# Cost-effectiveness and services for cardio vascular disease

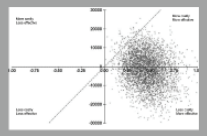
Nicholas Graves, PhD

# Plan

1 Why economics matters

2 The tools that are used

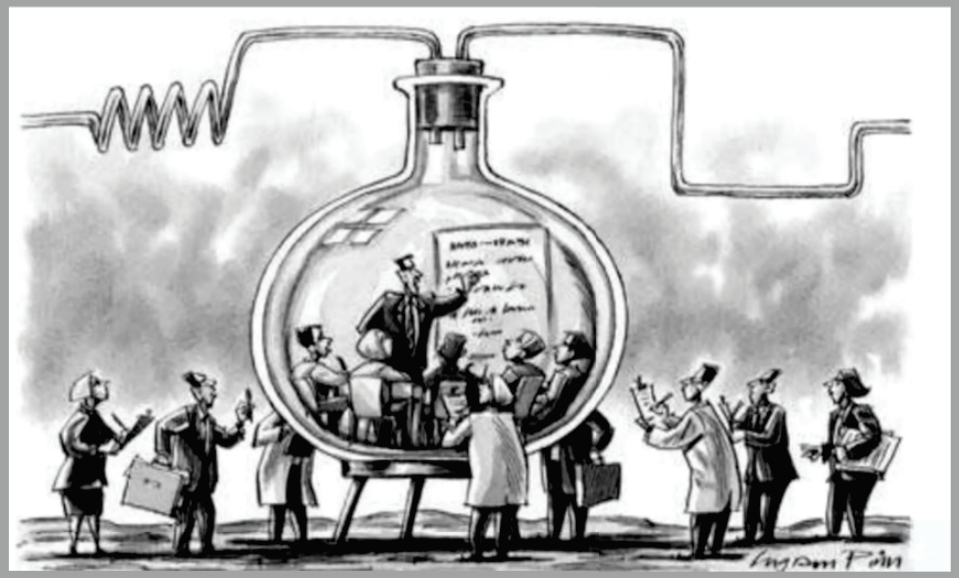
3 What knowledge emerges



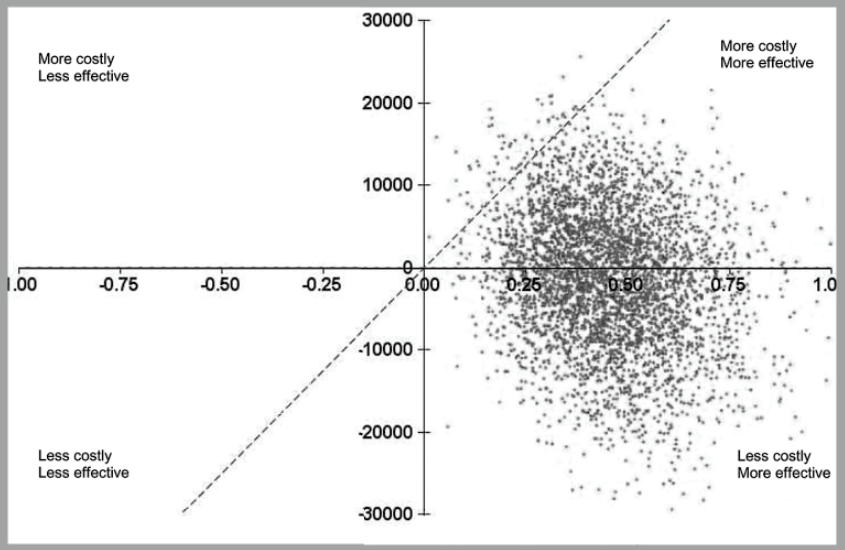
4 Singapore case studies for cardio vascular disease

# 1 Why economics matters

# 2 The tools that are used



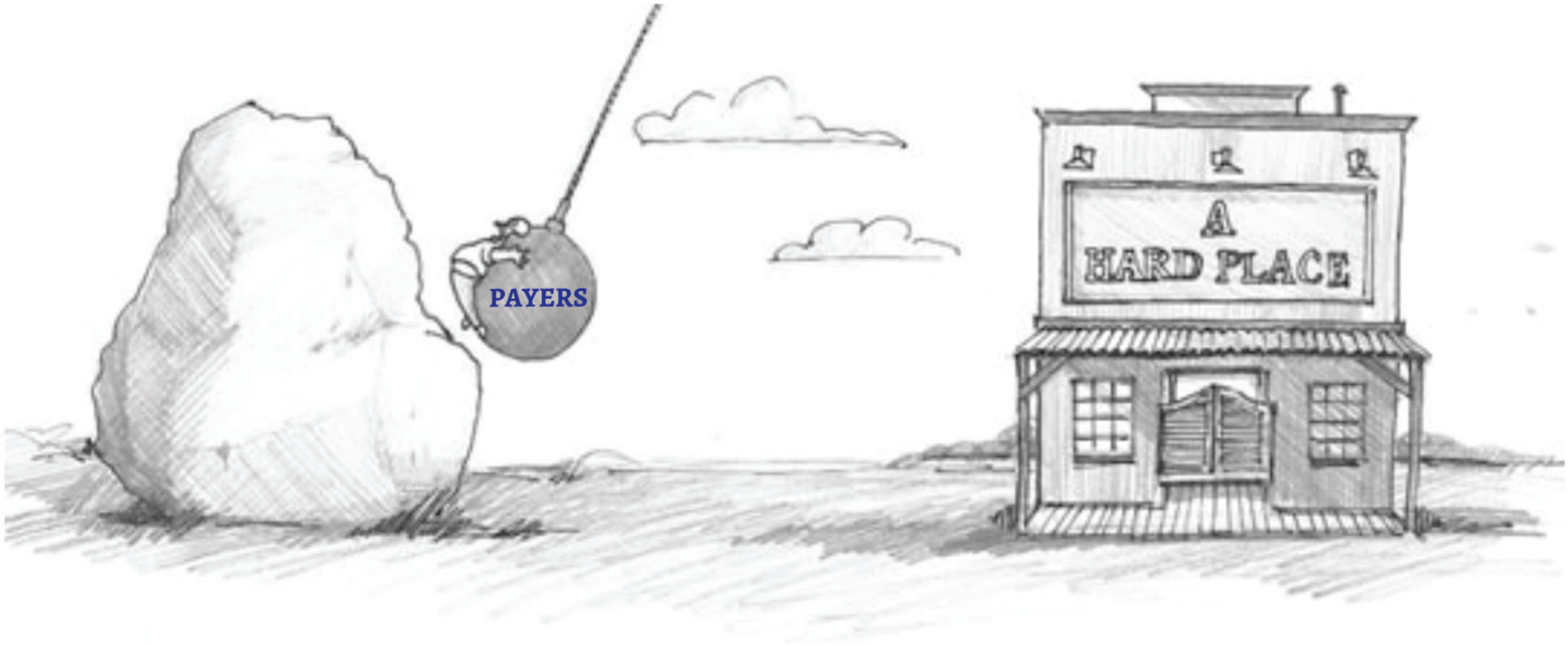
# 3 What knowledge emerges



# 4 Singapore case studies for cardio vascular disease

# 1 Why economics matters

# SCARCITY OF RESOURCES




new demand + new supply

health budgets are finite

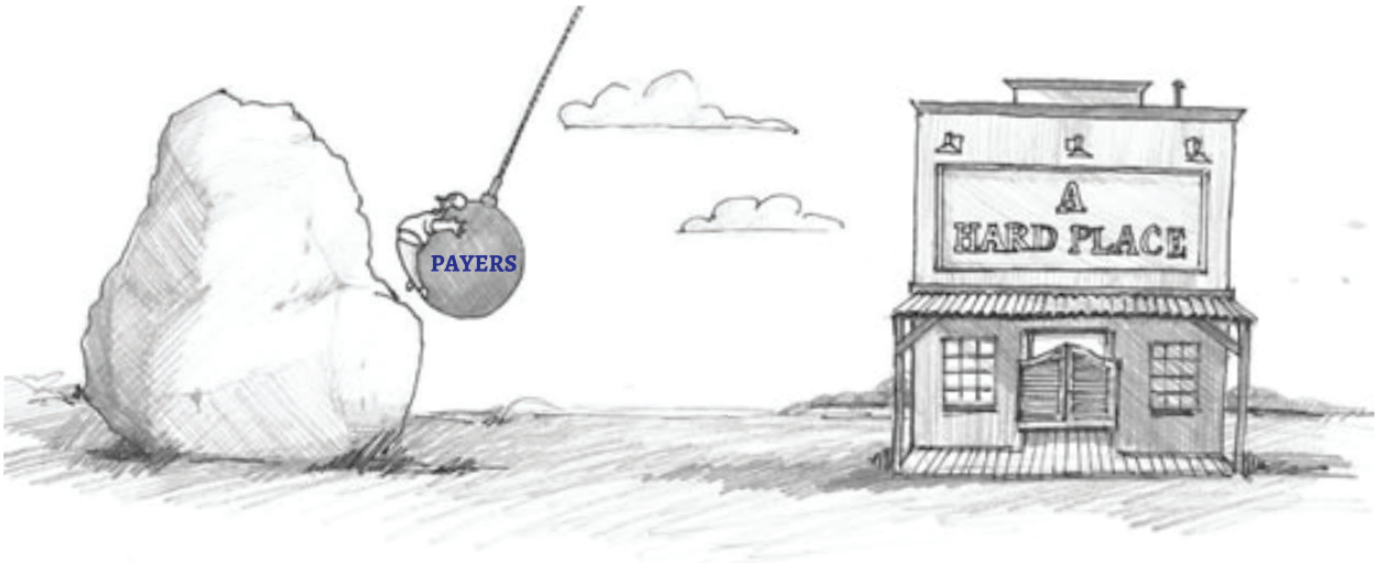
"unable to provide every service to every individual who could benefit, all of the time"

# SCARCITY

# Concentrate Resources on High Value Activities

"unable to provide every service to every individual who could benefit, all of the time"

