Malaysia's Experience in Childhood Pneumococcal Vaccination Programme

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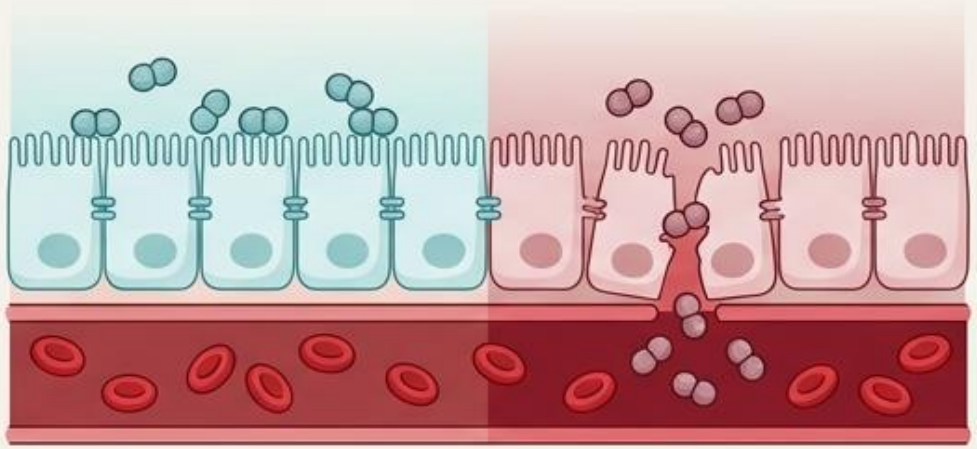
Pneumococcal Disease: The Critical Threshold

Non-invasive infections stay on the surface, while invasive infections breach sterile compartments to cause systemic disease.



NON-INVASIVE (NIPD)

Definition

Infection confined to non-sterile sites naturally exposed to the external environment.

The Battleground (Sites)

- Upper respiratory tract (nasopharynx, sinuses)
- Middle ear
- Bronchi and lungs

Clinical Syndromes

Acute otitis media, Sinusitis, Bronchitis, Non-bacteraemic pneumonia

Clinical Reality & Impact

Milder, highly common outpatient cases.

Drives massive healthcare utilization.

Heavy pediatric antibiotic use creates severe AMR pressure.

INVASIVE (IPD)

Definition

Occurs when *Streptococcus pneumoniae* breaches the barrier and invades normally sterile body compartments.

The Battleground (Sites)

