nature portfolio

Corresponding author(s): NCOMMS-26-020161

Last updated by author(s): Mar 17, 2026

Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our Editorial Policies and the Editorial Policy Checklist.

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed	
☐	☒	The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒	A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☐	☒	The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☒	☐	A description of all covariates tested
☒	☐	A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒	A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☐	☒	For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐	For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐	For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐	Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	Clinflash EDC (Tigermed, China)
Data analysis	All statistical analyses were performed using SAS software, version 9.4 (SAS Institute)

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio guidelines for submitting code & software for further information.

Data

Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our policy

All data supporting the finding of this study are available in the supplementary appendix. Researchers who provide a scientifically sound proposal are allowed access to the de-identified individual participant data. Individual participant data can be obtained with a request to the corresponding authors.

Research involving human participants, their data, or biological material

Policy information about studies with human participants or human data. See also policy information about sex, gender (identity/presentation), and sexual orientation and race, ethnicity and racism.

Reporting on sex and gender	Our study was designed to include participants of both sexes, which were determined based on their identify cards. Disaggregated sex data was collected at enrollment, and consent has been obtained for sharing of individual-level data before enrollment. We collected information on the sex of each participant, and 15387 (59.1%) of 26018 participants were female.
Reporting on race, ethnicity, or other socially relevant groupings	The ethnicity of each participant was determined and collected in this study through each participant's identity cards. Since the percentage of Han Chinese participants was 99.2%, ethnicity was not corrected in the analysis.
Population characteristics	In the safety population,the mean age was approximately 57.0 years in both groups, with 6002 (23.1%) participants aged 40-49 years, with 9012 (34.6%) participants aged 50-59 years, 9001 (34.6%) participants aged 60-69 years and 2004 (7.7%) participants aged 70 years and older. 15387 (59.1%) of 26018 participants were female, and 25817 (99.2%) of 26018 participants identified as Han Chinese. In the per-protocol efficacy population,the mean age was approximately 57.0 years in both groups, with 5882 (23.2%) participants aged 40-49 years, with 8789 (34.6%) participants aged 50-59 years, 8789 (34.8%) participants aged 60-69 years and 1950 (7.7%) participants aged 70 years and older. 14991 (59.0%) of 25387 participants were female, and 25187 (99.2%) of 25387 participants identified as Han Chinese. In the per-protocol immunogenicity population,the mean age was approximately 57.3 years in both groups, with 706 (24.0%) participants aged 40-49 years, with 977 (33.3%) participants aged 50-59 years, 978 (33.3%) participants aged 60-69 years and 276 (9.4%) participants aged 70 years and older. 1641 (55.9%) of 2937 participants were female, and 2935 (99.9%) of 2937 participants identified as Han Chinese.
Recruitment	Recruitment notices were issued to volunteers who met the enrollment criteria. The informed consent was explained to the volunteers in detail. Under the condition of voluntary participation, the volunteers and the study doctors sign the informed consent. Participants who are normal in physical examination and screened qualified as per other inclusion/exclusion criteria will be enrolled and given Research Number based on enrollment order. There were not any bias that might impact the results.
Ethics oversight	The protocol and informed consent were approved by the institutional review board of the Jiangsu Provincial Center of Disease Control and Prevention.

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☒ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	The sample size was calculated based on the assumption of 65% vaccine efficacy against herpes zoster, with an expected incidence of 8 cases per 1,000 person-years in the placebo group27. We assumed a 15% dropout rate over the 12-month surveillance period. A total of 13,000 participants per group provided 95% power to demonstrate vaccine efficacy with a lower bound of the 95% confidence interval exceeding 25%, at a one-sided alpha level of 0.025, and allows for accrual of at least 103 confirmed herpes zoster cases, as required by the case-driven study design. Sample size estimation was performed using PASS software (version 13).
Data exclusions	A total of 29439 participants underwent eligibility screening. Among them, 3400 were excluded due to failure to meet inclusion criteria. Of the 26039 participants successfully enrolled, 21 withdrew prior to receiving the first vaccine dose; 441 withdrew before the second vaccine dose; and 190 withdrew after the second dose.
Replication	No replication had been performed in this study due to the study design (a multicentre, randomised, double-blind, placebo-controlled, phase 3 trial). We have the protocol with the manuscript to ensure the reproducibility of this study. All experiments were performed using validated assays.
Randomization	Participants were stratified according to sites and age (40~49, 50~59, 60 ~69, and ≥70 years) before randomization. And then, participants were randomly assigned in a 1:1 ratio to receive either two-dose of LZ901 vaccine or placebo using an online centralized randomization system. Randomization lists were generated by an independent statistician using SAS (version 9.4).
Blinding	The packaging and appearance of vaccine and placebo were identical, with the randomization code labeled as the only identifier. The investigators, participants, and those who were responsible for the evaluation of any study end point were masked to the group assignment.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☒	☐ Animals and other organisms
☐	☒ Clinical data
☒	☐ Dual use research of concern
☒	☐ Plants

