

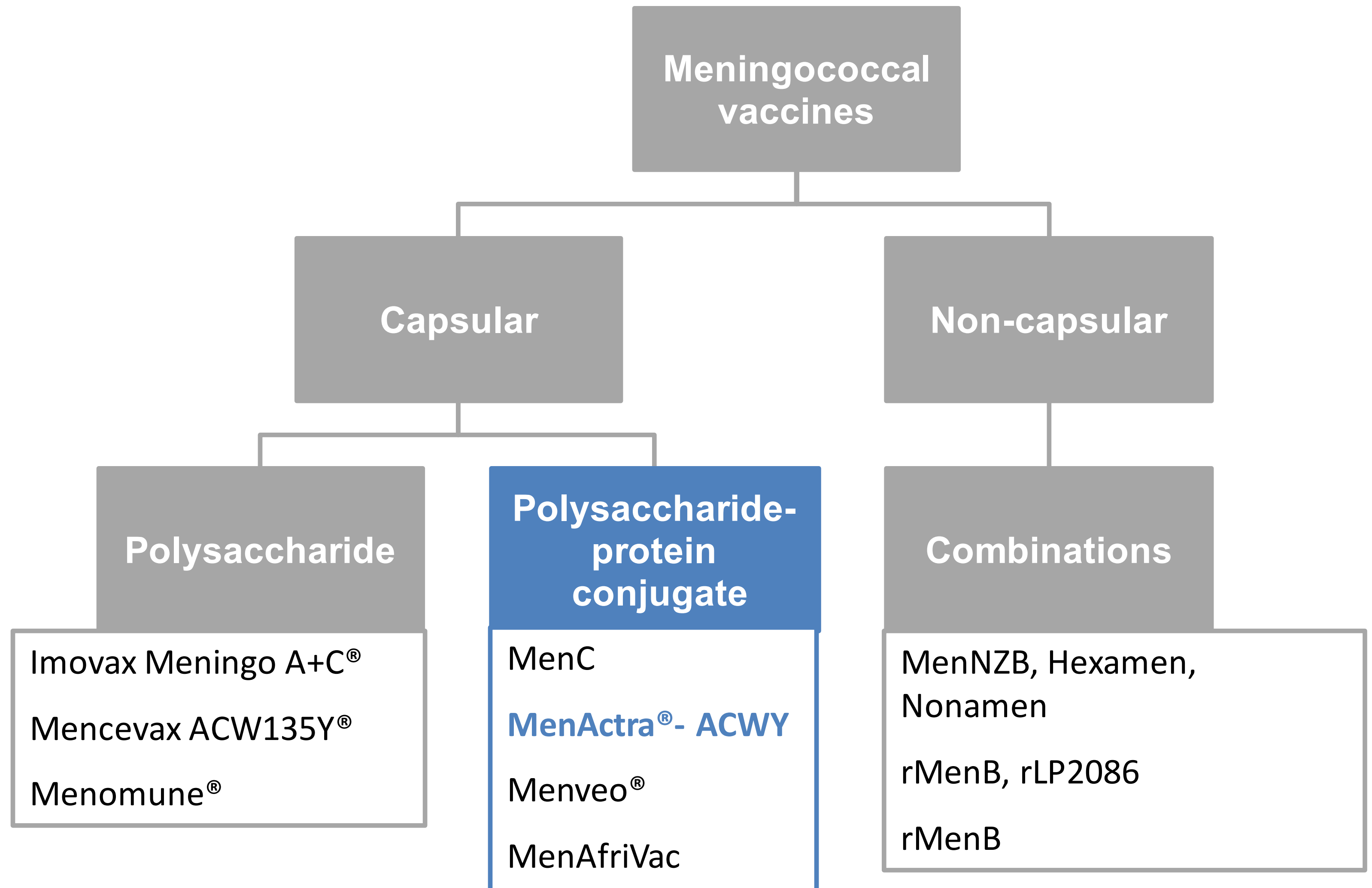
An economic model for introducing a quadrivalent conjugate meningococcal vaccine among adolescents in South Africa

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Meningococcal disease: South Africa

- Greatest incidence < 5-year-old age group.
- Serogroup B commonest in the coastal province of Western Cape.
- 60-80% of disease is caused by serogroups A, C, W and Y, which occur in the rest of the country.

