Population-level health and economic impacts of introducing Vaccae vaccination in China: A modeling study

Supplementary Appendix

1. Summary in Chinese 1
2. Brief introduction on the efficacy trail of Vaccae 2
Table S1. Study design of the efficacy trial. 2
Table S2. Vaccine efficacy of Vaccae as compared with placebo against pulmonary TB in adolescents and adults with evidence of tuberculosis infection. 3
3. Model structure 4
Table S3. Model parameters. 4
Table S4. Estimated crude birth rates in China during 1900-2050 8
Table S5. Estimated central death rates in China during 1900-2050 9
Figure S1. Daily number of respiratory contacts by age group in China 14
Table S6. Case detection rate (CDR) and treatment success rate (TSR) for tuberculosis in China. 15
4. Model calibration and status quo projection 16
Table S7. Procedure for model calibration 16
Table S8. Demographic calibration targets. 17
Figure S2. Model calibration and status quo projection of the population in China 18
Table S9. Epidemiological calibration targets 19
Figure S3. Model calibration and status quo projection of microbiologically-positive tuberculosis (TB) prevalence in China 20
Figure S4. Model calibration and status quo projection of TB incidence in China. 21
Figure S5. Model calibration and status quo projection of TB-related mortality in China 22
Figure S6. Status quo projection of latent tuberculosis infection (LTBI) prevalence in China 23
Figure S7. Estimated national population size and incident TB cases by age in China. 24
5. Vaccination strategies and epidemiological outcomes 25
Table S10. Health outcomes for routine vaccination targeting different ages, with PSI efficacy, conferring lifelong protection. 25
Table S11. Predicted incidence rate and mortality rate reduction in 2050 for government-funded national Vaccae vaccination in China 26
Table S12. Predicted number needed to vaccinate (NNV) per case or death averted in China during 2024-2050 27
6. Costs and cost-effectiveness analyses 28
Table S13. Unit cost parameters 28
Table S14. Estimated Chinese life expectancy during 2024-50 29
Table S15. Cost-effectiveness for routine vaccination targeting different ages, with PSI vaccine conferring lifelong protection, from healthcare sector perspective 31
Table S16. Cost-effectiveness for routine vaccination targeting different ages, with PSI vaccine conferring lifelong protection, from societal perspective 32
Table S17. Predicted cost per case averted (CCA) and cost per death averted (CDA) for government-funded national Vaccae vaccination in China during 2024-50. 33

Table S18. Cost-effectiveness for government-funded national Vaccae vaccination in China during 2024-50, from societal perspective....34
Figure S8. One-way sensitivity analyses compared with status quo, from healthcare sector perspective....35
Figure S9. Cost-effectiveness analyses of Vaccae vaccination in China, from societal perspective....36
Figure S10. One-way sensitivity analyses compared with status quo, from societal perspective....37
Figure S11. Cost-effectiveness analyses of Vaccae vaccination in China, from healthcare sector perspective (WTP=US$7849)....38
Figure S12. Cost-effectiveness analyses of Vaccae vaccination in China, from societal perspective (WTP=US$7849)....39
Table S19. Cost-effectiveness for vaccination with Vaccae provided through private market during 2024-50, from healthcare sector perspective.....40
Table S20. Cost-effectiveness for vaccination with Vaccae provided through private market during 2024-50, from societal perspective....41
Table S21. Cost-effectiveness for government-funded national Vaccae vaccination in China during 2024-2100, from healthcare sector perspective....42
Table S22. Cost-effectiveness for government-funded national Vaccae vaccination in China during 2024-2100, from societal perspective.....43
Table S23. Cost-effectiveness for government-funded national Vaccae vaccination in China during 2024-50, from healthcare sector perspective (WTP=US$7849)....44
Table S24. Cost-effectiveness for government-funded national Vaccae vaccination in China during 2024-50, from societal perspective (WTP=US$7849)....45
Table S25. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with PSI vaccine conferring 10-y protection, from healthcare sector perspective....46
Table S26. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with PSI vaccine conferring lifelong protection, from healthcare sector perspective....47
Table S27. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with PSI vaccine conferring 10-y protection, from societal perspective....48
Table S28. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with PSI vaccine conferring 20-y protection, from societal perspective....49
Table S29. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with PSI vaccine conferring lifelong protection, from societal perspective....50
Table S30. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring 10-y protection, from healthcare sector perspective....51
Table S31. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring 20-y protection, from healthcare sector perspective....52
Table S32. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring lifelong protection, from healthcare sector perspective....53
Table S33. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring 10-y protection, from societal perspective....54

Table S34. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring 20-y protection, from societal perspective 55
Table S35. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring lifelong protection, from societal perspective 56
Table S36. Budget impact of Vaccae all-age vaccination program in China during 2024-50, from healthcare sector perspective 57
Table S37. Budget impact of Vaccae all-age vaccination program in China during 2024-50, from societal perspective. 58
7. Extended references 59

1. Summary in Chinese

Population-level health and economic impacts of introducing Vaccae vaccination in China: A modeling study

中国新型结核疫苗接种策略的健康及经济影响：一项模型研究

摘要

背景

在中国人口老龄化的结核病流行背景下，全球首个获批临床适应症的新型结核疫苗“微卡”在III期临床试验中显示对预防潜伏性结核感染者发生结核疾病的有效率为 54.7%，为我国终结结核流行目标带来前所未有的机遇。本研究旨在评估微卡疫苗纳入政府资助的疫苗接种计划对人群健康及经济影响，为卫生决策者提供循证依据。

方法

我们假设从 2024 年开始实施由政府资助的微卡疫苗接种计划，疫苗保护期为 20 年，覆盖率为 90%，政府集中采购价格为 30 美元/剂。构建人口年龄结构仓室模型模拟不同策略情景：（1）不接种疫苗；（2）在 15-74 岁成人中开展大规模全人群疫苗接种；（3）对 60 岁老年人进行目标人群疫苗接种。评估疫苗接种计划对降低结核病发病、死亡和患者经济负担的影响，从医疗卫生体系角度进行成本分析，贴现率为 3%。

结果

在疫苗感染后预防（PSI）效果下，老年人目标接种策略可减少约 20%的结核病负担，在 2024-2050 年期间将累计减少 801（95%CI：582-1180）万结核病例和避免 20（17-26）万例死亡，每避免一个伤残调整生命年（DALY）所需成本为 4387（2218-10085）美元。目标人群接种策略需投入总预算约 225（176-434）亿美元。相比之下，全人群疫苗接种对控制结核病流行的效果更大，但其成本也更高（与目标人群接种策略相比，增量成本效果比[ICER]>1 倍人均 GDP）。此外，假设疫苗具有感染前和感染后预防（P&PI）理想效果，虽可产生最大的流行病学效果（如 2050 年结核发病率降低＞40%），但疫苗价格须严格控制不超过 5 美元/剂。

结论

微卡疫苗可为中国结核病防控提供稳健且具经济效益的选择，本研究有助于推动新型结核疫苗接种策略的制定与实施决策。

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2. Brief introduction on the efficacy trail of Vaccae

Table S1. Study design of the efficacy trial.

Item	Description
Official title	Phase III clinical study of efficacy and safety of mycobacterium Vaccae to prevent tuberculosis in high risk groups of tuberculosis infection
ClinicalTrials.gov identifier	NCT01979900
Study type	Interventional (clinical trial)
Actual enrollment	10,000 participants
Allocation	Randomized
Intervention model	Parallel assignment Vaccae group: 6 doses of Vaccae administered intramuscularly in the deltoid region of the arm Control group: 6 doses of placebo administered intramuscularly in the deltoid region of the arm
Masking	Double (participant, investigator)
Primary purpose	Prevention
Study start date	Oct, 2013
Actual study completion date	Nov 26, 2017
Main inclusion criteria	Aged from 15 to 65 years older, all genders. Skin test of tuberculin pure protein derivative (TB-PPD) is strongly positive (the average diameter of PPD skin test induration is greater than or equal to 15mm, and/or local blisters, necrosis).
Primary outcome	The whole TB incidence
Time frame	Terminal stage is two years after the last group of subjects enrolled

Source: Adapted from the online study record in ClinicalTrial.gov website.
https://clinicaltrials.gov/ct2/show/NCT01979900

Table S2. Vaccine efficacy of Vaccae as compared with placebo against pulmonary TB in adolescents and adults with evidence of tuberculosis infection.

Case definition	Vaccae			Placebo			Vaccine efficacy (% [95% CI])
	No. of incident cases	Person-yr of follow-up	Rate per 100 person-yr (95% CI)	No. of incident cases	Person-yr of follow-up	Rate per 100 person-yr (95% CI)	
Definite pulmonary TB disease	29	8846.3	0.328 (0.228, 0.472)	64	8838.2	0.724 (0.567, 0.925)	54.7 (29.8, 70.8)
Microbiological pulmonary TB disease	8	8858.3	0.090 (0.045, 0.181)	16	8872.2	0.180 (0.110, 0.294)	49.9 (-17.0, 78.6)
Smear or culture-positive pulmonary TB disease	7	8858.3	0.079 (0.038, 0.166)	8	8878.5	0.090 (0.045, 0.180)	12.3 (-141.8, 68.2)
Definite Xpert MTB/Rif positive pulmonary TB disease	1	8863.2	0.011 (0.002, 0.080)	8	8879.8	0.090 (0.045, 0.180)	87.5 (-0.1, 98.4)
Clinical TB disease	21	8851.7	0.237 (0.155, 0.364)	48	8852.1	0.542 (0.409, 0.720)	56.2 (26.9, 73.8)

TB, tuberculosis; Xpert MTB/RIF, nucleic acid amplification test to detect *M.tb* complex and resistance to rifampicin in sputum samples.

Source: Adapted from the online Package Insert of Mycobacterium Vaccae for Injection.[1]

3. Model structure

Table S3. Model parameters.

Parameter	Description	Value, prior range or fixed	Reference	Posterior range observed in 100 fits
Birth and background death				
B[k]	Number of births in year *k* UN estimates of total crude birth rate per 1000 population applied to modeled population，and tracks annual UN data from 1979 onwards.	See Table S4	UN Population Estimates (2022)[2]	NA
μ[j]	Background (all-cause) death risk at age *j*	See Table S5	UN Population Estimates (2022)[2]	NA
Transmission				
λ[i,j]	*M.tb* transmission risk (force of infection) in time step *i* for age *j* $\lambda[i,j] = q \sum_{y=1}^{nygroups} \eta[m,y] z \frac{I[i,y]}{N[i,y]}$ Calibrated by *q* to match TB incidence.			NA
q	Calibration factor for *λ*	1～5	Harris RC (2019)[3]	1.0～3.8
η[m,y]	Daily number of respiratory contacts by participants (infection source) age group *m* and contacts (infection targets) in age group *y.*	See Figure S1	Read JM (2014)[4] Leung K (2017)[5] Zhang J (2019)[6] Prem K (2021)[7]	NA
z	Infectivity (transmission probability) per respiratory contact.	0.1	Dye C (2008)[8] Abu-Raddad LJ (2009)[9] Knight GM (2014)[10]	NA
Active TB				
p[j]	Proportion of (re-)infected individuals, originally uninfected, latently infected or recovered, directly progress to active TB disease, at age *j*	*p[j < 15]* = 0.01～0.06 *p[j≥15, <65]* = 0.08～0.2	Ferebee SH (1970)[11] Comstock GW (1982)[12]	*p[j<15]*: 0.01～0.06 *p[j⩾15, <65]*: 0.08～0.2

		p[j≥65] = 0.14～0.36	Vynnycky E (1996)[13] Vynnycky E (1997)[14] Dye C (1998) [15] Dye C (2008)[8] Abu-Raddad LJ (2009)[9] Knight GM (2014)[10]	*p[j ⩾65]*: 0.14～0.36
x	Risk of re-infection or active disease from latent infection or recovered individuals, relative to uninfected (1-*x*) is the protection provided by previous infection.	0.25～0.45	Sutherland I (1982)[16] Vynnycky E (1996)[13] Vynnycky E (1997)[14] Abu-Raddad LJ (2009)[9] Gomes MGM (2007)[17] Dye C (2008)[8]	0.25～0.45
v[j]	Risk of reactivation from latently infected individuals at age *j*	*v[j<15]*: 0.0001～0.0003 *v[j≥15, j<55]*: 0.0001～0.0003 *v[j≥55, j<65]*: *(v [j≥15, j<55] + v [j≥65])/2* *v[j≥65]*: 0.0200 (0.0002, 0.04)	Sutherland I (1982)[16] Schulzer M (1992)[18] Dye C (1998)[15] Gomes MGM (2007)[17] Schaaf HS (2010)[19] Shea KM (2014)[20]	*v[j<15]*: 0.0001～0.0003 *v[j≥15, j<55]*: 0.0001～0.0003 *v[j≥55, j<65]*: 0.00016～0.004 *v[j≥65]*: 0.0002～0.0078
Infectious TB				
f[j]	Proportion of new active TB cases being infectious at age *j*	*f[j<15]*: 0.01～0.15 *f[j≥15, <65]*: 0.5～0.75 *f[j≥65]*: 0.5～0.75	Yoshikawa TT (1992)[21] Rajagopalan S (2000)[22] Dye C (2008)[8] Abu-Raddad LJ (2009)[9] Marion CR (2009)[23] Schaaf HS (2010)[19]	*f[j<15]*: 0.01～0.15 *f[j≥15, <65]*: 0.5～0.75 *f[j≥65]*: 0.5～0.75
ω	Conversion risk from non-infectious to infectious active disease	0.007～0.02	Ferebee SH (1970)[11] Dye C (1998)[15]	0.007～0.02
TB Mortality				
μ_i	Death risk for untreated or treatment-failed infectious TB cases	0.7	Tiemersma EW (2011)[24]	NA

μ_{ni}	Death risk for untreated or treatment-failed non-infectious TB cases	0.24	Tiemersma EW (2011)[24]	NA
μiscale	Calibration factor for μ_i and μ_{ni} $\mu_i = (1 + uiscale) * \mu_i$ $\mu_{ni} = (1 + uiscale) * \mu_{ni}$	*μiscale[j<15]*: -0.99～-0.01 *μiscale[j≥15, <65]*: -0.99～-0.01 *μiscale[j≥65]*: -0.99～-0.01	Schaaf HS (2010)[19]	*μiscale[j<15]:* -0.98～-0.64 *μiscale[j≥15, <65]:* -0.98～-0.97 *μiscale[j≥65]:* -0.95～-0.93
Spontaneous recovery and relapse				
n	Annual spontaneous recovery rate from active TB disease	*n[j<55]*: 0.085～0.115 *n[j≥55, <65]*: (*n[j<55]* + *n[j ≥ 65]*)/2 *n[j≥65]*: 0.085～0.115	Dye C (1998)[15] Abu-Raddad LJ (2009)[9]	*n[j<55]:* 0.085～0.11 *n[j≥55, <65]:* 0.086～0.11 *n[j≥65]:* 0.085～0.11
r	Annual risk of relapse from recovered to active TB	*r[j<15]* : 0.005～0.015 *r[j≥15, <55]* : 0.005～0.015 *r[j≥55, <65]* : (*r[j<55]* + *r[j≥65]*)/2 *r[j≥65]* : 0.005-0.2	Gomes MG (2004)[25] Schaaf HS (2010)[19] Knight GM (2014)[10]	*r[j<15]* : 0.005～0.015 *r[j≥15, <55]:* 0.005～0.015 *r[j≥55, <65]:* 0.0074～0.038 *r[j≥65]:* 0.005-0.063
Case detection				
CDR[k]	Case detection rate (proportion of new active TB cases detected and started treatment) in year *k* 2019 status quo: 88% $\begin{cases} CDR[k] = CDR[k] + (1 - CDR[k]) * CDRscale & \text{if } CDRscale \geq 0 \\ CDR[k] = (1 + CDRscale) * CDR[k] & \text{if } CDRscale < 0 \end{cases}$	See Table S6	WHO Tuberculosis Data (2022)[26]	NA
CDRscale	Calibration factor for CDR	*CDRscale[j<55]*: -0.5～0.99 *CDRscale[j≥55, <65]*: (*r[j<55]* + *r[j ≥65]*)/2 *CDRscale[j≥65]*: -0.99～-0.2	Schaaf HS (2010)[19]	*CDRscale[j<55]*: 0.16～0.79 *CDRscale[j≥55, <65]*: -0.15～0.23 *CDRscale[j≥65]*: -0.98～-0.2
e	Relative probability of case detection of non-infectious TB.	0.4～0.8	Harris RC (2019)[3]	NA
Treatment				
TSR[k]	Treatment success rate (including relapse cases) in year *k* WHO data 1994-2011, then constant *TSR* from 2011 (95%) onwards.	See Table S6	WHO Tuberculosis Data (2022)[26]	NA
Vaccination				
s	Sensitivity of tuberculin skin test (TST, the pre-vaccination screening test)	77.2% (66.4%-85.3%)	Krutikov M (2022)[27]	NA
c[k,j]	Screening and vaccination coverage for those aged *j* in year *k*	90%	Assumed	NA
eff	Vaccine efficacy for preventing active TB disease	54.7% (29.8%-70.8%)	Efficacy and its lower and higher bounds, results	NA

			from the clinical trial[1]	
$\theta_R[k,j]$	Vaccine effective coverage (VEC), proportion of vaccinated individuals at age j that move to the vaccine protection in year k through routine vaccination.	$\theta_R[k,j] = s \times c[k,j] \times eff$	Assumed	NA
$\theta_M[k,j]$	Vaccine effective coverage (VEC), proportion of vaccinated individuals at age j that move to the vaccine protection in year k through mass vaccination.	$\theta_M[k,j] = c[k,j] \times eff$	Assumed	NA
D	Duration of protection	10 years, 20 years, lifelong	Assumed	NA

Table S4. Estimated crude birth rates in China during 1900-2050.

Year	Birth rate (/1,000)	Year	Birth rate (/1,000)	Year	Birth rate (/1,000)	Year	Birth rate (/1,000)
1900-1950	41.049	1975	25.105	2000	13.755	2025	7.330
1951	40.094	1976	23.551	2001	12.943	2026	7.255
1952	45.052	1977	21.448	2002	12.735	2027	7.196
1953	41.844	1978	21.091	2003	12.575	2028	7.141
1954	43.083	1979	21.881	2004	12.707	2029	7.111
1955	42.607	1980	22.279	2005	12.766	2030	7.075
1956	39.574	1981	22.852	2006	12.892	2031	7.065
1957	42.842	1982	24.271	2007	13.077	2032	7.074
1958	37.775	1983	21.215	2008	13.368	2033	7.090
1959	31.406	1984	22.000	2009	13.502	2034	7.086
1960	29.804	1985	22.809	2010	13.308	2035	7.144
1961	26.185	1986	24.229	2011	13.136	2037	7.291
1962	40.402	1987	25.176	2012	14.070	2038	7.391
1963	48.988	1988	23.655	2013	13.269	2039	7.457
1964	42.914	1989	23.962	2014	13.506	2040	7.514
1965	41.830	1990	24.436	2015	12.522	2041	7.572
1966	39.562	1991	19.444	2016	13.038	2042	7.625
1967	36.267	1992	17.811	2017	13.065	2043	7.607
1968	40.554	1993	16.834	2018	10.948	2044	7.632
1969	38.589	1994	16.067	2019	10.293	2045	7.553
1970	38.337	1995	15.454	2020	8.597	2046	7.477
1971	35.288	1996	14.722	2021	7.633	2047	7.384
1972	33.097	1997	14.123	2022	7.544	2048	7.246
1973	31.317	1998	13.617	2023	7.477	2049	7.078
1974	28.535	1999	13.292	2024	7.421	2050	6.896

Source: Adapted from United Nations Population Estimates (2022), Table "WPP2022_Demographic_Indicators_Medium.csv".
https://population.un.org/wpp/Download/Standard/CSV/

Table S5. Estimated central death rates in China during 1900-2050.

Age / Year	0	1-4	5-9	10-14	15-19	20-24	25-29-	30-34	35-39	40-44	45-49
1900-1950	0.145220	0.023109	0.008913	0.005776	0.005089	0.006308	0.007128	0.008084	0.009622	0.013297	0.016943
1951	0.141263	0.022098	0.008583	0.005469	0.004845	0.006012	0.006765	0.007686	0.009211	0.012792	0.016365
1952	0.137154	0.021091	0.007935	0.005201	0.004639	0.005778	0.006477	0.007355	0.008867	0.012379	0.015906
1953	0.133564	0.020234	0.008575	0.004912	0.004411	0.005519	0.006172	0.006992	0.008478	0.011898	0.015349
1954	0.131577	0.019778	0.007427	0.004693	0.004238	0.005329	0.005953	0.006717	0.008181	0.011546	0.014954
1955	0.128100	0.018976	0.007206	0.004578	0.004150	0.005251	0.005873	0.006594	0.008059	0.011454	0.014903
1956	0.124765	0.018221	0.006943	0.004416	0.004013	0.005117	0.005736	0.006407	0.007837	0.011200	0.014639
1957	0.121659	0.017519	0.006752	0.004271	0.003871	0.004962	0.005584	0.006217	0.007605	0.010939	0.014376
1958	0.118301	0.016778	0.006675	0.004155	0.003741	0.004826	0.005457	0.006060	0.007395	0.010696	0.014138
1959	0.176415	0.033663	0.011095	0.007016	0.005422	0.006622	0.007407	0.008274	0.010028	0.013961	0.018372
1960	0.229251	0.049250	0.015508	0.009525	0.006844	0.008020	0.008933	0.010086	0.012223	0.016715	0.021998
1961	0.171860	0.032630	0.010832	0.006716	0.005135	0.006227	0.007024	0.007901	0.009534	0.013331	0.017723
1962	0.107656	0.014492	0.005663	0.003649	0.003265	0.004254	0.004926	0.005504	0.006598	0.009635	0.013050
1963	0.104975	0.013934	0.005480	0.003505	0.003150	0.004079	0.004755	0.005337	0.006382	0.009299	0.012661
1964	0.101642	0.013253	0.005211	0.003341	0.003033	0.003883	0.004552	0.005137	0.006137	0.008909	0.012184
1965	0.098125	0.012544	0.005013	0.003221	0.002885	0.003697	0.004352	0.004939	0.005907	0.008534	0.011711
1966	0.094780	0.011908	0.004818	0.003125	0.002777	0.003550	0.004187	0.004776	0.005721	0.008197	0.011243
1967	0.091915	0.011360	0.004618	0.003004	0.002648	0.003395	0.003996	0.004585	0.005509	0.007857	0.010770
1968	0.089215	0.010842	0.004443	0.002883	0.002520	0.003246	0.003798	0.004387	0.005295	0.007534	0.010303
1969	0.086436	0.010324	0.004268	0.002775	0.002399	0.003130	0.003622	0.004206	0.005104	0.007254	0.009882
1970	0.082540	0.009608	0.004057	0.002661	0.002302	0.002960	0.003426	0.003998	0.004881	0.006946	0.009420
1971	0.078700	0.008910	0.003819	0.002525	0.002185	0.002783	0.003221	0.003766	0.004629	0.006606	0.008919
1972	0.075009	0.008265	0.003616	0.002417	0.002096	0.002641	0.003062	0.003575	0.004422	0.006334	0.008520
1973	0.071324	0.007640	0.003395	0.002291	0.001988	0.002481	0.002893	0.003357	0.004180	0.006015	0.008070
1974	0.067659	0.007055	0.003173	0.002218	0.001927	0.002373	0.002803	0.003214	0.004020	0.005811	0.007786
1975	0.064123	0.006498	0.002973	0.002129	0.001857	0.002295	0.002674	0.003070	0.003857	0.005611	0.007530
1976	0.060264	0.005863	0.002706	0.002010	0.001758	0.002180	0.002514	0.002890	0.003648	0.005367	0.007238
1977	0.056839	0.005358	0.002575	0.001925	0.001695	0.002106	0.002403	0.002767	0.003487	0.005165	0.006991
1978	0.053705	0.004912	0.002408	0.001847	0.001641	0.002039	0.002306	0.002669	0.003343	0.004986	0.006780
1979	0.050921	0.004529	0.002247	0.001766	0.001586	0.001972	0.002207	0.002587	0.003204	0.004808	0.006573
1980	0.048607	0.004230	0.002114	0.001690	0.001539	0.001919	0.002152	0.002489	0.003084	0.004649	0.006390
1981	0.046580	0.003962	0.001994	0.001607	0.001484	0.001862	0.002091	0.002391	0.002962	0.004478	0.006192
1982	0.044982	0.003756	0.001904	0.001528	0.001432	0.001809	0.002034	0.002302	0.002856	0.004313	0.006006
1983	0.043776	0.003608	0.001795	0.001458	0.001382	0.001759	0.001979	0.002220	0.002767	0.004156	0.005828
1984	0.042978	0.003508	0.001705	0.001389	0.001329	0.001709	0.001924	0.002135	0.002694	0.004002	0.005649
1985	0.042534	0.003456	0.001624	0.001325	0.001276	0.001662	0.001877	0.002087	0.002600	0.003863	0.005480
1986	0.042329	0.003429	0.001558	0.001261	0.001220	0.001611	0.001830	0.002038	0.002512	0.003728	0.005305
1987	0.042334	0.003430	0.001499	0.001196	0.001163	0.001559	0.001782	0.001987	0.002425	0.003603	0.005122
1988	0.042409	0.003443	0.001454	0.001133	0.001112	0.001507	0.001737	0.001937	0.002342	0.003496	0.004943
1989	0.042412	0.003443	0.001412	0.001077	0.001065	0.001458	0.001698	0.001894	0.002261	0.003423	0.004786

