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Are Health Gains to Children and Adolescents More Important Than Health Gains to Adults? A Person Trade-Off Study

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Abstract

Purpose Healthcare decision-making often assumes equal value for quality-adjusted life years (QALYs) across patient groups, yet societal preferences suggest that the value of a QALY may vary with characteristics such as age. Evidence indicates some willingness to prioritise child health gains, though findings are inconsistent. This study used person trade-off (PTO) to estimate the relative social value of different types of health gains for children and adolescents (aged 0–24 years) compared with adults.

Methods A representative Australian sample aged 16 years and above ($n = 2098$) completed an online survey comparing life extension and quality-of-life improvements for different ages. A ‘chaining’ approach tested response consistency, and logistic regression explored associations between PTO choices and respondent characteristics. Attitudinal questions and open text responses provided additional insights.

Results PTO responses show that health gains for children and adolescents (4–24 years) are generally valued more highly than those for adults (age 40 or 55 years), with weights ranging from 1 to 1.3. For very young children, findings vary by health gain type: life extensions for infants (1 month or 2 years) are weighted lower, but pain alleviation is higher (weights ≥ 1.2). Qualitative and attitudinal data reveal diverse views, with many opposing age-weighting. Younger respondents and those with young children prioritise children more, while older and female participants preferred equal treatment.

Conclusions The relative value of child QALY gains varies by age of the child, by health gain type, and by adult comparison age. While alleviating children’s pain is strongly supported (weights ≥ 1.2), overall views are polarised, highlighting the complexity of age-based prioritisation.

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Key Points for Decision Makers

Person trade-off assessed willingness to prioritise identical health gains by age.

Respondents revealed diverse views, particularly in attitudinal questions.

On average, health gains for children over age 4 years were prioritised compared with adults.

Weights for very young children varied by type of health gain.

1 Introduction

Economic evaluation in healthcare often assumes that a quality-adjusted life year (QALY) holds equal value across recipients [1]; this is often the reference case position within health technology appraisal [2]. However, this assumption may not hold in all contexts. The social value of a QALY may vary with patient characteristics such as age, condition severity and social role. Funding decisions may account for these characteristics, either explicitly by weighting gains to certain patient groups or implicitly by considering patient characteristics alongside cost-effectiveness evidence in health technology assessment (HTA) deliberations.

Childhood has been proposed as a life stage that should be given greater weight when considering health gains [3]. The rationale draws both on efficiency arguments, such as differences in potential productivity or social role, and on fairness considerations, including the ‘fair innings’ principle (giving less weight to health gains for those who have already achieved a reasonable length of life) [4]. Productivity considerations would lead to age weights following an inverted U shape [5], whereas ‘fair innings’ considerations may see preferences that are highest for youngest children or constant across those years perceived to be below a fair innings (e.g. 70 years), depending on how the theory is conceived.

A recent review [6] found support for prioritising child health gains but noted variation in values and preferences across studies. The review included a range of preference elicitation methods, such as attitudinal surveys, willingness-to-pay studies, discrete choice experiments (DCE) and person trade-off (PTO) or benefit trade-off (BTO) exercises. Of the 14 PTO/BTO studies comparing health gains for adults versus children (findings separated by life extension and quality of life), 10 identified a preference for children [3, 7–13], three indicated a preference for young adults [14–16], and one had diverse findings [17].

Findings differed by method: attitudinal surveys generally reported less support for age-based prioritisation, while numerical or choice-based approaches (e.g. DCE and PTO) showed greater support for prioritising younger patients [6]. The reason for these inconsistencies is unclear. Better insight into public views on prioritising health gains for children and adolescents would provide timely, valuable information for healthcare decision-making. Social value weights can be estimated using the PTO approach, which determines how many patients with a particular characteristic are equivalent in social value to a set number of patients with a different characteristic. PTO has been widely applied to estimate social value across patients of different ages and treatment characteristics [3, 10, 14, 18].

This study used PTO to estimate the relative social value of health gains for Australian children and adolescents (aged 0–24 years) compared with adults. In line with Sawyer and colleagues [19], we define adolescence as extending up to age 24 years. The aim was to provide comparable weights for the full infant-to-adolescence age range and for different types of health gains, addressing gaps in the evidence base and informing policy.

2 Methods

The methodology, including study rationale, sample size considerations and survey content, is detailed in the published protocol in full [20].

2.1 The Survey

An online survey was conducted via Qualtrics with a broadly representative Australian sample of adults and adolescents aged 16 years and above (balanced by age, gender, education and state/territory) recruited through Online Research Unit (ORU). After a 6-min video (<https://youtu.be/SX1bZRChza4>), respondents completed seven PTO questions comparing treatment for children/adolescents (aged between 1 month and 24 years) versus adults (ages 40 or 55 years). For each question, respondents were asked which program a decision-maker should choose. The age categories were chosen to balance sample size considerations with gaps in the existing literature. Both adult ages clearly represent ‘adulthood’: age 40 years is typically associated with parenting young children, whereas age 55 years is less so [20]. Moreover, age 55 years approximates the mid-point between the oldest child/adolescent age (24 years) and Australian female life expectancy of 85 years [21]. Two PTO questions involved life-year gains (2 and 5 years), and three involved quality-of-life improvements (preventing pain, mobility or distress) (see Section S1.1 of the Supplementary Material). To test consistency, two additional PTO questions were included using the 2-year life extension scenario with different age comparisons. This enabled ‘chaining’ responses across three age comparisons. Respondents compared both their assigned child/adolescent age and their adult age (40 or 55 years) with a third age (x). For example, someone comparing age 4 to 40 years also compared age 4 to 14 years and 14 to 40 years. The predicted equivalence value from the intermediate age comparisons (4 versus 14 years and 14 versus 40 years) was then compared with the direct 4 versus 40 years result. Each initial PTO question compared 100 patients in both programs, differing only by patient age. In three follow-up questions, the number of patients in the

preferred age group was adjusted using a bisection approach to approximate equivalence. If respondents preferred treating 10 patients of one age group over 100 patients of the other age group, a further follow-up question was asked comparing 1 with 100 patients to gain more precision on these extreme preferences.

The PTO questions were presented in random order, with participants answering either life-extending or quality-of-life questions first. The younger age group appeared randomly on the left or right. Respondents were assigned to one of two study arms; one group was allowed to select a ‘no preference’ option (‘unforced arm’), while the other was required to make a choice (‘forced arm’). Offering a ‘no preference’ option risks respondents selecting it to quickly complete the survey. To mitigate this, those selecting ‘no preference’ on the first PTO iterative questions received a follow-up question comparing groups of 75 and 100. Respondents rated agreement with 10 reasons for their PTO choices, based on the literature [20] and survey piloting. They could also provide open-text responses. Respondents also answered attitudinal questions on age-based prioritisation in the context of Medicare, Australia’s public health insurance scheme (see S1.2 of the Supplementary Material for a survey overview). A small sample of respondents ($n = 41$) participated in ‘think aloud’ interviews, completing the same survey while discussing their thought processes. The qualitative findings are reported separately [22], but the PTO data collected during these interviews are included in the analysis here.

