



National Advisory Committee on Immunization (NACI): **Guidelines for the Economic Evaluation of Vaccination Programs in Canada**

April 19, 2024

CCHE Seminar

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English



French



Land acknowledgements

We wish to acknowledge the land on which we work and live.

For thousands of years, Toronto has been the traditional territory of many nations including the Mississaugas of the Credit, the Anishnabeg, the Chippewa, the Haudenosaunee and the Wendat peoples.

Many of you are joining us from all over Turtle Island, a name many Indigenous peoples use for North America, and around the world. We encourage you to seek out whose ancestral lands you are on today.

Disclosure

Dr. Beate Sander has no actual or potential conflict of interest in relation to this topic or presentation.

Dr. Ashleigh Tuite has no actual or potential conflict of interest in relation to this topic or presentation.

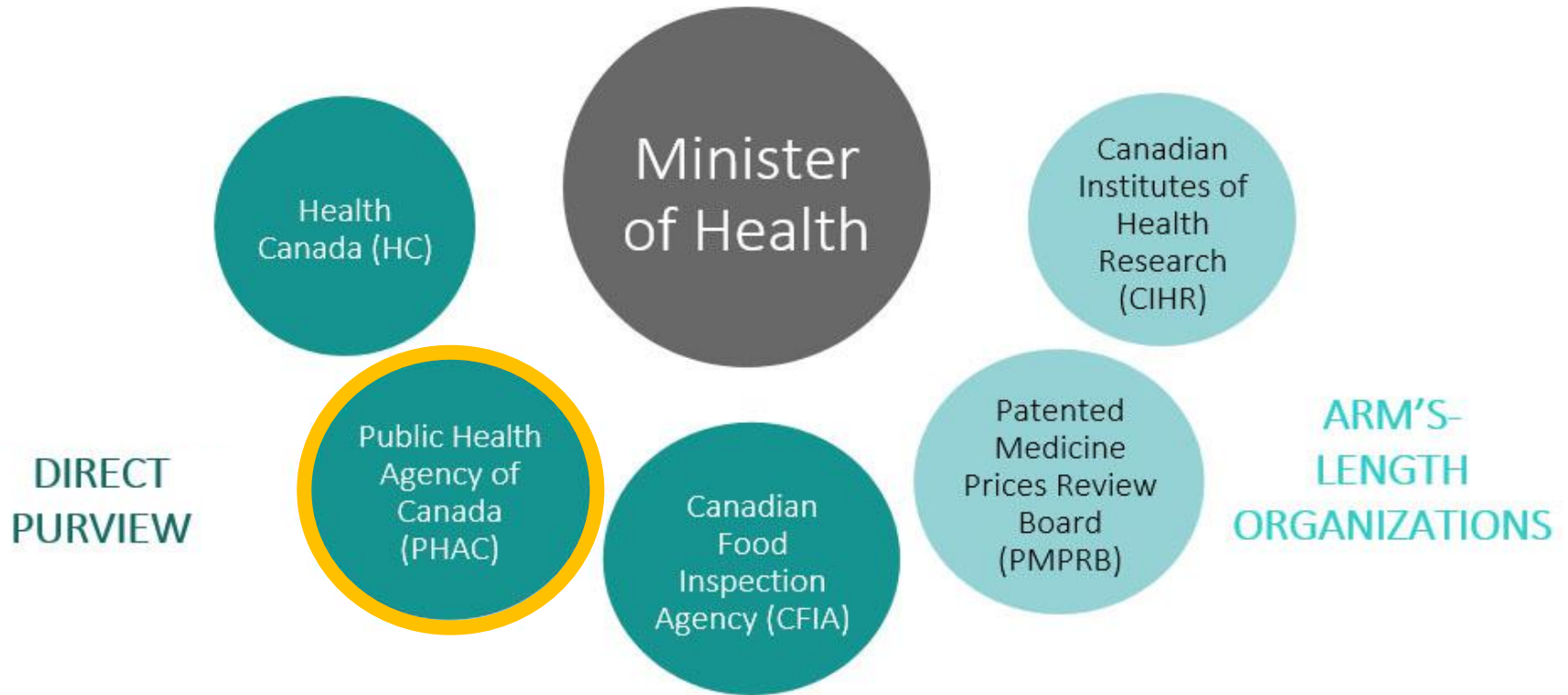
Outline

- Overview of National Advisory Committee on Immunization (NACI)
- Overview of Economic Guidelines Task Group (EGTG)
- Guidelines for economic evaluation of vaccine programs in Canada
- Applications and next steps

