

BROADER IMPACTS OF VACCINES IN THE CE-FRAMEWORK

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CONSENSUS STATEMENT

Methods for Health Economic Evaluation of Vaccines and Immunization Decision Frameworks: A Consensus Framework from a European Vaccine Economics Community

Bernhard Ultsch¹ · Oliver Damm² · Philippe Beutels³ ·
Joke Billeke³ · Bernd Brüggengjürgen⁴ · Andreas Gerber-Grote⁵ ·
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Daniel Levy-Bruhl¹³ · Matthias Perleth¹⁴ · Maarten Postma¹⁵ ·
Heini Salo¹⁶ · Uwe Siebert^{17,18} · Jürgen Wasem¹⁹ · Ole Wichmann¹

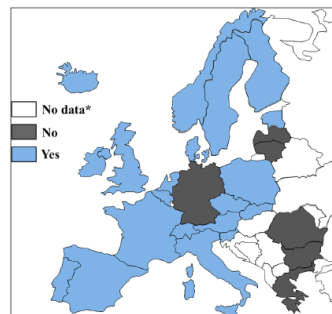


Fig. 1 Map of Europe indicating whether results from economic evaluations of vaccines are routinely considered in recommendations, based on [9, 11–14] (asterisk no response from country, country not considered, Malta and Cyprus not shown)

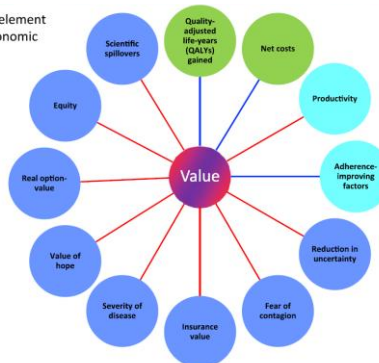
Defining Elements of Value in Health Care—A Health Economics Approach: An ISPOR Special Task Force Report [3]

Darius N. Lakdawalla, PhD^{1,*}, Jalpa A. Doshi, PhD², Louis P. Garrison Jr, PhD³, Charles E. Phelps, PhD, MBA⁴, Anirban Basu, PhD⁵, Patricia M. Danzon, PhD⁵

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Elements of Value

Challenge: Map each element into an underlying economic framework for value assessment.



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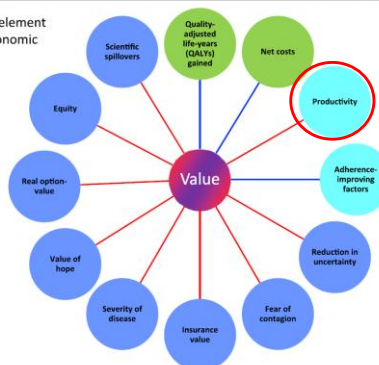
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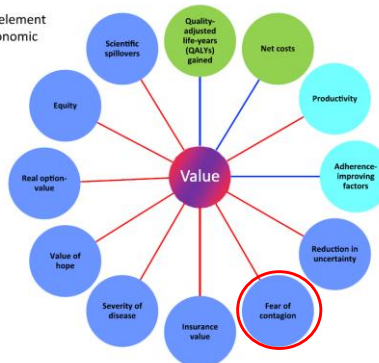
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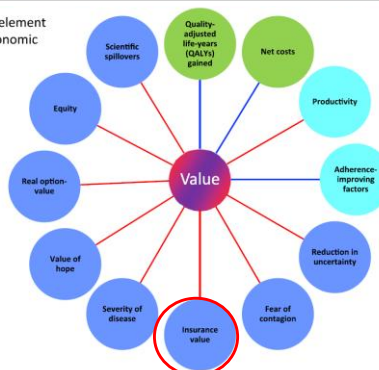
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Impacts of Vaccines

Narrow and traditional

- Reduced health-care resource use
- QALYs gained, inclusive parents

Broader and more acknowledged

- Productivity gains
- Dynamics of herd immunity/serotype replacement/age shifts
- Long-term impacts

Broader and still less acknowledged

- Indirect health-care costs
- Equity/avoidance of catastrophic expenditures
- Reduced AMR

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Perspective

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EXPERT
REVIEWS

Dynamic models for health economic assessments of pertussis vaccines: what goes around comes around...

