A SCOPING STUDY ON THE VALUATION OF RISKS TO LIFE AND HEALTH: THE MONETARY VALUE OF A LIFE YEAR (VOLY)

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FINAL REPORT

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DISCLAIMER

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PRESENTATION OUTLINE

- Policy background; Research brief; Method (SS)

- Proposed Method

    Section 1 Conceptual Framework for VOLY (and VPF and WTP-QALY elicitation)

    Section 2 Empirical study (Validity)

    Section 3 Cross-cutting policy issues

- Main Recommendations

POLICY BACKGROUND: HM TREASURY 'GREEN BOOK' GUIDANCE

- Fundamental duty of Government: implement policies that

(i) improve **social welfare**;

(ii) deliver **'value for money**'.

(i) **Policies** affecting risks to **life and health** - often **"cross-cutting"** in Dept. reach

→ requires **valuation** of these different types of **risk reductions**:

- **Value of a Prevented Fatality (VPF)**: values small changes **in fatality risks**; £1m (1997 prices) updated to £ 1.6m (2010 prices)
- **Value of Statistical Life Year** (value of a **SLY** or **VOLY**): values the impact of **risks** to the **length of life**; £60,000. [DEFRA £27,000 (2004 prices)]
- Quality Adjusted Life Year (QALY): values changes in **health-related quality of life** and **length of life**. £60,000.

SCOPING STUDY REMIT

- **assess the *need for* and *feasibility of* undertaking new large-scale primary research to update the VOLY (& value of a QALY)**

Any new framework must

- incorporate any recent theoretical & empirical advances
- accommodate the VPF, VOLY and WTP-QALY

Methods must be available that

- relate directly back to an underlying conceptual framework;
- have already been used in the field.

SCOPING STUDY METHODOLOGY: PHASE I: LITERATURE REVIEWS

- RQI: What are the **relevant published estimates** of the **Value of a Life Year,** and what are their strengths and weaknesses?
- RQII: What are the **main methodological issues in deriving a Value of a Life Year** and what approaches exist in literature for addressing these?
- RQIII: Can a **Value of a Life Year** be derived which is **compatible with** a **Quality-Adjusted Life Year** framework?
- RQIV: Is it possible to derive a **context-free Value of a Life Year** for application across different policy contexts?
- RQV: What is the **relationship** between the **Value of a Life Year** and the **Value of a Prevented Fatality**?

SCOPING STUDY METHODOLOGY: PHASE II: SYNTHESIS

Based on Lit reviews and research team discussions

- The need for and feasibility of undertaking new primary research and the most appropriate methodology
- Derivation and development of the underlying conceptual framework
- Strengths and limitations of the associated empirical methods
- Additional issues with respect to policy application in practice (cross-cutting and not restricted to any particular valuation methodology)

SCOPING STUDY METHODOLOGY: PHASE III: REPORT

- content derived from a combination of phases I and II.

WE **DON'T RECOMMEND**..

1. Deriving a VOLY from existing data sets e.g.

   VPF/LE (Carthy *et al.*, 1999)

   DEFRA (Chilton *et al.,* 2004) updated for inflation

   WTP-QALY value (s)

2. Meta-analysis of (UK and/or international) VOLY studies

3. Identify a 'gold standard' study → "off the shelf"

WE DO RECOMMEND..

Proposed method →

- **A VOLY can be derived with a clear conceptual link to the monetary value of a QALY and VPF.**

  - empirically derived from a **common data set** (same underlying preferences over health and safety)

  - maximises **consistency** across **policy** Appraisals

  - **flexibility** and **choice** over the valuation measure (**Govt**. **Depts.)**

SECTION 1 (REPORT): A CONCEPTUAL FRAMEWORK FOR THE VPF, VOLY AND WTP-QALY

CONCEPTUAL LINK BETWEEN VPF, VOLY AND WTP/QALY

- LE Gains can only be generated by small mortality risk reductions

$$E = (1 - p_1) + (1 - p_1)(1 - p_2) + (1 - p_1)(1 - p_2)(1 - p_3) + \ldots$$

- Risk reductions are valued using WTP; aggregated in two different ways for policy …

CONCEPTUAL LINK BETWEEN VPF & VOLY

- **VPF: aggregate WTP for small individual mortality risk reductions** which, taken over the affected group, are expected to **prevent one statistical fatality**/save one statistical life;
- **VOLY: aggregate WTP for small individual gains in LE** which, taken over the affected group, sum to one year i.e. value of a 'statistical' life year.

