A comparison of adolescent and adult health state values for the Child Health Utility-9D using profile case best worst scaling

Running head: Adolescent versus adult values for the CHU-9D

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Abstract

The main objective of this study was to compare and contrast adolescent and adult values for the Child Health Utility-9D (CHU9D), a new generic preference based measure of health related quality of life designed for application in the economic evaluation of treatment and preventive programmes for children and adolescents. Previous studies have indicated that there may be systematic differences in adolescent and adult values for identical health states but have failed to use a common valuation technique. An on-line survey including a series of best worst scaling discrete choice experiment questions for health states defined by the CHU9D, was administered to two general population samples comprising adults and adolescents respectively. The results highlight potentially important age related differences in the values attached to CHU9D dimensions. Adults, in general, placed less weight upon impairments in mental health (worried, sad, annoyed) and more weight upon moderate to severe levels of pain relative to adolescents. The source of values (adults or adolescents) has important implications for economic evaluation and may impact significantly upon health care policy. Profile case best worst scaling offers a promising approach for the elicitation and comparison of health state values across population groups.

Background

Adolescence represents a developmental period of transition and is associated with more biological, psychological and social role changes than any other stage of life except infancy (Williams, 2002). Adolescence also represents a pivotal period of development in relation to health and the utilisation of health services since it is during this period that many positive health and negative health risk behaviours adopted into adulthood first become established. However, the recent National Health and Hospitals Reform Commission report for Australia noted that adolescent health is often ignored and young people often delay or avoid seeking medical help because adolescent health services are not 'youth-friendly' (National Health and Hospitals Reform Commission, 2009). This is a significant problem as expenditure on treatment programs and health services that are not used appropriately is wasteful of scarce health care resources.

Recently, there have been increasing calls from clinicians and health professionals for greater engagement of young people in the systematic measurement of adolescent health, identification of their health issues and the development of appropriate targeted intervention and preventive programmes to promote adolescent health (Sawyer *et al.*, 2012; Resnick *et al.*, 2012). The importance of adolescent health and the need to incorporate the views and preferences of adolescents into the measurement and valuation of health for the economic evaluation of adolescent health care treatment and preventive programmes is also increasingly being recognised within health economics (Petrou 2003; Griebsch *et al.*, 2005; Ungar, 2011). Despite this greater recognition, in practice little information is currently available about adolescents' preferences for different health states and the extent to which the preferences of adolescents may or may not diverge from those of adults. This is a significant omission because this information is important for informing the valuation of health benefits within the economic evaluation of adolescent health care treatment and preventive programmes

The Child Health Utility 9D [CHU9D], is a new paediatric generic preference based measure of health related quality of life, specifically designed for application within cost utility analyses of health care treatment and preventive programs targeted at young people (Stevens 2010; Stevens 2011). In contrast to other generic preference based measures of health related quality of life recently developed for application with adolescent populations, including the EQ-5DY (Wille *et al.*, 2010) and the AQOL-6D (Moodie *et al.*, 2010), which represent adaptations of existing instruments originally developed for adults, the CHU9D was developed from its inception with young people (Stevens, 2009) The dimensions included in the CHU9D were identified from in-depth qualitative interviews with young people with a variety of chronic and acute health problems which aimed to explore how their health affects their lives (Stevens 2009).

The CHU9D has 9 dimensions: worried, sad, pain, tired, annoyed, schoolwork, sleep, daily routine, ability to join in activities, with 5 different levels representing increasing levels of severity within each dimension. Whilst it was originally developed for use with younger children aged 7 to 11 years, several recent studies have demonstrated the practicality, face and construct validity of the CHU9D in older adolescent populations aged 11-17 years (Ratcliffe *et al.*, 2011; Stevens and Ratcliffe, 2011; Ratcliffe *et al.*, 2012A). The instrument is also currently being applied in a number of research programmes internationally focused upon the adolescent age group including the economic evaluation of new innovative adolescent treatment programs for type 1 diabetes, attention deficit hyperactivity disorder, mental health, obesity prevention and liver transplantation.

Although there is no accepted gold standard scaling method for eliciting health state values for the estimation of quality adjusted life years [QALYs], historically health economists have tended to favour the choice based valuation methods of standard gamble [SG] and time trade off [TTO] (Brazier *et al.*, 2007). Traditionally, both methods been applied to elicit health state values from adult populations. The original health state valuation algorithm for the CHU9D was generated from application of the standard gamble method with 300 members of the UK adult general population (Stevens, 2010A).

