



TE TAI ŌHANGA
THE TREASURY

Wellbeing Virtual Seminar Series:

International guest speakers **Chris Krekel and Paul Frijters of the London School of Economics will present on:**
Well-Being Years cost benefit analyses, principles and examples

The session will begin at 3.30pm.
Please mute your microphones and turn off cameras
when you arrive in the meeting.

Technical help:

Please email Treasury.AcademicLinkages@treasury.govt.nz or send a chat message to the team.

09 June 2022

WELLBY cost-benefit analyses, principles and examples

Prof Paul Frijters

London School of Economics

Dr Christian Krekel

London School of Economics, CEP

NZ Treasury

June 9, 2022

The main CBA method used by rich countries

- One estimates how various outcomes Y_k will change with an amount ΔY_k for the relevant population due to some proposed policy.
- Example outcomes are number of crimes and number of park visits.
- One puts a \$ value P_k on each unit of outcome Y_k , using agreed-upon discount rates for changes in the future.
- Preferably P_k is a market price or an estimated “Willingness to pay” (WTP) for Y_k .
- One adds them up and says the policy has benefits $B = \sum_k (\Delta Y_k * P_k)$
- One compares B with estimated financial costs C of a proposed policy.
- C/B is the cost-benefit ratio. B/C is cost-effectiveness.

Commentary on this practise

- CBA is an attempt at a rational estimate of how much a proposed policy trajectory A would benefit a society relative to some status quo.
- It usually 'glues together' estimates of how various relevant outcomes are expected to change for different groups at different times. Complex CBA problems are almost never 'solved' from within a single model of how the world works: the ΔY_k come from multiple models.
- CBAs rely on many rules-of-thumb, stylised models, simplified alternatives, and views of the world. Every country and every government department has subtly different rules and models. Still, the economic view of the world dominates wherein Economic Surplus and WTP are big components.

Typical Example? What do CBAs look like?

Current Valuation by UK Airports Commission

Table 3.23: Appraisal results for Heathrow Airport Northwest Runway scheme, Present Value (£billion, 2014 prices)

Appraisal results	Assessment of Need	
	CT	CC
Carbon-traded (CT)/capped (CC) ⁴³	CT	CC
Monetised (*indicates the demand reduction sensitivity results)		
Consumer surplus (includes removal of scarcity rents and frequency benefits)	54.8	33.6*
Producer surplus	-38.4	-25.8*
Government revenue	1.8	1.9*
Delays	1.0	3.0
Wider economic impacts	11.5	7.7*
Noise	-1.0	-1.5
Air quality	-0.8	-0.8
Carbon emissions	-0.9	-0.7
Biodiversity	0.0	0.0
Total benefits	69.1	46.2
Total dis-benefits	-41.1	-28.8
Net social benefit	28.0	17.4
Scheme capex and surface access cost	-16.1	-16.0
NPV (net social benefits and PVC)	11.8	1.4
Non-monetised		
Surface access	Light green	
Quality of life	Neutral	
Community	Light red	
Place	Light red	
Local economy	Dark green	
Water and flood risk	Light red	

Source: Airports Commission analysis

Which is used to support conclusions like

- “Our choice at Heathrow is in favour of the Northwest Runway proposal by the airport operator.” – Airports Commission.
- “Against the objective of maximising economic benefits and supporting the competitiveness of the UK economy **the Heathrow Airport Northwest Runway option performs most strongly, generating £69.1 billion of benefits,**
 - compared to **£58.7 billion** from the Extended Northern Runway scheme and
 - **£60.1 billion** from the Gatwick Second Runway.”

Note particularly

- That what is not measured (ie monetised) does not show up in the final conclusions and recommendations.

Problems with 'CBA as usual'?

- Many things of greatest value are not things people pay for:
 - People value their children and their partners but do not buy them.
 - People value their mental health but do not know what affects it or how to buy it.
 - People value public goods like the environment, which are not traded.
 - People value friendship but would be offended if that were put in \$.
- Consumption externalities and limited awareness.
 - People value social position (a negative consumption externality), which is a zero-sum good. WTP does not capture it.
 - People do not know how some things affect them (like passive smoking in 1950 or air pollution now), so market signals and methods based on them (hedonic pricing) fail.
- Essentially:
 - Money is not the ultimate measure of value. To become more scientific and inclusive of social life and the environment one must directly measure what is important.

This means

- Dominant CBA analyses do not know how to value social life, mental health, or the environment.
- They usually solve this by presuming these elements have **no value**. That also makes it easier to calculate because one then needs no model to predict changes in social life, mental health, or the environment.
- So the brutal reality is that **unless** we explicitly adopt a measure of value that is easily related to social life, mental health or the environment, they will continue to not matter in CBAs. Our societies will continue to underinvest.
- Note that 17 SDGs measured via 900-odd individual indicators are not a viable measure of value to use in CBAs. It is hence not wide used or usable in actual government CBAs. So sustainability advocates need to align with a more low-dimensional actual measure of value that is usable in CBAs.