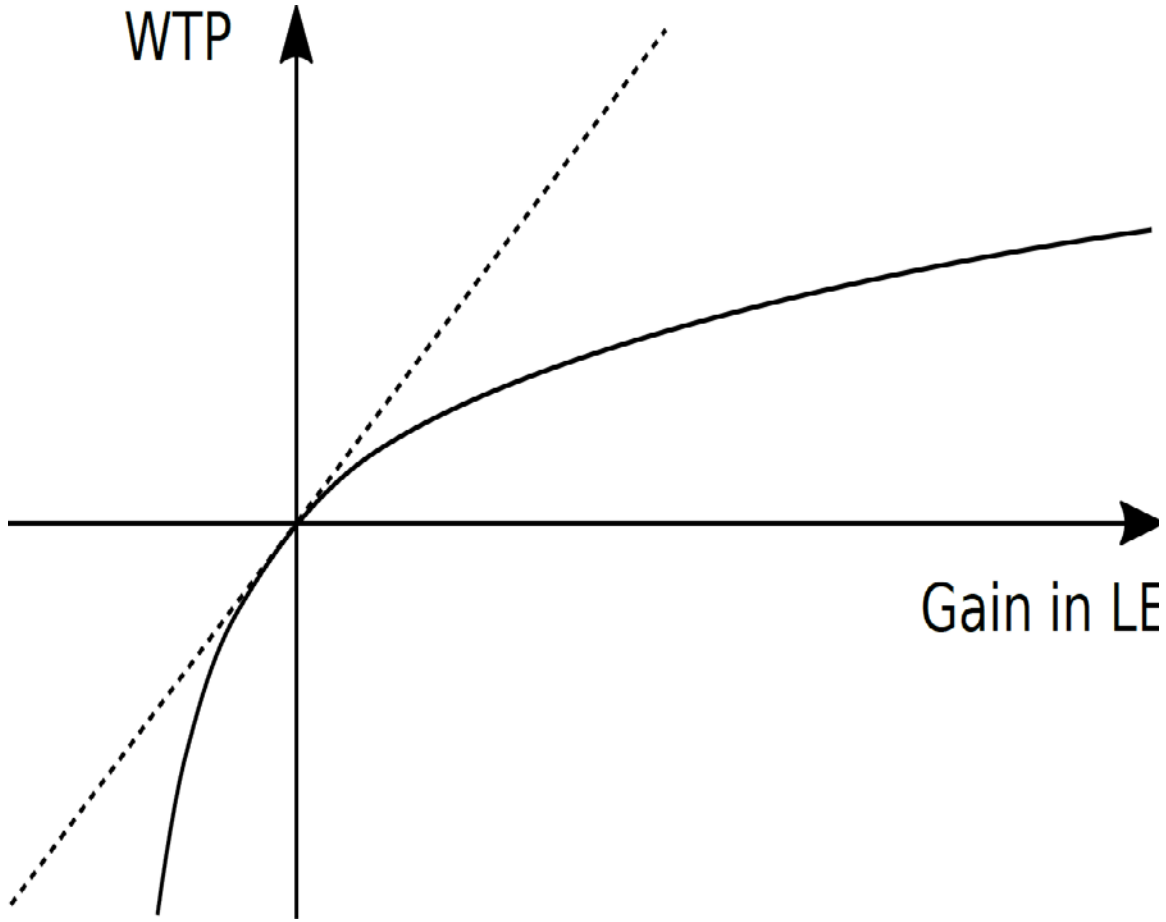
- Tec. Appx/RQV establishes [F(ΔE)]

  - expected utility increases in proportion to the LE gain implied by Δ *p*

  - diminishing marginal utility of wealth, linearity no longer holds

  → increase in WTP no longer proportionate to the LE gain (WTP 3 month gain **less than** 3 times that for a 1 month gain)

RELATIONSHIP BETWEEN WTP AND GAINS IN LIFE EXPECTANCY [F(ΔE)]



- > 1 LE gain → [F(ΔE)]
- MRS of wealth for a marginal gain in LE (dotted line)
- MRS of non-marginal gains?