Recently, there have been several applications of ordinal methods to estimate health or quality of life state values (Ryan *et al.*, 2005; Coast *et al.*, 2008; Ratcliffe *et al.*, 2012, Bansback *et al.*, 2012). Ordinal methods have been advocated due to their relative ease of comprehension and administration and greater reliability corresponding to reduced measurement error (Craig *et al.*, 2009). DCEs have their theoretical basis in random utility theory which relates the probability of choosing a particular item in preference to other items to the unobserved cardinal utility, or total benefit, associated with each health state. DCEs are usually operationalised within a conditional logistic regression model that relates the mean utility for a given item (in this case health state) to a set of explanatory variables (McFadden, 1973). Profile case best worst scaling [BWS] is a particular form of DCE which involves the presentation of individual health or quality of life states (or profiles) presented one at a time and requires respondents to make choices within, rather than between states. Specifically, the respondent is asked to indicate the best and worst attribute of the health state under consideration (Flynn *et al.*, 2007; Flynn *et al.*, 2008A). As such, BWS is potentially an easier task than a traditional multi-profile DCE task and therefore offers an attractive option for health state valuation exercises with more vulnerable population groups including adolescents and older people (Flynn, 2010; Ratcliffe et al. 2011). The approach has recently been successfully applied in a number of studies including the development of scoring algorithms for the ICECAP-O capability index for older people and the Carer Experience Scale (Coast *et al.*, 2008; Al Janabi *et al.*, 2010).

In an earlier study to generate an adolescent specific scoring algorithm for the CHU9D we noted the possibility of differences in adult and adolescent values for identical CHU9D health states, particularly relating to mental health impairments (Ratcliffe *et al.* 2012). However as the original scoring algorithm for the CHU9D was based on adult values generated using SG, (an alternative valuation method to that applied for the adolescent sample which was based upon BWS), it was not possible to rule out that the difference in findings may have been due to a method effect rather than a true difference in underlying values between adolescents and adults. The main objective of this study was therefore to apply an identical approach using profile case BWS methods to value a sample of health states described by the CHU9D with an adult sample and to compare and contrast the resulting estimated health state values with those previously derived from adolescents.

Methods

A web based survey was developed for administration to a community based sample of adults aged 18 years and above, recruited from an on-line panel company following invitation and informed consent to participate. The adult survey was identical to the adolescent survey with the exception that 'schoolwork' in the CHU9D descriptive system was replaced with 'work' in the adult version to make this dimension applicable for adult respondents.

The survey included three main sections. In Section A respondents were asked to complete the CHU9D instrument and an additional general health question with 5 response categories ranging from excellent to poor. Completion of the CHU9D at the outset helped to familiarise respondents with the wording, formatting and range of each of the 9 dimensions of the CHU9D prior to the profile case BWS task.

In Section B respondents were presented with a series of CHU9D health states and asked to indicate the best and worst attributes (dimension levels) for each health state. The full factorial generated 5^9 = 1,953,125 health states, representing practically far too many health states for presentation. A fractional factorial design was therefore employed to reduce the number of health states to a manageable number for the purposes of a web based survey whilst retaining maximum statistical efficiency for the estimation of model parameters. A fractional factorial that permitted the estimation of main effects, whilst maintaining the design properties of level balance and near orthogonality was generated in 50 health states (Burgess and Street, 2006). In common with other recent valuation studies of existing instruments complete orthogonality in the design was not possible due to the need to eliminate a small number of implausible health states (Louviere *et al.*, 2000; Burgess and Street, 2006). In order to promote participant completion rates and minimise error due to fatigue, the design was blocked into 5 versions so that each respondent was presented with a maximum of 10 health states for the CHU9D (Hensher *et al.*, 2005). The 10 CHU9D health states in each block were purposively chosen to include a range of mild, moderate and severe health states. Each health state description consisted of the 9 common dimensions of the CHU9D with different levels for each of the 10 health states presented. Respondents were asked to indicate the best and worst attribute levels of each health state.

The final section of the survey [Section C] elicited basic socio-demographic information including age, gender and additional questions relating to general health status and whether or not the respondent had a disability or long standing health condition. In the final section of the survey, participants were also asked to indicate how difficult they found the BWS DCE task was to complete on a scale from 1 to 4 where 1 indicates ‘not difficult’ and 4 indicates ‘very difficult’.