- Blood
- Cerebrospinal fluid (CSF)
- Pleural and joint fluid

Clinical Syndromes

Pneumococcal meningitis, Bacteraemia / Septicaemia, Bacteraemic pneumonia

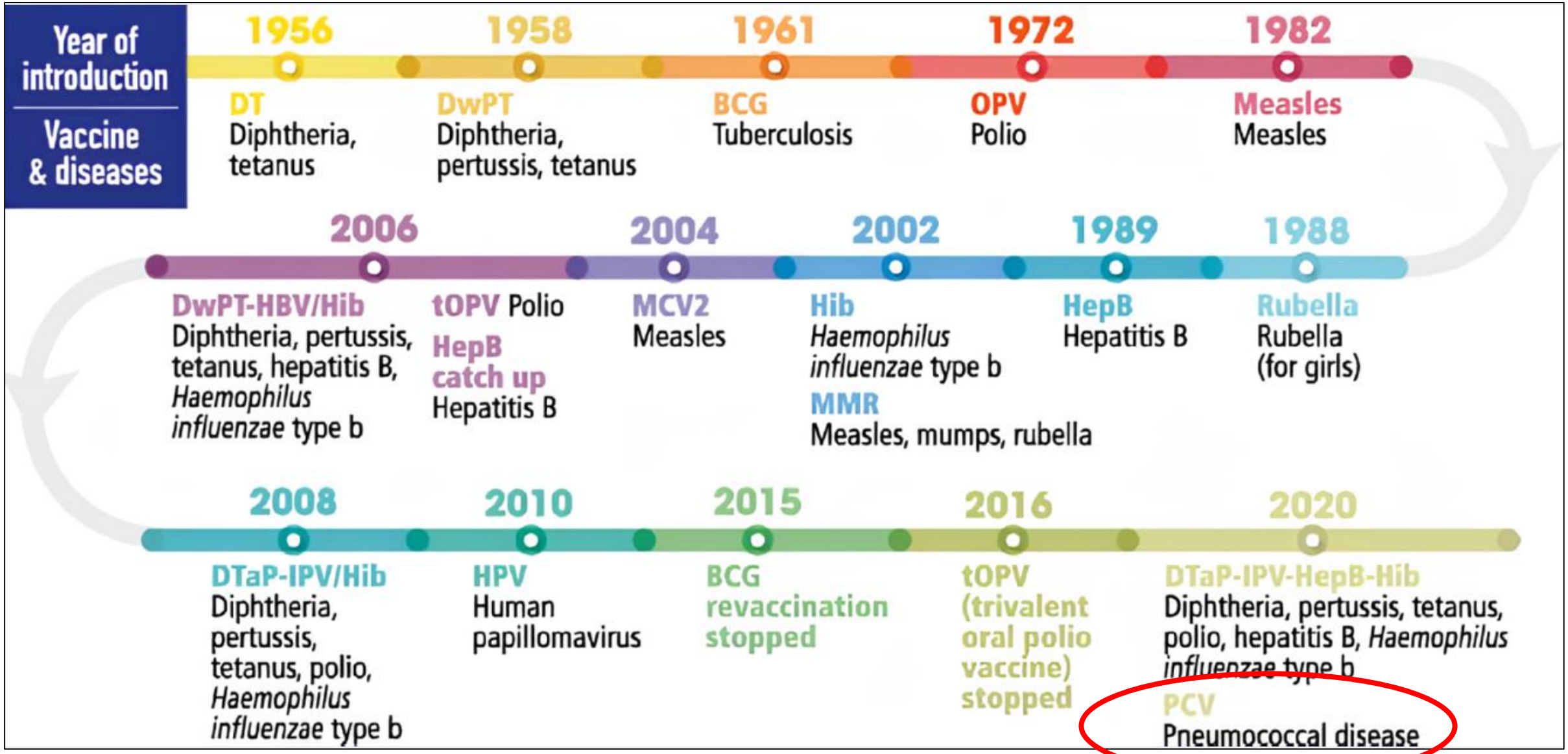
Clinical Reality & Impact

Severe, fatal risk; requires urgent IV antibiotics.

Primary endpoint for vaccine effectiveness (VE) studies.

Main driver for global health policy and PCV introduction.

MALAYSIA NATIONAL IMMUNISATION PROGRAMME



KEMENTERIAN KESIHATAN MALAYSIA

JADUAL IMUNISASI KEBANGSAAN

IMUNISASI	UMUR (BULAN)												UMUR (TAHUN)		
	0	1	2	3	4	5	6	8	9	12	15	18	21	7	12	15
BCG	DOS TUNGGAL															
Hepatitis B	DOS KELAHIRAN															
DTaP-IPV-Hep B-Hib			DOS 1	DOS 2		DOS 3						DOS PENGGALAK				
Measles							SABAH SAHAJA									
MMR									DOS 1	DOS 2						
Pneumokokal (PCV)					DOS 1		DOS 2				DOS PENGGALAK					
JE (Sarawak Sahaja)									DOS 1				DOS PENGGALAK			
DT														DOS PENGGALAK		
HPV															1 DOS	
TT																DOS PENGGALAK

BCG

ialah *Bacille Calmette-Guerin*, vaksin yang memberi perlindungan terhadap tuberkulosis.

Hepatitis B

ialah vaksin untuk mencegah penyakit hepatitis B.

MMR

ialah vaksin kombinasi *measles* (campak), *mumps* (beguk) dan *rubella*.

JE

vaksin ini diberikan di Sarawak untuk mencegah penyakit *Japanese encephalitis*.

DT

ialah dos penggalak yang memberi perlindungan terhadap difteria dan tetanus.

TT

ialah vaksin *Tetanus toxoid* yang diberi untuk mencegah penyakit tetanus (kancing gigi). Ia diberi sebagai dos penggalak untuk meningkatkan paras antibodi.

DTaP-IPV-Hep B-Hib

ialah vaksin kombinasi 6 serangkai yang memberi perlindungan terhadap difteria, tetanus (kancing gigi), pertusis (batuk kokol), poliomielitis, hepatitis B dan *Haemophilus influenzae* jenis B.

PCV

diberi untuk mencegah penyakit pneumokokal serius yang disebabkan oleh serotip bakteria *Streptococcus pneumoniae* tertentu.

