Effectiveness of COVID-19 Vaccines in Older Adults in Hong Kong

Lori Leung[1], Wey Wen Lim[1], Faith Ho[1], Yuyun Chen[1], Nancy H. L. Leung[1], Malik Peiris[1], Benjamin J. Cowling[1]

[1]School of Public Health, The University of Hong Kong, Hong Kong

Background

COVID-19 booster vaccines are recommended annually for all individuals in some locations, with particular prioritization of older adults and other high-risk groups. We examined the protection against infection provided by COVID-19 vaccinations in a cohort of older adults participating in a randomized controlled influenza vaccine trial in Hong Kong. Hong Kong has experienced several COVID-19 infection waves, and the infection number has risen to record high during the fifth wave (1 Jan 2022- 31 May 2022), with approximately 1.2million cumulative number of reported cases by nucleic acid tests or rapid antigen tests during the period.[3]

Objectives

With the implementation of the Vaccination Pass policy in February 2022, all individuals in Hong Kong had to be vaccinated with required doses to enter public areas. [1] According to the statistics published by the HKSAR government, around 80.9% and 67.4% of older adults aged between 70-79 and 80+ were vaccinated respectively by the end of May 2022.[3] We aimed to estimate the vaccine effectiveness of COVID-19 in older adults during the fifth wave and determine whether a boost dose is necessary. Currently, there are two types of COVID-19 vaccines available in Hong Kong: the Cominarty (BioNTech/Fosun Pharma) mRNA vaccine and CoronaVac (Sinovac) inactivated vaccine.[4]

Methods

In a trial of once-annual versus twice-annual vaccination, older adults 70-79 years of age were enrolled in 2015 and continuously followed up, with 175 participants remaining in the trial in January 2022. We interviewed participants to determine COVID-19 vaccination status and monitored COVID-19 infections through from 1 Jan 2022 to 31 May 2022 confirmed by PCR and/or rapid antigen tests. We used Cox regression models to estimate vaccine effectiveness (VE). It was calculated with the formula of **1-Hazard Ratio (HR) x 100%**.[2] There were 15 different combinations of COVID-19 vaccination by the end of fifth wave. We calculated the HR with the four combinations with most people and compared with the unvaccinated individuals. We have also summarized the vaccination history at the start of the wave to estimate the difference in the number of vaccinated individuals.

Characteristics	Number (n)
Number of participants	175
Withdrawal	0
Previous Infection	0
Male(n)	64.57%,113
Comorbidities	175
Vaccine Combination	
Unvaccinated	5
Homologous	
B	3
BB	18
BBB	42
BBBB	3
S	1
SS	38
SSS	43
SSSS	9
Heterologous	
BSS	1
BBBS	1
SSB	6
SSBB	3
SSSB	1
VSS	1

Table 1. Vaccine combinations of participants recorded at the start of wave 5. "B" denotes the BioNTech mRNA vaccine, "S" denotes Sinovac's inactivated vaccine and "V" denotes the Sputnik V adenovirus viral vector vaccine. The highlighted columns are the four chosen groups taken for comparison. As all the participants are elderly, so all of them got different types of comorbidity which were not discussed in detail here.

