National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Enhancing biosecurity on pig farms and freezing meat to prevent toxoplasmosis

A Social Cost-Benefit Analysis

Anita Suijkerbuijk BfR 4 November 2019

National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Contents

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National Institute for Public Health and the Environment

RIVM –

Committed to health and sustainability

National Institute for Public Health and the Environment

Governmental research and knowledge institute

providing policy support to (a.o)

- Dutch Ministry of Health, Welfare and Sport;
- Ministry of Housing, Spatial Planning and the Environment;
- Ministry of Agriculture Nature and Food Quality;
- National Food Authority, and several National Inspectorates.
- EU bodies

RIVM: 3 main fields of interest

1. Centre for Infectious diseases control
2. Environment and Safety
3. Public Health and Health Services

- ~1700 staff employed

Toxoplasmosis project here presented is collaboration of:

- Centre for Zoonoses and Environmental Microbiology
- Centre for Nutrition, Prevention and Health Services
- Centre for Infectious Diseases Epidemiology and Surveillance

Economic evaluation at the RIVM

- 10 health and environmental economists, wider group of about 30 people with economic interests

- Longstanding tradition of economic evaluation for public health interventions, some classical examples:
- Vaccination
- National screening campaigns, i.e. hepatitis screening
- Interventions targeted at (more) healthy living:
  - Stop smoking
  - Enhance physical activity
  - More healthy nutrition
  - Alcohol use

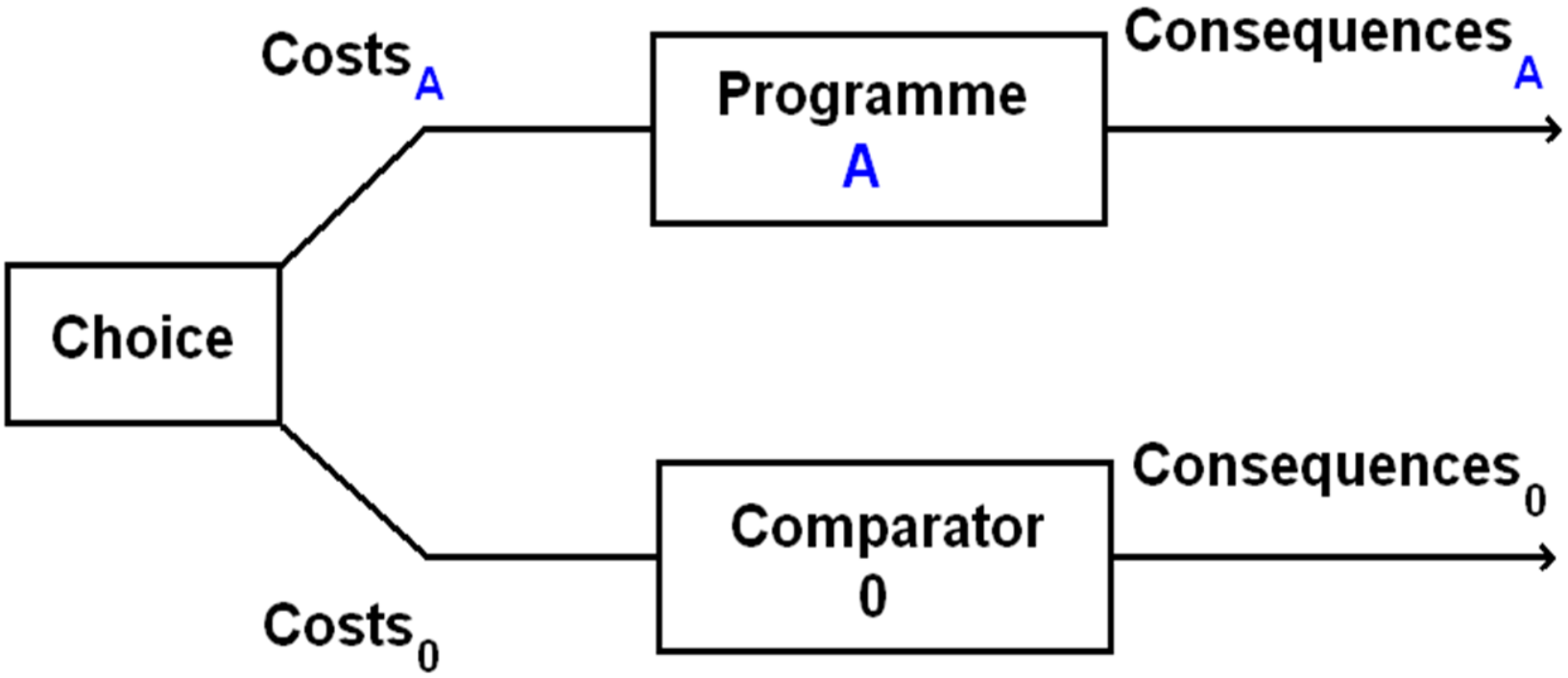
Economic evaluation: background

Always involves a comparative analysis of two or more alternative investment possibilities (incremental cost effectiveness analysis).