HPV

ialah vaksin *Human papillomavirus* (HPV) yang diberikan kepada murid perempuan Tahun 6 atau remaja perempuan berumur 12 tahun tidak bersekolah sebagai langkah pencegahan terhadap jangkitan virus berkenaan yang boleh menyebabkan kanser serviks (pangkal rahim).

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Aljunid *et al. BMC Infectious Diseases* 2011, **11**:248
http://www.biomedcentral.com/1471-2334/11/248

BMC Infectious Diseases

RESEARCH ARTICLE Open Access

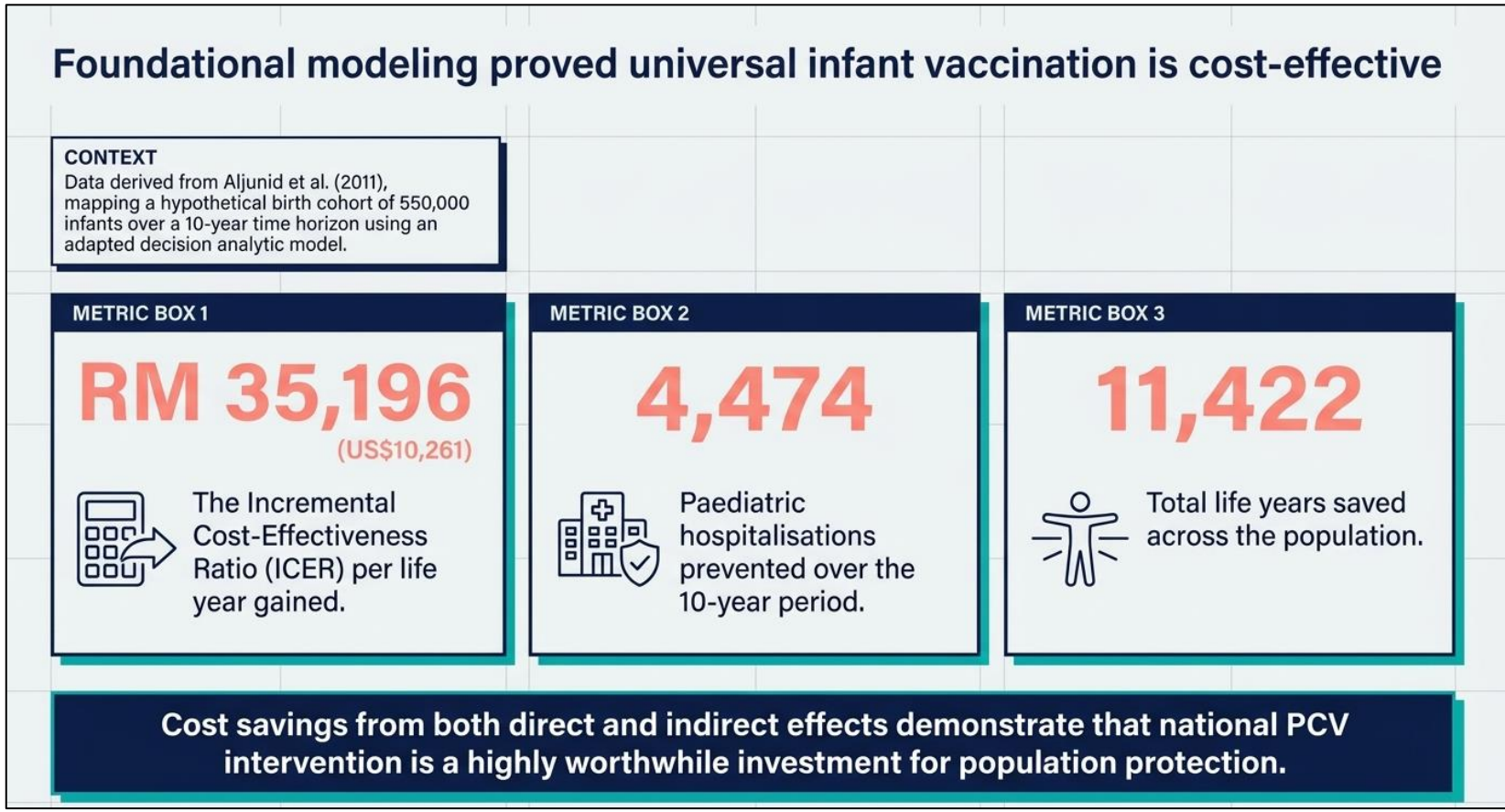
Impact of routine PCV7 (Prevenar) vaccination of infants on the clinical and economic burden of pneumococcal disease in Malaysia

