

Transmission dynamic models and economic evaluations of pneumococcal conjugate vaccines: a review of the literature

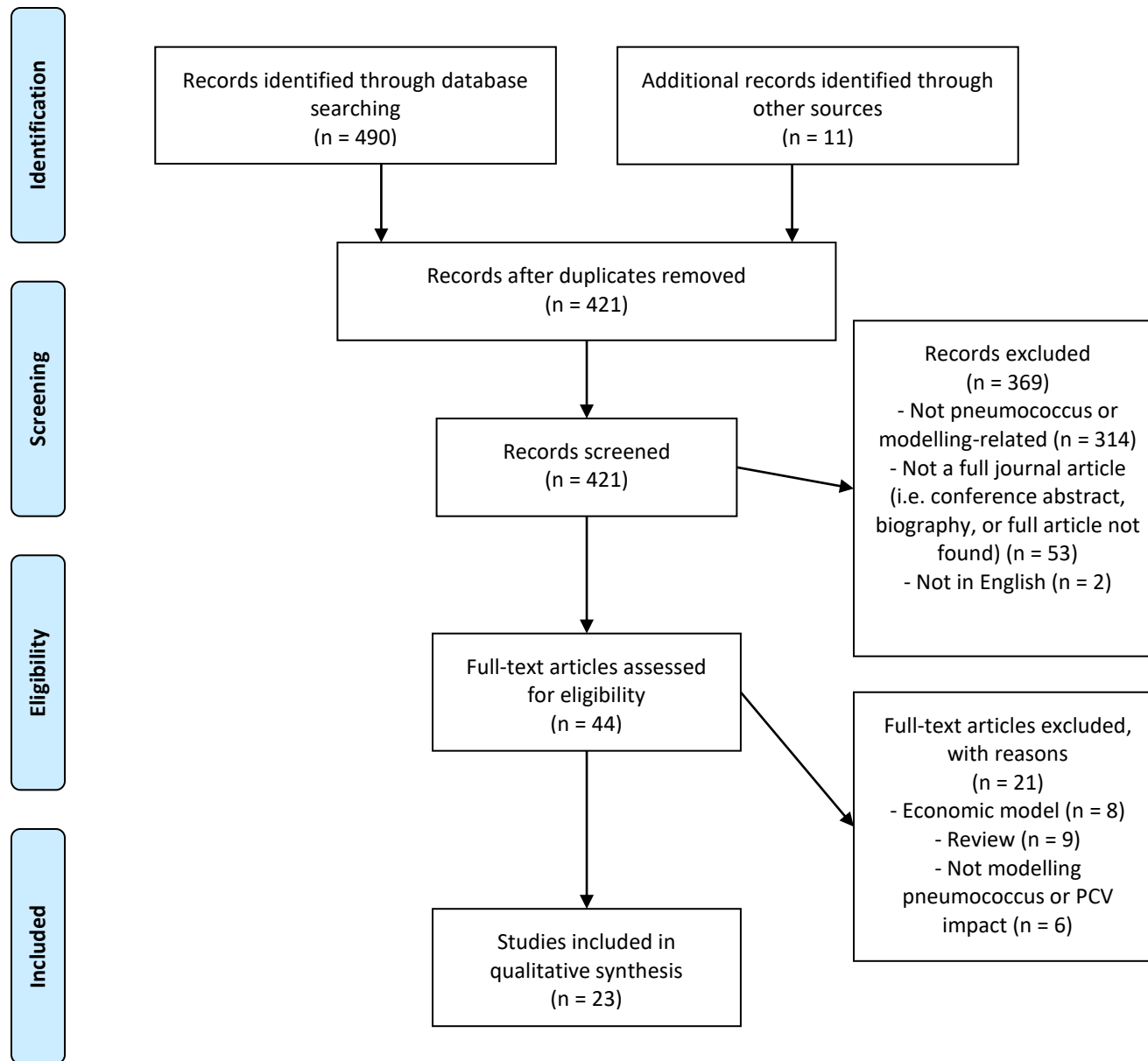
Supplementary Material

Review Search Strategy

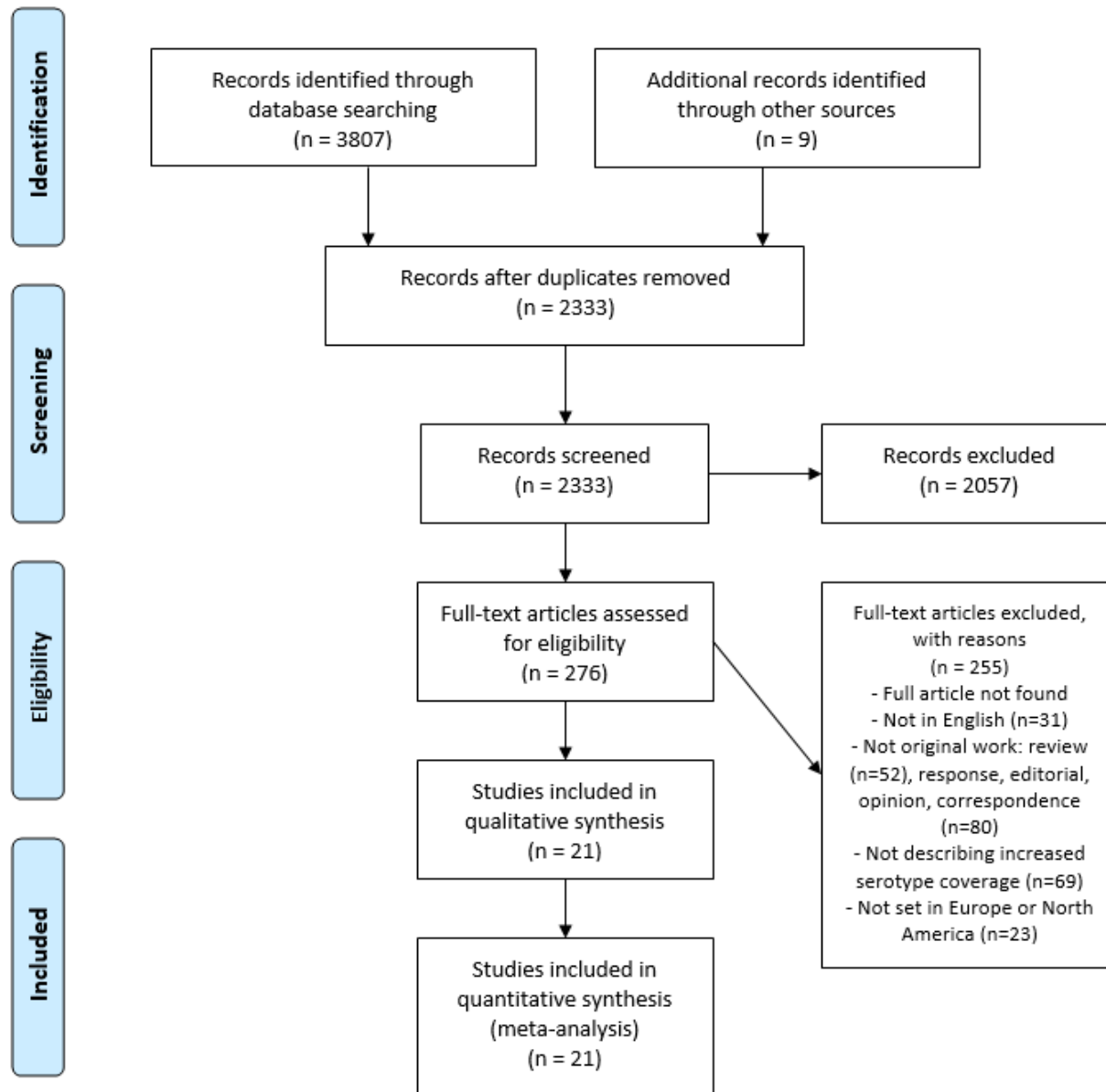
Pubmed, Scopus, Ovid and ISI Web of Knowledge were searched using the following terms: “*PCV OR pneumococc* AND dynamic AND transmission AND model**” and “*(pneumococcal AND vaccine) AND (stochastic OR deterministic OR compartmental OR individual-based)*”. The same databases, in addition to the Centre of Reviews and Dissemination (CRD), were searched using the following terms: “*PCV pneumococc* AND (econ* OR cost benefit OR cost effectiveness OR cost utility OR economic impact) AND (vaccin* or immun*)*”. Neither search was date-restricted.

