



Applying Multi-Criteria Decision Analysis (MCDA) to Health Care Prioritisation

Trudy Sullivan



Sam (8)

has cancer, current drugs not working, experimental drug available

\$15,000

Who would YOU treat?



Matt (22)

drunk driver, severe facial scarring
needs plastic surgery



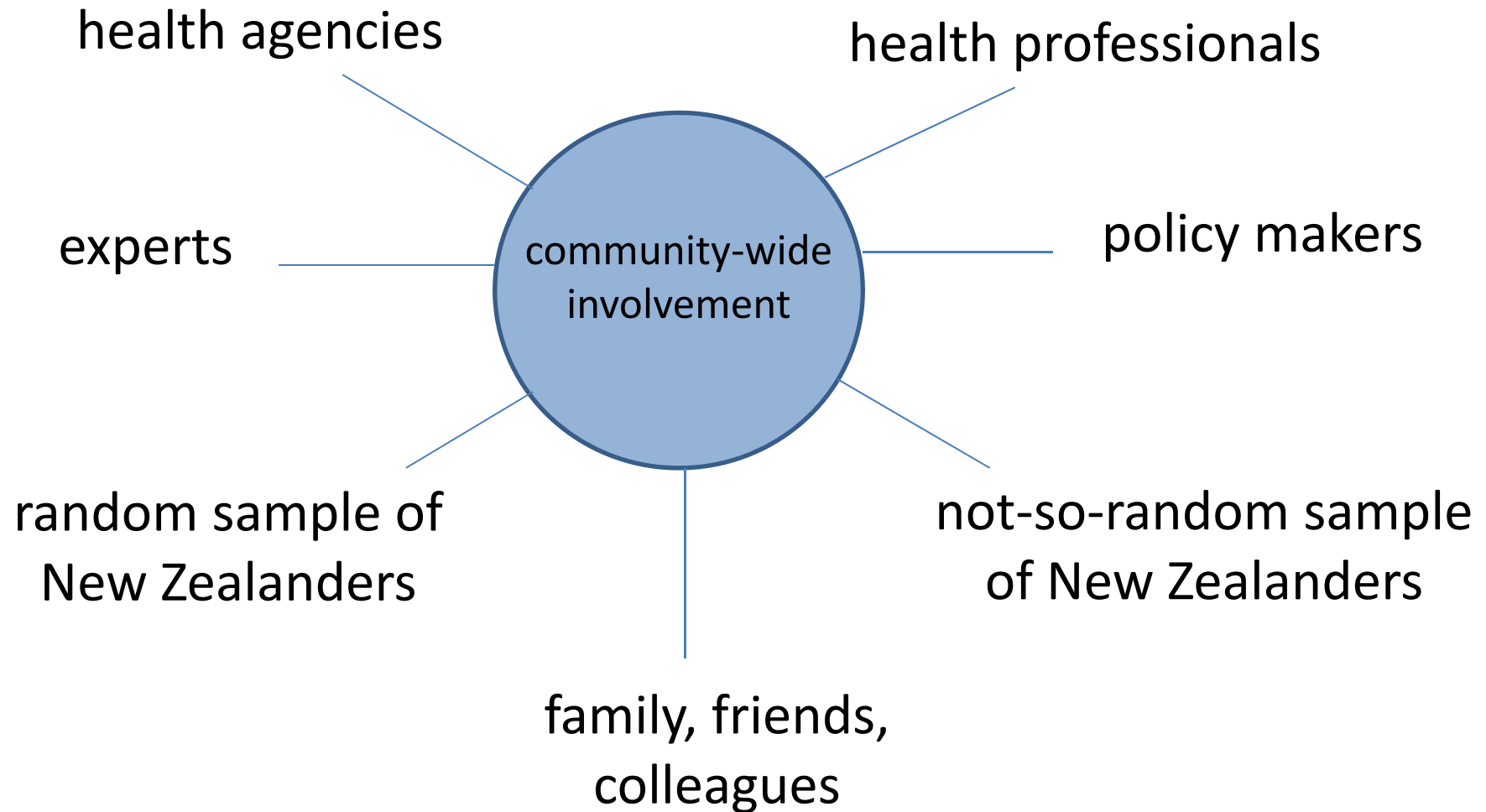
Erica (65)

needs a hip replacement
can no longer live alone

Overview

- Multi-criteria Decision Analysis (MCDA)
 - What is the decision context? Who should be involved?
 - What are the relevant criteria?
 - What is the relative importance of the criteria?
 - Use of criteria weights in decision-making

Who is involved?