Syed Aljunid[1,2*†], Gulifeiya Abuduxike[1†], Zafar Ahmed[2†], Saperi Sulong[2†], Amrizal Muhd Nur[2†] and Adrian Goh[3†]

Aljunid S, Abuduxike G, Ahmed Z, Sulong S, Nur AM, Goh A. Impact of routine PCV7 (Prevenar) vaccination of infants on the clinical and economic burden of pneumococcal disease in Malaysia. BMC Infect Dis. 2011 Sep 21;11:248. doi: 10.1186/1471-2334-11-248. PMID: 21936928; PMCID: PMC3189895.

Table 5 Outcomes and cost effectiveness

	No vaccination	PCV7 vaccination	Incremental
Hospitalised cases (n)			
Total	83,430	73,845	-9,585
Paediatric	51,933	47,459	-4,474
Adult	31,497	26,386	-5,111
Deaths (n)			
Total	1,074	666	-408
Paediatric	639	303	-336
Adult	435	363	-72
Life Years Lost (years)			
Total	26,154.00	14,731.60	-11,422.50
Paediatric	19,482.60	9,239.90	-10,242.70
Adult	6,671.40	5,491.60	-1,179.80
Costs (RM million)			
Total	255.8	657.9	402
Vaccine	0	439.6	439.6
Hospitalisation episodes	255.8	218.3	-37.5
Paediatric	137.2	118.9	-18.3
Adult	118.7	99.4	-19.3
ICER (per life year gained)			RM35,196 (US$10,261)



RESEARCH PAPER

Human Vaccines & Immunotherapeutics 12:2, 403–416; February 2016; © 2016 Taylor & Francis Group, LLC

Cost-effectiveness analysis of infant universal routine pneumococcal vaccination in Malaysia and Hong Kong

David Bin-Chia Wu[1,*], Craig Roberts[2], Vivian Wing Yan Lee[3], Li-Wen Hong[4], Kah Kee Tan[5], Vivienne Mak[1], and Kenneth Kwing Chin Lee[1]

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Keywords: herd effect, incremental cost-effectiveness ratio (ICER), Markov transition-state model, pneumococcal disease, 13-valent pneumococcal conjugate vaccine (PCV13), 10-valent pneumococcal conjugate vaccine (PCV10)

Wu DB, Roberts C, Lee VW, Hong LW, Tan KK, Mak V, Lee KK. Cost-effectiveness analysis of infant universal routine pneumococcal vaccination in Malaysia and Hong Kong. Hum Vaccin Immunother. 2016;12(2):403-16. doi: 10.1080/21645515.2015.1067351. PMID: 26451658; PMCID: PMC5049716.

Table 1. Health and Economic Outcomes of Pneumococcal Vaccination Strategies in Malaysia for Base Case Scenario

	Cumulative 10 years			
	No Vaccination	**PCV10 vs. No Vaccination**	**PCV13 vs. No vaccination**	**PCV13 vs. PCV10**
Pneumococcal Cases				
IPD	8,792	(1,638)	(4,034)	(2,396)
Pneumonia				
Hospitalized	1,096,892	(30,262)	(143,570)	(113,308)
Non-hospitalized	11,583,205	(33,188)	(625,161)	(591,973)
All pneumonia	12,680,097	(63,450)	(768,731)	(705,281)
AOM	4,726,634	(202,797)	(579,764)	(376,967)
Pneumococcal Deaths				
IPD	1,647	(383)	(823)	(440)
Pneumonia, hospitalized	38,682	(1,251)	(6,933)	(5,682)
Total deaths	40,329	(1,634)	(7,756)	(6,122)
Composite Measures				
Life Years (LY) Saved	n.a.	49,339	129,489	80,150
QALYs Saved	n.a.	46,504	120,576	74,072
Costs				
Direct medical excluding vaccination	$ 3,159,743,854	$ (62,977,917)	$ (289,612,306)	$ (226,634,389)
Vaccination program**	n.a.	$ 1,059,927,861	$ 1,059,946,438	$18,577
Non-medical	$ 2,424,145,432	$ (35,836,655)	$ (181,555,052)	$ (145,718,397)
Net Total Cost Perspective				
Payer	$ 3,159,743,854	$ 996,949,944	$ 770,334,132	$ (226,615,812)
Societal	$ 5,583,889,285	$ 961,113,290	$ 588,779,080	$ (372,334,210)
Incremental Cost-Effectiveness Ratios				
Cost/ LY Gained				
Payer perspective	n.a.	$20,206	$ 5,949	$(2,827)
Societal perspective	n.a.	$19,480	$ 4,547	$(4,645)
Cost/QALY Gained				
Payer perspective (net medical)	n.a.	$21,438	$ 6,389	$(3,059)
Societal perspective	n.a.	$20,667	$ 4,883	$(5,027)