The idea of the WELLBY

- One explicitly wants the government to maximise “happy years lived”. You can then value anything that makes life enjoyable.
- It hence about length of life and quality of life. The quality ‘weight’ is how satisfied people themselves say they are with their life. Like a vote on what they have experienced.

The UK life-satisfaction question (“ONS4”)

- ***Overall, how satisfied are you with your life nowadays?*** 0 is “not at all” and 10 is “completely”
- 1 WELLBY is one unit of life-satisfaction on a 0-10 scale for one person for one year.
- A normal level for someone who is very healthy is roughly an 8.
- The level at which people are indifferent between living on or not at all is around 2 (Peasgood et al. 2020). The UK Treasury uses 1 as the threshold.
- So 1 year of good health is worth 6 to 7 WELLBY is 1 regular year of happy life.
- The WELLBY captures (almost) everything that is important to people. Health measures miss joy, status, and things that give fulfilment.

How does this work in CBAs?

- The government then maximises the expectation of

$$\bullet \sum_t (1 - \rho^W)^t \sum_i S W_i * (LS_{it} - LS_0)$$

- In calculations you use *predicted* changes in life satisfaction from a policy compared to a status quo, using the best causal estimates you can find.
- There are over 200,000 studies since 1930s on the determinants of life-satisfaction including many (quasi-)experimental designs. We thus have a huge 'price-list' for things in terms of wellbeing, though analysis is very tricky.
- We know far more about the WELLBY than we knew about the QALY or GDP when those measures became widely used by government.

Those CBA calculations?

- Same procedure as otherwise, but now the P_k is in terms of WELLBY effect of a unit of Y_k .
- One can then decide on different policies on the basis of how much WELLBY per unit of public funds they buy.
- The weighting in the WELLBY of social life and the environment is far higher than it is in traditional CBA as still currently practised.
- So in practise, the goals of sustainability and social life are aligned with wellbeing CBA.

Wellbeing Cost-Effectiveness is then

$$\frac{\text{Net benefit}}{\text{Public cost}} > \lambda$$

- **Public cost** – the whole of government net costs
- **Net Benefit** – benefit in terms of a WELLBY: an additional unit of Life Satisfaction for one person for one year

Cost-effectiveness of low-hanging fruits...

