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Preference-Based Assessments

Exploration of the Reasons Why Health State Valuation Differs for Children Compared With Adults: A Mixed Methods Approach

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ABSTRACT

Objectives: Evidence comparing utilities for adults and children consistently report higher utility values for child health states. This study investigates the reasons why child health states are valued differently.

Methods: A total of 80 respondents (United Kingdom, Belgium, The Netherlands) participated in 1.5-hour face-to-face interviews. Respondents valued 4 health states from 2 perspectives (8-year-old child, 40-year-old adult) using visual analog scale and time trade-off. A total of 32 respondents participated in think-aloud interviews. Audio recordings were analyzed by 2 independent coders using NVIVO software. Statements, nodes, and themes were reviewed cyclically until consensus was reached.

Results: Qualitative results: a total of 5 themes were identified in the data regarding child and adult valuation—intergenerational responsibility and dependency (childhood is crucial for forming life skills based on new experiences; adulthood is an important time to take care of the family), staying alive is important (life is worth living even with impaired health-related quality of life (HRQoL), for children and adults), awareness of poor HRQoL and ability to make decisions (children have difficulties comprehending poor HRQoL and their parents make their healthcare decision; adults can assess their own HRQoL and decide for themselves), coping ability (children are flexible and resilient; adults have experience with dealing with difficulties), and practical organization of care (children are cared for by their parents; adults are able to organize and pay for care). Mixed methods: comparing qualitative statements with respondents' higher utilities for child health states confirmed concordance between results.

Conclusions: Quality-adjusted life-years are interpreted differently for children and adults. Child-specific value sets are needed to reflect society's preferences and to adequately conduct health technology assessment of pediatric treatments.

Keywords: child utilities, mixed methods, qualitative analysis, think-aloud, time trade-off.

VALUE HEALTH. 2022; 25(7):1185–1195

Introduction

Methods for valuing child and adolescent health populations have not been studied and developed to the same extent as methods for adults. A recent review identified several challenges and gaps in the research evidence regarding valuation research in these populations.[1] Published literature consistently reports higher utilities for child states (compared with adult states) valued by adult respondents with different valuation methods, including visual analog scale (VAS), composite time trade-off (TTO), discrete choice experiments (DCEs)-with-death, DCE-with-duration, lag-time-TTO, and a newly developed location-of-dead approach.[2,3] The higher utility values found in children may be considered rather counterintuitive because impaired health in children may be worse than similar states for adults. It is important to understand how these health states are interpreted and valued and why child health is valued differently from adult health, because the resulting value sets are used for priority setting. This study sets out to investigate why these differences occur.

No clear explanation has been formulated for the differences in child versus adult utility values: it is currently uncertain whether this outcome results from characteristics of the valuation methods or whether this reflects people's preferences for child health. The composite TTO methodology used in the EuroQol valuation protocol is the most commonly used valuation method to elicit preferences of the general public for different health states[1] and is used for estimating national value sets. One current hypothesis among researchers for TTO and DCE-with-duration methods is that adult respondents are reluctant to trade life-years for children, because they regard child life-years as being more valuable.[4] Such an effect may also be exacerbated by the 10-year life expectancy in the composite TTO scenarios. Nevertheless, methods with no time horizon (VAS) or a longer time horizon (eg, DCE-based methods) still produce higher values for children.[2] The

VAS valuation method with no time horizon has been shown to replicate the higher utility values for children in one study[3] and the opposite pattern in another.[5] It seems that the valuation method alone cannot be the only reason for the higher utility values for child states.

Evidence suggests that people consider nonhealth factors when valuing health states, as well as issues such as physical and psychological health. This includes the availability of care and support and the effect that poor health may have on other people.[6,7] These so-called conversion factors stem from the human development approach developed by Sen[8] (1992). Sen[8] described the process of combining available resources with conversion factors, to derive utility from these resources, with the ultimate aim of enjoying a long, healthy, and rewarding life. People have functionings and capabilities: functionings are things a person may value being or doing, such as being fed and sheltered, being healthy, having an education, and taking part in the community and on the labor market.[9] In contrast, capabilities represent the freedom to lead the life a person attaches importance to, including the freedom to seek healthcare, to attend school, and to work. Sen did recognize that people differ in their abilities to convert capabilities and functionings into wellbeing because of personal, social, or environmental conversion factors.[10] Personal conversion factors (age, sex, physical and mental condition, intelligence, ability to adapt, personal circumstances, etc), social conversion factors (public policies, societal hierarchy, available support, power relations related to sex or race, roles, cultural norms and values, etc), and environmental conversion factors (buildings, roads, climate, pollution, etc) affect the person's ability to use available resources toward their wellbeing.[11] These conversion factors are likely to have a different value, meaning, or interpretation for adults compared with children, and this may in turn lead to a different valuation of the same health state.

The perception of equity may also affect the valuation task. The "fair innings" concept is one such approach that is known to affect health state valuations.[12] Fair innings is the notion that everyone is entitled to live a long life in normal, average health. People either dying early or living in poor health have received less than what would be considered fair, whereas anyone getting more than this is "living on borrowed time." The fair innings argument may be able to explain the differences in health state valuation between adults and children. The quality of life (QOL) of a 60-year-old adult in moderate pain may be considered differently to a 6-year-old child in moderate pain because the child has enjoyed so few years up to this point (and that life has impaired health-related quality of life (HRQoL)).