Expert Rev. Vaccines 11(12), 1415–1428 (2012)

Mark H Rozenbaum*,
Elisabetta De Cao,
Tjalke A Westra and
Maarten J Postma

Despite childhood vaccination programs, pertussis remains endemic. To reduce the burden of pertussis, various extended pertussis vaccination strategies have been suggested. The aim of this article is to evaluate dynamic models used to assess the cost-effectiveness of vaccination. In total, 16 studies using a dynamic model were included, of which four also studied the cost-effectiveness of extended pertussis vaccination strategies. Generally, adolescent vaccination

Table 6. Mean age-specific outcomes* in terms of costs and QALYs. situation with adolescent pertussis booster vaccination over the 25 y



Age	$R_n = 8$ years		
	Direct medical costs (€)	Indirect costs (€)	QALYs
0 yr	10,786	1612	0.23
1–3 yrs	601	4613	1.04
4–9 yrs	669	77,474	8.86
10–19 yrs	737	275,300	137.76
20–49 yrs	–127	–281,796	–25.23
50–74 yrs	–42	–56,864	–8.00
Total	12,624	20,339	114.65

Negative numbers indicate an increase in costs or a decrease in QALYs as a result of ad

*Due to the extensive running time of the model_related to the high complexity_only 2t
 R_n = loss of immunity after natural infection.

doi:10.1371/journal.pone.0013392.t006

Economic models of vaccination in the literature

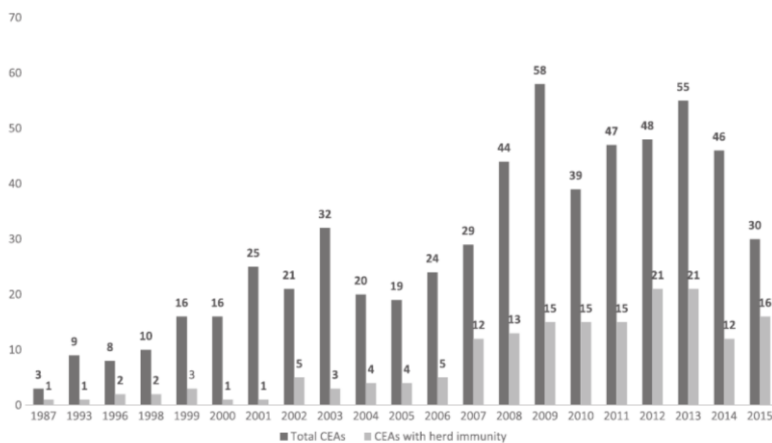


Fig. 2. Number of vaccine cost-effectiveness analyses including herd immunity, by year 1976–2015 (N = 625).

Correspondence: Richard Pebody (richard.pebody@phe.gov.uk)

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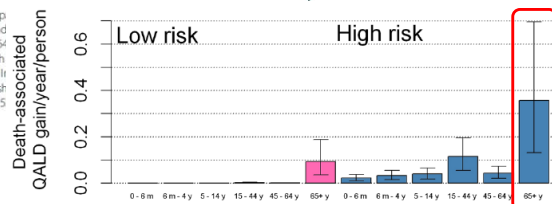
Extending the elderly- and risk-group programme of vaccination against seasonal influenza in England and Wales: a cost-effectiveness study