NACI

EXPANDED MANDATE

Canada's federal health portfolio

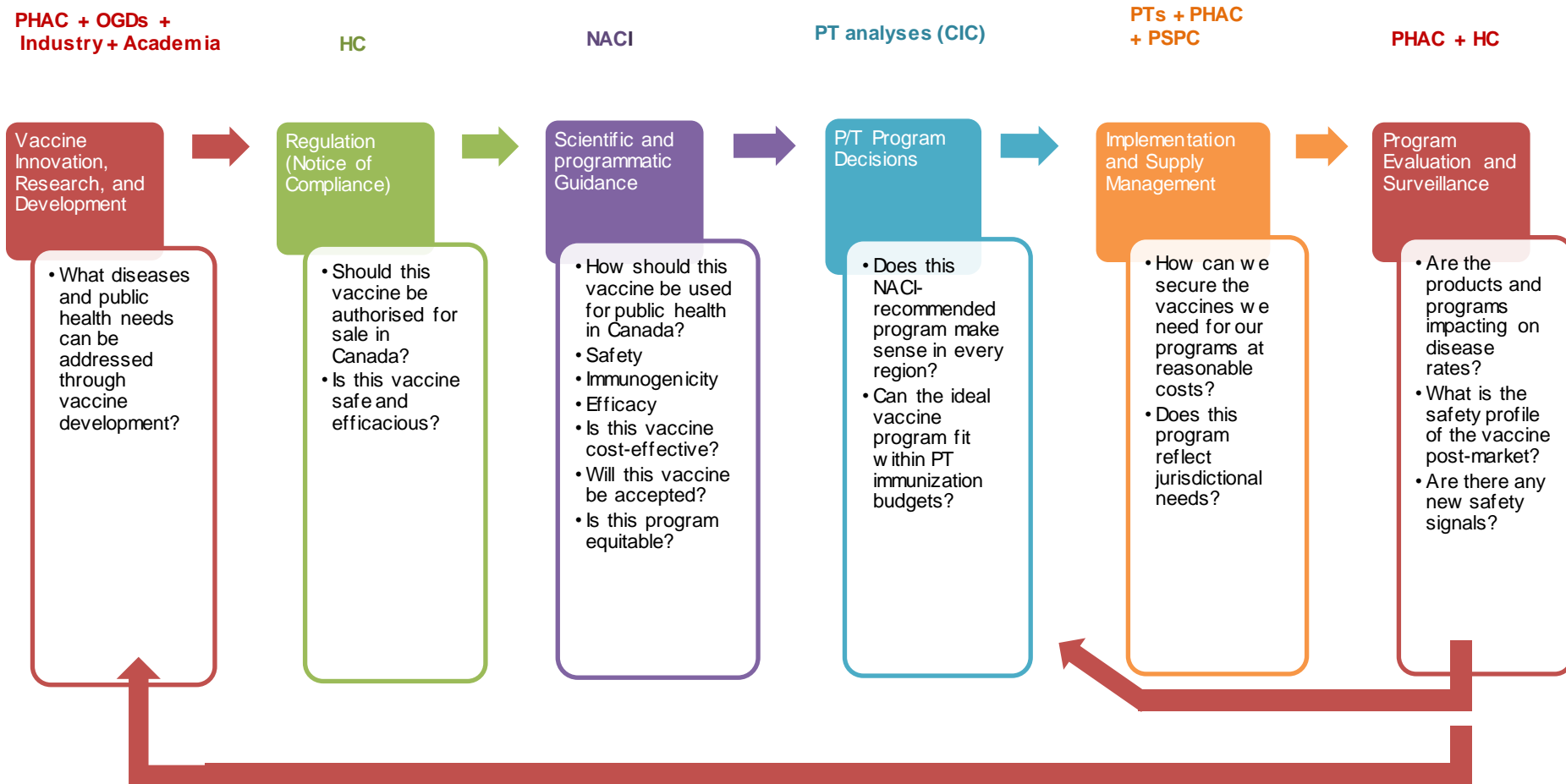


National Advisory Committee on Immunization (NACI): Structure and scope

- Established in 1964 by the Government of Canada (Health Canada)
- Provides public health advice relating to vaccines used for the prevention of disease and certain prophylactic agents for humans
- Comprised of Canadian experts in pediatric and adult infectious diseases, allergy/immunology, geriatrics, nursing, pharmacoeconomics, public health and preventive medicine, epidemiology, social sciences
- Scope has traditionally included recommendations based on safety, efficacy, immunogenicity, effectiveness and burden of illness
 - **As of 2019, NACI mandate is being gradually expanded to include programmatic factors, such as program feasibility and cost-effectiveness**
- Provinces/ territories (PTs) have discretion whether to accept NACI advice; Some PTs have own technical advisory groups and may complete complementary analyses
 - E.g. Comité sur l'immunisation du Québec (CIQ)
 - E.g. Alberta Advisory Committee on Immunization
 - E.g. Ontario Immunization Advisory Committee

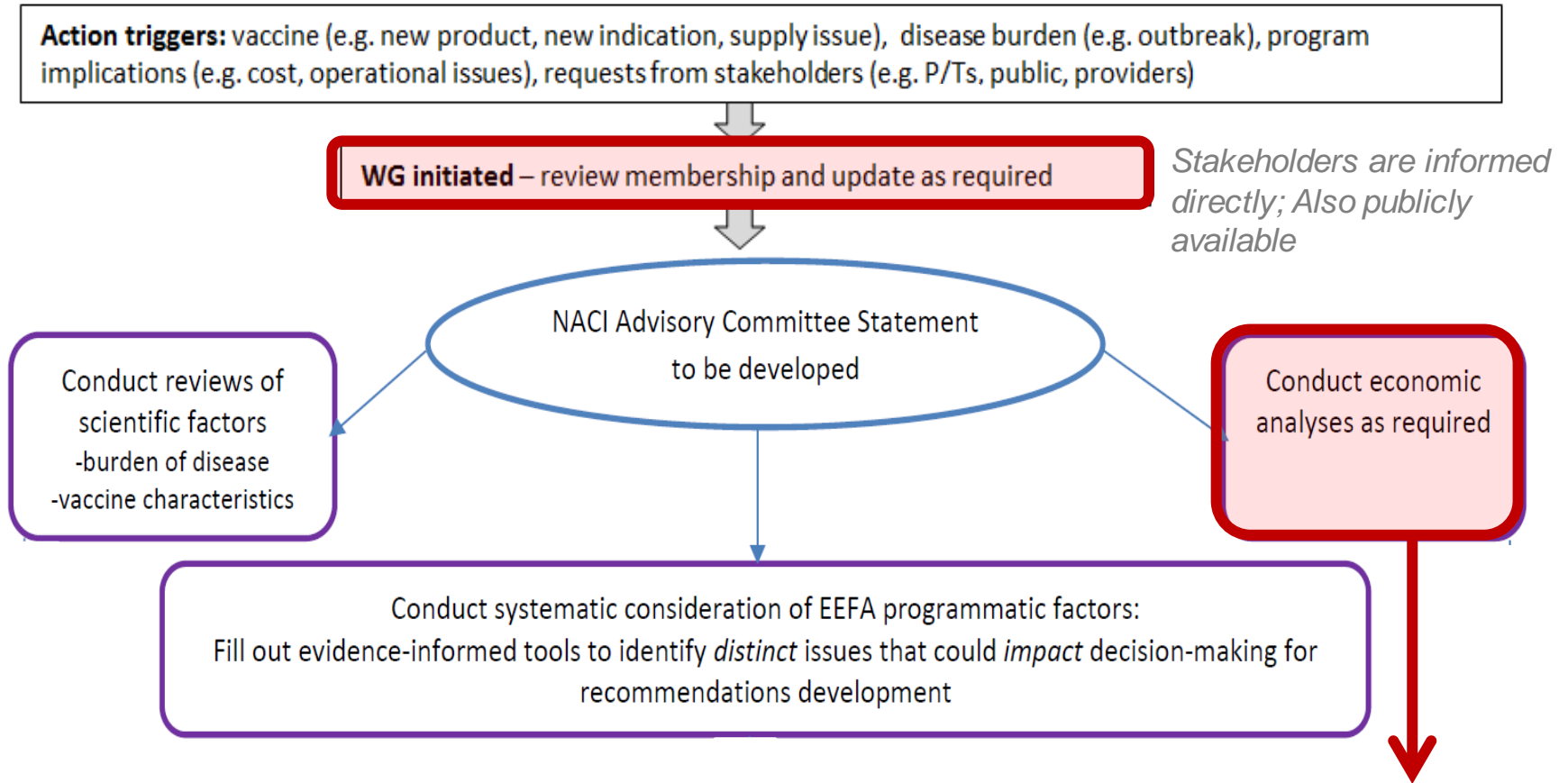


Vaccine decision pathways in Canada – a process of due diligence supporting the National Immunisation Strategy



