Estimated additional burden averted for the 2022–2023 influenza season from use of cell-based influenza vaccines compared to egg-based influenza vaccines among people 0–64 years of age in the United States (V000-60RWE)

Ian McGovern,[1] Alicia Stein,[2] Mendel Haag[3]

[1]CSL Seqirus, Waltham, MA, USA; [2]CSL Seqirus, Melbourne, Australia; [3]CSL Seqirus, Amsterdam, The Netherlands

Contact: Monica.AbouHarb@seqirus.com and Ian.McGovern@seqirus.com

CSL Seqirus

Objective

This study aimed to model the public health impact (i.e., additional burden averted) if all people aged 0–64 years vaccinated in the US during the 2022–2023 influenza season had received cell-based inactivated quadrivalent influenza vaccine (ccIIV4) instead of egg-based inactivated quadrivalent influenza vaccine (IIV4), in terms of symptomatic influenza cases and associated healthcare resource utilisation (HRU) and deaths.

Background

- Traditional influenza vaccine production in eggs can introduce egg-adapted mutations.
- Cell-based influenza vaccines avoid egg-adaptation, potentially improving vaccine match to circulating influenza viruses and thereby improving vaccine effectiveness (VE).
- A recent study evaluated the relative VE (rVE) of ccIIV4 versus IIV4 for prevention of test-confirmed influenza during the 2022–2023 influenza season.[1]
- Estimation of burden averted is useful to contextualize the impact of improved VE for one vaccine compared with another.

Methods

- The modeling method used by the US Centers for Disease Control and Prevention (CDC) for estimating overall burden averted due to influenza vaccination[2] was extended to an rVE context.
- The model utilized CDC data on influenza vaccine uptake,[3,4] influenza incidence,[5] influenza-related healthcare resource use (HRU) and deaths[6] from the 2022–2023 influenza season (**Table 1**).
- CDC estimates of absolute vaccine effectiveness[7] [aVE, i.e., effectiveness relative to no vaccination] for any vaccine type were used as a proxy for the aVE of IIV4 given that the majority of vaccines used in this age group in the US are IIV4 (**Table 1**).
- We applied an rVE of 7.7% (0.9 to 13.9%) for the rVE of ccIIV4 vs IIV4, estimated in a 2022–2023 retrospective test-negative design study in the US for the 6-month to 64-year age group.[1]
- The uncertainty around base-case results was evaluated with deterministic (DSA) and probabilistic (PSA) sensitivity analyses.
- The burden averted is expressed as symptomatic cases, outpatient visits, hospitalizations, intensive care unit (ICU) visits, and deaths prevented.

Table 1. Model input data: Absolute vaccine effectiveness of IIV4, vaccine coverage, influenza burden and HRU without vaccination among different age groups

	0–4 Years Old	5–17 Years Old	18–49 Years Old	50–64 Years Old
aVE	49%	49%	46%	46%
Vaccine coverage	66%	57%	35%	50%
Influenza burden and HRU without vaccination				
Symptomatic cases	3,342,052	9,016,337	11,162,710	6,280,920
Outpatient visits	2,239,175	4,688,495	4,130,203	2,700,796
Hospitalizations	23,299	24,722	62,656	66,607
ICU rate for hospitalizations	3,495	3,708	9,398	9,991
Deaths	228	248	1,003	4,523

Results

- **Table 2** shows the estimated number of symptomatic influenza cases and associated HRU and deaths prevented from use of either IIV4 or ccIIV4 in individuals aged 0–64 years, as well as the additional burden that would have been averted if all vaccinated people aged 0–64 years had received ccIIV4 instead of IIV4.
- **Table 3** shows the estimated additional burden averted by use of ccIIV4 instead of IIV4 by age group.
- Use of ccIIV4 would result in prevention of an additional 622,826 symptomatic illnesses, 307,682 outpatient visits, 3,680 hospitalizations, 559 ICU admissions, and 127 deaths compared to IIV4.
- DSA results showed that the rVE estimate was associated with the most variability in the estimated results followed by the influenza burden estimates (i.e., symptomatic cases) (**Figure 1**). Mean PSA results were all within a 0.1% difference of base-case results (**Table 4**).

Conclusions

Use of ccIIV4 instead of IIV4 during the 2022–2023 influenza seasons in the US would have had a substantial public health impact on the population aged 0–64 years due to prevention of an additional 622,826 symptomatic illnesses, as well as proportionate reductions in associated HRU and deaths.

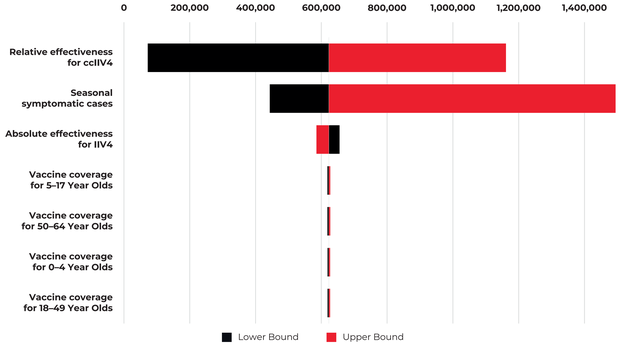
Table 2. Additional burden averted: Number of outcomes prevented from use of IIV4 or ccIIV4 in individuals aged 0–64 years

Outcome	Number of Outcomes Prevented		Additional Burden Averted by ccIIV4
	IIV4	ccIIV4	
Symptomatic cases	5,765,947	6,388,773	622,826
Outpatient visits	2,837,872	3,145,554	307,682
Hospitalizations	33,673	37,353	3,680
ICU admissions	5,118	5,678	559
Deaths	1,139	1,266	127

Table 3. Number of additional outcomes prevented from use of ccIIV4 compared to IIV4, by age group

Age Group (years)	Symptomatic Cases	Outpatient Visits	Hospitalizations	ICU Admissions	Deaths
0–4	114,166	76,491	796	121	8
5–17	231,092	120,168	634	96	6
18–49	138,860	51,378	779	118	12
50–64	138,708	59,644	1,471	224	100
Total	**622,826**	**307,682**	**3,680**	**559**	**127**

Figure 1. DSA results: symptomatic cases prevented



The DSA evaluated the impact that individual model input parameters had on the results by evaluating the change in the number of outcomes prevented from base-case analysis when using the upper/lower limits of the 95% confidence intervals of the estimates instead of the point estimate.

Table 4. PSA results: symptomatic cases prevented

Scenario	Mean	First Quartile	Third Quartile
ccIIV4	6,445,134	5,392,991	7,353,777
IIV4	5,822,757	4,852,212	6,648,788
Incremental	622,377	473,909	737,249

The PSA evaluated the distribution of expected results after repeatedly resampling the input parameters over an assumed distribution.

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Disclosures

Ian McGovern, Alicia Stein, Mendel Haag and Monica Abou Harb are employees of CSL Seqirus and own shares of stock/stock options in CSL.

Abbreviations:

aVE, absolute vaccine effectiveness; ccIIV4, cell-based inactivated quadrivalent influenza vaccine; DSA, deterministic sensitivity analysis; HRU, healthcare resource use, ICU, intensive care unit; IIV4, egg-based inactivated quadrivalent influenza vaccine; PSA, probabilistic sensitivity analysis.

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