Determining the relevant criteria

Focus groups

Nurses

Preventive & Social Medicine/Public Health

Retirees

GP practice

Maori health provider

Non-medical health workers

<p>Basis for potential diagnosis</p> <ul style="list-style-type: none"> - Postnatal depression (PND) is when mothers experience feelings of anxiety, irritability and loss of interest in their babies from about six weeks after the baby has been born. - PND can result in long-term negative emotional and developmental problems in babies because the mother is less likely to bond with the baby and provide a safe nurturing environment. - PND affects about 13% of new mothers and occurs across all cultures, families and family. - If untreated, PND can persist for several months or years and can lead to social isolation. - Treatment options include additional support and emotional assistance, medical treatment, counselling and psychological therapy. - Currently only 17% of the maternal services are assessing mental health services. - Number of women to receive treatment 1000 per up to one year (approx 20% of women with PND). <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>Antenatal drugs for HIV</p> <ul style="list-style-type: none"> - Human immunodeficiency virus (HIV) is a virus that attacks the immune system and can lead to AIDS within 3-10 years. AIDS-related disease includes opportunistic pneumonia, thrush, skin cancer and brain tumours. - HIV is transmitted through sex, blood transfusions, sharing of needles and between a mother and baby during pregnancy, birth and breastfeeding. - Men and women can be heterosexually infected with HIV, although men who have sex with men are most at risk. - A combination of three antiretroviral drugs can be used to suppress the HIV virus and control its progression. - There is no cure for HIV but antiretroviral treatment can increase life expectancy by an average of 12 years. - Of the 100 people diagnosed with HIV each year in NZ, approx 100 will die without antiretroviral treatment. - Number of people to receive antiretrovirals 100 for the rest of their lives. <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>Vaccine for preventing cervical cancer (Cervarix)</p> <ul style="list-style-type: none"> - Cervical cancer is caused by the human papillomavirus (HPV), a common virus passed on by sexual contact. - Cervarix is a vaccine targeting HPV types 16 and 18 which account for 70% of cervical cancer and HPV types 2 and 31 which cause 20% of genital warts. - Cervarix given to females 12-18 years and a second dose when girls have sex for the first time. - Although cervical cancer is still rare there is a reduction in diagnosis and treatment costs for abnormal cancers and for genital warts. - Each year about 100 women are diagnosed with cervical cancer and 60 will die. - In the future Cervarix could prevent around 25 deaths each year. - Number of young women to be vaccinated: 20,000 over 2 years. <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>Methadone for opioid addiction</p> <ul style="list-style-type: none"> - Methadone is used to help people who have an opioid addiction (e.g. heroin or morphine), by helping them to reduce their use of opioids. - Methadone reduces the death rate from overdoses and the spread of infectious diseases (hepatitis B, C and HIV) from injecting drugs and improves the health of addicts. - Opioid addiction is also associated with high mortality and release can be both costly and low rates of employment. - Methadone treatment reduces the social burden and economic costs resulting from drug abuse. - Alternatives to methadone such as buprenorphine-based treatments are largely ineffective. - Treating a woman with methadone treatment 20% of addictions requiring drugs after an average of 2 years' addiction. - Number of people to receive methadone: 1000 (including drug users and non-drug users). <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>Oral contraceptive pills (OCPs) as a method of contraception</p> <ul style="list-style-type: none"> - OCPs are very effective at preventing pregnancy and have an increased risk of bleeding. - The success of OCPs is unknown. - Contraceptive pills are a drug that binds or interferes with hormones which controls fertility in long-producing abnormal blood cells. - OCPs affect women and men, most commonly between the ages of 12-22 years. - People diagnosed with OCP usually live for around 2 years. - Successful treatment of oral contraceptive pills increases life expectancy from 2 years to over 10 years. - There are >2 million women per 100,000 people each year. - Number of people to receive oral contraceptive pills 10 for the rest of their lives (approx 10 years). <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>