2.2 Inclusion Criteria

Respondents accessed the survey via a unique link, earning points for completion that contributed to financial rewards sent by post. Inclusion criteria were: (a) completing the survey in at least 25% of the median time, (b) consistent age reporting, (c) correctly answering an attention check, (d) not responding to optional open-text questions with random letters (e.g. sdfgh), (e) not completing the survey multiple times and (f) passing a bot check and Google’s reCAPTCHA v3 with a score above 0.4. Additional exclusion criteria were considered in post-study focus groups with members of the public (data on file) but were not deemed necessary for the base case analysis. Sensitivity analysis examined results under alternative inclusion criteria.

2.3 Analysis Methods

An equivalence ratio was inferred for each PTO question at the point of equivalence, or if not offered or selected, it was assumed to lie midway between the final and previous group size, aligned to the preference direction. A ratio of 0.5/100 was applied when one patient was preferred over

100. Results were aggregated using the ratio of means (RoM) to address asymmetry in equivalence ratios [14, 23], and the median of individual ratios (MoIR) due to the non-normal distribution. We also estimate the ratio of geometric means (RoGM). Although this was not specified in our original analysis protocol, it was added post hoc for its property of matching the geometric mean of the ratios, and because it is less sensitive to extreme values in right-skewed distributions.

Confidence intervals for RoM and RoGM were estimated using the delta method drawing upon the approach set out by Friedrich et al. [24, 25]. RoM, MoIR and RoGM were visually compared for each age comparison and health gain type, with differences assessed approximately by overlapping confidence intervals. The RoMs were also regressed on PTO question attributes (child age, adult age and health-gain type). To assess whether the relative social value of QALY gains was constant across child age categories, we conducted an *F*-test of equality of the child age coefficients from our regression model. The additional question (100 versus 75) asked after an initial expression of ‘no preference’ was excluded from central tendency calculations.

The chaining test compared predicted equivalence values (e.g. age 2 versus 12 years and age 12 versus 40 years) with the related actual equivalence value (e.g. age 2 versus 40 years). Respondents showing a preference reversal or a difference of 20 or more in estimated versus actual equivalence group size are classified as ‘failing the chaining test’. A logit regression explored whether failing the chaining test is related to respondent characteristics or data quality indicators. We do not view failure as a sign of disengagement (e.g. a response of equivalence at 50 versus 100 group sizes for all three age comparisons above would fail the chaining test but could show a willingness to prioritise based on age, but not beyond a certain level). No data were excluded on the basis of chaining test failure.

PTO responses were classified as preferring the younger group, or the older group, or showing no preference. Multinomial logistic regression examined associations with respondent characteristics and the age/type of health gain, using only comparisons involving adults (40 and 55 years). Covariates included in the regressions are described in Table S2.1 in the Supplementary Material.

Attitudinal question responses are presented, with multinomial logit regression used to explore links to respondent characteristics. Responses to ten suggested reasons for PTO choices are shown alongside the open-text response where additional reasons were provided. Summary statements for open-text responses were developed inductively. Two team members classified responses to additional PTO choice reasons and general feedback as aligning with one or more summary statements. Previous literature [6] suggests that PTO and attitudinal responses may differ. We assess whether

such divergence occurs and whether it relates to respondent characteristics or survey features. Divergence was defined as an inconsistency between the PTO and related attitudinal question. For example, a PTO revealing pro-adult preferences would be divergent if the respondent selected ‘children should have some priority over adults’ in the attitudinal question, or vice versa. The association between respondent characteristics, study attributes and divergent responses was examined using logistic regression.

This paper presents key results and policy messages; detailed findings on the impact of offering a ‘no preference’ option are reported separately (data on file).

3 Results

3.1 Respondents

The survey ran from March to June 2023. Of 3898 respondents, 1565 dropped out (1431 during the introductory video). Of the 2333 completions, 313 (13.4% of online sample) failed at least one inclusion criteria; 231 failed the attention check, 63 failed the age consistency check, 5 failed the open-text sense check, and 47 were duplicates. No one failed the speeding or bot checks. Thirty-seven were reinstated on the basis of strong open-text engagement (see Table S2.2 and Figure S1.3 in the Supplementary Material). Exclusions were agreed with the survey company and in post-survey focus groups (reported separately). An additional 41 respondents completed the survey via a ‘think aloud’ interview, yielding a final (‘main’) sample of 2098 respondents, of which 50.1% were in the ‘unforced’ arm.

Further potential exclusions were discussed in focus groups with members of the public who reviewed the study findings (data on file). These included respondents who completed attitudinal questions in under 10 s ($n = 22$, 1.1%), those who indicated they did not want their responses to be used to support decision-making ($n = 50$, 2.4%) and those who reported difficulty understanding the questions ($n = 21$, 1%) (see Tables S2.3–S2.5 in the Supplementary Material). Focus group members did not support the last criterion but had mixed views on the other two. These responses were excluded in sensitivity analysis based on a ‘tight’ sample ($n = 2028$). The ‘main’ sample ($n = 2098$) was broadly representative of the Australian population across age, gender, state/territory and education (Table 1 and Table S2.6 in the Supplementary Material). More respondents reported speaking mainly English at home than the national average.

3.2 Data Quality

The median duration of the online survey was 21 min, with some respondents taking longer owing to the option

to re-enter and complete later. The trimmed mean for an assumed single sitting (< 75 min) was 23.0 min (see Table S2.7 in the Supplementary Material). Respondents demonstrated good understanding of the PTO questions, with 93.5% reporting that they found the questions easy or reasonably easy to understand. When asked if they would be happy for their responses to be combined with others to inform healthcare decision-making, 86.6% agreed, 11.1% were unsure and 2.4% disagreed (see Tables S2.4 and S2.5 in the Supplementary Material). The sensitivity analysis excluding those not wishing their results to be used in decisions revealed a minimal difference from the overall results (see Table S2.24 in the Supplementary Material).

3.3 Aggregate PTO Responses

We observe different PTO responses in the forced and unforced arms for some comparisons (data on file). As per protocol, we do not combine the data from the two arms and focus on the unforced arm for more cautious results that are less likely to be influenced by question framing. Figure 1 shows an example set of PTO responses for the 2-year life extension across each age comparison compared with adults aged 40 years, using each aggregation method (RoM, MoIR and RoGM). A ratio of 1 (on the y axis) implies that, on average, gains to children are valued the same as those to a 40-year-old, above 1 implies pro-child preferences, and below 1 implies favouring adults (see S2.12 to S2.15 in the Supplementary Materials for all health gains, for both adult comparison ages, and both arms). For RoM and RoGM, a preference reversal occurs between age of 4 and 6 years, switching from favouring adults to favouring children. The median ratio switches from favouring adults at 2 years or below to favouring equality at 4 years. The range of the ratios across age comparisons varies by aggregation method, being 0.6 for the MoIR, 0.8 for RoM and 1.88 for RoGM. The RoGM is more sensitive to outliers, while the MoIR shows little variation and does not reflect differences in strength of preference, therefore we focus on RoM.