This study is designed to explore whether the difference in utility values reflects societal preferences, given that the effect of valuation methodology on utilities is kept fixed and its effect has already been established elsewhere.[2,3,5]

Aims

This study set out to test whether child states have a higher valuation compared with adult states. It was designed to explore the thinking process of respondents when valuing health states for children and for adults and assess whether differences in utility values are an expression of society's preferences while keeping the valuation methodology constant (and equal to national valuation protocols). We explored this by using a mixed methods study design combining quantitative approaches, which included valuation tasks and qualitative approaches using think-aloud interviewing techniques.

Methods

Participants

Adult members of the general public (> 18 years of age) from Belgium, The Netherlands, and the United Kingdom were invited for a face-to-face interview. Participants were interviewed in French, Dutch, or English. Our study aimed to recruit 32 participants for the qualitative interviews, reflecting previous similar studies (eg, Karimi et al[7] 2017 [N = 21], Oliver[13] 2007 [N = 25], Ernstsson et al[14] 2020 [N = 20], Guest et al[15] 2006 [N = 6-12]).[7,13-16]

We aimed to enroll an additional 48 participants to complete the quantitative data collection only, to increase the power to find differences in valuation between adults and children. We calculated that our study was sufficiently powered to detect a 5-point difference in VAS valuations between adults and children with 80% power and 5% significance level, given that the sample size needed would be 79. For the TTO outcome, with this sample size and the same power and type 1 error, a difference in utility values between adults and children of 0.09 could be detected.

We used a convenience sampling approach, with participants recruited through advertisements in local newspapers, door-to-door ringing, and contacting acquaintances with a snowballing method to recruit further participants. Soft targets were set in terms of age and sex distribution and in the proportion of participants with and without parenting experience. Participants received €30 or £30 in cash or as a voucher for their participation.

Study Design

Participants completed a total of 16 valuation exercises that were performed on EQ-5D health states.[17] All participants valued 4 health states from 2 perspectives: participants were asked to imagine an 8-year-old child or a 40-year-old adult when valuing health states, in a random order. The 4 chosen health states were used in previous studies and showed large utility differences between adults and children,[2,5] and they had minimal conceptual differences in the dimension descriptions between child youth version of EQ-5D and adult 3-level version of EQ-5D (EQ-5D-3L). The selected health states described in function of the levels and the dimensions of the EQ-5D-3L descriptive system were as follows: mild 11221, moderate 22222, severe 23332, and worst 33333.

These 4 health states were valued both with the VAS and with composite TTO (referred to as TTO, which combines standard TTO with a 10-year time frame for states better than dead and a 10-year lead time health states valued worse than dead). Therefore, in total, respondents completed 16 tasks: 4 VAS followed by 4 TTO from the 40-year-old adult perspective (EQ-5D-3L) and 4 VAS followed by 4 TTO from the 8-year-old child perspective (EQ-5D-3L-youth version of EQ-5D). The order of the 4 health states presented within each set of VAS and TTO tasks was randomized, and the order of the perspectives (child or adult) was randomized as well. The EuroQol Portable Valuation Tool was used for the valuation.[18]

Interview Protocol

Participants completed demographic questions and the EQ-5D-3L. Five practice tasks were conducted, followed by the 8 valuation tasks from the first perspective and the 8 valuation tasks from the second perspective. Four interviewers received training in conducting TTO interviews with the EuroQol Portable Valuation Tool software and methodology. The standardized cyclic quality control process for TTO was followed.[19] All interviews ended with

debriefing questions, including asking respondents to rank the different dimensions of the EQ-5D, the viewpoint they were taking when valuing health states for a child or for an adult, their view on external factors influencing their responses, and how difficult the valuation tasks were. These questions can be consulted in Appendix 1 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2021.11.1377.

Participants in the qualitative interviews were encouraged to say aloud what their thinking process was when responding to the questions. They were encouraged to talk about the thoughts that they were having by saying everything that came to mind when completing the tasks. Interviewers stressed that there were no right or wrong answers and that the investigators were only interested in their opinions. A guide was developed for the interviewers to align on the interviewing technique and to avoid asking leading questions.

