZ: Formal analysis, Writing – review & editing. FG: Writing – review & editing. HL: Data curation, Writing – review & editing. JZ: Data curation, Writing – review & editing. LJ: Data curation, Writing – review & editing. XW: Data curation, Writing – review & editing. XL: Data curation, Writing – review & editing. LY: Data curation, Writing – review & editing. ND: Writing – review & editing. XS: Data curation, Writing – review & editing. JH: Conceptualization, Writing – original draft.

The RSV-21 study group

Jing Qiu, Juan Li, Yuting Liao, Zhi Li, and Zhuoying Huang (Shanghai Municipal Center for Disease Control and Prevention), Chunhua Lu (Sijing Township Community Health Service Center); Yeli Zhu (Chedun Township Community Health Service Center); Huijuan Jin (Nanxiang Township Community Health Service Center); Xueping Chen (Waigang Township Community Health Service Center); Huiying Du (Shiquan Street Community Health Service Center); Siwei Xia (Ganquan Street Community Health Service Center); Ling Ni (Qibao Community Health Service Center); Yan Lu (Xinzhuang Community Health Service Center); Haiyan Mao (Jiangchuan Community Health Service Center); Ye Sun (Meilong Community Health Service Center); Liqin Xu (Yanghang Township Community Health Service Center); Dongdong Zhou (Datuan Community Health Service Center); Mariaviviana Bennati, Elvira Maria Leon Gomez, Leo Deng, and Dan Lin (GSK).

Funding

The author(s) declared that financial support was received for this work and/or its publication. This study and related publication were sponsored by GSK. The funder was not involved in the study design, collection, analysis, interpretation of data, the writing of this article, or the decision to submit it for publication.

Acknowledgments

The authors would like to thank the study participants, the investigators, and the GSK study staff involved in the study. The authors also thank Akkodis Belgium for medical writing (Petronela M. Petrar), design, and coordination support on behalf of GSK.

Conflict of interest

GN, DB, SD, MD, XZ, FG, ND, and JH are GSK employees. GN, DB, SD, FG, XZ, ND, and JH hold financial equities in GSK. ND declares being a co-applicant on multiple patents filed by GSK.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that generative AI was not used in the creation of this manuscript.

Any alternative text (alt text) provided alongside figures in this article has been generated by Frontiers with the support of artificial intelligence and reasonable efforts have been made to ensure accuracy, including review by the authors wherever possible. If you identify any issues, please contact us.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fimmu.2026.1894773/full#supplementary-material

References

1. Li Y, Wang X, Blau DM, Caballero MT, Feikin DR, Gill CJ, 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) 399:2047–64. doi: 10.1016/s0140-6736(22)00478-0

2. Savic M, Penders Y, Shi T, Branche A, Pirçon JY. Respiratory syncytial virus disease burden in adults aged 60 years and older in high-income countries: A systematic literature review and meta-analysis. *Influenza Other Respir Viruses*. (2023) 17:e13031. doi: 10.1111/irv.13031

3. Shi T, Denouel A, Tietjen AK, Campbell I, Moran E, Li X, et al. Global disease burden estimates of respiratory syncytial virus-associated acute respiratory infection in older adults in 2015: A systematic review and meta-analysis. *J Infect Dis*. (2020) 222: S577–83. doi: 10.1093/infdis/jiz059

4. Shi T, Vennard S, Jasiewicz F, Brogden R, Nair H, RESCEU investigators. Disease burden estimates of respiratory syncytial virus related acute respiratory infections in adults with comorbidity: A systematic review and meta-analysis. *J Infect Dis*. (2022) 226:S17–21. doi: 10.1093/infdis/jiab040

5. Li ZJ, Zhang HY, Ren LL, Lu QB, Ren X, Zhang CH, et al. Etiological and epidemiological features of acute respiratory infections in China. *Nat Commun*. (2021) 12:5026. doi: 10.1038/s41467-021-25120-6