Data analysis

Firstly, the profile case BWS marginal choice frequencies were calculated as the number of times a particular attribute level was chosen as best (or worst) divided by how many times it was available to be chosen as best (or worst) within each survey version. Secondly, conditional logit regression models were estimated for the prediction of CHU9D health state values (Flynn *et al.*, 2008A; Marley *et al.*, 2008) Profile case BWS data were aggregated over best–worst pairs (which ‘sums to the margins’ of tables of all possible best-worst pairs) to estimate the attribute level utilities. Within a random utility framework, analysing choices implies that U_{iq}, the utility respondent q derives from choosing item i, is split into an explainable component (V_{iq}) and a random component (ε_{iq}).

Therefore the equation to be estimated was of the following form:

$$U_{iq} = V_{iq} + \varepsilon_{iq}$$

where $V_{iq} = \beta_{11}$ worried_not$_i$ + β_{12} worried_little$_i$ + β_{13} worried_bit$_i$ + β_{14} worried_quite$_i$ + β_{15} worried_very$_i$ + β_{21} sad_not$_i$ + β_{22} sad_little$_i$ + β_{23} sad_bit$_i$ + β_{24} sad_quite$_i$ + β_{25} sad_very$_i$ + β_{31} pain_not$_i$ + β_{32} pain_little$_i$ + β_{33} pain_bit$_i$ + β_{34} pain_quite$_i$ + β_{35} pain_very$_i$ + β_{41} tired_not$_i$ + β_{42} tired_little$_i$ + β_{43} tired_bit$_i$ + β_{44} tired_quite$_i$ + β_{45} tired_very$_i$ + β_{51} annoyed_not$_i$ + β_{52} annoyed_little$_i$ + β_{53} annoyed_bit$_i$ + β_{54} annoyed_quite$_i$ + β_{55} annoyed_very$_i$ + β_{61} schoolwork_not$_i$ + β_{62} schoolwork_little$_i$ + β_{63} schoolwork_bit$_i$ + β_{64} schoolwork_quite$_i$ + β_{65} schoolwork_very$_i$ + β_{71} sleep_not$_i$ + β_{72} sleep_little$_i$ + β_{73} sleep_bit$_i$ + β_{74} sleep_quite$_i$ + β_{75} sleep_very$_i$ + β_{81} routine_not$_i$ + β_{82} routine_little$_i$ + β_{83} routine_bit$_i$ + β_{84} routine_quite$_i$ + β_{85} routine_very$_i$ + β_{91} activities_not$_i$ + β_{92} activities_little$_i$ + β_{93} activities_bit$_i$ + β_{94} activities_quite$_i$ + β_{95} activities_very$_i$

Where β_{11} refers to the coefficient on the variable for attribute 1 level 1 (worried_not$_i$), β_{12} the coefficient on the variable for attribute 1 level 2 (worried_little$_i$) etc.

Assuming that the random components are distributed extreme value type 1 (EV1) enables choice data to be analysed using the conditional (multinomial) logit model:

$$P_{iq} = e^{\lambda v_{iq}} \Big/ \sum_{j \in C} e^{\lambda v_{jq}}$$

Where P_{iq} is the probability that respondent q chooses alternative i, j represents all the relevant alternatives in choice set C, and λ represents the EV1 scale parameter which is inversely proportional to the standard deviation of the random component $\sigma_{iq} = \pi\lambda^{-1}6^{-1/2}$

The estimates from the profile case BWS task were initially subjected to a linear transformation such that the best CHU9D health state was assigned the value 1 and the worst CHU9D or 'PITS' health state was assigned the value 0 (Coast *et al.*, 2008). However, in order for the BWS estimates to have QALY properties 0 must represent the death state, not the PITS state. One method for achieving this involves administering a traditional discrete choice experiment which varies length of life as an attribute (Flynn *et al.*, 2008). However, this would necessarily involve the presentation of many health states for valuation and a complex choice task. An alternative method involves rescaling the estimates onto the 0-1 QALY scale using the results from a second task involving a traditional choice based method. For consistency of methodology and to facilitate direct comparisons with the adolescent values, the existing adult general population value for the PITS health state from the UK adult general population scoring algorithm was utilised to re-scale the adult BWS estimates onto the QALY scale (Ratcliffe *et al*., 2012). The health state values generated from the adult sample were then compared with the values for identical health states previously generated from the adolescent sample.

Results

The completion rate for the adult survey was high with 600 (96%) of the total sample of consenting adult respondents [n=625] fully completing the survey. The characteristics of the adult and adolescent respondents are shown in Table 1. In comparison with the adolescent sample, a higher proportion of adult respondents [32%] indicated that they were living with a long standing illness or disability and a smaller proportion [37%] reported themselves as in excellent or very good general health.

