Real-World Effectiveness of mRNA, Subunit, and Vector-based Vaccines Against COVID-19

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STUDY BACKGROUND

- Limited Covid-19 vaccine effectiveness (VE) studies address the mRNA, adenoviral vector-based, and protein subunit vaccines. The VE against severity and death of mix and match in real-world settings remained unclear.
- BNT162v2 (Pfizer-BioNTech), mRNA-1273 (Moderna), or AZD1222 (AstraZeneca), and locally MVC-COV1901 (Medigen) were provided under the National Vaccination Program, and mix/match was commonly adopted.
- Taiwan maintained a low circulation of infection until the major BA.2 epidemic began in April 2022; *therefore, the VE in the study could be considered as "pure immunity" obtained from vaccines rather than natural infection.*

STUDY OBJECTIVES

- To estimate the VE against severe and fatal diseases (death) associated with Covid-19 in this predominantly infection-naïve population.
- To explore VE of mix / match of mRNA, subunit and vector-based vaccines.

MATERIAL & METHODS

- Population-based study, which enrolled 23.9 million people in Taiwan, and the study data period was between Mar 21, 2021, to Sep 30, 2022.

Taiwan CDC

National Immunization System
1. **23,933,482 individuals**
2. Covid-19 Vaccination status.

National Infectious Disease Reporting System
1. **6,202,496 infections**
2. Positive of PCR or antigen test.

Covid-19 CECC

Definition: WHO Guidelines
1. **30,976 severe status (CECC committee reviewed)**
2. Severe included fatal status.

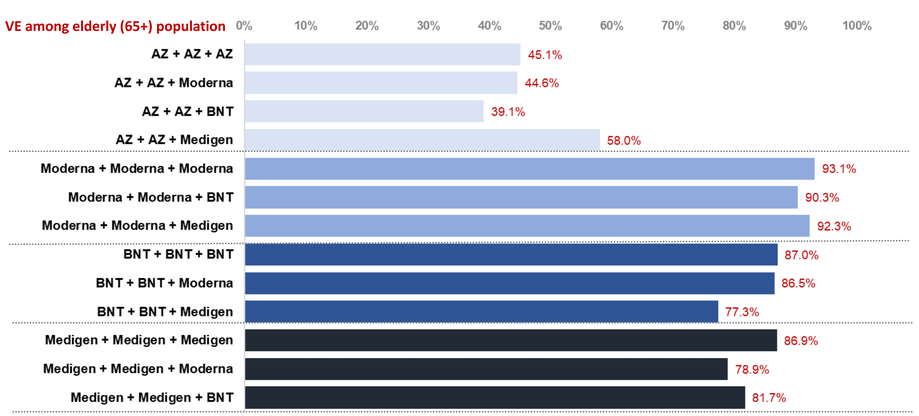
National Death Reporting
1. **10,851 deaths**
2. Covid-19 related death.

Estimation & calculation

Poisson regression
Incidence Rate Ratio, Severe, Fatal status.

Multiple logistic regression
Vaccine effectiveness.

- The effectiveness of mRNA, subunit and vector-based vaccines (and mix/match) against severity and death in real-world settings remained unclear.
- Individuals who received their primary series as AZD1222 might not have adequate protection against Covid-19 severity, even Boosted. ***(among elderly, VE against severity: 32.1%-54.0%; VE against death: 39.1%-58.0%)***
- The population-based results suggested ***that the protein subunit vaccine (MVC-COV1901) could provide similar protection against severity and death as mRNA vaccines.***



Effectiveness of Mix-and-Match vaccines in the real-world	Characteristics	VE against severity		VE against death	
	Case number	among All Ages	among Elderly (65+)	among All Ages	among Elderly (65+)
Primary series: AZD1222 (AstraZeneca) : Adenoviral vector-based Covid-19 vaccine					
AZ + AZ + AZ	12,540	65.9% (45.1%~78.8%)	46.2% (5.1%~69.5%)	60.9% (12.9%~82.5%)	45.1% (-32.3%~77.2%)
AZ + AZ + Moderna	4,652,714	69.8% (68.8%~70.8%)	44.2% (42.1%~46.2%)	61.1% (58.8%~63.2%)	44.6% (41.3%~47.7%)
AZ + AZ + BNT	1,598,320	74.9% (73.4%~76.3%)	32.1% (27.6%~36.3%)	71.0% (68.0%~73.8%)	39.1% (32.4%~45.2%)
AZ + AZ + Medigen	313,506	77.7% (74.9%~80.2%)	54.0% (47.5%~59.7%)	73.7% (68.0%~78.4%)	58.0% (47.8%~66.1%)
Primary series: mRNA-1273 (Moderna, Spikevax): mRNA Covid-19 vaccine					
Moderna + Moderna + Moderna	3,012,619	87.4% (86.8%~88.0%)	90.5% (90.0%~91.0%)	90.0% (89.1%~90.9%)	93.1% (92.4%~93.7%)
Moderna + Moderna + BNT	328,890	86.4% (84.4%~88.1%)	88.1% (86.2%~89.7%)	88.2% (84.7%~90.9%)	90.3% (87.3%~92.6%)
Moderna + Moderna + Medigen	107,957	84.9% (81.6%~87.7%)	89.1% (86.5%~91.3%)	87.7% (81.8%~91.7%)	92.3% (88.2%~95.0%)
Primary series: BNT162v2 (Pfizer-BioNTech, Comirnaty): mRNA Covid-19 vaccine					
BNT + BNT + BNT	1,839,690	95.8% (95.1%~96.4%)	84.3% (79.8%~87.8%)	95.6% (94.0%~96.7%)	87.0% (79.6%~91.7%)
BNT + BNT + Moderna	2,510,303	96.1% (95.5%~96.5%)	81.8% (77.4%~85.3%)	96.2% (95.1%~97.1%)	86.5% (79.6%~91.0%)
BNT + BNT + Medigen	93,493	90.7% (86.3%~93.7%)	74.5% (55.0%~85.5%)	91.9% (82.0%~96.4%)	77.3% (39.5%~91.5%)
Primary series: MVC-COV1901 (Medigen) - Protein subunit Covid-19 vaccine (Locally produced and TFDA approved in Taiwan)					
Medigen + Medigen + Medigen	341,841	91.4% (89.6%~92.8%)	87.0% (83.3%~89.8%)	90.3% (86.6%~93.0%)	86.9% (80.4%~91.2%)
Medigen + Medigen + Moderna	219,562	92.3% (89.7%~94.2%)	82.0% (70.6%~89.0%)	91.1% (85.0%~94.8%)	78.9% (55.8%~90.0%)
Medigen + Medigen + BNT	149,928	96.2% (93.5%~97.7%)	69.0% (40.4%~83.9%)	95.6% (88.2%~98.3%)	81.7% (26.6%~95.4%)

*A total of 27 combinations were analyzed to compare the VE. Due to the poster limitation, we adopted the combination results of three doses. Further details or more info could be obtained through the contact author: Dr. Cheng-Yi LEE, EIC, Taiwan CDC. E-mail : cylee@cdc.gov.tw

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Additional information:

- This was a policy analysis performed by Taiwan CDC. The study was IRB approved and categorized as exempt review research.
- The authors have no conflicts of interest to declare.

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