Data Analysis Process

All qualitative interviews were recorded, transcribed, and imported into NVIVO software. The transcriptions were reviewed in detail by 2 senior researchers (/ and M.J.) with an inductive approach,[20,21] which is appropriate when qualitative data have been collected specifically to answer a research question (as opposed to coding preexisting audio and visual material). An inductive approach is based on detailed readings of raw data to derive concepts, themes, or a model through interpretations made from the data by the researcher. This approach is data driven: every sentence in the transcriptions was examined for information that would capture something important in relation to our research questions. Coded fragments with similar content were assembled in nodes, and more nodes were created when new information was detected. Fragments could inform $>$ 1 topic. During the coding process, tentative names were given to the nodes, which were revised constantly as new nodes were added (to avoid overlap), merged (to cover the broadened topic), or split (to be more nuanced). The collection of nodes and the coded fragments that were attributed to them were reviewed cyclically to ensure that the coded fragments were as homogeneous as possible within a node and as heterogeneous as possible between nodes. This cyclical process ended when all transcripts were fully coded and reviewed by the 2 coders, and consensus was reached on which fragments were coded and to which node they were attributed. Nodes that clearly belonged to a common subject were grouped into themes, and names for the themes were formulated. Finally, a third team member (K.S.) then independently reviewed the codebook[22] (the collection of themes and nodes), the naming of the nodes, and the allocation of coded text fragments. Again, consensus was sought in the research team on the themes, nodes, and relationships between them, and diagrams were drawn to depict these relationships. The number of respondents and of coded fragments associated with each node in the codebook was reported to be transparent on the volume of available evidence, similar to reporting frequencies in quantitative analysis.

Quantitative analyses were conducted in SAS. Groups were compared with chi-square (categorical variables) and t tests (continuous variables). A generalized linear model was used for analyzing TTO responses, parameterized with main effects (for health state and for perspective) and interaction terms, a normal distribution and an identity link, taking into account that measurements from the same respondents are correlated. Contrast statements in SAS calculated the average difference in child and adult valuation of each health state. This model was estimated in SAS with proc GenMod and had the utility complement (1-utility value) as the dependent variable. Finally, qualitative and quantitative results were combined into a "mixed methods matrix"[23] to verify both the concordance and the discordance between the results.

This triangulation among different sets of results was done after both the quantitative and qualitative data sets had been analyzed separately. All qualitative data (coded fragments) belonging a topic were listed on the same page as the same respondent's qualitative data (TTO valuations), and statements on being more likely to give up life-years for children or adults were contrasted in a matrix with the actual number of life-years given up for children and adults during the TTO exercises. Concordance was defined as matching statements on giving up life-years and corresponding TTO results, whereas discordance was determined when statements on giving up more life-years were opposite to the results of the TTO valuation.

Results

Participants

A total of 78 participants completed the VAS and TTO tasks (2 participants had missing data), of whom 32 participated in the think-aloud interviews. The participants in the think-aloud interviews did not differ significantly on any of the observed background characteristic variables from the other respondents (Appendix Table S1 in Appendix 2 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2021.11.1377).

Qualitative Results

A total of 1221 pages of transcripts were reviewed and analyzed, resulting in 274 coded statements. Five main themes were developed and grouped into 2 meta-themes (Table 1). Each theme was independently mentioned in relation to the valuation of both child and adult health states, although with a different interpretation. Each of those themes are explained in detail below, together with the nodes belonging to the theme and some illustrative examples in Appendix 3 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2021.11.1377. The 2 meta-themes encompassed on the one hand axioms of life, that is, imperatives that are valid in life for all people and all families as general guiding rules when valuing people's health and HRQoL. This was labeled as "General Principles of the Value of Life" and included statements on the overall value and preciousness of life and on the intergenerational roles and responsibilities of people. All themes describing personal or family-specific circumstances were grouped in a meta-theme labeled "conversion factors."[8]

Meta-theme 1: general principles on the value of life

Theme 1: all lives are precious. Staying alive and living a long life were stated by all respondents to be of high importance. People reported difficulty in giving up life-years both for children and adults. Respondents stated that living a full life and experiencing all aspects of life are important, even when these experiences are difficult. People can feel love, connect with others, participate in life even when they have impaired HRQoL, and difficulties in life may result in important coping skills and overall life experience. Nevertheless, when health states are very severe and they cause a person to suffer a great deal physically or mentally, then QOL supersedes quantity of life and respondents were generally willing to trade a large amount of life-years. This theme was the only one of the 5 themes that did not have a different interpretation for adults and children: respondents gave similar statements on this subject, regardless of the person's stage in life. Examples of statements for each

Table 1. Codebook and frequency analysis.

Description of the node or theme	# respondents	# statements
General principles on the value of life	32	142
1. All lives are precious.	20	67
Staying alive is important.	13	29
Life is worth living even when moderately impaired.	12	19
Do not make people suffer through severe health states.	12	19
2. Intergenerational responsibility and dependency	27	75
Childhood are the foundation years for adulthood.	17	35
Children need to play and experience things in life.	10	21
Adulthood are the years for being a caretaker of the children.	6	8
Adults and the fair innings argument	8	11
Conversion factors	32	132
3. Awareness of one's own HRQoL and making decision	16	49
Children cannot compare good with poor health and take their HRQoL for what it is.	13	20
Children cannot decide for themselves and have their parents make healthcare decisions for them.	4	6
Adults are aware of their impairment and can compare their HRQoL.	6	11
Adults can decide themselves and have more control.	5	12
4. Coping and adapting	14	24
Children adapt more easily.	11	19
Adults adapt more easily.	4	5
5. Practical organization of care	21	59
Children receive help from caring parents.	15	20
Children's impaired QOL affects the parents.	4	6
Adults can organize or pay for help.	5	11
Adults' impaired QOL has a large impact on family and work.	13	22

# indicates number; HRQoL, health-related quality of life; QOL, quality of life.

node are presented in Box 1 in Appendix 3 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2021.11.1377.