SCARCITY OF RESOURCES



Must respond to scarcity of resources

Interventions to reduce risk of nosocomial infection

Primary prevention of T2 diabetes

Must respond to scarcity of resources

proton beam therapy

New therapies for CVD

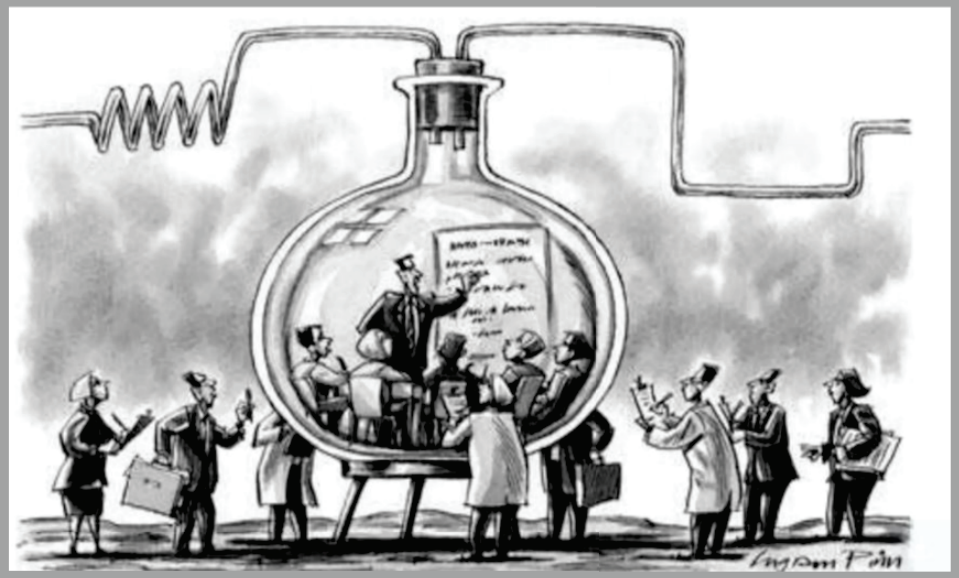
Specialist clinics for chronic wounds

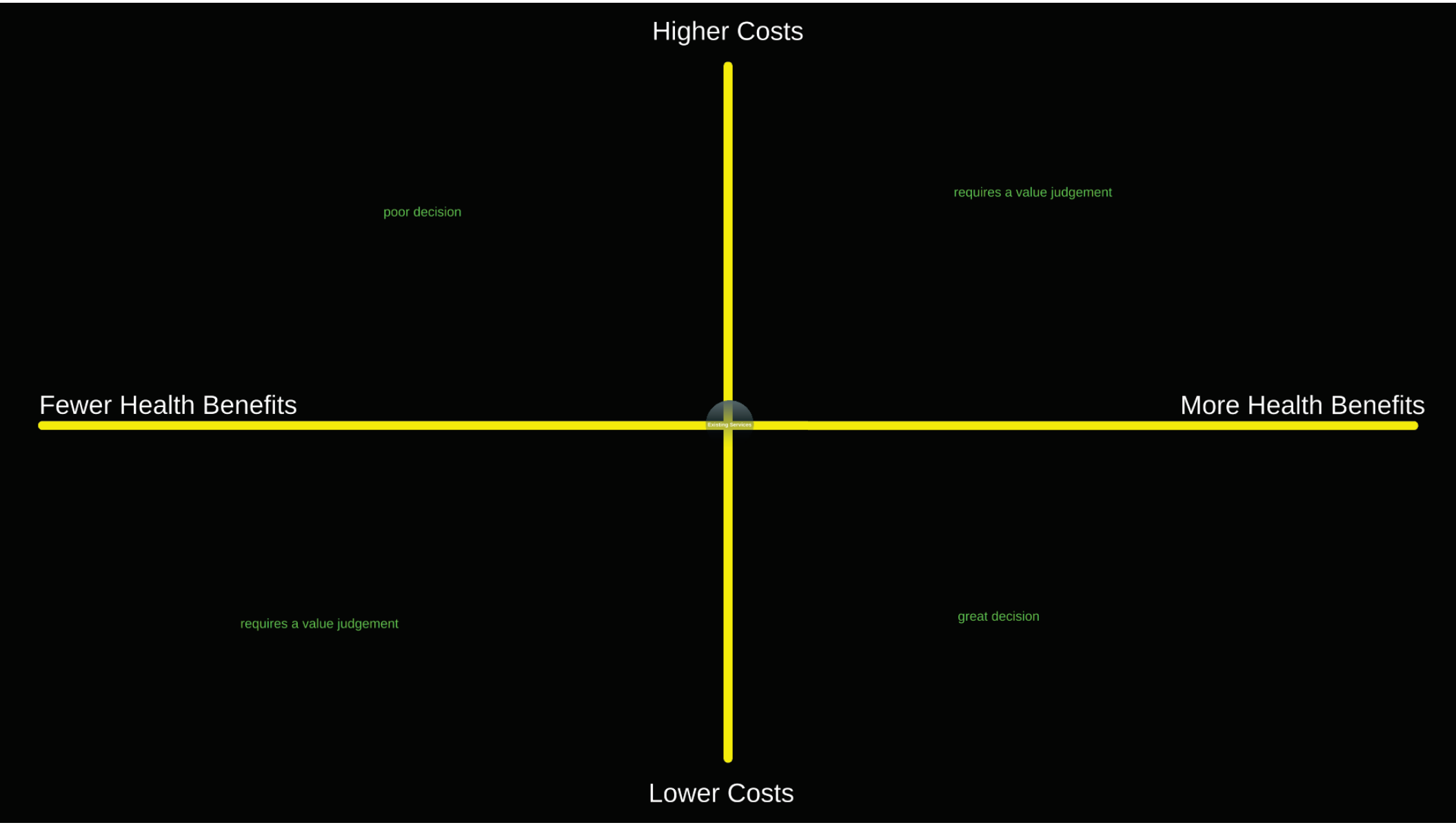
Robot for orthopaedic surgery

Whole exome sequencing to diagnose rare diseases

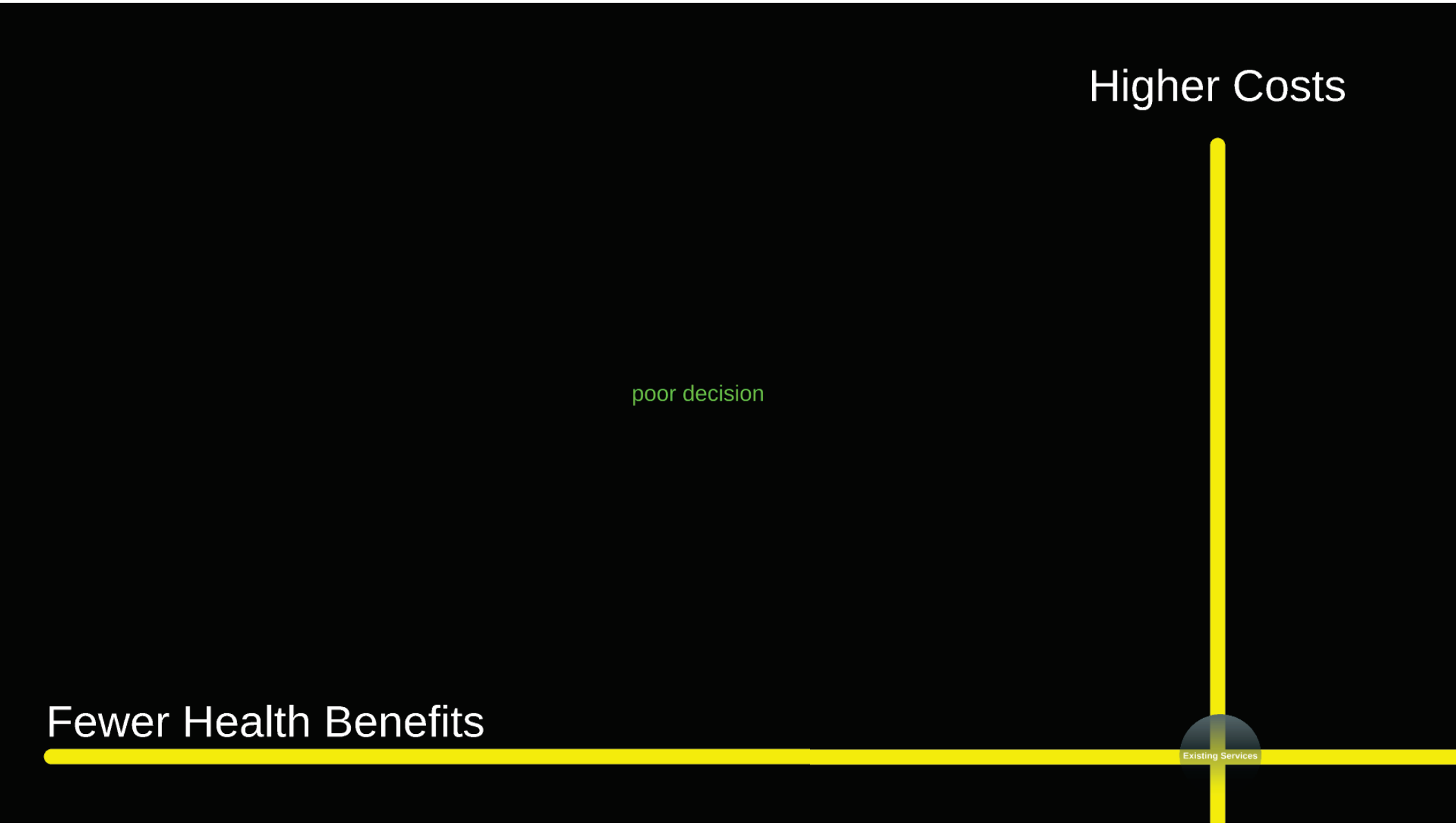
Reiki and Homepathy for renal failure

# 2 The tools that are used




Higher Costs
poor decision
requires a value judgement
Fewer Health Benefits
More Health Benefits
Existing Services
requires a value judgement
great decision
Lower Costs

# Existing Services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Higher Costs
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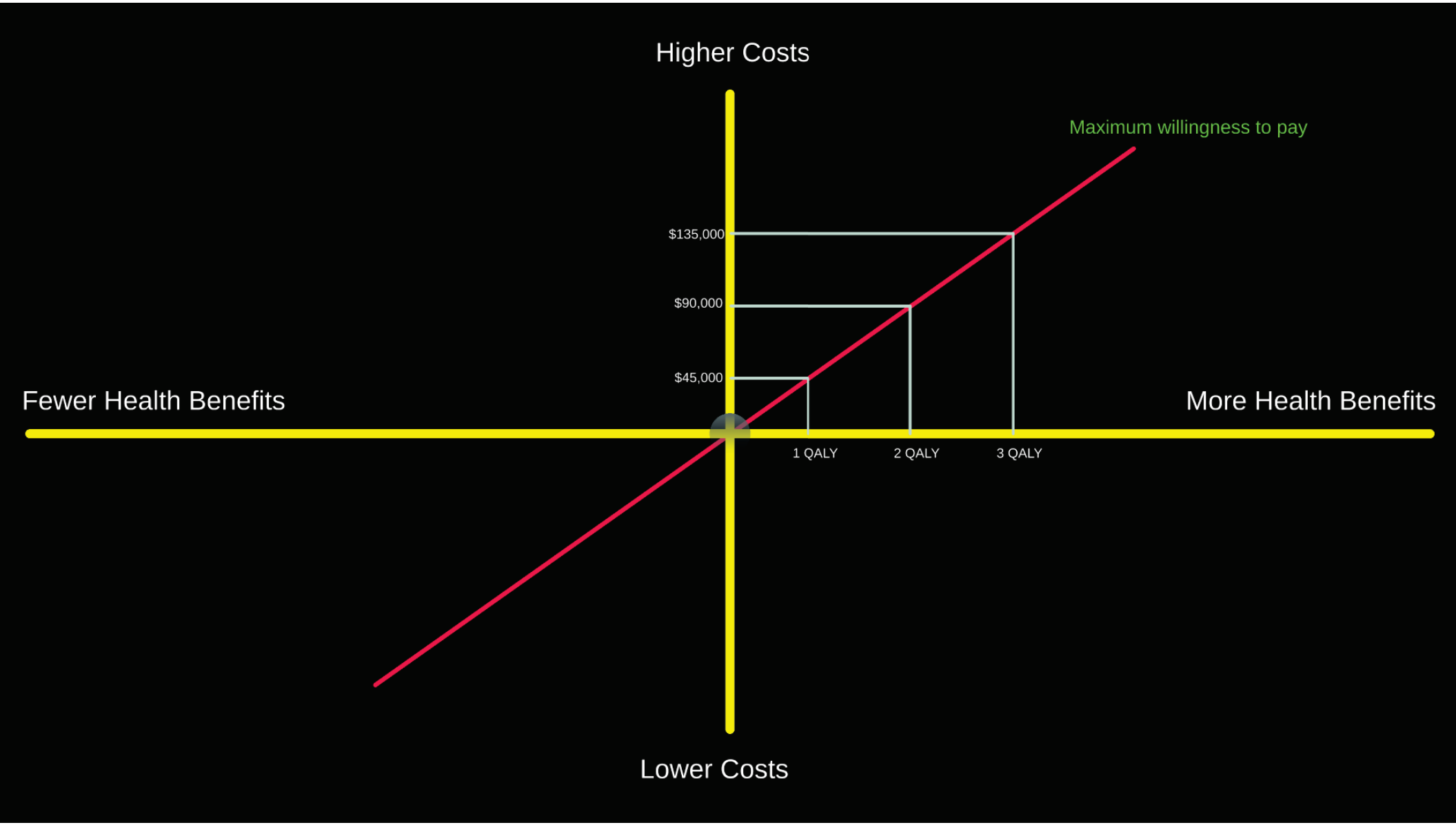
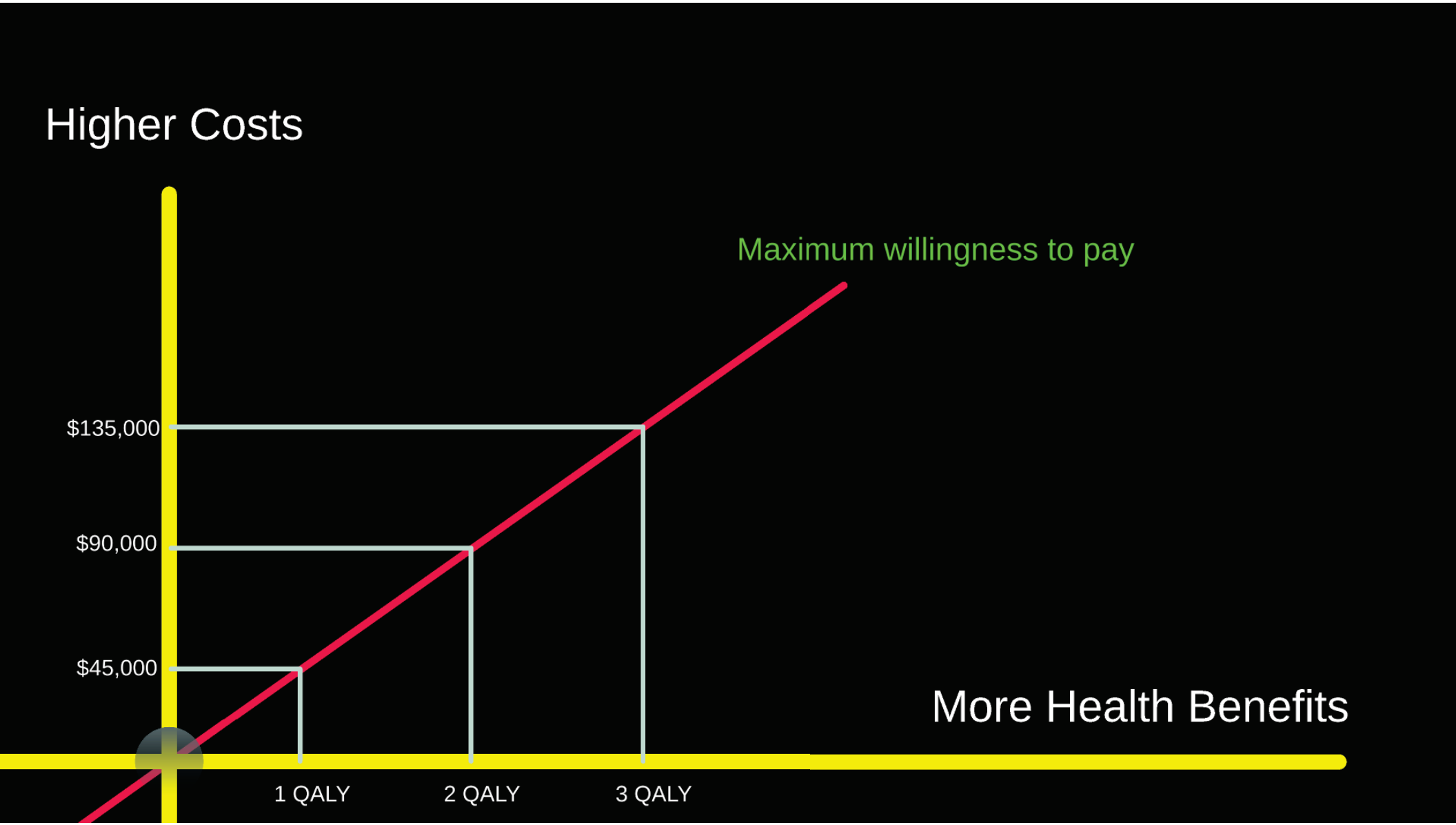
# Fewer Health Benefits