Figure 2 shows the distribution of PTO equivalence-point responses for the unforced arm for 2 years additional life expectancy comparing any age child/adolescent with adults. This shows the wide range of responses across the sample. About 27% did not prioritise between the groups, 45% preferred to treat the younger group, and 28% the older group; some held strong preferences in both directions and continued to prioritise their preferred group even when the size of the group was 1 patient compared with 100 in their less preferred group. The percentage of respondents not wishing to trade ranged from 24% for the question on mobility to 28% for questions on pain (see Table S2.16 in the Supplementary Materials)

Table 1 Description of the included sample and comparison with the Australian population

		Total (n = 2098)	Australian norms (2021 census)
Gender	Male	49.4%	49.2 ^a
	Female	50.0%	50.8
	Other/prefer not to say	0.6%	—
Age group (years)	16–24	13.1%	14.8% ^a
	25–34	14.7%	17.8%
	35–44	17.1%	16.8%
	45–54	16.7%	15.6%
	55–64	17.2%	14.4%
	65–74	12.1%	11.6%
	75+	9.2%	9.0%
Age (years)	Mean (SD), median, range	48.2 (SD) 18.3, 48, 16–90	—
Highest qualification	Degree or above	34.7%	32% (15–74-year-olds)
	Certificate, diploma or advanced diploma	40.8%	30%
	No non-school qualifications	24.5%	37%
Employment status	Employed or self-employed	62.1%	58.0% ^a
	Seeking opportunities	2.4%	3.1%
	Retired	21.3%	—
	Student	6.0%	—
	Maternity leave	0.4%	—
	Not working due to poor health	3.2%	—
	Not working due to caring responsibilities	1.6%	—
	Other/prefer not to say	3.0%	—
Demographic	Born outside Australia	26.1%	29.3%
	Speaks mostly a language other than English at home	7.0%	22.3%
	Aboriginal or Torres Strait Islander descent	2.3%	3.8%
State or Territory	New South Wales	26.8%	31.4% ^a
	Victoria	28.7%	25.6%
	Queensland	17.8%	20.4%
	Western Australia	11.1%	10.6%
	South Australia	9.3%	7.1%
	Tasmania	3.4%	2.2%
	Australian Capital Territory	1.8%	1.8%
	Northern Territory	1.1%	0.9%
Health	Experience of serious illness personally	28.6%	NA
	Child has experienced any serious illness	12.6%	NA
Children	Has children	56.8	66.4% of women ^a
	Has grandchildren	21.7	NA

^aAs a percentage of those aged ≥ 15 years

Data on employment, qualifications and women with children (number of children ever born, TISP) is sourced from Census of Population and Housing, 2021, TableBuilder. The percentage in Australia with a degree is: female, 34.2%; male, 28.4% (age 15–74 years) <https://www.abs.gov.au/statistics/people/education/education-and-work-australia/latest-release> [accessed on 18 May 2023]

Age and gender based on ABS Census of Population and Housing: Population data summary, 2021; <https://www.abs.gov.au/statistics/people/population/population-census/2021>

State and Territory data <https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/latest-release> [accessed on 18 May 2023]

Aboriginal and/or Torres Strait Islander descent <https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples/estimates-aboriginal-and-torres-strait-islander-australians/jun-2021> [accessed on 18 May 2023]

^bUp to ten respondents had some missing data on demographics; for parsimony, these are not reported

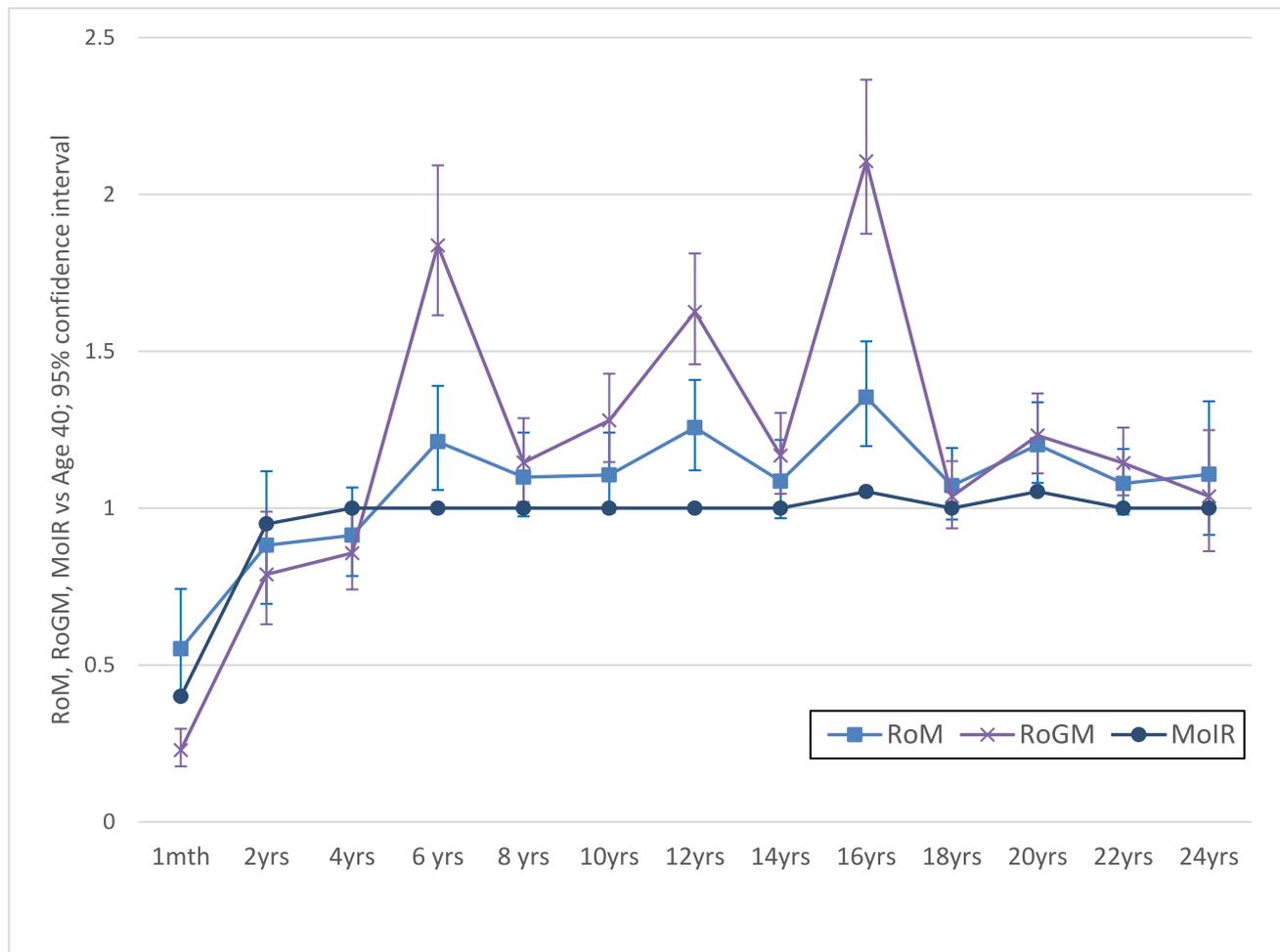


Fig. 1 PTO averages (ROM, RoGM and MoIR) for each young age versus age 40 years, 2-year life extension, 'unforced' arm. ROM ratio of means, RoGM ratio of geometric means, MoIR median of individual ratios

As shown in Figs. 3 and 4, for most kinds of health gains considered, children and adolescents (aged 4 years and above) are generally prioritised over adults aged 40 or 55 years, with slightly higher weights when compared with the older (55-year-old) adults. For school-age children (6–18 years), most weights fall between 1 and 1.3 when compared with adults aged 40 years, and between 1.1 and 1.4 when compared with adults aged 55 years. For both adult age comparisons, some average weights reach up to 1.5 in favour of children.