Vaccination as a control measure



Objective

- To compare the **cost-effectiveness** of
- **One-dose** of a quadrivalent conjugate meningococcal vaccine (MenACWY)
 - Given routinely at age **11-years old**
 - **School-based programme**
 - **No** catchup dose
 - Alternative of **no vaccination** in South Africa between 2003 and 2012

Methods

Perspective

- **Governmental** – to inform health system custodians

Time horizon

- **10 years** – long enough to determine cost and effects

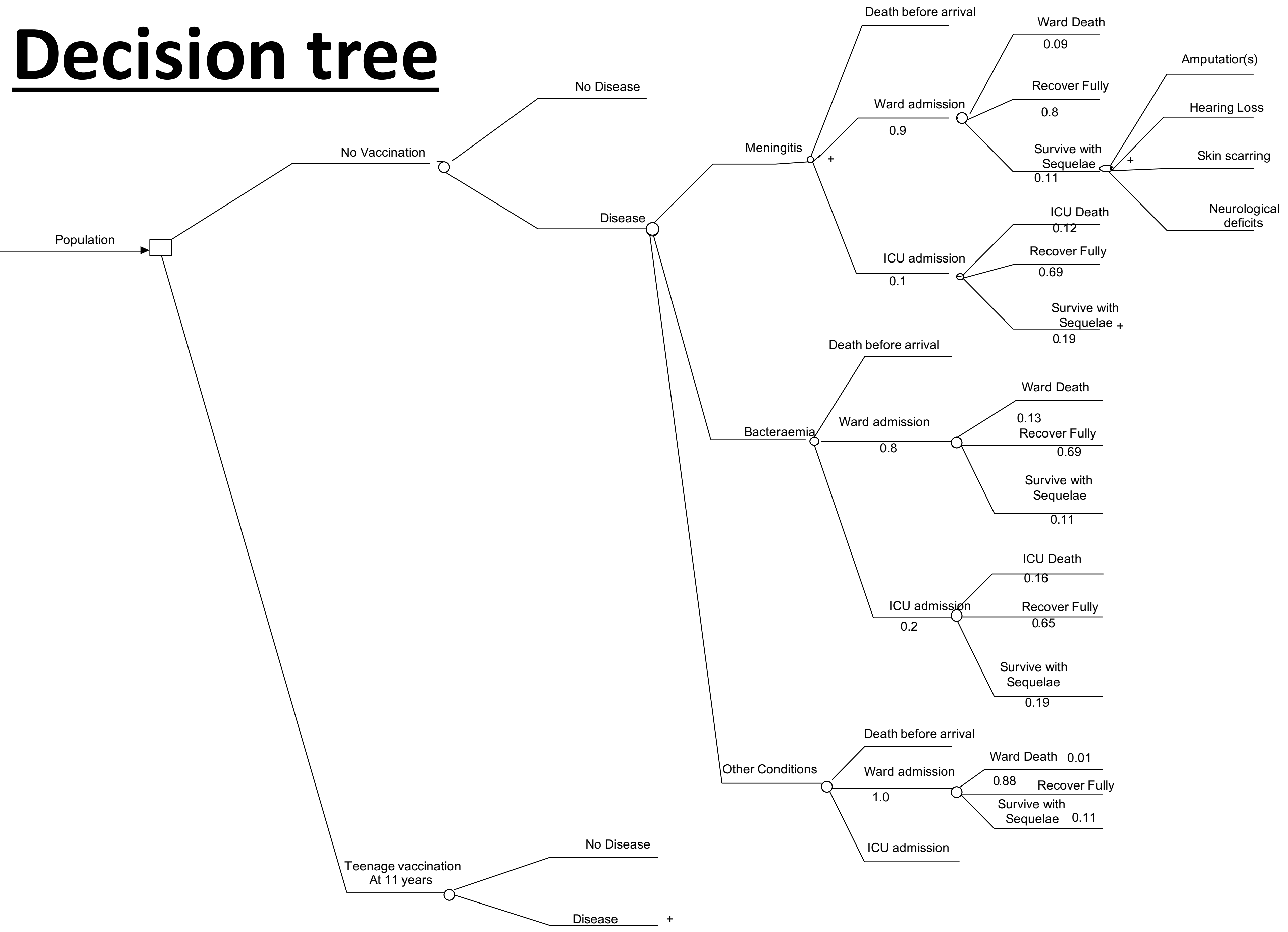
Data sources

- Epidemiological data (national laboratory-based data)
- Vaccine-related data (published literature)
- Costing data (local and non-local published literature)