Existing Services

requires a value judgement

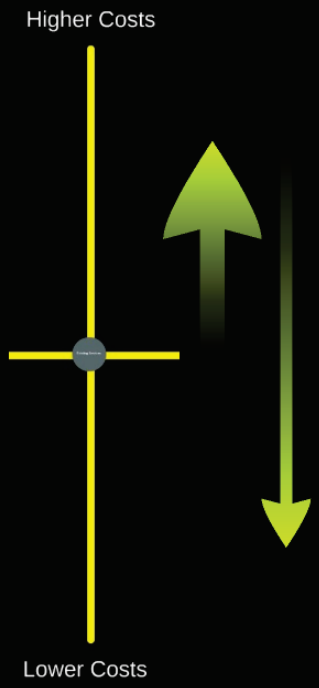
Lower Costs


Higher Costs
Maximum willingness to pay
$135,000
$90,000
$45,000
Fewer Health Benefits
More Health Benefits
1 QALY
2 QALY
3 QALY
Lower Costs


Higher Costs
Maximum willingness to pay
$135,000
$90,000
$45,000
More Health Benefits
1 QALY
2 QALY
3 QALY


Higher Costs
Maximum willingness to pay for health benefits
poor decision
>$45,000 per QALY
good decision
<$45,000 per QALY
More Health Benefits

# Movements on y-axis are changes to total costs




Extra costs to provide new therapy or service

+

Downstream effects on use of services (+ or -)


# Movements on x-axis are changes to health benefits

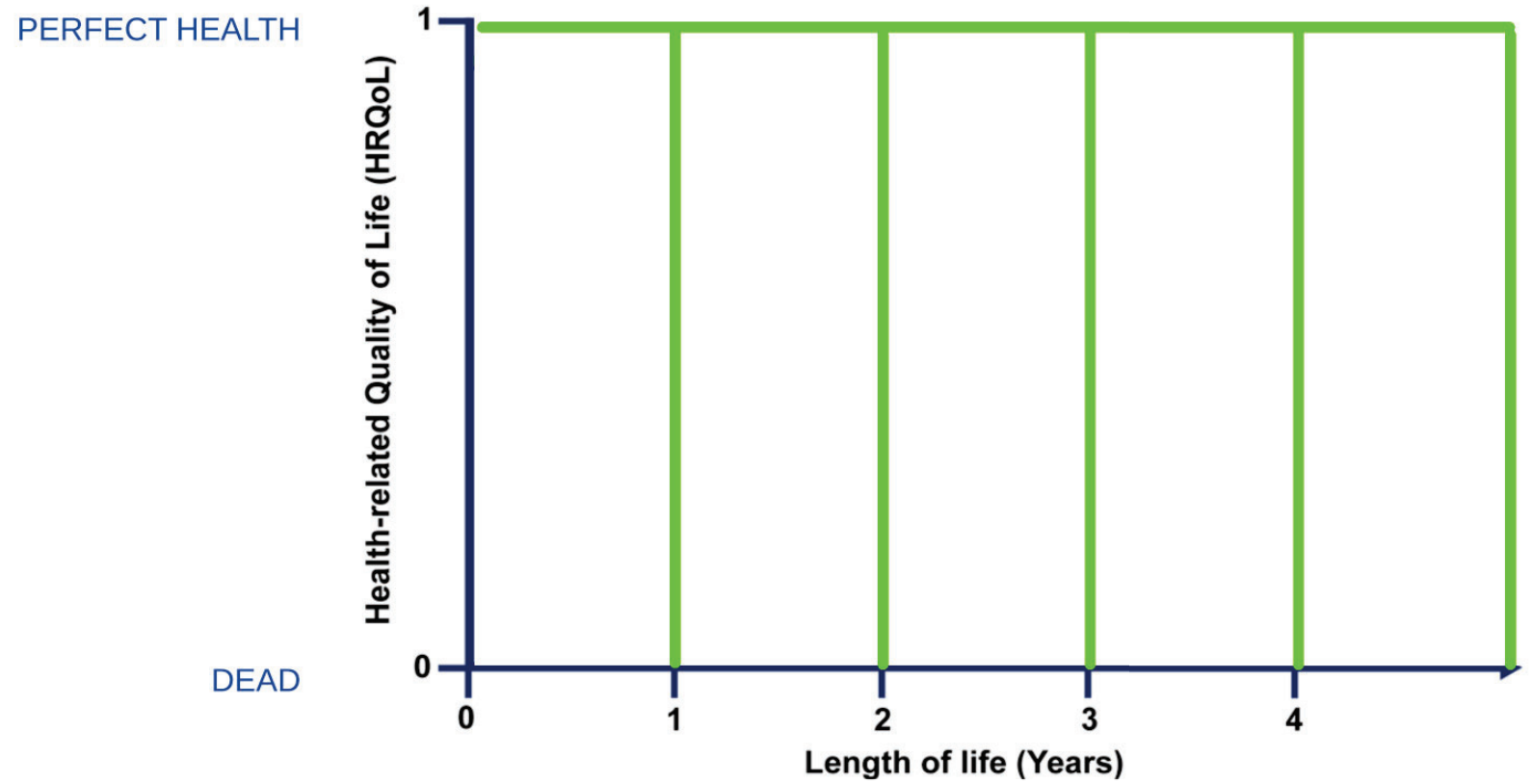
Measure what is valuable to patients

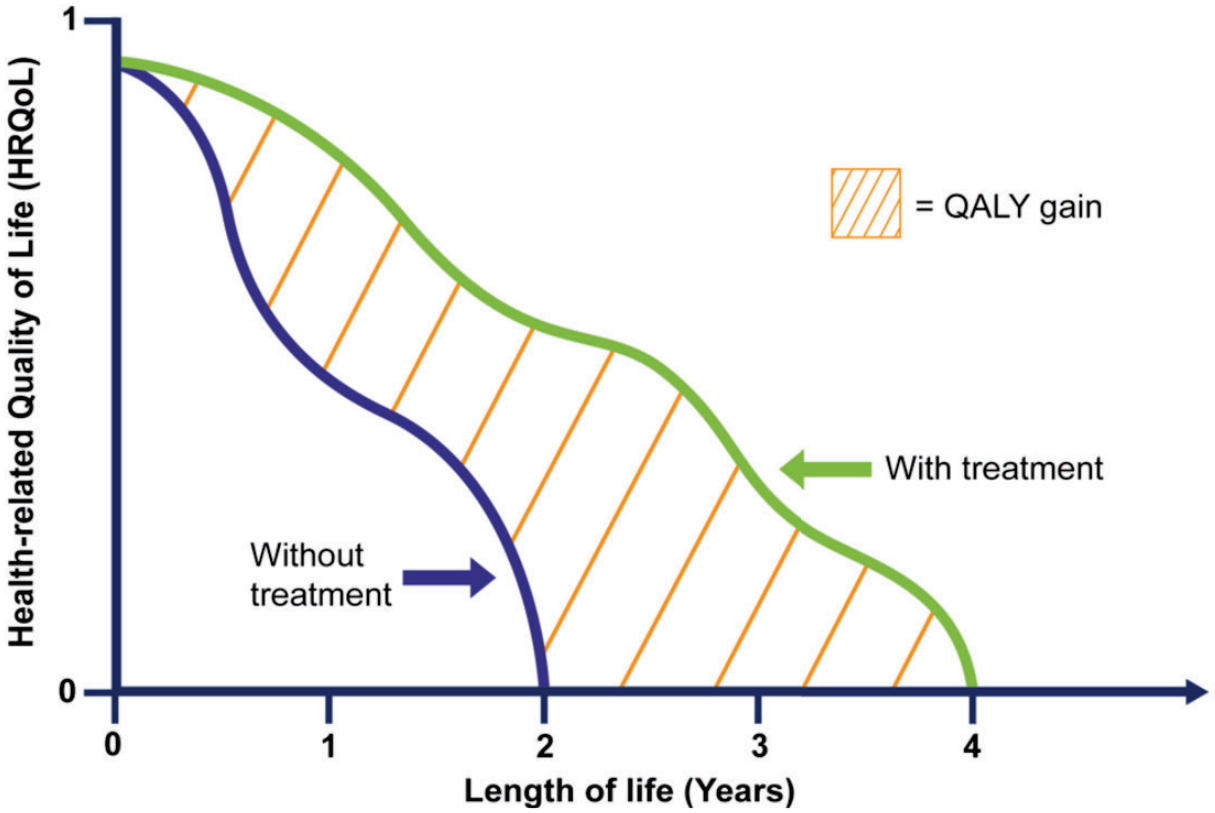
- Duration of life
- Value of the quality of life

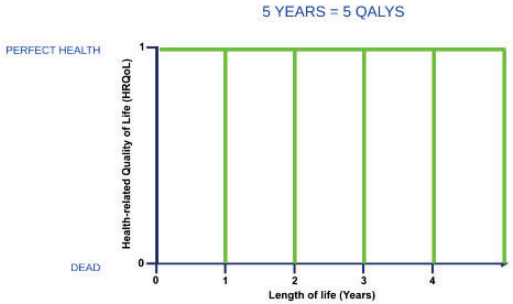
Measure what is valuable to patients

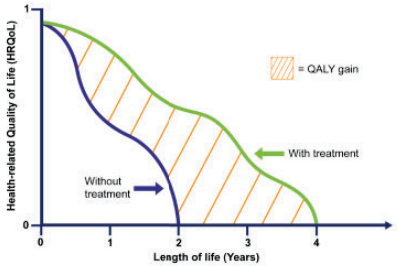
- Duration of life
- Value of the quality of life