<p>Dialysis for End-Stage Renal Disease</p> <ul style="list-style-type: none"> - End-stage renal disease is when the kidneys no longer function well enough to keep toxins above and controlling electrolyte balance (ESRD) is required. - ESRD involves kidney transplantation, haemodialysis and peritoneal dialysis. - Dialysis removes waste and extra fluids from the blood using a special filter (haemodialysis) or a catheter in the abdomen (peritoneal dialysis). - Dialysis is expensive and often causes complications. - The major cause of renal failure in diabetes, kidney disease, high blood pressure and genetics. - The average age of dialysis patients is 50 years, with many patients over 65. Almost 50% of patients are female. - The number of people receiving dialysis would double in the next 2 years. - Approx 20% of people starting dialysis are still alive after 2 years. - Number of people to start dialysis: 400 for the rest of their lives. <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>Growth hormone treatment for Prader-Willi syndrome</p> <ul style="list-style-type: none"> - Prader-Willi syndrome is a rare genetic disorder, which causes hyperphagia, obesity, intellectual disability, behavioural problems, and an inability to regulate and tolerate cold (which leads to overheating severely). - Growth hormone treatment (GHT) builds bone density and muscle mass increasing height and boosting energy. - Children gain the most benefit from GHT while they are still growing. - Malnourished children tend to up 12-18 cm shorter than the average child height. - There is no known cure although GHT can improve children's short term growth and their behaviour. - Prader-Willi Syndrome occurs in approx 1 in 20,000 births. Currently 22 children in NZ have this syndrome. - Number of children to receive growth hormone treatment 2 until they reach adulthood. <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>Hip replacement</p> <ul style="list-style-type: none"> - A hip replacement is a surgical procedure in which the damaged hip joint is replaced by a prosthetic device. - Hip damage is caused by osteoarthritis, rheumatoid arthritis and leg fractures. - The most common cause of deterioration of hip joints is osteoarthritis. As the surrounding tissues become damaged and torn away, the bones rub against each other causing pain and making difficult to get around. - Used often on men and women, and is more common over the age of 50. - A hip replacement takes up to 6 weeks to return to normal function. Patients resume walking and can lead a normal lifestyle. - A hip replacement typically lasts 12-20 years. - Number of people to receive hip replacement 1000. <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>TNF Treatment</p> <ul style="list-style-type: none"> - Fertility is when a couple is unable to get pregnant after a year of trying it. - Infertility may be caused by factors such as endometriosis, blocked fallopian tubes or poor quality sperm. - The most common reason for infertility is similar to almost all cases. - 20% of couples experience infertility within their reproductive lifetime. - The most common form of fertility treatment is In Vitro Fertilisation (IVF). IVF is where eggs are fertilised outside of the body and then reimplanted into the uterus. - Over 20,000 women in NZ who receive fertility treatment each year, 20% receive IVF treatment. - 20% of women (under 27 years) completing IVF treatment do become infertile. - Number of women to receive complete IVF treatment 1000. <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>Hand sanitizer use in primary schools</p> <ul style="list-style-type: none"> - Hand washing helps reduce infections from transmission. An alcohol-based sanitizer hand sanitizer is an alternative to using soap, water and drying facilities. - Helps to reduce the spread of respiratory and gastrointestinal infections by killing various types of bacteria and destroying different kinds of viruses. - On average approximately 11% of children are absent from school each week due to illness. - In addition to children being ill, spread of the flu virus happens through coughing and sneezing. This germs can easily pass on to other children. - Alcohol-based hand sanitizers in schools could reduce the rate of absenteeism due to illness by 20%-25%. - Number of children to use hand sanitizer 400,000 (for every 6 months period during winter). <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>