Assumptions

- **Wherever data was unavailable**

Decision tree

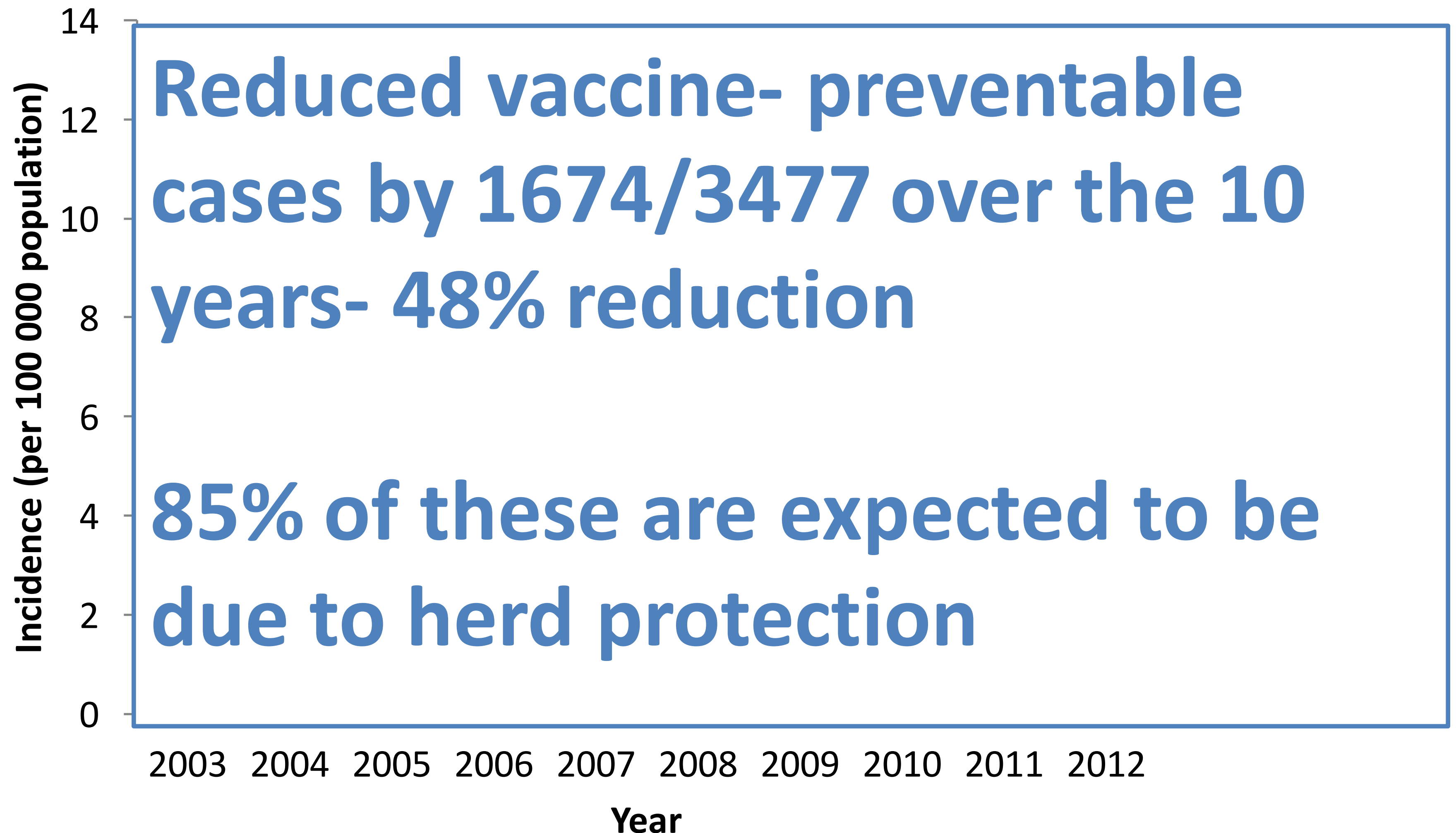


Key variables for sensitivity analysis for MenACWY vaccination amongst 11-12 year olds, South Africa, 2003-2012

Variable	Worst case	Best case	Base case
Vaccine protection/effectiveness	0.67	0.96	0.88
Vaccine coverage	0.95	0.1	0.87
Indirect effect	0-62%	67%	9-46%
Incidence per 100 000	0.83	0.59	0.71
Case-fatality ratio	0.13	0.20	0.16
Vaccine price	\$70.34	\$17.58	\$21.10
OPD visit costs	\$278.96	\$50.28	\$523.00
Hospitalisation costs	\$6 145.51	\$813.42	\$891.66
Discount rate	5%	9%	8.30%
Life expectancy	5% less	10% more	57.14
Proportion of sequelae	0.17	0.32	0.23
Sequelae LOS	1.50	13.06	6.30
Acute cases LOS	2.63	12.00	6.25
In-hospital mortality by syndrome and ward type	0.10	0.18	0.09
Weighted average disability weight	0.12	0.45	0.29
Ward type admissions	Low- 10% less	High-10% more	Average

R8.53:1\$ (Rand:Dollar exchange rate 2012)

Incidence of invasive meningococcal disease by age category, South Africa, 2003 to 2012 (n=4308, age unknown for 229 cases)



Summary of Projected Direct Medical Costs for MenACWY vaccination amongst 11-year olds, South Africa, 2003-2012

Medical costs	No vaccination	Routine 11-year old vaccination	Cost (Savings) in US Dollars
Acute medical costs	5 206 922	2 043 665	-3 163 257.00
Follow up costs	11 944 902	6 416 523	-5 528 379.51
Total disease cost	17 151 824	8 460 187	-8 691 636.51

2012 Rand:Dollar exchange rate (R8.53:\$1)

Summary of Projected Vaccine campaign costs for MenACWY vaccination amongst 11-year olds, South Africa, 2003-2012

Cost of vaccination of an adolescent	No vaccination	Routine vaccination	Costs (savings) from vaccination in US Dollars
\$21	N/A	299 953 142	299 953 142
Net cost	N/A	N/A	291 261 505