Advanced modeling captured the expanded benefits of PCV13 over PCV10

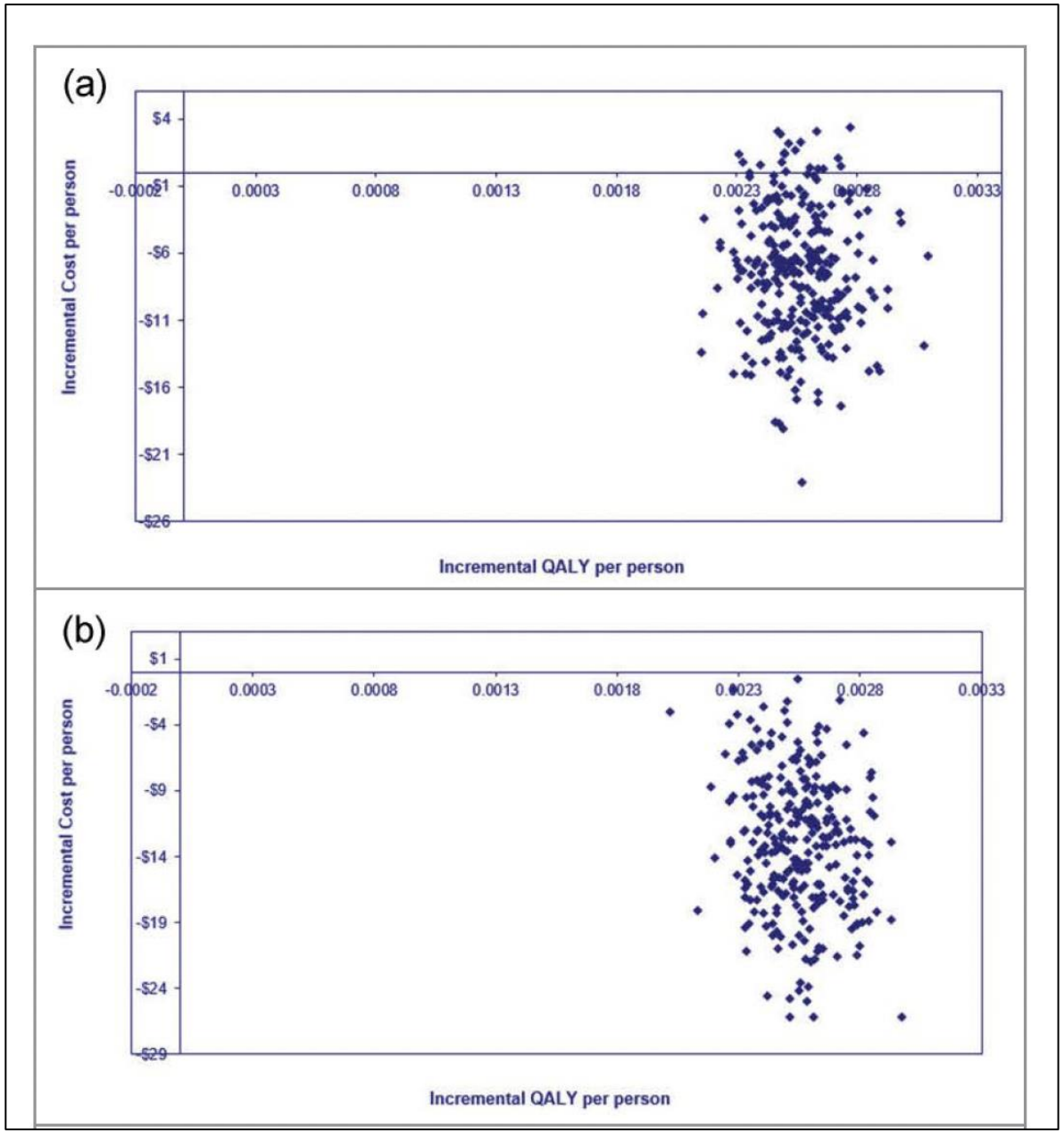
As newer vaccines emerged, models simulated cumulative 10-year outcomes for Universal Routine Vaccination.