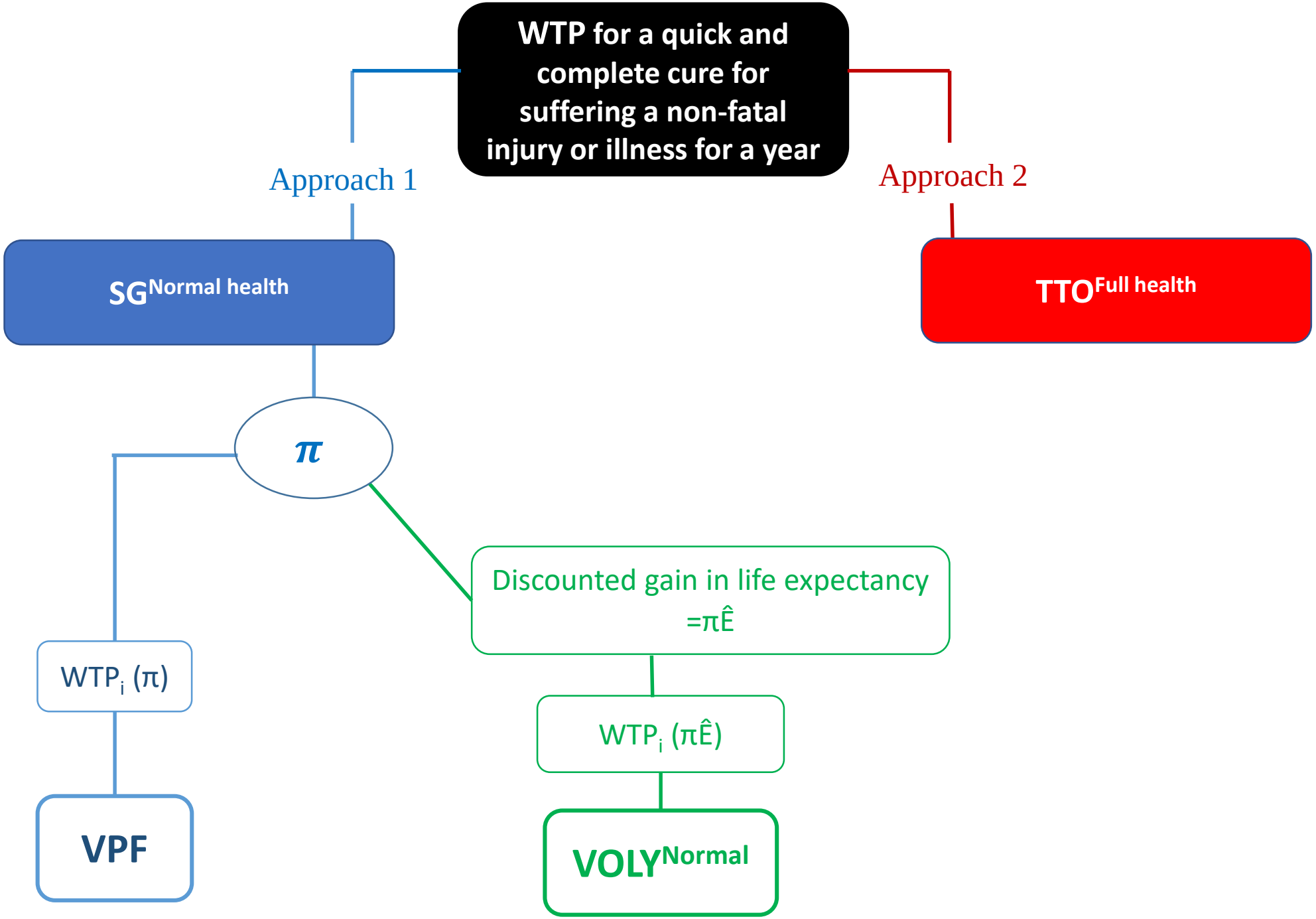
RELATIONSHIP BETWEEN WTP-QALY AND THE VOLY?