Theme 2: intergenerational responsibility and dependency. This second theme highlights differences in the trade-off between QOL and length of life between children and adults. The argument is related to a "Circle of Life" reasoning: children and adults both have their roles and responsibilities in life, and they are dependent on each other. Childhood was considered to be a crucial period because these years form the foundation for later years in life. Children's roles focus on developing themselves and building a catalog of experiences that they will draw on later in life. Children are learning how to connect with other people and are forming social skills. Furthermore, they need to experience difficulties in life, because this will give them important tools and coping skills for facing difficulties later in adulthood. Therefore, these years were considered by respondents as being precious (Box 2 in Appendix 3 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2021.11.1377).

In parallel, adult life-years are an important time for taking on responsibilities in society and taking care of their family. The adults' role is to raise their children to become good adults, and they have the responsibility over their wellbeing. Respondents stated that adults' lives are also precious, because their poor health or absence would be felt by the children. Nevertheless, a fair innings argument was also put forward, stating that adults have already lived for many years and that fewer new experiences are made during this time period. Respondents considered it normal or acceptable that HRQoL goes down in adulthood, so they felt that it would be easier to give up life-years in adulthood, even though their lives were perceived as also being precious.

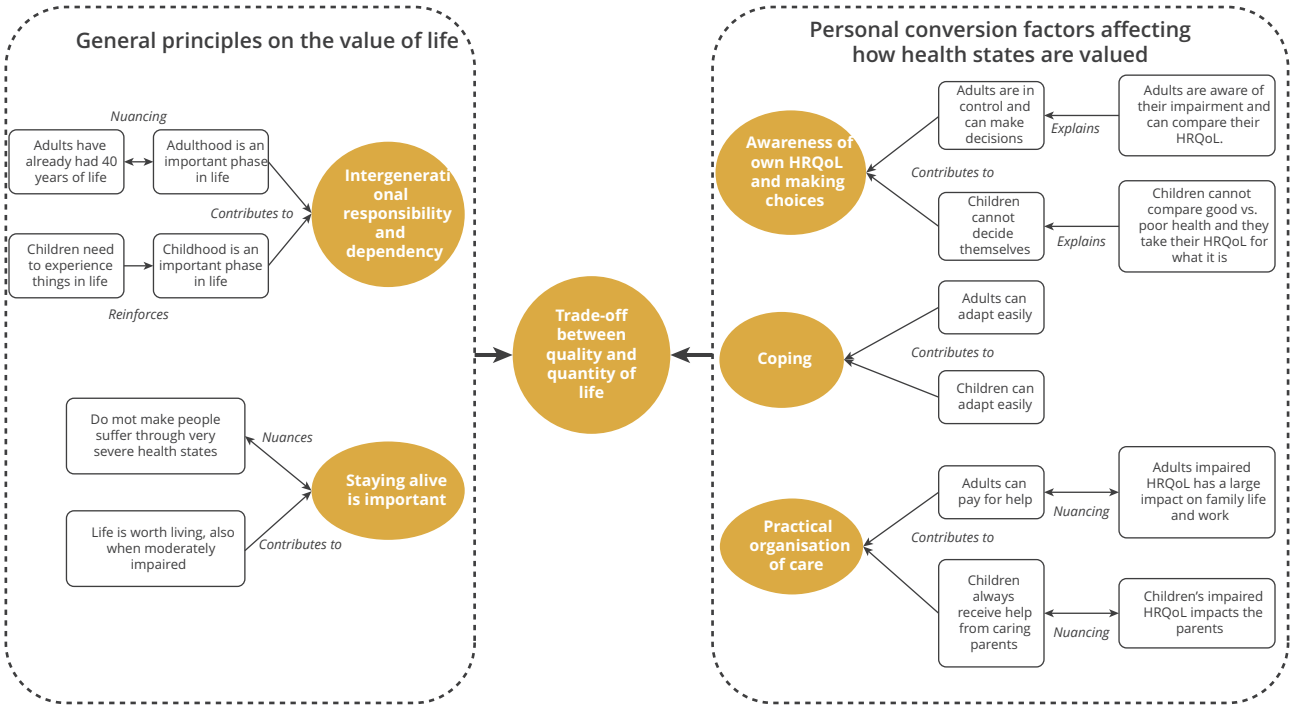
Meta-theme 2: conversion factors

The 3 themes presented below cover several personal conversion factors (ability to assess someone's HRQoL and the process of adapting and coping), social factors (adults' roles in society in making healthcare decisions and laws on labor for taking time off to care for someone), and environmental factors (availability of medical care and household help). Three themes emerged in both adult and child health state valuations: the ability to understand one's HRQoL and make healthcare decisions, adapting and coping with poor HRQoL, and the practical organization of care. These 3 themes differed between adults and children.