<https://www.canada.ca/en/public-health/services/publications/healthy-living/national-immunization-strategy-objectives-2016-2021.html>

Snapshot of overall NACI process



EEFA = ethics, equity, feasibility, acceptability

NACI

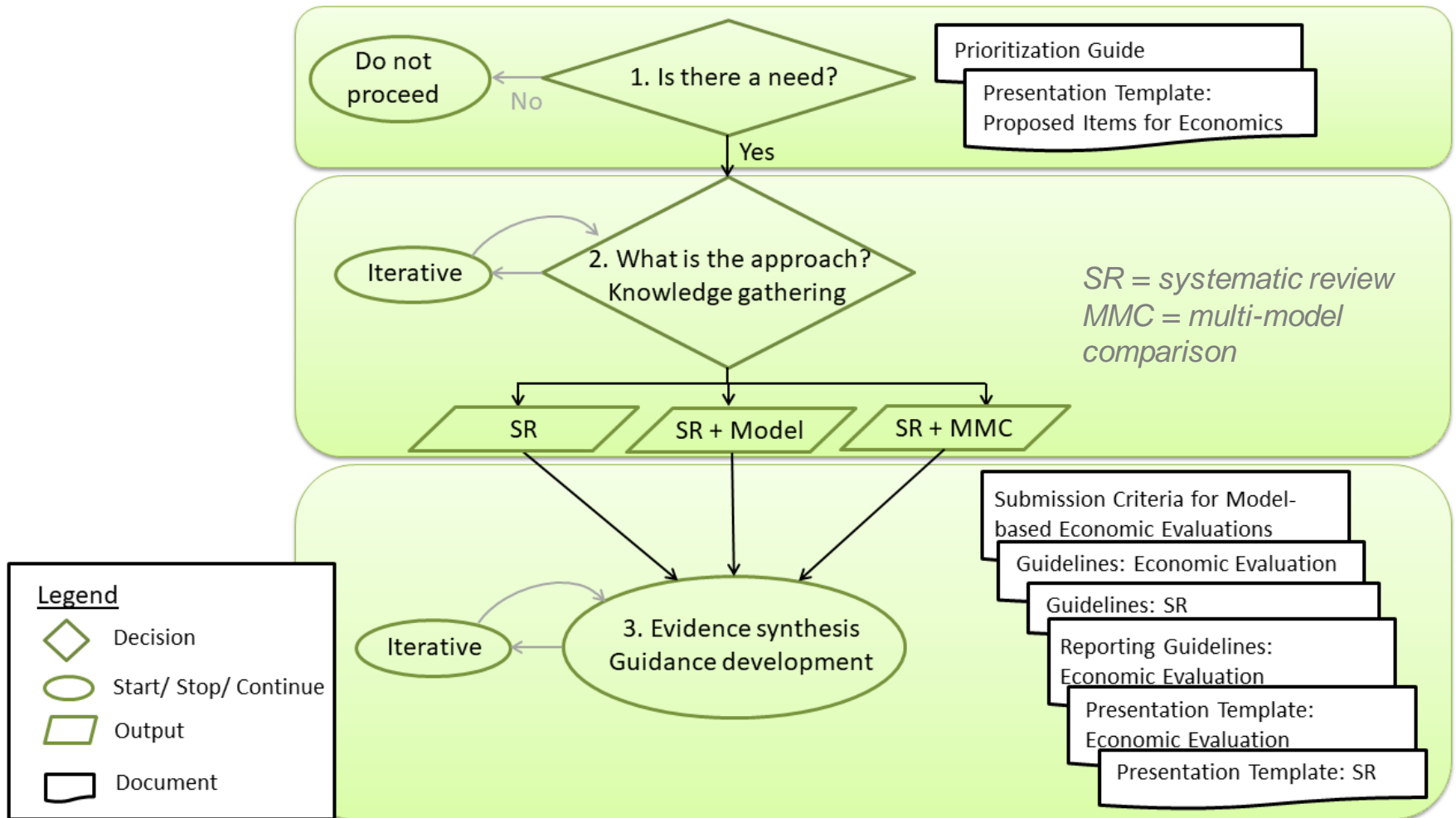
PROCESS FOR INCORPORATING ECONOMIC EVIDENCE

Economic Process

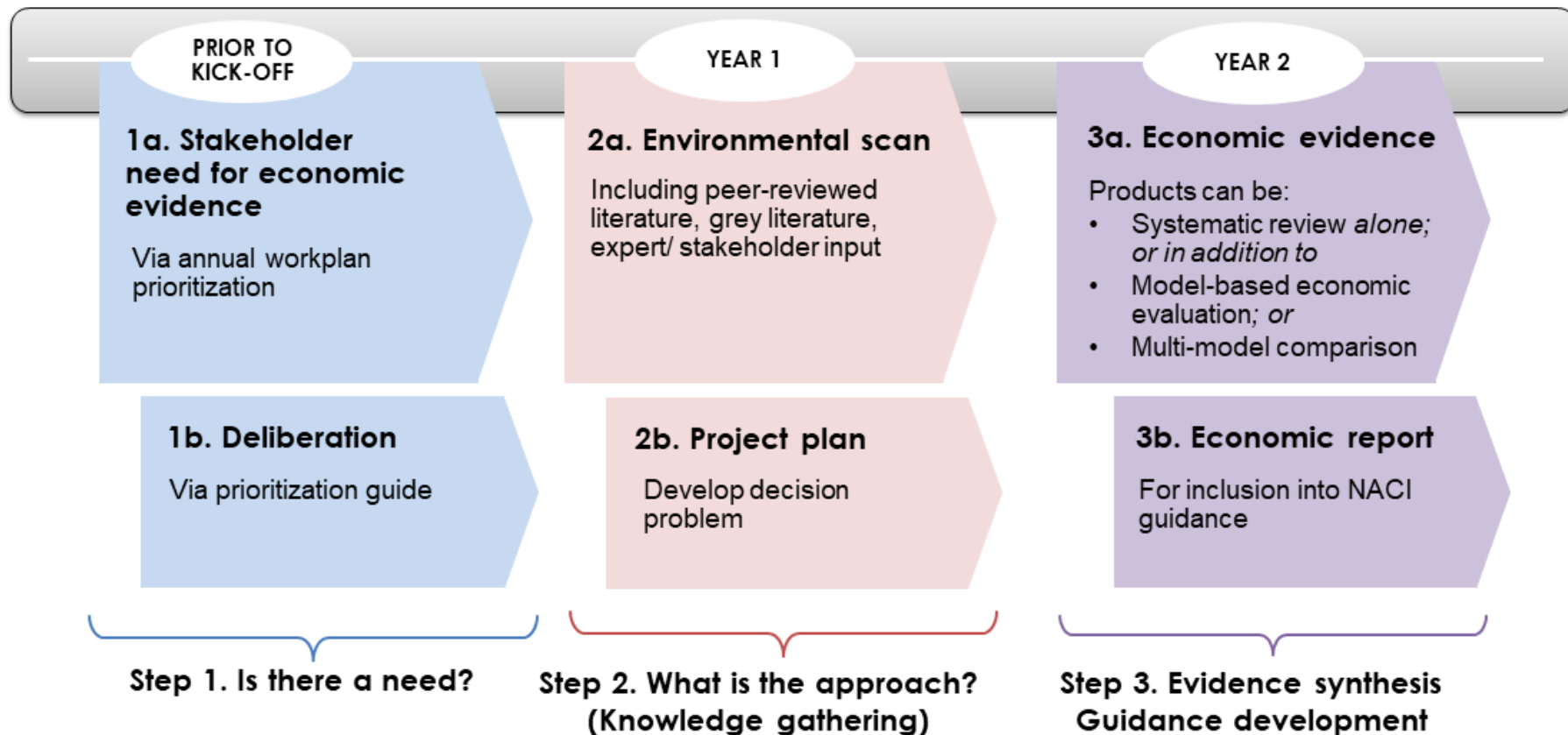
- What?**
- Outlines when and how NACI incorporates economic evidence for vaccine recommendations
 - E.g., how to prioritize economic analyses for NACI's workplan, how to submit models to NACI, and guidelines for economic evaluations and systematic reviews
- Why?**
- To support NACI's expanded mandate to include economic evidence
- How?**
- Informed by and/or consultations with:
 - Canadian Immunization Committee (CIC)
 - Public Health Ethics Consultative Group (PHECG)
 - Canadian Agency for Drugs and Technologies in Health (CADTH)
 - National Immunization Technical Advisory Groups (NITAGs)
 - US - ACIP, UK - JCVI, Germany - STIKO, Australia - ATAGI
 - Vaccine Industry Committee and other manufacturers
 - Provinces and territories via targeted consultations: AB (N = 2), BC (N = 1), QC (N = 1)

ACIP = Advisory Committee on Immunization Practices; JCVI = Joint Committee on Vaccination and Immunisation;
STIKO = Standing Committee on Vaccination; Australian Technical Advisory Group on Immunisation

NACI Economic process



Timeline for Economic Process



Types of Economic Evidence

Systematic review (of economic evaluations):

SR

- Capture peer-reviewed literature and grey literature
- Capture studies under development and unpublished studies via stakeholder engagement (e.g., NITAGs, subject matter experts, industry)
- Appraise study quality, vaccine-specific model, and applicability to Canadian context

De novo (or adapted) model-based economic evaluation:

SR + Model

- De novo = purpose-built
- Adapted = updating or adapting an existing economic evaluation for NACI's purposes
 - Decision will be based on i) ability to engage with the authors; (ii) relevance and applicability; (iii) study quality; (iv) source(s) of study funding and the role of funders