1990	0.042210	0.003415	0.001379	0.001034	0.001028	0.001417	0.001670	0.001870	0.002239	0.003348	0.004677
1991	0.041844	0.003377	0.001360	0.000996	0.000992	0.001374	0.001642	0.001849	0.002217	0.003279	0.004573
1992	0.041122	0.003287	0.001317	0.000933	0.000927	0.001288	0.001562	0.001771	0.002127	0.003114	0.004348
1993	0.040170	0.003174	0.001288	0.000888	0.000871	0.001221	0.001498	0.001712	0.002057	0.002983	0.004189
1994	0.038999	0.003041	0.001272	0.000865	0.000832	0.001176	0.001456	0.001682	0.002021	0.002896	0.004121
1995	0.037713	0.002901	0.001245	0.000834	0.000787	0.001121	0.001396	0.001630	0.001963	0.002819	0.003959
1996	0.036298	0.002741	0.001247	0.000827	0.000758	0.001080	0.001351	0.001602	0.001943	0.002795	0.003886
1997	0.034774	0.002571	0.001232	0.000812	0.000724	0.001030	0.001294	0.001556	0.001900	0.002738	0.003770
1998	0.033229	0.002413	0.001163	0.000798	0.000693	0.000974	0.001234	0.001502	0.001848	0.002665	0.003637
1999	0.031502	0.002233	0.001102	0.000802	0.000680	0.000940	0.001200	0.001475	0.001836	0.002647	0.003566
2000	0.029634	0.002047	0.001018	0.000795	0.000662	0.000895	0.001151	0.001423	0.001793	0.002594	0.003505
2001	0.027670	0.001860	0.000945	0.000768	0.000634	0.000836	0.001078	0.001338	0.001708	0.002488	0.003369
2002	0.025648	0.001675	0.000903	0.000763	0.000629	0.000807	0.001038	0.001294	0.001675	0.002456	0.003332
2003	0.023599	0.001495	0.000841	0.000751	0.000627	0.000783	0.000995	0.001252	0.001640	0.002425	0.003291
2004	0.021638	0.001331	0.000780	0.000731	0.000626	0.000764	0.000955	0.001210	0.001602	0.002392	0.003247
2005	0.019811	0.001186	0.000763	0.000704	0.000625	0.000749	0.000916	0.001169	0.001557	0.002354	0.003205
2006	0.018153	0.001061	0.000740	0.000672	0.000621	0.000735	0.000877	0.001122	0.001502	0.002301	0.003151
2007	0.016682	0.000952	0.000714	0.000650	0.000621	0.000734	0.000853	0.001088	0.001462	0.002275	0.003134
2008	0.015490	0.000925	0.000721	0.000679	0.000657	0.000775	0.000873	0.001093	0.001468	0.002287	0.003162
2009	0.014205	0.000781	0.000628	0.000615	0.000599	0.000732	0.000811	0.001004	0.001372	0.002183	0.003061
2010	0.013177	0.000720	0.000598	0.000605	0.000582	0.000736	0.000800	0.000969	0.001332	0.002132	0.003025
2011	0.012191	0.000653	0.000537	0.000587	0.000556	0.000732	0.000787	0.000930	0.001282	0.002065	0.002970
2012	0.011294	0.000599	0.000487	0.000565	0.000535	0.000728	0.000781	0.000899	0.001236	0.001998	0.002917
2013	0.010460	0.000550	0.000444	0.000536	0.000518	0.000719	0.000780	0.000874	0.001188	0.001936	0.002863
2014	0.009685	0.000507	0.000406	0.000501	0.000504	0.000703	0.000780	0.000854	0.001141	0.001874	0.002800
2015	0.008967	0.000466	0.000373	0.000463	0.000493	0.000680	0.000780	0.000839	0.001097	0.001814	0.002729
2016	0.008310	0.000432	0.000345	0.000426	0.000483	0.000655	0.000781	0.000831	0.001059	0.001756	0.002655
2017	0.007690	0.000399	0.000324	0.000399	0.000477	0.000645	0.000796	0.000845	0.001049	0.001737	0.002638
2018	0.007123	0.000371	0.000296	0.000356	0.000441	0.000607	0.000766	0.000821	0.000993	0.001625	0.002488
2019	0.006597	0.000345	0.000274	0.000328	0.000415	0.000593	0.000749	0.000823	0.000971	0.001563	0.002412
2020	0.006116	0.000323	0.000259	0.000306	0.000388	0.000584	0.000731	0.000830	0.000962	0.001517	0.002356
2021	0.005682	0.000303	0.000235	0.000284	0.000356	0.000572	0.000703	0.000831	0.000951	0.001463	0.002278
2022	0.005910	0.000312	0.000250	0.000302	0.000384	0.000553	0.000703	0.000775	0.000917	0.001478	0.002281
2023	0.005727	0.000303	0.000242	0.000293	0.000374	0.000539	0.000687	0.000758	0.000899	0.001448	0.002236
2024	0.005543	0.000293	0.000234	0.000283	0.000364	0.000526	0.000670	0.000742	0.000880	0.001418	0.002191
2025	0.005367	0.000284	0.000227	0.000275	0.000354	0.000512	0.000654	0.000725	0.000862	0.001389	0.002147
2026	0.005202	0.000275	0.000219	0.000266	0.000344	0.000499	0.000638	0.000709	0.000844	0.001360	0.002103
2027	0.005038	0.000266	0.000212	0.000257	0.000335	0.000487	0.000622	0.000693	0.000826	0.001332	0.002060
2028	0.004883	0.000258	0.000206	0.000249	0.000325	0.000474	0.000607	0.000677	0.000809	0.001304	0.002019
2029	0.004728	0.000250	0.000199	0.000241	0.000316	0.000462	0.000592	0.000662	0.000792	0.001277	0.001977
2030	0.004582	0.000242	0.000193	0.000233	0.000307	0.000450	0.000577	0.000646	0.000775	0.001250	0.001936
2031	0.004446	0.000235	0.000187	0.000226	0.000299	0.000438	0.000563	0.000631	0.000758	0.001224	0.001896
2032	0.004309	0.000228	0.000180	0.000219	0.000290	0.000427	0.000548	0.000616	0.000742	0.001198	0.001857
2033	0.004181	0.000221	0.000175	0.000211	0.000282	0.000415	0.000534	0.000601	0.000725	0.001172	0.001818

2034	0.004060	0.000214	0.000169	0.000205	0.000274	0.000404	0.000521	0.000587	0.000709	0.001147	0.001780
2035	0.003939	0.000208	0.000164	0.000198	0.000266	0.000394	0.000507	0.000573	0.000694	0.001123	0.001743
2036	0.003822	0.000201	0.000158	0.000191	0.000259	0.000383	0.000494	0.000559	0.000678	0.001098	0.001706
2037	0.003715	0.000196	0.000153	0.000185	0.000251	0.000373	0.000481	0.000545	0.000663	0.001074	0.001670
2038	0.003608	0.000190	0.000149	0.000179	0.000244	0.000363	0.000469	0.000532	0.000648	0.001051	0.001635
2039	0.003509	0.000184	0.000144	0.000174	0.000237	0.000353	0.000456	0.000519	0.000633	0.001028	0.001600
2040	0.003410	0.000179	0.000139	0.000168	0.000230	0.000344	0.000445	0.000506	0.000619	0.001005	0.001566
2041	0.003339	0.000174	0.000135	0.000163	0.000224	0.000335	0.000433	0.000494	0.000605	0.000983	0.001534
2042	0.003257	0.000170	0.000131	0.000158	0.000218	0.000326	0.000422	0.000483	0.000592	0.000962	0.001501
2043	0.003180	0.000166	0.000128	0.000153	0.000212	0.000318	0.000412	0.000471	0.000579	0.000941	0.001471
2044	0.003102	0.000161	0.000124	0.000148	0.000207	0.000310	0.000401	0.000460	0.000566	0.000920	0.001440
2045	0.003029	0.000157	0.000120	0.000144	0.000201	0.000302	0.000391	0.000449	0.000553	0.000900	0.001410
2046	0.002960	0.000153	0.000117	0.000140	0.000196	0.000295	0.000382	0.000439	0.000541	0.000881	0.001381
2047	0.002900	0.000150	0.000114	0.000136	0.000191	0.000288	0.000373	0.000429	0.000531	0.000864	0.001354
2048	0.002843	0.000147	0.000111	0.000132	0.000187	0.000281	0.000365	0.000420	0.000520	0.000846	0.001328
2049	0.002787	0.000143	0.000108	0.000129	0.000182	0.000275	0.000356	0.000411	0.000509	0.000829	0.001302
2050	0.002733	0.000140	0.000105	0.000125	0.000178	0.000268	0.000348	0.000402	0.000499	0.000813	0.001276

Age / Year	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99	100
1900-1950	0.024491	0.032736	0.052600	0.075011	0.105660	0.147352	0.209322	0.286471	0.377208	0.494742	1
1951	0.023571	0.031629	0.051107	0.073417	0.103653	0.145171	0.208077	0.286150	0.379979	0.502354	1
1952	0.022861	0.030717	0.049961	0.072129	0.102344	0.143429	0.207668	0.286291	0.383602	0.507312	1
1953	0.022051	0.029592	0.048499	0.070308	0.100609	0.140852	0.206250	0.285112	0.386470	0.515678	1
1954	0.021515	0.028781	0.047487	0.069084	0.099760	0.139362	0.205996	0.285671	0.391533	0.528575	1
1955	0.021524	0.028686	0.047592	0.069462	0.101058	0.140865	0.209592	0.292290	0.403205	0.543004	1
1956	0.021217	0.028172	0.046911	0.068808	0.100807	0.140778	0.210262	0.295803	0.409635	0.554060	1
1957	0.020929	0.027732	0.046246	0.068249	0.100499	0.141026	0.210760	0.299516	0.415490	0.568890	1
1958	0.020668	0.027380	0.045610	0.067748	0.100114	0.141505	0.211073	0.303108	0.421144	0.572308	1
1959	0.026143	0.034632	0.055227	0.081337	0.119002	0.167968	0.237257	0.331922	0.451714	0.615195	1
1960	0.030885	0.040969	0.063616	0.093155	0.135499	0.191202	0.260421	0.356782	0.479658	0.640950	1
1961	0.025409	0.033835	0.053638	0.079521	0.117191	0.167363	0.236682	0.334080	0.461945	0.625314	1
1962	0.019433	0.026071	0.042878	0.064640	0.097198	0.141084	0.211056	0.308903	0.442019	0.608608	1
1963	0.018964	0.025541	0.041999	0.063243	0.095723	0.139496	0.210270	0.307188	0.444175	0.613768	1
1964	0.018366	0.024828	0.040904	0.061406	0.093513	0.136796	0.207972	0.303202	0.442382	0.615273	1
1965	0.017768	0.024126	0.039868	0.059604	0.091185	0.133897	0.205109	0.298781	0.438560	0.612151	1
1966	0.017132	0.023365	0.038730	0.057700	0.088567	0.130759	0.201762	0.294700	0.433904	0.613185	1
1967	0.016496	0.022624	0.037662	0.055994	0.086022	0.127760	0.198187	0.291025	0.428515	0.610025	1
1968	0.015863	0.021889	0.036601	0.054421	0.083501	0.124819	0.194480	0.287801	0.423084	0.605231	1
1969	0.015280	0.021224	0.035639	0.053090	0.081198	0.122067	0.190937	0.284894	0.418077	0.599743	1
1970	0.014614	0.020434	0.034483	0.051528	0.078510	0.118556	0.186278	0.280091	0.411138	0.590450	1
1971	0.013864	0.019504	0.033121	0.049712	0.075521	0.114441	0.180879	0.273889	0.403598	0.579183	1
1972	0.013240	0.018733	0.032006	0.048245	0.073130	0.110810	0.176076	0.267790	0.396843	0.568912	1
1973	0.012514	0.017799	0.030605	0.046327	0.070198	0.106108	0.169509	0.258632	0.386173	0.553745	1
1974	0.012021	0.017167	0.029698	0.045108	0.068424	0.102912	0.164993	0.252329	0.379422	0.544616	1

1975	0.011572	0.016582	0.028883	0.044086	0.067073	0.100435	0.161565	0.247973	0.375525	0.541530	1
1976	0.011100	0.015953	0.027997	0.043001	0.065696	0.098008	0.158018	0.243647	0.371262	0.538331	1
1977	0.010681	0.015349	0.027088	0.041857	0.064235	0.095580	0.153995	0.238543	0.365137	0.532999	1
1978	0.010334	0.014818	0.026288	0.040876	0.063022	0.093711	0.150546	0.234267	0.359847	0.529382	1
1979	0.010010	0.014300	0.025479	0.039884	0.061789	0.092005	0.147182	0.229958	0.354508	0.523948	1
1980	0.009743	0.013850	0.024754	0.038996	0.060736	0.090669	0.144323	0.226032	0.349753	0.518897	1
1981	0.009467	0.013396	0.023983	0.037998	0.059548	0.089210	0.141392	0.221551	0.344212	0.511843	1
1982	0.009215	0.012992	0.023256	0.037041	0.058432	0.087926	0.138964	0.217396	0.339217	0.506168	1
1983	0.008983	0.012632	0.022561	0.036106	0.057338	0.086670	0.136825	0.213231	0.334000	0.500102	1
1984	0.008753	0.012299	0.021884	0.035168	0.056250	0.085459	0.135076	0.209523	0.329328	0.494971	1
1985	0.008537	0.012010	0.021265	0.034269	0.055178	0.084290	0.133523	0.206000	0.324284	0.488363	1
1986	0.008313	0.011727	0.020665	0.033346	0.054011	0.083035	0.131978	0.202652	0.318904	0.480863	1
1987	0.008082	0.011442	0.020083	0.032384	0.052725	0.081574	0.130159	0.199121	0.312454	0.471160	1
1988	0.007857	0.011170	0.019553	0.031456	0.051471	0.080191	0.128592	0.196493	0.307090	0.461920	1
1989	0.007657	0.010943	0.019138	0.030674	0.050405	0.079107	0.127584	0.195154	0.303482	0.455164	1
1990	0.007525	0.010810	0.018938	0.030225	0.049845	0.078811	0.128044	0.196524	0.304204	0.453999	1
1991	0.007375	0.010660	0.018738	0.029817	0.049329	0.078634	0.129051	0.199506	0.308490	0.460423	1
1992	0.007007	0.010200	0.017988	0.028504	0.047130	0.075508	0.124735	0.193633	0.298428	0.444335	1
1993	0.006715	0.009848	0.017436	0.027542	0.045421	0.073077	0.121472	0.189395	0.291297	0.430768	1
1994	0.006533	0.009645	0.017170	0.027114	0.044589	0.072107	0.120866	0.189923	0.292922	0.433513	1
1995	0.006269	0.009305	0.016641	0.026293	0.043021	0.069736	0.117608	0.185923	0.287313	0.425262	1
1996	0.006147	0.009155	0.016477	0.026112	0.042555	0.069122	0.117362	0.187075	0.290538	0.430191	1
1997	0.005970	0.008884	0.016104	0.025604	0.041584	0.067527	0.115311	0.185198	0.289239	0.430032	1
1998	0.005786	0.008566	0.015634	0.024930	0.040353	0.065291	0.111857	0.180653	0.283180	0.422413	1
1999	0.005752	0.008421	0.015488	0.024859	0.040270	0.065086	0.112276	0.183158	0.290347	0.436499	1
2000	0.005588	0.008172	0.015109	0.024350	0.039465	0.063419	0.109569	0.179740	0.286549	0.432584	1
2001	0.005316	0.007764	0.014395	0.023272	0.037748	0.060213	0.103804	0.170780	0.273263	0.413149	1
2002	0.005203	0.007606	0.014091	0.022936	0.037323	0.059324	0.102213	0.169018	0.272677	0.414308	1
2003	0.005090	0.007478	0.013778	0.022593	0.036916	0.058534	0.100639	0.167158	0.271828	0.415875	1
2004	0.004964	0.007389	0.013470	0.022234	0.036510	0.057836	0.099092	0.165171	0.270662	0.419542	1
2005	0.004914	0.007225	0.013156	0.021830	0.036024	0.057122	0.097415	0.162737	0.268453	0.416113	1
2006	0.004837	0.007039	0.012794	0.021299	0.035359	0.056234	0.095548	0.159873	0.265473	0.415023	1
2007	0.004820	0.006946	0.012628	0.021001	0.035092	0.055962	0.094709	0.158272	0.263911	0.415041	1
2008	0.004844	0.006899	0.012545	0.020712	0.034823	0.055687	0.093914	0.156529	0.262044	0.415762	1
2009	0.004711	0.006643	0.012296	0.020133	0.034117	0.054902	0.092656	0.154073	0.258963	0.412612	1
2010	0.004668	0.006599	0.012071	0.019726	0.033598	0.054328	0.091787	0.151992	0.256062	0.409368	1
2011	0.004610	0.006527	0.011825	0.019288	0.032950	0.053582	0.090770	0.149732	0.252517	0.405612	1
2012	0.004555	0.006462	0.011582	0.018907	0.032257	0.052789	0.089679	0.147431	0.248386	0.399128	1
2013	0.004505	0.006394	0.011345	0.018625	0.031601	0.052096	0.088886	0.145896	0.245474	0.394961	1
2014	0.004450	0.006317	0.011061	0.018421	0.030925	0.051291	0.087941	0.144258	0.242014	0.389196	1
2015	0.004389	0.006249	0.010973	0.018040	0.030271	0.050445	0.086935	0.142796	0.238688	0.384069	1
2016	0.004329	0.006197	0.010898	0.017715	0.029693	0.049591	0.085919	0.141451	0.235547	0.378451	1
2017	0.004365	0.006285	0.011072	0.017778	0.029810	0.049639	0.086349	0.142277	0.235528	0.376407	1
2018	0.004170	0.006050	0.010665	0.016969	0.028628	0.047460	0.083286	0.138055	0.228859	0.365922	1

2019	0.004085	0.005984	0.010552	0.016581	0.028366	0.046557	0.082216	0.137041	0.227301	0.363110	1
2020	0.004019	0.005957	0.010533	0.016595	0.028164	0.046502	0.082567	0.137366	0.226793	0.361067	1
2021	0.003906	0.005869	0.010440	0.016598	0.028160	0.046617	0.082413	0.137320	0.226379	0.359748	1
2022	0.003859	0.005637	0.009943	0.015625	0.026589	0.044074	0.078578	0.132041	0.221023	0.358320	1
2023	0.003781	0.005526	0.009737	0.015321	0.026038	0.043295	0.077384	0.130525	0.218988	0.356128	1
2024	0.003704	0.005414	0.009530	0.015015	0.025514	0.042491	0.076203	0.129013	0.216969	0.353872	1
2025	0.003628	0.005304	0.009328	0.014714	0.025020	0.041698	0.075045	0.127523	0.214935	0.351654	1
2026	0.003553	0.005197	0.009130	0.014416	0.024543	0.040912	0.073888	0.125983	0.212843	0.349202	1
2027	0.003479	0.005091	0.008935	0.014120	0.024075	0.040132	0.072769	0.124436	0.210948	0.346991	1
2028	0.003408	0.004989	0.008747	0.013835	0.023629	0.039401	0.071684	0.122940	0.209204	0.344937	1
2029	0.003336	0.004887	0.008560	0.013550	0.023183	0.038704	0.070573	0.121468	0.207449	0.342884	1
2030	0.003265	0.004785	0.008373	0.013264	0.022729	0.038015	0.069408	0.119895	0.205471	0.340438	1
2031	0.003196	0.004687	0.008195	0.012992	0.022293	0.037372	0.068300	0.118409	0.203594	0.338283	1
2032	0.003127	0.004587	0.008015	0.012716	0.021850	0.036722	0.067175	0.116925	0.201623	0.336221	1
2033	0.003059	0.004489	0.007839	0.012446	0.021416	0.036088	0.066088	0.115419	0.199593	0.334066	1
2034	0.002993	0.004395	0.007669	0.012185	0.020991	0.035464	0.065056	0.113883	0.197613	0.331968	1
2035	0.002928	0.004301	0.007499	0.011927	0.020572	0.034848	0.064077	0.112382	0.195712	0.329951	1
2036	0.002864	0.004207	0.007331	0.011671	0.020158	0.034229	0.063112	0.110872	0.193783	0.327828	1
2037	0.002802	0.004117	0.007168	0.011425	0.019756	0.033626	0.062170	0.109368	0.191861	0.325479	1
2038	0.002742	0.004028	0.007008	0.011184	0.019365	0.033036	0.061262	0.107960	0.190036	0.323428	1
2039	0.002682	0.003941	0.006852	0.010947	0.018980	0.032452	0.060353	0.106585	0.188053	0.321185	1
2040	0.002624	0.003856	0.006698	0.010714	0.018601	0.031877	0.059454	0.105282	0.186125	0.319113	1
2041	0.002568	0.003774	0.006547	0.010483	0.018225	0.031298	0.058526	0.103934	0.184058	0.316738	1
2042	0.002514	0.003693	0.006400	0.010258	0.017857	0.030731	0.057611	0.102609	0.182023	0.314443	1
2043	0.002462	0.003617	0.006260	0.010043	0.017507	0.030186	0.056724	0.101317	0.180060	0.312080	1
2044	0.002409	0.003541	0.006120	0.009828	0.017155	0.029643	0.055843	0.100051	0.178260	0.309823	1
2045	0.002359	0.003467	0.005985	0.009620	0.016815	0.029113	0.054972	0.098761	0.176420	0.307267	1
2046	0.002309	0.003395	0.005852	0.009413	0.016471	0.028578	0.054088	0.097445	0.174591	0.304770	1
2047	0.002265	0.003330	0.005732	0.009225	0.016161	0.028096	0.053287	0.096246	0.172931	0.302499	1
2048	0.002220	0.003266	0.005616	0.009042	0.015857	0.027618	0.052481	0.095008	0.171168	0.300080	1
2049	0.002177	0.003204	0.005501	0.008862	0.015557	0.027148	0.051689	0.093788	0.169421	0.297758	1
2050	0.002133	0.003142	0.005390	0.008688	0.015264	0.026684	0.050903	0.092558	0.167617	0.295409	1

Source: Adapted from United Nations Population Estimates (2022), Tables "WPP2022_Life_Table_Abridged_Medium_1950-2021.csv" and "WPP2022_Life_Table_Abridged_Medium_2022-2100.csv". https://population.un.org/wpp/Download/Standard/CSV/

Figure S1

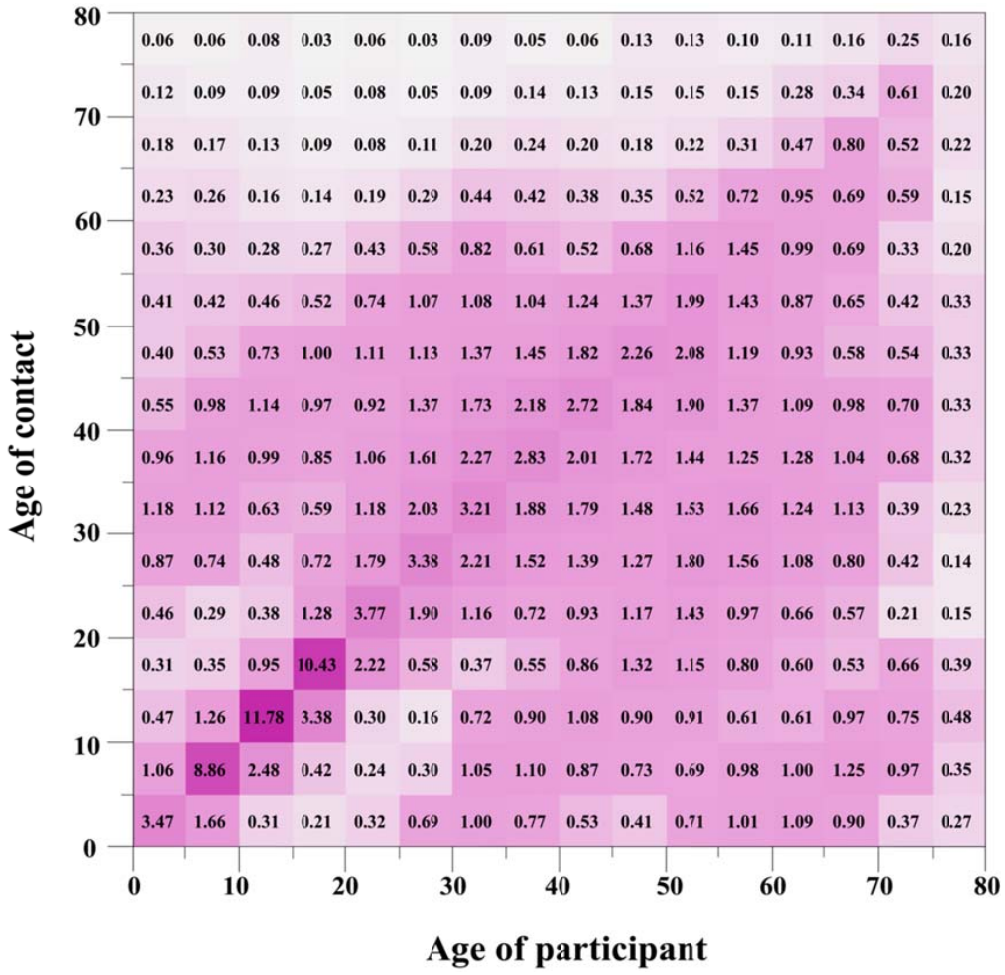

Figure S1. Daily number of respiratory contacts by age group in China.
Source: Adapted from the projected contact matrix reported by Prem K (2021),[7] which was based on three studies in Guangdong,[4] Hong Kong[5] and Shanghai[6] China respectively.

Table S6. Case detection rate (CDR) and treatment success rate (TSR) for tuberculosis in China.