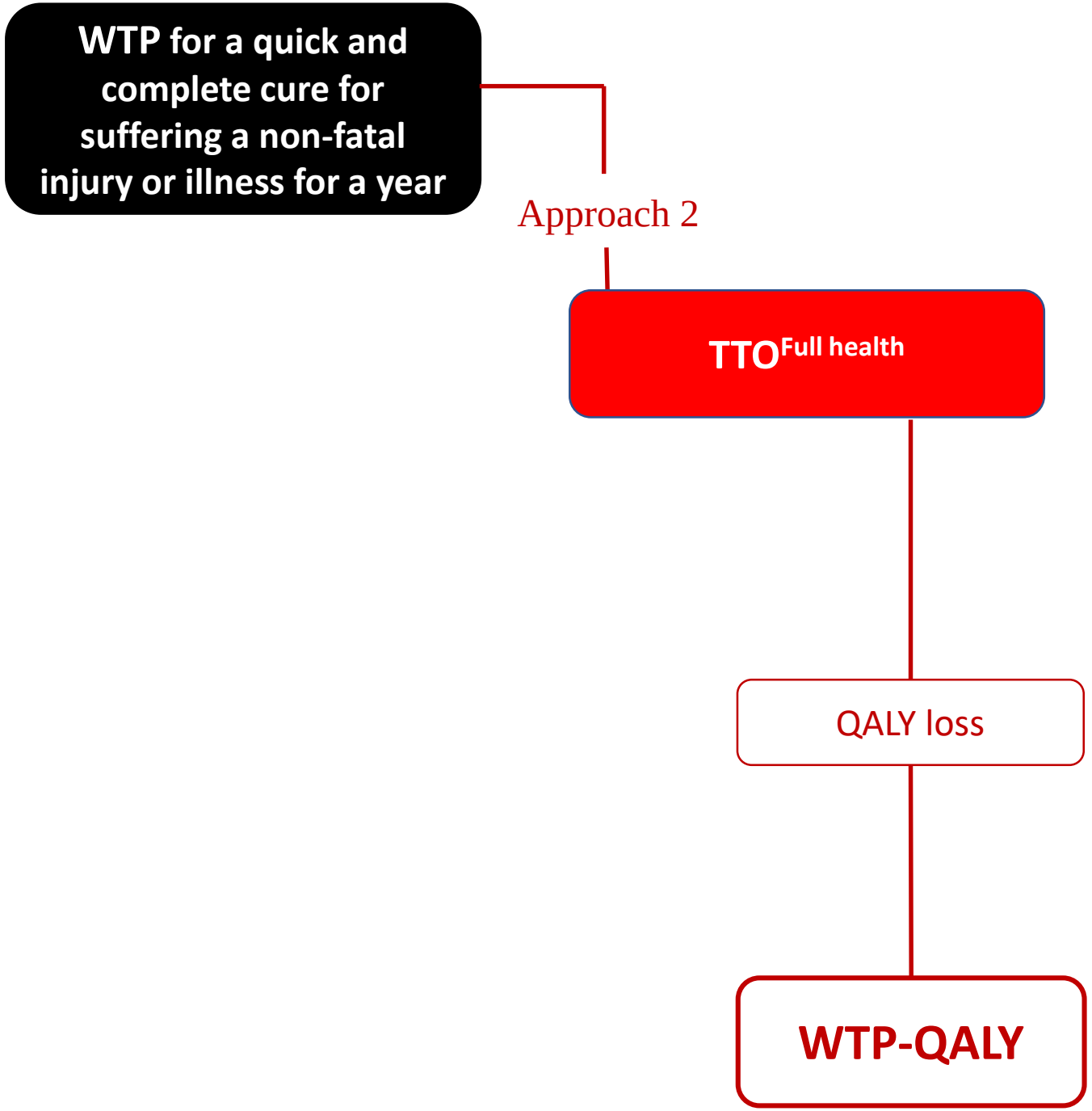
- WTP-QALY function & [F(ΔE)]?