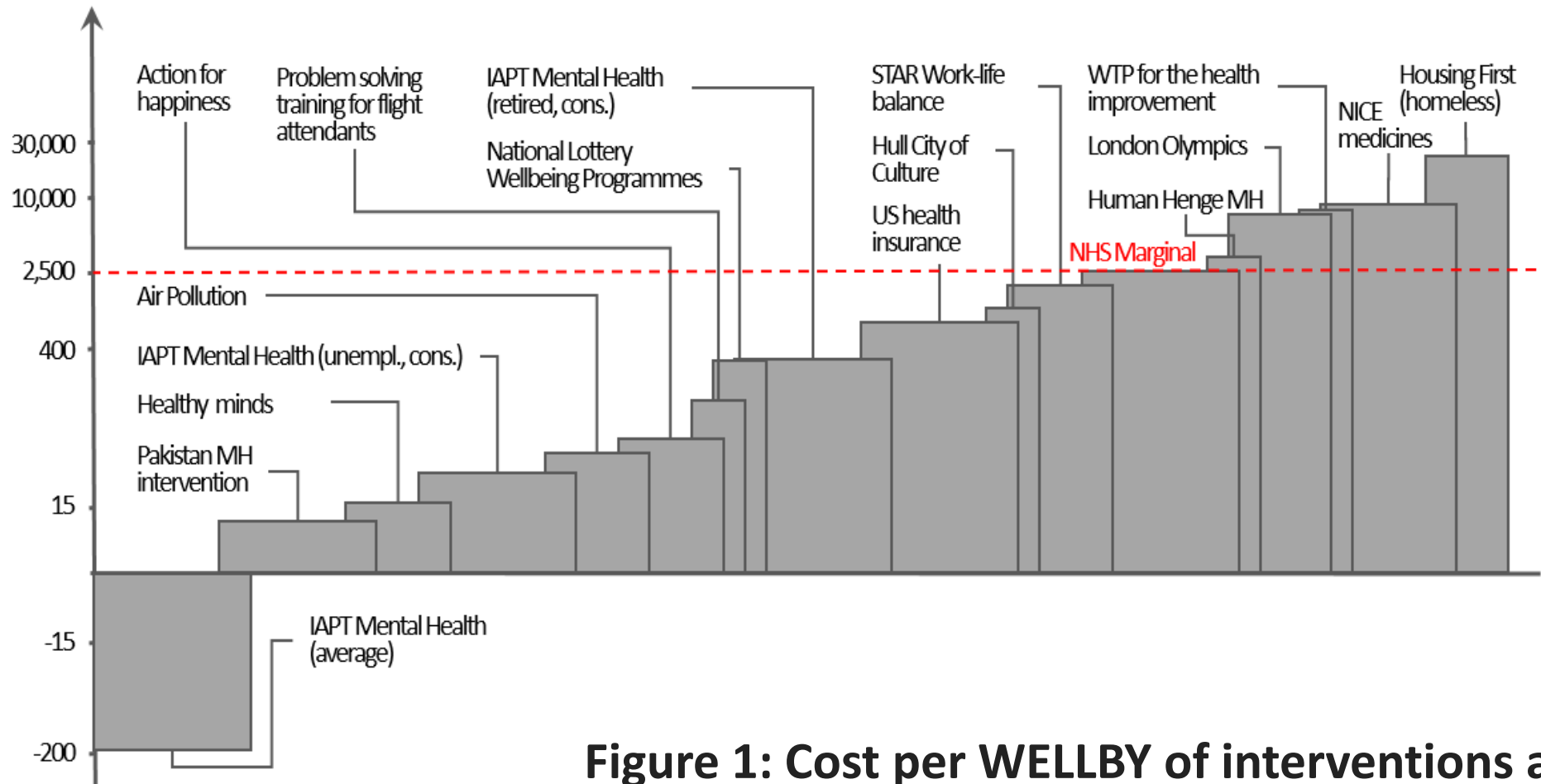


Figure 1: Cost per WELLBY of interventions at work, in the environment, and government services.

Institutionalisation?

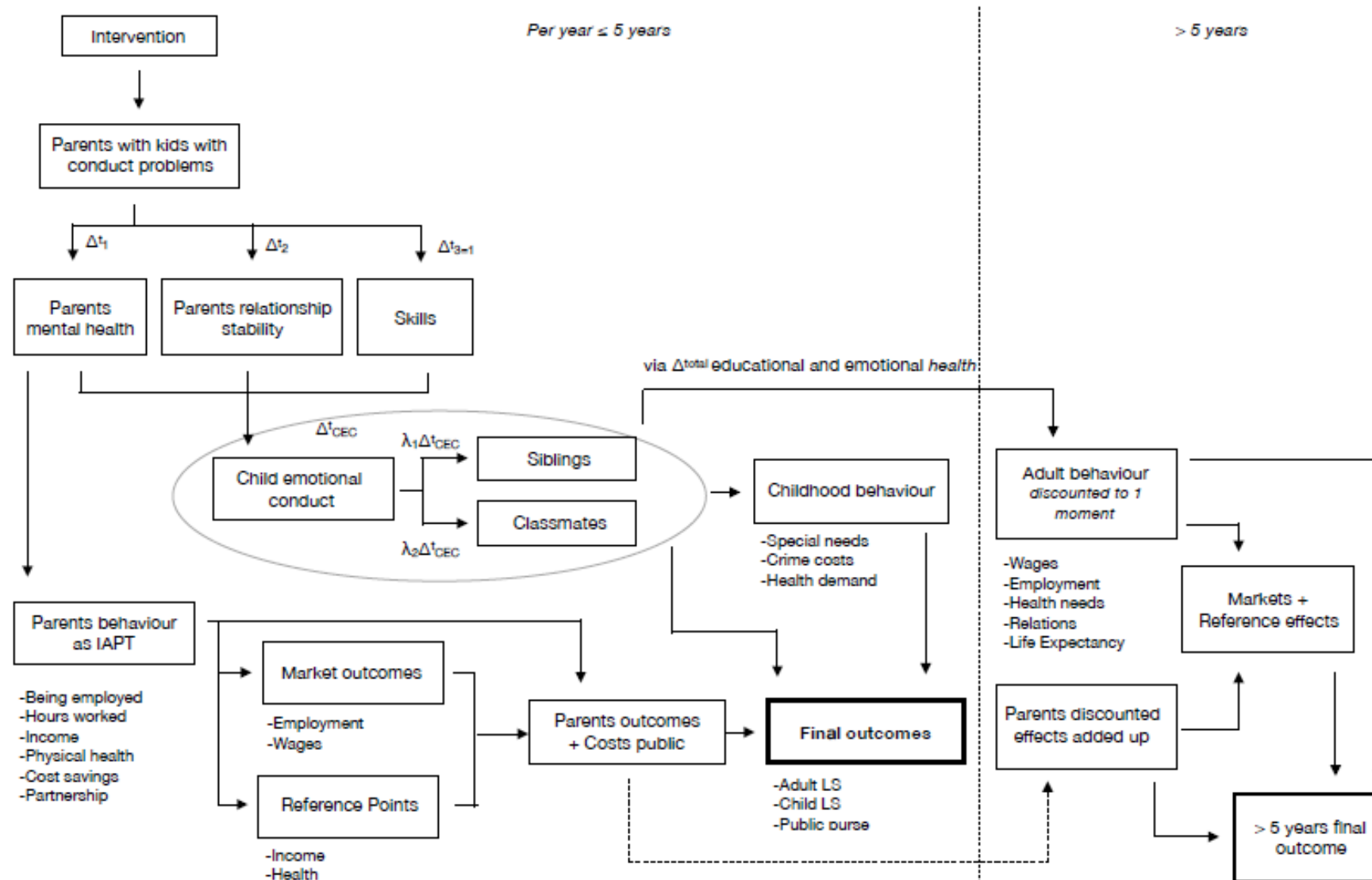
- The WELLBY is now adopted in the UK Green Book and in the NZ CBA guidelines. To grow, the practise needs several elements:
 - General price lists (believed effects of X on wellbeing) maintained by the bureaucracy.
 - Wellbeing frameworks and models in each major policy area maintained by Departments and research institutes (like the IFS). These take a lot of time to develop.
 - Extensions to groups not capable of self-evaluation, like children and the mentally incapable.
 - Training programs to teach methods.
 - Generalised information.
 - Inquiries, workgroups, and projects to deal with the problems as they come along.