# 5 YEARS = 5 QALYS

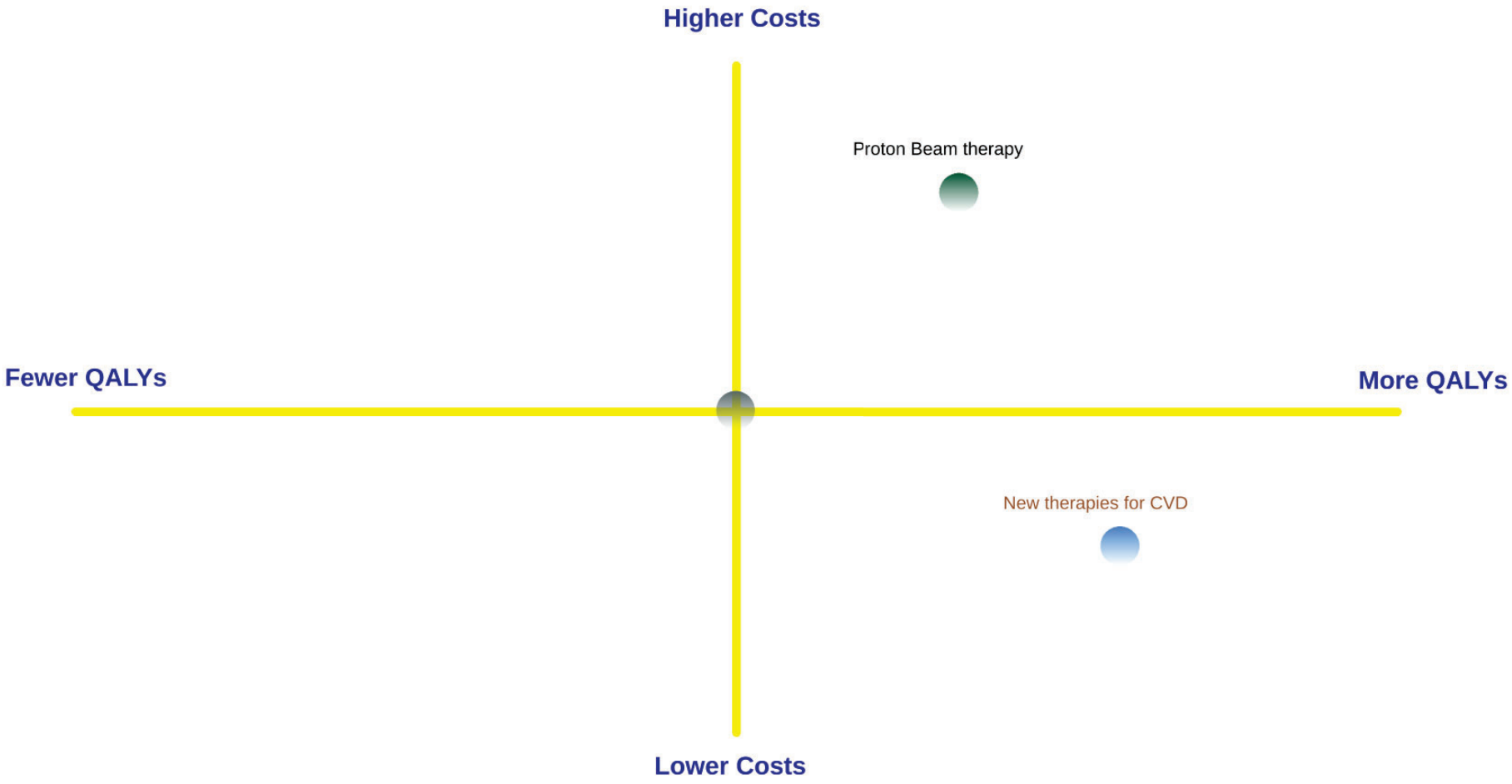



1
0
Health-related Quality of Life (HRQoL)
= QALY gain
With treatment
Without
treatment
0
1
2
3
4
Length of life (Years)




Heath Benefits shown by QALY gains from avoided morbidity & mortality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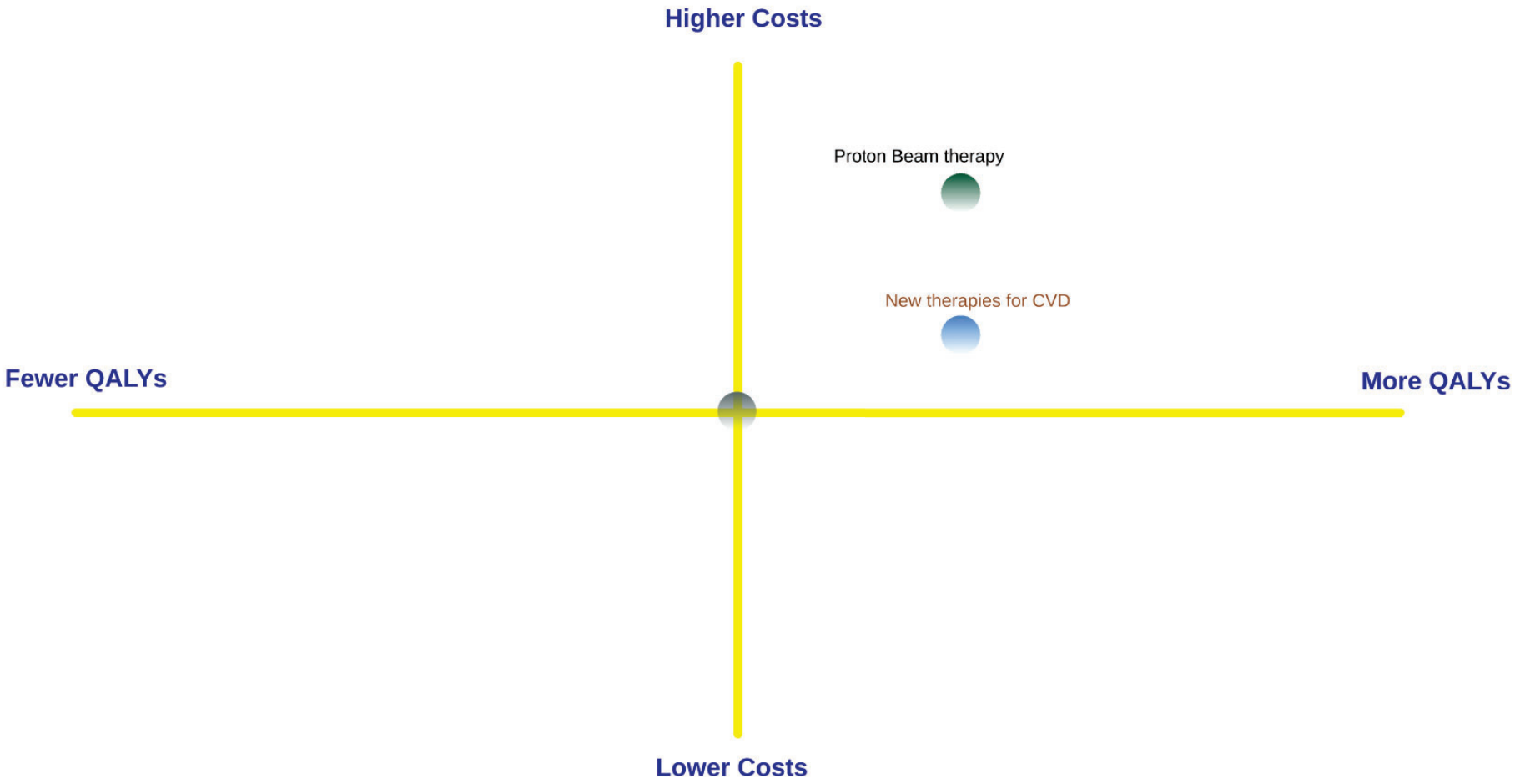
Proton Beam therapy
Fewer QALYs
More QALYs
New therapies for CVD
Lower Costs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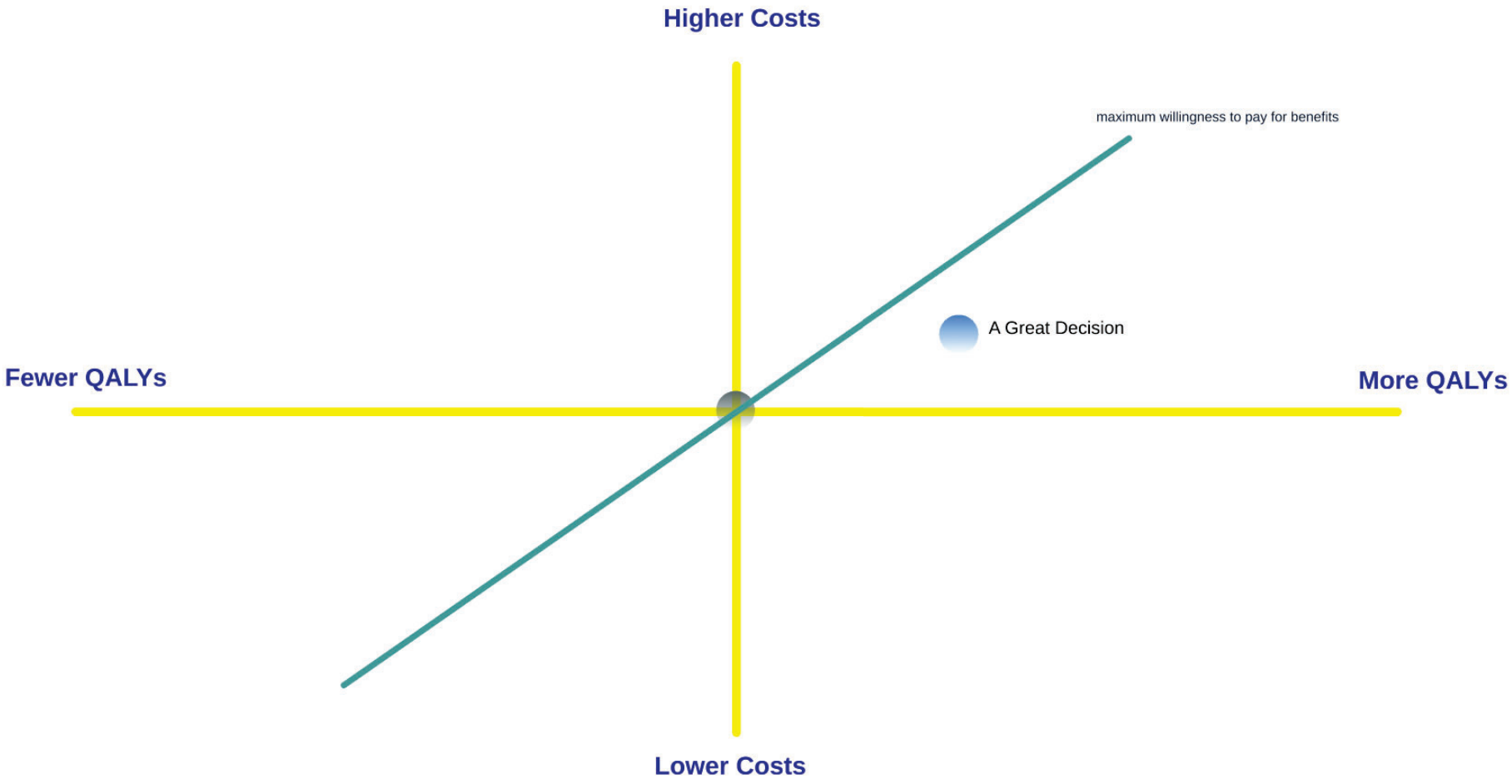

Higher Costs
maximum willingness to pay for benefits
A Great Decision
Fewer QALYs
More QALYs
Lower Costs