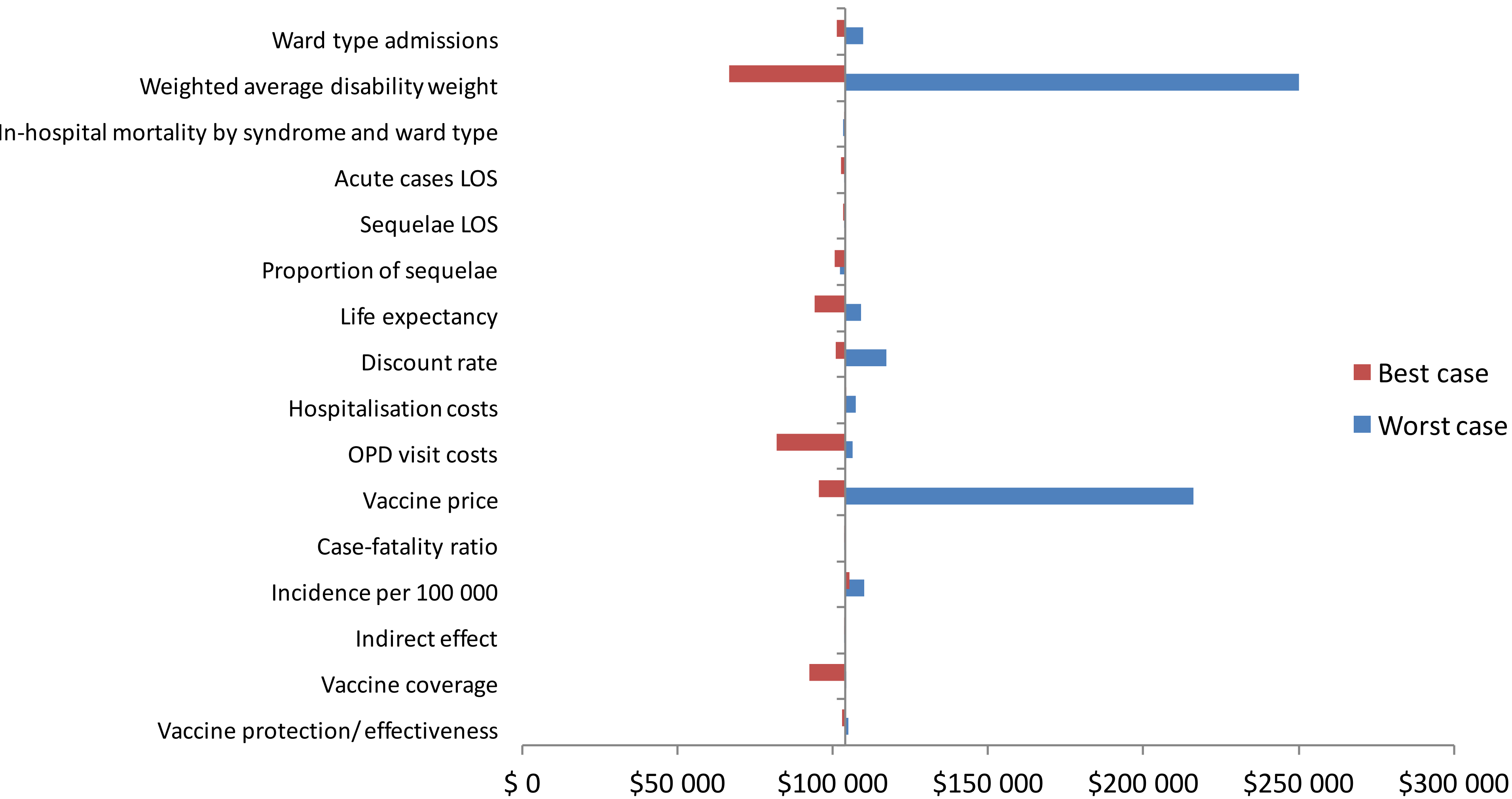
2012 Rand:Dollar exchange rate (R8.53:\$1)

Summary of Incremental cost-effectiveness ratios for MenACWY vaccination amongst 11-year olds, South Africa, 2003-2012

Incremental cost-effectiveness ratio	Costs (savings) in US Dollars
Cost per case prevented	173 984
Cost per death prevented	1 014 219
Cost per life-years saved (undiscounted)	36 464
Cost per life-years saved (discounted)	68 708
Cost per disability life-years saved (undiscounted)	103 678
Cost per disability life-years saved (discounted)	212 492

2012 Rand:Dollar exchange rate (R8.53:\$1)

One-way sensitivity analysis on the effect of key variables on the base case cost per DALY for MenACWY vaccination amongst 11-year olds, South Africa, 2003-2012