Price lists?

Effect sizes,
with high confidence
in green

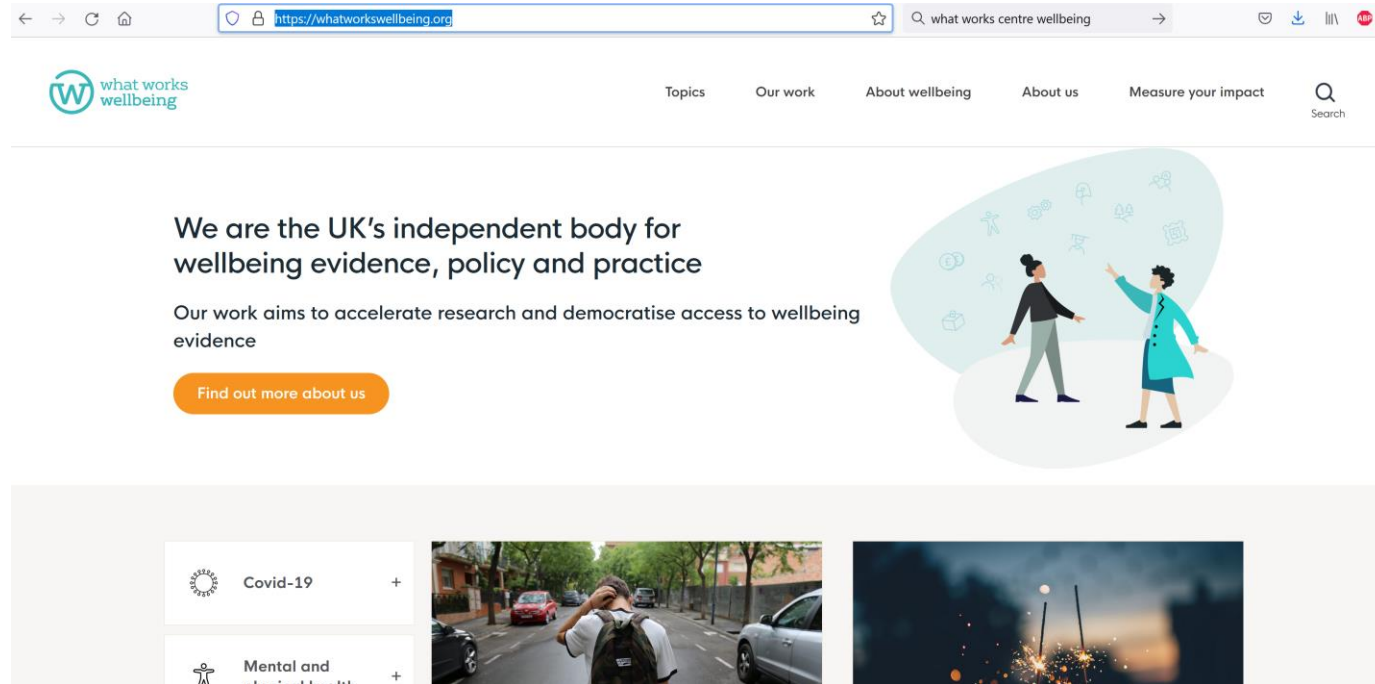
	Change	Effect on 0-10 Life Satisfaction	Dynamics	Key literature References	Confidence in effect and causality?
Work	From employment to Unemployment	-0.46 (UK) -0.71 (Ger)	Immediate effect higher, then reducing, but no long-run adaptation.	UK: [1] Tbl 4.2 Ger: [1] Tbl 4.2.	High. Large effects found in longitudinal studies, cross-sections, recession-related, and employment shock-related (plant closures).
	From unemployment to out-of-labour force	+0.32 (UK) +0.57 (Ger)	Unknown.	UK: [1] Tbl 4.2	Effect very robust in cross-section and panels, but causality unclear.
	From no commute to 1 hour car commute	-0.012 (UK) -0.151 (Ger)	Unknown.	UK: [2] Ger: [3]	Low. Findings disputed and causality unclear. No RCTs.
	From car commute to walking commute (time)	Insig. (UK) Insig. (Ger)	Unknown.	UK: [2] Ger: [3]	Low: results from fixed-effects, no RCTs.
Finances	Doubling of household income	+0.16 (UK) +0.5 (E-Ger)	Persistent effect with elation peak.	UK: [1] Tbl 2.1 E-Ger: [4]	High. Effect found in panels, cross-sections, and shock-related (lotteries). Height disputed and income measurement problematic.
Education	Extra year of compulsory education	-0.03 (UK)	Persistent effects.	UK: [5]	High for UK, since effect found from 1972 UK compulsory school changes. Marginal result also found in other Western countries.
Relationships	From single to partnered/married	+0.28 (UK) +0.1 (Ger)	Permanent effect, with initial peak.	UK: [1] Tbl 5.2 Ger: [6]	High. Ubiquitous finding around the world.
	From never married to married at 50	+0.2 (UK)	Permanent effect, high initial peak.	UK: [1] Tbl 9.1	Medium: cohort study findings, so causality unclear.
	From partnered to separated	-0.40 (UK)	High initial effect, then some adaptation.	UK: [1] Tbl 5.2	High as found everywhere, but most find new partners so don't stay separated. Lone men suffer more.