Published papers were included if:

- (i) They presented a dynamic transmission model that investigated the epidemiological impact of any PCV in any setting
- (ii) They described any type of economic evaluation comparing PCVs in the European or North American setting (as defined by the World Health Organization)
- (iii) They were in English
- (iv) They were not a duplicate of another paper and were original models or evaluations
- (v) A full article was available



Supplementary Figure 1: PRISMA flow diagram for dynamic transmission models review



Supplementary Figure 2: PRISMA flow diagram for economic evaluations review

Abbreviations
AOM: acute otitis media
CAP: community-acquired pneumonia
CEA: cost-effective analysis
CUA: cost-utility analysis
CFR: case-fatality ratio
DALY: disability-adjusted life years
EE: economic evaluation
ICER: incremental cost-effectiveness ratio
IPD: invasive pneumococcal disease
LY: life years
LYG: life years gained
MCMC: Markov Chain Monte Carlo
NIPD: non-invasive pneumococcal disease
NP: nasopharyngeal
NTHi: non-typeable Haemophilus influenza
NVT: non-vaccine-type serotype
PCV: pneumococcal conjugate vaccine
PPSV: pneumococcal polysaccharide vaccine
QALY: quality-adjusted life years
SEI: susceptible-exposed-infected model
SI: susceptible-infected model
SIS: susceptible-infected-susceptible model
SIR: susceptible-infected-recovered model
SIRS: susceptible-infected-recovered-susceptible model
VE: vaccine efficacy
VT: vaccine-type serotype

Supplementary Table 3: Glossary

Authors / Year published	Price year	Perspective	Administrative Cost	Vaccine cost	Discounting Rate	Hospitalization cost per case
Bakir 2012	N/A USD	Healthcare	\$3.26/dose	\$30/dose ¹	N/A	MEN: \$1000 BAC: \$500 PNE: \$325 AOM: \$438
Beutels 2011	2010 EUR	Healthcare	€5/dose	PCV7: €66.15/dose PCV10: €70.44/dose PCV13: €74.55/dose	Costs 3% and health outcomes 1.5%	MEN: €6306 BAC: €6282 Other IPD: €3108 PNE: €4775 AOM: €2946
Blank 2012	2012 EUR	Government	€24/dose	PCV7: €58/dose PCV13: €74/dose	3% for both costs and health outcomes	MEN: €3256 BAC: €1378 PNE: €2820 AOM: €426
By 2012	2010 SEK	Societal	18 SEK/dose	518.95 SEK/dose ¹	3% for both costs and health outcomes	MEN: 151,348 SEK BAC: 73,577 SEK PNE: 31,866 SEK AOM: 9000 SEK
Castiglia 2017	2015 EUR	Healthcare	N/A ³	€47.73/dose ¹	3% for both costs and health outcomes	MEN: €8067 BAC: €3176 PNE: €1948 AOM: €662
Chuck 2010	2008 CAN\$	Healthcare	N/A ³	\$284 (3+1)	Undiscounted	MEN: CAN\$35,017 BAC: CAN\$11,695 PNE: CAN\$8031 AOM: CAN\$616
De Wals 2009	2001 CAN\$	Societal, Healthcare, Family	N/A ³	\$71/dose ¹	3% for both costs and health outcomes	IPD: CAN\$ PNE: CAN\$ AOM: CAN\$
Delgleize 2016	2014 GBP	Healthcare	£7.64/dose	£48.88/dose ¹	3.5% for both costs and health outcomes	MEN: £ 7872 BAC: £ 6595 PNE: £ 5226 AOM: £ 1142
Earnshaw 2012	2010 CAN\$	Healthcare	\$7.84/dose	\$86.26/dose ¹	N/A	MEN: CAN\$61,115 BAC: CAN\$13,560 PNE: CAN\$10,305 AOM: CAN\$95
Klok 2013	2011 DKK; 2010 SEK	Payer	15.65 DKK 18 SEK	451.33 DKK ¹ 518.95 SEK ¹	3% for health outcomes only but not costs	MEN: 61,702 DKK BAC: 41,613 DKK PNE: 23,582 DKK