Year	CDR (%) WHO estimates[a]	TSR (%) WHO estimates[b]	Year	CDR (%) smoothed[c]	Year	CDR (%) smoothed[c]
1990	21	NA	1990	39	2022	77
1991	20	NA	1991	41	2023	78
1992	19	NA	1992	42	2024	79
1993	21	NA	1993	43	2025	79
1994	22	91	1994	45	2026	80
1995	32	93	1995	46	2027	80
1996	32	94	1996	48	2028	81
1997	31	95	1997	49	2029	81
1998	30	95	1998	51	2030	82
1999	31	95	1999	52	2031	82
2000	33	93	2000	54	2032	83
2001	36	95	2001	55	2033	83
2002	36	92	2002	56	2034	83
2003	49	93	2003	58	2035	84
2004	66	92	2004	59	2036	84
2005	76	92	2005	61	2037	84
2006	82	92	2006	62	2038	85
2007	87	93	2007	63	2039	85
2008	89	93	2008	64	2040	85
2009	89	94	2009	65	2041	85
2010	89	95	2010	67	2042	86
2011	89	95	2011	68	2043	86
2012	89	95	2012	69	2044	86
2013	89	95	2013	70	2045	86
2014	88	94	2014	71	2046	86
2015	88	94	2015	72	2047	86
2016	88	93	2016	73	2048	87
2017	88	93	2017	74	2049	87
2018	92	94	2018	74	2050	87
2019	88	94	2019	75		
2020	77	95	2020	76		
2021	75	NA	2021	77		

[a,b]Adapted from WHO Tuberculosis Data (2022). Tables "TB_burden_countries_2022-12-01.csv" and "TB_outcomes_2022-12-01.csv".
https://www.who.int/teams/global-tuberculosis-programme/data

[c]The generalized logistic function was fitted for CDR data to remove artificial noise in the data and derived a smoothed curve over 2000-50. Adapted from Harris RC (2020),[28] supplementary materials Figure 4.

4. Model calibration and status quo projection

Table S7. Procedure for model calibration.

Element	Specifications
Calibration targets	Demographic targets (see Table S8). Epidemiological targets (see Table S9).
Goodness of fit (GoF) metric	GoF metric served as the objective function for measuring the accuracy of the model's predictions vs. the targets. Mean percentage deviation, not weighted.
Nelder-Mead search algorithm	We used Latin hypercube sampling to draw multiple (e.g. 1000) sets of parameter values from their predefined distributions as the simplexes. With each simplex seeded, the Nelder-Mead search algorithm (using R package "dfoptim"[29]) was applied to produce 1 optimal set of input parameter values which locally minimized the overall GoF metric.
Acceptance criteria	For the input parameter values, only the calibrated parameter sets which best minimize GoF were deemed as acceptable, as we described elsewhere.[30]
Stopping rule	We repeated the same calibration step 1000 times with each simplex seeded and derived 100 best fitting parameter subsets.

Table S8. Demographic calibration targets.

Age (yr) / Year	Population (thousands) estimated by UN				
	All	**0-14**	**15-54**	**55-64**	**65+**
2000	1 259 610	313 187	776 177	84 322	85 924
2020	1 423 998	258 888	820 770	169 103	175 237
2035	1 401 489	154 898	736 292	201 227	309 071
2050	1 316 946	150 752	562 468	210 920	392 806

Source: Adapted from "World Population Prospects 2022: Summary of Results".[31]

Figure S2

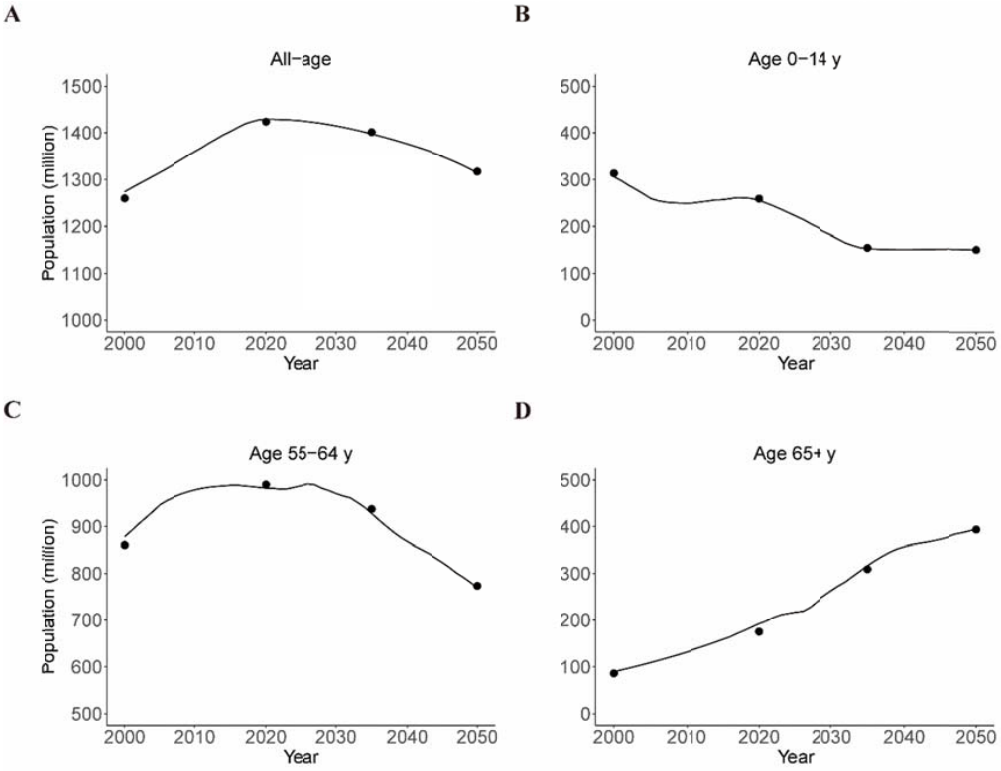

Figure S2. Model calibration and status quo projection of the population in China.
(A) the overall population, (B) 0-14 years, (C) 15-64 years, (D) ≥65 years.

Table S9. Epidemiological calibration targets.

Targets	**Microbiologically-positive pulmonary TB prevalence rate (/100,000/yr)[32]**				**TB incidence rate (/100,000/yr)[33]**	**TB mortality rate (/100,000/yr)[34]**					
Age (yr) / Year	**≥15**	**15-44**	**45-59**	**60+**	**All**	**All**	**0-14**	**15-29**	**30-44**	**45-59**	**60+**
2000	178 (163, 195)	106 (91, 123)	213 (174, 260)	596 (510, 698)	/	/	/	/	/	/	/
2005	/	/	/	/	96.9 (77.5, 116.3)	/	/	/	/	/	/
2010	116 (101, 132)	67 (53, 84)	133 (106, 168)	346 (294, 407)	74.3 (59.4, 89.1)	3.37 (3.25, 3.50)	0.29 (0.21, 0.40)	0.88 (0.75, 1.03)	1.77 (1.59, 1.97)	3.24 (2.97, 3.53)	15.7 (14.9, 16.5)
2014	/	/	/	/	65.6 (52.5, 78.8)	/	/	/	/	/	/
2018	/	/	/	/	59.3 (47.4, 71.1)	/	/	/	/	/	/

TB, tuberculosis.

Figure S3

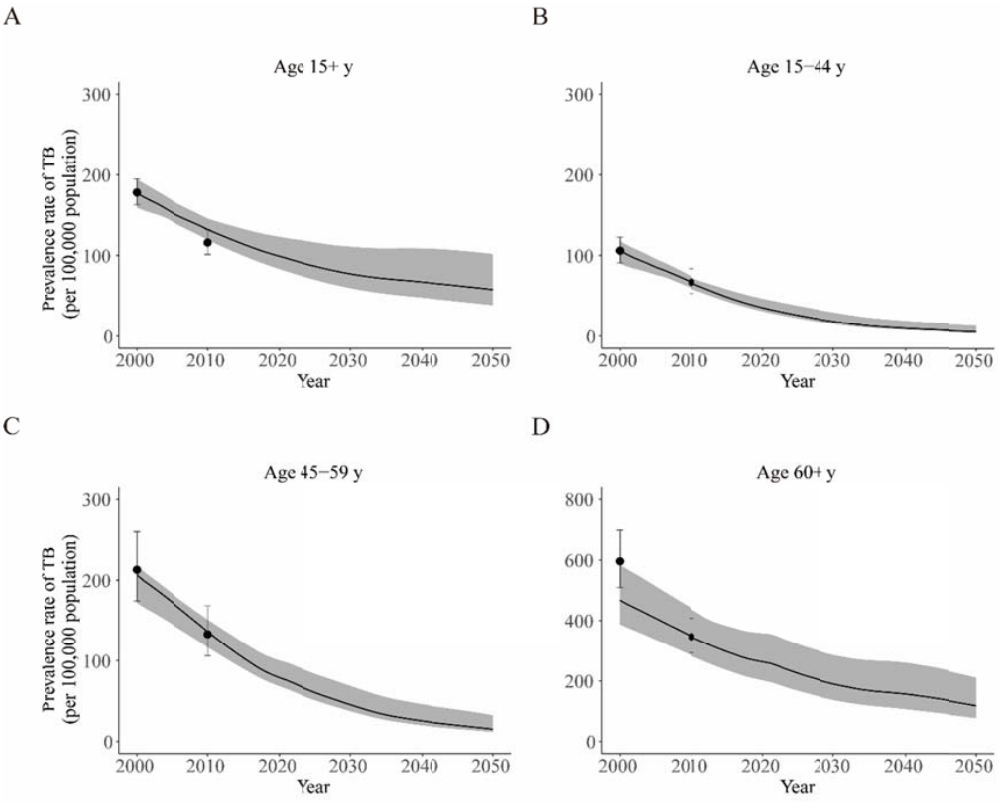

Figure S3. Model calibration and status quo projection of microbiologically-positive tuberculosis (TB) prevalence in China.
(A) the overall ≥15 years older population**,** (B) 15-44 years, (D) 44-59 years, (E) ⩾60 years.
Data are presented as median and 95% CI.

Figure S4

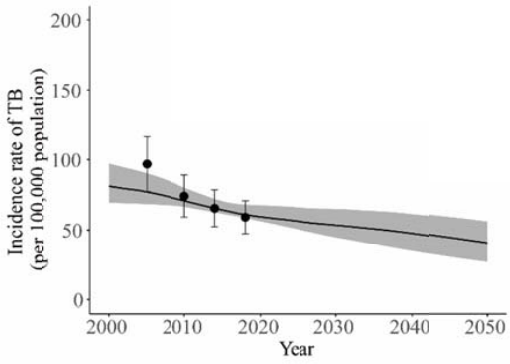

Figure S4. Model calibration and status quo projection of TB incidence in China.
Data are presented as median and 95% CI.

Figure S5

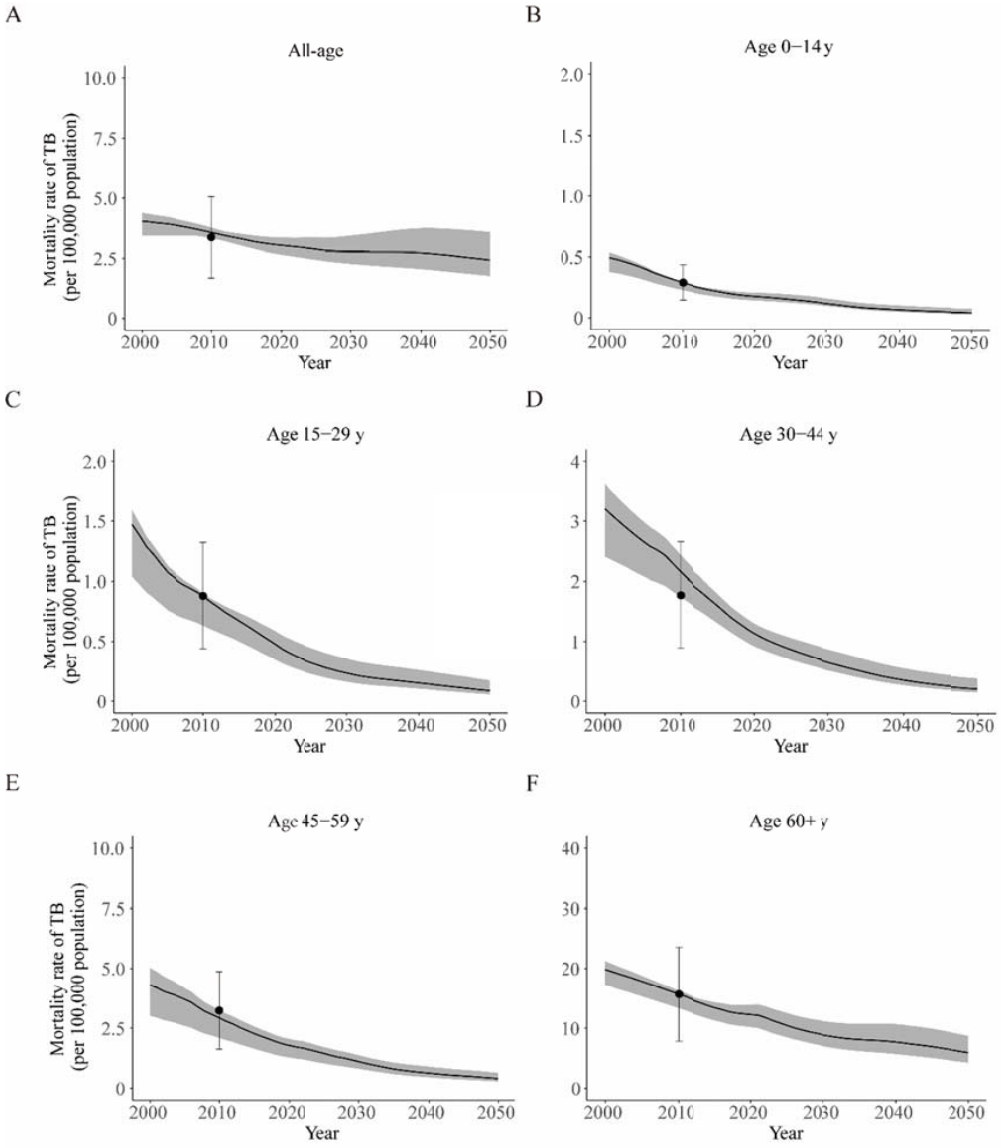

Figure S5. Model calibration and status quo projection of TB-related mortality in China.
(A) the overall population, (B) 0-14 years, (C) 15-29 years, (D) 30-44 years, (E) 45-59 years, (F) ≥60 years.
Data are presented as median and 95% CI.

Figure S6

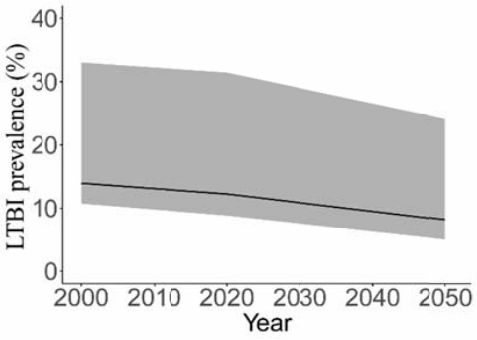

Figure S6. Status quo projection of latent **t**uberculosis infection (LTBI) prevalen**c**e in China.

Data are presented as median and 95% CI.

Figure S7

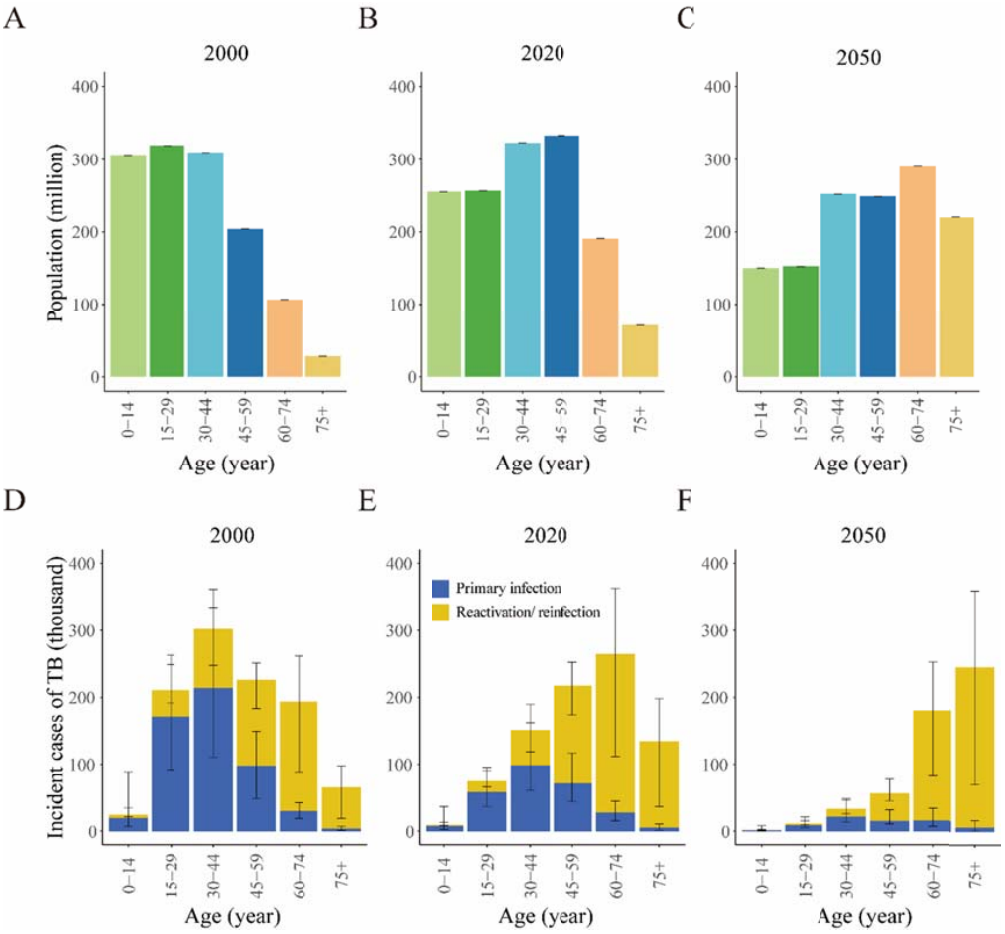

Figure S7. Estimated national population size and incident TB cases by age in China.
(A-C) Estimated China population size by age in 2000, 2020 and 2050. (D-F) Estimated incident cases of TB caused by primary infection or reactivation/reinfection in 2000, 2020 and 2050.
Data are presented as median and 95% CI.

5. Vaccination strategies and epidemiological outcomes

Table S10. Health outcomes for routine vaccination targeting different ages, with PSI efficacy, conferring lifelong protection.

Outcome \ Targeted age	15-year-olds[a]	30-year-olds[b]	45-year-olds[c]	60-year-olds[d]	Kruskal-Wallis H test	
					Chi square	*P*
TB cases averted (million)	0.165	1.02	5.16	8.35	368.46	<0.001
	(0.080, 0.494)	(0.644, 2.18)	(3.89, 7.87)	(6.05, 12.2)		
(%)	0.366	2.21	11.4	18.4	374.05	<0.001
	(0.172, 0.810)	(1.38, 3.38)	(9.98, 12.2)	(13.9, 20.9)		
TB-related deaths averted (million)	0.002	0.013	0.110	0.207	374.05	<0.001
	(0.001, 0.003)	(0.009, 0.018)	(0.092, 0.145)	(0.172, 0.274)		
(%)	0.172	1.28	10.9	20.8	374.06	<0.001
	(0.090, 0.291)	(0.886, 1.58)	(10.0, 11.8)	(18.8, 22.5)		
TB cases averted per million doses	2158	4458	11 471	13 193	307.90	<0.001
	(898, 5079)	(2195, 8379)	(5036, 19 410)	(5902, 22 708)		
TB-related deaths averted per million doses	23.5	53.7	235	332	347.34	<0.001
	(10.4, 41.6)	(28.6, 82.3)	(119, 321)	(178, 436)		

TB, tuberculosis. PSI, postinfection vaccine efficacy.

Tuberculin skin test (TST) with 77.2% sensitivity was applied to screening for latent tuberculosis infection. We assumed that 100% those screened TST positive would accept the vaccine injection. We assumed vaccination coverage to be 90%.

Data are presented as median and 95% CI.

[a]15-y population each year and catch-up 16-29 y population in 2024;

[b]30-y population each year and catch-up 31-44 y population in 2024;

[c]45-y population each year and catch-up 46-59 y population in 2024;

[d]60-y population each year and catch-up 61-74 y population in 2024.

Table S11. Predicted incidence rate and mortality rate reduction in 2050 for government-funded national Vaccae vaccination in China.

Strategy	Incidence rate (per 10^5 population)	IRR (%)	Mortality rate (per 10^5 population)	MRR (%)
No Vaccae	39.96 (30.63, 54.08)	-	2.43 (1.99, 3.37)	-
Vaccae with 10-y protection				
PSI, Older adult routine	35.73 (27.11, 47.94)	10.9 (9.7, 12.6)	2.16 (1.77, 2.95)	11.5 (10.3, 12.7)
P&PI, Older adult routine	33.94 (24.74, 45.08)	15.7 (13.5, 20.0)	2.04 (1.69, 2.71)	16.6 (14.5, 20.2)
PSI, All age campaign	28.85 (21.27, 38.30)	28.3 (26.3, 31.7)	1.77 (1.46, 2.43)	27.1 (25.5, 29.1)
P&PI, All age campaign	22.86 (14.54, 31.25)	42.8 (37.9, 53.9)	1.47 (1.24, 1.94)	39.3 (36.7, 44.1)
Vaccae with 20-y protection				
PSI, Older adult routine	31.35 (24.16, 42.08)	21.7 (19.9, 23.2)	1.80 (1.47, 2.49)	26.3 (24.1, 27.6)
P&PI, Older adult routine	28.11 (20.83, 37.22)	30.3 (27.7, 33.2)	1.55 (1.29, 2.08)	36.4 (33.5, 39.8)
PSI, All age campaign	28.92 (21.36, 38.35)	28.1 (26.1, 31.3)	1.77 (1.45, 2.43)	27.3 (25.5, 29.1)
P&PI, All age campaign	22.89 (14.62, 31.22)	42.7 (37.8, 53.6)	1.46 (1.23, 1.93)	39.9 (37.5, 44.5)
Vaccae with lifelong protection				
PSI, Older adult routine	27.01 (21.40, 36.83)	32.0 (28.2, 34.0)	1.64 (1.35, 2.30)	32.6 (30.1, 34.2)
P&PI, Older adult routine	22.34 (17.60, 30.30)	44.0 (41.0, 45.7)	1.35 (1.11, 1.84)	44.8 (42.2, 47.3)
PSI, All age campaign	26.47 (20.71, 36.04)	33.4 (30.9, 35.4)	1.60 (1.31, 2.25)	34.0 (31.9, 35.5)
P&PI, All age campaign	19.33 (13.44, 26.23)	51.8 (49.2, 56.0)	1.22 (1.00, 1.64)	49.9 (47.7, 52.9)

PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy; IRR, incidence rate reduction; MRR, mortality rate reduction.

Data are presented as median and 95% CI.

Table S12. Predicted number needed to vaccinate (NNV) per case or death averted in China during 2024-2050.

Strategy	Cases averted (thousand)	Deaths averted (thousand)	NNV per case averted	NNV per death averted
Vaccae with 10-y protection				
PSI, Older adult routine	5300 (3971, 7928)	131 (109, 171)	20 (12, 43)	803 (622, 1468)
P&PI, Older adult routine	7608 (5722, 11 287)	185 (154, 256)	91 (61, 121)	3729 (2703, 4500)
PSI, All age campaign	9208 (7032, 13 814)	206 (172, 267)	29 (18, 66)	1337 (1009, 2637)
P&PI, All age campaign	14 155 (11 081, 22 183)	302 (253, 407)	207 (132, 265)	9698 (7196, 11 555)
Vaccae with 20-y protection				
PSI, Older adult routine	8009 (5820, 11 756)	199 (166, 264)	13 (8, 29)	522 (399, 968)
P&PI, Older adult routine	11 267 (8276, 16 536)	280 (233, 377)	61 (42, 84)	2469 (1833, 2968)
PSI, All age campaign	9737 (7398, 14 397)	220 (184, 283)	19 (11, 42)	823 (615, 1632)
P&PI, All age campaign	14 927 (11 652, 22 966)	323 (273, 431)	129 (84, 165)	5948 (4455, 7017)
Vaccae with lifelong protection				
PSI, Older adult routine	8353 (6045, 12 229)	207 (172, 274)	13 (7, 28)	502 (383, 934)
P&PI, Older adult routine	11 671 (8582, 17 173)	290 (241, 390)	59 (40, 81)	2380 (1772, 2866)
PSI, All age campaign	10 168 (7684, 14 889)	229 (192, 296)	11 (7, 25)	506 (382, 961)
P&PI, All age campaign	15 613 (12 073, 23 846)	337 (286, 448)	64 (42, 83)	2976 (2235, 3506)

PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy.

Data are presented as median and 95% CI.

6. Costs and cost-effectiveness analyses

Table S13. Unit cost parameters.

Unit cost	Value (US$)	Range (US$)	Source	Government-funded		Self-paid	
				HCS	SOC	HCS	SOC
Direct costs							
Direct medical costs[a]							
Direct medical costs, self-paid	805.5	465.2-1145.8	[35 36]	✔	✔	✔	✔
Direct medical costs, covered by health insurance	419.1	147.6-690.6	[35 36]	✔	✔	✔	✔
Direct non-medical costs							
Transportation cost	55	±20%	[37]	✘	✔	NA	✔
Accommodation and food	46	±20%	[37]	✘	✔	NA	✔
Nutrition cost	367	±20%	[37]	✘	✔	NA	✔
Indirect costs (productivity loss)							
Patient ≤19 years[b]	12 458	±20%	[38]	NA	✔	NA	✔
Patient 20-59 years[c]	6229	±20%	[38]	NA	✔	NA	✔
Caregiver	79.5	±20%	[39]	NA	✔	NA	✔
Premature death ≤59 years[d]	12 458	±20%	[38]	NA	✔	NA	✔
Vaccination program costs							
TST screening	3.08	2.3-4.3	[40-42]	✔	✔	✔	✔
Vaccine cost, paid by patient	372			NA	NA	✔	✔
Vaccine cost, paid by government	180			✔	✔	NA	NA
Wastage	15%	12%-18%	Assumed	✔	✔	NA	NA
Buffer stock	5%	4%-6%	Assumed	✔	✔	NA	NA
Administrative cost[e]	19.08	±20%	[43]	✔	✔	NA	NA
Delivery cost[f]	2.32	1.60-2.80	[44]	✔	✔	NA	NA
Vaccine campaign cost[g]	1.55	±20%	[45]	✔	✔	NA	NA

Note: Costs are converted to U.S. dollars at the average exchange rate of 1:6.5 in 2021.