Marc Baquelin^{1,2*}, Anton Camacho², Stefan Flasche² and W. John Edmunds²

Abstract

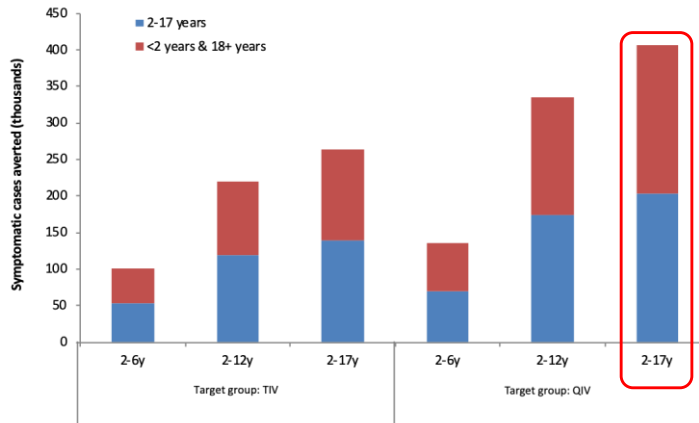
Background: The present study aims to evaluate the cost-effectiveness of extending the pre-2013 influenza immunisation programme for high-risk and elderly individuals to those at low risk of developing complications following infection with seasonal influenza.

Methods: We performed an economic evaluation comp programme to seven possible age groups of low-risk and 50–64 years, 2–16 years, 2–16 and 50–64 years, and 2–64 four base scenarios (no vaccination, risk group only with and 65+, and risk group with 75 % coverage and 65+). I model built and parameterised from a previously published in England and Wales representing an average total of 5



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PAEDIATRIC INFLUENZA VACCINATION



06 November 2019

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Expanding HPV vaccine to teenage boys 'not cost effective', says official advice

19 July 2017 | By Isobel Sims

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The HPV vaccination should not be extended to boys as it is not cost effective, the Joint Committee on Vaccination and Immunisation (JCVI) has recommended.

In an [interim statement](#), published today by the Department of Health, the JCVI concluded that the risk of infection in males has already been substantially reduced by good vaccine uptake in girls.

The JCVI based its conclusion on a cost-effectiveness analysis, which found extending the HPV vaccine to boys would not meet the NICE cost-effectiveness threshold of £20,000 per quality adjusted life year.

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Boys set to receive HPV jab after JCVI recommendation

By Emma Bower on the 18 July 2018

The Joint Committee on Vaccination and Immunisations (JCVI) has recommended that the HPV immunisation programme should be extended to cover boys.

[Discuss on Doctors.net.uk](#)

In its statement issued today, the JCVI said that under standard economic methodology, extending the vaccine to boys would not be considered cost-effective. However, given that the benefits of the programme would be seen over an extended period of time, it agreed to apply a different rate to assessing the vaccine which meant that a gender neutral programme was deemed to be cost-effective.

Pharmacoeconomics (2016) 34:227–244
DOI 10.1007/s40273-015-0335-2



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- The majority of, but not all, experts recommended differential discount rates for costs and effects in HHEs (exclusively in cost-utility and cost-effectiveness analysis) if the model's time horizon is long (e.g. >20 years).
- The discount rate of health effects could be around 50 % of the discount rate for costs. However, for a more evidence-based recommendation, empirical research has to be conducted [39].
- Constant discount rates over time should not be applied in models with a long time horizon (e.g. >20 years) according to a majority of experts.
- Further research on the, to date rarely applied, approach called time-shifted discounting approach is needed [39, 57, 115].
- Since discount rates and discount approaches usually have a major impact on results of HEE of vaccines, the variation of these aspects need to be analysed (see Sect. 3.3.9) and explained to decision-makers.

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EXPERT
REVIEWS

Economic evaluation of vaccines: specificities and future challenges illustrated by recent European examples

Expert Rev. Vaccines 12(5), 555–565 (2013)

Maarten J Postma^{a1},
Tjalke A Westra^a,
Sibilia Quilici^a and
Nathalie Largeron^a



Table 3. Stepwise numerical discounting approaches analyzed in the literature and hypothetical algorithm.

