

# What does the Cantril Ladder measure in adolescence?

Joanna Mazur<sup>1</sup>, Monika Szkultecka-Dębek<sup>2</sup>, Anna Dzielska<sup>1</sup>, Mariola Drozd<sup>3</sup>,  
Agnieszka Małkowska-Szkućnik<sup>1</sup>

<sup>1</sup>Department of Child and Adolescent Health, Institute of Mother and Child, Warsaw, Poland

<sup>2</sup>Department of Dermatology, Military Institute of Medicine, Warsaw, Poland

<sup>3</sup>Department of Applied Pharmacy, Medical University of Lublin, Lublin, Poland

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**Corresponding author:**

Prof. Joanna Mazur MD, PhD

Department of Child

and Adolescent Health

Institute of Mother

and Child

17 a Kasprzaka St

01-211 Warsaw, Poland

Phone: +48 600 85 22 99

E-mail: jmazur2006@gazeta.pl

## Abstract

**Introduction:** The Cantril Scale (CS) is a simple visual scale which makes it possible to assess general life satisfaction. The result may depend on the health, living, and studying conditions, and quality of social relations. The objective of this study is to identify key factors influencing the CS score in Polish adolescents.

**Material and methods:** The survey comprised 1,423 parent-child pairs (54% girls; age range: 10–17; 67.3% urban inhabitants; 89.4% of parents were mothers). Linear and logistic models were estimated; the latter used alternative divisions into “satisfied” and “dissatisfied” with life. In addition to age and gender, child-reported KIDSCREEN-52 quality of life indexes were taken into account, along with some information provided by parents – child physical (CSHCN) and mental (SDQ) health, and family socio-economic conditions.

**Results:** According to the linear model, nine independent predictors, including six dimensions of KIDSCREEN-52, explain 47.2% of the variability of life satisfaction on the Cantril Scale. Self-perception was found to have a dominating influence ( $\Delta R^2 = 0.301$ ,  $p < 0.001$ ). Important CS predictors also included Psychological Well-being ( $\Delta R^2 = 0.088$ ,  $p < 0.001$ ) and Parent Relations ( $\Delta R^2 = 0.041$ ,  $p < 0.001$ ). The impact of socioeconomic factors was more visible in boys and in older adolescents. According to logistic models, the key factors enhancing the chance of higher life satisfaction are Moods and Emotions (cut-off point CS > 5) and School Environment (CS > 8 points). None of the models indicated a relationship between the CS and physical health.

**Conclusions:** The Cantril Scale can be considered a useful measurement tool in a broad approach to psychosocial adolescent health.

**Key words:** life satisfaction, mental health, quality of life, social determinants, adolescents.

## Introduction

Quality of life (QoL) measurements present a challenge for researchers due to, among other factors, their subjectivity [1]. Even in the adult population it is not easy to maintain an objective approach when providing answers to QoL questionnaires. For 50 years the Cantril Scale (CS) has been cited as being an effective tool for measuring general well-being, mental health and happiness. The administration of the Cantril Ladder is simple, and does not require a major investment of time for either respondent or interviewer. This self-anchoring, one-item scale is helpful

in describing the cognitive aspects of well-being in various age groups [2].

The popularity of the CS rose significantly following its use in Gallup's World Poll. The cyclical HBSC (*Health Behaviour in School-aged Children*) surveys also use the Cantril Scale. Starting in 2002, results of four consecutive HBSC surveys have been subjected to a series of international comparisons [3] and trend analysis [4] studies via an adapted CS. The CS has also been used to measure factors affecting adolescent subjective health determinants [5, 6]. Additionally, it has been used in clinical trials where QoL assessments affect final outcome, and has proven an important tool for use where short and succinct questionnaires for respondents are needed [7]. The CS is sometimes used to evaluate the validity of both newly designed and adapted research tools [8]. The popularity of the scale stems from its "friendly" design and graphical representation. Similar devices have been used to evaluate self-esteem [9] and/or subjective social status assessment [10].

Despite growing popularity, there are few validation studies focusing on age-related issues, especially as concerns younger respondents. A 2014 article by Levin and Currie is unique. It sums up the results of 7 Scottish studies spanning 2008 to 2010 [2]. The study showed good convergent validity and reliability, positively comparing the CS and a range of other well-respected tools used to identify mental health problems.