Children aged 1 month or 2 years are given less weight than 40- or 55-year-olds for both 2- and 5-year life extensions. Additionally, preventing mental health problems has a lower weight for 1-month-olds compared with 55-year-olds, and a lower weight for the three youngest age categories compared with 40-year-olds. The weights for averting pain differ slightly from other gains. Children, including those under 4 years and up to age 16 years, are prioritised (with weights mostly above 1.2) compared with adults aged

40 and 55 years. The weight gradually decreases through adolescence.

Regression analysis explored the combined impact of PTO question attributes on the RoM (see Table S2.23 in the Supplementary Material). RoMs varied by child age, based on the *F*-test of equality of the child age coefficients. RoMs overall are highest for children aged 16 years, and comparisons made with 55-year-olds are 0.1 higher than those with 40-year-olds. The coefficients on child age are negative for age 4 years and younger, but we find positive interactions between child age of 4 years and younger for the PTO questions on pain, and for age 4 years and 1 month with mobility. Type of health gain does not have a significant impact on the RoMs except through interactions with child age. Of the variance in RoMs, 85% is explained by the PTO question attributes.

The sensitivity analysis shows minimal difference between the RoM based on the 'main' sample versus the

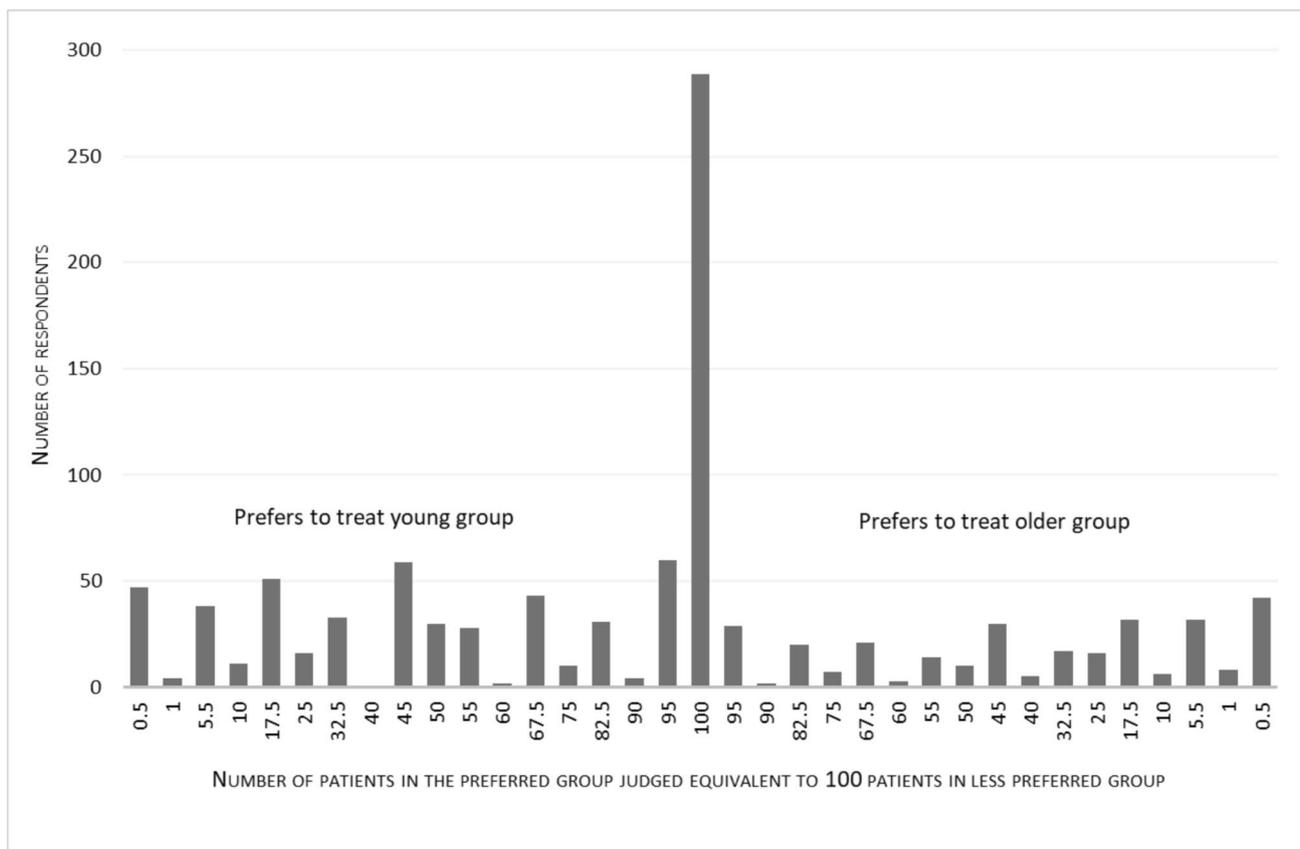


Fig. 2 Distribution of PTO equivalence point responses, unforced arm for 2-year life extension