HCS, healthcare sector perspective; SOC, societal perspective; TST, tuberculin skin test.

[a]Medical costs of TB diagnosis and treatment, including outpatient and inpatient expenses. Among new cases of tuberculosis, 5.7% patients have multidrug-resistant (MDR) tuberculosis.[36]

[b]Patients younger than 20 years would start working one year late because of their TB-related long-term sick leave. It would lead to productivity losses based on per capita GDP for one year.

[c]Patients older than 20 years would return to work from six months' TB-related sick leave. It would lead to productivity losses based on per capita GDP for a half year.

[d]Lifelong productivity loss due to premature death was calculated by per capita GDP × working years.

[e]Including total cost of administration, regular maintenance, low-value consumables and materials, immunization digital system maintenance.

[f]Assumed delivery costs per person immunised to be the same in mass campaign or routine settings.

[g]Variable cost per vaccinated individual through mass campaigns.

Table S14. Estimated Chinese life expectancy during 2024-50.

Year \ Age	0	1-4	5-9	10-14	15-19	20-24	25-29-	30-34	35-39	40-44	45-49
2024	78.9932	78.4306	74.5206	69.6048	64.6999	59.8128	54.9634	50.1392	45.3161	40.5043	35.7734
2025	79.1949	78.6196	74.7069	69.7886	64.8810	59.9911	55.1383	50.3104	45.4840	40.6690	35.9337
2026	79.3961	78.8087	74.8935	69.9728	65.0625	60.1700	55.3139	50.4824	45.6527	40.8345	36.0949
2027	79.5962	78.9968	75.0792	70.1561	65.2432	60.3479	55.4886	50.6536	45.8205	40.9992	36.2552
2028	79.7894	79.1786	75.2586	70.3333	65.4179	60.5200	55.6576	50.8190	45.9828	41.1585	36.4102
2029	79.9842	79.3619	75.4396	70.5120	65.5941	60.6936	55.8280	50.9859	46.1465	41.3191	36.5666
2030	80.1834	79.5504	75.6258	70.6961	65.7757	60.8727	56.0040	51.1584	46.3157	41.4852	36.7285
2031	80.3747	79.7316	75.8049	70.8731	65.9504	61.0450	56.1733	51.3243	46.4786	41.6451	36.8843
2032	80.5704	79.9172	75.9884	71.0545	66.1294	61.2216	56.3468	51.4945	46.6455	41.8090	37.0441
2033	80.7636	80.1009	76.1701	71.2343	66.3070	61.3968	56.5190	51.6634	46.8113	41.9718	37.2028
2034	80.9540	80.2823	76.3496	71.4119	66.4825	61.5700	56.6893	51.8304	46.9754	42.1329	37.3598
2035	81.1433	80.4625	76.5279	71.5884	66.6568	61.7420	56.8586	51.9964	47.1383	42.2929	37.5159
2036	81.3332	80.6437	76.7073	71.7660	66.8323	61.9153	57.0290	52.1637	47.3026	42.4543	37.6732
2037	81.5198	80.8223	76.8842	71.9412	67.0055	62.0863	57.1973	52.3289	47.4649	42.6137	37.8287
2038	81.7027	80.9972	77.0574	72.1127	67.1751	62.2539	57.3622	52.4907	47.6238	42.7698	37.9809
2039	81.8853	81.1722	77.2309	72.2846	67.3451	62.4219	57.5276	52.6532	47.7834	42.9266	38.1339
2040	82.0665	81.3460	77.4030	72.4552	67.5139	62.5887	57.6918	52.8145	47.9420	43.0823	38.2858
2041	82.2462	81.5205	77.5762	72.6269	67.6840	62.7569	57.8577	52.9775	48.1024	43.2401	38.4399
2042	82.4254	81.6935	77.7479	72.7973	67.8527	62.9238	58.0223	53.1394	48.2617	43.3968	38.5930
2043	82.5988	81.8612	77.9142	72.9623	68.0162	63.0857	58.1819	53.2965	48.4163	43.5489	38.7416
2044	82.7735	82.0299	78.0817	73.1285	68.1809	63.2486	58.3426	53.4546	48.5719	43.7020	38.8912
2045	82.9460	82.1969	78.2475	73.2930	68.3440	63.4101	58.5020	53.6115	48.7264	43.8541	39.0398
2046	83.1196	82.3653	78.4148	73.4591	68.5087	63.5732	58.6630	53.7702	48.8827	44.0081	39.1906
2047	83.2781	82.5193	78.5677	73.6110	68.6593	63.7224	58.8104	53.9154	49.0258	44.1490	39.3285
2048	83.4375	82.6744	78.7219	73.7641	68.8112	63.8730	58.9592	54.0620	49.1704	44.2915	39.4679
2049	83.5961	82.8287	78.8752	73.9165	68.9624	64.0228	59.1072	54.2079	49.3142	44.4332	39.6067
2050	83.7542	82.9828	79.0284	74.0686	69.1134	64.1725	59.2552	54.3539	49.4582	44.5751	39.7456

Year \ Age	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99	100
2024	31.1382	26.6707	22.3299	18.2895	14.5132	11.1370	8.1710	5.8222	4.0068	2.7111	2.0531
2025	31.2928	26.8171	22.4668	18.4122	14.6196	11.2239	8.2350	5.8653	4.0345	2.7262	2.0612
2026	31.4483	26.9644	22.6046	18.5358	14.7270	11.3125	8.3010	5.9105	4.0637	2.7431	2.0714
2027	31.6030	27.1109	22.7416	18.6587	14.8334	11.4002	8.3657	5.9548	4.0903	2.7584	2.0801
2028	31.7525	27.2526	22.8741	18.7774	14.9360	11.4847	8.4287	5.9975	4.1152	2.7729	2.0883
2029	31.9035	27.3955	23.0077	18.8972	15.0393	11.5694	8.4933	6.0403	4.1405	2.7875	2.0968
2030	32.0598	27.5438	23.1466	19.0220	15.1477	11.6589	8.5633	6.0877	4.1699	2.8051	2.107
2031	32.2103	27.6865	23.2801	19.1421	15.2519	11.7445	8.6306	6.1331	4.1978	2.8207	2.116
2032	32.3647	27.8328	23.4171	19.2654	15.3588	11.8321	8.6994	6.1794	4.2268	2.8359	2.1255
2033	32.5181	27.9784	23.5534	19.3881	15.4655	11.9197	8.7686	6.2273	4.2570	2.8520	2.1364
2034	32.6700	28.1226	23.6885	19.5099	15.5715	12.0068	8.8372	6.2761	4.2869	2.8678	2.1462

2035	32.8209	28.2658	23.8226	19.6306	15.6763	12.0927	8.9042	6.3243	4.3159	2.8832	2.1555
2036	32.9731	28.4104	23.9580	19.7526	15.7825	12.1799	8.9721	6.3737	4.3460	2.8995	2.1648
2037	33.1235	28.5533	24.0920	19.8734	15.8879	12.2668	9.0401	6.4235	4.3768	2.9176	2.1751
2038	33.2708	28.6934	24.2232	19.9916	15.9908	12.3512	9.1055	6.4707	4.4059	2.9334	2.1831
2039	33.4188	28.8341	24.3552	20.1107	16.0948	12.4371	9.1724	6.5194	4.4381	2.9510	2.1931
2040	33.5658	28.9740	24.4864	20.2291	16.1981	12.5221	9.2384	6.5666	4.4696	2.9674	2.202
2041	33.7153	29.1167	24.6208	20.3510	16.3050	12.6110	9.3082	6.6171	4.5041	2.9865	2.213
2042	33.8637	29.2584	24.7543	20.4721	16.4113	12.6996	9.3778	6.6673	4.5382	3.0052	2.2241
2043	34.0079	29.3961	24.8842	20.5902	16.5153	12.7865	9.4465	6.7169	4.5719	3.0247	2.2354
2044	34.1529	29.5346	25.0148	20.7088	16.6194	12.8731	9.5143	6.7651	4.6035	3.0433	2.2447
2045	34.2971	29.6724	25.1449	20.8273	16.7241	12.9608	9.5839	6.8154	4.6372	3.0648	2.2564
2046	34.4435	29.8127	25.2777	20.9487	16.8313	13.0508	9.6553	6.8670	4.6710	3.0860	2.2678
2047	34.5775	29.9410	25.3992	21.0597	16.9296	13.1333	9.7209	6.9144	4.7020	3.1053	2.2782
2048	34.7130	30.0708	25.5222	21.1727	17.0301	13.2184	9.7893	6.9647	4.7354	3.1264	2.2907
2049	34.8479	30.2001	25.6449	21.2853	17.1304	13.3033	9.8575	7.0149	4.7689	3.1473	2.3047
2050	34.9830	30.3296	25.7679	21.3985	17.2315	13.3893	9.9271	7.0667	4.8038	3.1687	2.3194

Source: Adapted from UN World Population Prospects (2022). Table "WPP2022_MORT_F07_1_ABRIDGED_LIFE_TABLE_BOTH_SEXE.csv" https://population.un.org/wpp/Download/Standard/Mortality/

Table S15. Cost-effectiveness for routine vaccination targeting different ages, with PSI vaccine conferring lifelong protection, from healthcare sector perspective.

Outcome \ Targeted age	15-year-olds[a]	30-year-olds[b]	45-year-olds[c]	60-year-olds[d]
DALY averted (million)	0.086	0.457	2.38	3.91
	(0.047, 0.195)	(0.292, 0.766)	(1.99, 3.19)	(3.23, 5.17)
CCA	25 888	9194	2763	1916
	(9738, 53 911)	(4805, 17 979)	(1387, 6670)	(851, 5066)
CDA	2 360 200	742 398	131 348	79 726
	(1 421 450, 4 740 227)	(496 862, 1 329 723)	(84 513, 278 157)	(46 048, 166 641)
ICER (vs. status quo)	46 036	19 990	6093	4234
	(23 974, 96 327)	(12 129, 38 229)	(3363, 13 574)	(2097, 9833)
ICER (vs. next best strategy)	46 036	19 990	6093	1161
	(23 974, 96 327)	(12 129, 38 229)	(3363, 13 574)	(-83, 3339)

PSI, postinfection vaccine efficacy; DALY, disability-adjusted life year; CCA, cost per case averted; CDA, cost per death averted; ICER, incremental cost-effectiveness ratio.

The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.

[a]15-y populations each year and catch-up 16-29 y populations in 2024;

[b]30-y populations each year and catch-up 31-44 y populations in 2024;

[c]45-y populations each year and catch-up 46-59 y populations in 2024;

[d]60-y populations each year and catch-up 61-74 y populations in 2024.

Data are presented as median and 95% CI.

Table S16. Cost-effectiveness for routine vaccination targeting different ages, with PSI vaccine conferring lifelong protection, from societal perspective.

Outcome \ Targeted age	15-year-olds[a]	30-year-olds[b]	45-year-olds[c]	60-year-olds[d]
DALY averted (million)	0.086	0.457	2.38	3.91
	(0.047, 0.195)	(0.292, 0.766)	(1.99, 3.19)	(3.23, 5.17)
CCA	19 883	5462	1489	1288
	(4577, 47 897)	(1151, 14 660)	(180, 5254)	(229, 4327)
CDA	1 805 691	441 869	68 675	50 796
	(698 362, 4 224 289)	(141 045, 1 059 995)	(10 765, 215 593)	(12 424, 142 094)
ICER (vs. status quo)	34 754	12 158	3214	2723
	(11 541, 85 430)	(3009, 31 122)	(429, 10 550)	(563, 8321)
ICER (vs. next best strategy)	34 754	12 158	1396	1590
	(11 541, 85 430)	(3009, 31 122)	(-580, 5969)	(-346, 5537)

PSI, postinfection vaccine efficacy; DALY, disability-adjusted life year; CCA, cost per case averted; CDA, cost per death averted; ICER, incremental cost-effectiveness ratio.

The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%

[a]15-y populations each year and catch-up 16-29 y populations in 2024;

[b]30-y populations each year and catch-up 31-44 y populations in 2024;

[c]45-y populations each year and catch-up 46-59 y populations in 2024;

[d]60-y populations each year and catch-up 61-74 y populations in 2024.

Data are presented as median and 95% CI.

Table S17. Predicted cost per case averted (CCA) and cost per death averted (CDA) for government-funded national Vaccae vaccination in China during 2024-50.

Strategy	CCA (US$ per case averted)		CDA (US$ per death averted)	
	Healthcare sector perspective	Societal perspective	Healthcare sector perspective	Societal perspective
Vaccae with 10-y protection				
PSI, Older adult routine	3479 (1755, 8061)	2667 (1021, 7117)	141 384 (94 617, 273 569)	106 166 (53 018, 241 756)
PSI, All age campaign	5696 (3295, 12 866)	4434 (2028, 11 283)	261 169 (188 127, 511 966)	197 446 (117 846, 444 729)
P&PI, Older adult routine	16 222 (10 667, 21 855)	15 400 (9653, 20 999)	666 674 (480 296, 807 299)	633 163 (435 756, 772 855)
P&PI, All age campaign	38 050 (23 987, 48 875)	36 352 (22 248, 47 165)	1 786 306 (1 317 462, 2 127 316)	1 701 795 (1 207 116, 2 040 491)
Vaccae with 20-y protection				
PSI, Older adult routine	2022 (915, 5279)	1376 (276, 4516)	83 733 (49 337, 173 388)	54 380 (14 948, 148 331)
PSI, All age campaign	3461 (1832, 8230)	2217 (640, 6738)	154 161 (104 098, 318 118)	95 101 (37 884, 256 750)
P&PI, Older adult routine	10 729 (7067, 14 907)	10 063 (6371, 14 182)	431 977 (313 866, 528 122)	401 246 (279 512, 500 423)
P&PI, All age campaign	23 797 (15 180, 30 735)	22 319 (13 538, 29 044)	1 101 463 (816 362, 1 301 968)	1 023 653 (730 065, 1 223 088)
Vaccae with lifelong protection				
PSI, Older adult routine	1916 (851, 5066)	1288 (229, 4327)	79 726 (46 048, 166 641)	50 796 (12 424, 142 094)
PSI, All age campaign	2300 (1112, 5693)	1085 (-13, 4251)	101 827 (63 003, 217 130)	46 613 (-873, 158 465)
P&PI, Older adult routine	10 337 (6783, 14 356)	9678 (6103, 13 647)	415 691 (303 075, 509 108)	384 653 (268 598, 481 432)
P&PI, All age campaign	14 823 (9429, 19 414)	13 453 (7907, 17 783)	687 647 (503 337, 814 516)	611 575 (429 758, 742 504)

PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy.

Data are presented as median and 95% CI.

Table S18. Cost-effectiveness for government-funded national Vaccae vaccination in China during 2024-50, from societal perspective.

Strategy	TB cases (million)		TB-related deaths (million)		Cost (US$ million)	DALY (million)		
No Vaccae (status quo)	45.59 (34.20, 74.18)		1.02 (0.87, 1.27)		133 712 (98 857, 213 263)	24.50 (20.73, 32.56)		
	TB cases averted		TB-related deaths averted		Incremental cost (US$ million)	DALY averted[a] (million)	ICER (US$ per DALY averted) relative	
	n (million)	%	n (million)	%			to status quo	to next best strategy[b]
Vaccae with 10-y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	5.30 (3.97, 7.93)	11.7 (9.4, 12.9)	0.13 (0.11, 0.17)	13.0 (11.9, 14.0)	13 847 (6983, 34 713)	2.79 (2.32, 3.67)	5006 (2206, 12 363)	5007 (2208, 12 364)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	7.61 (5.72, 11.29)	16.6 (14.0, 18.7)	0.19 (0.15, 0.26)	18.3 (17.0, 20.7)	117 395 (110 628, 120 194)	4.01 (3.32, 5.41)	29 215 (20 684, 36 216)	88 875 (48 350, 114 634)
PSI, All age (15-74 y, 10-yearly campaigns)	9.21 (7.03, 13.81)	20.1 (17.8, 21.4)	0.21 (0.17, 0.27)	20.3 (19.0, 21.6)	40 780 (23 942, 100 566)	4.46 (3.81, 5.96)	8844 (4580, 21 382)	15 906 (8272, 34 828)
P&PI, All age ((15-74 y, 10-yearly campaigns)	14.16 (11.08, 22.18)	31.1 (29.2, 33.6)	0.30 (0.25, 0.41)	30.0 (28.3, 32.5)	512 655 (490 891, 522 187)	7.05 (6.01, 9.63)	72 746 (51 390, 86 827)	113 745 (78 934, 142 254)
Vaccae with 20~y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	8.01 (5.82, 11.76)	17.7 (13.4, 20.0)	0.20 (0.17, 0.26)	20.0 (18.1, 21.6)	10 986 (2920, 32 096)	3.83 (3.16, 5.04)	2867 (668, 8548)	2868 (669, 8549)
PSI, All age (15-74 y, 20-yearly campaigns)	9.74 (7.40, 14.40)	21.2 (18.4, 22.6)	0.22 (0.18, 0.28)	21.8 (20.2, 23.1)	21 227 (8304, 62 093)	4.63 (3.91, 6.10)	4544 (1519, 12 823)	13 742 (4838, 34 489)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	11.27 (8.28, 16.54)	24.7 (19.9, 27.5)	0.28 (0.23, 0.38)	27.8 (25.7, 30.3)	112 940 (104 547, 117 279)	5.42 (4.44, 7.05)	20 856 (14 578, 26 372)	67 563 (38 753, 85 517)
P&PI, All age (15-74 y, 20-yearly campaigns)	14.93 (11.65, 22.97)	32.7 (30.6, 35.1)	0.32 (0.27, 0.43)	32.0 (30.4, 34.6)	329 527 (308 761, 338 883)	7.29 (6.22, 9.87)	45 505 (31 634, 54 248)	90 904 (59 682, 113 390)
Vaccae with lifelong protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	8.35 (6.05, 12.23)	18.4 (13.9, 20.9)	0.21 (0.17, 0.27)	20.8 (18.8, 22.5)	10 676 (2523, 31 861)	3.91 (3.23, 5.17)	2723 (563, 8321)	2724 (564, 8322)
PSI, All age (15-74 y, one campaign)	10.20 (7.68, 14.90)	22.0 (18.9, 23.6)	0.23 (0.19, 0.30)	22.8 (21.1, 24.2)	10 403 (-189, 40 783)	4.76 (3.99, 6.22)	2279 (-33, 8136)	1192 (-3699, 10 102)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	11.70 (8.58, 17.20)	25.7 (20.6, 28.6)	0.29 (0.24, 0.39)	28.8 (26.6, 31.5)	112 513 (103 948, 117 002)	5.55 (4.53, 7.20)	20 272 (14 196, 25 752)	132 713 (66 360, 291 444)
P&PI, All age (15-74 y, one campaign)	15.60 (12.1, 23.90)	33.9 (31.6, 36.5)	0.34 (0.29, 0.45)	33.4 (31.7, 36.2)	205 908 (185 311, 215 138)	7.45 (6.34, 10.07)	27 897 (18 728, 33 644)	70 759 (43 035, 91 977)

[a]Strategies were in ascending order of effectiveness; [b] WTP was set at 1 × national pGDP (US$12 458).

TB, tuberculosis. PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy; DALY, disability-adjusted life year.

ICER, incremental cost-effectiveness ratio, was calculated from societal perspective, with government contract price of US$30/dose, and costs and effectiveness discounted with 3% per year.

Data are presented as median and 95% CI.

Figure S8

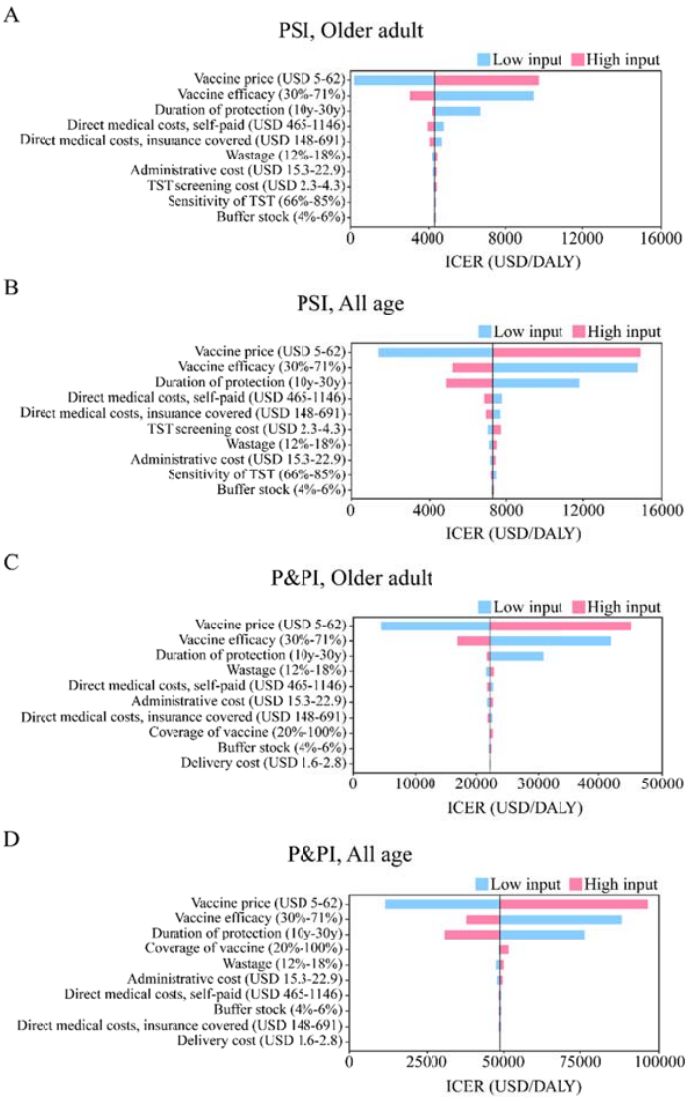

Figure S8. One-way sensitivity analyses compared with status quo, from healthcare sector perspective.

ICER, incremental cost effectiveness ratio; DALY, disability-adjusted life year.

Figure S9

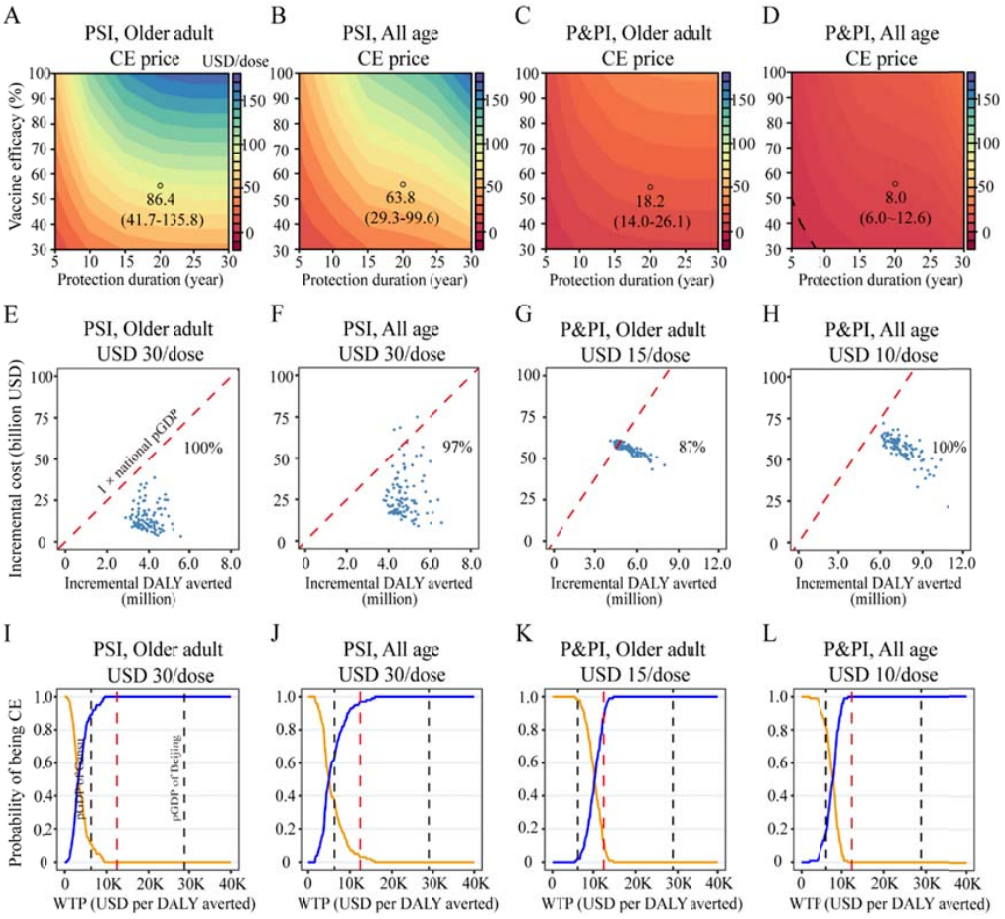

Figure S9. Cost-effectiveness analyses of Vaccae vaccination in China, from societal perspective. (A-D) Contour plots showing the cost-effective vaccine prices that lead to the incremental cost per DALY averted equal to 1 × GDP per capita, for specified vaccine efficacy and protection duration settings. The values below the dashed black line (D) denote that no price would be cost-effective. (E-H) Cost-effectiveness planes for vaccination strategies. (I-L) cost-effectiveness acceptability curves. PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy. CE, cost-effective; DALY, disability-adjusted life year; WTP willingness to pay; P&PI, both pre- and postinfection; K, thousand.