The low level of life satisfaction in Polish adolescents is a major public health problem. In light of the cited HBSC surveys, Poland has been constantly ranked at the bottom of international lists of more than 40 countries [11]. Interpretation of data becomes even more difficult when there is evidence that children and adolescents might have difficulty understanding the nature of the questions [12]. Previously, the CS has been used to explain variables seen in more complex profiles of life satisfaction [13]. The basic aim of this paper is to examine the reverse relationship, i.e. to identify which dimensions of the full KIDSCREEN questionnaire have the strongest impact on life satisfaction in children and adolescents. The question is whether or not the set of optimal predictors will change according to gender and age of respondents.

## Material and methods

### Participants

Data were collected in 2003 on a sample of 1,718 families as part of the international KIDSCREEN project funded by the European Commission to produce the first generic European QoL instrument for 8- to 18-year-olds. In Poland, postal addresses were collected in 132 school class-

es, and randomly selected in 7/16 administrative regions. A child and one parent completed the questionnaires at home and returned them to the national center. After two reminders, the 74% response rate was achieved.

For the purpose of the below analyses, 1,423 child-parent couples were selected (Table I) with the criteria of the narrowed child age group (10–17 years) and non-missing data according to the main outcome. The sample size in each of ten age groups ranged from 170 to 183, and the mean age was 13.51 ±2.30 years. Girls comprised 54%, urban inhabitants 67.3%, and 19.2% came from relatively low social classes (Table I). The most frequent adult respondent was the mother of the child (89.4%), compared to 9.7% fathers, and 0.9% "others".

### Variables

As the main dependent variable, the Cantril score was selected. It is derived from Cantril's Self-Anchoring Ladder of Life Satisfaction in the adapted version applied in the HBSC study since 2001, and thereby tested many times in similar age groups. Pupils were presented with a vertical visual scale (ladder) numbered from 0 to 10, and the following statement was asked: "Here is a picture of a ladder. Suppose the top of the ladder represents the best possible life for you and the bottom of the ladder the worst possible life. Where on the ladder do you feel you stand at the present time?" On the basis of guidelines from the HBSC protocol ([www.hbsc.org](http://www.hbsc.org)) and related papers, three levels of life satisfaction were defined: low (0–6), average (7–8) and high (9–10). In addition to age and gender, 14 independent variables were included both from the child (10 variables) and parent (4 variables) questionnaires.

Child-reported KIDSCREEN-52 indexes were considered as the main predictors of life satisfaction. Answers were scored on a 5-point Likert scale ranging from 1 (never; not at all) to 5 (always; extremely). The 52 items are distributed into 10 dimensions: Physical Well-being, Psychological Well-being, Moods and Emotions, Self-Perception, Autonomy, Parent Relations and Home Life, Social Support and Peers, School Environment, Social Acceptance/Bullying, and Financial Resources. Scores were transformed into the range 0–100, with a high value indicating a better QoL. In our sample, standardized KIDSCREEN-52 scores varied from 56.9 ±20.1 (School Environment) to 87.4 ±17.3 (Social Acceptance).

Parents provided details of socioeconomic background as well as data on child physical and mental health using the CSHCN (*Children with Special Health Care Needs*) and SDQ (*Strengths and Difficulties*) questionnaires, respectively. The

**Table I.** Life satisfaction in relation to selected socio-economic factors and health status in Polish adolescents aged 10–17 years

Variable	Percentage	Cantril score		Cantril level		
		Mean	SD	Low N = 233	Average N = 820	High N = 370
Subjective family wealth:						
Poor	11.6	6.42	1.91	34.0	52.9	13.1
Average	81.2	7.39	1.76	14.6	59.0	26.4
Rich	7.2	7.86	1.72	7.8	52.9	39.3
P-value		< 0.001		< 0.001		
Socioeconomic status (social class):						
Unemployed	8.3	7.03	2.86	23.3	53.4	23.3
Working class	10.9	7.09	2.01	20.6	55.2	24.2
Middle class	77.9	7.41	1.74	14.3	58.8	26.9
Upper class	2.9	7.39	1.59	10.5	68.4	21.1
P-value		0.052		0.114		
CSHCN:						
Yes	14.3	6.96	1.89	19.5	61.0	19.5
No	85.7	7.37	1.78	15.6	57.8	26.6
P-value		0.004		0.075		
SDQ:						
Abnormal	7.6	6.32	2.03	38.2	48.1	13.7
Borderline	10.6	6.50	2.09	33.1	49.4	17.6
Normal	81.8	7.30	1.69	12.2	60.0	27.8
P-value		< 0.001		< 0.001		

CSHCN – Children with Special Health Care Needs Screener, SDQ – Strengths and Difficulties Questionnaire.