Goal is to systematically:

- identify,
- measure,
- value, and
- compare
- costs and benefits (consequences) of different alternative
- interventions (investments)

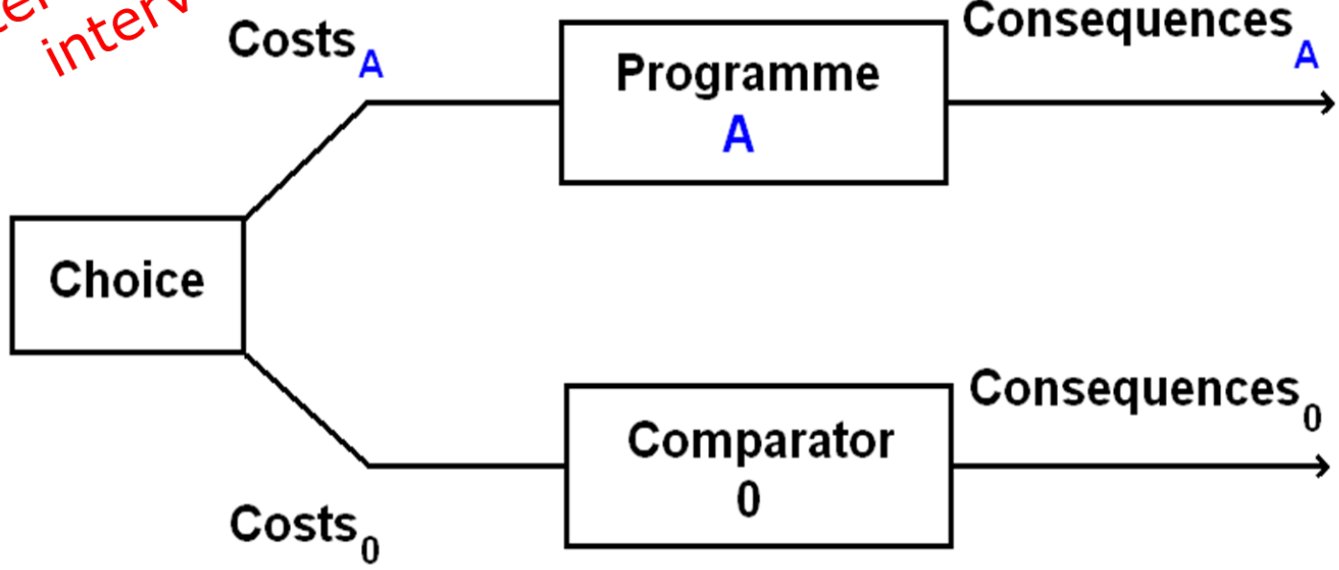
Economic evaluation



Comparator 0 = Current program / intervention

Economic evaluation

NOT: Is this intervention cheaper than other interventions



Cost-effectiveness analysis (CEA) most often used

- Ratio of cost differences over effect differences:

Cost-utility ratio of B (intervention under study) compared to A (reference situation – old situation):

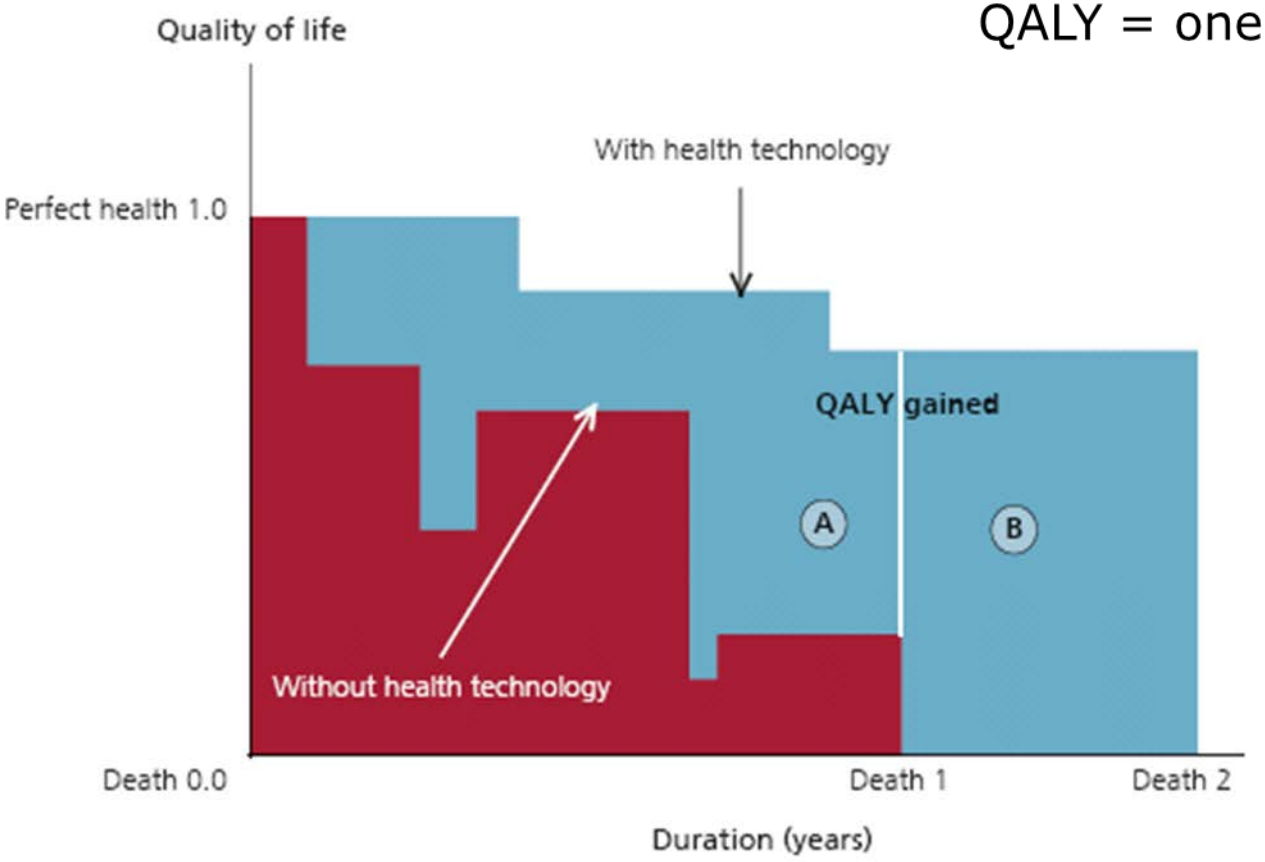
$$\frac{\text{net cost B} - \text{net cost A}}{\text{QALYs B - QALYs A}}$$