Figure S10

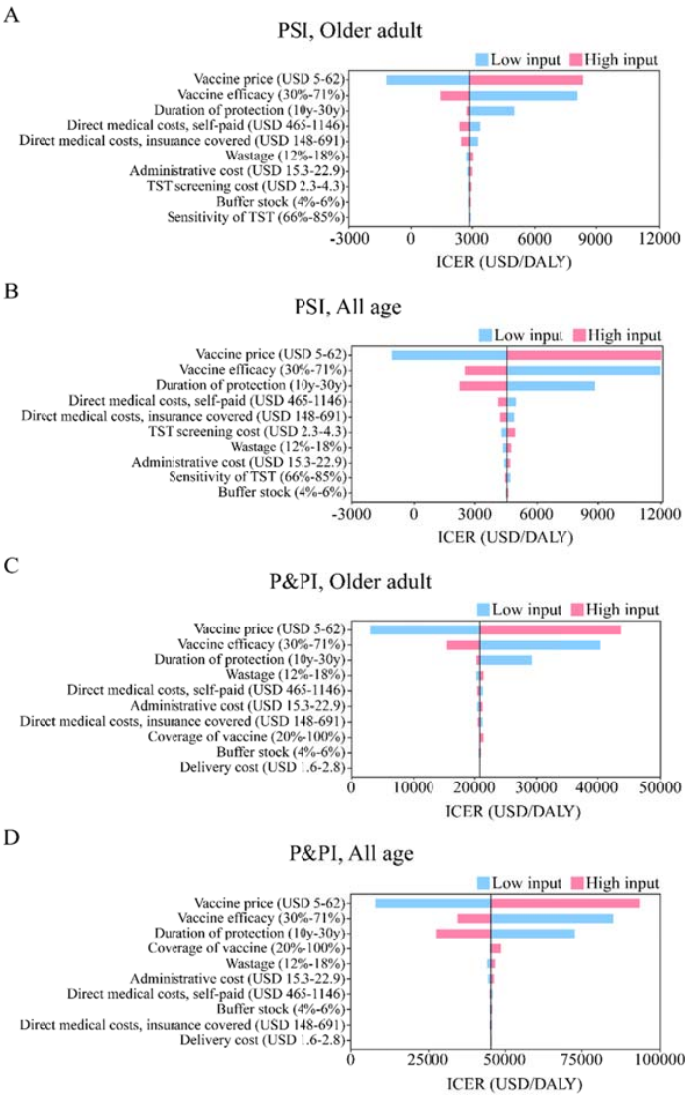

Figure S10. One-way sensitivity analyses compared with status quo, from societal perspective. ICER, incremental cost effectiveness ratio; DALY, disability-adjusted life year.

Figure S11

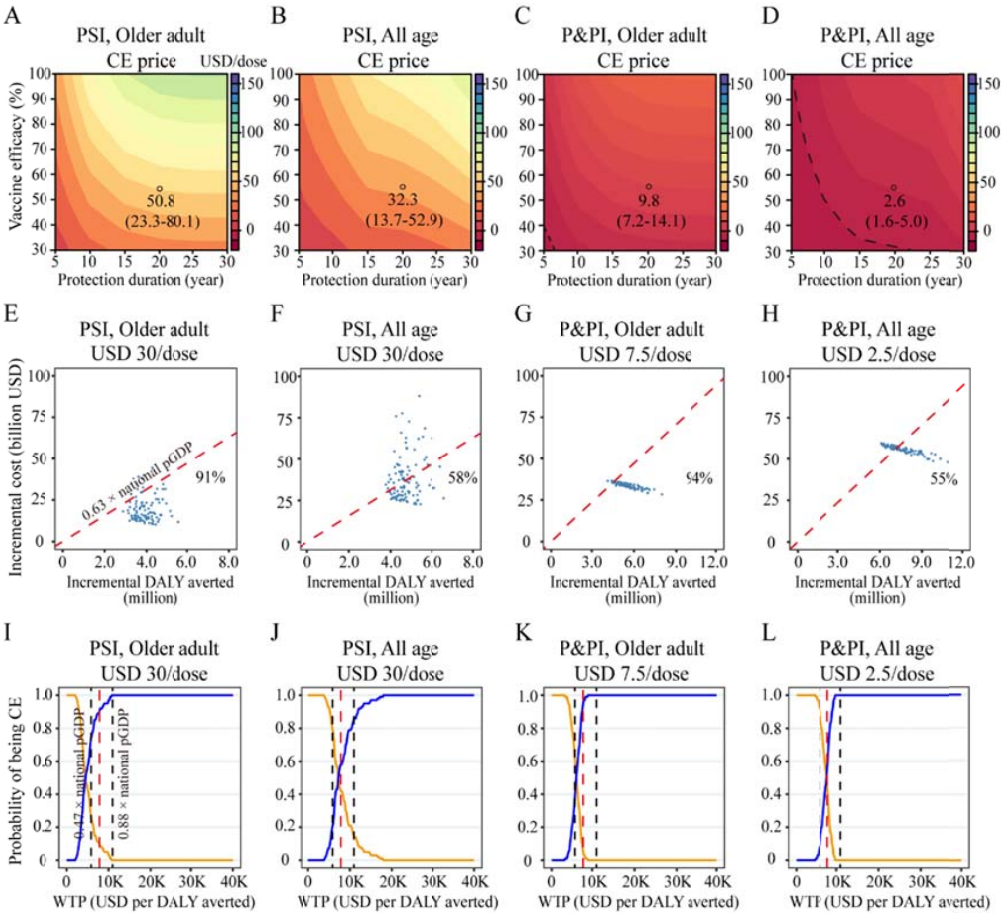

Figure S11. Cost-effectiveness analyses of Vaccae vaccination in China, from healthcare sector perspective (WTP=US$7849).

(A-D) Contour plots showing the cost-effective vaccine prices that lead to the incremental cost per DALY averted equal to 0.63 × GDP per capita, for specified vaccine efficacy and protection duration settings. The values below the dashed black line (D) denote that no price would be cost-effective. (E-H) Cost-effectiveness planes for vaccination strategies. (I-L) cost-effectiveness acceptability curves. PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy. CE, cost-effective; DALY, disability-adjusted life year; WTP willingness to pay; P&PI, both pre- and postinfection; K, thousand.

Figure S12

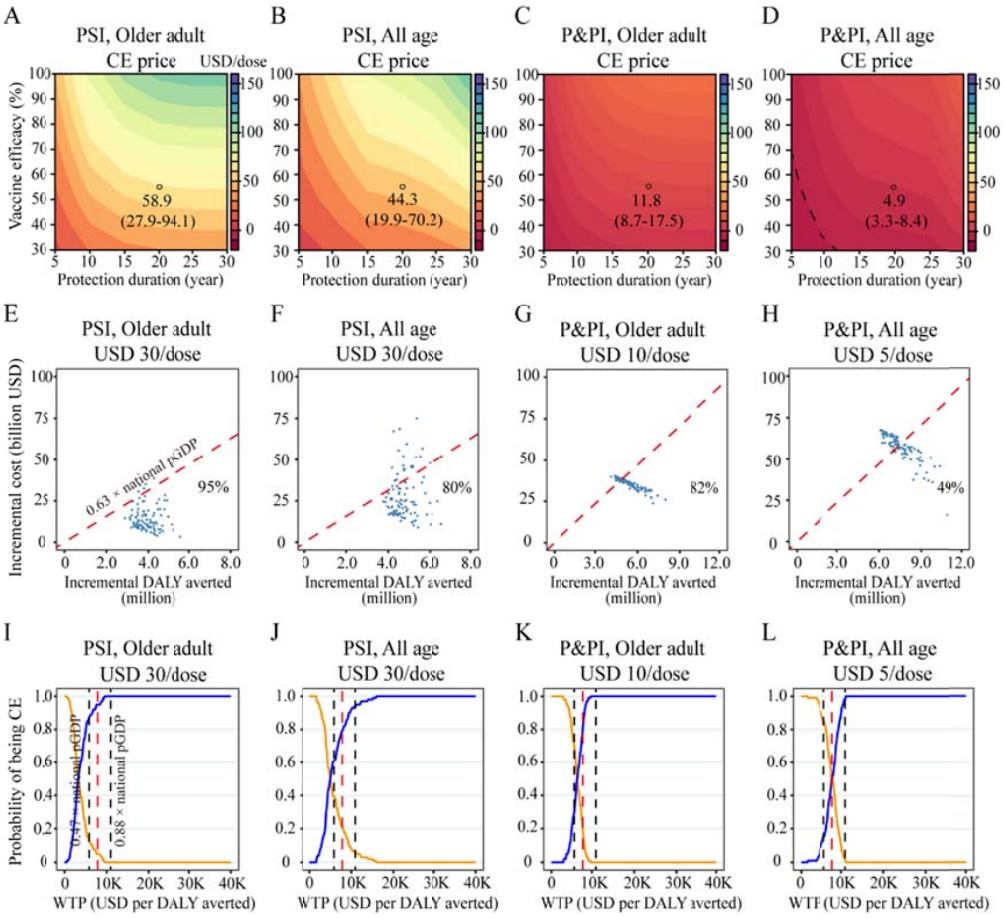

Figure S12. Cost-effectiveness analyses of Vaccae vaccination in China, from societal perspective (WTP=US$7849).

(A-D) Contour plots showing the cost-effective vaccine prices that lead to the incremental cost per DALY averted equal to 0.63 × GDP per capita, for specified vaccine efficacy and protection duration settings. The values below the dashed black line (D) denote that no price would be cost-effective. (E-H) Cost-effectiveness planes for vaccination strategies. (I-L) cost-effectiveness acceptability curves. PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy. CE, cost-effective; DALY, disability-adjusted life year; WTP willingness to pay; P&PI, both pre- and postinfection; K, thousand.

Table S19. Cost-effectiveness for vaccination with Vaccae provided through private market during 2024-50, from healthcare sector perspective.

Strategy	TB cases (million)		TB-related deaths (million)		Cost (US$ million)	DALY (million)		
No Vaccae (status quo)	45.587 (34.195, 74.175)		1.016 (0.869, 1.273)		40 352 (30 942, 64 094)	24.50 (20.73, 32.56)		
	TB cases averted		**TB-related deaths averted**		**Incremental cost**	**DALY averted[a]**	**ICER (US$ per DALY averted) relative**	
	n (million)	**%**	**n (million)**	**%**	**(US$ million)**	**(million)**	**to status quo**	**to next best strategy[b]**
Vaccae with 10-y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	1.184 (0.884, 1.767)	2.6 (2.1, 2.9)	0.029 (0.024, 0.038)	2.9 (2.6, 3.1)	6562 (4630, 13 750)	0.62 (0.52, 0.82)	10 826 (6619, 22 011)	10 826 (6619, 22 011)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	1.741 (1.300, 2.568)	3.8 (3.2, 4.3)	0.042 (0.035, 0.060)	4.2 (3.8, 4.8)	42 933 (42 228, 43 320)	0.91 (0.75, 1.25)	47 172 (33 909, 57 520)	132 474 (71 007, 173 982)
PSI, All age (15-74 y, 10-yearly campaigns)	2.056 (1.574, 3.077)	4.5 (4.0, 4.8)	0.046 (0.038, 0.060)	4.5 (4.2, 4.9)	18 166 (13 056, 38 752)	0.99 (0.85, 1.33)	18 116 (11 777, 37 267)	29 799 (20 083, 59 613)
P&PI, All age ((15-74 y, 10-yearly campaigns)	3.350 (2.618, 5.259)	7.4 (6.8, 8.2)	0.070 (0.059, 0.100)	7.0 (6.5, 7.8)	184 233 (182 639, 184 868)	1.68 (1.41, 2.32)	110 063 (78 982, 130 818)	165 285 (114 955, 206 126)
Vaccae with 20-y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	1.791 (1.299, 2.620)	3.9 (3.0, 4.5)	0.044 (0.037, 0.059)	4.4 (4.0, 4.8)	6194 (4088, 13 398)	0.85 (0.70, 1.12)	7407 (4234, 16 015)	7407 (4234, 16 015)
PSI, All age (15-74 y, 20-yearly campaigns)	2.171 (1.650, 3.209)	4.7 (4.1, 5.0)	0.049 (0.041, 0.063)	4.9 (4.5, 5.2)	11 797 (8 200, 25 807)	1.03 (0.87, 1.36)	11 534 (7084, 24 422)	31 483 (18 855, 62 172)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	2.557 (1.881, 3.745)	5.6 (4.5, 6.4)	0.063 (0.053, 0.087)	6.3 (5.8, 7.0)	42 360 (41 403, 42 916)	1.23 (1.01, 1.64)	34 405 (25 402, 42 518)	101 586 (55 514, 129 075)
P&PI, All age (15-74 y, 20-yearly campaigns)	3.487 (2.738, 5.414)	7.7 (7.2, 8.5)	0.075 (0.063, 0.104)	7.4 (7.0, 8.3)	121 992 (120 404, 122 620)	1.72 (1.45, 2.36)	71 104 (51 218, 84 245)	132 758 (86 502, 165 164)
Vaccae with lifelong protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	1.862 (1.349, 2.726)	4.1 (3.1, 4.7)	0.046 (0.038, 0.061)	4.6 (4.2, 5.0)	6156 (4025, 13 363)	0.87 (0.72, 1.15)	7172 (4052, 15 642)	7172 (4052, 15 642)
PSI, All age (15-74 y, one campaign)	2.266 (1.710, 3.314)	4.9 (4.2, 5.3)	0.051 (0.043, 0.066)	5.1 (4.7, 5.4)	8434 (5654, 18 596)	1.06 (0.89, 1.39)	8076 (4730, 17 227)	13 005 (7153, 25 576)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	2.663 (1.950, 3.888)	5.8 (4.7, 6.6)	0.065 (0.055, 0.090)	6.5 (6.0, 7.3)	42 297 (41 317, 42 874)	1.26 (1.03, 1.67)	33 643 (24 901, 41 590)	99 767 (54 639, 126 140)
P&PI, All age (15-74 y, one campaign)	3.625 (2.834, 5.586)	7.9 (7.4, 8.7)	0.078 (0.066, 0.107)	7.7 (7.3, 8.6)	79 989 (78 403, 80 632)	1.75 (1.48, 2.40)	45 884 (32 952, 54 297)	83 140 (52 900, 104 211)

[a]Strategies were in ascending order of effectiveness; [b] WTP was set at 1 × national pGDP (US$12 458).

TB, tuberculosis. PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy. DALY, disability-adjusted life year;

ICER, incremental cost-effectiveness ratio, was calculated from healthcare sector perspective, with government contract price of US$62/dose, coverage 20%, efficacy 54.7%, and costs and effectiveness discounted with 3% per year.

Data are presented as median and 95% CI.

Table S20. Cost-effectiveness for vaccination with Vaccae provided through private market during 2024-50, from societal perspective.

Strategy	TB cases (million)		TB-related deaths (million)		Cost (US$ million)	DALY (million)		
No Vaccae (status quo)	45.587 (34.195, 74.175)		1.016 (0.869-1.273)		133 712 (98 857, 213 263)	24.50 (20.73, 32.56)		
	TB cases averted		**TB-related deaths averted**		**Incremental cost**	**DALY averted[a]**	**ICER (US$ per DALY averted) relative**	
	n (million)	**%**	**n (million)**	**%**	**(US$ million)**	**(million)**	**to status quo**	**to next best strategy[b]**
Vaccae with 10-y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	1.184 (0.884, 1.767)	2.6 (2.1, 2.9)	0.029 (0.024, 0.038)	2.9 (2.6, 3.1)	5637 (3511, 12 728)	0.62 (0.52, 0.82)	9239 (4980, 20 279)	9239 (4980, 20 279)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	1.741 (1.300, 2.568)	3.8 (3.2, 4.3)	0.042 (0.035, 0.060)	4.2 (3.8, 4.8)	41 590 (40 046, 42 235)	0.91 (0.75, 1.25)	45 582 (32 221, 56 062)	130 953 (68 809, 172 430)
PSI, All age (15-74 y, 10-yearly campaigns)	2.056 (1.574, 3.077)	4.5 (4.0, 4.8)	0.046 (0.038, 0.060)	4.5 (4.2, 4.9)	15 614 (10 068, 35 859)	0.99 (0.85, 1.33)	15 143 (8 912, 34 072)	26 152 (14 978, 54 281)
P&PI, All age ((15-74 y, 10-yearly campaigns)	3.350 (2.618, 5.259)	7.4 (6.8, 8.2)	0.070 (0.059, 0.100)	7.0 (6.5, 7.8)	177 733 (172 375, 180 092)	1.68 (1.41, 2.32)	106 384 (75 356, 127 448)	160 257 (110 072, 201 494)
Vaccae with 20-y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	1.791 (1.299, 2.620)	3.9 (3.0, 4.5)	0.044 (0.037, 0.059)	4.4 (4.0, 4.8)	5009 (2628, 12 143)	0.85 (0.70, 1.12)	6034 (2703, 14 453)	6034 (2703, 14 453)
PSI, All age (15-74 y, 20-yearly campaigns)	2.171 (1.650, 3.209)	4.7 (4.1, 5.0)	0.049 (0.041, 0.063)	4.9 (4.5, 5.2)	9187 (5228, 22 987)	1.03 (0.87, 1.36)	8718 (4400, 21 380)	24 140 (10 832, 54 651)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	2.557 (1.881, 3.745)	5.6 (4.5, 6.4)	0.063 (0.053, 0.087)	6.3 (5.8, 7.0)	40 572 (38 668, 41 556)	1.23 (1.01, 1.64)	32 900 (23 504, 41 173)	100 041 (54 003, 127 654)
P&PI, All age (15-74 y, 20-yearly campaigns)	3.487 (2.738, 5.414)	7.7 (7.2, 8.5)	0.075 (0.063, 0.104)	7.4 (7.0, 8.3)	115 640 (110 519, 117 962)	1.72 (1.45, 2.36)	67 775 (47 775, 81 088)	126 728 (81 371, 159 993)
Vaccae with lifelong protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	1.862 (1.349, 2.726)	4.1 (3.1, 4.7)	0.046 (0.038, 0.061)	4.6 (4.2, 5.0)	4950 (2539, 12 091)	0.87 (0.72, 1.15)	5823 (2548, 14 113)	5823 (2548, 14 113)
PSI, All age (15-74 y, one campaign)	2.266 (1.710, 3.314)	4.9 (4.2, 5.3)	0.051 (0.043, 0.066)	5.1 (4.7, 5.4)	5608 (2545, 15 793)	1.06 (0.89, 1.39)	5298 (2064, 14 254)	5310 (-809, 18 217)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	2.663 (1.950, 3.888)	5.8 (4.7, 6.6)	0.065 (0.055, 0.090)	6.5 (6.0, 7.3)	40 474 (38 533, 41 494)	1.26 (1.03, 1.67)	32 185 (23 018, 40 252)	182 312 (79 099, 369 943)
P&PI, All age (15-74 y, one campaign)	3.625 (2.834, 5.586)	7.9 (7.4, 8.7)	0.078 (0.066, 0.107)	7.7 (7.3, 8.6)	73 702 (68 627, 75 991)	1.75 (1.48, 2.40)	42 647 (29 351, 51 128)	102 746 (61 233, 131 809)

[a]Strategies were in ascending order of effectiveness; [b] WTP was set at 1 × national pGDP (US$12 458).

TB, tuberculosis. PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy. DALY, disability-adjusted life year; ICER, incremental cost-effectiveness ratio.

ICER, incremental cost-effectiveness ratio, was calculated from societal perspective, with government contract price of US$62/dose, coverage 20%, efficacy 54.7%, and costs and effectiveness discounted with 3% per year.

Data are presented as median and 95% CI.

Table S21. Cost-effectiveness for government-funded national Vaccae vaccination in China during 2024-2100, from healthcare sector perspective.

Strategy	TB cases (million)		TB-related deaths (million)		Cost (US$ million)	DALY (million)		
No Vaccae (status quo)	76.17 (56.03, 124.34)		1.81 (1.49, 2.57)		51 218 (39 381, 82 293)	30.88 (25.80, 42.59)		
	TB cases averted		TB-related deaths averted		Incremental cost (US$ million)	DALY averted[a] (million)	ICER (US$ per DALY averted) relative	
	n (million)	%	n (million)	%			to status quo	to next best strategy[b]
Vaccae with 10-y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	9.13 (6.54, 14.43)	11.9 (10.6, 13.0)	0.23 (0.18, 0.35)	12.5 (11.6, 13.7)	19 304 (12 311, 42 765)	3.75 (2.98, 4.98)	5295 (3018, 10 803)	5295 (3018, 10 803)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	13.37 (9.49, 21.23)	17.0 (15.2, 19.8)	0.32 (0.25, 0.53)	17.9 (16.2, 21.2)	160 025 (155 561, 162 340)	5.38 (4.29, 7.80)	29 864 (20 075, 37 750)	90 258 (46 592, 121 236)
PSI, All age (15-74 y, 10-yearly campaigns)	18.18 (13.63, 29.55)	23.9 (22.3, 26.3)	0.43 (0.34, 0.66)	24.1 (22.5, 26.3)	59 428 (41 405, 129 799)	6.53 (5.42, 9.31)	9071 (5824, 17 877)	13 797 (9226, 26 202)
P&PI, All age (15-74 y, 10-yearly campaigns)	28.52 (20.83, 46.83)	37.1 (33.5, 42.2)	0.65 (0.49, 1.04)	35.8 (32.4, 41.0)	741 389 (731 250, 745 372)	10.32 (8.37, 14.75)	71 795 (49 733, 89 069)	110 146 (72 226, 139 828)
Vaccae with 20~y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	15.83 (11.15, 24.42)	20.7 (17.0, 22.6)	0.41 (0.32, 0.60)	22.3 (20.7, 24.1)	16 317 (7983, 39 749)	5.62 (4.47, 7.56)	2929 (1271, 6796)	2929 (1271, 6796)
PSI, All age (15-74 y, 20-yearly campaigns)	19.85 (14.55, 31.24)	25.9 (23.6, 27.9)	0.48 (0.38, 0.72)	26.4 (24.9, 28.7)	32 986 (20 613, 77 047)	6.88 (5.64, 9.62)	4854 (2727, 10 259)	13 265 (8216, 23 840)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	22.20 (15.47, 33.99)	28.6 (25.0, 32.2)	0.56 (0.44, 0.88)	31.0 (28.6, 35.0)	155 575 (149 251, 159 315)	7.91 (6.25, 11.04)	19 540 (13 652, 25 431)	64 708 (34 739, 83 182)
P&PI, All age (15-74 y, 20-yearly campaigns)	30.53 (22.54, 49.81)	39.7 (36.7, 44.3)	0.71 (0.54, 1.11)	39.2 (36.1, 44.0)	426 086 (415 732, 430 257)	10.75 (8.74, 15.40)	39 636 (27 247, 49 150)	79 546 (49 625, 102 675)
Vaccae with lifelong protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	19.19 (13.66, 29.74)	25.4 (20.4, 27.8)	0.50 (0.39, 0.74)	27.6 (25.3, 29.7)	14 866 (6280, 38 627)	6.20 (4.94, 8.40)	2443 (897, 6014)	2443 (897, 6014)
PSI, All age (15-74 y, one campaign)	20.00 (14.33, 29.89)	25.8 (22.6, 27.4)	0.48 (0.38, 0.69)	26.6 (24.6, 28.2)	19 837 (9708, 49 676)	6.88 (5.66, 9.33)	2902 (1248, 6747)	7608 (3233, 22 857)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	26.97 (18.72, 40.56)	34.7 (29.4, 38.9)	0.68 (0.53, 1.06)	37.8 (35.2, 41.7)	154 000 (146 780, 158 189)	8.77 (6.86, 12.02)	17 529 (12 390, 22 988)	77 414 (40 126, 128 296)
P&PI, All age (15-74 y, one campaign)	31.42 (23.36, 50.85)	41.0 (38.6, 44.3)	0.75 (0.60, 1.15)	41.3 (39.3, 45.1)	225 601 (215 014, 229 941)	10.98 (8.97, 15.54)	20 615 (14 111, 25 691)	51 295 (29 509, 66 179)

[a]Strategies were in ascending order of effectiveness; [b] WTP was set at 1 × national pGDP (US$12 458).

TB, tuberculosis. PSI, post-infection vaccine efficacy; P&PI, both pre- and post-infection vaccine efficacy; DALY, disability-adjusted life year.

ICER, incremental cost-effectiveness ratio, was calculated from healthcare sector perspective, with government contract price of US$30/dose, and costs and effectiveness discounted with 3% per year.

Data are presented as median and 95%CI.

Table S22. Cost-effectiveness for government-funded national Vaccae vaccination in China during 2024-2100, from societal perspective.