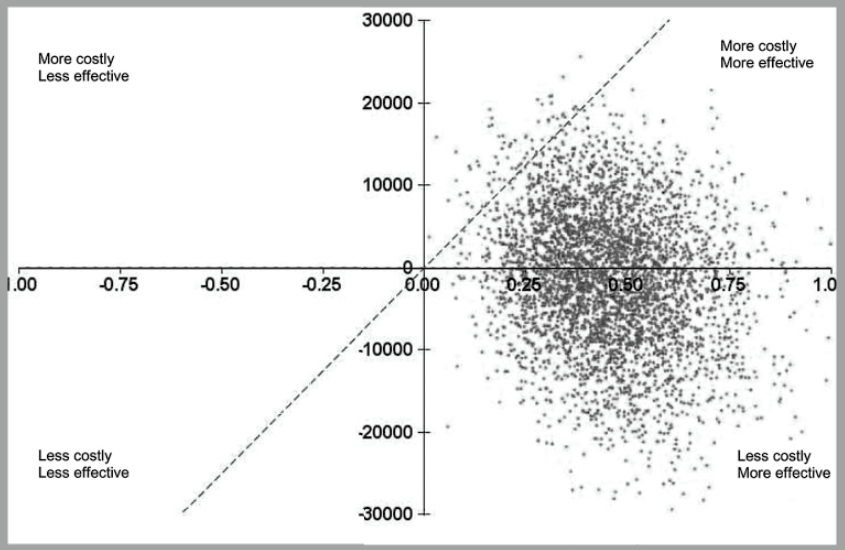
*For Debate . . .*

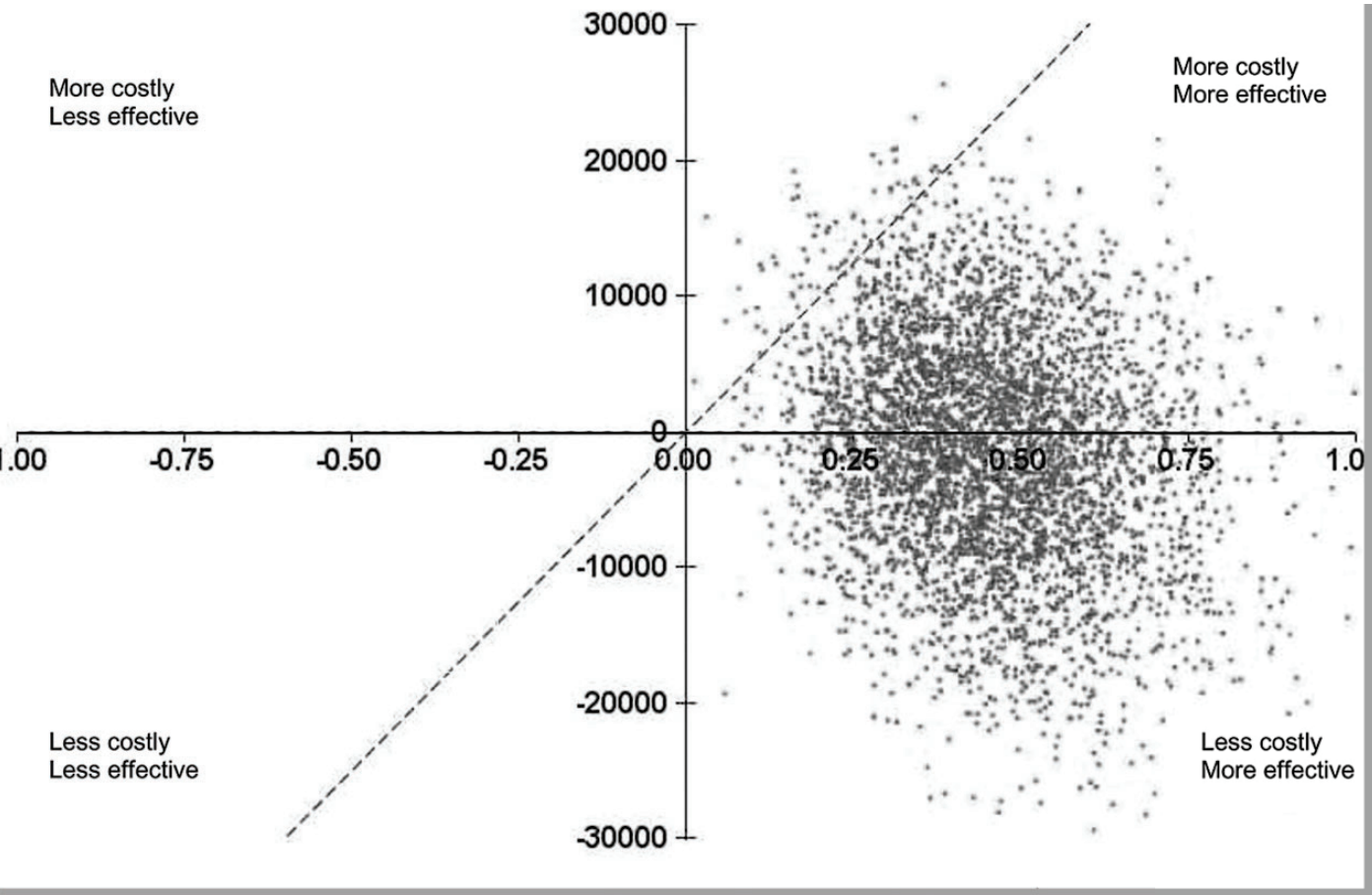
# Economics of coronary artery bypass grafting

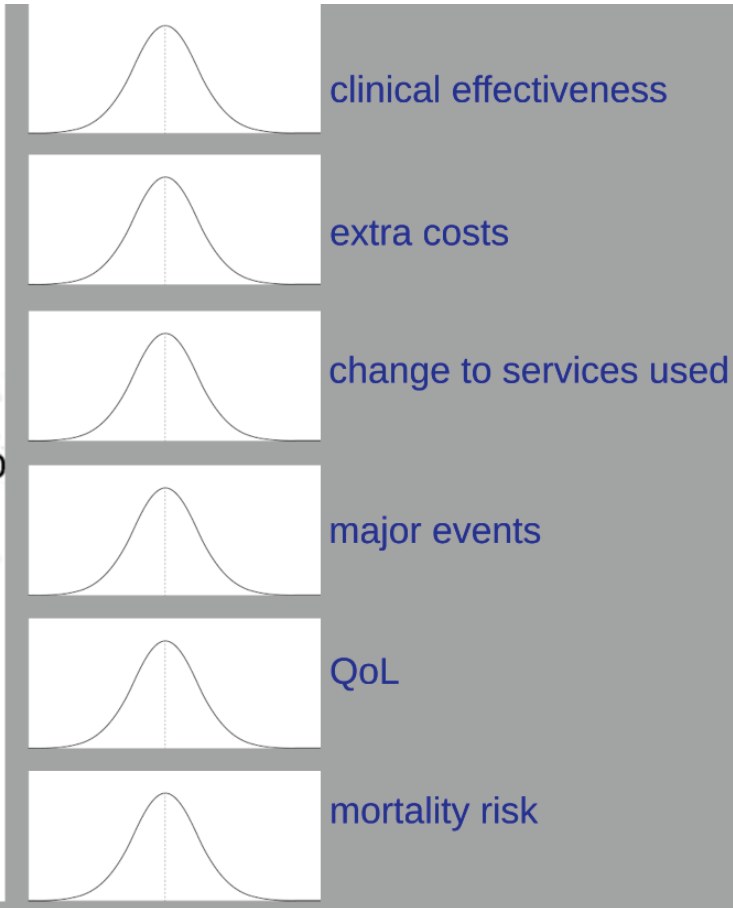
ALAN WILLIAMS

"Procedures should be ranked so that activities that generate more gains to health for every $ of resources used take priority over those that generate less; thus the general standard of health in the community would be correspondingly higher"

# 3 What knowledge emerges

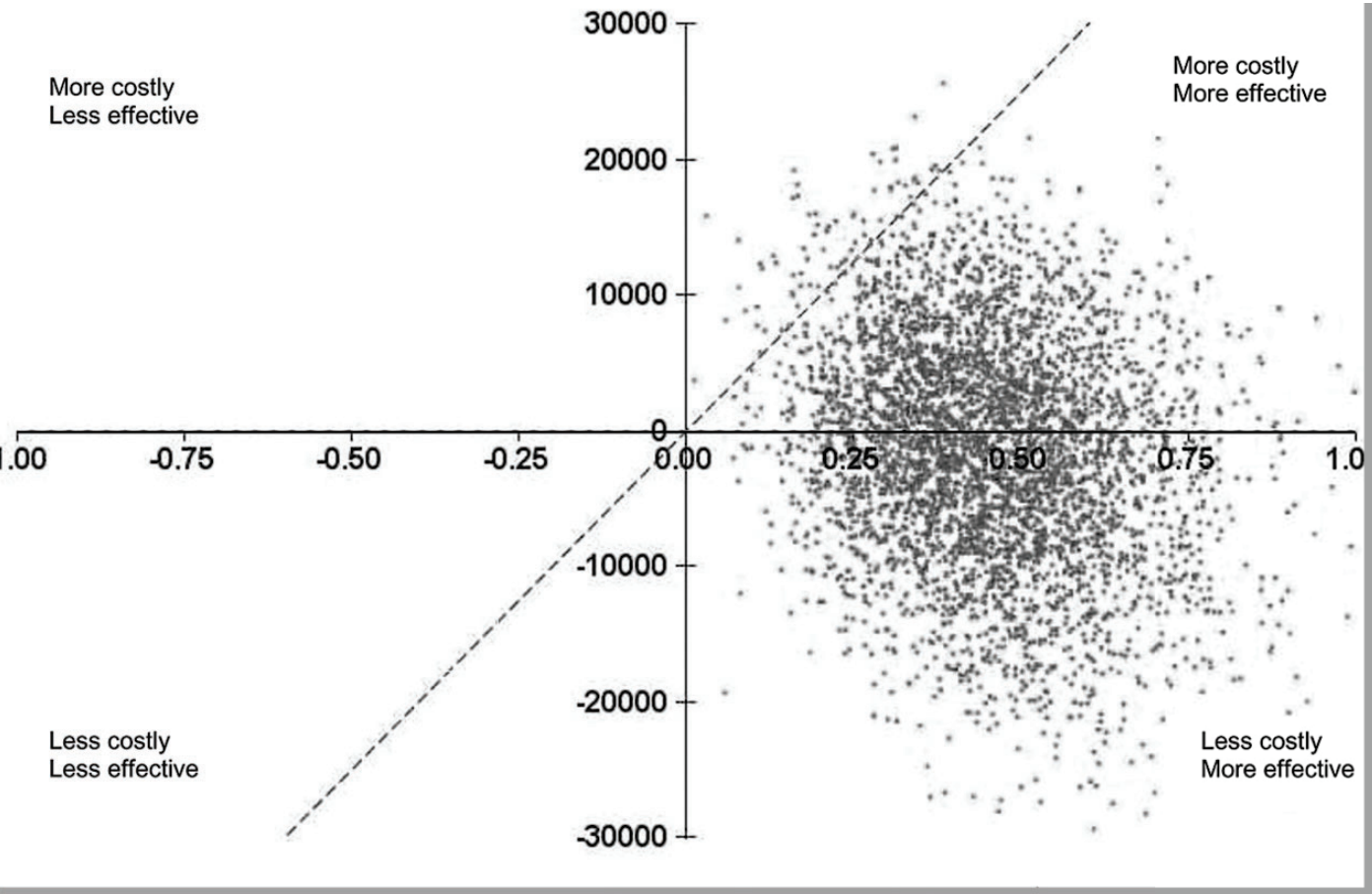





Evidence can be synthesised from many sources

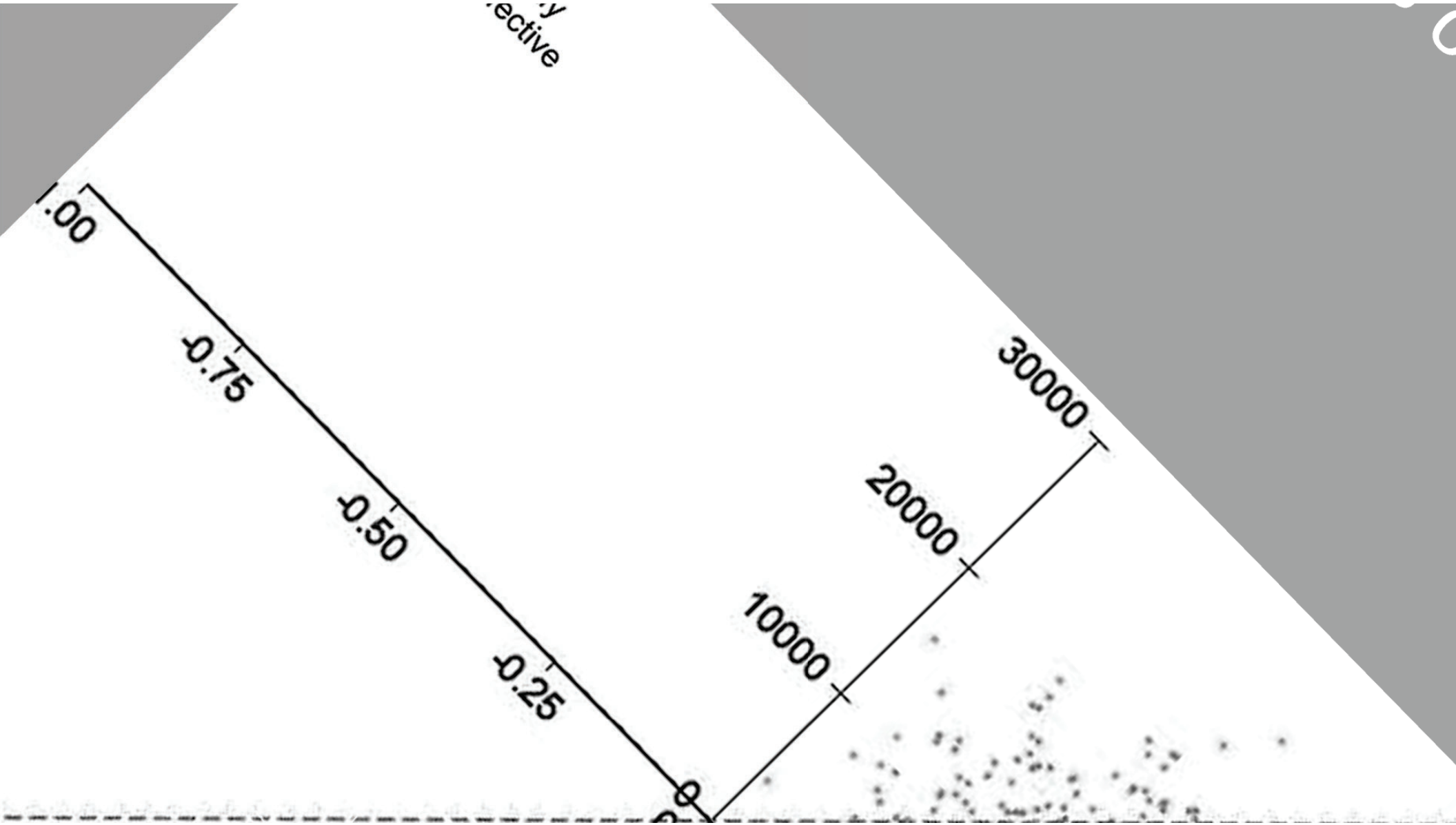
Simulate thousands of possible versions of all outcomes