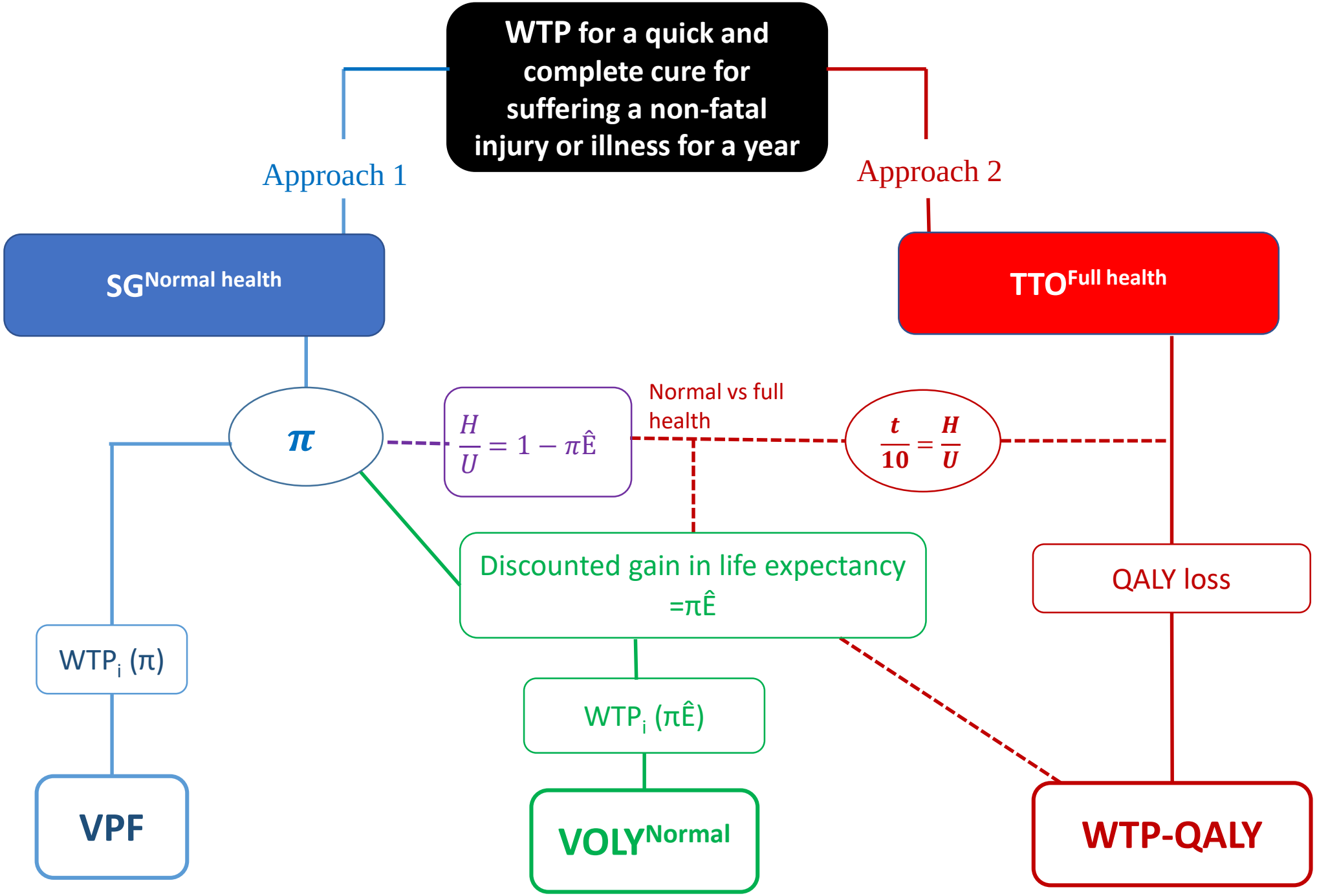
Conceptual framework requires a mechanism to convert WTP for a non-fatal injury or a health state into an equivalent gain in LE (point on F(ΔE)]) ("Chained method").