Strategy	TB cases (million)		TB-related deaths (million)		Cost (US$ million)	DALY (million)		
No Vaccae (status quo)	76.17 (56.03, 124.34)		1.81 (1.49, 2.57)		156 976 (115 565, 254 394)	30.88 (25.80, 42.59)		
	TB cases averted		**TB-related deaths averted**		**Incremental cost (US$ million)**	**DALY averted[a] (million)**	**ICER (US$ per DALY averted) relative**	
	n (million)	**%**	**n (million)**	**%**			**to status quo**	**to next best strategy[b]**
Vaccae with 10-y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	9.13 (6.54, 14.43)	11.9 (10.6, 13.0)	0.23 (0.18, 0.35)	12.5 (11.6, 13.7)	13 052 (5105, 36 279)	3.75 (2.98, 4.98)	3534 (1208, 9014)	3534 (1208, 9014)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	13.37 (9.49, 21.23)	17.0 (15.2, 19.8)	0.32 (0.25, 0.53)	17.9 (16.2, 21.2)	151 774 (142 138, 156 052)	5.38 (4.29, 7.80)	28 283 (18 361, 36 288)	88 559 (44 420, 119 694)
PSI, All age (15-74 y, 10-yearly campaigns)	18.18 (13.63, 29.55)	23.9 (22.3, 26.3)	0.43 (0.34, 0.66)	24.1 (22.5, 26.3)	42 566 (22 749, 112 134)	6.53 (5.42, 9.31)	6452 (3087, 15 023)	10 396 (4965, 22 102)
P&PI, All age ((15-74 y, 10-yearly campaigns)	28.52 (20.83, 46.83)	37.1 (33.5, 42.2)	0.65 (0.49, 1.04)	35.8 (32.4, 41.0)	707 892 (676 638, 721 571)	10.32 (8.37, 14.75)	68 862 (46 913, 86 253)	182 057 (104 150, 245 102)
Vaccae with 20~y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	15.83 (11.15, 24.42)	20.7 (17.0, 22.6)	0.41 (0.32, 0.60)	22.3 (20.7, 24.1)	7 713 (-2168, 31 098)	5.62 (4.47, 7.56)	1437 (-337, 5206)	1437 (-337, 5206)
PSI, All age (15-74 y, 20-yearly campaigns)	19.85 (14.55, 31.24)	25.9 (23.6, 27.9)	0.48 (0.38, 0.72)	26.4 (24.9, 28.7)	16 115 (1208, 59 652)	6.88 (5.64, 9.62)	2358 (158, 7554)	7416 (1747, 18 458)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	22.20 (15.47, 33.99)	28.6 (25.0, 32.2)	0.56 (0.44, 0.88)	31.0 (28.6, 35.0)	144 674 (131 268, 150 821)	7.91 (6.25, 11.04)	18 101 (11 870, 24 106)	139 445 (55 287, 339 652)
P&PI, All age (15-74 y, 20-yearly campaigns)	30.53 (22.54, 49.81)	39.7 (36.7, 44.3)	0.71 (0.54, 1.11)	39.2 (36.1, 44.0)	393 428 (363 006, 406 491)	10.75 (8.74, 15.4)	36 815 (24 278, 46 385)	100 031 (56 424, 133 169)
Vaccae with lifelong protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	19.19 (13.66, 29.74)	25.4 (20.4, 27.8)	0.50 (0.39, 0.74)	27.6 (25.3, 29.7)	5837 (-4808, 29 326)	6.20 (4.94, 8.40)	949 (-672, 4458)	949 (-672, 4458)
PSI, All age (15-74 y, one campaign)	20.00 (14.33, 29.89)	25.8 (22.6, 27.4)	0.48 (0.38, 0.69)	26.6 (24.6, 28.2)	3635 (-9571, 32 916)	6.88 (5.66, 9.33)	562 (-1180, 4269)	-1834 (-6869, 9793)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	26.97 (18.72, 40.56)	34.7 (29.4, 38.9)	0.68 (0.53, 1.06)	37.8 (35.2, 41.7)	141 812 (127 274, 149 072)	8.77 (6.86, 12.02)	16 165 (10 529, 21 685)	78 226 (40 480, 132 363)
P&PI, All age (15-74 y, one campaign)	31.42 (23.36, 50.85)	41.0 (38.6, 44.3)	0.75 (0.60, 1.15)	41.3 (39.3, 45.1)	194 265 (165 984, 206 263)	10.98 (8.97, 15.54)	17 828 (11 103, 22 734)	47 319 (25 913, 62 738)

[a]Strategies were in ascending order of effectiveness; [b] WTP was set at 1 × national pGDP (US$12 458).

TB, tuberculosis. PSI, post-infection vaccine efficacy; P&PI, both pre- and post-infection vaccine efficacy; DALY, disability-adjusted life year.

ICER, incremental cost-effectiveness ratio, was calculated from societal perspective, with government contract price of US$30/dose, and costs and effectiveness discounted with 3% per year.

Data are presented as median and 95% CI.

Table S23. Cost-effectiveness for government-funded national Vaccae vaccination in China during 2024-50, from healthcare sector perspective (WTP=US$7849).

Strategy	TB cases (million)		TB-related deaths (million)		Cost (US$ million)	DALY (million)		
No Vaccae (status quo)	45.59 (34.20, 74.18)		1.02 (0.87, 1.27)		40 352 (30 942, 64 094)	24.5 (20.7, 32.6)		
	TB cases averted		**TB-related deaths averted**		**Incremental cost**	**DALY averted[a]**	**ICER (US$ per DALY averted) relative**	
	n (million)	**%**	**n (million)**	**%**	**(US$ million)**	**(million)**	**to status quo**	**to next best strategy[b]**
Vaccae with 10-y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	5.30 (3.97, 7.93)	11.7 (9.4, 12.9)	0.13 (0.11, 0.17)	13.0 (11.9, 14.0)	18 305 (12 172, 39 281)	2.79 (2.32, 3.67)	6723 (3829, 14 098)	6723 (3829, 14 098)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	7.61 (5.72, 11.29)	16.6 (14.0, 18.7)	0.19 (0.15, 0.26)	18.3 (17.0, 20.7)	123 403 (120 282, 125 036)	4.01 (3.32, 5.41)	30 797 (22 387, 37 671)	90 458 (50 443, 116 174)
PSI, All age (15-74 y, 10-yearly campaigns)	9.21 (7.03, 13.81)	20.1 (17.8, 21.4)	0.21 (0.17, 0.27)	20.3 (19.0, 21.6)	52 908 (37 527, 113 380)	4.46 (3.81, 5.96)	11 815 (7506, 24 567)	20 135 (13 367, 40 165)
P&PI, All age ((15-74 y, 10-yearly campaigns)	14.16 (11.08, 22.18)	31.1 (29.2, 33.6)	0.30 (0.25, 0.41)	30.0 (28.3, 32.5)	538 652 (532 094, 541 311)	7.05 (6.01, 9.63)	76 430 (55 350, 89 932)	118 681 (84 464, 146 564)
Vaccae with 20-y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	8.01 (5.82, 11.76)	17.7 (13.4, 20.0)	0.20 (0.17, 0.26)	20.0 (18.1, 21.6)	16 715 (9539, 37 704)	3.83 (3.16, 5.04)	4387 (2217, 10 085)	4387 (2217, 10 085)
PSI, All age (15-74 y, 20-yearly campaigns)	9.74 (7.40, 14.40)	21.2 (18.4, 22.6)	0.22 (0.18, 0.28)	21.8 (20.2, 23.1)	33 663 (22 432, 74 632)	4.63 (3.91, 6.10)	7315 (4259, 15 860)	21 450 (12 797, 42 019)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	11.27 (8.28, 16.54)	24.7 (19.9, 27.5)	0.28 (0.23, 0.38)	27.8 (25.7, 30.3)	120 883 (116 642, 123 262)	5.42 (4.44, 7.05)	22 205 (16 616, 27 715)	69 036 (40 418, 86 908)
P&PI, All age (15-74 y, 20-yearly campaigns)	14.93 (11.65, 22.97)	32.7 (30.6, 35.1)	0.32 (0.27, 0.43)	32.0 (30.4, 34.6)	355 192 (348 620, 357 923)	7.29 (6.22, 9.87)	48 746 (35 414, 57 384)	96 300 (65 229, 118 322)
Vaccae with lifelong protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	8.35 (6.05, 12.23)	18.4 (13.9, 20.9)	0.21 (0.17, 0.27)	20.8 (18.8, 22.5)	16 556 (9263, 37 547)	3.91 (3.23, 5.17)	4234 (2097, 9833)	4234 (2097, 9833)
PSI, All age (15-74 y, one campaign)	10.20 (7.68, 14.90)	22.0 (18.9, 23.6)	0.23 (0.19, 0.30)	22.8 (21.1, 24.2)	23 204 (14 279, 53 276)	4.76 (3.99, 6.22)	4933 (2644, 11 071)	8788 (4675, 17 409)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	11.70 (8.58, 17.20)	25.7 (20.6, 28.6)	0.29 (0.24, 0.39)	28.8 (26.6, 31.5)	120 639 (116 258, 123 078)	5.55 (4.53, 7.20)	21 667 (16 207, 27 089)	67 664 (39 862, 85 144)
P&PI, All age (15-74 y, one campaign)	15.60 (12.10, 23.90)	33.9 (31.6, 36.5)	0.34 (0.29, 0.45)	33.4 (31.7, 36.2)	231 423 (224 826, 234 259)	7.45 (6.34, 10.07)	31 091 (22 428, 36 845)	59 694 (39 583, 73 943)

[a]Strategies were in ascending order of effectiveness; [b] WTP was set at 0.63 × national pGDP (US$7849).

TB, tuberculosis. PSI, post-infection vaccine efficacy; P&PI, both pre- and post-infection vaccine efficacy; DALY, disability-adjusted life year.

ICER, incremental cost-effectiveness ratio, was calculated from healthcare sector perspective, with government contract price of US$ 30, and costs and effectiveness discounted with 3% per year. WTP was set at 0.63 × GDP per capita.

Data are presented as median and 95% CI.

Table S24. Cost-effectiveness for government-funded national Vaccae vaccination in China during 2024-50, from societal perspective (WTP=US$7849).

Strategy	TB cases (million)		TB-related deaths (million)		Cost (US$ million)	DALY (million)		
No Vaccae (status quo)	45.59 (34.20, 74.18)		1.02 (0.87, 1.27)		133 712 (98 857, 213 263)	24.50 (20.73, 32.56)		
	TB cases averted		TB-related deaths averted		Incremental cost (US$ million)	DALY averted[a] (million)	ICER (US$ per DALY averted) relative	
	n (million)	%	n (million)	%			to status quo	to next best strategy[b]
Vaccae with 10-y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	5.30 (3.97, 7.93)	11.7 (9.4, 12.9)	0.13 (0.11, 0.17)	13.0 (11.9, 14.0)	13 847 (6983, 34 713)	2.79 (2.32, 3.67)	5006 (2206, 12 363)	5007 (2208, 12 364)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	7.61 (5.72, 11.29)	16.6 (14.0, 18.7)	0.19 (0.15, 0.26)	18.3 (17.0, 20.7)	117 395 (110 628, 120 194)	4.01 (3.32, 5.41)	29 215 (20 684, 36 216)	88 875 (48 350, 114 634)
PSI, All age (15-74 y, 10-yearly campaigns)	9.21 (7.03, 13.81)	20.1 (17.8, 21.4)	0.21 (0.17, 0.27)	20.3 (19.0, 21.6)	40 780 (23 942, 100 566)	4.46 (3.81, 5.96)	8844 (4580, 21 382)	15 906 (8272, 34 828)
P&PI, All age ((15-74 y, 10-yearly campaigns)	14.16 (11.08, 22.18)	31.1 (29.2, 33.6)	0.30 (0.25, 0.41)	30.0 (28.3, 32.5)	512 655 (490 891, 522 187)	7.05 (6.01, 9.63)	72 746 (51 390, 86 827)	113 745 (78 934, 142 254)
Vaccae with 20~y protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	8.01 (5.82, 11.76)	17.7 (13.4, 20.0)	0.20 (0.17, 0.26)	20.0 (18.1, 21.6)	10 986 (2920, 32 096)	3.83 (3.16, 5.04)	2867 (668, 8548)	2868 (669, 8549)
PSI, All age (15-74 y, 20-yearly campaigns)	9.74 (7.40, 14.40)	21.2 (18.4, 22.6)	0.22 (0.18, 0.28)	21.8 (20.2, 23.1)	21 227 (8304, 62 093)	4.63 (3.91, 6.10)	4544 (1519, 12 823)	13 742 (4838, 34 489)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	11.27 (8.28, 16.54)	24.7 (19.9, 27.5)	0.28 (0.23, 0.38)	27.8 (25.7, 30.3)	112 940 (104 547, 117 279)	5.42 (4.44, 7.05)	20 856 (14 578, 26 372)	67 563 (38 753, 85 517)
P&PI, All age (15-74 y, 20-yearly campaigns)	14.93 (11.65, 22.97)	32.7 (30.6, 35.1)	0.32 (0.27, 0.43)	32.0 (30.4, 34.6)	329 527 (308 761, 338 883)	7.29 (6.22, 9.87)	45 505 (31 634, 54 248)	90 904 (59 682, 113 390)
Vaccae with lifelong protection								
PSI, Older adult (60-y routine + 61-74 y catch-up)	8.35 (6.05, 12.23)	18.4 (13.9, 20.9)	0.21 (0.17, 0.27)	20.8 (18.8, 22.5)	10 676 (2523, 31 861)	3.91 (3.23, 5.17)	2723 (563, 8321)	2724 (564, 8322)
PSI, All age (15-74 y, one campaign)	10.20 (7.68, 14.90)	22.0 (18.9, 23.6)	0.23 (0.19, 0.30)	22.8 (21.1, 24.2)	10 403 (-189, 40 783)	4.76 (3.99, 6.22)	2279 (-33, 8136)	1192 (-3699, 10 102)
P&PI, Older adult (60-y routine + 61-74 y catch-up)	11.70 (8.58, 17.20)	25.7 (20.6, 28.6)	0.29 (0.24, 0.39)	28.8 (26.6, 31.5)	112 513 (103 948, 117 002)	5.55 (4.53, 7.20)	20 272 (14 196, 25 752)	132 713 (66 360, 291 444)
P&PI, All age (15-74 y, one campaign)	15.60 (12.1, 23.90)	33.9 (31.6, 36.5)	0.34 (0.29, 0.45)	33.4 (31.7, 36.2)	205 908 (185 311, 215 138)	7.45 (6.34, 10.07)	27 897 (18 728, 33 644)	70 759 (43 035, 91 977)

[a]Strategies were in ascending order of effectiveness; [b] WTP was set at 0.63 × national pGDP (US$7849).

TB, tuberculosis. PSI, post-infection vaccine efficacy; P&PI, both pre- and post-infection vaccine efficacy; DALY, disability-adjusted life year.

ICER, incremental cost-effectiveness ratio, was calculated from societal perspective, with government contract price of US$30/dose, and costs and effectiveness discounted with 3% per year. Data are presented as median and 95%CI.

Table S25. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with PSI vaccine conferring 10-y protection, from healthcare sector perspective.

Year	Screened population[a] (million)	Vaccinated population (million)	Vaccination program budget[b] (US$ million)	Direct medical costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted					
2024	216.46 (216.18, 216.63)	40.15 (31.77, 75.75)	10 303 (8277, 18 906)	12.9 (9.03, 19.0)	10 291 (8265, 18 896)
2025	22.12 (22.09, 22.13)	3.50 (2.67, 6.90)	906 (707, 1729)	62.0 (44.0, 91.7)	846 (627, 1677)
2026	21.73 (21.71, 21.74)	3.35 (2.55, 6.67)	870 (677, 1673)	107 (76.9, 160)	768 (538, 1582)
2027	20.65 (20.63, 20.66)	3.11 (2.36, 6.24)	808 (627, 1565)	150 (108, 223)	668 (433, 1436)
2028	23.88 (23.86, 23.89)	3.51 (2.65, 7.09)	914 (706, 1780)	191 (138, 284)	733 (459, 1616)
2029	23.62 (23.60, 23.63)	3.39 (2.55, 6.90)	884 (680, 1732)	231 (165, 342)	659 (381, 1533)
2030	24.36 (24.33, 24.37)	3.41 (2.55, 6.99)	892 (684, 1756)	267 (192, 396)	630 (335, 1524)
2031	23.27 (23.25, 23.28)	3.18 (2.37, 6.56)	834 (637, 1649)	300 (216, 446)	538 (240, 1386)
2032	22.59 (22.57, 22.60)	3.02 (2.23, 6.25)	791 (602, 1573)	331 (240, 491)	465 (164, 1281)
2033	22.08 (22.06, 22.09)	2.88 (2.12, 5.99)	756 (574, 1509)	360 (262, 533)	398 (101, 1191)
2034	20.75 (20.74, 20.76)	2.64 (1.94, 5.52)	694 (525, 1392)	375 (274, 552)	314 (35, 1058)
2035	18.79 (18.77, 18.80)	2.33 (1.70, 4.90)	614 (463, 1236)	353 (261, 523)	255 (-3, 915)
2036	18.07 (18.06, 18.08)	2.18 (1.59, 4.62)	577 (434, 1165)	336 (252, 499)	237 (-5, 856)
2037	16.84 (16.83, 16.85)	1.98 (1.44, 4.21)	525 (393, 1064)	321 (242, 477)	204 (-21, 765)
2038	16.91 (16.90, 16.92)	1.93 (1.40, 4.13)	514 (384, 1045)	307 (230, 456)	207 (-7, 757)
2039	17.89 (17.88, 17.90)	1.99 (1.43, 4.27)	530 (395, 1082)	291 (219, 437)	238 (27, 804)
2040	18.58 (18.57, 18.59)	2.00 (1.44, 4.34)	535 (399, 1099)	279 (209, 418)	258 (51, 830)
2041	19.43 (19.42, 19.44)	2.03 (1.46, 4.43)	545 (406, 1124)	264 (199, 400)	281 (77, 865)
2042	21.04 (21.03, 21.05)	2.13 (1.53, 4.68)	574 (427, 1189)	251 (190, 384)	323 (117, 939)
2043	18.76 (18.75, 18.77)	1.84 (1.32, 4.07)	497 (370, 1035)	239 (180, 369)	257 (76, 795)
2044	19.78 (19.77, 19.79)	1.88 (1.34, 4.18)	509 (379, 1065)	230 (172, 356)	281 (101, 834)
2045	20.86 (20.85, 20.87)	1.92 (1.37, 4.29)	522 (388, 1095)	219 (164, 344)	304 (124, 873)
2046	22.55 (22.53, 22.56)	2.01 (1.42, 4.51)	547 (406, 1153)	210 (156, 333)	340 (156, 939)
2047	23.87 (23.85, 23.88)	2.05 (1.45, 4.65)	562 (417, 1189)	203 (149, 323)	361 (178, 981)
2048	22.87 (22.86, 22.88)	1.90 (1.34, 4.33)	522 (387, 1109)	196 (144, 316)	329 (156, 907)
2049	23.60 (23.59, 23.61)	1.89 (1.33, 4.34)	523 (387, 1113)	190 (139, 309)	334 (164, 916)
2050	24.54 (24.52, 24.54)	1.90 (1.33, 4.37)	526 (389, 1125)	185 (135, 303)	341 (173, 932)
Total	765.87 (765.14, 766.24)	104.39 (78.60, 211.15)	27 353 (21 119, 53 153)	6490 (4863, 9708)	21 040 (13 182, 47 088)
Discounted (3%)					
Total	765.87 (765.14, 766.24)	104.39 (78.60, 211.15)	22 552 (17 554, 43 371)	4436 (3295, 6597)	18 305 (12 172, 39 281)

PSI, postinfection vaccine efficacy. Data are presented as median and 95% CI.

The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[a]Screening population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.
[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[c]Net cost (healthcare sector perspective) = vaccination program budget - direct medical costs averted

Table S26. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with PSI vaccine conferring lifelong protection, from healthcare sector perspective.

Year	Screened population[a] (million)	Vaccinated population (million)	Vaccination program budget[b] (US$ million)	Direct medical costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted					
2024	216.46 (216.18, 216.63)	40.15 (31.77, 75.75)	10 303 (8277, 18 906)	12.9 (9.03, 19.0)	10 291 (8265, 18 896)
2025	22.12 (22.09, 22.13)	3.49 (2.67, 6.90)	906 (707, 1729)	62.0 (44.0, 91.7)	846 (627, 1677)
2026	21.73 (21.71, 21.74)	3.35 (2.55, 6.67)	870 (677, 1673)	107 (76.9, 160)	768 (538, 1582)
2027	20.65 (20.63, 20.66)	3.11 (2.36, 6.24)	808 (627, 1565)	150 (108, 223)	668 (433, 1436)
2028	23.88 (23.86, 23.89)	3.51 (2.65, 7.09)	914 (706, 1780)	191 (138, 284)	733 (459, 1616)
2029	23.62 (23.60, 23.63)	3.39 (2.55, 6.90)	884 (680, 1732)	231 (165, 342)	659 (381, 1533)
2030	24.36 (24.33, 24.37)	3.41 (2.55, 6.99)	892 (684, 1756)	267 (192, 396)	630 (335, 1524)
2031	23.27 (23.25, 23.28)	3.18 (2.37, 6.56)	834 (637, 1649)	300 (216, 446)	538 (240, 1386)
2032	22.59 (22.57, 22.60)	3.02 (2.23, 6.25)	791 (602, 1573)	331 (240, 491)	465 (164, 1281)
2033	22.08 (22.06, 22.09)	2.88 (2.12, 5.99)	756 (574, 1509)	360 (262, 533)	398 (101, 1191)
2034	20.75 (20.74, 20.76)	2.64 (1.94, 5.52)	694 (525, 1392)	388 (282, 570)	301 (19, 1049)
2035	18.79 (18.77, 18.80)	2.33 (1.70, 4.90)	614 (463, 1236)	412 (300, 605)	205 (-76, 870)
2036	18.07 (18.06, 18.08)	2.18 (1.59, 4.61)	577 (434, 1165)	433 (315, 635)	147 (-133, 779)
2037	16.84 (16.83, 16.85)	1.98 (1.44, 4.21)	524 (393, 1064)	452 (329, 661)	74 (-198, 660)
2038	16.91 (16.90, 16.92)	1.93 (1.40, 4.13)	514 (384, 1045)	469 (341, 684)	49 (-228, 626)
2039	17.89 (17.88, 17.90)	1.99 (1.43, 4.27)	530 (395, 1082)	483 (350, 703)	52 (-234, 650)
2040	18.58 (18.57, 18.59)	2.00 (1.44, 4.33)	535 (399, 1099)	495 (358, 719)	49 (-243, 656)
2041	19.43 (19.42, 19.44)	2.03 (1.46, 4.42)	544 (406, 1123)	504 (364, 732)	51 (-246, 671)
2042	21.04 (21.03, 21.05)	2.13 (1.53, 4.67)	573 (427, 1188)	511 (369, 741)	75 (-231, 730)
2043	18.76 (18.75, 18.77)	1.84 (1.32, 4.06)	497 (370, 1034)	515 (371, 748)	-16 (-294, 571)
2044	19.78 (19.77, 19.79)	1.88 (1.34, 4.17)	509 (378, 1063)	516 (370, 751)	-3 (-285, 598)
2045	20.86 (20.85, 20.87)	1.92 (1.36, 4.28)	521 (387, 1093)	515 (369, 752)	12 (-275, 627)
2046	22.55 (22.53, 22.56)	2.00 (1.42, 4.50)	546 (406, 1151)	513 (367, 752)	45 (-252, 685)
2047	23.87 (23.85, 23.88)	2.05 (1.45, 4.64)	561 (416, 1186)	509 (364, 750)	66 (-236, 722)
2048	22.87 (22.86, 22.88)	1.89 (1.34, 4.32)	521 (386, 1106)	504 (360, 746)	22 (-260, 643)
2049	23.60 (23.59, 23.61)	1.89 (1.33, 4.32)	521 (386, 1110)	500 (355, 742)	27 (-253, 650)
2050	24.54 (24.52, 24.54)	1.89 (1.33, 4.36)	524 (388, 1121)	494 (350, 736)	38 (-242, 664)
Total	765.87 (765.14, 766.24)	104.34 (78.58, 211.06)	27 340 (21 113, 53 131)	10 229 (7403, 14 975)	17 702 (8147, 43 974)
Discounted (3%)					
Total	765.87 (765.14, 766.24)	104.34 (78.58, 211.06)	22 545 (17 550, 43 359)	6508 (4716, 9539)	16 556 (9263, 37 547)

PSI, postinfection vaccine efficacy. Data are presented as median and 95% CI.

The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%. Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)

[a]Screened population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.

[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost

[c]Net cost (healthcare sector perspective) = vaccination program budget - direct medical costs averted

Table S27. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with PSI vaccine conferring 10-y protection, from societal perspective.

