A Cost Utility Analysis Framework for the Prioritization of Health Programmes Based on Societal Preferences from Trinidad and Tobago.

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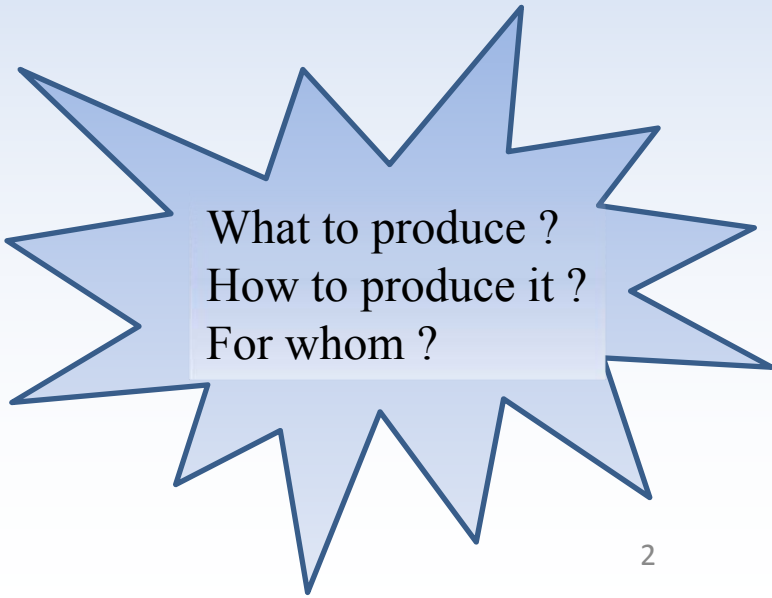
Background: The Fundamental Economic Problem in Health.

- Health needs are infinite
- Resources available to health are finite

→ Scarcity

→ Choice



Implicit Rationing based on:
- Historical Line Item Budgeting
- Epidemiological Data
- Policy Decisions: M-O-H, MLAs

- Objectives of the health system:
  - **Maximize Population Health**
  - Minimize Differences in health

Set of Rules

Explicit Prioritization

Prioritization in Healthcare

Simple Problem:

Gall bladder removal:

Total Cost of approach A = $ 4419

Total Cost of approach B = $ 6578

Total Cost of approach C = $ 9339

…per gallbladder removed

Bailey and Dan 2005

Prioritization in Healthcare

Complex Problem:

	US$ / Pt	Unmet Need
Hip Replacement	10,000	100
Angioplasty	20,000	300
Dialysis	6,000/yr	200

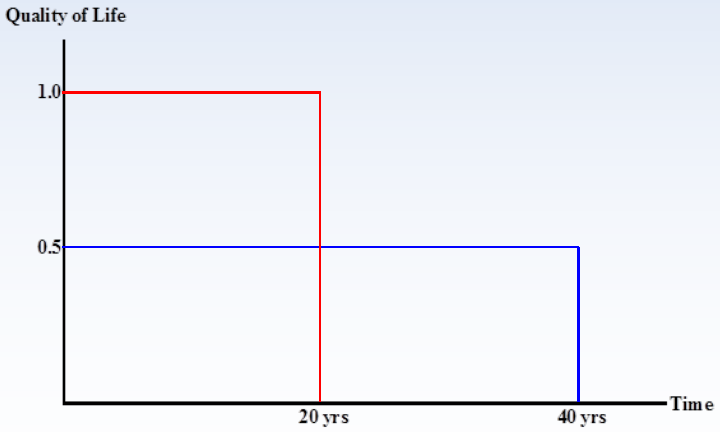
How can we compare these procedures ?

Issues comparing procedures / treatments with qualitatively different outcomes.