<p>Oral drugs for metabolic dysfunction (eg. Viagra, Cialis)</p> <ul style="list-style-type: none"> - Erectile dysfunction (ED) occurs when a man is unable to sustain an erection. - Most ED cases are caused by physical problems, with a small percentage caused by psychological problems. - Physical problems include high blood pressure, high cholesterol, diabetes, stress, smoking and an unhealthy diet. - ED can lead to loss of self-esteem and self-confidence or depression, as well as relationship problems. - Oral drugs such as Viagra or Cialis usually allow an erection to occur (with stimulation). - Around 20% of men over 40 will have erection problems but only 2% will seek help. - The success rate is approx 90%. - Number of men to receive 1 year supply of drugs: 2000 (approx 2.5% of men with ED). <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>Medicine for patients at high risk of metabolic disorders</p> <ul style="list-style-type: none"> - Cardiovascular disease (heart stroke and blood vessel disease) is the leading cause of death and hospitalization in NZ. - Risk factors are smoking, physical inactivity, an unhealthy diet, high cholesterol, high blood pressure and diabetes. - Death rates are higher for men than women and are much higher for Maori and Pacific Island people. - Diet and drugs that reduce the production of cholesterol by the liver, helping to prevent blood vessels becoming blocked with fatty deposits. - Approx 20% of people over the age of 35 would benefit from using statins, depending on the likelihood for developing heart disease. - Statins reduce the risk of a heart attack or coronary death by about 50%. - Number of people to receive statins 200,000 (for the rest of their lives, potentially preventing 40,000 heart attacks or coronary deaths). <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>Allopathy for hair loss treatment of alopecia areata</p> <ul style="list-style-type: none"> - Alopecia areata (AA) is a chronic and progressive autoimmune condition causing patchy and partial baldness and can cause permanent damage. - Chronic AA mostly occurs between 10-18 years affecting 2 times as many women as men. - Although it damages the immune system blocking healthy tissue in the body. - Although it is a cure for AA but has been combined with other drugs can significantly improve the quality of life of a person by reducing pain, joint inflammation and damage to bones and cartilage. - Although it is used when treatment with other drugs has been unsuccessful. - A serious side effect is that it can reduce growth ability in fight infection. - Number of people to receive allopathy 20 for the rest of their lives. <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	<p>Patient Education Technology (PET Scan)</p> <ul style="list-style-type: none"> - PET scan is a sensitive form of imaging scanning which uses small amounts of radioactive material to detect tumors such as cancer, some heart disease and brain abnormalities. - PET scans are most commonly used to detect cancer to determine if the spread and to assess the effectiveness of treatment. They help doctors plan the best form of treatment eg surgery, chemotherapy or palliative care. - PET scans can save people's lives by providing a more accurate diagnosis. - The risks and benefits of major surgery for patients who cannot be cured can be avoided. - About 10,000 people in NZ develop cancer each year. - 20% of patients who receive a PET scan have their treatment changed as a result. - Number of people to receive a PET scan: 1000. <p>When making this treatment doesn't consider its cost - just consider its benefit value for society.</p>	