Year	Screened population[a] (million)	Vaccinated population (million)	Vaccination program budget[b] (US$ million)	Direct and indirect costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted					
2024	216.46 (216.18, 216.63)	40.15 (31.77, 75.75)	10 303 (8277, 18 906)	18.6 (13.1, 27.5)	10 286 (8258, 18 891)
2025	22.12 (22.09, 22.13)	3.50 (2.67, 6.90)	906 (707, 1,729)	94.6 (67.2, 138)	815 (586, 1649)
2026	21.73 (21.71, 21.74)	3.35 (2.55, 6.67)	870 (677, 1,673)	173 (126, 253)	702 (457, 1522)
2027	20.65 (20.63, 20.66)	3.11 (2.36, 6.24)	808 (627, 1,565)	251 (186, 368)	559 (301, 1340)
2028	23.88 (23.86, 23.89)	3.51 (2.65, 7.09)	914 (706, 1,780)	334 (246, 481)	587 (277, 1481)
2029	23.62 (23.60, 23.63)	3.39 (2.55, 6.90)	884 (680, 1,732)	414 (306, 596)	483 (153, 1360)
2030	24.36 (24.33, 24.37)	3.41 (2.55, 6.99)	892 (684, 1,756)	485 (362, 712)	414 (69, 1313)
2031	23.27 (23.25, 23.28)	3.18 (2.37, 6.56)	834 (637, 1,649)	555 (413, 821)	285 (-67, 1138)
2032	22.59 (22.57, 22.60)	3.02 (2.23, 6.25)	791 (602, 1,573)	620 (460, 922)	180 (-185, 998)
2033	22.08 (22.06, 22.09)	2.88 (2.12, 5.99)	756 (574, 1,509)	681 (503, 1015)	68 (-290, 876)
2034	20.75 (20.74, 20.76)	2.64 (1.94, 5.52)	694 (525, 1,392)	709 (534, 1078)	-29 (-382, 720)
2035	18.79 (18.77, 18.80)	2.33 (1.70, 4.90)	614 (463, 1,236)	692 (529, 1050)	-101 (-439, 568)
2036	18.07 (18.06, 18.08)	2.18 (1.59, 4.62)	577 (434, 1,165)	671 (514, 1019)	-113 (-440, 505)
2037	16.84 (16.83, 16.85)	1.98 (1.44, 4.21)	525 (393, 1,064)	647 (498, 988)	-135 (-451, 414)
2038	16.91 (16.90, 16.92)	1.93 (1.40, 4.13)	514 (384, 1,045)	624 (482, 958)	-126 (-431, 407)
2039	17.89 (17.88, 17.90)	1.99 (1.43, 4.27)	530 (395, 1,082)	603 (465, 928)	-93 (-388, 457)
2040	18.58 (18.57, 18.59)	2.00 (1.44, 4.34)	535 (399, 1,099)	585 (448, 899)	-68 (-354, 488)
2041	19.43 (19.42, 19.44)	2.03 (1.46, 4.43)	545 (406, 1,124)	565 (429, 869)	-39 (-316, 528)
2042	21.04 (21.03, 21.05)	2.13 (1.53, 4.68)	574 (427, 1,189)	544 (411, 840)	6 (-263, 609)
2043	18.76 (18.75, 18.77)	1.84 (1.32, 4.07)	497 (370, 1,035)	527 (393, 811)	-39 (-299, 472)
2044	19.78 (19.77, 19.79)	1.88 (1.34, 4.18)	509 (379, 1,065)	508 (376, 784)	-9 (-260, 518)
2045	20.86 (20.85, 20.87)	1.92 (1.37, 4.29)	522 (388, 1,095)	488 (360, 758)	19 (-222, 564)
2046	22.55 (22.53, 22.56)	2.01 (1.42, 4.51)	547 (406, 1,153)	470 (345, 733)	60 (-174, 639)
2047	23.87 (23.85, 23.88)	2.05 (1.45, 4.65)	562 (417, 1,189)	455 (331, 711)	94 (-139, 690)
2048	22.87 (22.86, 22.88)	1.90 (1.34, 4.33)	522 (387, 1,109)	439 (319, 692)	69 (-151, 623)
2049	23.60 (23.59, 23.61)	1.89 (1.33, 4.34)	523 (387, 1,113)	424 (308, 674)	83 (-132, 640)
2050	24.54 (24.52, 24.54)	1.90 (1.33, 4.37)	526 (389, 1,125)	411 (298, 658)	103 (-111, 664)
Total	765.87 (765.14, 766.24)	104.39 (78.60, 211.15)	27 353 (21 119, 53 153)	12 932 (9895, 19 953)	14 190 (5395, 40 072)
Discounted (3%)					
Total	765.87 (765.14, 766.24)	104.39 (78.60, 211.15)	22 552 (17 554, 43 371)	8690 (6652, 13 365)	13 847 (6983, 34 713)

PSI, postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[a]Screened population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.
[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[c]Net cost (societal perspective) = vaccination program budget - direct and indirect costs averted

Table S28. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with PSI vaccine conferring 20-y protection, from societal perspective.

Year	Screened population[a] (million)	Vaccinated population (million)	Vaccination program budget[b] (US$ million)	Direct and indirect costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted					
2024	216.46 (216.18, 216.63)	40.15 (31.77, 75.75)	10 303 (8277, 18 906)	18.6 (13.1, 27.5)	10 286 (8258, 18 891)
2025	22.12 (22.09, 22.13)	3.49 (2.67, 6.90)	906 (707, 1729)	94.6 (67.2, 138)	815 (586, 1649)
2026	21.73 (21.71, 21.74)	3.35 (2.55, 6.67)	870 (677, 1673)	173 (126, 253)	702 (457, 1522)
2027	20.65 (20.63, 20.66)	3.11 (2.36, 6.24)	808 (627, 1565)	251 (186, 368)	559 (301, 1340)
2028	23.88 (23.86, 23.89)	3.51 (2.65, 7.09)	914 (706, 1780)	334 (246, 481)	587 (277, 1481)
2029	23.62 (23.60, 23.63)	3.39 (2.55, 6.90)	884 (680, 1732)	414 (306, 596)	483 (153, 1360)
2030	24.36 (24.33, 24.37)	3.41 (2.55, 6.99)	892 (684, 1756)	485 (362, 712)	414 (69, 1313)
2031	23.27 (23.25, 23.28)	3.18 (2.37, 6.56)	834 (637, 1649)	555 (413, 821)	285 (-67, 1138)
2032	22.59 (22.57, 22.60)	3.02 (2.23, 6.25)	791 (602, 1573)	620 (460, 922)	180 (-185, 998)
2033	22.08 (22.06, 22.09)	2.88 (2.12, 5.99)	756 (574, 1509)	681 (503, 1015)	68 (-290, 876)
2034	20.75 (20.74, 20.76)	2.64 (1.94, 5.52)	694 (525, 1392)	730 (545, 1100)	-45 (-406, 706)
2035	18.79 (18.77, 18.80)	2.33 (1.70, 4.90)	614 (463, 1236)	773 (582, 1177)	-166 (-549, 502)
2036	18.07 (18.06, 18.08)	2.18 (1.59, 4.61)	577 (434, 1165)	811 (615, 1245)	-239 (-635, 389)
2037	16.84 (16.83, 16.85)	1.98 (1.44, 4.21)	524 (393, 1064)	846 (642, 1301)	-313 (-730, 249)
2038	16.91 (16.90, 16.92)	1.93 (1.40, 4.13)	514 (384, 1045)	878 (662, 1349)	-350 (-786, 199)
2039	17.89 (17.88, 17.90)	1.99 (1.43, 4.27)	530 (395, 1082)	903 (678, 1389)	-358 (-807, 210)
2040	18.58 (18.57, 18.59)	2.00 (1.44, 4.33)	535 (399, 1099)	922 (690, 1420)	-367 (-831, 205)
2041	19.43 (19.42, 19.44)	2.03 (1.46, 4.42)	544 (406, 1123)	933 (698, 1445)	-369 (-844, 212)
2042	21.04 (21.03, 21.05)	2.13 (1.53, 4.67)	573 (427, 1188)	942 (703, 1462)	-351 (-831, 264)
2043	18.76 (18.75, 18.77)	1.84 (1.32, 4.06)	497 (370, 1034)	950 (705, 1474)	-418 (-915, 105)
2044	19.78 (19.77, 19.79)	1.88 (1.34, 4.17)	509 (378, 1063)	948 (698, 1465)	-398 (-893, 136)
2045	20.86 (20.85, 20.87)	1.92 (1.36, 4.28)	521 (387, 1093)	915 (671, 1415)	-352 (-833, 187)
2046	22.55 (22.53, 22.56)	2.00 (1.42, 4.50)	546 (406, 1151)	883 (646, 1368)	-302 (-762, 268)
2047	23.87 (23.85, 23.88)	2.05 (1.45, 4.64)	561 (416, 1186)	851 (622, 1325)	-260 (-705, 326)
2048	22.87 (22.86, 22.88)	1.89 (1.34, 4.32)	521 (386, 1106)	823 (600, 1286)	-269 (-703, 268)
2049	23.60 (23.59, 23.61)	1.89 (1.33, 4.32)	521 (386, 1110)	792 (578, 1248)	-243 (-665, 293)
2050	24.54 (24.52, 24.54)	1.89 (1.33, 4.36)	525 (388, 1121)	765 (557, 1212)	-215 (-624, 325)
Total	765.87 (765.14, 766.24)	104.34 (78.58, 211.06)	27 340 (21 113, 53 132)	18 274 (13 679, 28 250)	9124 (-1807, 35 409)
Discounted (3%)					
Total	765.87 (765.14, 766.24)	104.34 (78.58, 211.06)	22 545 (17 550, 43 359)	11 655 (8788, 18 048)	10 986 (2920, 32 096)

PSI, postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[a]Screened population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.
[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[c]Net cost (societal perspective) = vaccination program budget - direct and indirect costs averted

Table S29. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with PSI vaccine conferring lifelong protection, from societal perspective.

Year	Screened population[a] (million)	Vaccinated population (million)	Vaccination program budget[b] (US$ million)	Direct and indirect costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted					
2024	216.46 (216.18, 216.63)	40.15 (31.77, 75.75)	10 303 (8277, 18 906)	18.6 (13.1, 27.5)	10 286 (8258, 18 891)
2025	22.12 (22.09, 22.13)	3.49 (2.67, 6.90)	906 (707, 1729)	94.6 (67.2, 138)	815 (586, 1649)
2026	21.73 (21.71, 21.74)	3.35 (2.55, 6.67)	870 (677, 1673)	173 (126, 253)	702 (457, 1522)
2027	20.65 (20.63, 20.66)	3.11 (2.36, 6.24)	808 (627, 1565)	251 (186, 368)	559 (301, 1340)
2028	23.88 (23.86, 23.89)	3.51 (2.65, 7.09)	914 (706, 1780)	334 (246, 481)	587 (277, 1481)
2029	23.62 (23.60, 23.63)	3.39 (2.55, 6.90)	884 (680, 1732)	414 (306, 596)	483 (153, 1360)
2030	24.36 (24.33, 24.37)	3.41 (2.55, 6.99)	892 (684, 1756)	485 (362, 712)	414 (69, 1313)
2031	23.27 (23.25, 23.28)	3.18 (2.37, 6.56)	834 (637, 1649)	555 (413, 821)	285 (-67, 1138)
2032	22.59 (22.57, 22.60)	3.02 (2.23, 6.25)	791 (602, 1573)	620 (460, 922)	180 (-185, 998)
2033	22.08 (22.06, 22.09)	2.88 (2.12, 5.99)	756 (574, 1509)	681 (503, 1015)	68 (-290, 876)
2034	20.75 (20.74, 20.76)	2.64 (1.94, 5.52)	694 (525, 1392)	730 (545, 1100)	-45 (-406, 706)
2035	18.79 (18.77, 18.80)	2.33 (1.70, 4.90)	614 (463, 1236)	773 (582, 1177)	-166 (-549, 502)
2036	18.07 (18.06, 18.08)	2.18 (1.59, 4.61)	577 (434, 1165)	811 (615, 1245)	-239 (-635, 389)
2037	16.84 (16.83, 16.85)	1.98 (1.44, 4.21)	524 (393, 1064)	846 (642, 1301)	-313 (-730, 249)
2038	16.91 (16.90, 16.92)	1.93 (1.40, 4.13)	514 (384, 1045)	878 (662, 1349)	-350 (-786, 199)
2039	17.89 (17.88, 17.90)	1.99 (1.43, 4.27)	530 (395, 1082)	903 (678, 1389)	-358 (-807, 210)
2040	18.58 (18.57, 18.59)	2.00 (1.44, 4.33)	535 (399, 1099)	922 (690, 1420)	-367 (-831, 205)
2041	19.43 (19.42, 19.44)	2.03 (1.46, 4.42)	544 (406, 1123)	933 (698, 1445)	-369 (-844, 212)
2042	21.04 (21.03, 21.05)	2.13 (1.53, 4.67)	573 (427, 1188)	942 (703, 1462)	-351 (-831, 264)
2043	18.76 (18.75, 18.77)	1.84 (1.32, 4.06)	497 (370, 1034)	950 (705, 1474)	-418 (-915, 105)
2044	19.78 (19.77, 19.79)	1.88 (1.34, 4.17)	509 (378, 1063)	955 (704, 1480)	-407 (-907, 129)
2045	20.86 (20.85, 20.87)	1.92 (1.36, 4.28)	521 (387, 1093)	957 (701, 1481)	-394 (-894, 155)
2046	22.55 (22.53, 22.56)	2.00 (1.42, 4.50)	546 (406, 1151)	955 (695, 1477)	-363 (-863, 213)
2047	23.87 (23.85, 23.88)	2.05 (1.45, 4.64)	561 (416, 1186)	949 (688, 1469)	-341 (-839, 253)
2048	22.87 (22.86, 22.88)	1.89 (1.34, 4.32)	521 (386, 1106)	939 (679, 1459)	-372 (-865, 178)
2049	23.60 (23.59, 23.61)	1.89 (1.33, 4.32)	521 (386, 1110)	926 (669, 1446)	-362 (-850, 190)
2050	24.54 (24.52, 24.54)	1.89 (1.33, 4.36)	524 (388, 1121)	912 (657, 1430)	-348 (-829, 210)
Total	765.87 (765.14, 766.24)	104.34 (78.58, 211.06)	27 340 (21 113, 53 131)	18 812 (14 100, 29 185)	8493 (-2661, 34 932)
Discounted (3%)					
Total	765.87 (765.14, 766.24)	104.34 (78.58, 211.06)	22 545 (17 550, 43 359)	11 968 (8995, 18 519)	10 676 (2523, 31 861)

PSI, postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[a]Screened population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.
[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[c]Net cost (societal perspective) = vaccination program budget - direct and indirect costs averted

Table S30. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring 10-y protection, from healthcare sector perspective.

Year	Vaccinated population[a] (million)	Vaccination program budget[b] (US$ million)	Direct medical costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted				
2024	195.58 (195.32, 195.74)	47 269 (47 206, 47 307)	18.5 (13.6, 26.8)	47 250 (47 181, 47 292)
2025	19.95 (19.93, 19.96)	4821 (4817, 4824)	89.1 (65.9, 129)	4732 (4688, 4756)
2026	19.60 (19.58, 19.61)	4737 (4732, 4739)	155 (115, 223)	4582 (4509, 4623)
2027	18.63 (18.61, 18.64)	4502 (4498, 4504)	217 (162, 312)	4286 (4186, 4341)
2028	21.54 (21.52, 21.55)	5206 (5201, 5208)	274 (207, 395)	4932 (4806, 5001)
2029	21.30 (21.28, 21.31)	5148 (5143, 5150)	327 (248, 473)	4821 (4670, 4902)
2030	21.97 (21.95, 21.98)	5309 (5304, 5311)	378 (286, 548)	4930 (4756, 5024)
2031	20.99 (20.97, 20.99)	5072 (5067, 5074)	425 (322, 617)	4646 (4449, 4751)
2032	20.37 (20.35, 20.38)	4923 (4919, 4925)	469 (355, 682)	4453 (4,237, 4570)
2033	19.91 (19.90, 19.92)	4813 (4808, 4814)	510 (385, 741)	4301 (4067, 4429)
2034	18.71 (18.70, 18.72)	4523 (4519, 4524)	532 (400, 772)	3991 (3747, 4123)
2035	16.94 (16.92, 16.95)	4094 (4090, 4095)	503 (381, 735)	3591 (3355, 3714)
2036	16.29 (16.28, 16.30)	3938 (3934, 3939)	481 (363, 703)	3456 (3232, 3576)
2037	15.19 (15.17, 15.19)	3670 (3667, 3672)	460 (346, 674)	3210 (2994, 3324)
2038	15.25 (15.23, 15.25)	3684 (3681, 3686)	440 (331, 648)	3244 (3033, 3354)
2039	16.13 (16.12, 16.14)	3898 (3895, 3900)	423 (316, 627)	3476 (3268, 3583)
2040	16.75 (16.74, 16.76)	4048 (4045, 4050)	406 (302, 606)	3643 (3439, 3748)
2041	17.52 (17.50, 17.52)	4234 (4230, 4235)	389 (286, 585)	3845 (3645, 3949)
2042	18.97 (18.95, 18.97)	4584 (4581, 4585)	369 (271, 565)	4215 (4015, 4314)
2043	16.91 (16.90, 16.92)	4088 (4085, 4089)	351 (257, 546)	3737 (3539, 3832)
2044	17.83 (17.82, 17.84)	4309 (4306, 4311)	334 (244, 528)	3976 (3779, 4067)
2045	18.80 (18.79, 18.81)	4544 (4541, 4545)	319 (232, 511)	4225 (4031, 4313)
2046	20.32 (20.31, 20.33)	4911 (4908, 4913)	306 (221, 493)	4606 (4416, 4691)
2047	21.51 (21.50, 21.52)	5199 (5196, 5200)	294 (212, 478)	4905 (4720, 4988)
2048	20.61 (20.60, 20.62)	4982 (4979, 4983)	283 (205, 465)	4699 (4516, 4778)
2049	21.27 (21.26, 21.28)	5140 (5138, 5142)	274 (198, 453)	4866 (4686, 4943)
2050	22.11 (22.10, 22.12)	5344 (5341, 5345)	267 (193, 444)	5077 (4899, 5152)
Total	690.94 (690.28, 691.28)	166 987 (166 827, 167 068)	9316 (7007, 13 822)	157 635 (153 012, 160 023)
Discounted (3%)				
Total	690.94 (690.28, 691.28)	129 785 (129 650, 129 852)	6377 (4784, 9370)	123 403 (120 282, 125 036)

P&PI, both pre- and postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[a] Vaccinated population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.
[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[c]Net cost (healthcare sector perspective) = vaccination program budget - direct medical costs averted

Table S31. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring 20-y protection, from healthcare sector perspective.

Year	Vaccinated population[a] (million)	Vaccination program budget[b] (US$ million)	Direct medical costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted				
2024	195.58 (195.32, 195.74)	47 269 (47 206, 47 307)	18.5 (13.6, 26.8)	47 250 (47 181, 47 292)
2025	19.95 (19.93, 19.96)	4821 (4817. 4824)	89.1 (65.9, 129)	4732 (4688, 4756)
2026	19.60 (19.58, 19.61)	4737 (4732. 4739)	155 (115, 223)	4582 (4509, 4623)
2027	18.63 (18.61, 18.64)	4502 (4498. 4504)	217 (162, 312)	4286 (4186, 4341)
2028	21.54 (21.52, 21.55)	5206 (5201. 5208)	274 (207, 395)	4932 (4806, 5001)
2029	21.30 (21.28, 21.31)	5148 (5143, 5150)	327 (248, 473)	4821 (4670, 4902)
2030	21.97 (21.95, 21.98)	5309 (5304, 5311)	378 (286, 548)	4930 (4756, 5024)
2031	20.99 (20.97, 20.99)	5072 (5067, 5074)	425 (322, 617)	4646 (4449, 4751)
2032	20.37 (20.35, 20.38)	4923 (4919, 4925)	469 (355, 682)	4453 (4237, 4570)
2033	19.91 (19.90, 19.92)	4813 (4808, 4814)	510 (385, 741)	4301 (4067, 4429)
2034	18.71 (18.70, 18.72)	4523 (4519, 4524)	547 (412, 795)	3975 (3724, 4112)
2035	16.94 (16.93, 16.95)	4094 (4090, 4095)	580 (435, 845)	3513 (3246, 3660)
2036	16.29 (16.28, 16.30)	3938 (3934, 3939)	608 (455, 889)	3329 (3046, 3483)
2037	15.19 (15.17, 15.19)	3670 (3667, 3672)	635 (472, 928)	3034 (2740, 3199)
2038	15.25 (15.23, 15.25)	3684 (3681, 3686)	658 (486, 961)	3025 (2721, 3199)
2039	16.13 (16.12, 16.14)	3898 (3895, 3900)	676 (497, 989)	3221 (2907, 3401)
2040	16.75 (16.74, 16.76)	4048 (4045, 4050)	690 (506, 1012)	3357 (3034, 3543)
2041	17.52 (17.50, 17.52)	4234 (4230, 4235)	701 (512, 1030)	3533 (3201, 3722)
2042	18.97 (18.95, 18.97)	4584 (4581, 4586)	706 (515, 1043)	3877 (3539, 4070)
2043	16.91 (16.90, 16.92)	4088 (4085, 4089)	709 (516, 1052)	3379 (3034, 3572)
2044	17.83 (17.82, 17.84)	4309 (4306, 4311)	704 (509, 1044)	3606 (3263, 3801)
2045	18.80 (18.79, 18.81)	4544 (4541, 4545)	675 (486, 1001)	3870 (3540, 4059)
2046	20.32 (20.31, 20.33)	4911 (4908, 4913)	648 (465, 964)	4263 (3946, 4447)
2047	21.51 (21.50, 21.52)	5199 (5196, 5200)	622 (446, 930)	4577 (4266, 4754)
2048	20.61 (20.60, 20.62)	4982 (4979, 4983)	598 (428, 901)	4384 (4079, 4554)
2049	21.27 (21.26, 21.28)	5140 (5138, 5142)	581 (412, 873)	4560 (4265, 4729)
2050	22.11 (22.10, 22.12)	5344 (5341, 5345)	561 (397, 847)	4782 (4494, 4947)
Total	690.95 (690.28 691.28)	166 988 (166 827, 167 068)	13 798 (10 135, 20 250)	153 190 (146 585, 156 895)
Discounted (3%)				
Total	690.95 (690.28, 691.28)	129 786 (129 651, 129 852)	8877 (6558, 13 010)	120 883 (116 642, 123 262)

P&PI, both pre- and postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[a]Vaccinated population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.
[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[c]Net cost (healthcare sector perspective) = vaccination program budget - direct medical costs averted

Table S32. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring lifelong protection, from healthcare sector perspective.

Year	Vaccinated population[a] (million)	Vaccination program budget[b] (US$ million)	Direct medical costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted				
2024	195.58 (195.32, 195.74)	47 269 (47 206, 47 307)	18.5 (13.6, 26.8)	47 250 (47 181, 47 292)
2025	19.95 (19.93, 19.96)	4821 (4817, 4824)	89.1 (65.9, 129)	4732 (4688, 4756)
2026	19.60 (19.58, 19.61)	4737 (4732, 4739)	155 (115, 223)	4582 (4509, 4623)
2027	18.63 (18.61, 18.64)	4502 (4498, 4504)	217 (162, 312)	4286 (4186, 4341)
2028	21.54 (21.52, 21.55)	5206 (5201, 5208)	274 (207, 395)	4932 (4806, 5001)
2029	21.30 (21.28, 21.31)	5148 (5143, 5150)	327 (248, 473)	4821 (4670, 4902)
2030	21.97 (21.95, 21.98)	5309 (5304, 5311)	378 (286, 548)	4930 (4756, 5024)
2031	20.99 (20.97, 20.99)	5072 (5067, 5074)	425 (322, 617)	4646 (4449, 4751)
2032	20.37 (20.35, 20.38)	4923 (4919, 4925)	469 (355, 682)	4453 (4237, 4570)
2033	19.91 (19.90, 19.92)	4813 (4808, 4814)	510 (385, 741)	4301 (4067, 4429)
2034	18.71 (18.70, 18.72)	4523 (4519, 4524)	547 (412, 795)	3975 (3724, 4112)
2035	16.94 (16.93, 16.95)	4094 (4090, 4095)	580 (435, 845)	3513 (3246, 3660)
2036	16.29 (16.28, 16.30)	3938 (3934, 3939)	608 (455, 889)	3329 (3046, 3483)
2037	15.19 (15.17, 15.19)	3670 (3667, 3672)	635 (472, 928)	3034 (2740, 3199)
2038	15.25 (15.23, 15.25)	3684 (3681, 3686)	658 (486, 961)	3025 (2721, 3199)
2039	16.13 (16.12, 16.14)	3898 (3895, 3900)	676 (497, 989)	3221 (2907, 3401)
2040	16.75 (16.74, 16.76)	4048 (4045, 4050)	690 (506, 1012)	3357 (3034, 3543)
2041	17.52 (17.50, 17.52)	4234 (4230, 4235)	701 (512, 1030)	3533 (3201, 3722)
2042	18.97 (18.95, 18.97)	4584 (4581, 4586)	706 (515, 1043)	3877 (3539, 4070)
2043	16.91 (16.90, 16.92)	4088 (4085, 4089)	709 (516, 1052)	3379 (3034, 3572)
2044	17.83 (17.82, 17.84)	4309 (4306, 4311)	712 (515, 1056)	3599 (3251, 3795)
2045	18.80 (18.79, 18.81)	4544 (4541, 4545)	711 (513, 1058)	3833 (3484, 4032)
2046	20.32 (20.31, 20.33)	4911 (4908, 4913)	709 (509, 1056)	4202 (3853, 4403)
2047	21.51 (21.50, 21.52)	5199 (5196, 5200)	706 (505, 1053)	4493 (4144, 4695)
2048	20.61 (20.60, 20.62)	4982 (4979, 4983)	702 (499, 1047)	4281 (3932, 4484)
2049	21.27 (21.26, 21.28)	5140 (5138, 5142)	695 (492, 1040)	4446 (4099, 4649)
2050	22.11 (22.10, 22.12)	5344 (5341, 5345)	688 (485, 1030)	4657 (4311, 4860)
Total	690.95 (690.28 691.28)	166 988 (166 827, 167 068)	14 292 (10 509, 21 030)	152 668 (145 804, 156 521)
Discounted (3%)				
Total	690.95 (690.28, 691.28)	129 786 (129 651, 129 852)	9125 (6743, 13 395)	120 639 (116 258, 123 078)

P&PI, both pre- and postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[a]Vaccinated population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.
[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[c]Net cost (healtncare sector perspective) = vaccination program budget - direct medical costs averted

Table S33. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring 10-y protection, from societal perspective.