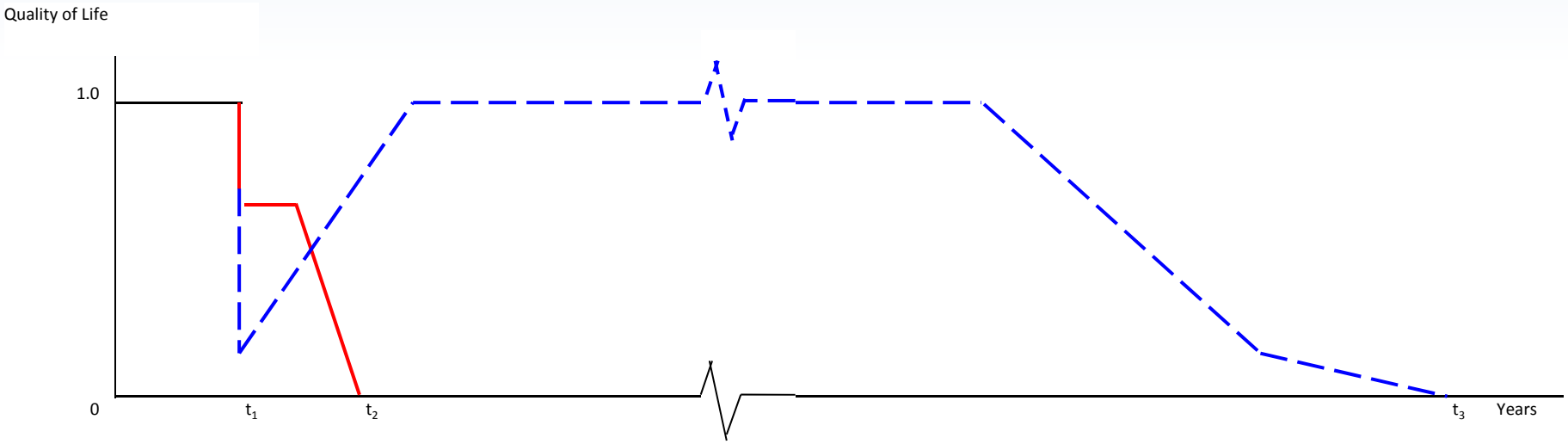
Bailey 2013 (1)

4-Cost per QALY

- Basic Idea:
  - CUA considers consequences in terms of Life Years adjusted in some way for quality.
    - E.g. QALYs.
    - 2 dimensions: 1)duration and 2)quality adjustment.



Cost Utility Analysis



Where do the quality adjustments come from?

– Descriptive systems:
  - EurQol EQ-5D
  - HUI
  - QWB
  - 15D

Cost Utility Analysis

EQ-5D:

- Standardized instrument to measure health outcomes.

- 5 Dimensions:
  - Mobility
  - Self Care
  - Ability to perform Usual Activities
  - Pain/Discomfort
  - Anxiety/Depression

- 3 Levels:

  1-No Problems

  2-Some Problems

  3-Extreme Problems

Cost Utility Analysis

SCORE	MOBILITY	SELF CARE	USUAL ACTIVITIES	PAIN / DISCOMFORT	ANXIETY / DEPRESSION
1	No problems in walking about	No problems with self-care	No problems performing usual activities (e.g. work, study, housework, family or leisure activities)	No pain or discomfort	Not anxious or depressed
2	Some problems in walking about	Some problems washing or dressing self	Some problems with performing usual activities	Moderate pain or discomfort	Moderately anxious or depressed
3	Confined to bed	Unable to wash or dress self	Unable to perform usual activities	Extreme pain or discomfort	Extremely anxious or depressed

Eg 11232 describes the following:

No Problems walking about
No problems with self-care
Some problems performing usual activities
Extreme pain/discomfort
Moderately anxious or depressed.

Bailey and Kind 2010

Cost Utility Analysis

- Illustration:
  - Condition X:

    Perfect Health 11111, Value = 1.00

    Health State 'X': 11232,Value = 0.85

    'Cure' results in production of : 0.15 QALYs per yr, per pt.
    - No of pts → Total QALYs
  - Here we can compare (in $per QALY Produced)
    - Treatments, interventions.
    - Programmes
    - Projects, etc.

5

Cost Utility Analysis

- 'Democracy' in health resource allocation
  - Decisions based on populations' preferences among states of health.

- Allows for comparison of treatments, programmes etc with qualitatively different consequences.