→ Framework did NOT require (significant) new theoretical inquiry

- simply involved bringing together two previously "separate" traditions in the UK/approaches in the literature (VPF/VOLY and WTP_QALY)
- only one "small" extension to explicitly link them


WTP for a quick and complete cure for suffering a non-fatal injury or illness for a year
Approach 1
Approach 2
SG Normal health
TTO Full health
π
Discounted gain in life expectancy =πÊ
WTP_i (π)
WTP_i (πÊ)
VPF
VOLY Normal


WTP for a quick and complete cure for suffering a non-fatal injury or illness for a year
Approach 2
TTO Full health
QALY loss
WTP-QALY


WTP for a quick and complete cure for suffering a non-fatal injury or illness for a year
Approach 1
Approach 2
SG Normal health
TTO Full health
π
$\frac{H}{U} = 1 - \pi\hat{E}$
Normal vs full health
$\frac{t}{10} = \frac{H}{U}$
Discounted gain in life expectancy =πÊ
QALY loss
WTP$_i$ (π)
WTP$_i$ (πÊ)
VPF
VOLY Normal
WTP-QALY

1.DISCOUNTING (INTUITION)

the loss of life expectancy implied by π should be computed as the product of π and *discounted* remaining life expectancy

- Ignoring discounting means underestimating the VOLY

e.g. WTP 6-month gain = £10,000

→ then VOLY = £10,000/0.5 = £20,000.

- However, WTP values will actually be based on discounted utility → 6-month objective gain may equate to a 4-month gain in discounted LE.
- To accommodate this effect – use appropriately discounted LE

→VOLY = £10,000/(1/(1/3)) = £30,000.

Plus..

- Jones-Lee *et al*. (2015): "*if gains in life expectancy are computed on a discounted basis using the personal rate of time preference, then under reasonable assumptions concerning the pattern of anticipated future annual utilities, the VOLY will be completely independent of whether the risk reduction that gives rise to the gain in discounted life expectancy occurs in the current year or is instead on-going over a person's lifetime*".