Results

Compared to unvaccinated individuals, the vaccine effectiveness for 3 doses of Cominarty (BioNTech/Fosun Pharma) mRNA vaccine against infection was 41% (CI: -206%, 88%), and the VE of 3 doses of CoronaVac (Sinovac) inactivated vaccine against infection was 40% (CI: -204%, 88%). The VE for 2 doses of Cominarty or CoronaVac vaccine were 10% (CI: -267%, 78%) and 54% (CI: -476%, 59%) respectively. Around 1/3 of the individuals in the cohort were not vaccinated at the start of wave 5, only 5 individuals were left unvaccinated at the end of wave 5. The most commonly seen vaccine combinations were 2 doses of Sinovac, 2 doses of BioNTech at the start of fifth wave. The most popular vaccine combinations were 2 doses of Sinovac, 2 doses of BioNTech, 3 doses of Sinovac and 3 doses of BioNTech at the end of fifth wave. Thus, these four combinations were employed to compare with "unvaccinated" individuals to calculate HR and VE.
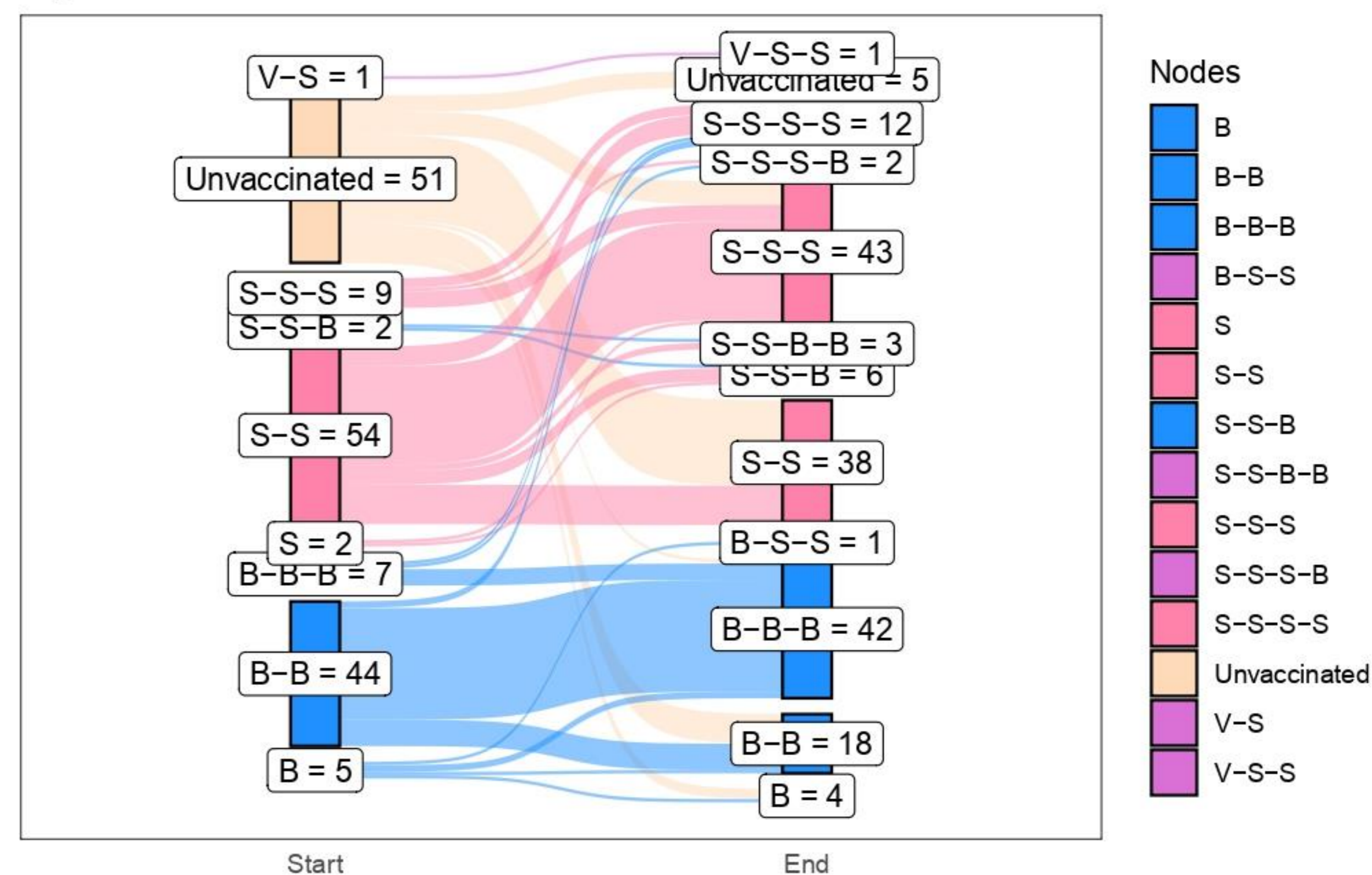
Figure 1

Figure 1 Changes of vaccine combinations through wave 5. Numbers indicated the total number of individuals per group.

Characteristic	HR[1]	95% CI[1]	p-value
Vaccine History			
Unvaccinated	-	-	
B-B	0.90	0.22, 3.67	0.9
B-B-B	0.59	0.12, 3.06	0.5
S-S	1.54	0.41, 5.76	0.5
S-S-S	0.60	0.12, 3.04	0.5
Age	0.93	0.82, 1.06	0.3
Sex	0.87	0.39, 1.94	0.7
Comorbidities	0.89	0.19, 4.14	0.9

[1]HR = Hazard Ratio, CI = Confidence Interval

Table 2. Hazard ratio of chosen vaccine combination compared with unvaccinated individuals. In both Table 2 and Figure 1, "B" denotes the BioNTech mRNA vaccine, "S" denotes Sinovac's inactivated vaccine and "V" denotes the Sputnik V adenovirus viral vector vaccine.

Conclusion

The result showed a positive effect of taking a booster dose of either BioNTech and Sinovac against COVID-19 infection than that of 2 doses of either BioNTech or Sinovac. However, the result was statically insignificant with wide 95% confidence interval due to the limited sample size and most individuals in the cohort only started taking COVID-19 vaccine at the start or during the fifth wave. Hence, the samples of taking 3 doses or above were lacking. We will continue to examine the VE in wave 6-8 with greater number of booster doses, i.e. 4 and 5 doses and determine whether additional booster dose is necessary for older adults.

References

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