The results from the estimation of marginal choice frequencies for best and worst attribute levels for the adult vs adolescent samples are presented in Table 2. Some similarities are evident in that for both samples (with the exception of the activities attribute with more equally spaced choice frequencies) the highest level for each attribute was much more likely to be chosen as the best feature overall. A similar pattern was observed for the worst marginal choice frequencies with the lowest level for each attribute being more likely to be chosen as the worst feature overall.

The results from the re-scaled conditional logit model to estimate part-worth utilities for all attribute levels on the QALY scale for each of the adult and adolescent samples are presented in Table 3. Re-anchoring the original conditional logit model estimates ensured that the PITS or most severe health state [555555555] value was identical to that generated by application of the existing UK adult scoring algorithm [0.33]. It can be seen that the highest level for the activities attribute, being able to join in with all activities today, exhibited the greatest impact upon utility for both adults and adolescents. The lowest level for the annoyed attribute, I feel very annoyed today, also exhibited the lowest impact upon utility for both samples. Figures 1 and 2 illustrate the results from the re-scaled conditional logit models for both the adult and adolescent samples presented in a graphical format. It can be seen that, in comparison to adolescents, adults tended to place a much greater weight on the absence of pain. There was also relatively more differentiation between the three middle levels for all attributes for the adult sample. In common with adolescents, adults also valued four of the five levels relating to the attribute activities relatively highly, with a large difference in value between the middle levels and the lowest level for this particular attribute, a unique pattern which was not apparent for any of the other CHU9D attributes.

Summing the utilities for each attribute level within each population groups enables estimation of adult and adolescent specific scoring algorithms. Application of the algorithms then generates the total utility for every possible health state defined by the CHU9D. Table 4 presents predicted values for a selection of CHU9D health state values grouped according to the more severe levels, levels 3-5, of the mental health, daily activities and physical health attributes. It can be seen that the most consistent difference in values is in relation to the mental health attributes of the CHU9D: worried, sad and annoyed. Application of the adolescent algorithm producing consistently lower mean values than the adult algorithm for identical CHU9D mental health impairment states with differences ranging between 0.038 and 0.043 on the 0-1 QALY scale. These results indicate that relative to adults, adolescents tend to place more weight upon the CHU9D attributes relating to mental health impairments. The highest difference in values is evident for the pain dimension of the CHU9D with adults tending to weight moderate to severe pain levels more highly than adolescents (a difference of 0.080 on the 0-1 QALY scale).

Table 5 compares the time taken to complete the survey and the level of difficulty indicated. The mean time taken to complete the survey was very similar for both adults and adolescents (adults: 14 minutes, adolescents: 13 minutes), although it is important to note that it was not possible to identify respondents who did not complete the survey in a single session. The vast majority of both the adult and adolescent responders indicated little or no difficulty completing the survey with only a small minority (4% of adolescents and 2% of adults) indicating a high level of difficulty.

Discussion

This study adds to a burgeoning literature indicating that BWS represents a practical and feasible methodology for the valuation of health states. One of the main strengths of our study is the utilisation of an identical methodology (both in terms of the elicitation method utilised and the presentation of CHU9D health states to be valued) thereby facilitating a direct comparison of adult and adolescent values for the CHU9D. The results highlight potentially important age related differences in the values attached to CHU9D dimensions. Adults, in general, appear to place less weight upon impairments in mental health (worried, sad, annoyed) and more weight upon moderate to severe levels of pain relative to adolescents. These findings may have important implications for economic evaluation, a point previously noted in a study which aimed to assess the cost effectiveness of treatments for adolescent depression (Norquist *et al*., 2008). The authors expressed concern that only health state values from adults were available to estimate QALYs for the depressed adolescents and these may represent an unreliable guide to the true benefits from treatment since adults tend to underestimate the impact of this condition (and the consequent treatment impact) upon the adolescent's health and quality of life. The findings from this study lend support to this proposition.

It is important that further research is conducted to assess the extent to which cost effectiveness studies which utilise health state values or utilities obtained from adults will likely reach incorrect conclusions about the adolescents' perceptions of the relative health benefits of alternative new adolescent treatment and service programs. The availability of both adult and adolescent values for the CHU9D instrument will facilitate further empirical investigation of this important issue.