Year	Vaccinated population[a] (million)	Vaccination program budget[b] (US$ million)	Direct and indirect costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted				
2024	195.58 (195.32, 195.74)	47 269 (47 206, 47 307)	26.9 (19.8, 39.0)	47 241 (47 168, 47 286)
2025	19.95 (19.93, 19.96)	4821 (4817, 4824)	137 (101, 197)	4685 (4620, 4720)
2026	19.60 (19.58, 19.61)	4737 (4732, 4739)	253 (189, 361)	4483 (4371, 4548)
2027	18.63 (18.61, 18.64)	4502 (4498, 4504)	372 (281, 535)	4130 (3961, 4222)
2028	21.54 (21.52, 21.55)	5206 (5201, 5208)	486 (371, 713)	4720 (4486, 4837)
2029	21.30 (21.28, 21.31)	5148 (5143, 5150)	595 (457, 885)	4554 (4259, 4691)
2030	21.97 (21.95, 21.98)	5309 (5304, 5311)	705 (539, 1039)	4603 (4265, 4770)
2031	20.99 (20.97, 20.99)	5072 (5067, 5074)	808 (614, 1184)	4262 (3884, 4459)
2032	20.37 (20.35, 20.38)	4923 (4919, 4925)	896 (681, 1318)	4026 (3601, 4243)
2033	19.91 (19.90, 19.92)	4813 (4808, 4814)	976 (742, 1440)	3836 (3369, 4071)
2034	18.71 (18.70, 18.72)	4523 (4519, 4524)	1,028 (778, 1513)	3495 (3006, 3745)
2035	16.94 (16.92, 16.95)	4094 (4090, 4095)	991 (761, 1477)	3104 (2614, 3334)
2036	16.29 (16.28, 16.30)	3938 (3934, 3939)	951 (740, 1439)	2987 (2496, 3199)
2037	15.19 (15.17, 15.19)	3670 (3667, 3672)	919 (712, 1401)	2752 (2267, 2959)
2038	15.25 (15.23, 15.25)	3684 (3681, 3686)	895 (686, 1364)	2790 (2318, 2999)
2039	16.13 (16.12, 16.14)	3898 (3895, 3900)	873 (660, 1325)	3026 (2571, 3239)
2040	16.75 (16.74, 16.76)	4048 (4045, 4050)	853 (635, 1287)	3197 (2759, 3414)
2041	17.52 (17.50, 17.52)	4234 (4230, 4235)	824 (609, 1250)	3410 (2982, 3625)
2042	18.97 (18.95, 18.97)	4584 (4581, 4585)	791 (584, 1213)	3793 (3370, 4001)
2043	16.91 (16.90, 16.92)	4088 (4085, 4089)	765 (559, 1177)	3324 (2910, 3530)
2044	17.83 (17.82, 17.84)	4309 (4306, 4311)	734 (535, 1141)	3576 (3168, 3776)
2045	18.80 (18.79, 18.81)	4544 (4541, 4545)	707 (511, 1110)	3838 (3433, 4034)
2046	20.32 (20.31, 20.33)	4911 (4908, 4913)	684 (489, 1084)	4228 (3826, 4423)
2047	21.51 (21.50, 21.52)	5199 (5196, 5200)	661 (469, 1053)	4539 (4145, 4731)
2048	20.61 (20.60, 20.62)	4982 (4979, 4983)	640 (451, 1026)	4342 (3955, 4531)
2049	21.27 (21.26, 21.28)	5140 (5138, 5142)	621 (435, 1001)	4519 (4139, 4706)
2050	22.11 (22.10, 22.12)	5344 (5341, 5345)	602 (421, 977)	4742 (4365, 4924)
Total	690.94 (690.28, 691.28)	166 987 (166 827, 167 068)	18 408 (14 249, 28 461)	148 614 (138 380, 152 819)
Discounted (3%)				
Total	690.94 (690.28, 691.28)	129 785 (129 650, 129 852)	12 389 (9656, 19 031)	117 395 (110 628, 120 194)

P&PI, both pre- and postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[a]Vaccinated population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.
[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[c]Net cost (societal perspective) = vaccination program budget - direct and indirect costs averted

Table S34. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring 20-y protection, from societal perspective.

Year	Vaccinated population[a] (million)	Vaccination program budget[b] (US$ million)	Direct and indirect costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted				
2024	195.58 (195.32, 195.74)	47 269 (47 206, 47 307)	26.9 (19.8, 39.0)	47 241 (47 168, 47 286)
2025	19.95 (19.93, 19.96)	4821 (4817, 4824)	137 (101, 197)	4685 (4620, 4720)
2026	19.60 (19.58, 19.61)	4737 (4732, 4739)	253 (189, 361)	4483 (4371, 4548)
2027	18.63 (18.61, 18.64)	4502 (4498, 4504)	372 (281, 535)	4130 (3961, 4222)
2028	21.54 (21.52, 21.55)	5206 (5201, 5208)	486 (371, 713)	4720 (4486, 4837)
2029	21.30 (21.28, 21.31)	5148 (5143, 5150)	595 (457, 885)	4554 (4259, 4691)
2030	21.97 (21.95, 21.98)	5309 (5304, 5311)	705 (539, 1039)	4603 (4265, 4770)
2031	20.99 (20.97, 20.99)	5072 (5067, 5074)	808 (614, 1184)	4262 (3884, 4459)
2032	20.37 (20.35, 20.38)	4923 (4919, 4925)	896 (681, 1318)	4026 (3601, 4243)
2033	19.91 (19.90, 19.92)	4813 (4808, 4814)	976 (742, 1440)	3836 (3369, 4071)
2034	18.71 (18.70, 18.72)	4523 (4519, 4524)	1052 (795, 1549)	3470 (2970, 3728)
2035	16.94 (16.93, 16.95)	4094 (4090, 4095)	1120 (842, 1648)	2974 (2443, 3253)
2036	16.29 (16.28, 16.30)	3938 (3934, 3939)	1176 (881, 1734)	2762 (2201, 3057)
2037	15.19 (15.17, 15.19)	3670 (3667, 3672)	1223 (915, 1808)	2447 (1859, 2756)
2038	15.25 (15.23, 15.25)	3684 (3681, 3686)	1263 (942, 1872)	2422 (1810, 2743)
2039	16.13 (16.12, 16.14)	3898 (3895, 3900)	1293 (963, 1924)	2606 (1971, 2936)
2040	16.75 (16.74, 16.76)	4048 (4045, 4050)	1317 (978, 1967)	2732 (2079, 3071)
2041	17.52 (17.50, 17.52)	4234 (4230, 4235)	1333 (988, 1999)	2901 (2232, 3246)
2042	18.97 (18.95, 18.97)	4584 (4581, 4586)	1343 (993, 2022)	3241 (2560, 3592)
2043	16.91 (16.90, 16.92)	4088 (4085, 4089)	1348 (995, 2037)	2740 (2049, 3094)
2044	17.83 (17.82, 17.84)	4309 (4306, 4311)	1334 (983, 2025)	2975 (2282, 3327)
2045	18.80 (18.79, 18.81)	4544 (4541, 4545)	1275 (946, 1957)	3269 (2585, 3599)
2046	20.32 (20.31, 20.33)	4911 (4908, 4913)	1234 (910, 1894)	3679 (3015, 4002)
2047	21.51 (21.50, 21.52)	5199 (5196, 5200)	1195 (877, 1836)	4005 (3361, 4323)
2048	20.61 (20.60, 20.62)	4982 (4979, 4983)	1157 (846, 1783)	3825 (3197, 4137)
2049	21.27 (21.26, 21.28)	5140 (5138, 5142)	1124 (815, 1731)	4017 (3407, 4327)
2050	22.11 (22.10, 22.12)	5344 (5341, 5345)	1090 (785, 1681)	4254 (3661, 4560)
Total	690.95 (690.28 691.28)	166 988 (166 827, 167 068)	26 207 (19 483, 39 239)	140 798 (127 605, 147 552)
Discounted (3%)				
Total	690.95 (690.28, 691.28)	129 786 (129 651, 129 852)	16 856 (12 546, 25 114)	112 940 (104 547, 117 279)

P&PI, both pre- and postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[a]Vaccinated population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.
[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[c]Net cost (societal perspective) = vaccination program budget - direct and indirect costs averted

Table S35. Budget impact of Vaccae older adult routine vaccination program in China during 2024-50, with P&PI vaccine conferring lifelong protection, from societal perspective.

Year	Vaccinated population[a] (million)	Vaccination program budget[b] (US$ million)	Direct and indirect costs averted (US$ million)	Net cost[c] (US$ million)
Undiscounted				
2024	195.58 (195.32, 195.74)	47 269 (47 206, 47 307)	26.9 (19.8, 39.0)	47 241 (47 168, 47 286)
2025	19.95 (19.93, 19.96)	4821 (4817, 4824)	137 (101, 197)	4685 (4620, 4720)
2026	19.60 (19.58, 19.61)	4737 (4732, 4739)	253 (189, 361)	4483 (4371, 4548)
2027	18.63 (18.61, 18.64)	4502 (4498, 4504)	372 (281, 535)	4130 (3961, 4222)
2028	21.54 (21.52, 21.55)	5206 (5201, 5208)	486 (371, 713)	4720 (4486, 4837)
2029	21.30 (21.28, 21.31)	5148 (5143, 5150)	595 (457, 885)	4554 (4259, 4691)
2030	21.97 (21.95, 21.98)	5309 (5304, 5311)	705 (539, 1039)	4603 (4265, 4770)
2031	20.99 (20.97, 20.99)	5072 (5067, 5074)	808 (614, 1184)	4262 (3884, 4459)
2032	20.37 (20.35, 20.38)	4923 (4919, 4925)	896 (681, 1318)	4026 (3601, 4243)
2033	19.91 (19.90, 19.92)	4813 (4808, 4814)	976 (742, 1440)	3836 (3369, 4071)
2034	18.71 (18.70, 18.72)	4523 (4519, 4524)	1052 (795, 1549)	3470 (2970, 3728)
2035	16.94 (16.93, 16.95)	4094 (4090, 4095)	1120 (842, 1648)	2974 (2443, 3253)
2036	16.29 (16.28, 16.30)	3938 (3934, 3939)	1176 (881, 1734)	2762 (2201, 3057)
2037	15.19 (15.17, 15.19)	3670 (3667, 3672)	1223 (915, 1808)	2447 (1859, 2756)
2038	15.25 (15.23, 15.25)	3684 (3681, 3686)	1263 (942, 1872)	2422 (1810, 2743)
2039	16.13 (16.12, 16.14)	3898 (3895, 3900)	1293 (963, 1924)	2606 (1971, 2936)
2040	16.75 (16.74, 16.76)	4048 (4045, 4050)	1317 (978, 1967)	2732 (2079, 3071)
2041	17.52 (17.50, 17.52)	4234 (4230, 4235)	1333 (988, 1999)	2901 (2232, 3246)
2042	18.97 (18.95, 18.97)	4584 (4581, 4586)	1343 (993, 2022)	3241 (2560, 3592)
2043	16.91 (16.90, 16.92)	4088 (4085, 4089)	1348 (995, 2037)	2740 (2049, 3094)
2044	17.83 (17.82, 17.84)	4309 (4306, 4311)	1348 (992, 2044)	2962 (2263, 3318)
2045	18.80 (18.79, 18.81)	4544 (4541, 4545)	1343 (986, 2044)	3201 (2498, 3559)
2046	20.32 (20.31, 20.33)	4911 (4908, 4913)	1331 (977, 2038)	3580 (2871, 3935)
2047	21.51 (21.50, 21.52)	5199 (5196, 5200)	1317 (965, 2026)	3882 (3171, 4235)
2048	20.61 (20.60, 20.62)	4982 (4979, 4983)	1302 (952, 2011)	3680 (2969, 4031)
2049	21.27 (21.26, 21.28)	5140 (5138, 5142)	1287 (936, 1992)	3855 (3147, 4205)
2050	22.11 (22.10, 22.12)	5344 (5341, 5345)	1269 (919, 1969)	4076 (3373, 4425)
Total	690.95 (690.28 691.28)	166 988 (166 827, 167 068)	27 067 (20 045, 40 455)	139 932 (126 390, 146 990)
Discounted (3%)				
Total	690.95 (690.28, 691.28)	129 786 (129 651, 129 852)	17 286 (12 820, 25 712)	112 513 (103 948, 117 002)

P&PI, both pre- and postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[a]Vaccinated population: 60-74 y olds in 2024, then 60-y olds from 2025 to 2050.
[b]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[c]Net cost (societal perspective) = vaccination program budget - direct and indirect costs averted

Table S36. Budget impact of Vaccae all-age vaccination program in China during 2024-50, from healthcare sector perspective.

Year	Vaccinated population (thousand)	Doses of vaccine required[a] (thousand)	Vaccine cost[b] (US$ million)	Vaccination program budget[c] (US$ million)	Direct medical cost averted (US$ million)	Net cost[d] (US$ million)
PSI vaccine type						
Protection duration 10-y scenario						
Undiscounted						
2024	114.769 (86.215, 236.614)	826.334 (620.747, 1703.620)	24 968 (18 756, 51 475)	31 003 (24 057, 60 640)	18.7 (13.5, 27.1)	30 983 (24 037, 60 624)
2034	93.736 (68.055, 199.925)	674.897 (489.994, 1439.462)	20 392 (14 805, 43 494)	25 911 (19 664, 51 740)	489 (373, 716)	25 409 (19 083, 51 292)
2044	64.971 (46.069, 145.737)	467.791 (331.698, 1049.309)	14 134 (10 022, 31 705)	18 623 (14 025, 38 268)	542 (408, 824)	18 097 (13 385, 37 749)
2024-2050	274.600 (200.339, 582.277)	1977.117 (1442.439, 4192.392)	59 739 (43 584, 126 674)	75 803 (57 738, 150 640)	11 277 (8611, 16 916)	63 991 (44 136, 139 957)
Discounted (3%)						
2024-2050	274.6 (200.339, 582.277)	1977.117 (1442.439, 4192.392)	48 169 (35 322, 101 393)	60 813 (46 447, 120 321)	7347 (5644, 11 000)	52 908 (37 527, 113 380)
Protection duration 20-y scenario						
Undiscounted						
2024	114.769 (86.215, 236.614)	826.334 (620.747, 1703.620)	24 968 (18 756, 51 475)	31 003 (24 057, 60 640)	18.7 (13.5, 27.1)	30 983 (24 037, 60 624)
2044	64.954 (46.053, 145.723)	467.665 (331.578, 1049.206)	14 131 (10 019, 31 702)	18 619 (14 021, 38 265)	586 (436, 867)	18 052 (13 314, 37 719)
2024-2050	180.856 (132.267, 382.337)	1302.163 (952.325, 2752.827)	39 345 (28 775, 83 177)	49 892 (38 072, 98 899)	11 924 (9059, 17 631)	37 975 (23 631, 87 820)
Discounted (3%)						
2024-2050	180.856 (132.267, 382.337)	1302.163 (952.325, 2752.827)	32 984 (24 303, 69 028)	41 522 (31 815, 81 821)	7784 (5924, 11 460)	33 663 (22 432, 74 632)
Protection duration lifelong scenario						
Undiscounted						
2024	114.769 (86.215, 236.614)	826.334 (620.747, 1703.620)	24 968 (18 756, 51 475)	31 003 (24 057, 60 640)	18.7 (13.5, 27.1)	30 983 (24 037, 60 624)
2024-2050	114.769 (86.215, 236.614)	826.334 (620.747, 1703.620)	24 968 (18 756, 51 475)	30 999 (24 053, 60 636)	12 452 (9409, 18 233)	19 046 (8783, 49 212)
Discounted (3%)						
2024-2050	114.769 (86.215, 236.614)	826.334 (620.747, 1703.620)	24 968 (18 756, 51 475)	30 999 (24 053, 60 636)	8041 (6097, 11 758)	23 204 (14 279, 53 276)
P&PI vaccine type						
Protection duration 10-y scenario						
Undiscounted						
2024	1002.392 (1001.732, 1 002.745)	7217.220 (7212.468, 7219.763)	218 070 (217 927, 218 147)	243 812 (243 651, 243 898)	33.1 (25.6, 48.6)	243 780 (243 600, 243 872)
2034	1010.728 (1010.407, 1010.993)	7277.240 (7274.931, 7279.147)	219 884 (219 814, 219 941)	245 839 (245 761, 245 904)	767 (602, 1 158)	245 077 (244 606, 245 282)
2044	916.166 (915.947, 916.392)	6596.395 (6594.815, 6598.026)	199 312 (199 264, 199 361)	222 839 (222 786, 222 894)	804 (615, 1 284)	222 036 (221 515, 222 249)
2024-2050	2929.264 (2928.145, 2930.098)	21 090.704 (21 082.641, 21 096.708)	637 261 (637 018, 637 443)	712 485 (712 213, 712 688)	17 335 (13 570, 27 166)	695 150 (685 045, 699 134)
Discounted (3%)						
2024-2050	2929.264 (2928.145, 2930.098)	21 090.704 (21 082.641, 21 096.708)	492 035 (491 825, 492 180)	550 116 (549 881, 550 278)	11 471 (8978, 17 779)	538 652 (532 094, 541 311)
Protection duration 20-y scenario						
Undiscounted						
2024	1002.392 (1001.732, 1002.745)	7217.220 (7212.468, 7219.763)	218 070 (217 927, 218 147)	243 812 (243 651, 243 898)	33.1 (25.6, 48.6)	243 780 (243 600, 243 872)
2044	916.149 (915.931, 916.377)	6596.270 (6594.702, 6597.917)	199 308 (199 261, 199 358)	222 835 (222 782, 222 890)	880 (670, 1 372)	221 962 (221 423, 222 200)
2024-2050	1918.519 (1917.691, 1919.091)	13 813.335 (13 807.375, 13 817.452)	417 374 (417 194, 417 498)	466 641 (466 440, 466 780)	18 280 (14 269, 28 124)	448 390 (438 320, 452 526)
Discounted (3%)						
2024-2050	1918.519 (1917.691, 1919.091)	13 813.335 (13 807.375, 13 817.452)	328 419 (328 256, 328 522)	367 186 (367 004, 367 302)	12 005 (9391, 18 381)	355 192 (348 620, 357 923)
Protection duration lifelong scenario						
Undiscounted						
2024	1002.392 (1001.732, 1002.745)	7217.220 (212.468, 7219.763)	218 070 (217 927, 218 147)	243 812 (243 651, 243 898)	33.1 (25.6, 48.6)	243 780 (243 600, 243 872)
2024-2050	1002.392 (1001.732, 1002.745)	7217.220 (7212.468, 7219.763)	218 070 (217 927, 218 147)	243 812 (243 651, 243 898)	19 120 (14 784, 29 202)	224 708 (214 506, 229 120)
Discounted (3%)						
2024-2050	1002.392 (1001.732, 1002.745)	7217.220 (7212.468, 7219.763)	218 070 (217 927, 218 147)	243 812 (243 651, 243 898)	12 402 (9646, 18 880)	231 423 (224 826, 234 259)

PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
[a]Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[b]Vaccine cost = vaccine price × doses of vaccine required + vaccine campaign cost (US$1.55 per person) × vaccinated population
[c]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[d]Net cost (healthcare sector perspective) = vaccination program budget - direct medical costs averted

Table S37. Budget impact of Vaccae all-age vaccination program in China during 2024-50, from societal perspective.

Year	Vaccinated population (thousand)	Doses of vaccine required[a] (thousand)	Vaccine cost[b] (US$ million)	Vaccination program budget[c] (US$ million)	Direct and indirect cost averted (US$ million)	Net cost[d] (US$ million)
PSI vaccine type						
Protection duration 10-y scenario						
Undiscounted						
2024	114.769 (86.215, 236.614)	826.334 (620.747, 1703.620)	24 968 (18 756, 51 475)	31 003 (24 057, 60 640)	56.0 (40.3, 86.5)	30 946 (23 995, 60 586)
2034	93.736 (68.055, 199.925)	674.897 (489.994, 1439.462)	20 392 (14 805, 43 494)	25 911 (19 664, 51 740)	1282 (987, 1969)	24 615 (18 209, 50 475)
2044	64.971 (46.069, 145.737)	467.791 (331.698, 1049.309)	14 134 (10 022, 31 705)	18 623 (14 025, 38 268)	1327 (1014, 2139)	17 313 (12 545, 36 887)
2024-2050	274.600 (200.339, 582.277)	1977.117 (1442.439, 4192.392)	59 739 (43 584, 126 674)	75 803 (57 738, 150 640)	29 686 (22 722, 47 046)	45 346 (23 383, 120 582)
Discounted (3%)						
2024-2050	274.600 (200.339, 582.277)	1977.117 (1442.439, 4192.392)	48 169 (35 322, 101 393)	60 813 (46 447, 120 321)	19 595 (15 114, 31 011)	40 780 (23 942, 100 566)
Protection duration 20-y scenario						
Undiscounted						
2024	114.769 (86.215, 236.614)	826.334 (620.747, 1703.620)	24 968 (18 756, 51 475)	31 003 (24 057, 60 640)	56.0 (40.3, 86.5)	30 946 (23 995, 60 586)
2044	64.954 (46.053, 145.723)	467.665 (331.578, 1049.206)	14 131 (10 019, 31 702)	18 619 (14 021, 38 265)	1326 (1011, 2043)	17 319 (12 503, 36 903)
2024-2050	180.856 (132.267, 382.337)	1302.163 (952.325, 2752.827)	39 345 (28 775, 83 177)	49 892 (38 072, 98 899)	29 800 (22 805, 46 217)	18 808 (2 088, 68 930)
Discounted (3%)						
2024-2050	180.856 (132.267, 382.337)	1302.163 (952.325, 2752.827)	32 984 (24 303, 69 028)	41 522 (31 815, 81 821)	19 637 (15 216, 30 576)	21 227 (8 304, 62 093)
Protection duration lifelong scenario						
Undiscounted						
2024	114.769 (86.215, 236.614)	826.334 (620.747, 1703.620)	24 968 (18 756, 51 475)	31 003 (24 057, 60 640)	56.0 (40.3, 86.5)	30 946 (23 995, 60 586)
2024-2050	114.769 (86.215, 236.614)	826.334 (620.747, 1703.620)	24 968 (18 756, 51 475)	30 999 (24 053, 60 636)	30 196 (23 085, 46 337)	374 (-14 011, 30 059)
Discounted (3%)						
2024-2050	114.769 (86.215, 236.614)	826.334 (620.747, 1703.620)	24 968 (18 756, 51 475)	30 999 (24 053, 60 636)	19 814 (15 355, 30 638)	10 403 (-189, 40 783)
P&PI vaccine type						
Protection duration 10-y scenario						
Undiscounted						
2024	1002.392 (1001.732, 1002.745)	7217.220 (7212.468, 7219.763)	218 070 (217 927, 218 147)	243 812 (243 651, 243 898)	124 (96.0, 202)	243 692 (243 449, 243 801)
2034	1010.728 (1010.407, 1010.993)	7277.240 (7274.931, 7279.147)	219 884 (219 814, 219 941)	245 839 (245 761, 245 904)	2477 (1893, 3854)	243 359 (241 921, 243 979)
2044	916.166 (915.947, 916.392)	6596.395 (6594.815, 6598.026)	199 312 (199 264, 199 361)	222 839 (222 786, 222 894)	2367 (1708, 3822)	220 470 (218 977, 221 133)
2024-2050	2929.264 (2928.145, 2930.098)	21 090.704 (21 082.641, 21 096.708)	637 261 (637 018, 637 443)	712 485 (712 213, 712 688)	55 621 (41 528, 88 313)	656 787 (623 920, 671 063)
Discounted (3%)						
2024-2050	2929.264 (2928.145, 2930.098)	21 090.704 (21 082.641, 21 096.708)	492 035 (491 825, 492 180)	550 116 (549 881, 550 278)	37 341 (28 016, 59 001)	512 655 (490 891, 522 187)
Protection duration 20-y scenario						
Undiscounted						
2024	1002.392 (1001.732, 1002.745)	7217.220 (7212.468, 7219.763)	218 070 (217 927, 218 147)	243 812 (243 651, 243 898)	124 (96.0, 202)	243 692 (243 449, 243 801)
2044	916.149 (915.931, 916.377)	6596.270 (6594.702, 6597.917)	199 308 (199 261, 199 358)	222 835 (222 782, 222 890)	2351 (1742, 3687)	220 491 (219 101, 221 111)
2024-2050	1918.519 (1917.691, 1919.091)	13 813.335 (13 807.375, 13 817.452)	417 374 (417 194, 417 498)	466 641 (466 440, 466 780)	55 626 (42 067, 86 942)	410 920 (379 510, 424 651)
Discounted (3%)						
2024-2050	1918.519 (1917.691, 1919.091)	13 813.335 (13 807.375, 13 817.452)	328 419 (328 256, 328 522)	367 186 (367 004, 367 302)	37 576 (28 370, 58 245)	329 527 (308 761, 338 883)
Protection duration lifelong scenario						
Undiscounted						
2024	1002.392 (1001.732, 1002.745)	7217.220 (7212.468, 7219.763)	218 070 (217 927, 218 147)	243 812 (243 651, 243 898)	124 (96.0, 202)	243 692 (243 449, 243 801)
2024-2050	1002.392 (1001.732, 1002.745)	7217.220 (7212.468, 7219.763)	218 070 (217 927, 218 147)	243 812 (243 651, 243 898)	56 356 (42 785, 87 108)	187 438 (156 532, 201 079)
Discounted (3%)						
2024-2050	1002.392 (1001.732, 1002.745)	7217.220 (7212.468, 7219.763)	218 070 (217 927, 218 147)	243 812 (243 651, 243 898)	37 868 (28 727, 58 329)	205 908 (185 311, 215 138)

PSI, postinfection vaccine efficacy; P&PI, both pre- and postinfection vaccine efficacy. Data are presented as median and 95% CI.
The government contact price of Vaccae was assumed to be US$30 per dose. Coverage 90% and efficacy 54.7%.
[a]Six doses of vaccine required per person, plus buffer stock (5%) and vaccine wastage (15%)
[b]Vaccine cost = vaccine price × doses of vaccine required + vaccine campaign cost (US$1.55 per person) × vaccinated population
[c]Vaccination program budget = screening cost + vaccine cost + delivery and administrative cost
[d]Net cost (societal perspective) = vaccination program budget - direct and indirect costs averted

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