UK Treasury [106]		Beutels et al. [1]		Bazelon and Smetters [41]		Hypothetical algorithm	
Time (years)	Rate (%)	Time (years)	Rate (%)	Time (years)	Rate (%)	Time (years)	Rate (%)
0–30	3.5	1–5	4	0–10	3.5	0–10	4
31–75	3.0	6–25	3	11–20	1.5	11–20	3.5
76–25	2.5	26–75	2	21 and beyond	0	21–30	3
126–200	2.0	76–300	1			31–40	2.5
201–300	1.5	300 and beyond	0			41–50	2
300 and beyond	1.0					51–60	1.5
						61–70	1
						71–80	0.5
						81 and beyond	0

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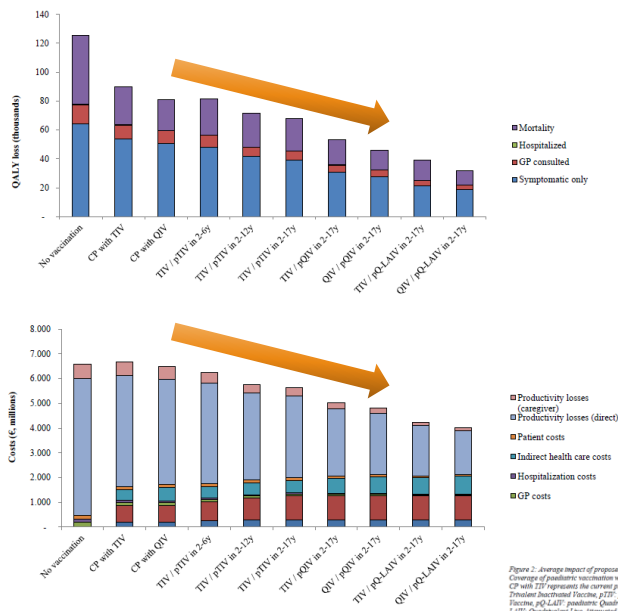


Figure 2: Average impact of proposed influenza vaccination strategies on costs and QALY loss over a period of 20 years. Coverage of pediatric vaccination was assumed at 10%. Future costs were annually discounted at 4% and QALY loss at 1.5%. CP with TIV represents the current practice in the Netherlands. CP, Current programme; GP, General Practitioner; TIV, Trivalent Inactivated Vaccine; pTIV, pediatric Trivalent Inactivated Vaccine; pQIV, pediatric Quadrivalent Inactivated Vaccine; pQALIV, pediatric Quadrivalent Live-Attenuated Influenza Vaccine; QIV, Quadrivalent Inactivated Vaccine; QALIV, Quadrivalent Live-Attenuated Influenza Vaccine; y = year.