Net cost: Cost of intervention -/- future savings

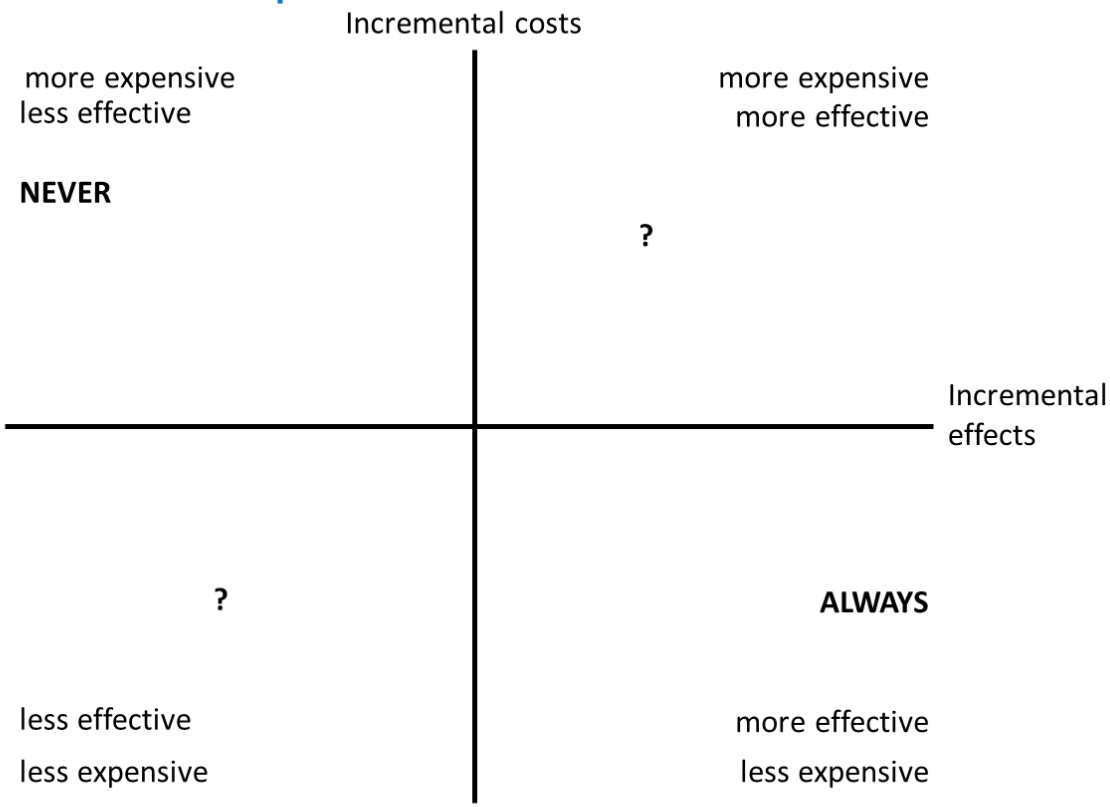
The cost-utility ration expresses the amount of money needed (and will not be available for alternative options anymore) to achieve one additional **Quality Adjusted Life Year (QALY)**, if we replace the reference situation (A) with the intervention under study (B)