- Will **not** use model developed by industry (i.e., developed by industry employees or by consultants sponsored by industry)

Multi-model comparison:

SR + MMC

- Compare two or more models
 - One will be a de novo/ adapted model
 - Other(s) may be developed or funded by others (e.g., academia, government, a recognized funding agency, industry)
- Assess model structures, inputs, assumptions and results

NACI

GUIDELINES FOR ECONOMIC EVALUATION OF VACCINE PROGRAMS IN CANADA

Economic Guidelines Task Group (EGTG)

Time-limited task group: Jan 2019 – 2023

Mandate: Develop guidelines for economic evaluations of vaccines in Canada

- Inform best practices
- Promote standardized and high-quality evidence for decision-making

Rationale:

- Existing guidelines are **not specific to Canada** (**World Health Organization** guidelines, 2nd ed., 2019 and **US Second Panel guidelines**, 2nd ed., 2017);
- Or are **not specific to vaccines** (**CADTH**, Canadian Agency for Drugs and Technologies in Health, 4th ed., 2017)

https://www.cadth.ca/sites/default/files/pdf/guidelines_for_the_economic_evaluation_of_health_technologies_canada_4th_ed.pdf

<https://apps.who.int/iris/bitstream/handle/10665/329389/WHO-IVB-19.10-eng.pdf>

Vaccines vs. other health technologies

Vaccines can have broad impacts that are unique or are unusually large:

- Can affect both vaccinated and unvaccinated individuals
 - Via non-health spillovers and externalities
 - E.g., intergenerational effects
- Some externalities are vaccine-specific
 - E.g., herd/ community immunity, age-shifting of disease, serotype replacement, disease eradication
- Can have non-health impacts
 - E.g., productivity, consumption, education, environment

Hence, excluding broader impacts can undervalue vaccination programs

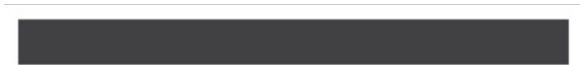
Economic Guidelines Task Group (EGTG)

Scope:

- Includes: Conducting and reporting of model-based economic evaluations
- Excludes: Budget impact analyses, decision-making processes

Target audience:

- Primary: Researchers (analysts conducting economic evaluations; mathematical modellers)
- Secondary: End-users of generated results (policy-makers and others)



National Advisory Committee
on Immunization (NACI)

Guidelines for the Economic Evaluation of
Vaccination Programs in Canada

1st Edition
April 2023



 Public Health
Agency of Canada

Agence de la santé
publique du Canada

Canada 

Economic Guidelines Task Group (EGTG)



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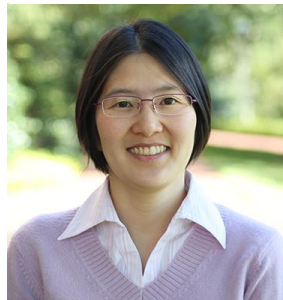
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Development process: Outreach, consultations and review

- Chief Medical Officers of Health (CCMOH)
- Canadian Immunization Committee (CIC)
- Public Health Ethics Consultative Group (PHECG)
- Indigenous Services Canada (ISC)
- Canadian Indigenous Nurses Association (CINA)
- Indigenous Physicians Association of Canada (IPAC)
- NACI immunologists
- Sister task group, NACI Economics Task Group (ETG)
- Patented Medicine Prices Review Board (PMPRB)
- Academic peer-reviewers (Canadian and international)
- Public consultation via webinars and online survey (April – June 2022)
 - Various stakeholders including but not limited to industry, patient groups, economic guideline groups, health technology assessment agencies, general public

Chapters

1	Decision problem
2	Types of Evaluations
3	Study populations
4	Comparators
5	Perspectives
6	Time Horizon
7	Discounting
8	Modelling
9	Effectiveness
10	Measurement and Valuation of Health
11	Resource Use and Costs
12	Analysis
13	Uncertainty
14	Equity
15	Reporting

0	Foreword
0	Introduction
0	Abbreviations
0	Glossary
Appendix	Impact inventory table
Appendix	Reference case

Chapters to be highlighted today

1	Decision problem
2	Types of Evaluations
3	Study populations
4	Comparators
5	Perspectives
6	Time Horizon
7	Discounting
8	Modelling
9	Effectiveness
10	Measurement and Valuation of Health
11	Resource Use and Costs
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15	Reporting

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Appendix	Impact inventory table
Appendix	Reference case

Recall:

Types of Economic Evaluations (Drummond et al 2005*)

Type of study	Measurement / valuation of costs in both alternatives	Measurement / valuation of outcomes
*Cost Effectiveness Analysis (CEA)	Monetary units	Natural units (e.g., life-years gained, cases averted, hospitalizations, etc.)
*Cost Utility Analysis (CUA)	Monetary units	Quality Adjusted Life Year (QALY)
*Cost Benefit Analysis (CBA)	Monetary units	Monetary units
Cost Minimisation Analysis (CMA)	Monetary units	Natural units (equal effectiveness)

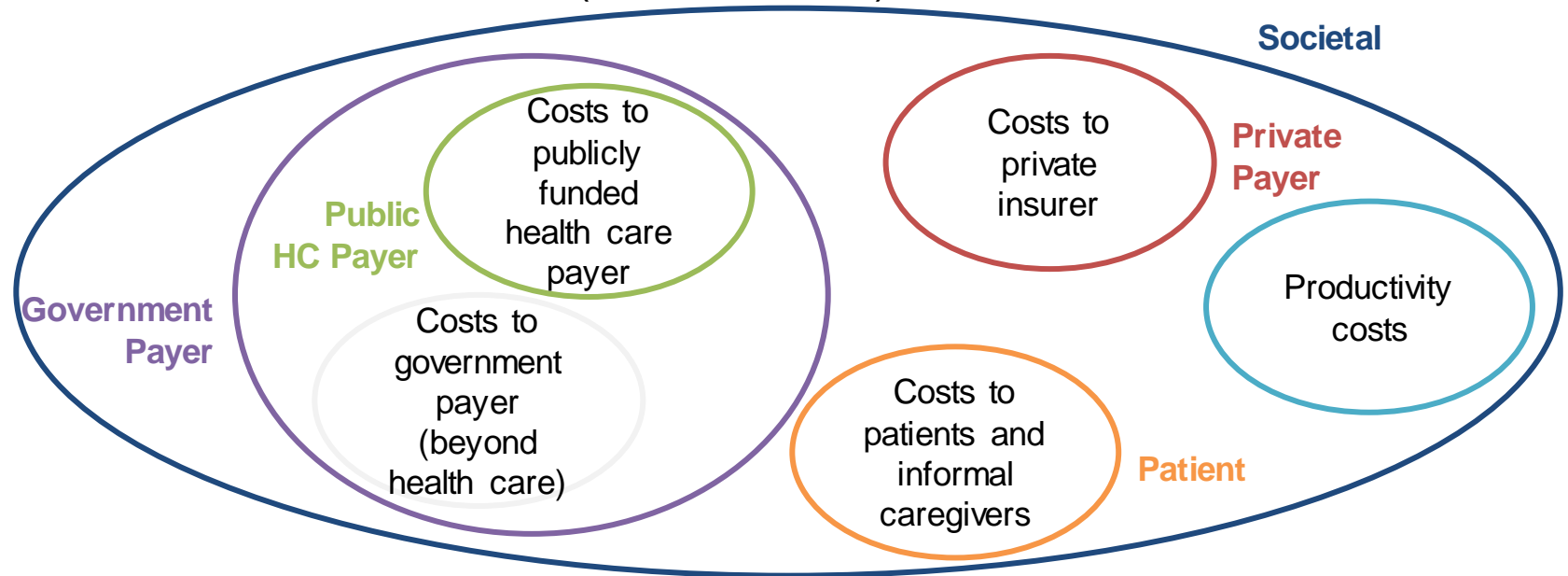
Guideline statements:

Chapter 2. Types of evaluations

1. In the reference cases, the economic evaluation should be a cost-utility analysis (CUA) with outcomes expressed as quality-adjusted life-years (QALYs). Any departure from this approach should be clearly justified.
[CADTH Guideline Statement with amendment]
2. A cost-benefit analysis (CBA) may be used alongside the reference case CUAs in situations where the vaccination program may be compared to a non-health intervention.