- Requires the use of a Value Set.
  - A full set of $3^5 = 243$ values

Cost Utility Analysis

- Obtain Societal Value for each of the 243 states:
  - Value a subset
  - Estimate coefficients for the 10 domains of the EQ-5D Instrument:

Val = β_0+ β_1MO2+ β_2MO3 + β_3SC2+ β_4SC3+ β_5UA2 + β_6UA3+ β_7PD2+ β_8PD3+ β_9AD2+ β_{10}AD3.

	Coeff	11232	23222
Const	-0.140	-0.140	-0.140
MO2	-0.089		
MO3	-0.344		-0.344
SC2	-0.072		-0.072
SC3	-0.133		
UA2	-0.076	-0.076	-0.076
UA3	-0.118		
PD2	-0.054		-0.054
PD3	-0.149	-0.149	
AD2	-0.032	-0.032	-0.032
AD3	-0.069		
		-0.397	**-0.719**
Value		**0.603**	**0.281**

Cost Utility Analysis

- Standard elicitation approaches: TTO, VAS, SG.
- Developed protocol:
  - Small respondent samples
  - Simple valuation tasks
- DCE / Paired comparisons

Bailey 2013 (1)

Bailey and Kind 2009

Method: DCE

Pair	Choice A	Choice B
1	Confined to bed Unable to bathe or dress self Unable to perform usual activities (e.g. work, study, housework, family or leisure activities) No pain or discomfort Not anxious or depressed *rl*	Some problems in walking about Unable to bathe or dress self Some problems with performing usual activities (e.g. work, study, housework, family or leisure activities) Moderate pain or discomfort Moderately anxious or depressed. *gm*
2	Some problems in walking about Some problems bathing or dressing self Some problems with performing usual activities (e.g. work, study, housework, family or leisure activities) Extreme pain or discomfort Extremely anxious or depressed *mj*	Confined to bed Unable to bathe or dress self Unable to perform usual activities (e.g. work, study, housework, family or leisure activities) No pain or discomfort Not anxious or depressed *dl*
3	No problems in walking about Some problems bathing or dressing self No problems with performing usual activities (e.g. work, study, housework, family or leisure activities) Moderate pain or discomfort Extremely anxious or depressed *es*	Some problems in walking about No problems with self-care Unable to perform usual activities (e.g. work, study, housework, family or leisure activities) Extreme pain or discomfort Moderately anxious or depressed. *am*

Which Pairs to include?

How may pairs?

Which States to include?

- Minimize number of pairs
- Avoid implausible combinations
  - E.g. “Confined to bed” with “No problems” on SC or UA
- Allow models that account for respondent heterogeneity.

- D-Efficient DCE design
  - Minimize determinant of the AVC Matrix:

$$\Omega_N(X, Y, \tilde{\beta}) = -[E(I_N(X, Y, \beta))]^{-1} = \left(\frac{\partial^2 L_N(X,Y,\tilde{\beta})}{\partial\beta\partial\beta'} \right)^{-1}$$

$$D_p\text{-error} = \det(\Omega_1(X, \tilde{\beta}))^{1/H}$$

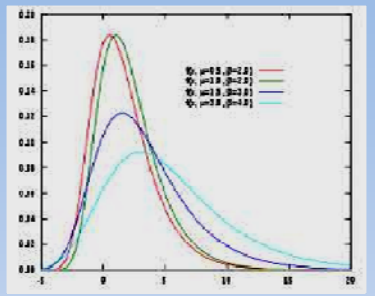
DCE Design and Sample

Choice Set	Alternatives	
1	23312	21133
2	21332	33223
3	32212	23321
4	23211	12322
5	32323	13232
6	22131	11213
7	11221	22112
8	13333	32221
9	33311	23222
10	22233	33311
11	12123	21332
12	33222	32313
13	21122	12231
D error		0.81721
A error		1.56063
B estimate		85.71077
S estimate		60.29419
D-Optimality		44.84%