Fig. 3 Ratio of means (RoM) for PTO comparisons with age 40 years, unforced arm

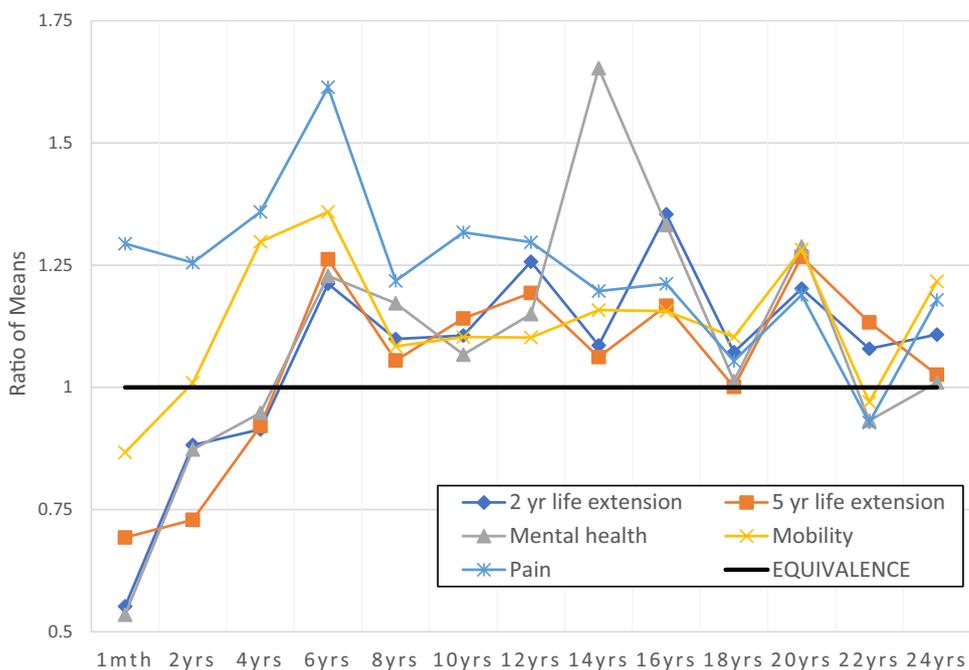
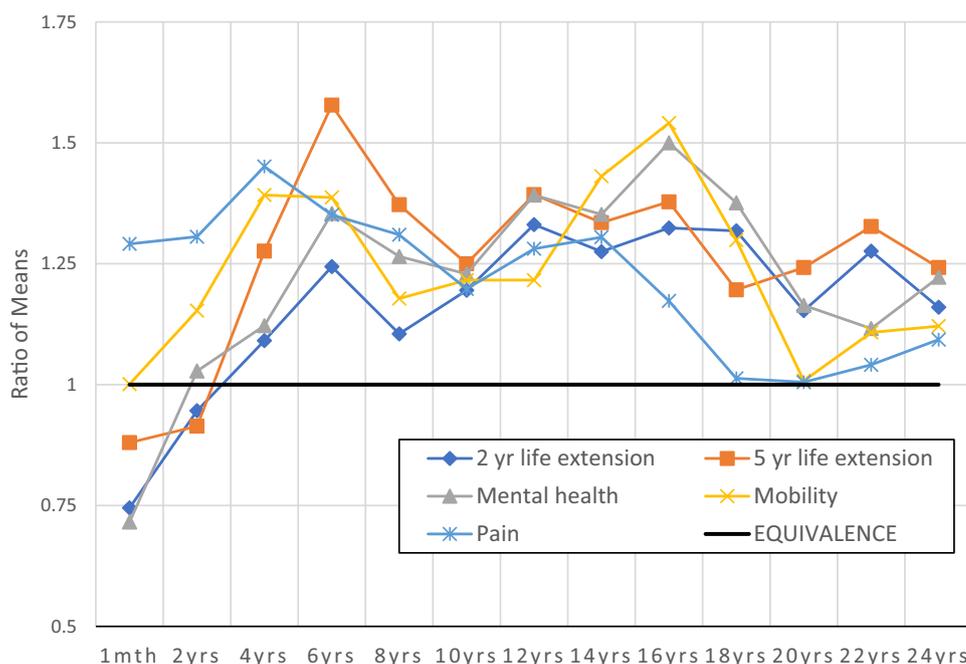


Fig. 4 Ratio of means (RoM) for PTO comparisons with age 55 years, unforced arm



‘tight’ sample that adopted the more rigorous inclusion criteria (see Table S2.24 in the Supplementary Material).

3.4 Chaining Test Findings

We identified respondents whose chained expected result for the 2-year life extension question closely matched their actual results (i.e. the estimated and actual equivalence group size differed by less than 20 people). Fifty-five percent of respondents in the unforced arm had close PTO results, compared with 43.4% in the forced arm (see S2.17 in the Supplementary Material for a breakdown across the samples using alternative inclusion criteria). Regressions exploring characteristics of respondents who met the chaining criteria showed that those with close predictions were more likely to be female and to be responding to PTO questions that compared children/adolescents with adults aged 55 years rather than aged 40 years (see S2.18 in the Supplementary Material). Preference reversals were more common among respondents aged 16–24 years than other ages.

3.5 Correlates of Individual Responses

Multinomial regression on the combined PTO responses explored associations between respondent characteristics, survey design features and PTO response classification (prefer older group, prefer younger group, showing no preference; see S2.19 in the Supplementary Material). Respondents with young children, regardless of whether they have experienced a serious illness, are more likely to prefer the younger age group (1.42 and 1.56 times more

likely, respectively). Younger respondents tend to prioritise younger patients; those aged 45+ years are about one-third as likely as 16–24-year-olds to prioritise the younger age group. Female respondents are more likely to favour equal weighting. Those with mid-level education (certificate, diploma or advanced diploma) are more likely to prioritise one group over equal weighting.

Health gain type matters: 5-year life extension, mental health and mobility improvements all increased the likelihood of selecting the younger group relative to the 2-year life extension. When the gain is avoiding pain, respondents are much less likely to prioritise the older group.

Design features also influence results. Forcing a response raises the likelihood of prioritising either group (at least 1.8 times higher). Respondents are also more likely to prioritise the younger group when making comparisons with adults aged 55 years than with adults aged 40 years, and less likely to prioritise the older group. Screen position of the age group had no significant effect.

3.6 Reasons Given for PTO Responses

Table 2 presents the percentage of respondents agreeing with each reason for their PTO responses (see S2.8 in the Supplementary Material). Agreement ranged from 47.8% for ‘adults might not have support or carers at home’ to 79.4% for ‘children haven’t yet had a chance to lead a full life’. However, respondents might agree with the suggested reasons simply because they seem reasonable, not necessarily because they influenced their decisions.

Table 2 Stated reasons for PTO responses (both study arms, online survey only)

	Frequency (%)
Children (aged 18 years or under) are especially vulnerable	1407 (68.4%)
The child's parents would need to look after the sick children	1086 (52.8%)
Children getting ill would have consequences for their health in the future	1346 (65.4%)
Adults might not have support or carers at home	983 (47.8%)
Adults might be parents, and spending time with their children is important	1389 (67.5%)
Childhood is an important time for developing social relationships or for learning	1444 (70.2%)
Adults need to be able to work	1243 (60.4%)
Children have not yet had a chance to lead a full life	1634 (79.4%)
If we start treating people differently because of their age, this might lead to older people not getting access to healthcare	1326 (64.5%)
Seeing their children suffer is very hard on parents	1542 (75.0%)

Over 65% of respondents reported considering that 'children getting ill would have consequences for their health in the future', suggesting that the PTO framing of identical gains was not fully accepted by respondents. Post-study focus groups and qualitative interviews indicated that some found this assumption unrealistic and viewed future consequences more broadly, including relationships, education attainments, general development and emotional health.

Respondents could provide additional reasons for their PTO choices and general feedback in open-ended comments. Over a quarter provided substantive reasons (672) indicating strong engagement and understanding. Respondents gave a wide range of reasons for their PTO responses, providing over 50 different explanations (see S2.22 in the Supplementary Material). Some replicated the suggested reasons (shown in Table 2), often phrased differently. Some respondents reported needing to balance conflicting priorities and finding the PTO questions challenging and emotional. Others reported that even asking the PTO questions was inappropriate, describing them as "discriminatory", "ageist", "disgusting" and "illegal". Most responses indicated a desire to make rational choices, considering the number of patients treated alongside four key factors:

1. Preventing the worst quality-of-life problems, based on anticipated speed of recovery, coping ability, illness impact on daily activities and likely support availability. Respondents held different views on how age relates to each of these factors.
2. Accounting for future consequences of ill health on different developmental stages, including consequences for relationships, learning and future memories.
3. Considering the broader consequences of ill health or premature death on others: parents, children, siblings, grandchildren, friends, the economy and society.

