VALUE-BASED PRICING OF AN EBOLA VACCINE IN RESOURCE-CONSTRAINED COUNTRIES BASED ON COST-EFFECTIVENESS ANALYSIS

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Introduction

•Pricing, affordability, and access are important deliberations around infectious disease interventions.[1]
•Fair pricing incentivizes development and ensures value and access for patients.[1]

Objective

•To use ebola virus disease (EVD) as exemplar to elucidate the estimation of a value-based price (VBP) for a vaccine package.
•To consider how the price compares across selected countries that have experienced EVD outbreaks.

Method

A dynamic transmission model simulated EVD outbreaks in Democratic Republic of Congo, Liberia, Sierra Leone, Uganda.

Cost-effectiveness of the vaccine package – composed of the vaccine, storage, maintenance, and administration - for vaccination toward herd immunity was estimated.

The “QALY-capped” approach was used to estimate the price based on value in terms of DALYs and WTP = GDP per capita.

Sensitivity analyses were conducted to assess the influence of parameter uncertainty on the model.

Fig. 1 Model structure

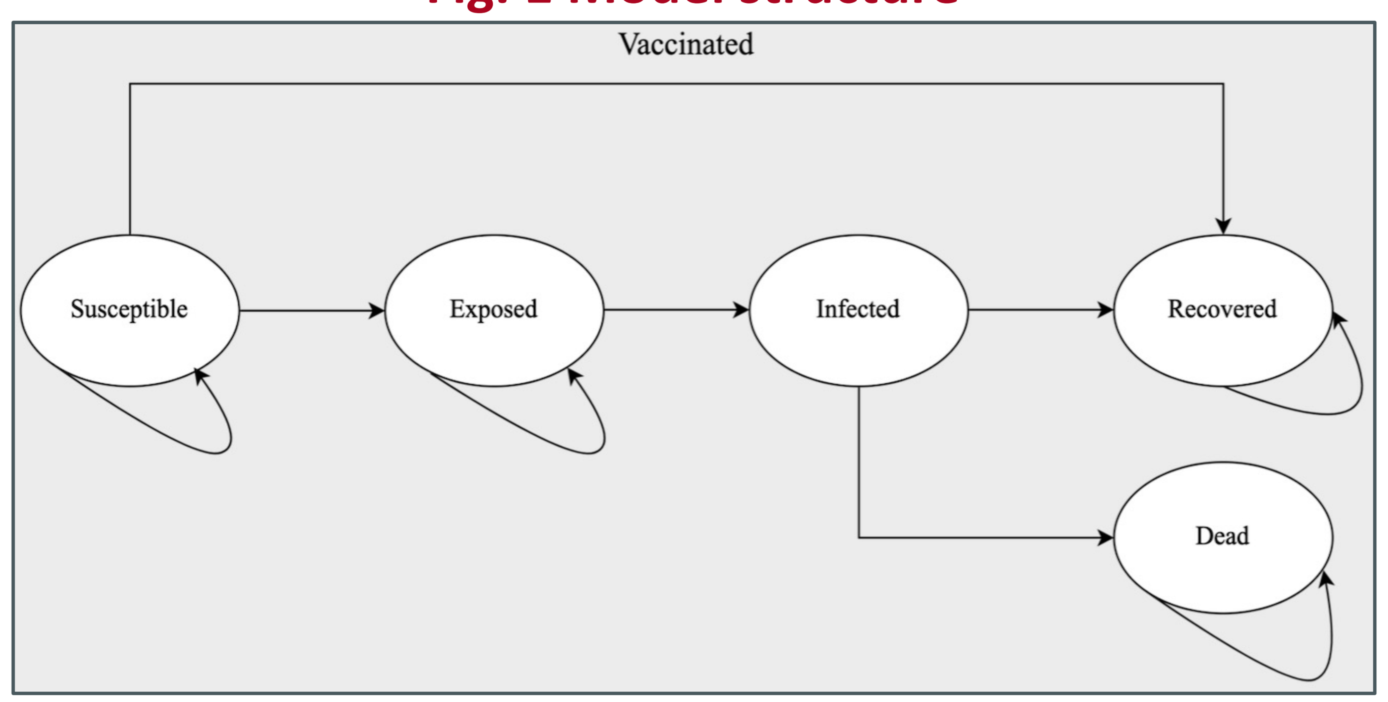


Fig. 2 Flow chart of VBP calculation

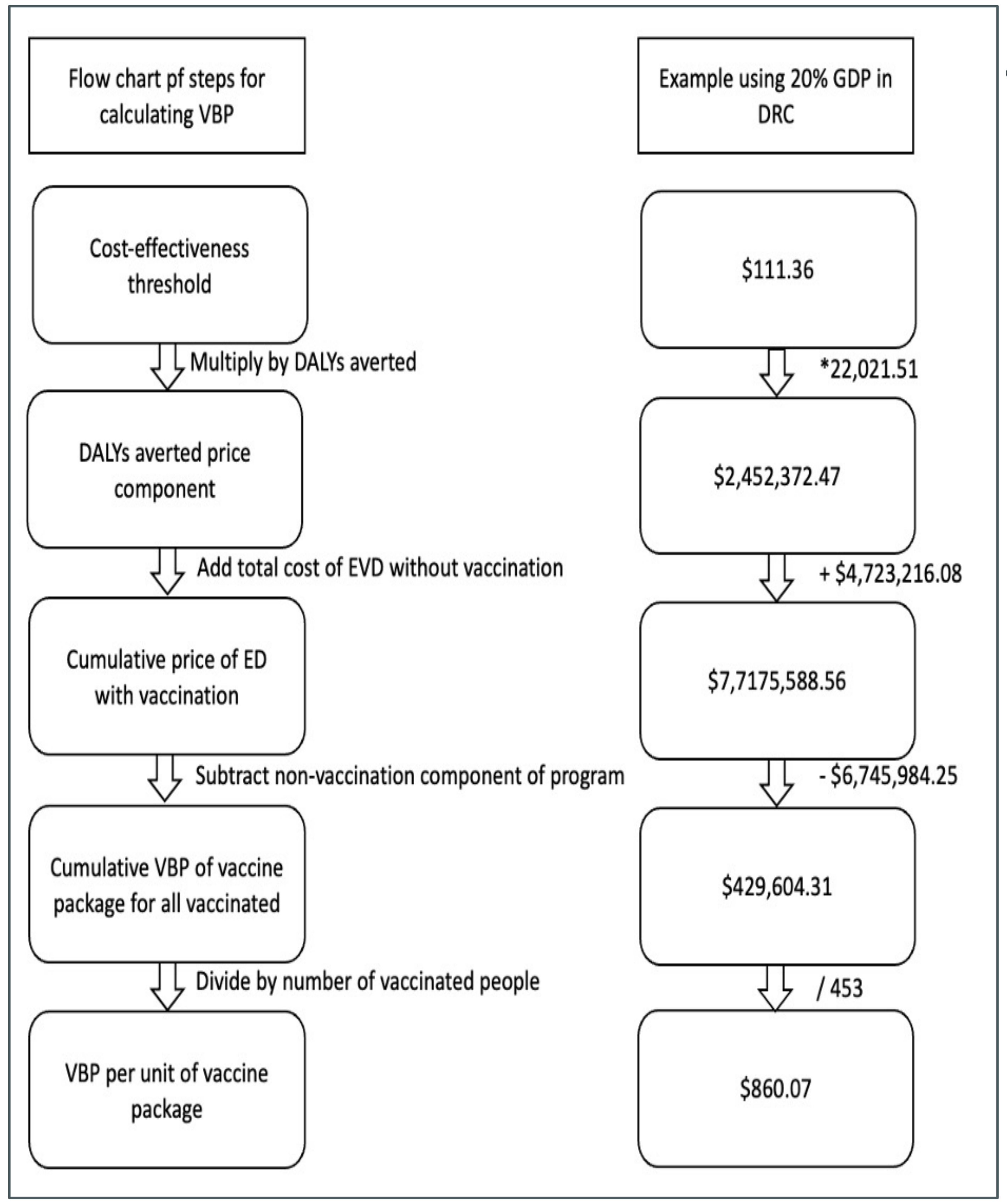


Table 1 Model input parameters

	DRC[2]	Liberia[2]	Sierra Leone[2]	Uganda[3]
Transmission rate (β)/day	0.33	0.16	0.13	0.50
Incubation rate (ξ)/ day	0.19	0.08	0.1	0.08
Infectious rate (γ) / day	0.18	0.07	0.05	0.1
Case fatality rate	0.14	0.08	0.1	0.12
Basic reproductive number (R_0)	1.83	2.02	1.81	2.7
Median age (years)	19.2	19.4	19.4	16.7
Life expectancy (years)	60.97	64.1	54.7	63.37
GDP per capita ($)	556.80	583.30	484.50	817.00

Results

•Vaccination resulted in increased total costs while decreasing DALYs.
•Averting a DALY was estimated to cost $73.43 (Uganda), $94.51 (DRC), $ 101.63 (Liberia), and $666.49 (Sierra Leone).
•The maximum cost of the vaccine package based on its value was $22741 (Uganda), $20498 (DRC), $894 (Liberia), and $88 (Sierra Leone).
•In Uganda and DRC, the vaccine package has 100% probability of cost-effectiveness at WTP thresholds of approximately $175 and $185.