Framework for relationship interventions



Generalised information

- <https://whatworkswellbeing.org/>



The screenshot shows the homepage of the What Works Wellbeing website. At the top, there is a navigation bar with the logo on the left and menu items: Topics, Our work, About wellbeing, About us, and Measure your impact. A search icon is on the right. The main content area features a large heading: "We are the UK's independent body for wellbeing evidence, policy and practice". Below this is a sub-heading: "Our work aims to accelerate research and democratise access to wellbeing evidence". An orange button labeled "Find out more about us" is positioned below the text. To the right of the text is an illustration of two people, a man and a woman, standing and talking, with various icons floating around them. At the bottom, there is a horizontal row of three items. The first item is a card with a gear icon, the text "Covid-19", and a plus sign. The second item is a photograph of a person with a backpack walking on a city street. The third item is a photograph of a night sky with fireworks or sparklers.

The WELLBY or the QALY?

What is the QALY?

- Like the WELLBY, it is based on responses to survey questions.
- With the QALY, those questions are not about the whole of life but (with the EQ5D) 5 physical health domains:
 - **mobility, self-care, usual activities, pain/discomfort and anxiety/depression.**
 - Roughly 4/5 physical health and 1/5 mental health.
- Perfect health means a QALY of 1. The worst health is QALY of -0.59
 - So there are health states presumed significantly worse than death.
- Note that people care about more than just their own physical health:
 - They care about their children, their social status, their relationships.

How do the WELLBY and the QALY relate?

- The WELLBY is broader and more encompassing than the QALY.
- Roughly speaking:
 - An extra year of life in perfect health is 6 to 7 WELLBY.
 - One year of life spent in perfect health in stead of a QALY of 0 is about 2 to 3 WELLBY.
 - Huang et al. (2018), using about 20,000 observations and an SF-6 measure of QALY (with a bit more weight on mental health than the EQ5D) found a move of health from QALY=0 to QALY=1 to increase life satisfaction by 2.3 in the year of the improvement, and another 0.7 in the year later.
 - This is close to the relation found in the wider literature (Clark et al. 2018; Dolan and Metcalfe 2012) and also the implicit relation from randomised trials that aim to improve health but also measure life satisfaction.
 - The big loading in the QALY on life satisfaction is from the anxiety/depression part of the QALY.
 - I think an effect of 2.5 is 'about right', ie own health is about 40% of what makes life worthwhile.

Bottom line

- The importance of length of life (rather than quality) is basically the same with the WELLBY and the QALY.
- The difference is in the weighting of years of life: physical health (QALY) or life satisfaction (WELLBY)?
- The adoption of the WELLBY reduces the importance of physical health for policy, elevating the importance of mental health and social relations. Physical health thus captures about 40% of the quality of life, not 100% as is implicit in current uses of the QALY.

