

Effectiveness and coverage of COVID-19 vaccination among the infection-naïve population: a community-based retrospective cohort study in China



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Introduction

- China eased its zero-COVID policy in November 2022 and then pandemic outbreak has imposed a substantial burden.
- This study aims to analyze real-world vaccination effectiveness and waning effects among community-based COVID-19 infection-naïve individuals and among different sub-groups.

Methods

- An online questionnaire survey was conducted in Beijing, from January 13th to February 9th, 2023 and a total of 45,344 eligible respondents were included in the analysis.
- Vaccination and infection status among different groups classified by age (under 18, 18-59, and over 60) and health conditions (having underlying disease, allergy, cancer, immune deficiency or organ transplant) were analyzed.
- Propensity score matching and ordered logistic regression were used to examine the effectiveness of different COVID-19 vaccine types (inactivated, adenovirus, subunit protein, and mRNA vaccine), vaccination strategies (non-vaccination, primacy vaccination, homogenous booster, and heterogenous booster) and the waning effects.

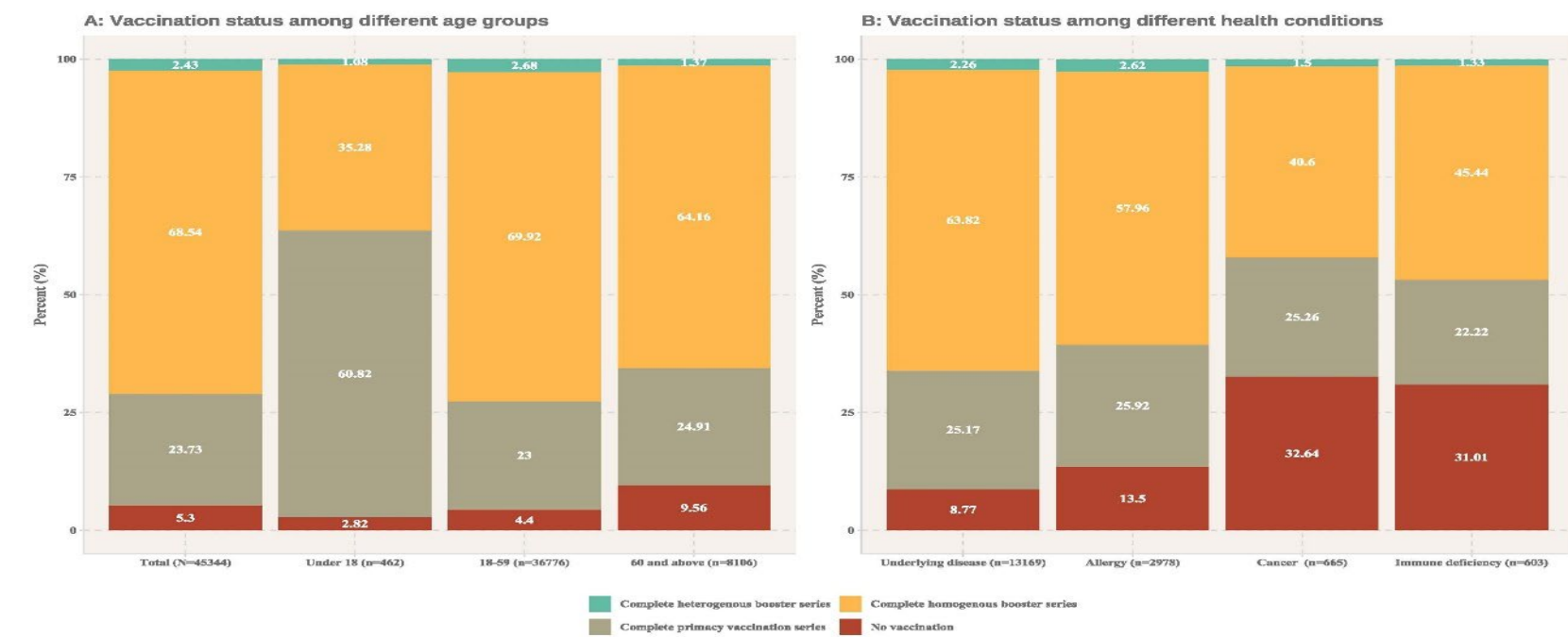


Figure 1 Vaccination status among different groups

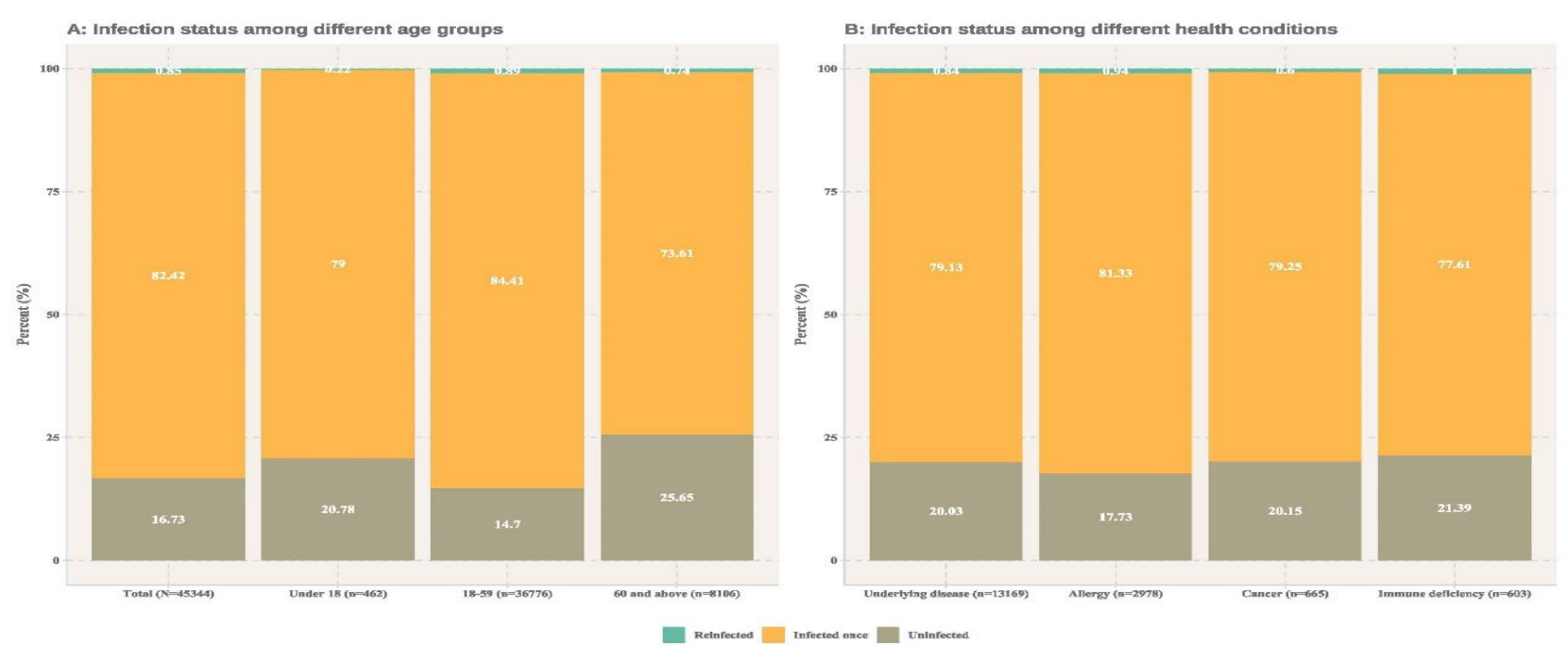


Figure 2 Infectious status among different groups

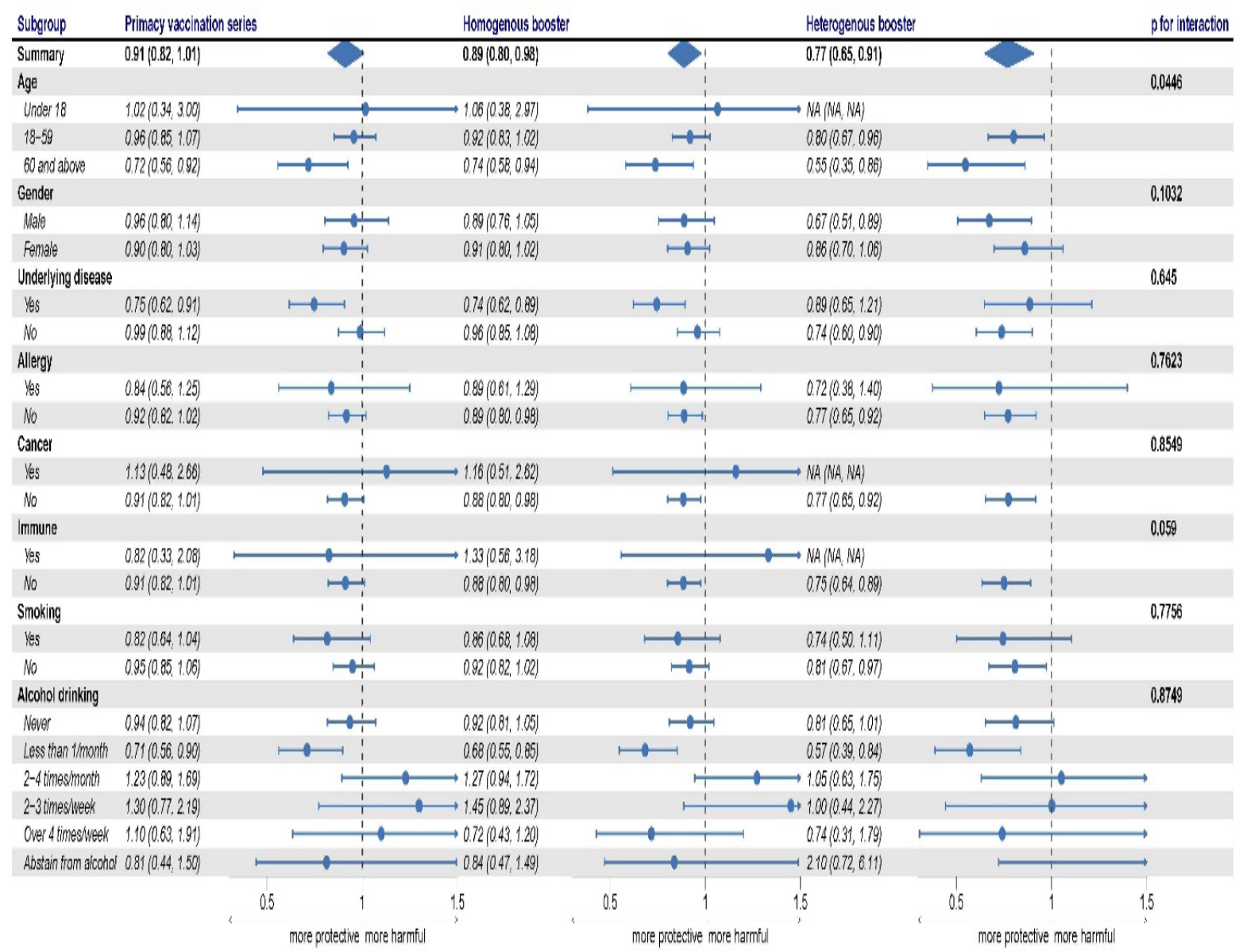


Figure 3 The effects of different vaccination strategies classified by subgroup

Results

- The infection rate was 82.42% among sampled population. (Figure 1)
- The vaccination rate was 94.70%, with 23.73% of them completed primacy vaccination series, 68.54% completed homogenous booster vaccination and 2.43% completed heterogenous booster vaccination; however, the high-risk population had a lower vaccination coverage. (Figure 2)
- Real-world vaccine effectiveness (VE) of homogenous and heterogenous booster vaccination against infection were 11% and 23%, and the elderly benefited the most. Adolescents had a lower booster vaccination coverage and no significant VE was identified. (Table 1)
- Waning effects were identified in the booster vaccination group after 12 months of injection. (Table 2)