Theme 3: awareness of HRQoL and ability to make decisions. This theme covers people's ability to assess their HRQoL and acknowledges their competence and freedom to consider this in healthcare decisions. A clear distinction was made by the respondents in the interpretation of this theme between adults and children: given that children have had fewer experiences in life, they do not have a frame of reference to compare their own (ill) health with (Box 3 in Appendix 3 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2021.11.1377). They may be less aware of their impairment because they may be used to their own situation and normalize it and are therefore less able to make decisions concerning their health. Children are dependent on their parents for making decisions about their health for them.

In contrast, adults were perceived to be able to compare their own or their child's HRQoL with the HRQoL of their peers or with their own previous health. Because of their life experience, they are aware of their impairments and they can see the deterioration, and they can assess how to best spend their remaining life-years. Adults can better decide for themselves whether to continue living

Figure 1. Conceptual framework presenting the Circle of Life.



HRQoL indicates health-related quality of life.

life with their current health or whether to give up some life-years and trade these for a higher QOL. They can decide when their life has been satisfactory, and it is preferable for them to give up life-years. This theme reinforces the previous theme on intergenerational roles and responsibilities.

Theme 4: coping and adapting. The theme of coping and adapting was frequently mentioned in both child and adult health state valuations. Coping and adapting are personal conversion factors that will allow a person living a difficult situation to achieve a higher physical and mental HRQoL, by either modifying the current situation or revising expectations, which will allow them to cope with the situation.[24] Children were perceived by respondents to adapt easily to a difficult situation because they are flexible and resilient, partly because of their limited experience about what is good or poor health. Adults were also perceived to have the tools to adapt to impaired HRQoL thanks to their longer life experience during which they encountered other difficulties that they had to overcome (Box 4 in Appendix 3 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2021.11.1377).

Theme 5: practical organization of care. This third conversion factor deals with the practical considerations when a family member has impaired HRQoL (Box 5 in Appendix 3 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2021.11.1377). It spans social conversion factors (availability of a support network, availability of household help, accessibility of personal and social care, laws on the labor market, norms and values in society) and environmental factors (available healthcare services). These elements are instrumental in assisting parents and children with poor HRQoL to achieve the best level of HRQoL possible. This theme has a different interpretation for children and adults. Respondents stated that children are often assumed to be surrounded by loving parents who will help them, care for them, and assist them with adapting to their situation. When children are in poor health, then parents are the carers, which probably affects their QOL considerably. Emotionally parents suffer for their child, and materially it affects their work and daily life.

In contrast, when adults have impaired HRQoL, they do not automatically have other family members available who can care for them. Some adults can receive external assistance with their self-care or their daily tasks. When adults have impaired HRQoL, it has a large impact on everyone around them by affecting family life, their ability to take care of the family, and their ability to work and provide for their family.

In Figure 1 below, we have brought all the nodes, themes, and categories together in a conceptual model labeled the "Circle of Life." Arrows indicate the relationship between the nodes and the themes, labeled "Contributes to" (for nodes to indicate their explicative relationship to the theme), labeled "In contrast" (for nodes nuancing the statement in the node or theme preceding it), or labeled "Reinforces" (indicating that one node supports the statements from another node and perhaps even creates a causal relationship).

Quantitative Results

The quantitative results show overall higher utility values for children than for adults, for both VAS and TTO (Table 2). The TTO valuations were consistent with the results from the VAS results but were more pronounced. The generalized linear model revealed that significant differences were found between child and adult utility values at all severity levels (all $P < .001$), implying that fewer life-years were traded for a higher QOL when the health state referred to a child than when it referred to an adult. Overall, increasing severity of the health state was associated with a more marked difference in valuation for the child and the adult perspective.

Table 2. VAS and utility values from the child and the adult perspective.

EQ-5D-3L health state	Child		Adult		Difference (child − adult)		
	Mean	SD	Mean	SD	Mean	95% CI	*P* value
VAS							
11221	76.4	14.1	75.0	13.4	1.0	−2.5 to 4.5	.46
22222	54.4	16.3	52.8	14.7	1.5	−2.8 to 5.8	.39
23332	31.7	12.8	28.0	16.8	3.9	−0.2 to 8.0	.04
33333	14.9	11.1	9.8	9.0	5.2	2.9-7.5	.005
TTO							
11221	0.958	0.061	0.932	0.095	0.026	0.009-0.043	.0009
22222	0.855	0.221	0.741	0.322	0.112	0.051-0.174	.0002
23332	0.329	0.570	−0.043	0.669	0.377	0.242-0.512	<. 0001
33333	−0.117	0.700	−0.400	0.585	0.294	0.175-0.414	<. 0001

CI, confidence interval; EQ-5D-3L, 3-level version of EQ-5D; TTO, time trade-off; VAS, visual analog scale.

We also examined whether health state valuation differed between respondents with and without parenting experience. For the VAS, we found that parents valued child health states significantly higher than respondents without children. No difference in VAS values was observed between adult and child valuations among respondents without children. In the TTO analysis, no effect of parenting experience on utility values was found. Neither in the TTO nor in the VAS analysis was a country effect on the values found.