Recall: Perspective

→ Determines which costs (and outcomes) to include in economic evaluation



Adapted from the Health Technology Assessment Institute
(Toronto Health Economics and Technology Assessment Collaborative, THETA)

Guideline statements:

Chapter 5. Perspectives

1. Two reference case analyses should be presented as part of the economic evaluation of vaccination programs: one conducted from the publicly funded health system perspective, and the other conducted from the societal perspective.
2. “Both costs and outcomes should be consistent with the stated perspective.” [CADTH Guideline Statement]

Guideline statements: Chapter 5. Perspectives

- Health system = healthcare clinical services AND public health

1. Two reference case analyses should be presented as part of the economic evaluation of vaccination programs: one conducted from the publicly funded **health system perspective**, and the other conducted from the **societal perspective**.
2. “Both **costs and outcomes** should be consistent with the stated perspective.” [CADTH Guideline Statement]

- Not only for vaccinated individuals
- Also for unvaccinated individuals through externalities (e.g., herd/ community immunity, age-shifting of disease) and spillover (e.g., caregivers)

- Recommended because many vaccines prevent diseases that have impacts in areas beyond health
- Otherwise can undervalue vaccination programs

Comparison to other major guidelines on economic evaluations

Guidelines	Jurisdiction	Type of health intervention	Recommendation on perspective
WHO, 2019	Low-, middle- or high-income economies	Vaccines	“Should reflect national guidelines about the reference case for health economic evaluation. If these do not exist, then analyses should adopt the perspective of society ”
2 nd Panel on Cost-Effectiveness in Health and Medicine, 2016	US	Health technologies in general	Healthcare sector perspective AND societal perspective
1 st Panel, 1996	US	Health technologies in general	Societal perspective
CADTH, 2017	Canada	Health technologies in general	Publicly funded health care payer

Appendix: Impact inventory

Purpose: Provide a comprehensive list of health and non-health impacts;
Have researchers explicitly indicate which impacts are included vs. excluded

Impacts include:

- Health outcomes (individual, population; vaccine recipient, caregiver)
- Health system costs (healthcare costs and public health costs; costs funded and unfunded by the system)
- Direct out-of-pocket costs
- Losses in productivity (e.g., paid work, unpaid work, caregiver, macroeconomic consequences)
- Consumption (e.g., future individual non-medical, household)
- Education, Social services and community services, Environment, Other areas (e.g., legal, criminal, housing)

Area of Impact	Definitions/Examples	Included in Reference Case?		Comments
		Publicly funded health system perspective	Societal perspective	
<i>Health</i>				
Health outcomes	Individual health outcomes for persons intended for vaccination			
	Mortality	<input type="checkbox"/>	<input type="checkbox"/>	
	Health-related quality of life	<input type="checkbox"/>	<input type="checkbox"/>	
	Safety (i.e., adverse events)	<input type="checkbox"/>	<input type="checkbox"/>	
	Health impacts not captured by QALYs	<input type="checkbox"/>	<input type="checkbox"/>	
	Individual health outcomes for informal caregivers			
	Health-related quality of life	<input type="checkbox"/>	<input type="checkbox"/>	
	Population health outcomes			
	Incidence of infection and disease in vaccinated and unvaccinated individuals	<input type="checkbox"/>	<input type="checkbox"/>	
	Changes in age distribution of individuals who develop infection and disease	<input type="checkbox"/>	<input type="checkbox"/>	
	Emergence of new diseases related to variations of the pathogen (i.e., serotypes, serogroups, strains) or unrelated pathogens that may replace the one(s) targeted by the vaccine	<input type="checkbox"/>	<input type="checkbox"/>	
	Disease eradication	<input type="checkbox"/>	<input type="checkbox"/>	

Excerpt

Highlights:

Chapter 8. Modelling

1. "Model conceptualization and development should address the decision problem."
[CADTH Guideline Statement]
2. Researchers should consider any existing well-constructed and validated models that appropriately capture the clinical or care pathway for the infectious disease of interest when conceptualizing their model. [CADTH Guideline Statement with amendment]
3. The model structure should reflect the **natural history of disease**, the **clinical or care pathway**, and **account for susceptibility, infectiousness, immunity, morbidity and mortality related to the infection**.
4. Relevant **behavioural dynamics** including contact patterns between individuals and behaviours related to infection prevention and control should be incorporated into the model where appropriate.
5. **Dynamic models** should be considered in economic evaluations of **vaccines that are associated with externalities** such as prevention of human-to-human transmission of infection and age-shifting of disease.
6. Other model attributes should be considered in the context of the decision problem such as whether the model is deterministic or stochastic, whether the population is modelled at the aggregate level or individual level, and whether the population is open or closed.
7. Researchers should transparently report on model calibration and validation processes that were undertaken and on their results.

Highlights:

Chapter 8. Modelling

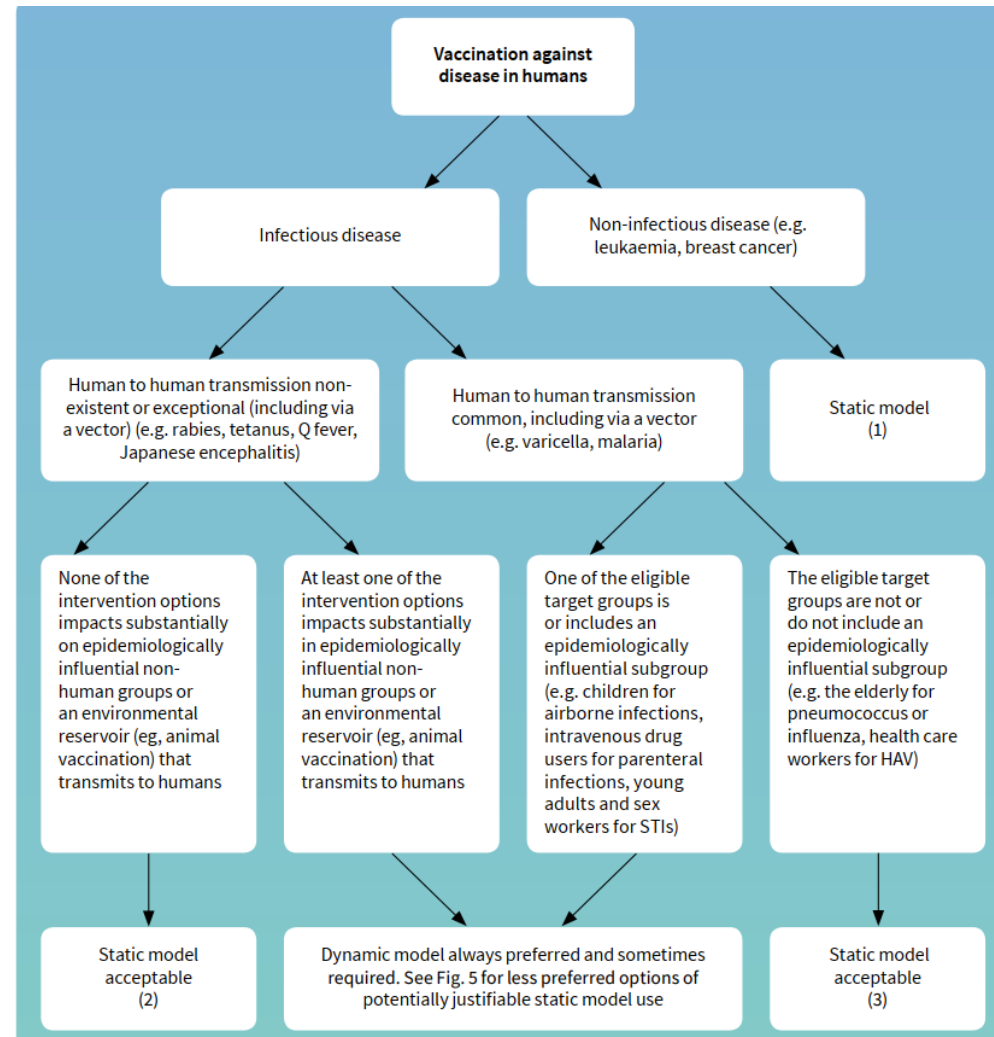
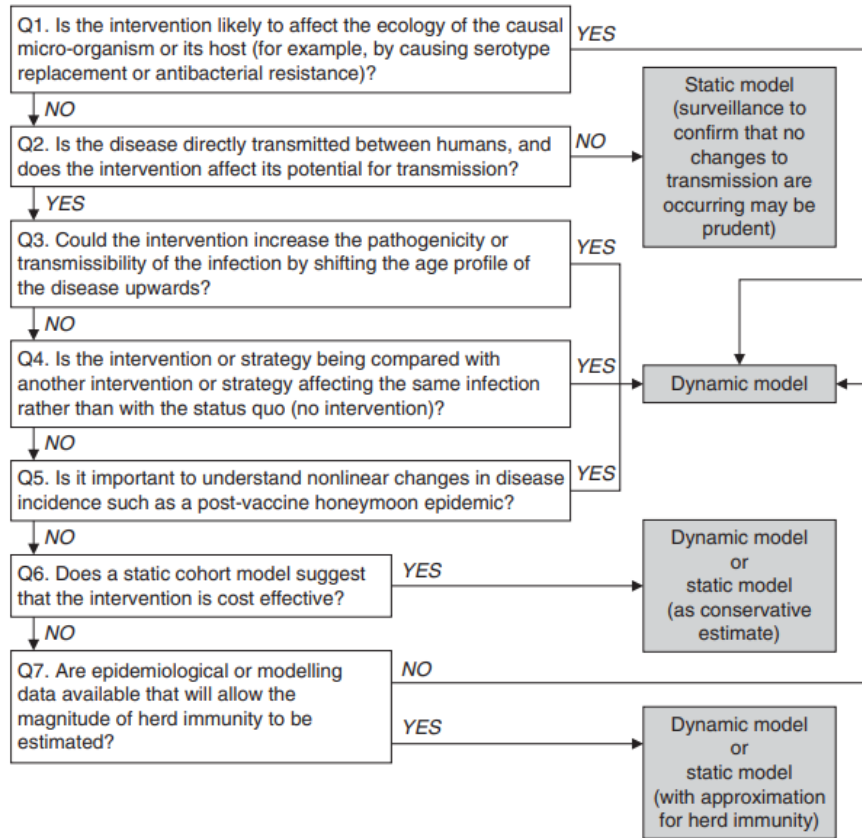
- Use **dynamic models** when there are externalities, e.g.,:
 - Prevention of human-to-human transmission of infection
 - Age-shifting of disease
 - Serotype replacement
- Can use **static models** under certain circumstances, e.g.,:
 - No human-to-human transmission (e.g., tetanus or rabies).
 - Intended group for vaccination is not epidemiologically influential with respect to transmission (e.g., hepatitis A vaccination of healthcare workers, influenza or pneumococcal vaccination in the elderly)
 - Individual is already a “host” (e.g., some pneumococcal strains; varicella zoster virus where herpes zoster (shingles) can occur later in life due to reactivation of latent infection that follows primary varicella (chickenpox) infection)
 - When a vaccination program is demonstrated to be cost-effective, and a dynamic model would only serve to reinforce this conclusion by accounting for infections prevented through indirect protection or secondary transmission
 - When there are epidemiological or modelling data available that will allow estimation of the magnitude of community immunity or secondary transmission in the same or very similar setting

Highlights:

Chapter 8. Modelling

- Consider other model attributes:
 - Deterministic or stochastic
 - Aggregate level or individual level
 - Open or closed population

Consult published schematic diagrams to determine dynamic vs. static model



Left: Jit M., Brisson M. *Pharmacoeconomics*. 2011; 29(5): 371-86.

Right: WHO Guide for Standardization of Economic Evaluations of Immunization Programs: 2nd Ed. 2019.

Guideline statements:

Chapter 14. Equity

1. Researchers and decision-makers should work together to establish which equity dimensions and goals should be included in the economic evaluation of the vaccination program being considered. Equity should be considered in the context of NACI's Ethics, Equity, Feasibility, and Acceptability (EEFA) framework.
2. Analyses that incorporate relevant equity concerns should accompany the reference case analysis (e.g., distributional cost-effectiveness analysis, extended cost-effectiveness analysis, or other emerging methods) and presented alongside the reference case.

Guideline statements: Chapter 14. Equity

1. **Researchers and decision-makers should work together** to establish which **equity dimensions and goals** should be included in the economic evaluation of the vaccination program being considered. Equity should be considered in the context of NACI's Ethics, Equity, Feasibility, and Acceptability (EEFA) framework.