Quality adjusted life year (QALY) as outcome measure

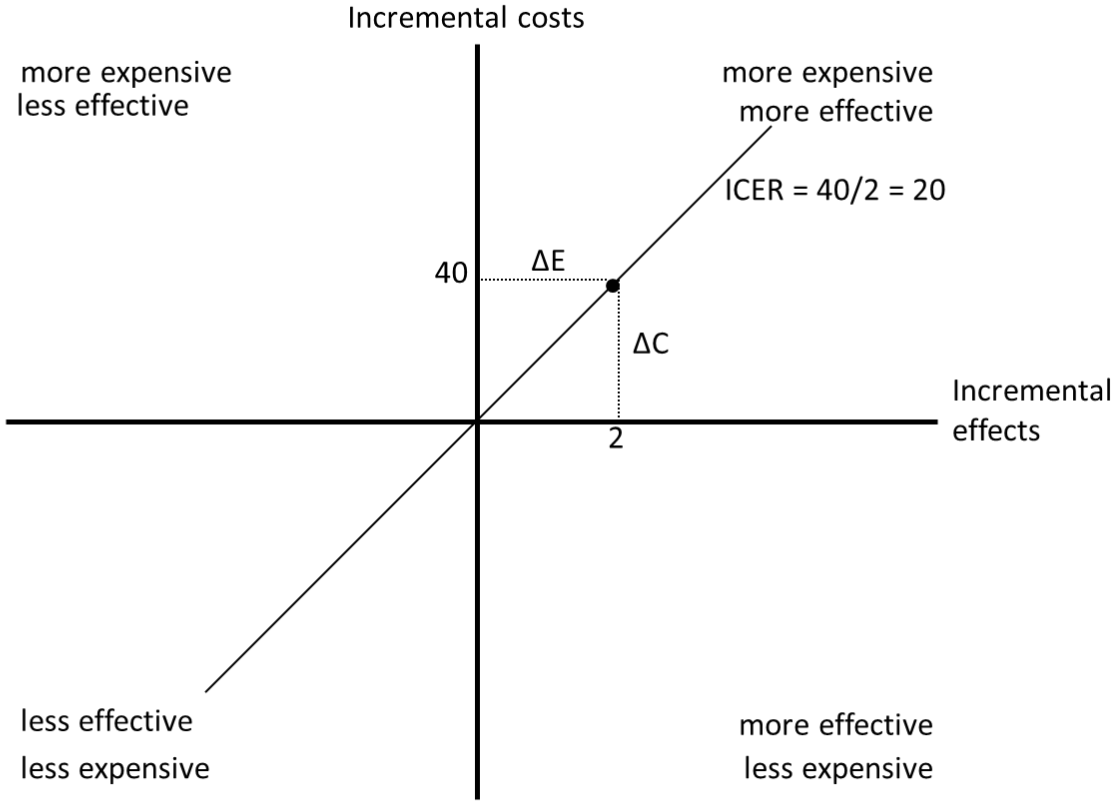
QALY = one life year in full quality



Cost-effectiveness plane



Cost-effectiveness plane



WTP for QALY international

Country	Currency	Threshold local currency	Threshold in Euro
US	USD	50000-100000	36.600-73.200
Sweden	SEK	500000	54.000
UK	GBP	30000	44.500
Australia	AUSD	42000-76000	26.200-47.400
Canada	CND	20000-100000	13.700-68.700
The Netherlands	EURO	20000-80.000	20.000-80.000
New Zealand	NZD	20000	11.200

World Bank: QALY may cost up to 3 times GDP per capita, if ≤1 GDP/capita, intervention is very cost-effective
Dutch GDP ~ €35.000 per capita

Economic evaluation - perspective

- Perspective: the viewpoint from which an economic evaluation is conducted, determines which costs to include and how effects are valued

- Two perspectives most often used in health economic evaluations:

- Health care perspective: include health care costs and health effects only (third party payer perspective / insurance perspective / Ministry of Health)

- Societal perspective: Include ALL COSTS and ALL BENEFITS regardless who incurs costs and who obtains benefits

Main features of Social Cost-Benefit Analysis

- Policy options are compared based on their consequences for welfare levels for society at large

- All costs and all effects are expressed in monetary terms, including health effects, death, pain, suffering

- Starting point is an inventory of all societal effects of interventions: healthcare, criminal justice, school system, production losses, traffic accidents, companies, etc etc.

- A positive net benefit implies that the intervention has more benefits than costs, and vice versa

Some additional features of SCBA (2)?

SCBA is a cumulation of:

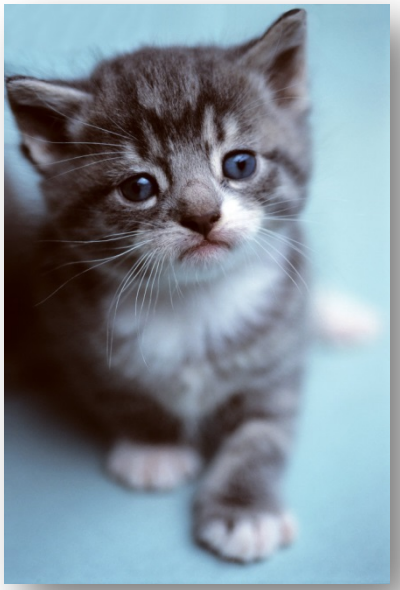
- "soft" Euro's (hypothetical, non-financial Euro's, e.g. monetary value of health effects)
- "real" Euro's (real money, e.g. savings as a consequence of less hospitalisation)
- This implies that the net benefit is not similar to money that can be readily spent
- Effects that cannot be quantified will return as a PM (Pro Memori) in the SCBA