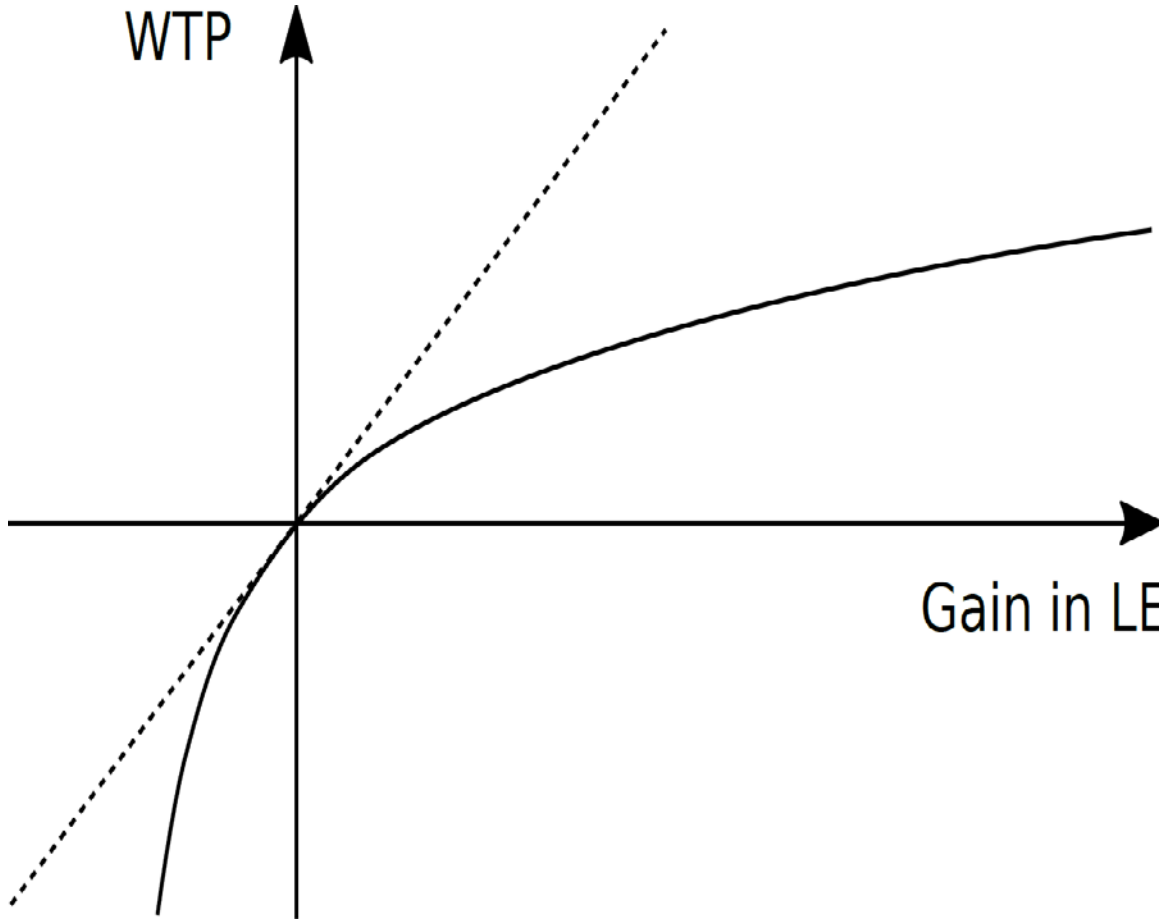
2. NORMAL VS. FULL HEALTH DISTINCTION

- the loss implied by the SG response (Carthy *et al*. (1999)) will require further downward adjustment to account for the fact that:

the TTO-based QALY-loss is a loss of survival time in *full or perfect* health, whereas the SG response is based on the assumption that the rest of life will be spent in *normal* health.

→Using as is; WTP/QALY will be higher than VOLY.

RELATIONSHIP BETWEEN WTP AND GAINS IN LIFE EXPECTANCY (LE)



- The curve should be based on discounted gains in life expectancy i.e. VOLYd
- We can draw a curve for gains in life expectancy in full health
  - WTP/QALYd (the gradient)
  - will be a steeper than the VOLY

SECTION 2 (REPORT): AN EMPIRICAL STUDY FOR THE VPF, VOLY AND WTP-QALY).

Survey design and methodological considerations of the chained method

EMPIRICAL METHODS

- Chained Approach
  - Standard Gamble
  - Time –Trade Off
  - Willingness to Pay

  → complete compatibility with the conceptual framework

- ‘Scenarios’ of varying severities required (3-5)
  - Health States/Illness

  → estimation of the WTP LE gains value function

SURVEY DESIGN: CHAINED METHOD

The chained approach relies on the quality of the data in response to both the SG/TTO and the WTP questions

Methodological considerations:

- Trading (non traders or excess traders)
- Scope insensitivity
- Interactions in the chaining process (direct vs indirect chains)

(RQII)

QUALITATIVE PRE-TESTING

- Essential that survey design and development includes qualitative methods
  - *understanding* and ***interpretation*** of the injury / illness scenarios
  - presentation of WTP and SG/TTO questions
  - time preference questions

- Construction of values and the rationales given by respondents for their value

OUTSTANDING CONSIDERATIONS

1. Based on a one-period model (advantages e.g. update current UK VPF to reflect current preferences; estimate a WTP-QALY).

- But might underestimate the VOLY for people who have higher values for (equivalent) LE gains generated by on-going risk reductions.
- Degree of bias depends on how significantly estimates of π differ between these respondents and those strictly preferring a LE gain from a one-period risk reduction (RQV).
- Address? Employ a relative valuation study/approach identify the necessary adjustments to a VOLY generated from on-going risk reductions.