Some examples

A Policy Example

- Welsh Government's Youth Traineeships programme between 2015 and 2019.
- Targeted young job-seekers aged 16 to 18 referred to by Careers Wales.
- Intake of 15,917 trainees until December 2018.
- Benefits: 10% point increase in job-finding after completion.
- Costs: £18,218,364.



Table 5.1 Traditional CBA

Traditional Cost-Benefit Analysis				
Period	1	2	3	Combined total
Increased total individual income per person	642	1,811	1,811	4,264
Higher personal consumption	514	1,449	1,449	3,411
Higher taxes	128	362	362	853
Crime cost savings	40	80	80	200
Healthcare cost savings	9	17	17	43
Programme costs per participant				1,145
Benefits minus costs				3,362

Note: For simplicity, the discount rate used here is 0 per cent.

Source: Own calculations.

Table 5.2 Wellbeing-augmented CBA

Wellbeing-Augmented Cost-Benefit Analysis					
Period	1	2	3	Combined total	
Increased total individual income per person	642	1,811	1,811	4,264	
Higher personal consumption	514	1,449	1,449	3,411	
Higher taxes	128	362	362	853	
Additional wellbeing items, monetised	<i>LS effect of unemployment</i>	<i>-0.4600</i>	<i>-0.4600</i>	<i>-0.4600</i>	
	<i>LS effect of reduced unemployment</i>	<i>0.0460</i>	<i>0.0920</i>	<i>0.0920</i>	
	<i>WTP for reduced unemployed</i>	<i>414</i>	<i>828</i>	<i>828</i>	<i>2,070</i>
	<i>Accounting for social multiplier</i>				<i>4,140</i>
Crime cost savings	40	80	80	200	
Healthcare cost savings	9	17	17	43	
Programme costs per participant				1,145	
Benefits minus costs				7,502	

Note: For simplicity, the discount rate used here is 0 per cent.

Source: Own calculations.

Table 5.3 Wellbeing CEA

Wellbeing Cost-Effectiveness Analysis				
Period	1	2	3	Combined total
Increased total individual income per person	642	1,811	1,811	4,264
Higher personal consumption	514	1,449	1,449	3,411
<i>LS effect of log annual household income</i>	<i>0.4000</i>	<i>0.4000</i>	<i>0.4000</i>	
<i>LS effect of higher consumption</i>	<i>0.0137</i>	<i>0.0386</i>	<i>0.0386</i>	
<i>Easterlin discounted LS effect of higher consumption</i>	<i>0.0034</i>	<i>0.0097</i>	<i>0.0097</i>	<i>0.0227</i>
<i>LS effect of unemployment</i>	<i>-0.4600</i>	<i>-0.4600</i>	<i>-0.4600</i>	
<i>LS effect of reduced unemployment</i>	<i>0.0460</i>	<i>0.0920</i>	<i>0.0920</i>	<i>0.2300</i>
Accounting for social multiplier				<i>0.4600</i>
Crime cost savings	40	80	80	200
Healthcare cost savings	9	17	17	43
Higher taxes	128	362	362	853
Programme costs per participant				1,145
Net public costs				49
WELLBY per pound of net public costs				0.009795

Note: For simplicity, the discount rate used here is 0 per cent.

Source: Own calculations.

- The future: when policies are evaluated *exclusively* by how much wellbeing they generate.
- All benefits in wellbeing now.
- Divide benefits by costs to obtain the wellbeing cost-effectiveness ratio:
 - $LS \text{ points} / \text{Costs} = \text{WCEA ratio}$
- Sort policies according to cost-effectiveness, then execute until budget runs out.
- Yields the shadow price of wellbeing.

A Policy Example

- Traditional CBA, wellbeing-augmented CBA, and wellbeing CEA all suggest that the youth traineeship programme in Wales was worth the costs.
- Augmenting traditional CBA with insights from wellbeing, in particular on the detrimental effect of unemployment on individuals and their families above and beyond income losses, more than doubles the benefits of the programme.
- Moving to a wellbeing CEA leads us to the same conclusion but underlying mechanism is different: less about private consumption and more about reduced hardship of unemployment.

Another example: NHS Volunteer Responders

- The pandemic is a major public crisis, and we have witnessed a strong increase in volunteers, probably the greatest mobilisation of voluntary action since World War II.
- The leading example is again the Royal Voluntary Service which organises the NHS Volunteer Responders.
 - They launched the scheme in March 2020 to offer help and support to individuals and families struggling with Covid-19. It is ongoing.
 - They recruited 750,000 people in just two days. The initial target of 250,000 was met within 24 hours. Heavily oversubscribed.
 - Volunteers register online to participate in a specific service (Transport, Community Response, Check In and Chat). 'Phone-based' versus 'location-based' services.
 - Tasks are then distributed via pre-existing smartphone app ('GoodSAM').