In sum

Economic evaluations are important for policy making

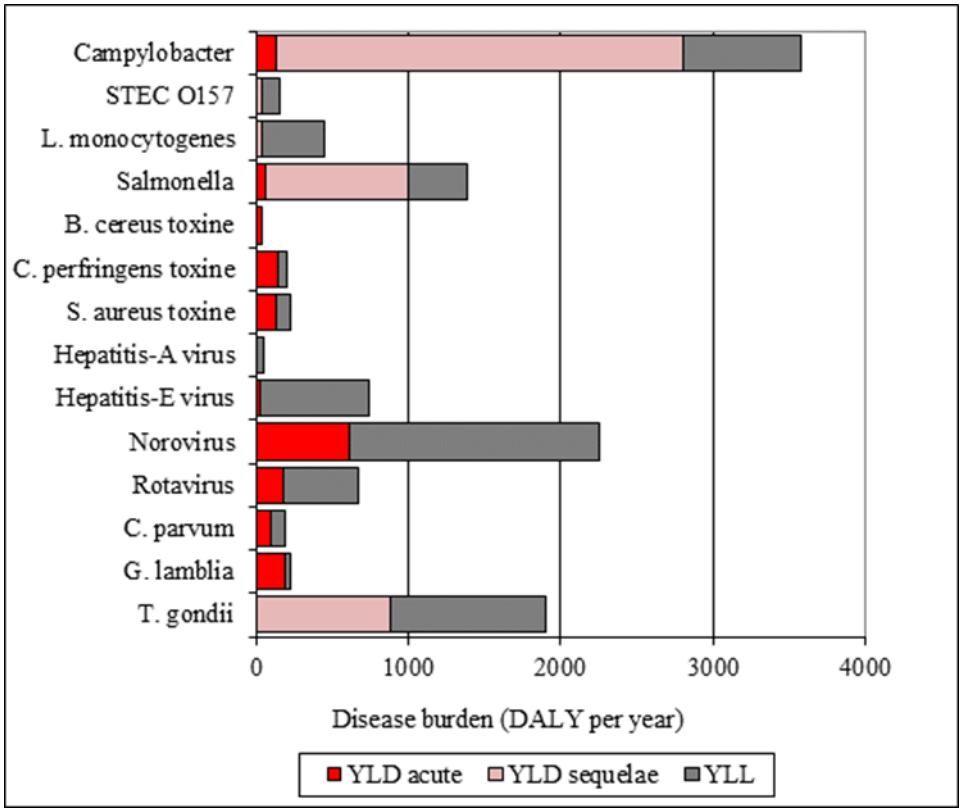
Social Cost-Benefit Analyses are preferred when more sectors of society are involved

Toxoplasmosis



Disease burden (DALYs) in the Netherlands

	2012	2016
Congenital	2151	1622
Acquired	1345	280
Total	3496	1902



Prevention of toxoplasmosis

- High burden among foodborne diseases: effective and cost-effective preventive interventions are warranted

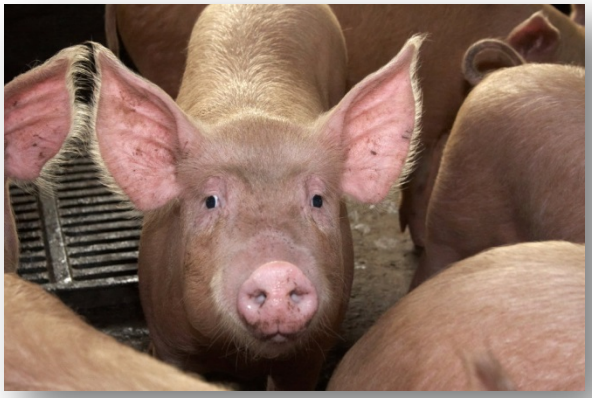
- It is essential to determine the extent and dimensions of the problem, possible effective interventions and the costs and benefits of implementing those for society

- Freezing meat intended for raw or undercooked consumption, and enhancing biosecurity on pig farms are promising interventions to prevent *T. gondii* infections in humans

- Implementing these interventions would expectedly reduce the number of infections; the net benefits for society are unknown.

Two hypothetical interventions

1. Enhancing biosecurity on pig farms



2. Freezing meat intended for raw or undercooked consumption

- Assumption: implementation within EU (with no additional advantages or disadvantages for countries)

Freezing meat intervention

Targeted at:

- Steak tartare also known as filet américain
- Steak
- Lamb chop
- Leg of mutton

Biosecurity intervention

Quality assurance and monitoring working procedures on pig farms is already established in the Netherlands

In this SCBA we assess:

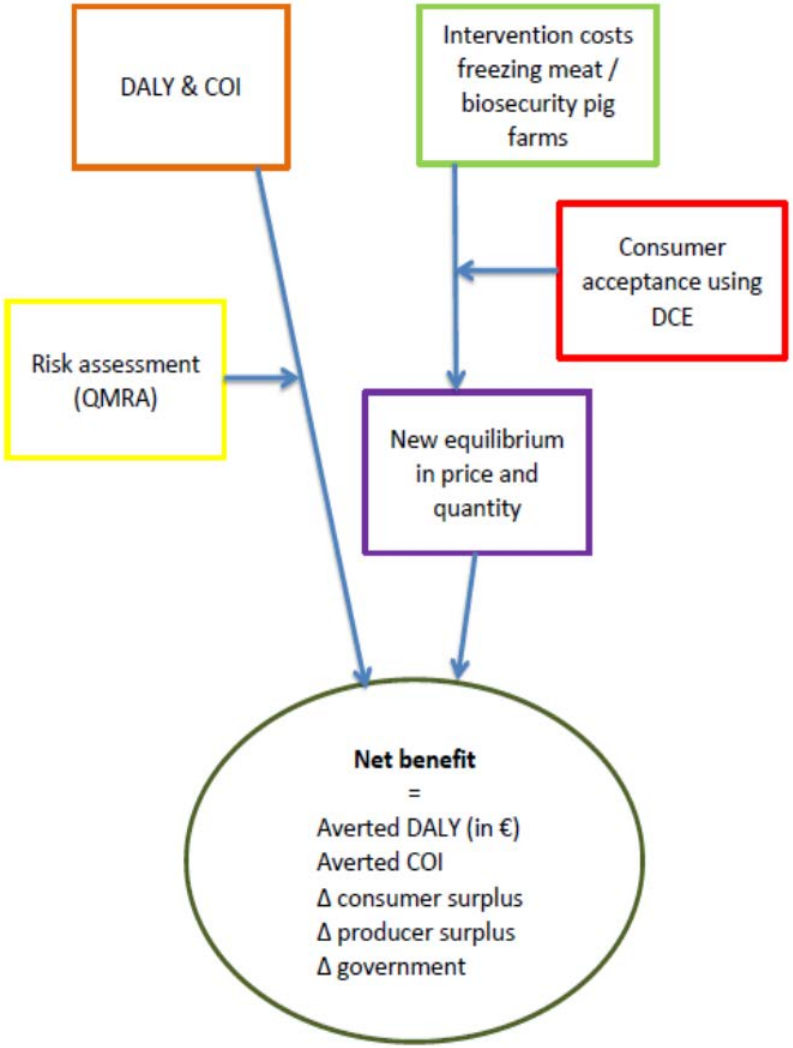
- A practical risk based surveillance program
- Identification of seropositive pig farms by blood samples taken at slaughter
- An additional audit on positive farms for the presence of risk factors and recommendations how to control these risk factors (e.g. measures to exclude cats from stables, storage of feed, control of rodents)

Design of the SCBA model

Information of costs, benefits and stakeholders from several sources and models is needed:

1. Estimation of disease burden, cost-of-illness, and meatborne attribution
2. Quantitative microbial risk assessment (QMRA)
3. Costs of the interventions
4. Acceptance by consumers (DCE)
5. Estimation of producer and consumer changes due to new prices
6. Cost and benefits for the stakeholders involved: government, consumers, farmers, freezing meat companies, and slaughterhouses

Model


DALY & COI
Intervention costs freezing meat / biosecurity pig farms
Consumer acceptance using DCE
Risk assessment (QMRA)
New equilibrium in price and quantity
Net benefit
=
Averted DALY (in €)
Averted COI
Δ consumer surplus
Δ producer surplus
Δ government

Stakeholders involved with the interventions

Consumers:	Improvement of quality of life
	Decline of patient cost
	Less productivity losses
	Meat consumption will change, consumer surplus
Producers:	Farmers, higher costs for biosecurity interventions
	Freezing meat companies, freezing costs ->consumers
	Slaughterhouses, serology and audit cost->consumers
Government:	Less healthcare costs
	Less special education costs

QMRA meatborne toxoplasmosis: insight in risky products

Species	QMRA 2011	QMRA 2018
Beef	**67.6**	**84.0**
Lamb & Mutton	14.0	0.2 & 3.7
Pork	11.2	12.0
Products		
Filet américain	**37.8**	**79.8**
Pork sausage (theeworst)	0.2	10.3
Leg of mutton	1.0	3.7

Discrete choice experiment (DCE)

Aim:

- To gather information on consumers' change in willingness to pay for frozen meat

DCE:

- Technique to elicit preferences of respondents
- By presenting choices to respondent of service or product of interest
- Based on systematic variation of relevant characteristics

Results:

- Most consumers are not willing to pay more for frozen meat, regardless the increase in food safety.
- People trust that food sold in NL is safe

Economic evaluation

- All available input and output from the models are collected in an Excel model
- The net value is assessed by comparing the reference scenario (current situation with no addition measures) with the two interventions including reduced Toxoplasma transmission
- Based on the input parameters, net results are presented in a range with the least and most favourable outcomes
- Price level 2016

Annual costs and benefits freezing meat intervention * €1000

	Steak tartare		Beef steak		Lamb chop		Leg of mutton	
Stakeholders	Min	Max	Min	Max	min	max	min	max
Freezing companies	-975	-89	-4,811	-626	-98	-8	-28	-8
	+975	+89	+4,811	+626	+98	+8	+28	+8
Consumers								
Freezing costs	-975	-89	-4,811	-626	-98	-8	-28	-8
DALYs averted	10,408	15,612	190	286	5.3	8	487	730
Patient costs	12	24	0.2	0.4	0.0	0.0	0.6	1.1
Productivity losses	199	362	3.6	6.6	0.1	0.2	9	17
Consumer surplus	-907	-112	-2,722	-622	-10	-8	-4	-3
Government								
Healthcare costs	1,836	15,136	33.6	277	0.9	7.8	86	708
Special education costs	3.2	143.3	0.06	2.6	0.0	0.1	0.2	6.7
Net benefits	10,576	31,077	-7305	-625	-102	-0.6	550	1,452