The complexity and abstract nature of the choice tasks are increasingly being recognised as important disadvantages of the application of traditional choice based methods SG and TTO, for health state valuation. Both methods place a considerable cognitive burden on respondents who are required to evaluate a series of separate health states successively until the point of indifference is found. Ordinal approaches such as DCEs and BWS are computationally easier and our previous research has indicated that these methods are less burdensome than traditional choice based methods for the elicitation of health state values from adolescent populations (Ratcliffe *et al.,* 2011). However the main disadvantage of the application of ordinal methods within this context without a length of life attribute is that they are not anchored onto the 0-1 QALY scale required for use in economic evaluation. In this study we utilised the adult general population value for the most severe or PITS health state from the original SG generated scoring algorithm for the CHU9D to re-scale the profile case BWS estimates from both the adult and adolescent samples.

Recently, Brazier and colleagues have indicated that re-scaling BWS estimates using several health state values reflecting a range of health impairments (as opposed to a single value for the most severe or PITS state only) generated via a traditional TTO choice based method offers a potentially superior method for anchoring onto the 0-1 QALY scale (Brazier *et al*. 2011) which makes best use of the desirable properties of each elicitation technique and elicited data. Relative to TTO, BWS has the advantage that it is a cognitively simple task and the values generated are not affected by time preference. Conversely, TTO fully encapsulates the trade-off between quality and quantity of life. Combining the two methods may mean that large scale data collection using DCE or BWS can be undertaken inexpensively online and small scale TTO data can be collected by interview as its reliability in an online mode of administration may be questioned (Norman *et al.*, 2010).

Relative to its administration with adults, administration of TTO in adolescent samples presents additional problems due to the ethical difficulties associated with presentation of the concept of immediate death. However, a recently conducted study to obtain adolescent values for the AQOL-6D has indicated that a modified TTO task, whereby the concept of death was replaced by zero years in full health, in a sample of older adolescents may be practical and feasible and few of the participants exhibited difficulty with the notion of trading quantity and quality of life (Moodie *et al* 2010). Further research should be conducted to further explore new methods for converting modelled BWS values for a health state classification system onto the 0-1 QALY scale and their suitability for application in different population groups, including adolescents.

In summary, the findings from this study highlight potentially important age related differences in the values attached to CHU9D dimensions with adults, in general, appearing to place less weight upon impairments in mental health (worried, sad, annoyed) and more weight upon pain relative to adolescents. These findings may have important implications for the economic evaluation of adolescent treatment and service programmes. Profile case BWS offers a promising approach for the elicitation of health state values with both adults and adolescents and for the comparison of health state values across population groups.

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Table 1: Characteristics of respondents

Characteristic	Adolescents N=590	Adults N=600
Number of females (%)	268 (45.3)	309 (51.5)
Number of males (%)	322 (54.7)	291 (48.5)
Age range	11-17 years	18-70 years and over
Long standing health condition or disability		
Yes (%)	67 (11.4)	191 (32.0)
No (%)	523 (88.6)	409 (68.0)
Socio-economic status		
Low Family Affluence Scale (%)	57 (9.7)	
Medium Family Affluence Scale (%)	227 (38.5)	
High Family Affluence Scale (%)	306 (51.9)	
General health		
Excellent	145 (25)	40 (7.0)
Very Good	268 (45)	181 (30.0)
Good	129 (22)	216 (36.0)
Fair	39 (7)	130 (22.0)
Poor	9 (2)	33 (6.0)