NHS
VOLUNTEER
RESPONDERS

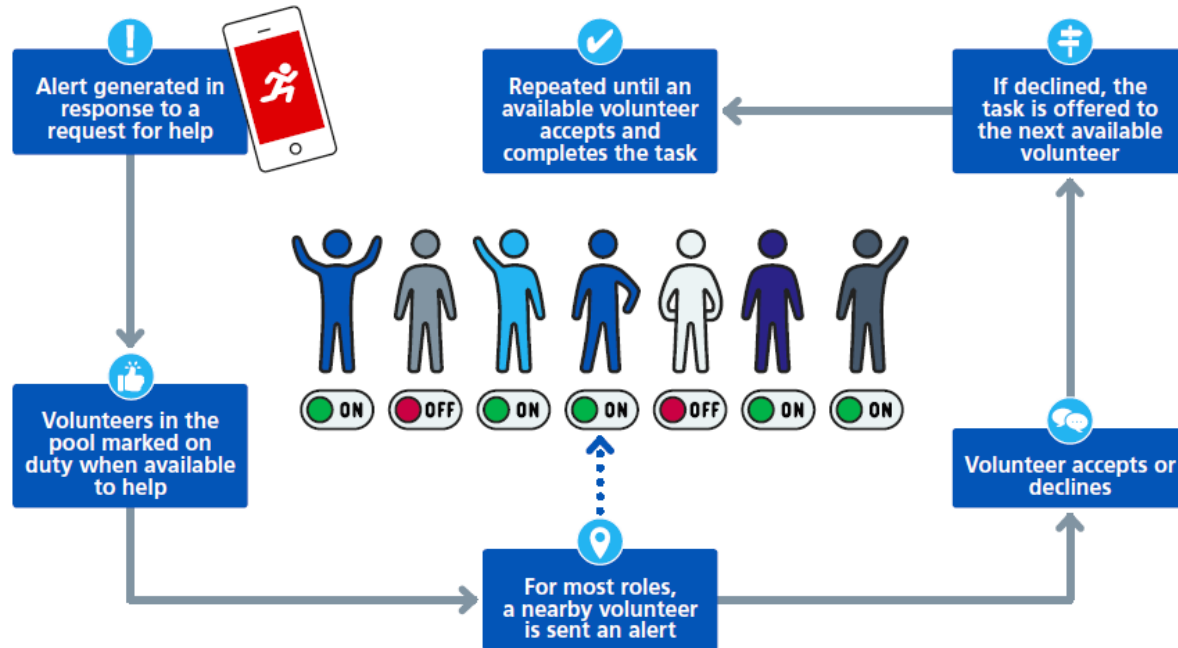
DELIVERED BY
ROYAL
VOLUNTARY
SERVICE

NHS

**400,000+ tasks
completed and
NHS Volunteer
Responders are
ready for more!**

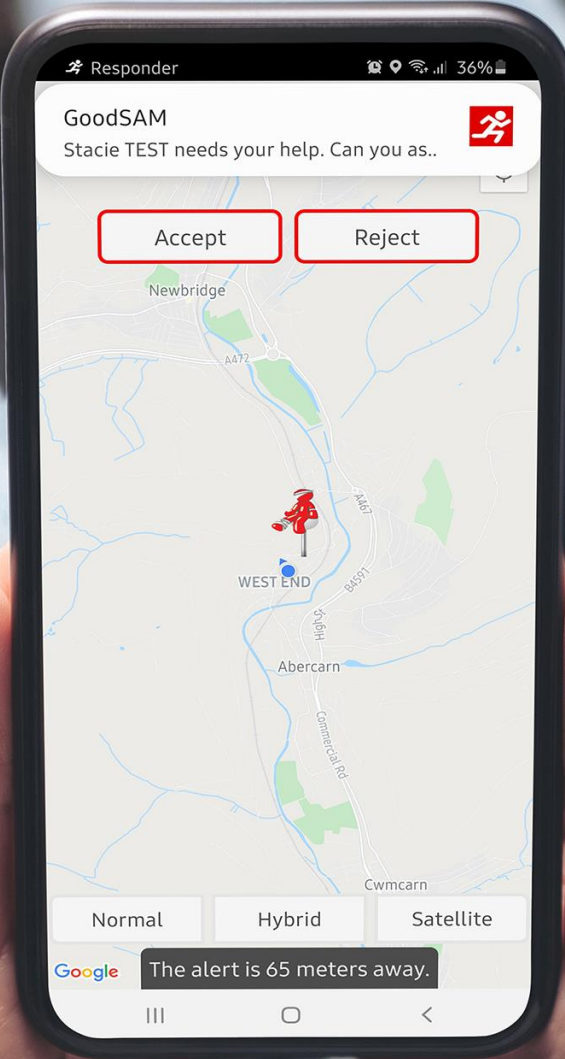
Call 0808 196 3646

Micro-volunteering and the NHS Volunteer Responders Programme



The ultimate flexible volunteering scheme made possible by the volume of volunteers in the pool, each able to control their time commitment through an app on their smart phone