	N	Sample %	Trinidad and Tobago %
Male	99	49%	51%
Female	105	51%	49%
	204	100%	100%
Indo Trin	84	41%	39%
Afro Trin	80	39%	39%
Mixed/Other	40	20%	22%
	204	100%	100%
18-24	40	20%	19%
25-34	43	21%	22%
35-44	46	23%	22%
45-54	35	17%	16%
55-64	21	10%	10%
65+	19	9%	10%
	204	100%	100%
Primary	39	19%	25%
Secondary	117	57%	64%
University	21	10%	11%
Tech/Voc	27	13%	
	204	100%	100%
NWRHA	57	28%	24%
SWRHA	97	48%	41%
NCRHA	37	18%	23%
TRHA	9	4%	4%
ERHA	4	2%	8%
	204	100%	100%

DCE Analysis

- 'Workhorse' is MNL
  - IIA, Panel data



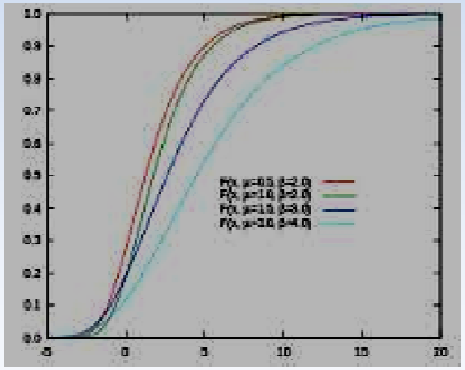
- MMNL

$$U_{njt} = \beta_n X_{njt} + \varepsilon_{njt}$$

$$P_i = \frac{\exp \beta_n X_{nit}}{\sum_{J=1}^{J} \exp \beta_n X_{njt}}$$

$$L_{ni}(\beta) = \prod_{t=1}^{T} \left[\frac{\exp(\beta_n' X_{nijt})}{\sum_{j=1}^{J} \exp(\beta_n' X_{nijt})} \right]$$