35/1000 = 3.5% not cost effective

965/1000 = 96.5% cost effective

600/1000 = 60% cost saving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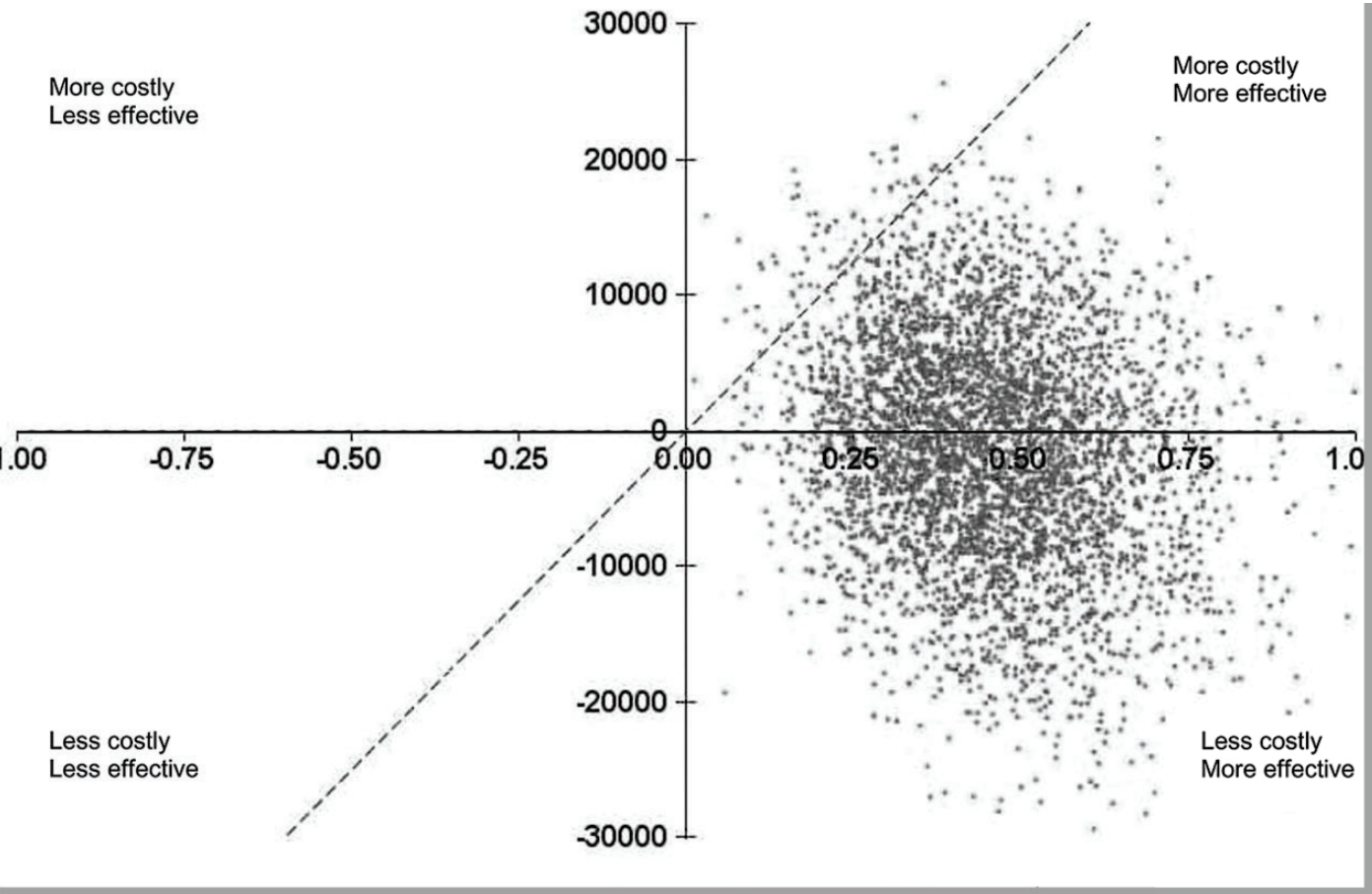


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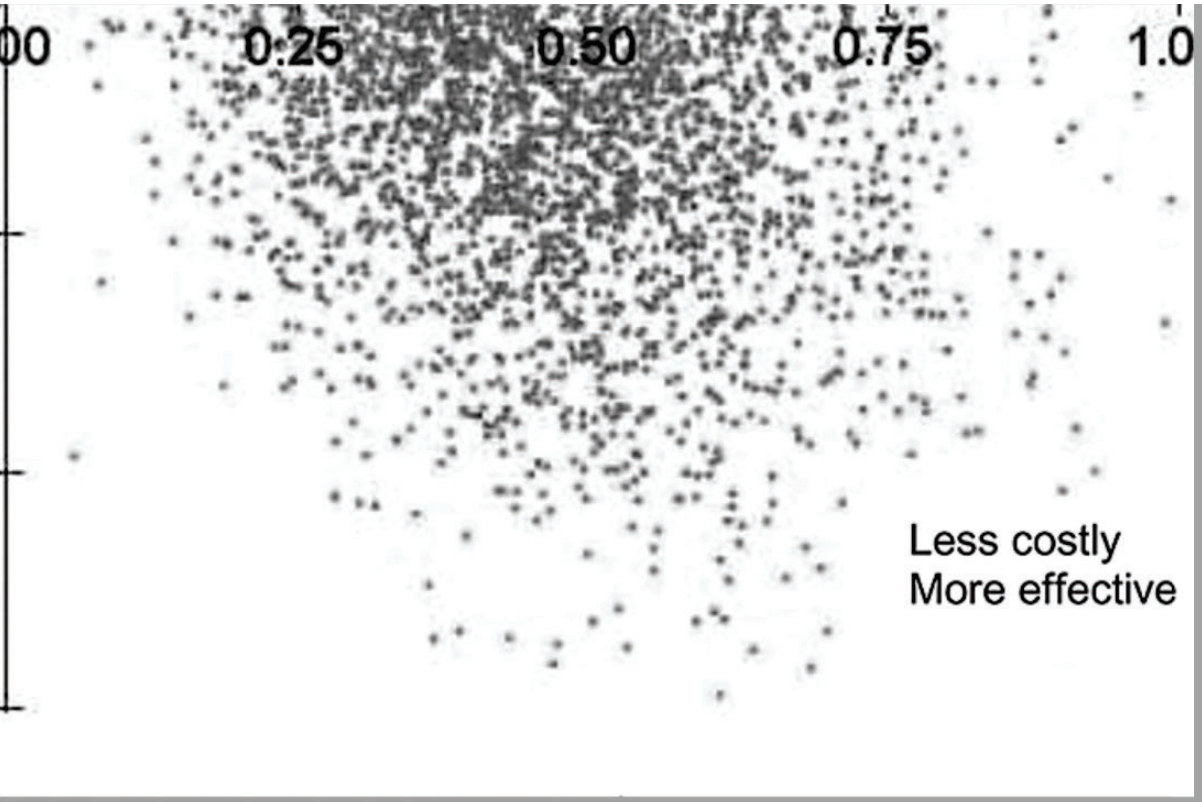


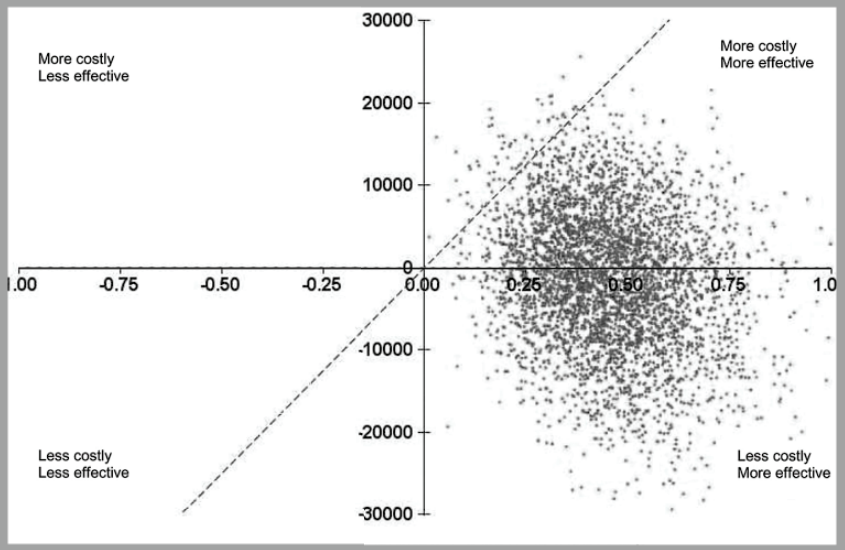

600/1000 = 60% cost saving

# Logically

If the probability adoption was cost effective >50% *ADOPT*

If the probability adoption was not cost effective >50% REJECT

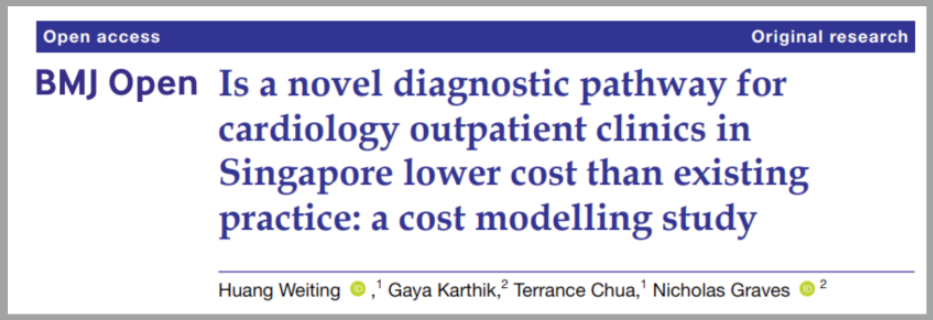
# 3 What knowledge emerges



- Based on current (uncertain) information about the disease and treatments
- We will make statements about the probability that adoption of a new treatment will be cost-effective
- Against a stated theshold of "*value for money*" in a descison making justristiction

# 4 Singapore case studies for cardio vascular disease

# Published Studies



Open access Original research

BMJ Open

Is a novel diagnostic pathway for cardiology outpatient clinics in Singapore lower cost than existing practice: a cost modelling study

Huang Weiting [1], Gaya Karthik [2], Terrance Chua [1], Nicholas Graves [2]

Weiting et al. Health Economics Review (2022) 12:56
https://doi.org/10.1186/s13561-022-00401-y

Health Economics Review

RESEARCH Open Access

The clinical value and cost-effectiveness of treatments for patients with coronary artery disease

Huang Weiting [1], Alwin Zhang Yaoxian [2], Yeo Khung Keong [1], Shao Wei Lam [3], Lau Yee How [2], Anders Olof Sahlén [1], Ahmadreza Pourghaderi [4], Matthew Che [2], Chua Siang Jin Terrance [1] and Nicholas Graves [3]

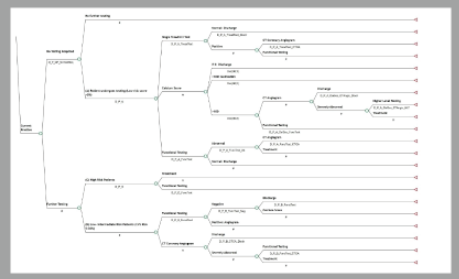
To evaluate change to costs from a novel diagnostic pathway for referrals to cardiology outpatients with symptoms of chest pain.

All new referrrals to OP (n=10,622) for 2017

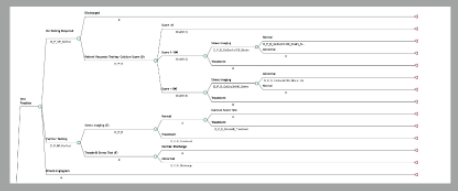
Current practice vs New practice

Outcomes will be similar.