Composite Health Measures
(PCV13 vs. No Vax)

Life Years (LY) Saved	**129,489**
QALYs (Quality-Adjusted Life Years) Saved	**120,576**

Disease Prevention Matrix
(PCV13 vs. PCV10 Incremental Gains)

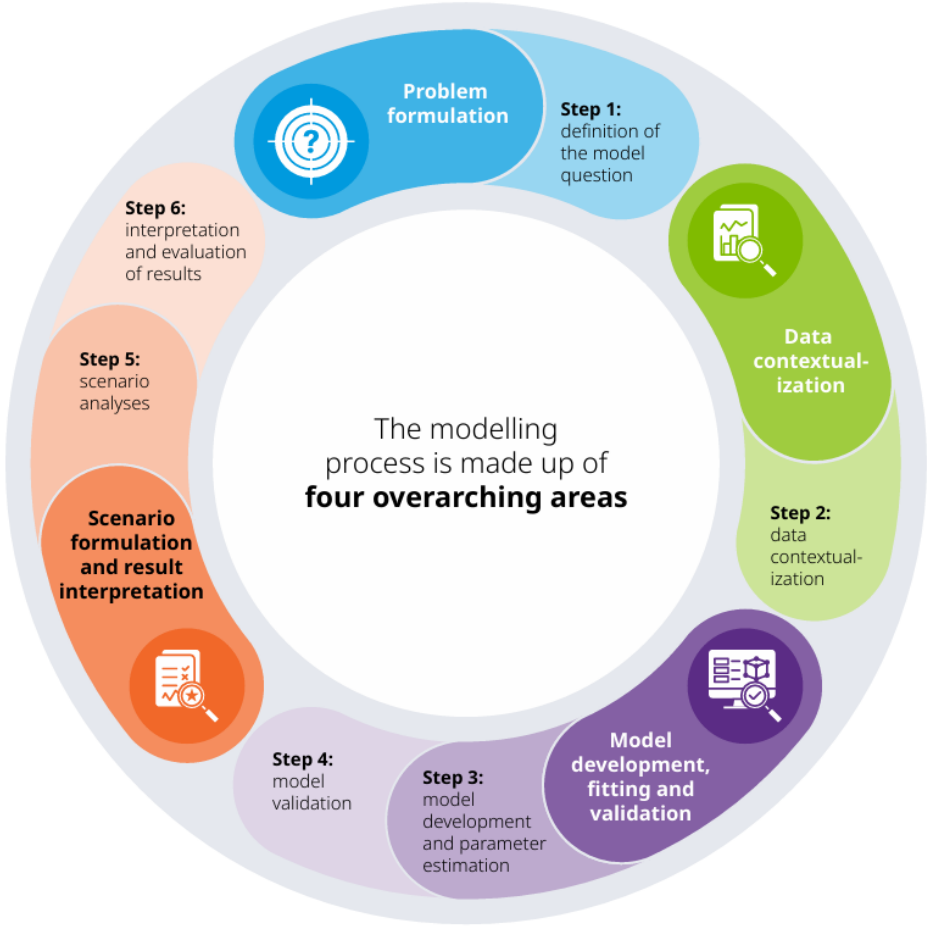
Additional IPD Cases Prevented	**2,396**
Additional Pneumonia Hospitalizations Prevented	**113,308**
Additional Total Deaths Prevented	**6,122**



Simulation of 1,000 cohorts varying all input parameters
compared PCV13 versus PCV10 from both payer and societal
perspectives was shown in Figure 1.