6. Murray A, Chu HY. A promise fulfilled: Updates on respiratory syncytial virus vaccines and monoclonal antibodies. *J Allergy Clin Immunol*. (2026) 157:38–44. doi: 10.1016/j.jaci.2025.10.023

7. Surie D, Self WH, Zhu Y, Yuengling KA, Johnson CA, Grijalva CG, et al. RSV vaccine effectiveness against hospitalization among US adults 60 years and older. *JAMA*. (2024) 332:1105–7. doi: 10.1001/jama.2024.15775

8. Surie D, Self WH, Yuengling KA, Lauring AS, Zhu Y, Safdar B, et al. RSV vaccine effectiveness against hospitalization among US adults aged 60 years or older during 2 seasons. *JAMA*. (2025) 334:1442–51. doi: 10.1001/jama.2025.15896

9. Liu L, Cao H, Ou Z, Peng W, Chen H, Fang Y, et al. Associations of altruistic factors and perceptions with intention to receive respiratory syncytial virus (RSV) vaccination among older adults in China. *Hum Vaccin Immunother*. (2025) 21:2567705. doi: 10.1080/21645515.2025.2567705

10. Papi A, Ison MG, Langley JM, Lee DG, Leroux-Roels I, Martinon-Torres F, et al. Respiratory syncytial virus prefusion F protein vaccine in older adults. *N Engl J Med*. (2023) 388:595–608. doi: 10.1056/NEJMoa2209604

11. Ison MG, Papi A, Athan E, Feldman RG, Langley JM, Lee DG, et al. Efficacy and safety of respiratory syncytial virus (RSV) prefusion F protein vaccine (RSVPreF3 OA) in older adults over 2 RSV seasons. *Clin Infect Dis*. (2024) 78:1732–44. doi: 10.1093/cid/ciae010

12. Ison MG, Papi A, Athan E, Feldman RG, Langley JM, Lee DG, et al. Efficacy, safety, and immunogenicity of the $AS01_E$-adjuvanted respiratory syncytial virus prefusion F protein vaccine (RSVPreF3 OA) in older adults over three respiratory syncytial virus seasons (AReSVi-006): a multicentre, randomised, observer-blinded, placebo-controlled, phase 3 trial. *Lancet Respir Med*. (2025) 13:517–29. doi: 10.1016/S2213-2600(25)00048-7

13. McDonald JU, Rigsby P, Atkinson E, Engelhardt OG. Expansion of the 1st WHO international standard for antiserum to respiratory syncytial virus to include neutralisation titres against RSV subtype B: An international collaborative study. *Vaccine*. (2020) 38:800–7. doi: 10.1016/j.vaccine.2019.10.095

14. McDonald JU, Rigsby P, Dougall T, Engelhardt OG. Establishment of the first WHO International Standard for antiserum to respiratory syncytial virus: Report of an international collaborative study. *Vaccine*. (2018) 36:7641–9. doi: 10.1016/j.vaccine.2018.10.087

15. European Medicine Agency and Committee for Medicinal Products for Human Use. Assessment Report. Arexvy (2025). Available online at: https://www.ema.europa.eu/en/documents/variation-report/arexvy-vr-0000276225-epar-assessment-report-variation_en.pdf (Accessed June 29, 2026).

16. National Medical Products Administration. Guidelines for Grading Criteria of Adverse Events in Clinical Trials of Preventive Vaccines (2019). Available online at: http://english.nmpa.gov.cn/2019-12/31/c_448385.htm (Accessed March 26, 2026).