						AOM: 7741 DKK MEN: 71,888 SEK BAC: 67,454 SEK PNE: 32,562 SEK AOM: 8345 SEK
Knerer 2012	2007 GBP, CAN\$	Societal, Healthcare, Family	N/A ³	£27.60/dose (UK) ¹ \$70/dose (Canada) ¹	3.5% (UK) and 3% (Canada) for both costs and health outcomes	UK MEN: £7504 BAC: £5360 PNE: £4457 AOM: £722 Canada MEN: CAN\$31,792 BAC: CAN\$11,034 PNE: CAN\$7305 AOM: CAN\$585
Kuhlmann 2017	2013 EUR	Societal, Healthcare	€6.95/dose	PCV10: €52.57/dose PCV13: €55.82/dose	3% for both costs and health outcomes	IPD: €9906 PNE: €8372 AOM: €1392
Nakamura 2011	2005 USD	Societal	\$5/dose	\$10/dose for lower middle-income countries \$20/dose for higher middle-income countries ¹	4% for both costs and health outcomes	MEN: \$5350-\$5657 NPNM: \$1105-\$1112 PNE: \$1301-\$2213
Robberstad 2011	2009 NOK	Societal	81 NOK/dose	346 NOK/dose ¹	4% for both costs and health outcomes	MEN: 117,156 NOK BAC: 106,488 NOK PNE: 45,270 NOK AOM: 9782 NOK
Rozenbaum 2010	EUR	Healthcare	€5.95/dose	PCV7: €50/dose PCV10: €62.25/dose PCV13: €68.56/dose	Costs 4% and health effects 1.5%	IPD: €1091 - 27,318 PNE: €26 - 2614 AOM: €17 - 381
Rubin 2010	2008 USD	Societal	\$11/dose	PCV7: \$73/dose PCV13: \$100/dose	3% for both costs and health outcomes	MEN: \$17,048 BAC: \$3253 PNE: \$10,148 AOM: \$840
Strutton 2012	2008/ 2009 EUR	Healthcare	Germany: €7/dose Greece: €30/dose Netherlands: €5.95/dose	PCV7: €49/dose (Germany) €52.40/dose (Greece) €57.13/dose (NL) PCV10: €39.90/dose (Germany) €42.14/dose (Greece) €57.13/dose (NL)	5% (Germany), 3% (Greece) and 1.5% (NL) respectively for health outcomes only but not costs	Germany MEN: €10,071 BAC: €8503 PNE: €5627 AOM: €135 Greece MEN: €34,163 BAC: €18,635 PNE: €5708

				PCV13: €49/dose (Germany) €49.64/dose (Greece) €68.56/dose (NL)		AOM: €3861 Netherlands MEN: €18,781 BAC: €10,759 PNE: €2615 AOM: €96
Talbird 2010	2008 CAN\$/ EUR/ Pesos/ NOK	Healthcare	N/A	Not considered because of price parity and analysis focused on incremental costs	Undiscounted	Canada MEN: CAN\$7213 BAC: CAN\$11,048 PNE: CAN\$7616 AOM: CAN\$593 Germany MEN: €2940 BAC: €3265 PNE: €2789 AOM: €40 Mexico: MEN: 172,849 Pesos BAC: 73,934 Pesos PNE: 76,217 Pesos AOM: 5315 Pesos Norway: MEN: 114,733 NOK BAC: 104,285 NOK PNE: 44,333 NOK AOM: 9778 NOK
Vemer 2014	2012 EUR	Societal	N/A ³	Price difference between vaccines: € 0 -€25/dose (baseline €11)	Costs 4% and health outcomes 1.5%	PNE: €3147.82 AOM: €657.59
Vucina 2015	2014 USD	Government, Societal	N/A ³	PCV10: \$63/dose; \$30/dose ² PCV13: \$67/dose; \$35/dose ²	3% for both costs and health outcomes	MEN: \$8000 NPNM: \$4000 PNE: \$2000 Household: \$50 (all)
Waye 2015	2014 CAN\$	Direct payer	N/A	Not considered because of price parity	3% for both costs and health outcomes	MEN: CAN\$ 38,070 BAC: CAN\$ 12,714 PNE: CAN\$ 8731

¹ Assumed price parity (PCV7 = PCV10 = PCV13)

² With universal childhood immunization

³ It was assumed that if no administration cost was provided, it was accounted for in the vaccine cost listed

Supplementary Table 4: Summary of costs and perspectives in economic evaluations of PCV. When hospitalization costs listed both children and adults, the higher of the two is listed here.