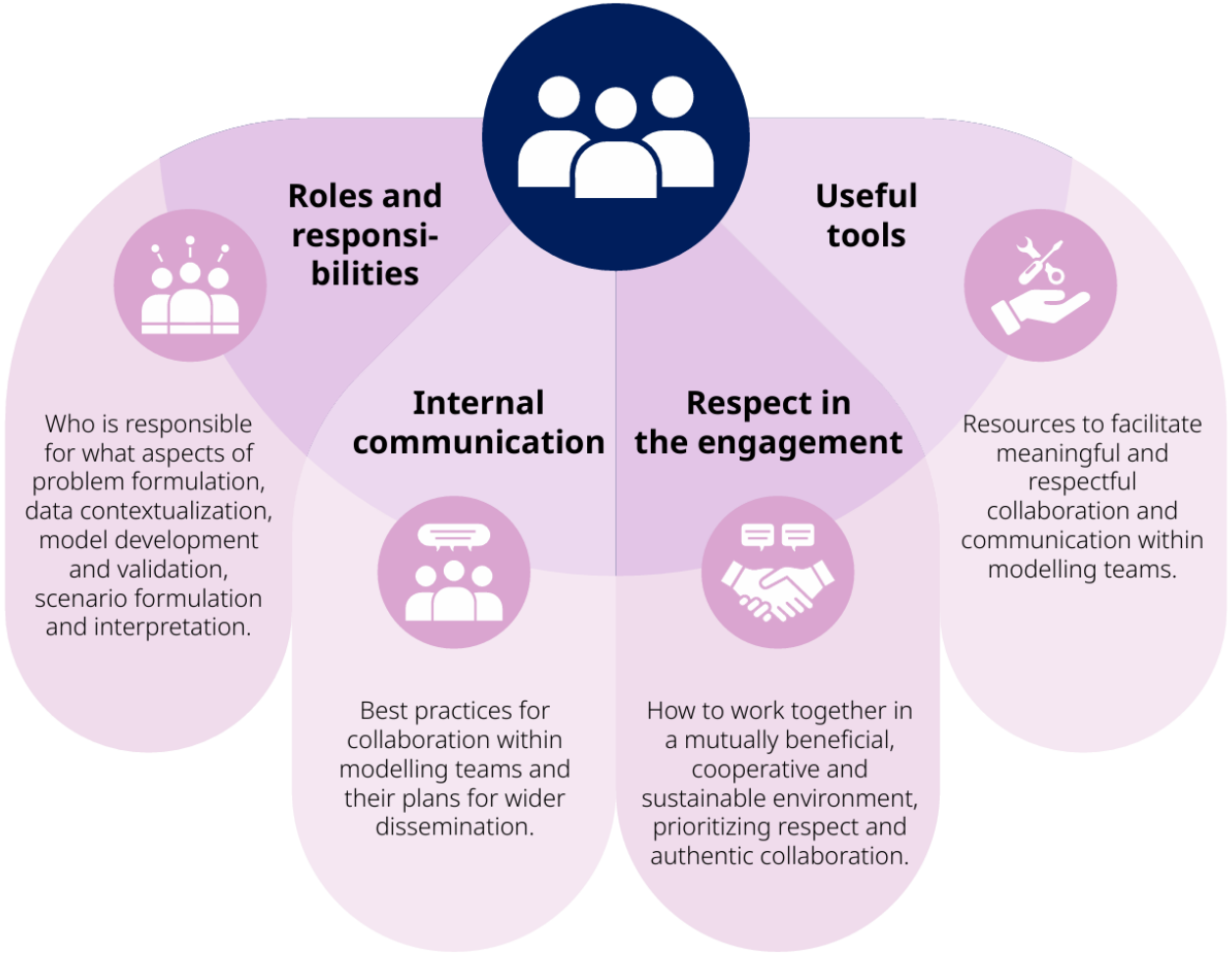
In the Malaysia analysis, PCV13 improved QALYs compared to PCV10 in all simulated results from both perspectives (Fig 1A, B).

How to participate in the modelling process



Problem formulation	Advise on priorities for research and modelling Define decision problems Translate policy question into quantifiable modelling questions Advise on feasibility assessment Synthesize knowledge on disease and vaccine/clinical trials
Data contextualization	Conduct an extensive literature review to understand the broader views of similar questions and existing modelling work on the topic in various settings Review model structures, assumptions and parameters Review roles and dose regimens of vaccines in the model Review assumptions about the disease and transmission Assess feasibility of vaccine implementation
Model development, fitting and validation	Make sure data are parameterized correctly for the model Help identify the sources of data for modelling Review data inputs and data for model validation Review or provide data related to vaccine characteristics and efficacy Review or provide data related to disease characteristics
Scenario formulation and result interpretation	Perform scenario analyses and sensitivity analyses Review scenario formulation and interpretation Assemble model results Provide feedback on the practical points regarding the model scenarios Review vaccine scenario construction and interpretation

How to collaborate effectively with modelers



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