2. The problem posed by the inherent inconsistency of a constant VOLY and constant VPF (RQV) if deployed in policy remains.

3. Respondents' understanding of how life expectancy gains are generated from small changes in the underlying hazard rate? ... a parallel directed, in-depth qualitative investigation..

4. Behavioural biases not included (e.g. non-standard discounting)

5. Purpose of framework: NOT to identify categories of practical application for which the VOLY (as distinct from the VPF or the QALY) is to be preferred.

SECTION 3-REPORT: CROSS-CUTTING ISSUES ARISING FROM THE LITERATURE REVIEWS AND THEIR SYNTHESIS

The incompatibility between a constant VPF, a constant VOLY and a constant WTP-QALY

Discounting for delay

Dread and anxiety

Behavioural biases and heuristics

INCOMPATIBILITY BETWEEN AGE-INDEPENDENT VPF AND AGE-INDEPENDENT VOLY OR WTP-QALY

Conceptually inconsistent to employ age-independent VPF and age-independent VOLY.

Imagine 3 alternative projects:

Project	Discounted remaining LE of affected group (yrs)	Reduction in hazard rate	Statistical fatalities prevented	Statistical life years (or QALYs) gained	Value assuming constant VPF = £1.8m	Value assuming constant VOLY = £60k
A	10	0.001				
B	40	0.001				
C	10	0.004				

Incompatibility between age-independent VPF and age-independent VOLY or WTP-QALY

Conceptually inconsistent to employ age-independent VPF and age-independent VOLY.

Now allow the VPF and VOLY to vary with remaining life expectancy

Project	Discounted remaining LE of affected group (yrs)	Reduction in hazard rate	Statistical fatalities prevented	Statistical life years (or QALYs) gained	Value allowing nonconstant VPF	Value allowing nonconstant VOLY
A	10	0.001	1	0.01 SLY		
B	40	0.001	1	0.04SLY		
C	10	0.004	4	0.04SLY		

INCOMPATIBILITY BETWEEN AGE-INDEPENDENT VPF AND AGE-INDEPENDENT VOLY OR WTP-QALY

Conclusions:

- It is not possible to have age independent VPF and age-independent VOLY and to have policy preference orderings that are consistent between these measures.

- Instead, to have consistency in policy preference, we must let the values vary with age.
  - Individual-level implementation of the conceptual framework

- Alternatively, select an average value for each of the VOLY and VPF (using age-representative sample), accepting that:
  - Using the VOLY will lead to greater priority for risk reductions to younger vs older people.
  - Using the VPF will lead to greater priority for risk reductions to older vs younger people.

DISCOUNTING IN APPLICATION: PERSONAL DISCOUNTING

Discounting in our conceptual framework:

- Discounted remaining life expectancy is an ingredient in calculating the VOLY.
- Theoretically: individuals' pure rate of time preference (i.e. utility discount rate) relevant

Any measure of VOLY will embed personal time preferences.

- To understand the VOLY, even if directly elicited, important to know the level of personal discounting
- Non-exponential discounting: may be applied by individuals; should it be respected in policy?

DISCOUNTING IN APPLICATION: SOCIAL DISCOUNTING

In policymaking, Social Time Preference Rate is based on policy judgements and norms, historic decisions etc.

- May also wish to respect public social time preference rate: rate at which individuals are willing to trade off *other people's* welfare or utility over time.

To apply an STPR to current generation's stated valuations of future benefits without "double discounting", need to "re-inflate" stated values for personal time preferences.

- Alternatively, respect personal time preferences and do not adjust.

Discounting the utility of future generations is subject to a largely separate debate.

RECOMMENDATIONS

Recommendations: General

- **No imminent need for further theoretical development prior to any new primary research**. The conceptual link between the three measures is clear.

- **Empirical Methods exist** (in principle)

- Adopting a VOLY underpinned by this framework **maintains Government Departmental flexibility** when valuing their own policy outcomes.

- No strong grounds (RQIV) for a contextual VOLY. To maintain transferability across Departments, a **‘generic’ VOLY** should be elicited (if possible).

THANK YOU!