

# Analyzing Influenza Vaccine Effectiveness by Age for Influenza A/B Viruses Between 2011 to 2020

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## Introduction

- Influenza virus is a highly contagious endemic respiratory illness that occurs seasonally (mid-November to mid-March, in Canada) and affects all age groups. While the effects of the influenza virus vary, the burden on individuals, families, and society has historically been high, with at-risk populations having a greater chance of complications and death. Understanding how vaccine effectiveness differs by age is crucial to determine which populations might need refinements in vaccination strategy or additional measures to reduce influenza rates and in turn, hospitalization rates and deaths.
- Vaccine effectiveness (VE) is a measure of how well vaccines work in the real world and is calculated by<sup>1</sup>:  
$$\frac{\text{Risk among unvaccinated group} - \text{Risk among vaccinated group}}{\text{Risk among unvaccinated group}}$$
  - Children under 5yrs, individuals with underlying medical conditions, and people over 65 are at the highest risk of serious illness, hospitalization and death from influenza.<sup>2</sup>
  - A study showed that older individuals who were vaccinated for influenza had a lower number of antibodies compared to younger, vaccinated individuals.<sup>3</sup>
  - Based on prior research, we hypothesized that vaccine effectiveness (VE) will be highest in the 18-49 year old age group and lowest in those over 65 years old.

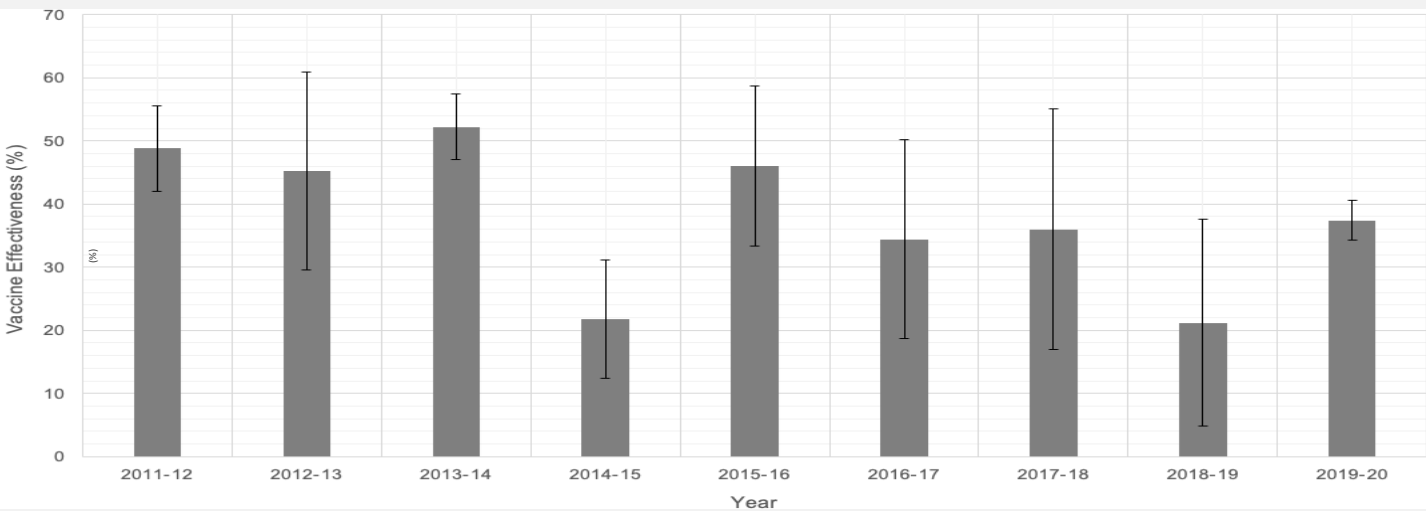
## Methods

- We compiled, summarized and analyzed data obtained from the Centers for Disease Control and Prevention (CDC) website to determine our results.<sup>4</sup>
- Estimated mean VE for Influenza A/B viruses for each year from 2011-2020 (with a 95%CI) by age group (6 months to 8 years, 9-17, 18-49, 50-64, 65+) was obtained
- ANOVA was used to compare VE-Year, VE-Age Group, VE-age-strain, VE-Age-Year and VE-age-year-strain ( $\alpha = 0.05$ )
- Tukey Honest Significant Difference (HSD) was completed as a post-hoc analysis