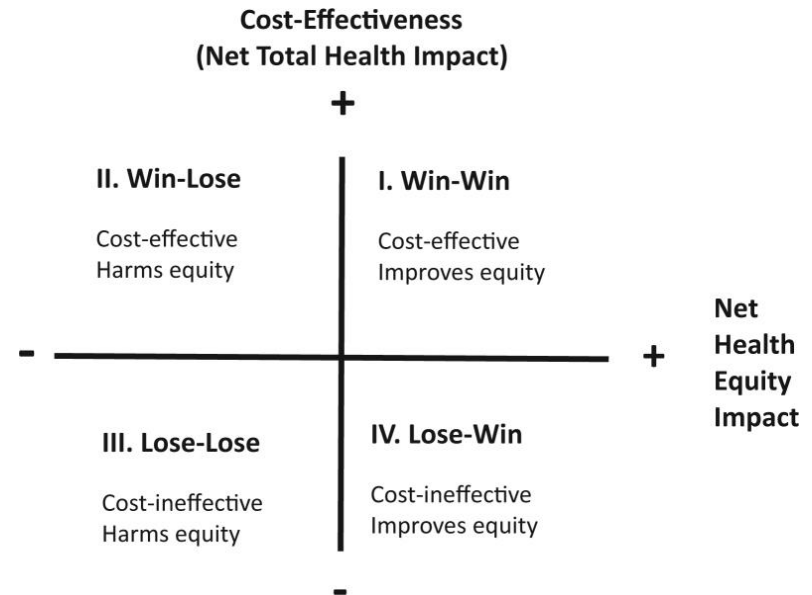
2. Analyses that incorporate the reference case analysis, extended case analysis, and other methods) and present

1. Improving equity in access
2. Improving equity in uptake
3. Improving equity in health benefit related to health conditions addressed by the vaccination program
4. Reducing lifetime health inequities between groups
5. Reducing overall inequities (i.e., health and non-health related) between groups

Equity-informed Economic Evaluation

Two major ways of using EE to address health equity concerns:

1. Equity impact analysis: quantifies the distribution of costs and effects by equity-relevant variables (e.g., SES, location, ethnicity, sex, and severity of illness)
2. Equity trade-off analysis: quantifies trade-offs between improving total health and other equity objectives



Cookson R, Mirelman AJ, Griffin S, et al. Using Cost-Effectiveness Analysis to Address Health Equity Concerns. *Value Health*. 2017;20(2):206–

Reference case [1]

Section	Guidance
Decision Problem	Specify the details of 1) the interventions to be compared; 2) the setting(s) in which they are to be compared; 3) the type of evaluation being conducted; 4) the perspectives from which the analysis is being carried out; 5) the costs and outcomes to be quantified in the analysis; 6) the time horizon over which the analysis is to be carried out; 7) and the population(s) for the evaluation.
Types of Evaluations	Conduct a cost-utility analysis (CUA) capturing health outcomes in terms of quality-adjusted life-years (QALYs).
Study Populations	Identify the population(s) in which the vaccination program will be used, and, when applicable, any populations that might experience externalities resulting from the vaccination program. Stratify analyses and report by subgroups when heterogeneities between groups of individuals may affect the results of the economic evaluation.
Comparators	Compare all relevant interventions, including other vaccination programs, screening interventions, medical and non-medical preventive interventions, and treatment-based approaches presently used in a Canadian context.
Perspective	Conduct two reference case analyses, one from the publicly funded health system perspective and one from the societal perspective.
Time Horizon	Select a time horizon that is long enough to capture all relevant differences in the future costs and outcomes associated with the interventions being compared.
Discounting	Discount costs and outcomes at a rate of 1.5% per year.
Measurement and Valuation of Health	Identify, measure, and value all relevant health outcomes based on the perspectives of the publicly funded health system and society. Use health preferences that reflect the general Canadian population. Obtain health preferences from an indirect method of measurement that is based on a generic classification system.
Resource Use and Costs	Identify, measure, and value all relevant resources and costs based on the perspective of the i) publicly funded health system, and ii) society. Estimate Canadian resources and costs using data that reflect the jurisdiction(s) of interest.

Reference case [2]

Analysis	<p>Derive expected values of costs and outcomes for both the publicly funded health system perspective and the societal perspective for each intervention through probabilistic analysis, incorporating potential correlation among parameters, whenever possible.</p> <p>Where distinct subgroups are identified within the study population, stratify analyses and report by subgroups.</p> <p>Calculate incremental costs, incremental effectiveness, and incremental cost-effectiveness ratios (ICERs) for both the publicly funded health system and societal perspective analyses. For evaluations with more than two comparators, calculate ICERs sequentially.</p>
Uncertainty	<p>Address methodological uncertainty by comparing the reference case results to those from a non-reference case analysis.</p> <p>Summarize decision uncertainty, using cost-effectiveness acceptability curves (CEACs) and cost-effectiveness acceptability frontiers (CEAFs), where possible.</p> <p>Use scenario analysis to address structural uncertainty.</p> <p>If a value-of-information analysis is undertaken, summarize the value of additional information using the expected value of perfect parameter information and the population expected value of perfect parameter information.</p>
Equity	<p>Consider whether there are inequities experienced by specific groups that could be improved by the vaccination program.</p> <p>Equity should be explored using methods such as distributional cost-effectiveness analysis and extended cost-effectiveness analysis. Any additional analyses should accompany the reference case analyses when applicable.</p>

Application and next steps

- To be used by NACI Secretariat for workplan items that require model-based economic evaluations
- Encourage use among health economists and mathematical modellers in academia, PTs, industry, etc.
 - NACI has a mechanism for accepting models for review as part of a multi-model comparison
- NACI recently published an Interpretation guide for decision-makers
- Next steps:
 - Worked example
 - List of commonly used societal costs and consequences
- Triggers for future revisions:
 - Methodological developments in the field of health economics (e.g., updates to CADTH guidelines); and/or
 - Identification of areas requiring updated guidance following periodic reviews by the NACI Secretariat

Acknowledgements

Peer-reviewers:

- Bohdan Nosyk
- IHE (Christopher McCabe; Ellen Rafferty; Jeff Round; Sasha van Katwyk; Kate Harback; Erin Kirwin)
- David Fisman
- Wendy Ungar
- Ava John-Baptiste
- Lauren Cipriano
- Kim Dalziel
- Susan Griffin

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Access Online



Guidelines



Process



Interpretation
Guide

NACI Home Page > Methods and Process