Systematic Review of Economic Evaluations of Pneumococcal Conjugate Vaccines in East and Southeast Asia

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OBJECTIVE

To systematically assess and summarize characteristics, assumptions, and results for cost effectiveness analyses (CEAs) of infant Pneumococcal Conjugate Vaccines (PCV) programs in East and Southeast Asia.

METHODS

- Systematic literature review (SLR) conducted to identify economic evaluations of infant PCVs in East and Southeast Asia.
- Studies from 1/1/2006 through 10/11/2019 in MEDLINE and EMBASE. English language only.
- Studies without a CEA of PCV7/10/13 versus no vaccination or comparisons of PCV10 (PHiD-CV10) to PCV13 were excluded.
- Data regarding study characteristics, model inputs, clinical results, economic results, and results drivers were extracted.

RESULTS

1,012 records identified; **32** studies included with **53** unique CEAs (Table 1).

- **44** CEAs compared a PCV to no vaccination.
- **9** CEAs compared PCV13 vs. PCV10 or PCV10 vs. PCV13.

Table 1. Study Characteristics and Analyses

STUDY CHARACTERISTICS								ANALYSES			
								NO VACCINE VS.			
STUDY	SETTING	FUNDER	TYPE	PERSPECTIVE	POPULATION	TIME HORIZON	DISCOUNT RATE	PCV7	PCV10	PCV13	PCV10 & PCV13[1]
Aljunid 2011	Malaysia	I	CEA	Payer	550,000 infants	10 years	3%	✔			
Aljunid 2014	Malaysia	I	CUA	Payer	Birth cohort	Lifetime	5% C&O		✔		✔
Caldwell 2015	China	I	CUA	Payer	Whole population	Lifetime	3%	✔			
Che 2014	China	N-I	CUA	Societal	One birth cohort	100 years	3%	✔			
Chen 2019	GAVI-Eligible	N-I	CUA	HSs	30 birth cohorts	Lifetime	3%			✔	
Dilokthornsakul 2019	Thailand	I	CUA	Societal	Birth cohort	Lifetime	3%		✔	✔	
Dorji 2018	Bhutan	N-I	CUA	Governmental	One birth cohort	Lifetime	3%		✔	✔	✔
Haasis 2015	Philippines	N-I	CUA	HS	Birth cohort	Lifetime	3.5% C&O		✔	✔	✔
Hoshi 2012	Japan	N-I	CUA	Societal	Birth cohort	5 years	3% C&O	✔			
Hoshi 2013	Japan	N-I	CEA/CUA	Societal	Birth cohort	5 years	3% C&O	✔		✔	
Hu 2014	China	I	CUA	Payer	Birth cohort	5 – 7 years	5%	✔			
Krishnamoorthy 2019	India	N-I	CUA	Governmental	10 birth cohorts	10 years	3% C&O			✔	
Kulpeng 2013	Thailand	N-I	CUA	Societal	Unclear	Lifetime	3% C&O		✔	✔	
Lee 2009	Hong Kong	I	CEA	Payer & Societal	Birth cohort	10 years	5% C&O	✔			
Lee 2013	Hong Kong	I	CEA/CUA	Payer	Birth cohort	10 years	5%				✔
Maurer 2016	China	N-I	CUA	Societal	16m Chinese infants	Lifetime	3%	✔	✔	✔	
Megiddo 2018	India	N-I	ECEA	HS	25,000 individuals	20 years	3% costs			✔	
Mo 2016	China	N-I	CUA	Societal	100,000 newborns	100 years	3%	✔		✔	
Nakamura 2011	MICs	N-I	CUA	Societal	Under 5-year olds	Lifetime	3%	✔	✔	✔	
Shen 2018	China	I	CUA	Payer	One birth cohort	Lifetime	3%			✔	
Shiragami 2015	Japan	I	CUA	HC & Societal	Birth cohort	5 years	3% C&O				✔
Sohn 2010	Korea	N-I	CEA	Societal	Birth cohort	5 years	5% C&O	✔			
Sundaram 2017	Mongolia	N-I	CUA	HS & Societal	30 birth cohorts	100 years	3% C&O			✔	
Tasslimi 2011	Global	N-I	CUA	Societal	Under 5-year olds	Lifetime	3%	✔	✔	✔	
Tyo 2011	Singapore	N-I	CUA	HC	Infant/child cohort	5 years	3% C&O	✔	✔	✔	
Wang 2017	Malaysia	I	CUA	Payer	Birth cohort	10 years	3%		✔		✔
Wu 2012	Taiwan	N-I	CEA	HC & Societal	Total population	10 Years	3% C&O			✔	
Wu 2013	Taiwan	N-I	CEA	Payer & Societal	Birth cohort	10 years	3% C&O	✔			
Wu 2016	Malaysia /Hong Kong	I	CUA	Payer & Societal	10 birth cohorts	10 years	3%		✔	✔	✔
Zhang 2014	Philippines	I	CUA	Governmental	Birth cohort	Lifetime	5%		✔		✔
Zhang 2018	Korea	I	CUA	Governmental	2012 birth cohort	10 years	5% C&O				✔
Zhou 2018	China	N-I	CUA	Payer & Societal	One birth cohort	Lifetime	5%			✔	