Mixed Methods

To assess the strength of our overall results, we combined the results from the quantitative analysis with the results from the qualitative interviews to evaluate either concordance or discordance in our findings (Table 3). Statements on the value of childhood as being the foundation years (eg, respondent 1: "The fact that you're actually being mentally and socially and psychologically formed, and taking that experience with you, is that, are those the most important years") and statements on adults' role in life to take care of their children (eg, respondent 1: "Because, of course, you have to take more things into account than when you are living alone or in a couple. And in that case, if you have children and a partner, that seems to me the most important thing, yes. As a phase of life.") were compared with the same respondents' TTO responses on the number of life-years traded (respondent 1: "2 and 3 more life-years given up for adults than for children for health states 22222 and 23332, but 0.5 life yeas less for 11221). Generally, a good concordance between the qualitative and quantitative results was found. Respondents found it harder to give up life-years for children than for adults because of the intergenerational roles and responsibilities, and therefore, utilities for children were generally higher than for adults.

Discussion

This study aimed to investigate and understand potential differences in child versus adult valuations of health. Our study confirmed existing evidence showing higher utilities for children than adults.[2,3] We developed a conceptual model to describe the relationship between themes and to explain commonalities and differences in child and adult valuation.

Child Life-Years Are Considered More Precious

Life-years for children are considered to be more precious than for adults, given that fewer life-years are being traded for the same increase in QOL. The intergenerational argument is key in understanding the differences between child and adult health state valuation. Although both adults' and children's lives are considered as being precious, the years in childhood are considered as being more important and fundamental for later years in life. The significance of adults' lives lies in their relationship with their children to raise them to become good adults. Once a person has grown into adulthood, the importance of their life and their good health is directed toward others (children), whereas the importance of children's life-years lies in their own lives. Children need to make sure that their childhood years are of high quality, that is, that they have a sufficient number of good and difficult experiences to become a "well-balanced" adult, who can then take his or her turn in the role of a parent and take up a role in society as well. Note that the question on whose life is more precious was not asked directly (indirectly 2 questions were asked about children and adults separately, and respondents indicated that all lives are precious). Another conclusion from this finding is that overall for children staying alive is most important, whereas for adults HRQoL is more important, the latter being in accordance with the fair innings argument.

A Child-Specific Value Set Is Warranted

This study also shows that the same health state has a different implication for adults compared with children. Indeed, different dimensions of the health state description (mobility, self-care, usual activities, pain or discomfort, anxiety or depression) have a different interpretation and weight when they refer to children. A consequence of this is that a different value set for children is warranted, giving a better reflection of people's preferences for child health states. The different interpretation of the dimensions will have an influence on the relative weights given to each dimension and to the associated levels. Overall the weights or disutilities will likely be smaller for child states, leading to higher overall utility values. Furthermore, like in the study of Karimi et al,[7] we observed that there are additional factors that are taken into consideration when valuing health states, such as the ability to cope, the availability of a caregiver, and the awareness of one's poor health. These dimensions are not included in the EQ-5D

Table 3. Mixed methods: comparison of respondent's statements on childhood or adulthood with their TTO valuations.

ID	Statements related to "childhood are the foundation years for adulthood"	Difference in number of traded life-years (child − adult)			
		11221	22222	23332	33333
1	Because, because, the younger you are, the more logically you want to have a meaning in life, to have more experiences, and to accomplish even more things. And after a certain age you've already accomplished it. And then it's easy to say: okay.	*−0.5*	**2**	**3**	0
	The fact that you're actually being mentally and socially and psychologically formed, and taking that experience with you, is that, are those the most important years, yes.				
2	Because that's for a kid, if that's after that, yeah, to miss all those years of your childhood, yeah, I think that's a very long time.0.15	**1.5**	*−1*	**10**	0
3	Yeah, 10 years in childhood, just because those are important years. I think it's a lot to miss out on.	0	**3**	**10**	**7**
4	I think in all cases, I would say that the life of the child is a life worth living and that more years are more of a life worth living.	0	0	0	0
5	I think people develop at different stages and stuff, but I think missing all the teenage years, 10 to 18, would impact their resumed life so much that you would not trade-off too much.	*−0.5*	0	**2**	**7.5**
6	Childhood is the most important phase in life, because it is the foundation	**0.5**	**4.5**	**2**	**13**
	I'm just thinking, it's also entirely up to the children's education. If a child is raised well, then that can indeed be a very good basis, but only then.				
	It is always difficult to take years of life away from children. I think it's more because you just do not want to. You never want to take years away from children, only you have to be careful not to end up in selfishness, you always have to assume what is best for the child. I think that's a very important one. Seeing a child suffer is terrible.				
7	Because it's a very important phase in life. And you just shouldn't leave years in between when it's doable.	0	0	**15**	**3**
8	You've built up so much in your life, that's normally the period in which you build up most things in your life,	**0.5**	**1**	**1**	0
	Yeah, I find it very difficult to give up years of life for anything, say, to talk about that…				
	I just find it very difficult to give up years of life for anything.				
	They're important years in your life, I think, between your… Until you were 18.				
	Your puberty are important years, so to speak, in your youth, in which you can build up a lot of things.				
	Yeah. You live from the age of 8 to the age of 18 in full health. Then you skip 10 years. I think that's less important, those 10 years after 18, because of course you learn a lot more in those years from 8 to 10. So, then I would choose to give up those years to have a normal life after that.				
9	I find it (the decision) a little easier in that sense because I think it really is a very crucial phase for children. So, I'm less willing to trade a year for it.	0	**0.5**	0	**1**