Hip replacements

- A hip replacement is a surgical procedure in which the damaged hip joint is replaced by a prosthetic implant.
- Hip damage is caused by osteoarthritis, rheumatoid arthritis and hip fractures.
- The most common cause of deterioration of the hip joint is osteoarthritis. As the cartilage lining becomes damaged and wears away, the bones within the joint rub together causing pain and making it difficult to get around.
- It can affect men and women, and is more common over the age of 50.
- A hip replacement relieves pain and restores function to the joint. Patients become mobile again and can lead a normal lifestyle.
- A hip replacement typically lasts 15-20 years.
- Number of people to receive a hip replacement: 7000

When ranking this treatment don't consider its cost - just consider its benefits/value to society.

Ranking survey

Click the technologies to see descriptions, and then rank them by dragging the diamond icons. Click **save changes**.

Please rank these technologies (i.e. treatments) in terms of their overall **benefits/value to society**. Do not consider their costs (i.e. just consider their **benefits/value to society**).

Status: Not invited yet

save changes – as "in progress"

save changes – as "finished"

RANK	TECHNOLOGY click to open	YOUR NOTES optional	
1 st	Antiretroviral drugs for HIV		◆
2 nd	Dialysis for renal disease		◆
3 rd	IVF Treatment		◆
4 th	Methadone		◆
5 th	Statins for cardiovascular disease		◆
6 th	Hip replacements		◆
7 th	PET Scan		◆
8 th	Imatinib mesylate for chronic myeloid leukaemia		◆
9 th	Abatacept for rheumatoid arthritis		◆
10 th	Hand sanitiser use in primary schools		◆
11 th	Growth hormone treatment		◆
12 th	Vaccine for cervical cancer		◆
13 th	Service for postnatal depression		◆
14 th	Oral drugs for erectile dysfunction		◆

Frequencies of ranks for each of the 14 patient vignettes

Number of participants (out of 10 in total) who gave the identified patient the identified rank.

RANK	1 st	4	1	1	4							1			
	2 nd	1	4	2	1	1									
	3 rd	1	1	1				1	1	1	1	1	1		
	4 th	1	1	4		1	1		1					1	
	5 th		1	1	1	1	3	2				1	1		
	6 th	1			1	2		1	1	2	1		1	1	
	7 th		1			2	1	1	1	2	2			1	
	8 th	1			1		2			1	1	2	1		
	9 th				1		2	2	2		1				2
	10 th	1				2			2	1	1				2
	11 th						1	1	1	2	1		2	1	1
	12 th					1		1	1			1	2	2	2
	13 th				1			1		1	1	1	1	2	1
	14 th		1	1							1	3	1	2	2
PET Scan															
Service for postnatal depression															
Statins for cardiovascular disease															
Vaccine for cervical cancer															
Hip replacements															
Dialysis for renal disease															
Abatacept for rheumatoid arthritis															
Antiretroviral drugs for HIV															
IVF Treatment															
Imatinib mesylate for chronic myeloid leukaemia															
Hand sanitiser use in primary schools															
Methadone															
Oral drugs for erectile dysfunction															
Growth hormone treatment															

Criteria and levels for the 'decision' survey

Patient's health before treatment

relatively good (though treatment is still beneficial)
fair (neither good nor bad)
poor (but not immediately life threatening)
will die soon without treatment

Benefit to patient (ie length and/or quality of life)

small
medium
large

Age of patient

65+ years
15-64 years
0-14 years

Illness or injury caused mainly by lifestyle choices

yes
no

Benefit to others (eg family or society)

small
large

Treatment options for this patient

this is the best treatment (there are less effective alternatives)
this is the **ONLY** treatment available

How important are the criteria?

Each box represents one patient. Which patient do you think should be treated **FIRST**? (The other patient **MAY** receive treatment in the future.)

(given they're identical in all other respects)

Age of patient

65+ years

Patient's health before treatment

poor (but not immediately life threatening)

this one

this one is impossible

or

Age of patient

0-14 years

Patient's health before treatment

relatively good (though treatment is still beneficial)

this one

this one is impossible

they are equal

« undo last decision

skip this question for now »

33% complete

1000Minds: PAPRIKA (Potentially All Pairwise RanKings of all possible Alternatives)

Hansen, P, Ombler F. (2008) "A new method for scoring multi-attribute value models using pairwise rankings of alternatives." J. Multi-Criteria Decision Analysis 15: 87-107.

Sample groups

- Random sample (N=322)
- Snowball sample (N=275)
- Health services researchers' sample (N=12)

Criteria weights

Criteria	Random sample (N=322)	Snowball sample (N=275)	Health services researchers' sample (N=12)
Need	28.4%	29.7%	31.5%
Individual benefit	22.0%	24.6%	27.9%
Age	14.2%	13.1%	11.3%
Lifestyle	12.8%	11.0%	5.8%
Societal benefit	12.1%	12.0%	13.1%
Only available treatment	10.5%	9.6%	10.4%

Comments relating to 'individual benefit'

“Having been born with a congenital deformity I am strongly in favour of making sure that only the strongest in our society survive. Being different in this life is no fun at all.”

“I also don't agree with surgery for SOME congenital/hereditary illnesses where in the natural order of things, they would die.”

Comments relating to 'lifestyle'

“People who smoke or are obese should not be given treatment until they get rid of both.”

“I would have answered differently if it were someone becoming injured making a good lifestyle choice like running for health, rather than someone making a poor lifestyle choice such as smoking.”

but...