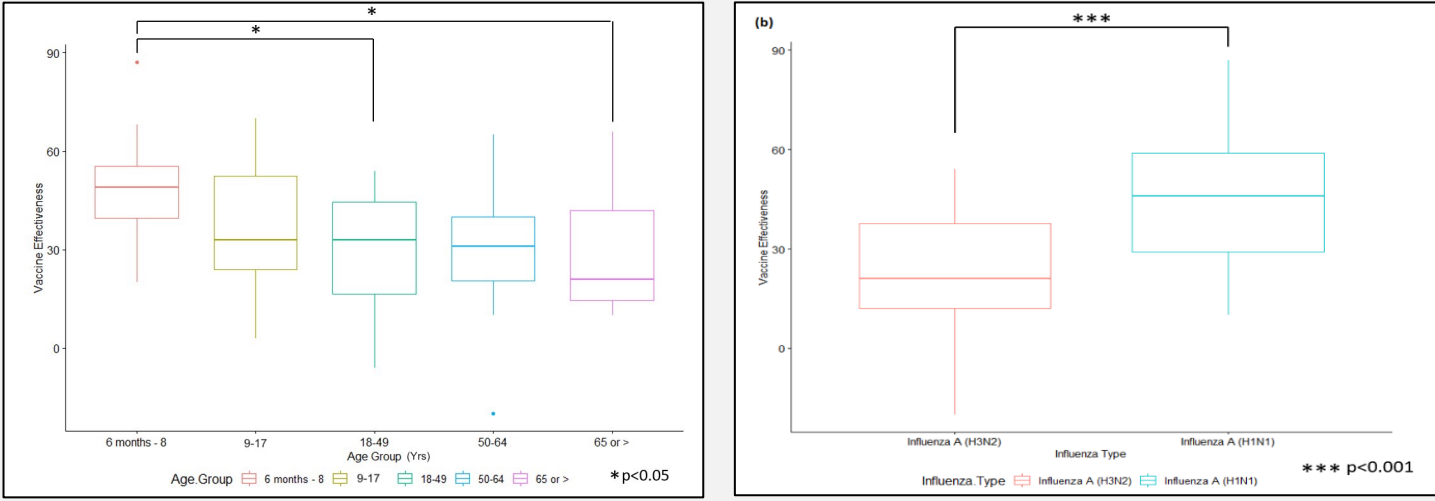
## Results

**Table 1:** Influenza vaccine effectiveness (%) broken down by age group for all flu vaccine types, against influenza A or B viruses.

Age Group (yrs)	Vaccine Effectiveness (%)									
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Mean±SD
6 months - 8	45	57	45	2	51	57	68	48	34	47.8±12.8
9 - 17	58	39	53	25	59	36	32	7	40	38.8±16.7
18 - 49	44	39	54	7	52	19	33	25	34	34.1±15.4
50 - 64	54	65	59	20	26	40	30	14	40	38.7±17.8
≥ 65	43	26	50	32	42	20	17	12	39	31.2±13.2
Mean±SD	48.8±6.8	45.2±15.6	52.2±5.2	21.8±9.3	46±12.7	34.3±15.7	36±19.0	21.2±16.4	37.4±3.1	—



**Figure 1:** Mean flu vaccine effectiveness from 2011-2020.



**Figure 2:** (A) Box plots displaying flu vaccine effectiveness against Influenza A and B viruses, across various age groups. (B) Box plots displaying overall vaccine effectiveness by influenza strain.

## Discussion

- VE for influenza varies between seasons, ranges from 21.8-52.2% between 2011-2020, but in most years was <50%.
- There was a statistically significant difference between the youngest age group (6 months-8 yrs) and adults (18-49yrs) and similarly between the oldest (65+ yrs) and the youngest.
- Our results are consistent with literature showing decreased immune response among older adults.<sup>3</sup>
- Other studies that have shown conflicting results with no pattern of decreasing VE with increased age.<sup>5,6</sup>
- Given the limited, and conflicting information about VE in those 65+, more information is needed to better understand how well influenza vaccines works in the elderly.
- Influenza case rate has decreased from an average of 38,000 to 551 this season. Therefore, masks are a viable method of improving protection against the spread of influenza.<sup>7</sup>

## References

<sup>1</sup> Centers for Disease Control and Prevention. (2012, May 18). *Principles of Epidemiology*. Centers for Disease Control and Prevention. Retrieved April 15, 2022, from <https://www.cdc.gov/csels/dsepd/ss1978/lesson3/section6.html>

<sup>2</sup> Khalil N, Bernstein DI. Influenza vaccines: where we are, where we are going. *Curr Opin Pediatr*. 2022 Apr 1;34(2):119-125. doi: 10.1097/MOP.0000000000001103. PMID: 35034078.

<sup>3</sup> Lord J. The effect of aging of the immune system on vaccination responses. *Human Vaccines & Immunotherapeutics* 9:6, 1364–1367

<sup>4</sup> Centers for Disease Control and Prevention. (2021, August 26). *Past seasons vaccine effectiveness estimates*. Centers for Disease Control and Prevention. Retrieved April 15, 2022, from <https://www.cdc.gov/flu/vaccines-work/past-seasons-estimates.html>

<sup>5</sup> Russell K, Chung JR, Monto AS, Martin ET, Belongia EA, McLean HQ, Gaglani M, Murthy K, Zimmerman RK, Nowalk MP, Jackson ML, Jackson LA, Flannery B. Influenza vaccine effectiveness in older adults compared with younger adults over five seasons. *Vaccine*. 2018 Feb 28;36(10):1272-1278. doi: 10.1016/j.vaccine.2018.01.045. PMID: 29402578; PMCID: PMC5812289

<sup>6</sup> Osterholm MT, Kelley NS, Sommer A, Belongia EA. Efficacy and effectiveness of influenza vaccines: a systematic review and meta-analysis. *Lancet Infect Dis*. 2012 Jan;12(1):36-44. doi: 10.1016/S1473-3099(11)70295-X. Epub 2011 Oct 25. Erratum in: *Lancet Infect Dis*. 2012 Sep;12(9):655. PMID: 22032844.

<sup>7</sup> CBC/Radio Canada. (2022, April 7). *Is it covid or a cold? how to know as omicron cases rise* | CBC news. CBCnews. Retrieved April 15, 2022, from <https://www.cbc.ca/news/health/covid-cold-flu-how-to-tell-the-difference-1.6410856>