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Clinical data

Policy information about clinical studies

All manuscripts should comply with the ICMJE guidelines for publication of clinical research and a completed CONSORT checklist must be included with all submissions.

Clinical trial registration	This study has already completed the trial registration at Chinese Clinical Trial Registry, ChiCTR (ChiCTR2300076253).
Study protocol	The study protocol is available in the Supplementary Information file.
Data collection	In the safety subgroup, all participants were monitored for any immediate adverse reactions following vaccination, and paper diary cards were provided to record any solicited adverse events occurring within 7 days after each vaccination. Unsolicited adverse events within 30 days after each vaccination, as well as all serious adverse events throughout the study period until 12 months after the second vaccination, were documented. Immunogenicity subgroup involving 3000 participants were recruited from Guanyun site, Jiangsu Province. Participants in the immunogenicity subgroup donated blood samples for immunogenicity measurements at baseline before the first dose, and 30 days, 12 months after the second dose. Serum anti-gE antibody concentrations were measured by China National Institutes for Food and Drug Control (NIFDC) with an in-house enzyme-linked immunosorbent assay (ELISA) (recombinant VZV gE was supplied by Beijing Luzhu Biotechnology Co., Ltd., Beijing, China).From 30 days after full vaccination until 1 year post-vaccination, investigators shall follow up with subjects monthly (either through on-site visits or online visits) to collect and record suspected herpes zoster cases and subjects survival status. In the per-protocol efficacy population, from 30 days after completion of the full-course vaccination to 1 year after vaccination, investigators shall conduct monthly follow-up of participants (via on-site visits or online visits) to collect and document suspected herpes zoster cases and the survival status of participants.
Outcomes	The primary objective of the study was to evaluate the efficacy of the LZ901 vaccine in reducing the risk of herpes zoster, as compare with placebo. The primary endpoint was herpes zoster occurring ≥30 days after the second dose, including laboratory-confirmed cases and clinically confirmed cases in whom laboratory results were unavailable or inconclusive. The secondary efficacy end point was the laboratory-confirmed herpes zoster cases occurring at least 30 days after the second dose. Safety endpoints include the incidence of participants with solicited injection-site or systemic reactions, unsolicited adverse events, and serious adverse events (SAEs). Immunological secondary end points were geometric mean concentrations (GMCs) and geometric mean fold increase (GMFI) at day 30 and month 12 after the second dose. Seropositivity of gE-specific IgG antibodies in serum is defined as concentration ≥100 milli-International Units (mIU)/mL.

Plants

Seed stocks	*Report on the source of all seed stocks or other plant material used. If applicable, state the seed stock centre and catalogue number. If plant specimens were collected from the field, describe the collection location, date and sampling procedures.*
Novel plant genotypes	*Describe the methods by which all novel plant genotypes were produced. This includes those generated by transgenic approaches, gene editing, chemical/radiation-based mutagenesis and hybridization. For transgenic lines, describe the transformation method, the number of independent lines analyzed and the generation upon which experiments were performed. For gene-edited lines, describe the editor used, the endogenous sequence targeted for editing, the targeting guide RNA sequence (if applicable) and how the editor was applied.*
Authentication	*Describe any authentication procedures for each seed stock used or novel genotype generated. Describe any experiments used to assess the effect of a mutation and, where applicable, how potential secondary effects (e.g. second site T-DNA insertions, mosiacism, off-target gene editing) were examined.*