- 10% response rate (random sample)

however...

- test re-test

Using the
criteria
weights:

Scoring
'dialysis
for renal
disease'

Patient's health before treatment		Score
relatively good (though treatment is still beneficial)	0.0 %	28.4
fair (neither good nor bad)	6.7 %	
poor (but not immediately life threatening)	14.1 %	
will die soon without treatment	28.4 %	
Benefit to patient (ie length and/or quality of life)		
small	0.0 %	22.0
medium	12.2 %	
large	22.0 %	
Age of patient		
65+ years	0.0 %	0
15-64 years	7.4 %	
0-14 years	14.2 %	
Illness or injury caused mainly by lifestyle choices		
yes	0.0 %	0
no	12.8 %	
Benefit to others (eg family or society)		
small	0.0 %	0
large	12.1 %	
Treatment options for this patient		
this is the best treatment (there are less effective alternatives)	0.0 %	10.6
this is the ONLY treatment available	10.6 %	
Total Score:		61.0

Categorising and scoring health treatments

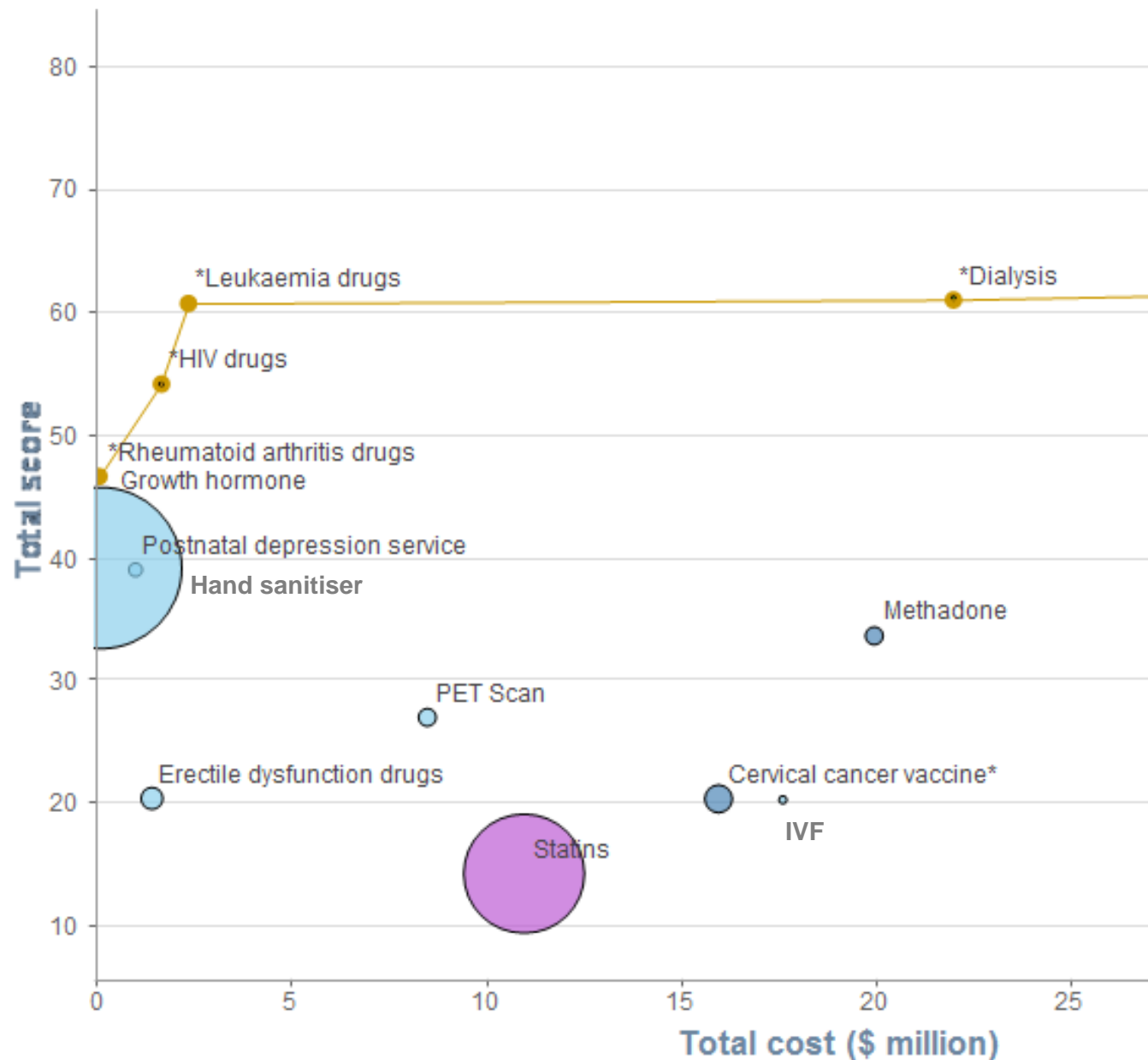
	CRITERIA							
TECHNOLOGY click to open ↕	Treatment options for this patient ↕	Age of patient ↕	Benefit to others (eg family or society) ↕	Patient's health before treatment ↕	Benefit to patient (ie length and/or quality of life) ↕	Illness or injury caused mainly by lifestyle choices ↕	RANK ↕	TOTAL SCORE ↕
Hip replacements	this is the ONLY treatment available	15-64 years	small	poor (but not immediately life threatening)	large	no	1 st	66.9 %
Dialysis	this is the ONLY treatment available	65+ years	small	will die soon without treatment	large	yes	2 nd	61.0 %
Leukaemia drugs	this is the best treatment (there are less effective alternatives)	15-64 years	small	will die soon without treatment	medium	no	3 rd	60.7 %
HIV drugs	this is the ONLY treatment available	15-64 years	small	poor (but not immediately life threatening)	large	yes	4 th	54.1 %