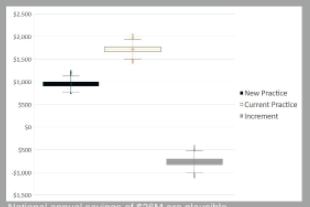
Costs will be saved.



classification of risk via treadmill tests, calcium scores, functional testing and CT angiogram.

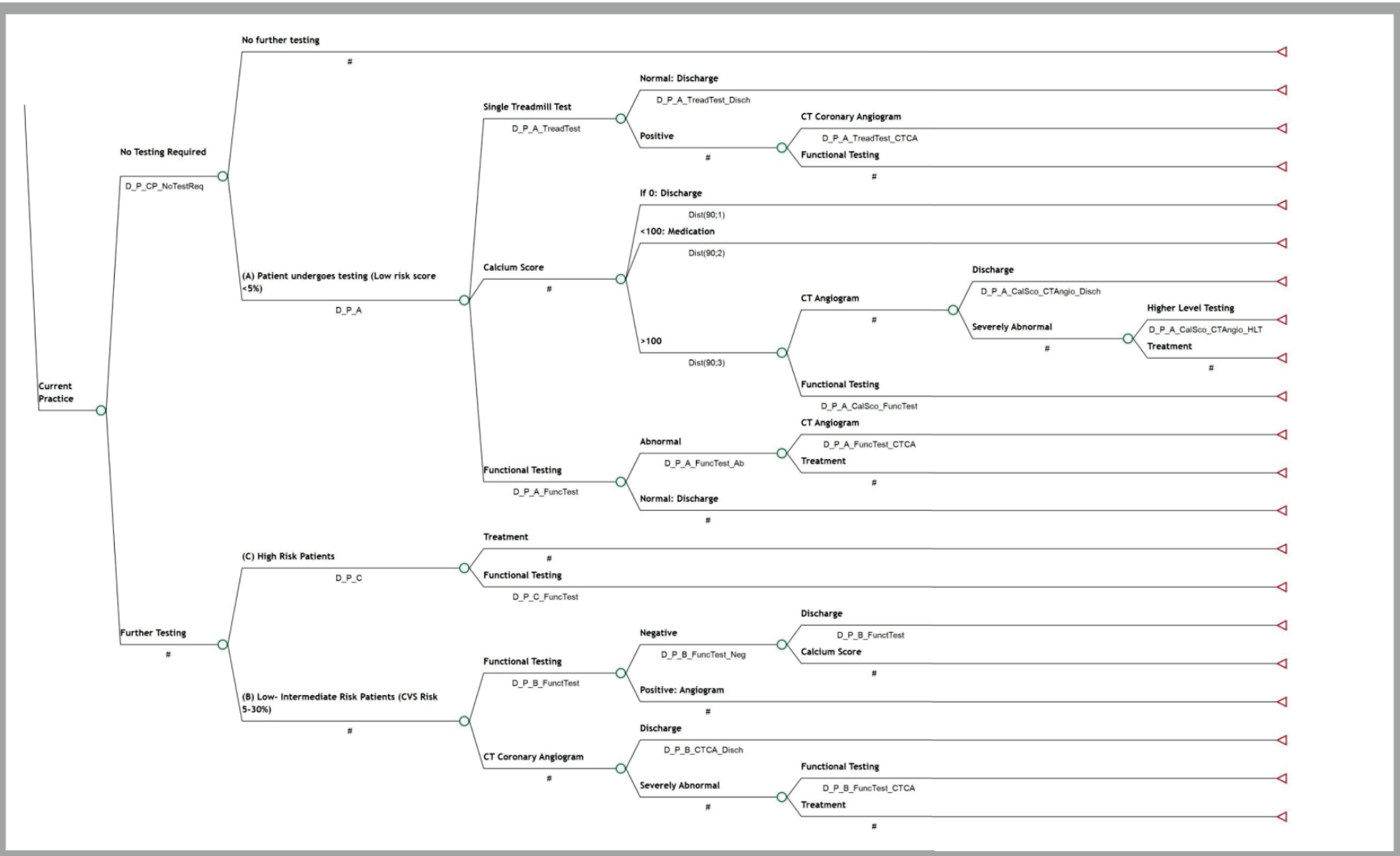


some offered angiogram directly and for low-risk patients a calcium score is used to refine risk stratification.




National annual savings of $26M are plausible

Modest study - modelling existing data
Conslusions are likely robust enough to inform a decision
A definitive trial migt never happen or take a long time

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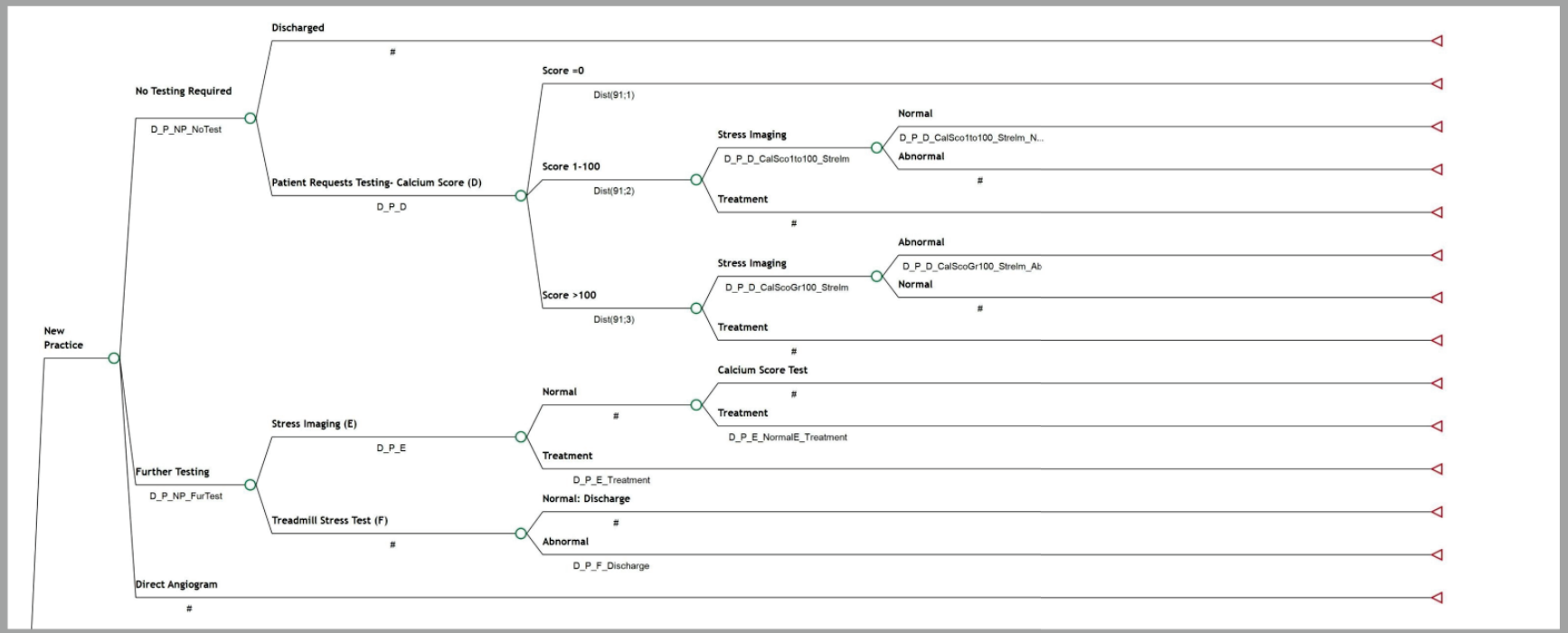


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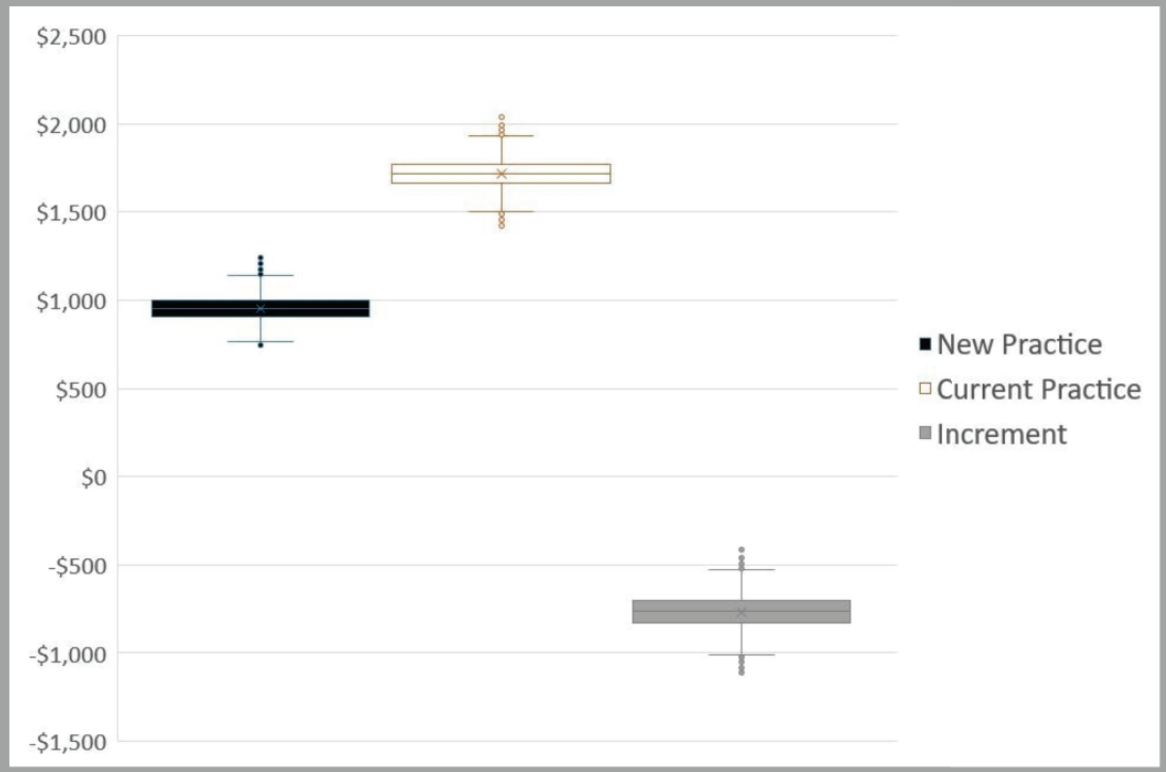


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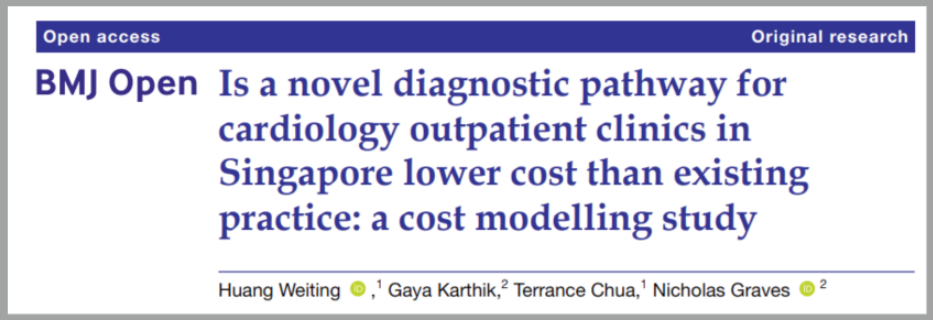

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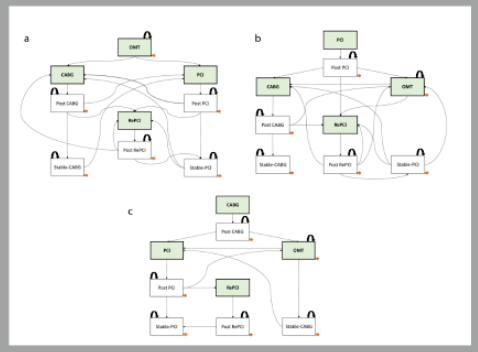
Invasive CABG & PCI frequently used as a starting treatment, yet they are much more costly than optimal medical therapy.