Safeguarding and problem solving teams available 7 days a week



Responder

36%

GoodSAM

Stacie TEST needs your help. Can you as..



Accept

Reject

Newbridge

WEST END

Abercarn

Hybrid

Satellite

Google

The alert is 65 meters away.



Preliminaries

- Running the NHS Volunteer Responders during the period from April to July 2020 costed about GBP 3.1 million, of which GBP 2.7 million were direct costs incurred by the NHS and GBP 350,000 were developer costs of the smartphone app.
- We ask: were the benefits of running the programme worth its costs?
- To answer this question, we conduct two types of social welfare analyses:
 - Wellbeing cost-benefit analysis
 - Wellbeing cost-effectiveness analysis

Wellbeing Cost-Benefit Analysis

- On average, volunteering benefited the volunteers and increased their overall life satisfaction measured on a zero-to-ten scale by about 0.17 points.
- A 1% change in log annual gross household income increases overall life satisfaction, on average, by about 0.007 points (Sacks et al., 2010). The median annual gross household income in England in 2019 was about GBP 29,600 (ONS, 2019), or GBP 7,400 during the period from April to July 2020.
- We now trade off the effect of volunteering on overall life satisfaction with that of income (i.e. the ‘marginal rate of substitution’).

Wellbeing Cost-Benefit Analysis

- Volunteers would have to be compensated with, on average, GBP $(74 \times 0.17) / 0.007 = 1,800$ to reach the same utility level in the counterfactual case in which they had not taken part in the programme.
- At 250,000 volunteers, this yields a total monetised wellbeing benefit of about GBP 445 million.
- Hence, the net benefit (or increase in social welfare) of running the NHS Volunteer Responders was about GBP 445 million - GBP 3.1 million = **GBP 442 million**.

Wellbeing Cost-Benefit Analysis

- This net benefit is probably a lower bound:
 - Does not account for wellbeing benefits to recipients of volunteering.
 - Does not account for market value of volunteering hours: if each volunteer worked two hours at UK minimum wage (GBP 8.72), the total market value of volunteering hours is GBP 4.4 million (which is greater than the costs).
 - Does not account for knock-on effects or intra-household spillovers.
- Break-even effect: how large would the impact on life satisfaction have to be so that benefits are greater than costs? The effect would have to be greater than $(3,100,000 / 250,000) / (74 / 0.007) = 0.0012$ ($< 0.01\sigma$). Likely.

Wellbeing Cost-Effectiveness Analysis

- As you could see, our wellbeing cost-benefit analysis crucially depends on having an unbiased estimate of the income coefficient, which can be problematic (coefficient often endogenous, different estimates).
- A wellbeing cost-effectiveness bypasses this dependency.
- The wellbeing cost-effectiveness ratio of the programme can be calculated as $(0.17 \times 250,000) / 3,100,000 = \mathbf{0.0137}$.
- We compare this ratio with the wellbeing cost-effectiveness ratio of producing one year of healthy life (i.e. Quality-Adjusted Life-Year or QALY).

Wellbeing Cost-Effectiveness Analysis

- It is estimated that the minimum *social* production cost of a QALY by the NHS are about GBP 15,000 (Claxton et al., 2015; Lomas et al., 2019; see also Department of Health and Social Care & Department for Education, 2017).
- This yields a ratio of $(1 / 15,000) / 7.5 = \mathbf{0.0005}$, whereby the division by 7.5 converts one QALY (which is measured on a zero-to-one scale) into life satisfaction (which is measured on a zero-to-ten scale and which is, on average, 7.5 in the UK).
- As 0.0137 is much greater than 0.0005, the NHS Volunteer Responders is a highly cost-effective programme.

Wellbeing Cost-Effectiveness Analysis

- The minimum *private* production cost of a QALY is much higher (estimated to be about GBP 60,000, cf. HMT, 2020, page 86), yielding a comparator ratio of 0.0002. This makes the programme even more favourable in terms of cost-effectiveness.
- As with our wellbeing cost-benefit analysis, we can again calculate the break-even effect as $(0.0005 \times 3,100,000) / 250,000 = 0.0062$, which is slightly higher than before but still very low. Likely.

Thank you.