17. Miettinen O, Nurminen M. Comparative analysis of two rates. *Stat Med*. (1985) 4:213–26. doi: 10.1002/sim.4780040211

18. Clopper CJ, Pearson ES. The use of confidence or fiducial limits illustrated in the case of the binomial. *Biometrika*. (1934) 26:404–13. doi: 10.2307/2331986

19. Ferguson M, Schwarz TF, Núñez SA, Rodríguez-García J, Mital M, Zala C, et al. Noninferior immunogenicity and consistent safety of respiratory syncytial virus prefusion F protein vaccine in adults 50–59 years compared to ≥60 years of age. *Clin Infect Dis*. (2024) 79:1074–84. doi: 10.1093/cid/ciae364

20. Schwarz TF, Hwang SJ, Ylisastigui P, Liu CS, Takazawa K, Yono M, et al. Immunogenicity and safety following 1 dose of AS01E-adjuvanted respiratory syncytial virus prefusion F protein vaccine in older adults: A phase 3 trial. *J Infect Dis*. (2024) 230: e102–10. doi: 10.1093/infdis/jiad546

21. Zimmermann P, Curtis N. Factors that influence the immune response to vaccination. *Clin Microbiol Rev*. (2019) 32:e00084–00018. doi: 10.1128/cmr.00084-18

22. Semelka CT, DeWitt ME, Blevins MW, Holbrook BC, Sanders JW, Alexander-Miller MA. Frailty impacts immune responses to Moderna COVID-19 mRNA vaccine in older adults. *Immun Ageing*. (2023) 20:4. doi: 10.1186/s12979-023-00327-x

23. Leroux-Roels I, Feldman RG, Antonelli-Incalzi R, Lee DG, Papi A, Ison MG, et al. Robust and consistent immune response of the adjuvanted respiratory syncytial virus (RSV) prefusion F protein vaccine (RSVPreF3 OA) across different age ranges and frailty status in older adults. *Open Forum Infect Dis*. (2025) 12:ofae631.077. doi: 10.1093/ofid/ofae631.077

24. De Smedt J, Gruselle O, Sacconnay L, Baup D, Lambert C, Xavier S, et al. Estimated efficacy of the adjuvanted RSVPreF3 vaccine against diverse and worldwide predominant RSV strains, irrespective of RSV F protein variation: Results of a post-hoc analysis from the AReSVi-006 trial. *eBioMedicine*. (2026) 128:106296. doi: 10.1016/j.ebiom.2026.106296

25. Chandler R, Montenegro N, Llorach C, Aguirre LN, Germain S, Kuriyakose SO, et al. Immunogenicity, reactogenicity, and safety of AS01E-adjuvanted RSV prefusion F protein-based candidate vaccine (RSVPreF3 OA) when co-administered with a seasonal quadrivalent influenza vaccine in older adults: Results of a phase 3, open-label, randomized controlled trial. *Clin Infect Dis*. (2024) 83:e62-70. doi: 10.1093/cid/ciad786

26. Peng D. Negative population growth and population ageing in China. *China Popul Dev Stud*. (2023) 7:95–103. doi: 10.1007/s42379-023-00138-z

27. World Health Organization. Ageing and Health in China (2026). Available online at: https://www.who.int/china/health-topics/ageing (Accessed March 27, 2026).

28. Njue A, Nuabor W, Lyall M, Margulis A, Mauskopf J, Curcio D, et al. Systematic literature review of risk factors for poor outcomes among adults with respiratory syncytial virus infection in high-income countries. *Open Forum Infect Dis*. (2023) 10: ofad513. doi: 10.1093/ofid/ofad513

29. Penders Y, Brusselle G, Falsey AR, Rohde G, Betancur E, Guardado ME, et al. Burden of respiratory syncytial virus disease in adults with asthma and chronic obstructive pulmonary disease: A systematic literature review. *Curr Allergy Asthma Rep*. (2025) 25:14. doi: 10.1007/s11882-025-01194-w

30. Penders Y, Falsey AR, Bhatt DL, Böhm M, Coats AJS, Mason LMK, et al. Burden and severity of respiratory syncytial virus infection in adults with cardiovascular diseases: A systematic literature review. *Prog Cardiovasc Dis*. (2025) 92:130–43. doi: 10.1016/j.pcad.2025.06.010