4. Providing additional years of life that bring the highest quality of life.

For the latter, whether the patient knows of their impending death influenced some decisions. Some respondents gave priority to adults owing to the importance of 'getting affairs in order'; adults were also perceived by some as better able to cope with the knowledge of death. Others avoided extending the lives of children to spare parents the suffering of living in the knowledge of their child's imminent death. Although the PTO questions did not specify whether patients knew about their life expectancy, open-text responses suggest that assumptions about this influence preferences. Many responses indicated that choices aimed to avoid the worst quality-of-life problems and to prioritise extra years for the age that brought the highest quality of life. The most strongly preferred age varied; some thought adults had more opportunities, others believed that older children could have more new experiences during the additional years, and some noted that very young children were less able to benefit owing to lack of self-awareness. When prioritising children for life extension, respondents often cited giving them a chance to live a full life, with comments such as "children deserve the same opportunity", "deserve to have their life extended", "deserve a chance" and should be given the "chance to live a few more years" or the "opportunity to live". None of the 47 responses prioritising children for deservingness, or because the health gain represented a larger percentage of their life explicitly mentioned fairness. In contrast, many who supported equal treatment emphasized fairness, describing denying treatment for the elderly as "really unfair and cruel", and age-based decisions as "unfair" and "concerning", because "all humans need to be treated fairly" and "everyone deserves a fair go". Respondents noted that age-weighting "does not feel fair or in line with Australian values" and "it went against my morals to prioritise one person over another solely based on age". One summarised, "I cannot be the one to decide who should be given extra life

Table 3 Responses to attitudinal questions (both study arms)

	Frequency (%)
For medical care that improves quality of life temporarily	
Children should have priority	508 (24.3%)
Adults should have priority	253 (12.1%)
Priority should be the same regardless of age	1327 (63.5%)
For medical care that extends length of life	
Children should have priority	680 (32.7%)
Adults should have priority	254 (12.2%)
Priority should be the same regardless of age	1146 (55.1%)
If the Australian governments were willing to pay more for a treatment for children compared with adults which gave the identical health gain. What would you think?	
This would be fair because they are children	746 (35.6%)
I am not sure	680 (32.4%)
This would be unfair	672 (32.0%)
View on Medicare prioritisation	
Medicare should give priority to treating patients who will die young	130 (6.2%)
Medicare should give priority to treating patients who will get the largest amount of health benefit from treatment	487 (23.2%)
Medicare should give the same priority to treating all patients. Amount of health benefit and whether patients have had a short life is not relevant	794 (37.9%)
Medicare should base priority on a combination of treating patients who will get the largest amount of health benefit and treating those who will die young	393 (18.7%)
Unsure	178 (8.5%)
None of the above statements describes my views about Medicare prioritisation	115 (5.5%)

Respondents were asked “Which of these statements best reflects your views about prioritising different types of health care?”. Missing $n = 10$ and $n = 18$ for the first two questions, respectively. Missing $n = 1$ for the last question

when the choice is between two age groups, irrespective of the size of that group”.

3.7 Attitudinal Responses

Most respondents favoured equal treatment across ages in the attitudinal questions, especially for temporary quality-of-life improvements (see Table 3 and Table S2.9 in the Supplementary Material). Of those expressing a preference, more prioritised children.

When asked what they would think ‘if the Australian governments were willing to pay more for a treatment for children (aged 18 or under) compared to adults which gave the identical health gain’ responses were fairly evenly split between considering it fair, unfair or uncertain (see Table 3 and Table S2.10 in the Supplementary Material). Attitudinal responses varied significantly (based on chi-squared) by age, gender and parenthood status. Respondents with children (≤ 18 years) were more likely to prioritise children than those with older children or without children, for both life extension (41.1% versus 29.4% versus 30.2%, respectively) and quality-of-life improvements (33.7% versus 21.2% versus 21.1%). They were also more likely to consider it ‘fair’ to prioritise children (43.2% versus 31.9% versus 33.9%). Females were more likely than males to favour equal priority

for both life extension (60.6% versus 49.8%) and quality-of-life improvements (68.7% versus 58.4%).

Comparing the youngest (16–24 years) versus oldest (75+ years) respondents, 24.2% versus 51% agreed that ‘Medicare should give the same priority to treating all patients. Amount of health benefit and whether patients have had a short life is not relevant.’ Younger respondents were less likely to judge prioritising children as ‘unfair’ (18.9% versus 38.9%), and more likely to prioritise children for life-extending (44.3% versus 24.0%) and quality-of-life treatments (32.7% versus 20.7%). These differences remained significant after controlling for other demographic factors (see Table S3.1 in the Supplementary Material). Respondents in the forced arm were also more likely to support prioritising both adults and child groups, a finding discussed separately (data on file).

Respondents were asked to select a statement which best reflected their views about Medicare priorities. The most popular option (37.9%) was to ‘give the same priority to all patients regardless of the patients’ length of life or amount of health benefit from treatment’ (see Table 3 and Table S2.11 in the Supplementary Material). Multinomial logistic regression (Table S3.1 in the Supplementary Material) showed that this choice option was more common among older and female respondents. Those without a degree were less likely

to opt for prioritisation based on the size of health gain, while respondents with children under 19 years were more likely to support prioritising those who would otherwise die young.

3.8 Divergence Between PTO Responses and Attitudinal Responses

Over 46% of PTO responses diverged from related attitudinal responses (see S2.20 in the Supplementary Material). Divergence was greater for quality-of-life gains than life extension and higher in the forced arm. A regression examining divergence across the five PTO health gain types (see S2.21 in the Supplementary Material) found that respondents with children who had not experienced serious illness in their children were less likely to show divergence between PTO on quality-of-life gains and the respective attitudinal question. Other demographic factors showed no consistent pattern. Those in the forced arm were more likely to give divergent PTO questions when controlling for other design attributes and respondent characteristics.

4 Discussion

4.1 Summary of Our Results

PTO responses find that health gains to children and adolescents (aged 4–24 years) are weighted more highly, on average (based on RoMs), than similar gains to adults aged 40 or 55 years, with weights typically ranging from 1 to 1.3. However, life extensions for children aged 1 month or 2 years receive less weight than 40- or 55-year-olds. The pattern of age weights can be explained in part by considerations of productivity potential. The lower weight to gains for very young children suggests minimum support for fair innings.

Alternative measures of central tendency, such as geometric means and medians, yield similar results, but the differences between them caution against relying upon a single weight. The wider study also explored the reasons for respondent preferences and attitudes through qualitative work conducted alongside the survey. Additionally, we consulted with a sample of the public to understand their interpretation of the survey findings. These qualitative components are not the focus of this paper, but they helped inform our interpretation of the study results.