Annual costs and benefits biosecurity intervention * €1000

	Biosecurity intervention	
Stakeholders	**Min**	**Max**
Farmers	**-2,103**	**-701**
Slaughterhouses	-439	-482
	+439	+482
Consumers		
- Intervention costs slaughterhouses	**-439**	**-482**
- DALYs averted	**16**	**23**
- Patient costs	0.02	0.04
- Productivity losses	0.3	0.5
Government		
- Healthcare costs	3	23
- Special education costs	~~0.006~~	~~0.2~~
Net costs/benefits	**-2,525**	**-1,136**

To conclude

- Freezing meat is more effective than enhancing biosecurity to prevent toxoplasmosis
- A low effectiveness of biosecurity intervention was assumed, only 1%. Possibly in future results can be adjusted in a positive way
- Freezing filet américain and leg of mutton result in net benefits to society
- Surprisingly, consumers are *not* intended to buy industrially frozen (and thawed) meat

Publications

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ORIGINAL ARTICLE

WILEY

The design of a Social Cost-Benefit Analysis of preventive interventions for toxoplasmosis: An example of the One Health approach

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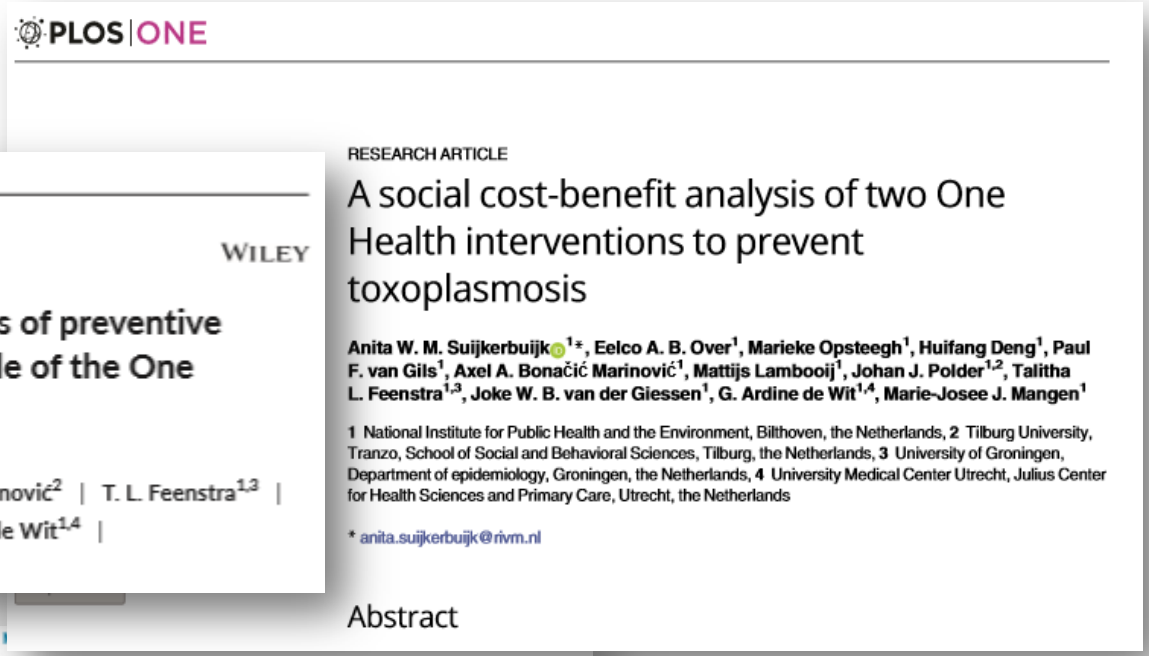

PLOS ONE

RESEARCH ARTICLE

A social cost-benefit analysis of two One Health interventions to prevent toxoplasmosis

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Abstract

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Consumers' preferences for freezing of meat to prevent toxoplasmosis– A stated preference approach