Table 2 The effects of waning among three vaccination strategy groups

Severity	Model 1 ^a OR (95% CI) n=8,823	Model 2 ^b OR (95% CI) n=25,968	Model 3 ^c OR (95% CI) n=821
Waning effects (ref= within 3-month)			
3-6 months	0.97 (0.82, 1.16)	1.10 (0.99, 1.21)	0.70 (0.30, 1.66)
6-12 months	1.04 (0.89, 1.22)	1.00 (0.92, 1.09)	0.91 (0.46, 1.77)
>12 months	0.96 (0.82, 1.11)	1.09* (1.00, 1.17)	0.57 (0.30, 1.10)

Note: confounding factors are controlled in Model 1-3, and propensity score matching was not performed in regression
^a Model 1 is the primacy vaccination series group, due to missing value, 8823 out of 10759 observers are included in analysis;
^b Model 2 is the homogenous vaccination group, due to missing value, 25968 out of 31079 observers are included in analysis;
^c Model 3 is the heterogenous vaccination group, due to missing value, 821 out of 1102 observers are included in analysis
* p<0.05, ** p<0.01

Conclusion

- Low vaccination coverage among high-risk and vulnerable may lead to a huge disease and societal burden, thus improving vaccine coverage of these groups should be prioritized. In addition, due to waning immunity, regular booster vaccination should be scheduled within 12 months.

Table 1 The effects of different vaccination strategies in avoiding severity of COVID-19 infection

Variables	Severity ^a OR (95% CI)
Vaccination (ref=non-vaccination)	
Primacy vaccination series	0.91 (0.82, 1.01)
Homogenous booster	0.89* (0.81, 0.98)
Heterogenous booster	0.77** (0.65, 0.91)
Marriage status	1.03 (0.98, 1.08)
Occupation	0.99** (0.98, 1.00)
Age	1.00 (0.99, 1.01)
Gender (ref=male)	1.08** (1.02, 1.15)
Medication	1.09** (1.07, 1.10)
Educational level	1.05** (1.04, 1.07)
Medical insurance type (ref=OOP)	
Employee	1.07 (0.95, 1.19)
Resident	1.11 (0.99, 1.25)
Socialized	1.03 (0.89, 1.20)
Other	1.07 (0.87, 1.31)
Smoking (ref=no)	1.44** (1.34, 1.54)
Drinking frequency (ref=never)	
Less than 1/month	1.09** (1.03, 1.16)
2-4/month	1.15** (1.06, 1.25)
2-3/week	1.10 (0.97, 1.24)
4/week and above	1.16* (1.02, 1.31)
Abstain from alcohol	0.92 (0.81, 1.05)
BMI (ref=Normal)	
Malnutrition	1.17** (1.04, 1.32)
Obesity	1.03 (0.98, 1.07)
Nutrition (meals per day, ref=3 meals)	
0-1	0.82 (0.63, 1.08)
2	1.00 (0.94, 1.05)
>3	1.21* (1.02, 1.44)
Exercise per day (ref=never)	
<0.5 h	0.91** (0.86, 0.96)
0.5-1 h	0.78** (0.73, 0.83)
1-2 h	0.71** (0.65, 0.78)
>2 h	0.65** (0.57, 0.74)
Sleep quality (ref=normal)	
Very bad	1.37** (1.23, 1.52)
Bad	1.35** (1.26, 1.45)
Good	0.92** (0.87, 0.97)
Very good	0.79** (0.71, 0.88)
Number of symptoms after infection	1.29** (1.28, 1.29)
Underlying disease	1.12** (1.06, 1.19)
Allergy	1.22** (1.12, 1.33)
Cancer	1.13 (0.94, 1.36)
Immune deficiency	1.03 (0.84, 1.26)

Note: ^a Propensity score matching was performed in regression
Employee: basic medical insurance for urban employees; OOP: out-of-pocket payment; Resident: basic medical insurance for urban and rural residents; Socialized: socialized medicine insurance
* p<0.05, ** p<0.01