$$P_{ni} = \int L_{ni}(\beta) f(\beta | \theta) d\beta$$

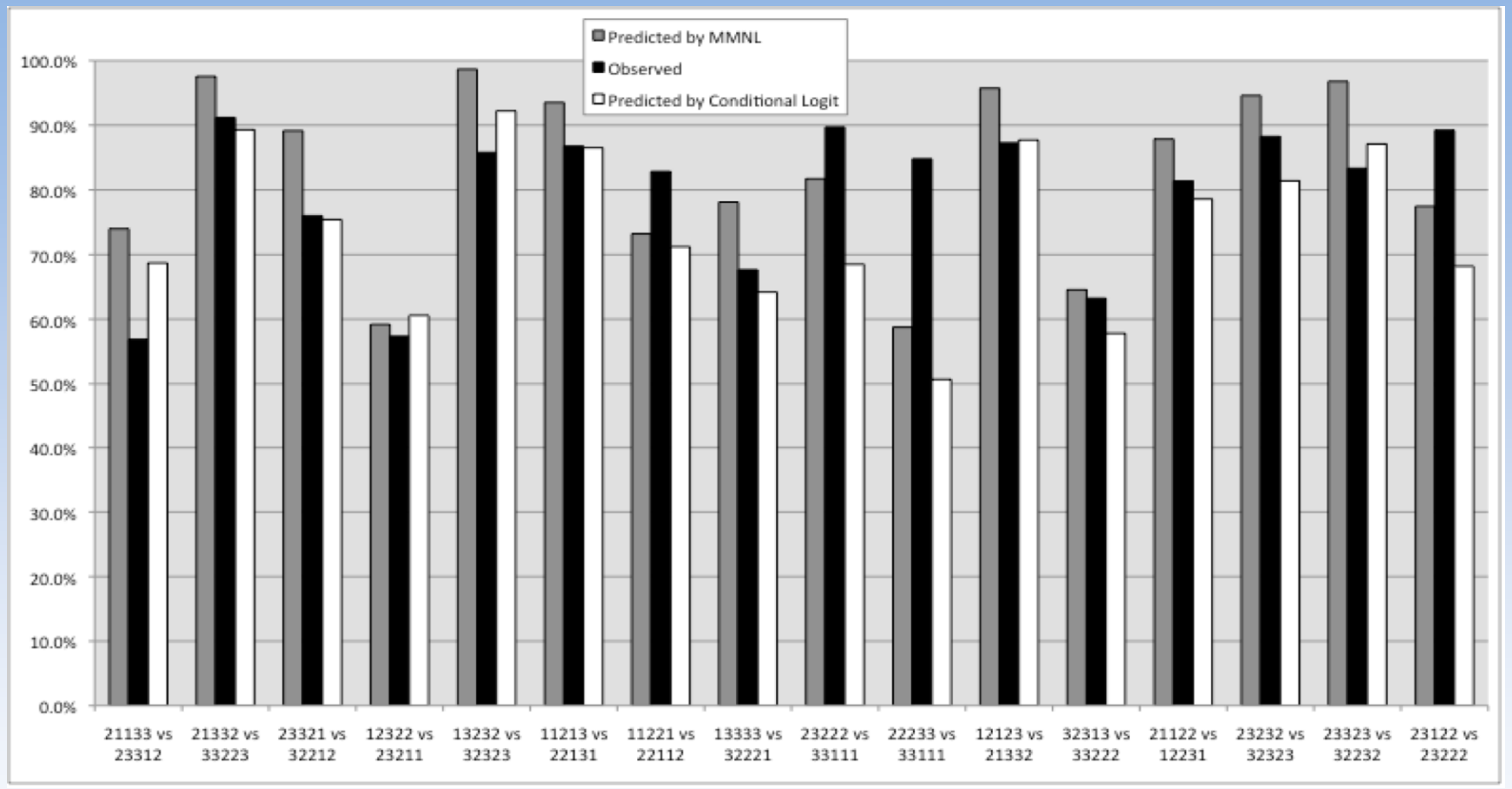


Results

	Coeff.	Std.Err.	P-value	95% Conf. Interval	
Means					
MO2	-1.4393	0.1237	0.0000	-1.6817	-1.1968
MO3	-5.5568	0.3541	0.0000	-6.2509	-4.8628
SC2	-1.1641	0.1089	0.0000	-1.3777	-0.9506
SC3	-2.1477	0.1665	0.0000	-2.4741	-1.8213
UA2	-1.2341	0.1155	0.0000	-1.4606	-1.0077
UA3	-1.8982	0.1464	0.0000	-2.1850	-1.6113
PD2	-0.8756	0.1082	0.0000	-1.0877	-0.6635
PD3	-2.4060	0.1997	0.0000	-2.7973	-2.0146
AD2	-0.5112	0.0953	0.0000	-0.6979	-0.3245
AD3	-1.1068	0.1690	0.0000	-1.4380	-0.7756
Standard Deviations					
MO3	2.0915	0.2394	0.0000	1.6222	2.5608
SC3	0.6637	0.1465	0.0000	0.3767	0.9508
UA3	0.3706	0.1494	0.0130	0.0779	0.6634
PD3	1.2110	0.1530	0.0000	0.9111	1.5109
AD3	1.0016	0.1391	0.0000	0.7289	1.2742

Observations	5824	LR Chi Sq	239.16
Log likelihood	-1302.2903	Prob > chi2	0.0000

Model vs Observed Choices



Rescaling to 0-100 for final model

Const.	MO2	MO3	SC2	SC3	UA2	UA3	PD2	PD3	AD2	AD3
-0.1401	-0.0891	-0.3442	-0.0721	-0.1330	-0.0764	-0.1176	-0.0542	-0.1490	-0.0317	-0.0686