Discussion

South African Department of Health EPI delivery¹

- Cost \$131 million for 2011/2012
- All vaccination costs (medicine components) included

World Health Organization threshold

- 3 times the Gross Domestic Product (GDP) per capita is cost-effective²
- 2012 the GDP per capita \$7 590, South Africa
- \$23 000 per DALY saved

1. Blecher M.S, *Vaccine*, 2014 2. Newall A.T, *PharmacoEconomics*, 2014

Comparison of strategies already introduced

	MenACWY	PCV ¹	MCC-UK ²	MenACWY-USA ³
Year	2012	2008	2000	2005
Cost per DALY*/life year saved**/QALY saved***	\$104 000*	\$1 347*	£6 259**	\$147 000***
Cost per course	\$21	\$24	£12	\$83
Total annual costs	\$29 million	\$65.7 million	£172 million	\$326.8 million

MenACWY- quadrivalent conjugate meningococcal vaccine,

PCV- conjugate pneumococcal vaccine, MCC- monovalent C conjugate meningococcal vaccine

1. Blecher M.S, *Vaccine*, 2014 2. Trotter C.L, *BMJ*, 2002 3. Ortega-Sanchez I.R, *CID*, 2008

*“Vaccination of adolescents in a combined publicly funded catch-up and routine vaccination program with MCV4 would result in **net economic costs to society**, even under the most optimistic scenarios.” – Ortega-Sanchez, 2008*

Limitations

Epidemiologic data

- Assumptions
- Available data non-disease specific
- Non-local data

Costing data

- Non-specific local data
- No local threshold for cost-effectiveness
- **No public health costs available**

Perspective

- Different perspective, i.e. **societal**

Conclusion

One-dose of a quadrivalent conjugate meningococcal vaccine

- introduced routinely among **11-year olds**
- in a school-based programme
- is **not cost-effective**
- for the South African government
- when compared to the current situation of **no vaccination** between 2003 and 2012

Acknowledgements

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Centers for Disease Control and Prevention, Atlanta, Georgia, United States of America - ML Martin, M Washington, C Atkins and B Greening

Summary of Projected Direct medical costs for Catch-up campaign plus routine vaccination of 11-year olds

Variable	No vaccination	Routine 11-year old vaccination	Costs (Savings) routine 11-year old vaccination	Catch-up and routine 11-year old vaccination	(Savings) in US dollars ²
Acute medical costs	\$5 206 922	\$2 043 665	-\$3 163 257	\$521 402	-\$4 685 519
Follow up costs	\$11 944 902	\$6 416 523	-\$5 528 380	\$3 634 197	-\$8 310 706
Total disease cost	\$17 151 824	\$8 460 187	-\$8 691 637	\$4 155 599	-\$12 996 225

Summary of Projected Vaccine campaign costs for Catch-up campaign plus routine vaccination of 11-year olds

Cost of vaccination of an adolescent	No vaccination	Routine vaccination	Costs (savings) from vaccination	Catch up and routine 11-year old vaccination	Costs (savings) from vaccination with catch up and routine 11-year old vaccination
\$21	N/A	299 953 142	299 953 142	468 959 905	468 959 905
Net cost	N/A	N/A	291 261 505		455 963 680

2012 Rand:Dollar exchange rate (R8.53:\$1)

Summary of Incremental cost-effectiveness ratios for MenACWY vaccination amongst 11-year olds, South Africa, 2003-2012

Incremental cost-effectiveness ratio	Costs (savings) in US Dollars- Routine vaccination	Costs (savings) in US Dollars- catchup and routine vaccination
Cost per case prevented	173 984	151 070
Cost per death prevented	1 014 219	924 091
Cost per life-years saved (undiscounted)	36 464	33 224
Cost per life-years saved (discounted)	68 708	66 823
Cost per disability life-years saved (undiscounted)	103 678	90 833
Cost per disability life-years saved (discounted)	212 492	186 165

2012 Rand:Dollar exchange rate (R8.53:\$1)