We find considerable diversity of viewpoint, with some respondents strongly preferring the younger ages, some strongly preferring the older age groups and some (based on free-text responses) strongly holding a view that age weighting is not appropriate. Findings to the attitudinal questions reinforce the diversity of views across the sample. In contrast to the pro-child average PTO findings, the attitudinal

questions find that most people think priority should be the same for the same health gain regardless of age, particularly so for quality-of-life improvements. Older and female respondents were more likely to opt for treating patients the same regardless of age, whereas younger respondents were more willing to prioritise based on age and health gain. Respondents with young children had the most pro-child attitudes.

4.2 Divergence Between Attitudinal and PTO Questions

While the difference between PTO and attitudinal questions was anticipated, the divergence observed here is notable. Over half of the PTO responses on quality-of-life gains were inconsistent with the related attitudinal question. Regression analysis found no association between these inconsistencies and factors such as education, age or whether respondents were born overseas. If the inconsistencies were driven by data quality issues, we would expect them to correlate with these factors, indicating that data quality is probably not the underlying cause. Four possible reasons for this are considered. Firstly, preferences may be more nuanced than the broad child versus adult categories used in attitudinal questions. Grouping children (≤ 18 years) and adults (19+ years) may mask differences within each group. For instance, some respondents may give less weight to infants but more to older children (as found in our PTO results), or less weight to elderly adults but more to those of working age.

Secondly, general statements may not engage respondents with difficult decisions. As Nord [10] noted, specific age numerical comparisons may encourage more reflective choices. Thirdly, general attitudinal statements may leave open many factors that respondents may wish to consider. The PTO keeps factors such as cost and carer impact constant. If respondents believe that prioritisation should consider individual circumstances, the lack of these constants when referring to ‘all adults’ and ‘all children’ may make choosing no age weighting seem a safer option. Finally, the PTO format prompts respondents to make a trade-off between groups, even when they may not have had a clear initial preference, thereby creating an implicit expectation that a decision must be made. This framing effect is stronger in the forced arm, as seen in the higher rate of inconsistent PTO responses. As Nord and colleagues noted, PTO questions may encourage respondents to focus on the numerical trade-offs and pay less attention to principles of equal entitlement to treatment [10]. Referencing Medicare in attitudinal questions may have led respondents to consider access to care at the point of need, or the access needs of people they know. Further insight into the inconsistency between attitudinal and PTO responses was gained through qualitative interviews and focus group discussions (data on file).

Baker et al. [26] propose a framework for analysing public views and exploring consensus drawing on Sunstein's concept of *incompletely theorized agreements* [27]. This framework categorises decision-making into three levels: (1) high-level principles or normative claims about how health resources should be allocated; (2) operational norms, tools and priority setting policies; and (3) specific treatment decisions for patient groups under constrained resources. Levels move down from the more abstract to the more specific. Consensus may occur at any level despite disagreement elsewhere, and coherence can be analysed by comparing principles with choices on policies and patient care.

This framework helps clarify our findings. The apparent agreement between responders on a PTO choice (e.g. favouring under 16-years-olds for pain alleviation) may stem from different underlying reasoning, as shown in the diverse justifications identified in the qualitative interviews and open-text responses. Likewise, agreement on general principles (best reflected in the attitudinal questions) may manifest in different response choices to the more specific PTO choice questions. For example, two respondents may agree that priority should focus on maximising quality-of-life gains across patients and their families but reach different assessments on which age group this would be. This framework encourages reflection on where agreement or consensus can be found.

Petrou argues for the need for both strong theoretical and empirical bases in support of any age weighting of QALY [28]. Drawing upon the Baker et al. framework, empirical findings may align to a theoretical prediction even when the underlying normative principles held by people differ. This would suggest that empirical evidence should extend to understanding motivations behind people's reported preferences. In healthcare policies with clear winners and losers, public consensus at only one level across the framework may lack sufficiently robust public support to achieve policy stability.

4.3 Democratic Interpretation and Policy Relevance

Devlin et al. [29] argue that aggregating public preferences to guide healthcare decision-making should align with democratic principles underlying publicly funded healthcare systems. They propose three criteria: (i) respect the majority view, (ii) equal weight for each person's preferences and (iii) ensure representativeness, minimising the exclusion of individual preferences.

The first criterion could mean confirming that a majority supports *any* age weighting of health outcomes before determining specific weights, or that a majority supports additional weighting for children's health gains before estimating this. PTO responses show that between 72% and 76% of respondents expressed a preference between child and adult ages depending upon the health gain type, whilst some

choosing 'no preference' might still support age weighting for other comparisons not presented to them. Although this may suggest majority support for age weighting, focus group feedback raised concerns about implicit framing, where respondents might assume that the study favours active choices between age groups simply by posing the question.

The second criterion is challenging, as no measures of central tendency equally weights every person's preferences; extreme views, for example, disproportionately impact the mean. PTO distributions show long tails on both sides (pro-adult and pro-child) with a prominent spike at a ratio of 1:1. While the median reflects the central view, it misses the slightly stronger pro-child views than pro-adult views. Since PTO values are capped at a 200:1 ratio, using the median is less justified. The geometric mean reduces sensitivity to positively skewed outliers but is still vulnerable to outliers below 1, making it no better than RoM, which remains our preferred measure.

The third criterion of representativeness could refer to different groups: the population, healthcare funders (taxpayers), users or future users, all of which may have different characteristics and importantly in this context a different age profile. Since the study's minimum age was 16 years, interests of those under 16 years are represented through respondents with altruistic or socially motivated preferences. Parents with young (≤ 18 years) children tend to prioritise children's health more, presenting a challenge for representativeness when some groups choose on the basis of personal (family/dependents) interests and others on altruistic motivations.

4.4 Comparisons with Related Literature

Our findings are broadly in line with those identified in the international review of PTO age weights [6], providing a more nuanced picture, particularly in relation to the weights for very young children where we find differences in weights by type of health gain. Comparisons with two Australian and one UK study are particularly relevant. Lancsar and Louviere [30] estimated Australian social value age weights using an online DCE, finding relative weights compared with adults (age 30–40 years) as follows: infants (0–12 months) 1.0725; child (1–12 years) 1.1065; teens (13–17 years) 1.1262; and young adult (18–29 years) 1.1122. All were statistically significant compared with adults, but not with each other. While the lower weight for infants is less pronounced than our PTO findings, the weight for childhood is similar.

Richardson et al. [13] estimated social value age weights for Australia on the basis of a relative social willingness to pay approach. Similar to our study, younger children (5-year-olds) are prioritised more for physical than mental health issues. For life extension in poor physical health, they found a weight of 1.185 for 10-year-olds versus 40-year-olds,

comparable to our estimate of 1.141 for a 5-year life extension (to full health) for the same age comparisons. For avoiding mental health issues, their 10- versus 40-year-old weight was 1.106, close to our 1.067.

The similarity of our findings to weights derived from DCE and relative social willingness to pay approaches suggests that our focus on age alone in the PTO did not inflate weights. Additionally, both studies also show minimal difference between weights for children and young adults.