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Table 3. Continued

ID	Statements related to "childhood are the foundation years for adulthood"	Difference in number of traded life-years (child − adult)			
		11221	22222	23332	33333
	Yes, it's a period where you develop a lot and that's a bit less with adults. Of course, it still is, but on a completely different level or so. I do not know, with children it's just a bit more fundamental yes. That's why I'm less willing to give up something.				
	That I'm less willing to give up years of childhood than I am with adults. Yeah, from a developmental perspective, I think I agree,				
10	Between 12 and 18 is one of the most significant parts of a person's life, where they go through the difference of potentially being a child or just starting to become an adult to actually being an adult.	0	*−0.5*	**8**	**16.5**
11	A child between 12-18… It's an important time.	0	*−1*	**2**	**6**
12	A child is younger at the time. And that's why… that's a very nice phase in your life. And that it's better to live a year longer with a little… eventually only problems than a year shorter in perfect conditions. Yeah, that's my logic. I think that's the period that you live most intensely and everything is still new and… yes, all the experiences, the smells, what you see, what you hear, what you experience, comes in a lot more.	0	*−1*	**10**	0
	And when you have had a great childhood, it also ensures that as an adult you have a better chance to be a happy person. While, if you have had a difficult or violent or turbulent childhood, it is at that moment of course very bad, but that also extends into adulthood. You not only experience it more intensely but it also has consequences for your later life. It's a double…				
13	I think you're developing. There's a lot of critical development going on in your childhood life-years. So, if we assume that that's all missed out and you end up with a kind of half-baked adult because they've not been able to– then those are clearly vital years from that point of view. So, they're at a developmental step that we cannot really skip.	**1**	0	**3**	0
14	I do not think the level of pain or discomfort or the issues would severely affect a child who moves through the teenage years to 18. I think it's, those years there's always turbulence. Different issues with a lot of different people. So, in a time of change, I do not think this would warrant losing any life.	0	**1.5**	**2**	**10.5**
	Yeah, I would say I'd be more likely to trade-off adult years over the child years. I think that we're at the age where the child is moving through, there's still a lot of experiences to learn things anew.				
15	Childhood are such formative, changing years that to miss out on those, I feel you would feel a real loss with that as well.	**0.5**	**1**	*−3*	**2**
	I just think that "some problems" is something that– and a bit of sadness, to not have all the other things that you can have at those ages when so many other things are going on. Trading just isn't worth it really. So much changes in those years. And I think you get so much value out of those years from other things as well.				
16	So 13-18 are pretty important years, I think, in someone's life.	0	**1**	*−1*	**4**

continued on next page

Table 3. Continued

ID	Statements related to "childhood are the foundation years for adulthood"	Difference in number of traded life-years (child − adult)			
		11221	22222	23332	33333
17	Because children have a different vision of life… they are much younger, then you have a different thought than in adults. With children you hope they stay alive as long as possible and you think differently, I think, than with adults.	**1**	**2**	0	**1**
	I think children should live as long as possible because they are so young and still get the most out of their lives, I think.				

ID	Statements related to "adulthood are the years for being a caretaker of the children"	Difference in number of traded life-years (child − adult)			
		11221	22222	23332	33333
1	Because, of course, you have to take more things into account than when you are living alone or in a couple. And in that case, if you have children and a partner, that seems to me the most important thing, yes. As a phase of life.	*−0.5*	**2**	**3**	0
2	But then you have to decide based on the fact that your absence would be felt by your family, which is–except your presence is very much felt and a burden. So, which is better?	**1.5**	**1**	**1**	*−1*
3	Me as an adult I don't want to miss too much of life	**0**	**3**	**10**	**7**
4	Yes, so here you can say between 40 and 50 so to speak, is a phase where you can do a lot with your family with children and so on.	0	**0.5**	0	**1**
	Yes, I still choose B. Has to do with the fact that in that period 40 to 50, I think, is quite a crucial period in your life in which a lot still happens. Maybe that person also has children or something like that, I do not know and to give up 3 years of life, I think of wow then you miss quite a lot.				
5	Yeah. You have to be in good shape to raise your child, right?	0	*−1.5*	0	0
6	I think they're both just really horrible situations, aren't they? Just being absent from the family–especially when you've got young kids.	**0.5**	**1**	*−3*	2

Note. Differences in utility values consistent with the respondents' statement are in bold; inconsistent differences are in italics.
ID indicates identification document; TTO, time trade-off; VAS, visual analog scale.

descriptive system, which strengthens the relevance of developing bolt-on dimensions to the EQ-5D.