Table 2: Marginal choice frequencies - best and worst

Attribute	Level	Adult		Adolescent	
		Best	Worst	Best	Wors
Worried	I don’t feel worried today	0.347	0.028	0.271	0.043
	I feel a little bit worried today	0.057	0.054	0.049	0.086
	I feel a bit worried today	0.048	0.052	0.054	0.088
	I feel quite worried today	0.044	0.163	0.056	0.135
	I feel very worried today	0.022	0.197	0.044	0.143
Sad	I don’t feel sad today	0.260	0.024	0.218	0.043
	I feel a little bit sad today	0.055	0.068	0.043	0.086
	I feel a bit sad today	0.052	0.083	0.051	0.115
	I feel quite sad today	0.033	0.154	0.040	0.131
	I feel very sad today	0.025	0.236	0.042	0.192
Pain	I don’t have any pain today	0.328	0.024	0.176	0.065
	I have a little bit of pain today	0.064	0.106	0.055	0.105
	I have a bit of pain today	0.050	0.123	0.059	0.112
	I have quite a lot of pain today	0.026	0.369	0.047	0.187
	I have a lot of pain today	0.021	0.379	0.041	0.182
Tired	I don’t feel tired today	0.268	0.035	0.200	0.065
	I feel a little bit tired today	0.133	0.073	0.127	0.116
	I feel a bit tired today	0.094	0.072	0.107	0.119
	I feel quite tired today	0.044	0.118	0.077	0.133
	I feel very tired today	0.041	0.137	0.074	0.145
Annoyed	I don’t feel annoyed today	0.148	0.034	0.144	0.074
	I feel a little bit annoyed today	0.038	0.060	0.051	0.111
	I feel a bit annoyed today	0.041	0.067	0.055	0.120
	I feel quite annoyed today	0.026	0.120	0.042	0.142
	I feel very annoyed today	0.018	0.114	0.044	0.118
School	I have no problems with my work today	0.314	0.030	0.287	0.086
	I have a few problems with my work today	0.034	0.048	0.051	0.127
	I have some problems with my work today	0.040	0.068	0.064	0.128
	I have many problems with my work today	0.022	0.148	0.038	0.197
	I can't do my work today	0.013	0.145	0.048	0.173
Sleep	Last night, I had no problems sleeping	0.336	0.052	0.243	0.059
	Last night, I had a few problems sleeping	0.043	0.131	0.048	0.100
	Last night, I had some problems sleeping	0.046	0.140	0.052	0.109
	Last night, I had many problems sleeping	0.023	0.285	0.033	0.176
	Last night, I couldn’t sleep at all	0.019	0.347	0.035	0.181
Daily	I have no problems with my daily routine	0.308	0.025	0.256	0.061
	I have a few problems with my daily routine	0.058	0.063	0.064	0.097
	I have some problems with my daily routine	0.040	0.077	0.058	0.098
	I have many problems with my daily routine	0.010	0.216	0.041	0.121
	I can’t do my daily routine today	0.029	0.178	0.045	0.108
Activities	I can join in with any activities today	0.418	0.015	0.393	0.042
	I can join in with most activities today	0.350	0.019	0.359	0.046
	I can join in with some activities today	0.223	0.018	0.277	0.053
	I can join in with a few activities today	0.289	0.022	0.328	0.054
	I can join in with no activities today	0.098	0.148	0.123	0.132

Table 3: Re-scaled conditional logit estimates*

CHU9D Attribute	Attribute Level	Adolescents	Adults
Worried	Level 1	0.129	0.123
	Level 2	0.062	0.073
	Level 3	0.060	0.069
	Level 4	0.048	0.050
	Level 5	0.043	0.038
Sad	Level 1	0.115	0.109
	Level 2	0.054	0.062
	Level 3	0.049	0.059
	Level 4	0.041	0.043
	Level 5	0.027	0.032
Annoyed	Level 1	0.090	0.120
	Level 2	0.045	0.063
	Level 3	0.044	0.058
	Level 4	0.021	0.020
	Level 5	0.017	0.017
Tired	Level 1	0.097	0.105
	Level 2	0.060	0.072
	Level 3	0.054	0.068
	Level 4	0.043	0.051
	Level 5	0.038	0.046
Pain	Level 1	0.072	0.080
	Level 2	0.036	0.052
	Level 3	0.034	0.052
	Level 4	0.026	0.040
	Level 5	0.032	0.038
Sleep	Level 1	0.115	0.107
	Level 2	0.045	0.062
	Level 3	0.048	0.059
	Level 4	0.026	0.044
	Level 5	0.034	0.043
Daily routine	Level 1	0.114	0.114
	Level 2	0.053	0.054
	Level 3	0.050	0.051
	Level 4	0.031	0.030
	Level 5	0.025	0.019
Schoolwork	Level 1	0.116	0.114
	Level 2	0.056	0.067
	Level 3	0.055	0.061
	Level 4	0.046	0.035
	Level 5	0.047	0.039
Activities	Level 1	0.153	0.127
	Level 2	0.146	0.118
	Level 3	0.129	0.106
	Level 4	0.134	0.106
	Level 5	0.066	0.057

***** Re-scaled such that the highest CHU9D health state, state 111111111, is equal to 1.00 and the lowest (PITS) CHU9D health state, state 555555555, is equal to 0.33, the corresponding PITS value from the adult SG algorithm

