The State of cost-effectiveness Analyses in Vaccines: A Systematic Review

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Background

- Economic evaluations are a major consideration of public health decisions on vaccine programs.
- Given the rapid growth in the number of published economic evaluations of vaccines, we sought to better understand global trends in the publication of cost-effectiveness analyses (CEA) of vaccines globally.
- While this has been previously studied specific jurisdictions including Canada, Spain, and Brazil [1-3], it has not been studied for vaccine economic evaluation publications worldwide.

Objectives

Describe all published cost-effectiveness analyses of vaccines in terms of:

- Trends in studied vaccines, funding sources, and research quality over time
- Examine the impact of the type of vaccine and funding source on study quality and study findings in terms of incremental cost-effectiveness ratios (ICERs)

Methods

Identification of CEA Publications: We reviewed published economic evaluation of vaccines from 1980 – 2016 using the Tufts CEA Registry[4], a comprehensive database of 5,546 published healthcare-related cost-effectiveness analyses.

Descriptive Analysis and Quality Assessment: Tufts reviewers extracted descriptive data from publications and assigned quality scores to each study. We performed descriptive and inferential analyses of the registry data for this study.

Results

Table 1. Description of Vaccine-Related Cost-Effectiveness Analyses, 1980-2016

	Number of Studies	Percent (%)
Vaccine Type		
HPV	94	24.8%
Pneumococcal	61	16.1%
Influenza	60	15.8%
Hepatitis A or B	36	9.5%
Rotavirus	30	7.9%
Pipeline Vaccine	20	5.3%
Meningococcal	20	5.3%
Pediatric Combination (DTaP, MMR)	19	5.0%
Herpes Zoster (Shingles)	17	4.7%
Adult Booster (Tdap)	10	2.6%
Multiple Vaccines	7	1.8%
Travel/Endemic	5	1.3%
Study Sponsorship		
Industry	120	31.7%
Government	94	24.8%
Other (e.g. Healthcare, NGO, Foundation)	16	4.2%
Multiple	51	13.5%
None or Not determined	98	25.9%
Study Location		
North America	157	41.4%
Europe	132	34.8%
Asia	48	12.7%
Latin America	15	4.0%
Oceania	14	3.7%
Middle East	7	1.8%
Africa	4	1.1%
Other	2	0.5%

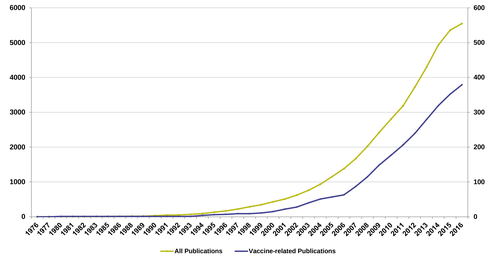

Figure 1. Vaccine-related cost-effectiveness analyses: comparison of the cumulative number of vaccine-related and other cost-effectiveness analyses (number of vaccine-related publications plotted on secondary axis)

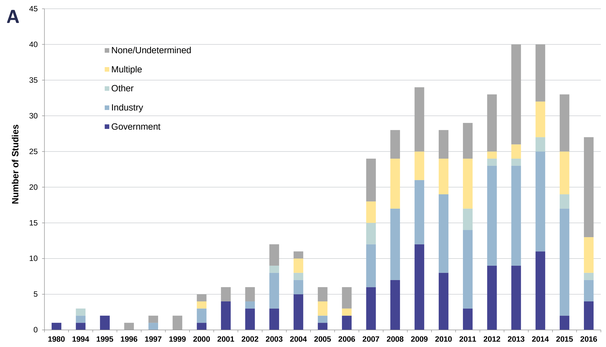

Figure 2. Vaccine-related cost-effectiveness analyses by (A) study sponsorship and (B) vaccine type, 1980 – 2016.

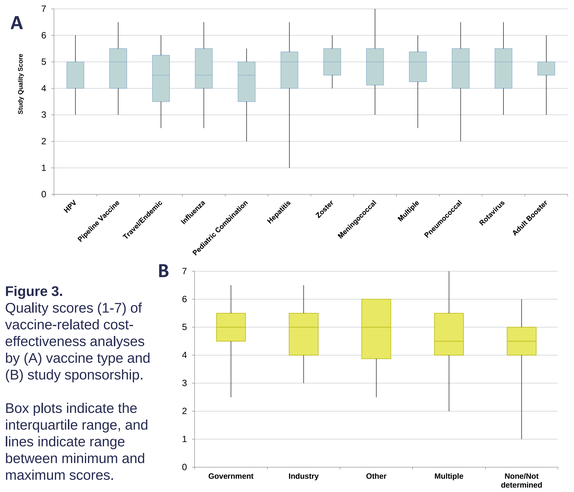

Figure 3.
Quality scores (1-7) of vaccine-related cost-effectiveness analyses by (A) vaccine type and (B) study sponsorship.

Box plots indicate the interquartile range, and lines indicate range between minimum and maximum scores.

Table 2. Incremental Cost Effectiveness Ratios (ICERs) Reported in Vaccine-Related cost-effectiveness Analyses, 1980 to 2016 *(in 2016 $USD/QALY)*[a]

	Reported ICERs	Median ICER	Minimum ICER[b]	Maximum ICER
Study Sponsorship				
Government	321	**$30,623**	Dominant	$3,868,636
Industry	262	**$16,374**	Dominant	$3,791,790
Other	41	**$19,213**	Dominant	$558,831
Multiple	130	**$30,847**	Dominant	$4,913,551
Unknown	177	**$19,402**	Dominant	$23,265,472
Type of Vaccine				
Adult Booster	14	**$41,472**	Dominant	$2,113,648
HPV	241	**$19,402**	Dominant	$459,032
Hepatitis	104	**$11,194**	Dominant	$5,548,417
Influenza	150	**$10,067**	Dominant	$6,718,381
Meningococcal	36	**$177,545**	Dominant	$4,913,551
Multiple	33	**$9,902**	Dominant	$197,092
Pediatric Combination	44	**$13,794**	Dominant	$3,176,938
Pipeline Vaccine	38	**$39,568**	Dominant	$393,365
Pneumococcal	154	**$26,273**	Dominant	$7,674,147
Rotavirus	58	**$47,568**	Dominant	$308,167
Travel/Endemic	10	**$11,109**	Dominant	$88,832
Zoster	49	**$35,203**	Dominant	$23,265,472

[a]Database does not provide base-case ICER values. Some studies can contribute multiple ICER values from different scenarios/interventions.
[b]Dominant: The intervention costs less and is at least as effective as the comparator

Conclusions

- From 1980-2016, there has been a steady growth of publications examining the cost-effectiveness of vaccines, with a total of 379 out of 5,546 articles in the CEA registry.
- The period from 2007-2016 saw a large increase in vaccine-related CEA publications, driven largely by the introduction of new vaccines such as HPV, pneumococcal, and influenza vaccines.
- Most vaccine-related CEA studies were performed in North America and Europe
- Industry was the primary sponsor of vaccine-related CEA publications, although a large number of studies were funded by government and other groups.
- The median study quality score of the identified CEA publications were not significantly different across vaccine types and study sponsorship.
- Government-sponsored studies generally reported higher cost-effectiveness ratios compared to studies funded by industry or other groups, although this is potentially confounded by the inclusion of non-base case ICERs in the publications.
- Future research will focus on identifying other factors that can affect study quality or outcomes as well as the effect of outlier data points.

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