Assessing the Cost-Effectiveness of Pediatric Treatments

Higher utility values for child health states will undeniably have consequences for the reimbursement of pediatric treatments, and this may be in either direction. For purely lifesaving or life-extending interventions, this will lead to a higher incremental quality-adjusted life-year (QALY) compared with adults (given that the saved life-years will be valued at a higher tariff) and therefore a new treatment being found more cost-effective for children. Nevertheless, for QOL-improving interventions, the opposite may happen: bringing a child from poor to good health will generate a lower incremental QALY than would be the case for adults. This is due to value compression: the range of utilities for children is smaller than for adults. Although the values of full health (1) and of dead (0) remain anchored, all the other values are squeezed toward the upper end of the utility scale. In our study, the worst health state (33333, the lowest level in each dimension) is −0.12 for children and −0.40 for adults, effectively reducing the child utility range by 20%. Valuing a poor health state at a higher utility reduces the scope for improvement in HRQoL. This effect may in part be offset when the smaller QALY changes for children are applied to a longer time horizon in a lifetime analysis, although the effect of QALY improvements far in the future are heavily discounted. Most interventions have the aim to bring patients in better or full health without having an impact on mortality; other interventions have a combination of lifesaving and HRQoL-improving effect, and the impact on the incremental cost-effectiveness ratio will depend on the relative size of each effect.

Furthermore, using higher utilities for children with the same cost-effectiveness threshold used to assess health technologies for adults may also have unintended consequences for the health economic evaluation of pediatric medicines. Indeed, several factors are at play and the relative effect of each (value of the utilities, time horizon, discounting, type of intervention) will vary on a

case-by-case basis, and ceteris paribus the higher utilities in combination with the same cost-effectiveness threshold may lead to decisions of not reimbursing treatments that society would like to reimburse. This poses a challenge for fair resource allocation when adult and child healthcare are funded from the same budget. This raises the question whether a separate cost-effectiveness threshold for children might be appropriate. Applying a subgroup-specific cost-effectiveness threshold is not new; higher thresholds are already accepted for patients with high unmet need or for highly specialized technologies in orphan indications. The threshold reflects society's willingness to pay for additional gains in QALYs; if those life-years are of a different quality for children than for adults, then this may indeed make a case for a youth-specific cost-effectiveness threshold. An alternative may be to apply equity weighting in cost-effectiveness analysis, where the weights reflect the extent to which society is willing to forego overall health benefits to stimulate a more equitable distribution of these benefits among all subgroups (eg, groups defined by age).[25] Indeed, the higher utility weights for child states reflect the fact that society places a higher value on child health (and therefore treatments).[26] This would allow decision makers to use child-specific utilities to reflect what society values are important while keeping the same cost-effectiveness threshold as for adults and weigh child treatments according to the equity value society places on childhood.

Limitations

A few limitations of our study have to be addressed. First, we used a convenience sampling method, applied in study samples from a limited number of 3 western countries, which may question the generalizability of the study findings to other continents and cultures. Although the sample was balanced in terms of certain factors (age, sex, having children or not), other key factors that might have an impact on the study results were not accounted for in the sampling method (eg, socioeconomic background, parents living with children with impaired health), and views from respondents may differ from those from the general public. Some respondents might have experience with impaired health and having to cope with difficulties might have affected their valuation. Furthermore, it might be that not all thoughts were verbalized in the think-aloud technique and that opinions may change or further crystallize while respondents are verbalizing their thoughts. In our study, we have also put a lot of focus on adults as parents and their role in the "Circle of Life" of raising children. The role of adults without parenting experience could be further investigated. Finally, this study is focused on adult valuations of EQ-5D health states pertaining to children and adults and not on preferences of children or adolescents. Only adults were invited to participate, given that the conventional view is that adults are taxpayers and hence the payers of healthcare policy. It is accepted in national valuation protocols (among others also in Belgium, The Netherlands, and the United Kingdom where this study was conducted) that adults should be assessing health states used for utility calculations.

Conclusions

Our study showed that the QOL aspects taken into consideration when valuing child or adult health states are similar, but they have a different interpretation. This leads to different utility values for children compared with adults. Intergenerational responsibility is key in understanding child health state valuation. Child-specific value sets are required to correctly reflect society's preferences for child health states. It was found that the QALY has a different interpretation for children compared with adults; therefore, society's willingness to pay for additional childhood life-years may also be different. A youth-specific cost-effectiveness threshold or equity weighting may be required to adequately fund access to healthcare for children.

Supplemental Materials

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.jval.2021.11.1377.

Article and Author Information

Accepted for Publication: November 19, 2021

Published Online: February 26, 2022

doi: https://doi.org/10.1016/j.jval.2021.11.1377

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Conflict of Interest Disclosures: All authors reported receiving grants from EuroQol Research Foundation during the conduct of the study. Drs Janssen and Shah reported receiving grants from the EuroQol Research Foundation outside the submitted work. Dr Lloyd reported being a member of the EuroQol Group Executive Committee during the conduct of this study. No other disclosures were reported.

Funding/Support: This work was supported by grant EQ20180640 from the EuroQol Foundation.

Role of the Funder/Sponsor: The funder had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Acknowledgment: The authors thank the interviewers Nafthali Tollenaar, Zoe Wilson, and Sam McCall.

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