Petrou et al. [3] conducted an online PTO survey with UK residents. For 5-year life extension in full health, they found lower weights for newborns compared with aged 40 years (0.74) and aged 55 years (0.64). Higher weights were reported for ages of 5, 10, 15, 20, and 25 years, ranging from 1.09 to 1.29, compared with age 40 years (peaking at age 10 years) and 1.3 to 1.89 compared with age 55 years (peaking at age 15 years). These UK weights are slightly higher than ours, possibly reflecting cultural differences. The higher weights may also stem from the absence of a 'no preference' option in their PTO questions, which we found can slightly raise child weights (data on file). A recent PTO study conducted in the Netherlands [31], which was not included in the systematic review [6], found that respondents were more willing to prioritise a 10-year-old child over adults their own age. The Netherlands study found greater pro-child preferences for extension of life than for improving quality of life. This contrasts with our findings which show little difference in type of gain at age 10 years, and stronger pro-child preference for quality of life than length of life extensions for children aged 4 years and younger. This difference may be in part due to the difference in the number of years of life extension considered: 2 and 5 years in our study but 20 years in the Netherlands study [31].

4.5 Limitations

As with any online survey, it is hard to gauge respondent concentration or ensure accurate interpretation of questions. Many dropped out before completing the compulsory 6-min video, which may affect representativeness but likely reduced responses from those rushing through the survey. Consistent patterns across data sub-groups (forced/unforced, interview/online sample) provide confidence in the data. Additionally, the higher weight for children when comparing with 55- versus 40-year-olds aligns with expectations.

Though the sample is large (2098 across both arms), each age comparison has a modest sample size and only two adult ages were included for comparison. On the basis of prior work [6], it would be reasonable to expect a comparison with an older adult age range to show stronger pro-child preferences. As such, the findings from the 55-year-old comparison may be more representative of 'adults' than those from the comparisons with 40-year-olds. We also only focus on

temporary extensions to years of life (2 and 5 years), and age weights for life-saving interventions, particularly for very young children, cannot be inferred from these findings.

The study aimed to create a choice scenario focussed solely on age differences by keeping all other variables constant. However, 65% of respondents indicated that factors intended as constant, such as potential long-term consequences for children, influenced their choices (Table 2). Identifying a pure age effect on prioritisation is challenging given the multiple interactions among age, likely patient gain from treatment and consequences to the patient's future and their family. Open text responses noted parents needing to take time off work as a reason behind favouring avoiding health problems in children, suggesting a risk of double counting if both child QALY weights and carer impacts are incorporated into HTA [32].

Furthermore, the abstract nature of the PTO question may have resulted in a more rational approach to program selection than would have been the case if the scenarios were described in a real-world context. The review exploring the evidence on the relative social value of children [6] found that most of the studies that reported a willingness to prioritise the youngest children were those in which a health condition or medical context was given—suggesting that our finding of lower weight to children aged 4 years and under may not hold where health conditions of very young children are made more explicit. Although this study, along with the findings from the 'think-aloud' component, sheds some light on the differences between attitudinal and more abstract numerical questions, it does not provide evidence on which view a decision-maker should give most consideration to.

While representative in terms of age, gender and education, the sample may not fully reflect marginalised groups, such as those from rural or low-income backgrounds. Fewer respondents spoke a language other than English at home compared with the national average. However, completing the survey in English may have influenced answers to this question. Within the qualitative companion work, several bilingual respondents who spoke multiple languages at home said they could have selected more than one category but mostly chose English. Recruitment via an online company may also have led to fewer culturally and linguistically diverse respondents. Generalisability to other countries may be limited.

4.6 What Is the Policy Message?

Our study provides little support for using a single weight to represent the social value of child versus adult health gains. The lower weight for some health gains for children under 4 years, variation in weights across different types of health gains, differences depending on whether the comparison was with adults aged 40 versus 55 years and similar weights for

older adolescents/young adults (18–24 years) and older children (4–18 years) all suggest that a simple ‘child’ versus ‘adult’ weighting is insufficient. Operationalising age-specific weights would add additional complexity and uncertainty, particularly in models with a lifetime horizon [30]. Moreover, significant disagreement on the acceptability, direction and size of age-based weights suggests that age weighting child QALY gains could be contentious. Some agencies, such as the NICE, have avoided age weighting owing to concerns about age discrimination [33], a concern shared by some of our respondents.

Furthermore, the relative social value of health gains between adults and children must be interpreted in the light of health state valuation, which can differ when adopting a child perspective compared with an adult perspective. Typically, higher utility values are observed for children, especially when applying the time trade-off method [34]. If differences in PTO responses reflect considerations of equity, these could be seen as independent considerations. However, if PTO responses are influenced by perceived differences in quality of life, for example, mobility problems being less impactful for infants, then the social value derived from PTO responses cannot be considered independently of health state preference elicitation, as doing so risks double counting. Alternatively, if people hesitate to trade off life years for children because a child’s year in full health is seen as more valuable than an adult’s, then applying child-specific QALY weights could allow comparisons of health gains across adults and children to be on a common social value scale.

4.7 Future Research

The lower weight for life extension at age 4 years and below compared with adults suggests limited support for the notion of ‘fair innings’. Understanding when fair-innings concerns do influence preferences and why improving equality in life expectancy does not more strongly drive decisions would help understand public support for interventions to reduce lifetime health inequalities. When asked about Medicare, the most popular choice of response was ‘Medicare should give the same priority to treating all patients. Amount of health benefit and whether patients have had a short life is not relevant’. It would be useful to see if alternative phrasing, such as ‘Medicare should give priority to treating patients who will die young’, or a response including the term ‘same’ e.g., ‘Medicare should give priority to patients to help achieve the same life expectancy for all’, would change the results.

5 Conclusions

The answer to the question ‘Are health gains to children more important than health gains to adults?’ is complex. In short, ‘it depends’. On average, there is support for weighting child QALY

gains above 1, but this cannot readily be used to support a simple ‘child versus adult’ decision rule: it depends on the child’s age (with most kinds of health gains to children below aged 4 years seemingly less important than those to adults), on the type of health gain and on the age of adults whose health gain is compared. Furthermore, underlying these average weights are highly polarised views: some members of the Australian general public are willing to strongly prioritise children, some strongly prioritise adults, some have no preference, and some even resent the question being asked. The strongest support for favouring health gains in children was found for pain alleviation, where all child age groups received a weight of at least 1.2 compared with adults aged 40 and 55 years. Operationalising a weight disaggregated by health attribute is unlikely to be workable in HTA and would interact with age-specific utility values. Furthermore, any application of age weights would run counter to the majority attitude that priority should not be based on age.

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Declarations

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process During the preparation of this work, the author(s) used ChatGPT to suggest edits to the text to reduce the word limit. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Conflicts of Interest T.P., N.D., R.V., R.N. and K.S. are members of the EuroQol group.

Ethical Approvals Ethical approval was granted by the University of Melbourne Human Ethics Committee (ref. no. 2023-24869-37630-4).

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