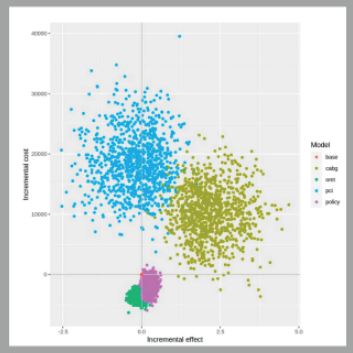
We used existing data on

OMT (n=19,467, 81.9%)
PCI (n=3,205, 13.5%)
CABG (n=1,102, 4.6%)

Model costs and QALY outcomes for 'Existing Practice' vs. 'Reccomended' policy

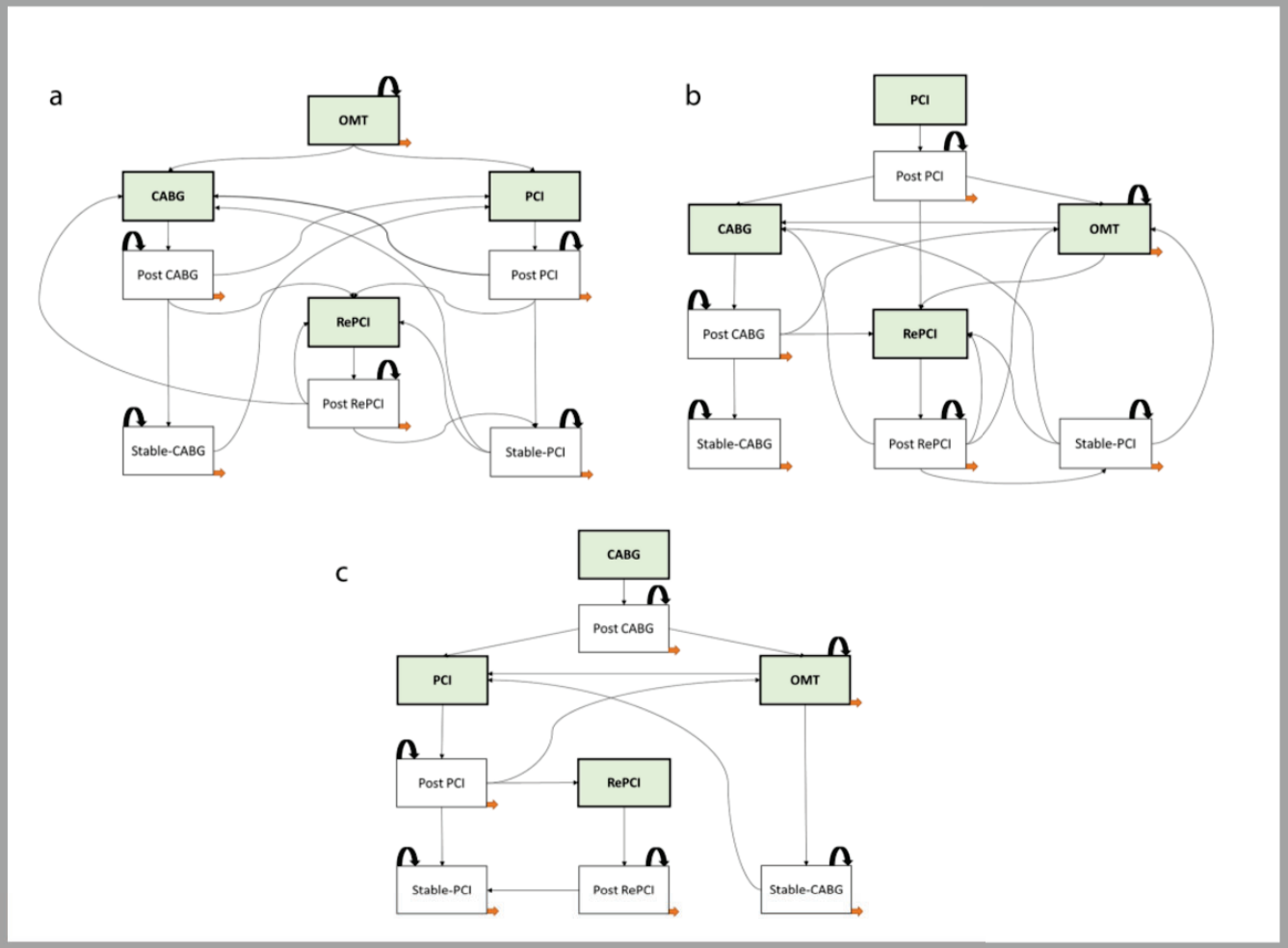
**RECCOMENDED**
14% suitable for CABG and 86% OMT.
Zero patients stent PCI as the starting treatment.




Cost savings are -$1743 (95% Cr. I -1808 -1678)  QALY gains are 0.23 (95% Cr. I 0.22–0.24)

For 6,000 patients/yr this would save >$10 million + 1,380 extra QALYs (worth $62M/year)


a
OMT
CABG
PCI
Post CABG
Post PCI
RePCI
Post RePCI
Stable-CABG
Stable-PCI
b
PCI
Post PCI
CABG
OMT
Post CABG
RePCI
Stable-CABG
Post RePCI
Stable-PCI
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CABG
Post CABG
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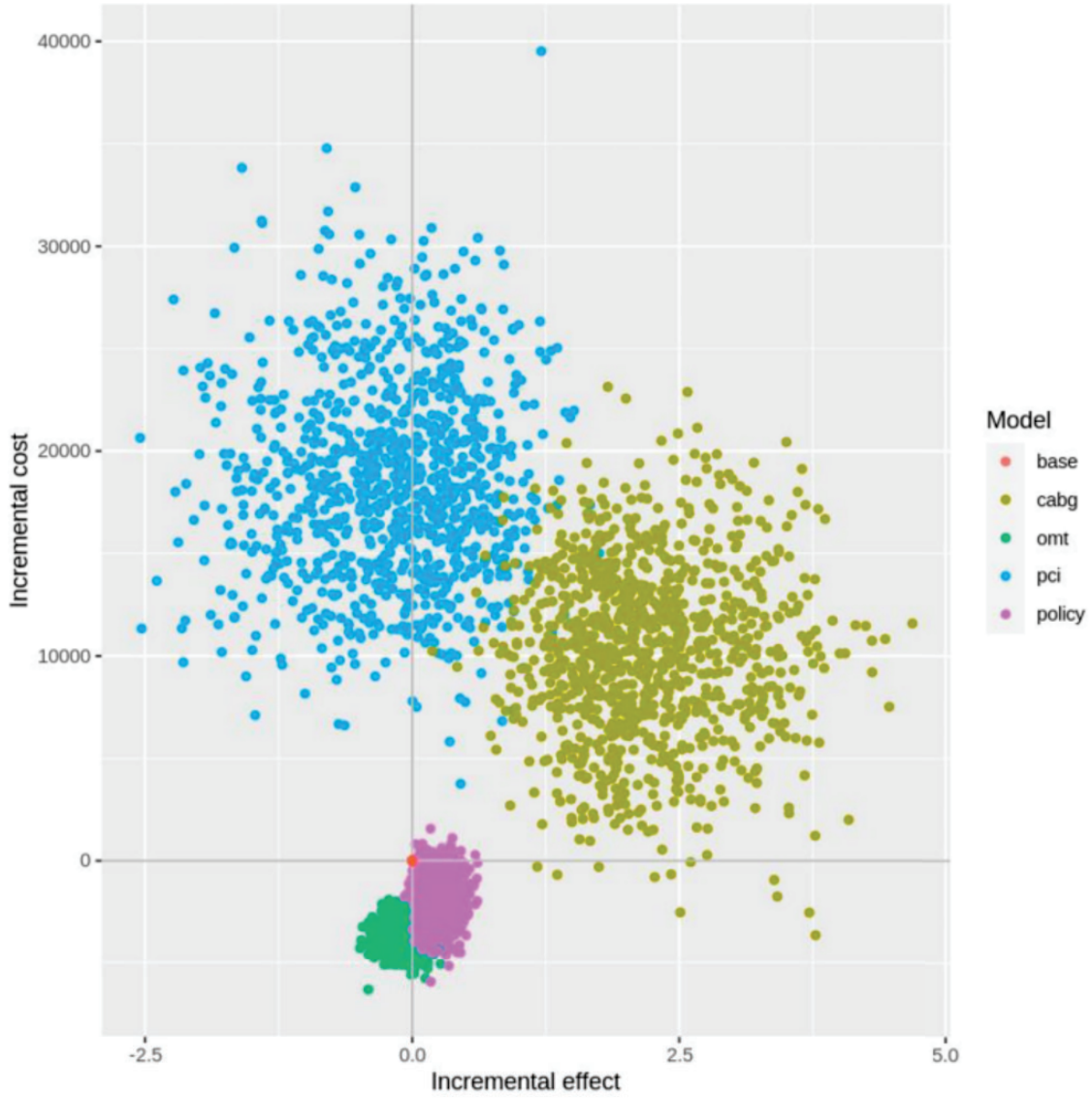
RePCI
Stable-PCI
Post RePCI
Stable-CABG


40000
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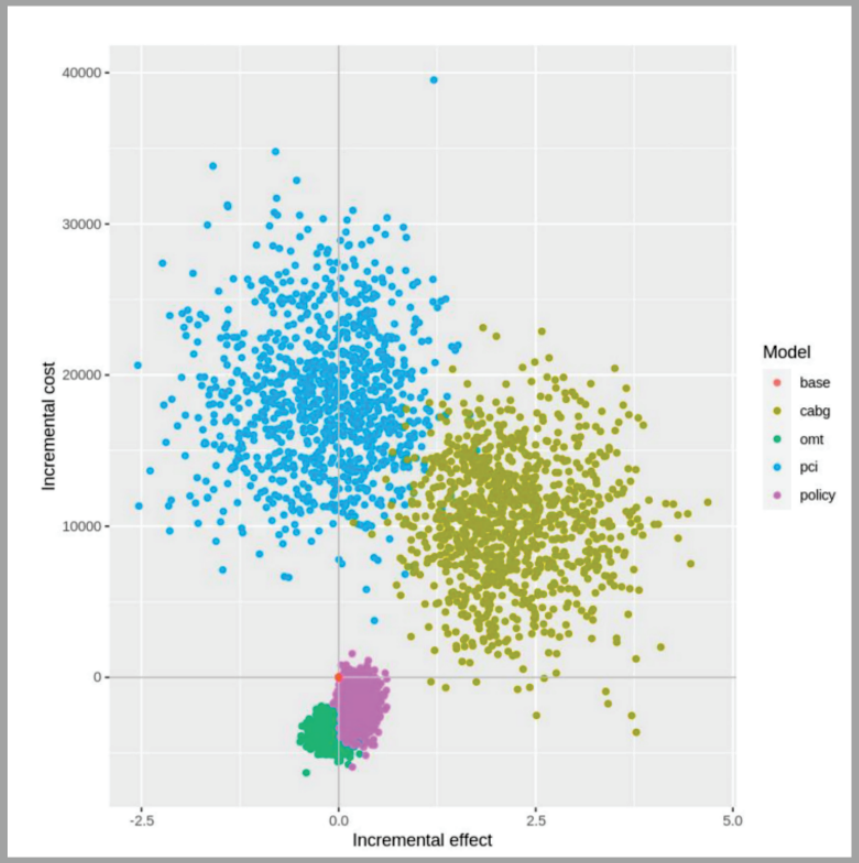


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# Planned Studies

**CA**rdiovascular **D**iseas**E** **N**ational **C**ollaborative **E**nterprise (**CADENCE**)

National Clinical Translational Program (**NCTP**)

| JOINT PLATFORM 1 | JOINT PLATFORM 2 | JOINT PLATFORM 3 |
|---|---|---|
| DATA, IMAGING & TISSUE REPOSITORY | EARLY PHASE MECHANISTIC CLINICAL TRIALS | ARTIFICIAL INTELLIGENCE, DIGITAL HEALTH & HUMAN POTENTIAL |
| *Leads - NHCS, NUHCS, A*STAR (Input from MOH, TTSH, CGH, SKH, NTFGH, IHiS, NTU, Duke-NUS, NUS)* | *Leads - NHCS, NUHCS, TTSH (Input from CGH, SKH, NTFGH, A*STAR)* | *Leads - LKCMed, NUS, SGH (Input from NHCS, NUHCS, TTSH, CGH, SKH, NTFGH, A*STAR)* |

1

Increasing interest in detecting cancer therapy-associated cardiac dysfunction (CRTCD) early so that the patient can receive appropriate heart failure treatment.

Clinical trial and economic evaluation of AI Point-of-Care Echocardiographic Imaging Solution for early detection.

2

For participants receiving lipid-lowering medication with suboptimal LDL-c control.

Intervention: Human coach-supported digital personal health assistant (App intervention)

Comparator: Standard care (Prescription of a statin without additional effort to support adherence)

Randomised clinical trial and economic evaluation

3

Understanding the economics of existing heart failure medical therapies.

The objective is to assess the cost-effectiveness of a decision to adopt ‘quadruple therapy’ for patients with heart failure with reduced ejection fraction in Singapore as compared to existing practice, which comprises triple therapy or less.

# Thanks For Listening

Cost-effectiveness and services for cardio vascular disease

Nicholas Graves, PhD

DukeNUS Medical School