nature portfolio

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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	No software was used for the data collection process.
Data analysis	The statistical power for the primary outcome was determined using a Score test implemented in PASS 2008. The modified Poisson regression analysis and the generalized estimating equation linear model were conducted using Proc GENMOD in SAS 9.4.

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

Since patients have not explicitly consented to data sharing, we are not allowed to post individual participant data in a public data repository for legal reasons. However, researchers with a valuable research question can request study data from the corresponding authors: Prof. Sun at yxsun@cmu.edu.cn or Prof. He at jiang.he@utsouthwestern.edu. If the proposal is approved by the CRHCP Study Steering Committee, de-identified individual data may be shared after consultation

with the data protection officers and legal representatives of the participating institutions and after signing a data-sharing agreement. All data sharing will abide by the rules and policies defined by the sponsor, relevant ethics committees, and government laws and regulations. A response to requests for data access can be expected within 4 weeks.

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	Subgroup analysis by sex is presented in Figure 3.
Reporting on race, ethnicity, or other socially relevant groupings	All study participants are Chinese ethnicity.
Population characteristics	On average, study participants were 62.8 years old in the intervention group and 63.3 years old in the usual care group. In the intervention group, 60.8% of participants were female, compared to 61.6% in the usual care group.
Recruitment	From May 8, 2018, to November 28, 2018, a total of 46,740 individuals were assessed for eligibility from 326 villages in rural China. Of these, 33,995 participants (17,407 in 163 intervention villages and 16,588 in 163 usual care villages) were enrolled. Of these participants, 15,972 (91.8%) in the intervention group and 15,072 (90.9%) in the usual care group were followed up for clinical outcomes at the 48-month visit, which concluded on March 26, 2023.
Ethics oversight	The trial protocol was approved by the ethics committees of the First Hospital of China Medical University and all participating institutes and by an independent data and safety monitoring board. Informed consent was obtained from all participants.

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	We calculated statistical power based on the following assumptions: 163 clusters in each group, an average of 104 participants per cluster, a 5.0% cumulative proportion of dementia at 48 months, a 15% risk reduction, an average follow-up duration of four years, a lost-to-follow-up rate of 1.6% per year, an intra-cluster correlation of 0.001, and a two-sided significance level of 0.05. The dementia prevalence was informed by previous studies in the Chinese population, and the effect size was derived from a meta-analysis of four prior trials. The statistical power for the primary outcome was determined to be 85.8%, based on a Score test implemented with PASS software.
Data exclusions	No data were excluded.
Replication	Since this study is a large cluster-randomized trial, replication is not necessary.
Randomization	The randomization was conducted by a biostatistician using a random allocation sequence generated with SAS software and was stratified by province, county, and township to ensure group balance in geographic and socioeconomic conditions. The randomization assignments were concealed until recruitment and baseline data collection were completed for all participating villages within each township.
Blinding	Due to the cluster design and the nature of the intervention program, the study participants, NPCHPs, and research staff who collected BP data were unmasked. However, all research staff responsible for collecting cognitive outcome data and the members of the endpoint adjudication committee were masked to the randomization assignments.

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	ClinicalTrials.gov: NCT03527719
Study protocol	The full trial protocol is available upon request.
Data collection	From May 8, 2018, to November 28, 2018, a total of 33,995 participants (17,407 in 163 intervention villages and 16,588 in 163 usual care villages) were enrolled from rural China. Of these participants, 15,972 (91.8%) in the intervention group and 15,072 (90.9%) in the usual care group were followed up for clinical outcomes at the 48-month visit, which concluded on March 26, 2023.
Outcomes	All-cause dementia was the primary outcome, and cognitive impairment no dementia (CIND) was the main secondary outcome. These outcomes were pre-defined before follow-up data collection. At the 48-month follow-up visit, trained and certified neurologists, who were masked to randomization assignments, collected medical history data and conducted neurological assessments, including a mental status evaluation. The final diagnosis of all-cause dementia or CIND was determined by an expert adjudication panel that was blinded to the intervention assignment.

Plants

Seed stocks	N/A
Novel plant genotypes	N/A
Authentication	N/A