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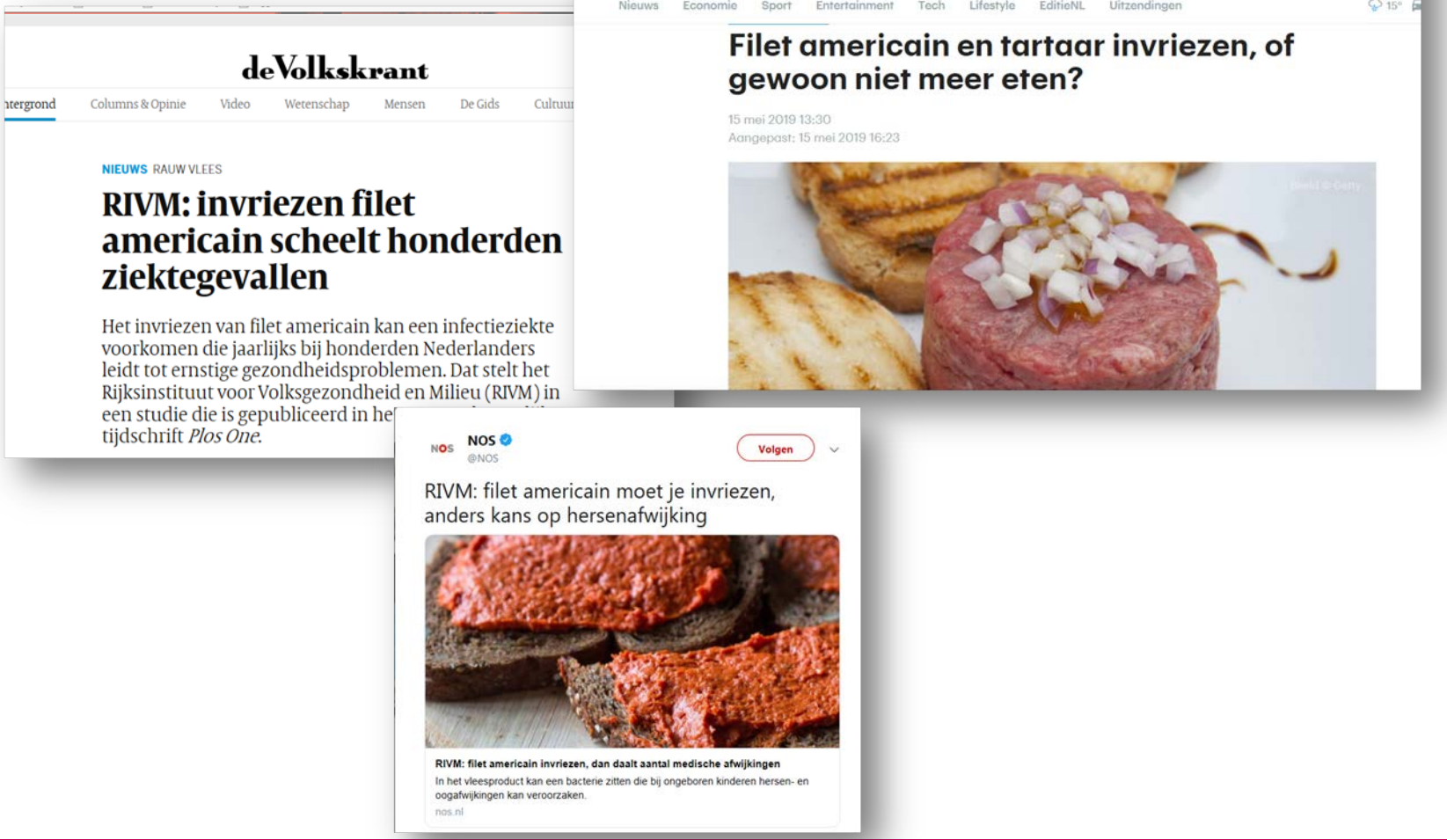
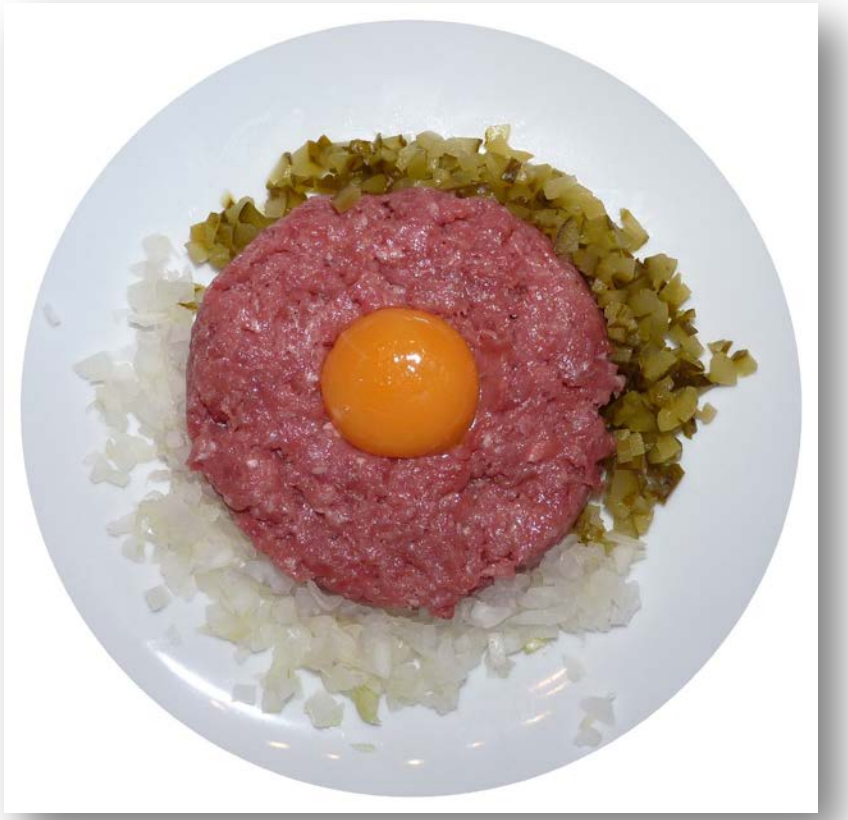
Media attention…..



Relevance for other countries?



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