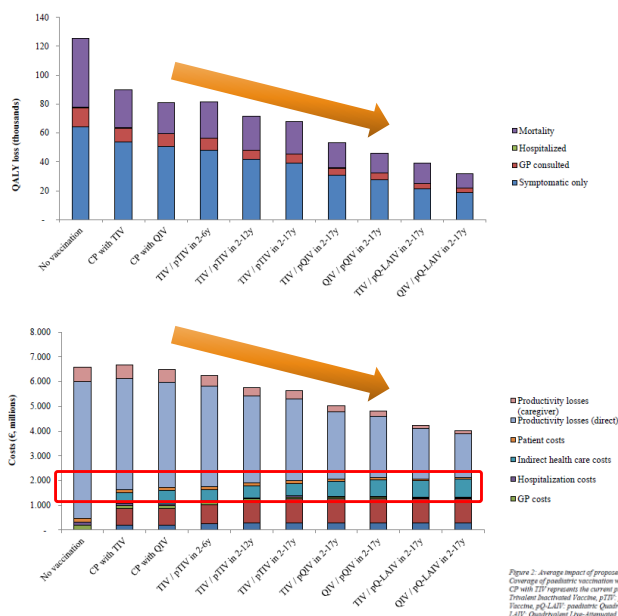


Figure 2. Average impact of proposed influenza vaccination strategies on costs and QALY loss over a period of 10 years. Coverage of pandemic vaccination was assumed at 50%. Future costs were annually discounted at 4% and QALY loss at 1.5%. CP with TIV represents the current practice in the Netherlands. CP: Current programme, GP: General Practitioner, TIV: Trivalent Inactivated Vaccine, pTIV: pandemic Trivalent Inactivated Vaccine, pQIV: pandemic Quadrivalent Inactivated Vaccine, pQJ-LAIV: pandemic Quadrivalent Live-attenuated Influenza Vaccine, QIV: Quadrivalent Inactivated Vaccine, QJ-LAIV: Quadrivalent Live-attenuated Influenza Vaccine, y = year.

Extended Cost-Effectiveness Analysis for Health Policy Assessment: A Tutorial

Stéphane Verguet¹ · Jane J. Kim² · Dean T. Jamison^{3,4}

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Abstract Health policy instruments such as the public financing of health technologies (e.g., new drugs, vaccines) entail consequences in multiple domains. Fundamentally, public health policies aim at increasing the uptake of effective and efficient interventions and at subsequently leading to better health benefits (e.g., premature mortality and morbidity averted). In addition, public health policies can provide non-health benefits in addition to the sole well-being of populations and beyond the health sector. For instance, public policies such as social and health insurance programs can prevent illness-related impoverishment and procure financial risk protection. Furthermore, public policies can improve the distribution of health in the population and promote the equalization of health among individuals. Extended cost-effectiveness analysis was developed to address health policy assessment, specifically to evaluate the health and financial consequences of public policies in four domains: (1) the health gains; (2) the financial risk protection benefits; (3) the total costs to the policy makers; and (4) the distributional benefits. Here, we present a tutorial that describes both the intent of extended

cost-effectiveness analysis and its keys to allow easy implementation for health policy assessment.

Key Points for Decision Markers

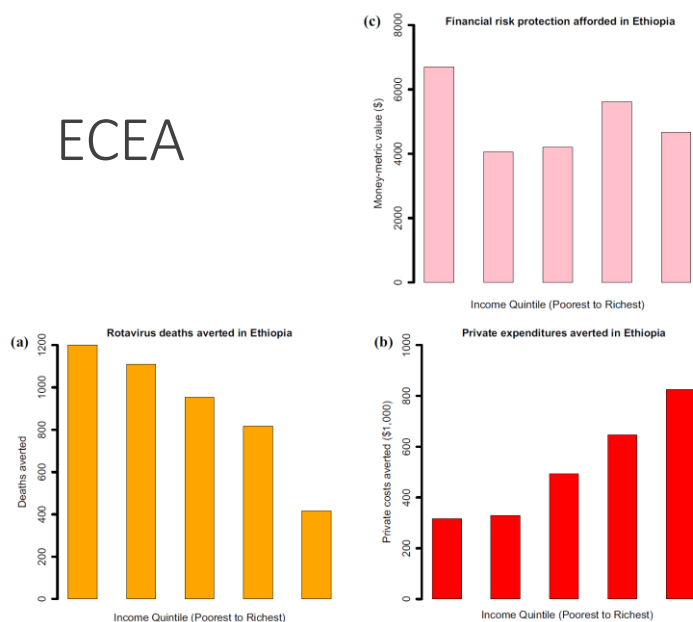
Extended cost-effectiveness analysis (ECEA) fundamentally builds on cost-effectiveness analysis and provides quantitative methods for health policy assessment. It examines public policies, whether health or inter-sectoral policies, and policy instruments that have an impact on the health of populations.

ECEA further assesses the health and financial consequences of policies, including financial risk protection and disaggregated outcomes per population stratum of interest.

The ECEA approach permits the inclusion of non-health benefits (financial risk protection) and distributional consequences or equity in the economic evaluation of health policies. It enables the consideration of key criteria into the resource allocation problem and into the design of the health benefits package.