Discussion:
An Application:
Dialysis Patients in T&T

0.722 for dialysis group

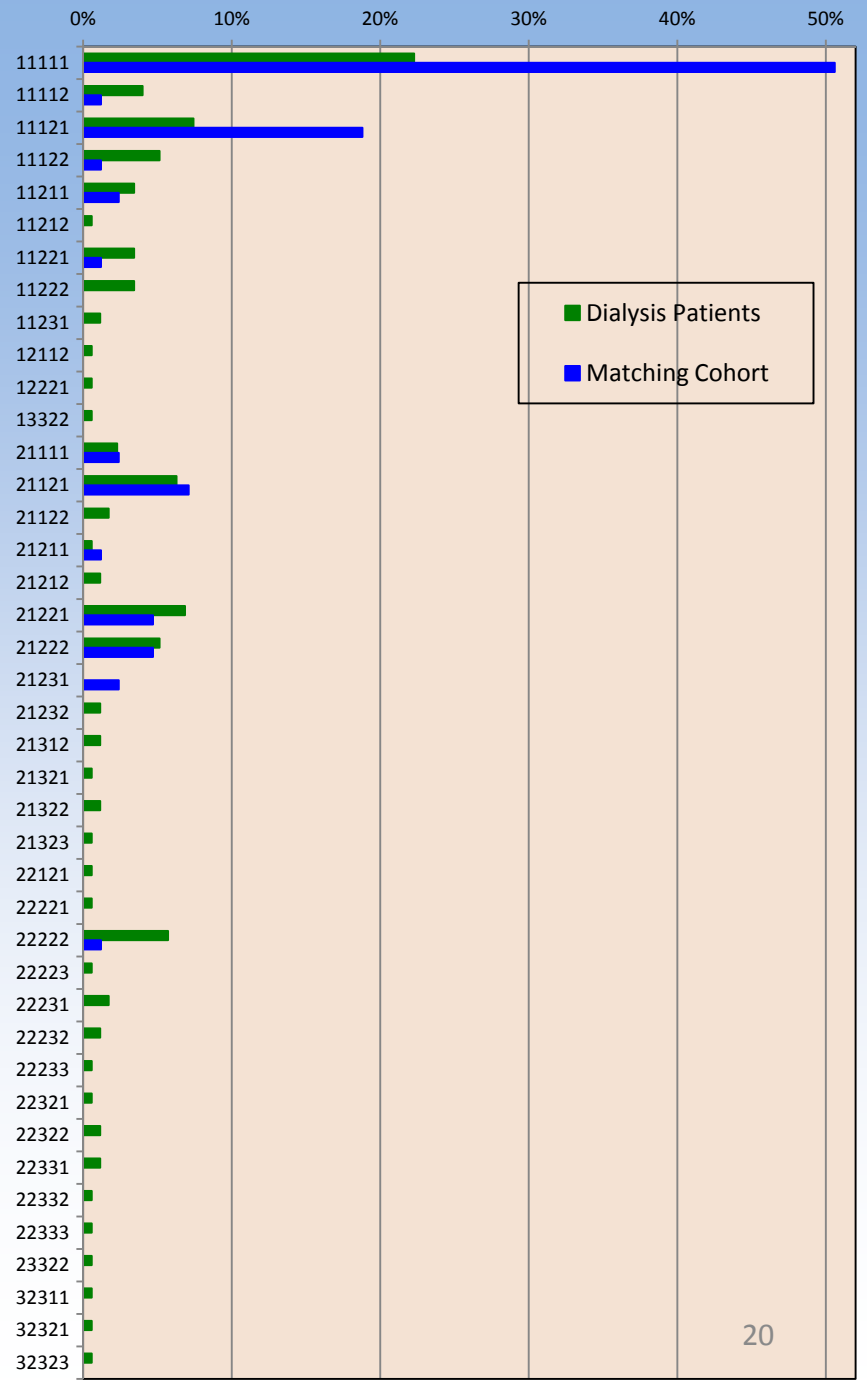
0.860 for matching cohort

Cost/QALY$_{[hemodialysis]}$ =

US$40k÷0.722 = $55.4k

More elaborate modeling for

ICER$_{[Transplant]}$= US$1875/QALY



Research Agenda

- Nephrology:
  - SRH of haemodialysis Pts in different settings.
- Ophthalmology
  - SRH EQ-5D-5L vs Eye instrument: 5k observations.
- SRH: 8k respondents: T&T, Barbados, OECS, Suriname
- 5-L Study T&T
- Diabetic Foot Study
- Gastrectomy Series
- Potential:
  - Value Sets for other Countries
  - Applications in other specialties

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Thank You !