[1]Includes PCV13 vs. PCV10 and PCV10 vs. PCV13 analyses; [2]Excluded for AOM in Base Case A; Included in AOM Base Case B
Abbreviations: CEA = Cost-Effectiveness Analysis; CUA = Cost-Utility Analysis; CEA = Cost-Effectiveness Analysis; C&O = Costs & Outcomes; ECEA = Extended Cost-Effectiveness Analysis; HC = Healthcare; HS = Health System; I = Industry; MICs = Middle-Income Countries; N-I = Non-Industry

PCV7/PCV10/PCV13 vs. No Vaccination

- Of CEAs comparing a PCV to no vaccination, 86.4% (n=38) were cost-effective. The most consistent cost-effective findings were found for PCV13 vs. no vaccine (94.4%) (Table 2).

Table 2. Cost-Effectiveness Results

COMPARISON	COST-EFFECTIVE
PCV7 vs. No Vaccine (n=14)	78.6% (11/14)
PCV10 vs. No Vaccine (n=12)	83.8% (10/12)
PCV13 vs. No Vaccine (n=18)	94.4% (17/18)
PCV10 vs. PCV13 (n=6)	100% (6/6)
PCV13 vs. PCV10 (n=3)	100% (3/3)

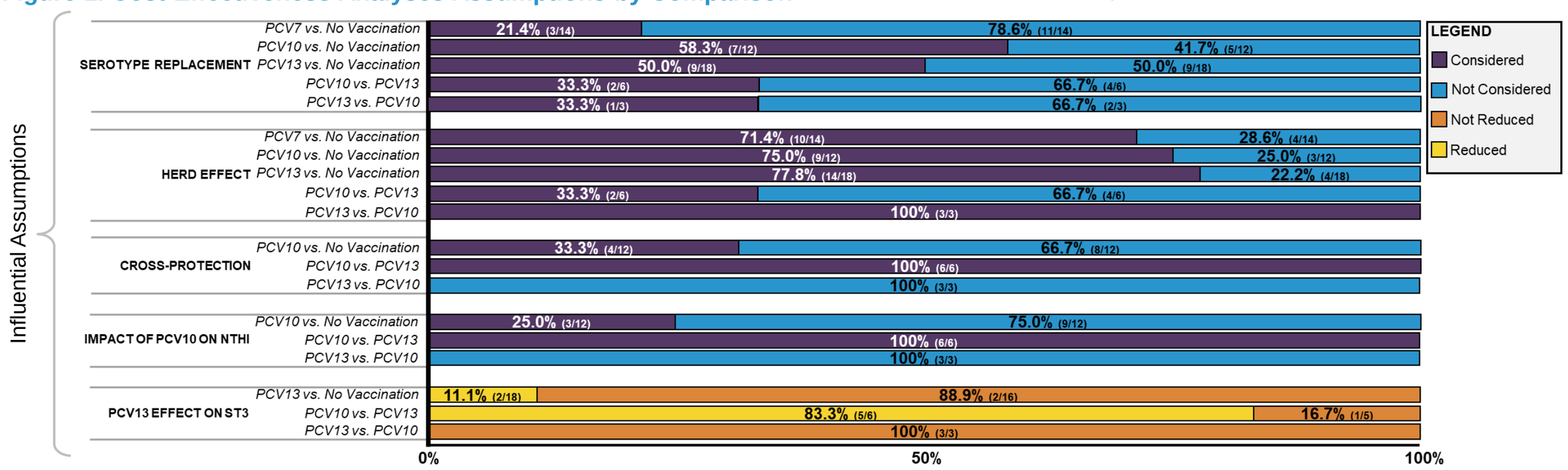
PCV13 vs. PCV10

- **7/9** CEAs were funded by industry, with **6/6** PCV10 vs. PCV13 CEAs funded by GSK reporting PCV10 cost-effective. **3/3** CEAs comparing PCV13 to PCV10 found PCV13 cost-effective.

Influential Modelling Assumptions

- Five key modelling assumptions were identified across the different CEAs included in this review (Figure 1).
- All PCV10 vs. PCV13 CEAs assumed impact of PCV10 on NTHi and PCV10 cross-protection for serotype (ST) 6A and/or ST19A, and most CEAs (83%) reduced or eliminated effect of PCV13 on ST3.
- No PCV13 vs. PCV10 CEAs made assumptions on PCV10 cross protection, reduced PCV13 effect for ST3, and PCV10 impact on NTHi.

Figure 1. Cost-Effectiveness Analyses Assumptions by Comparison



CONCLUSION

- We identified key assumptions that substantially influence CEA results, particularly in PCV10 vs. PCV13 CEAs. Impact of PCV10 on NTHi, PCV10 cross-protection for STs 6A/19A, and excluding PCV13 effects on ST3, were the most influential parameters on results; yet are not supported by strong evidence.
- CEAs are highly dependent on quality of data, which underscores the need for assumptions supported by strong scientific evidence.
- **Model assumptions can substantially change results of CEAs. When choosing a PCV for a National Immunization Program, consumers of CEAs must assess whether model assumptions are scientifically robust.**

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