Table 2 Country-specific VBP of vaccine package

Country	Cost with vax ($)	DALYs with vax	Cost without vax ($)	DALYs without vax	Cost averted ($)	DALYs averted	ICER ($/DALY averted)	VBP ($)
DRC	6,804,551	187	4,723,216	22,209	2,081,335	22,022	94.51	20498
Liberia	6,821,783	50	6,738,990	864	82,793	815	101.63	894
Sierra Leone	6,820,836	42	6,751,731	146	69,105	104	666.49	88
Uganda	6,818,167	81	5,411,455	19239	1,406,712	19,157	73.43	22741

Fig. 3 Cost effectiveness plane

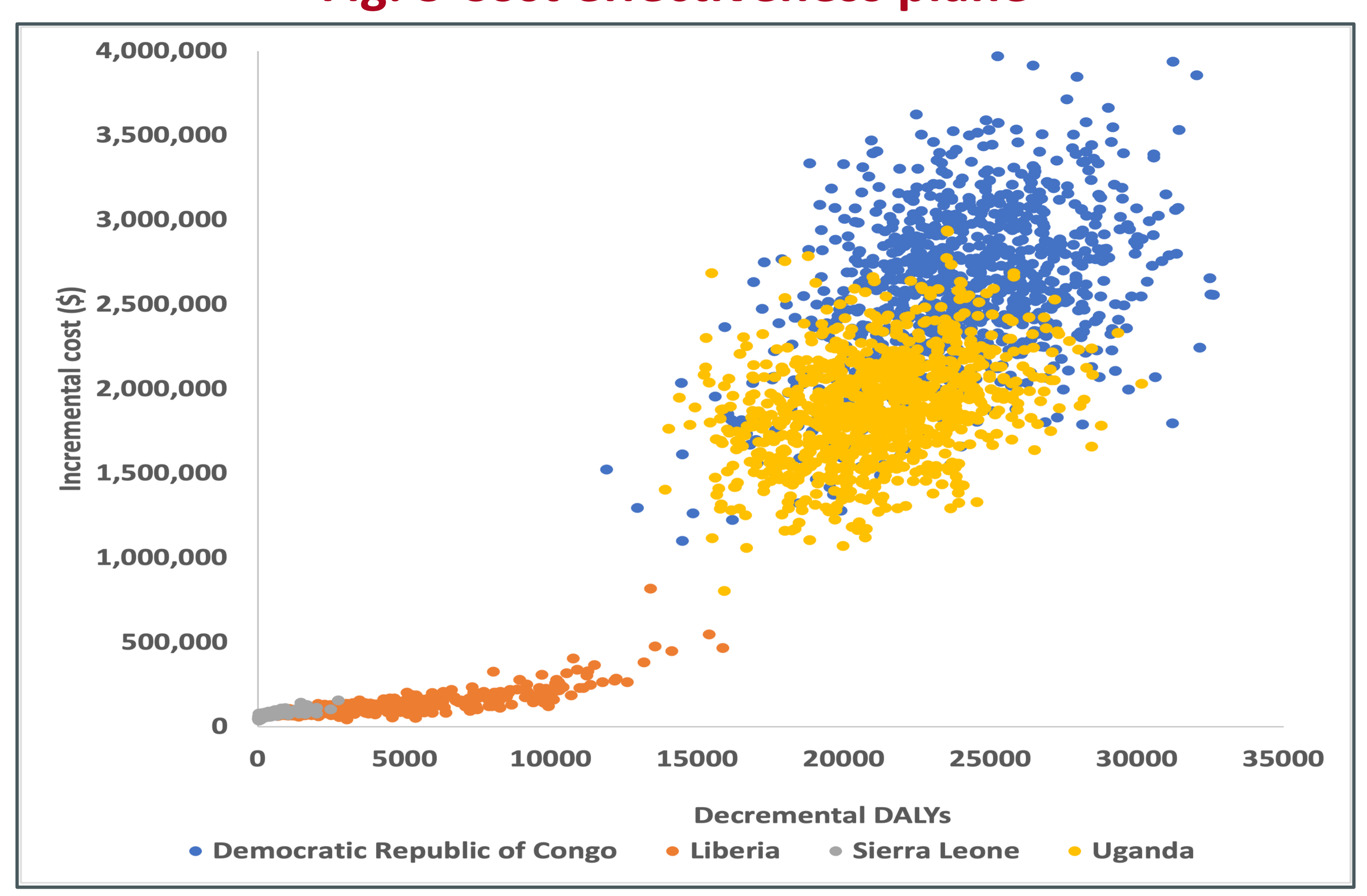
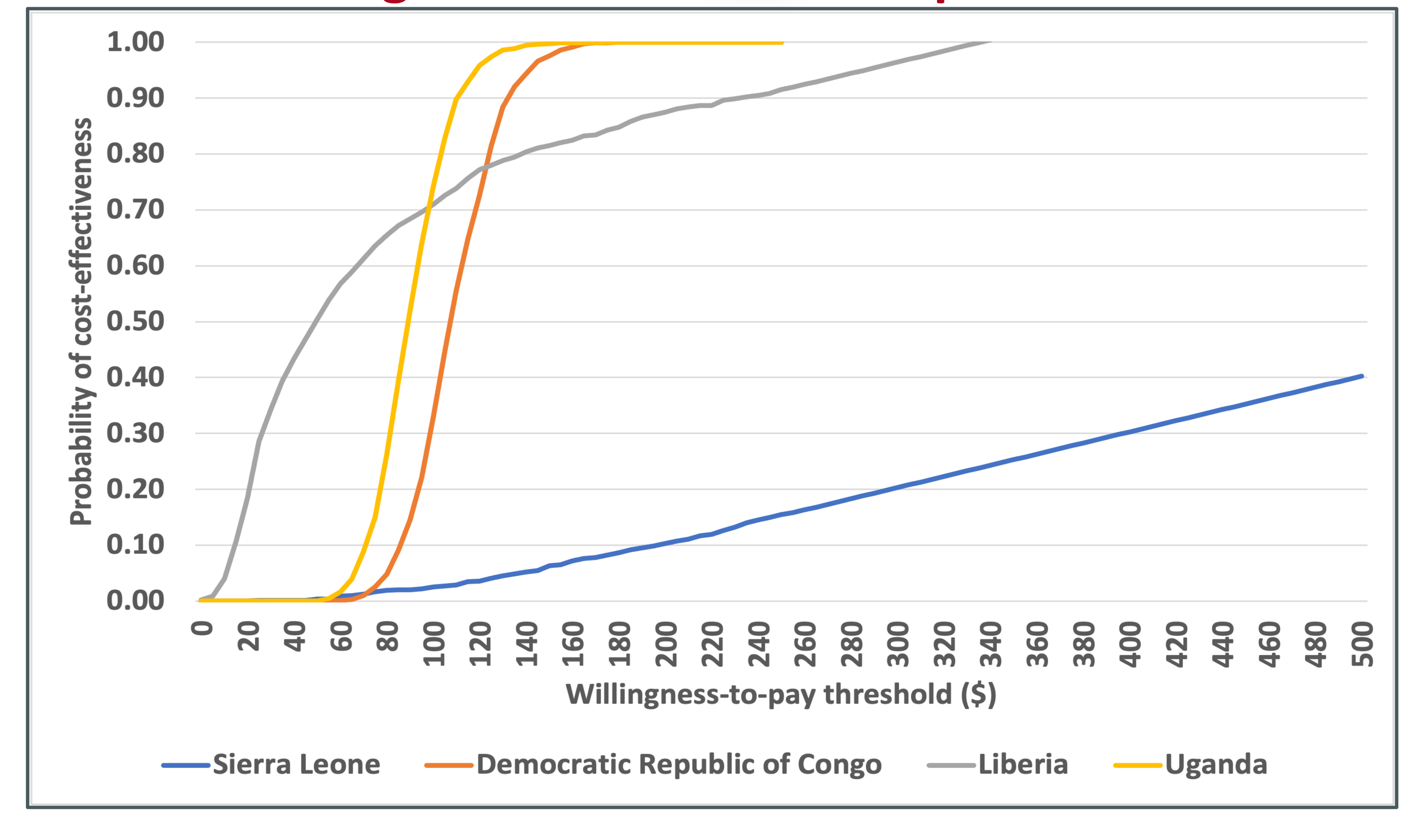


Fig. 4 Cost effectiveness plane



Discussion

•Vaccination is more cost-effective with higher transmission rates.
• VBP for the vaccine package is directly proportional to both cost-effectiveness and GDP per capita.
• VBP reflects both the clinical and economic benefits of the intervention.
•WTP threshold acts as a control on price, within the intervention’s cost offsets as well as its incremental effectiveness.

Conclusion

•“QALY-cap” approach is an easily comprehensible method for determining the VBP of a vaccine using a cost-effectiveness analysis.
•Choice of data, population characteristics, disease dynamics, and others are among factors that need to be considered when comparisons are made across countries.

References

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