Figure 1: Adolescents BWS CHU9D utilities by attribute level

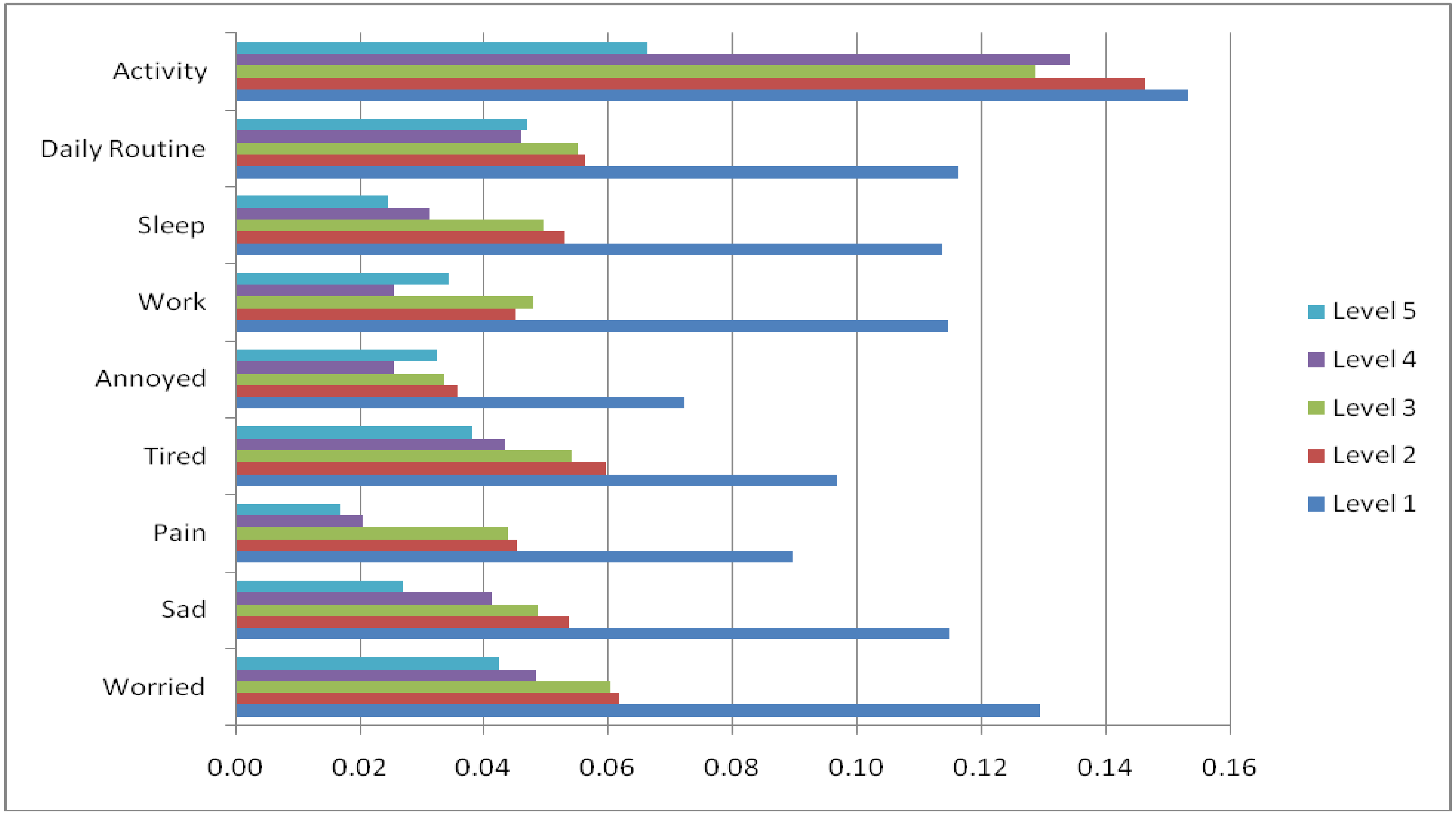

Figure 2: Adults BWS CHU9D utilities by attribute level

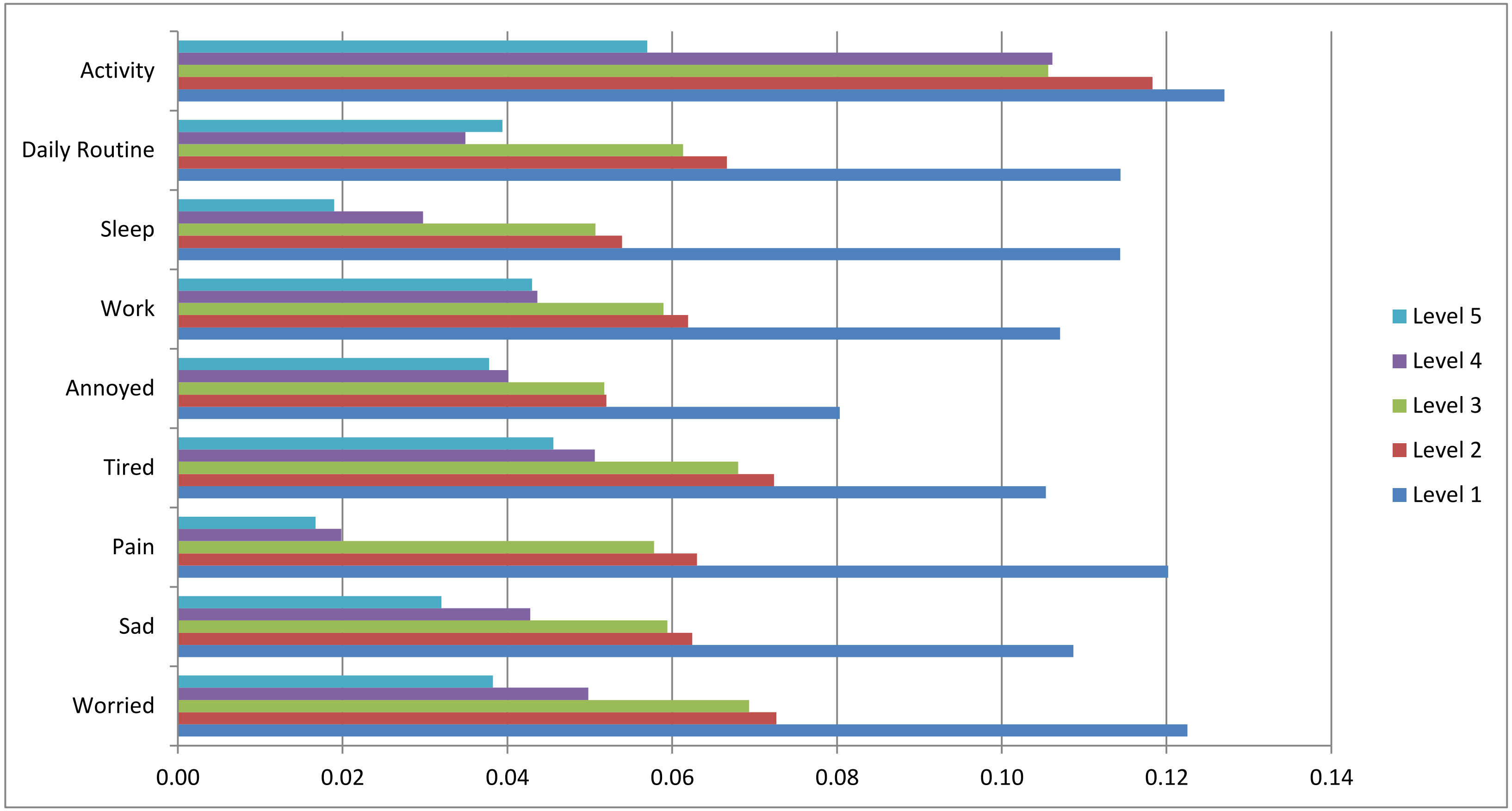

Table 4: Predicted health state values adult vs adolescent algorithm grouped by attributes at lower levels

CHU9D Health state	CHU9D attributes at lower levels	Adolescent BW value	Adult BW value	BW Adult - Adolescent BW
551151111 441141111 331141111	Worried, sad, annoyed[1]	0.753 0.777 0.819	0.796 0.821 0.857	0.043 0.044 0.038
111115155 111114144 111113133	Schoolwork, daily routine, activities[2]	0.755 0.828 0.850	0.791 0.836 0.878	0.036 0.008 0.028
115511511 114411411 113311311	Pain, tired, sleep[3]	0.821 0.811 0.852	0.741 0.760 0.837	-0.080 -0.051 -0.015

[1] Group of CHU9D health states reflecting lower levels of attributes relating to mental health

[2] Group of CHU9D health states reflecting lower levels of attributes relating to daily activities

[3] Group of CHU9D health states reflecting lower levels of attributes relating to physical health

Table 5: Time to complete and level of difficulty indicated for survey

Time to completion (mins)	***Adolescents Mean (SD)***	***Adults Mean (SD)***
	13 (37)	14 (35)
Level of difficulty	***Adolescents Frequency (%)***	***Adults Frequency (%)***
Not difficult	306 (52%)	404 (67%)
Slightly difficult	173 (29%)	118 (20%)
Moderately difficult	86 (15%)	64 (11%)
Very difficult	25 (4%)	14 (2%)