✉ Stéphane Verguet
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ECEA



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ECEA

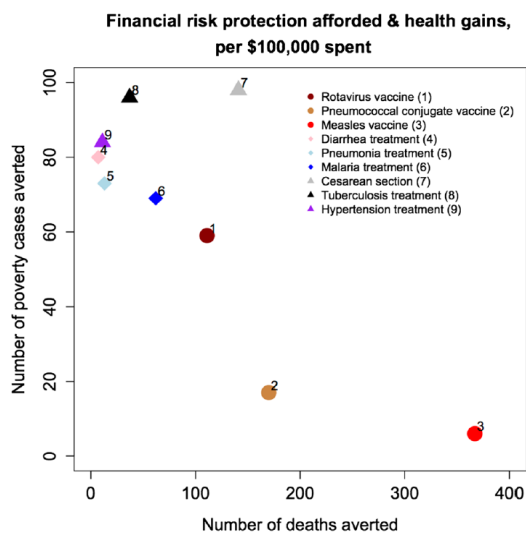


Fig. 5 Financial risk protection afforded (poverty cases averted) vs. health gains (deaths averted), per \$100,000 spent (in 2011 US\$), for each of nine interventions provided through universal public finance in Ethiopia. Source: adapted from [28]

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Use of mathematical modelling to assess the impact of vaccines on antibiotic resistance

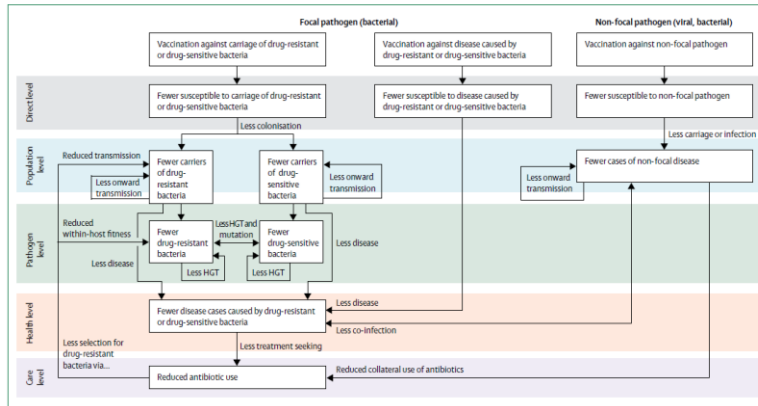


Figure 2: Pathways through which vaccination against focal bacteria and non-focal bacteria and viruses can control antibiotic resistance.
HGT=horizontal gene transfer.



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IMPACTS OF VACCINES

Broader and more acknowledged

- Parents partners
- Productivity gains
- Dynamics of herd immunity/serotype replacement/age shifts
- Long-term impacts

Broader and still less acknowledged

- Indirect health-care costs
- Equity/avoidance of catastrophic expenditures
- Reduced AMR

Broader and not/hardly acknowledged

- Fear of contagion/insurance value
- Macro-economic impact through multiplier effects
- Improved skills and capabilities

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Value in Health

Methodological and Policy Aspects Related to Health Economic Evaluations for Vaccines

Vaccines reflect one of the most effective interventions in prevention. In recent years, the growth in introduction, uptake, and coverage of vaccines has lagged behind or even reversed due to specific trends in societies (eg, vaccine hesitancy, potential distrust in producers, conceived high prices and rumored side effects, etc). As this is a multidimensional problem that requires a broad multidisciplinary approach, Value in Health aims to compile a special collection of papers on the health technology assessment of vaccination strategies to inform decision making, including its effectiveness, safety, cost-effectiveness, population impacts, prioritization, affordability, acceptability and sustainability. This themed section aims to bring together papers on sophisticated models for vaccine health technology assessment -evaluations in national immunization technical advisory groups.

Submissions received before January 1, 2020 will have the best chance of being included in this themed section in Value in Health. Final decisions regarding ultimate acceptance rest solely with the Editors.

Authors should submit manuscripts through our web-based tracking system and indicate in the cover letter that it is part of the "Vaccines" themed section.

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