Using criteria weights to assist in decision-making

Strength of medical evidence:
* weak

Size of bubbles:
number of patients
(23 - 400,000)

Duration of treatment:
light blue: one-off
mid blue: 5 years
purple: life



✓	✗	?	Patient	x: Total cost (\$ million)	y: Total score	x/y ratio	Number of patients	Duration of treatment	Cost per patient (\$)	Quality/strength of medical evidence	Rank
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	* Hip replacements	119	66.9 %	1.77813	7000	one-off	17000	strong	1 st
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	* Dialysis	22	61.0 %	0.360866	440	5-10yrs	50000	strong	2 nd
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	* Leukaemia drugs	2.4	60.7 %	0.0395131	40	5-10yrs	60000	strong	3 rd
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	* HIV drugs	1.6875	54.1 %	0.031173	125	life	13500	strong	4 th
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	* Rheumatoid arthritis drugs	0.09	46.5 %	0.00193534	30	10+yrs	3000	strong	5 th
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Growth hormone	0.414	44.2 %	0.00936195	23	10+yrs	18000	strong	6 th
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>		0.136	39.0 %	0.003484	400000	one-off	0.34	weak	7 th
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Postnatal depression service	1	39.0 %	0.0256419	2500	one-off	400	strong	8 th
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Methadone	20	33.6 %	0.594625	4000	5yrs	5000	strong	9 th
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	PET Scan	8.5	26.9 %	0.315847	5000	one-off	1700	strong	10 th
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>		17.64	20.2 %	0.873449	1225	one-off	14400	strong	11 th =
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Cervical cancer vaccine*	16	20.2 %	0.792244	10000	5yrs	1600	weak	11 th =
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Erectile dysfunction drugs	1.422	20.2 %	0.0704107	9000	one-off	158	strong	11 th =
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Statins	11	14.1 %	0.778989	220000	life	50	strong	14 th

Total, selected patients:	145.1775	7635	143500
Total, rejected patients:	35.062	20225	16158
Total, undecided patients:	41.05	631523	25150.34
Sum:	221.2895	659383	184808.34
Budget or constraint (optional):	< click to enter >	< click to enter >	< click to enter >
Not yet allocated:			

✓ Select ✗ Reject ? Undecided

☐ Show break-down of totals for selected patients by bubble colour (e.g. spending sub-totals)