CSHCN is a US parent survey-based screening tool to identify children who have or are at increased risk for a chronic health condition [14]. It has three definitional domains: dependency on prescription medications; service use above that considered usual or routine; and functional limitations. The SDQ is a mental health screening tool containing 25 items indexed in five subscales: Emotional Symptoms, Conduct Problems, Hyperactivity-Inattention, Peer Problems, and Prosocial behavior; all but the last are summed to generate a total SDQ score [15]. Children were assigned to three categories: normal (score 0–13), borderline (score 14–16), and abnormal (score 17–40) ([www.sdqinfo.com](http://www.sdqinfo.com)).

In relation to socioeconomic background, two variables were applied: subjective family wealth and a more objective social class measure, based on parent or caregiver employment and educational level, with reference to sociological terminology of working and middle class. Both socioeconomic variables

were transformed to cumulative rank probabilities (ridit scores), which ranged from 0 to 1.

The basic characteristics of the sample are shown in the first column of Table I.

### Statistical analysis

We performed four sets of analyses. First, the mean Cantril score and percentages of high/low scores were compared in the subgroups of respondents using  $\chi^2$  and ANOVA tests. Second, Pearson’s correlation was calculated to test the simple association between CS and KIDSCREEN-52 dimensions. Third, a series of multiple linear regression models was used to find independent predictors of a CS continuous score in the total group and according to age and gender. Finally, two multivariate logistic regression models containing the same covariates were fitted. Two alternative cut-off points were considered, representing relatively high (6–10) and extremely high (9–10) life satisfaction. The results are presented

as an odds ratio (OR) with a 95% confidence interval (CI).

In all models the method of stepwise selection was applied and some goodness of fit statistics are shown –  $R^2$  (linear) and pseudo  $R^2$  (logistic model). Missing data were inputted only for KIDSCREEN-52 dimensions. Data were analyzed using SPSS 17 software.

**Results**

Adolescents assessed their life satisfaction as 7.31 ±1.81 points on average. The three levels of the CS included 16.4%, 57.6% and 26.0% of respondents, respectively (Table I). Taking into account the mean values, a significant deterioration was found in the older age group in comparison with the younger groups (7.62 ±1.81 vs. 7.00 ±1.76;  $p < 0.001$ ), while the gender-dependent difference was insignificant (boys 7.32 ±1.77 vs. girls 7.30 ±1.84;  $p = 0.899$ ).

The relationship between the CS and child health and family living conditions is shown in Table I. The relationship was strongest in the case of subjective assessment of family affluence and mental health.

A significant relationship between the CS index and all ten KIDSCREEN-52 dimensions was found

(Table II). Pearson’s correlation coefficients range from 0.229 (Social Acceptance) to 0.550 (Parent Relations and Home Life).

Table III shows the linear regression results in the total sample. Out of the 16 potential predictors of the general CS index, nine were included in the final model; together they explain 47.1% of the CS variability. The influence of Self-Perception was found to be dominant. Positive moods and relationship with the parents also have a strong impact on adolescent life satisfaction. The influence of material resources, school environment and mental health problems on CS was slightly lower. The last three factors included in Table III explain only 1.0% of the CS variability.

Table IV shows linear models specific for both genders and age groups. The variables shown in Table IV explain 50.0% of the CS index variability in boys and 46.4% in girls, while the set of optimal predictors is similar. Self-Perception comes first in both models, followed by Parent Relations and Psychological Well-being; only the order is different for each gender. Financial resources have more significance for boys, being the fourth CS predictor. In girls this factor did not qualify for the final model at all. Autonomy and Moods and Emotions were included in the key group of predictors only

**Table II.** Pearson correlation ( $r$ ) between Cantril score and KIDSCREEN-52 indices

KIDSCREEN-52 domain	Value of $r$	KIDSCREEN-52 domain	Value of $r$
Physical well-being	0.355**	Parent relations and home life	0.550**
Psychological well-being	0.541**	Peers and social support	0.351**
Moods and emotions	0.527**	School environment	0.466**
Self-perception	0.543**	Social acceptance	0.229**
Autonomy	0.369**	Financial resources	0.301**

\*\* $p < 0.001$

**Table III.** Significant predictors of Cantril score according to stepwise linear regression in total group ( $N = 1423$ )

Independent variables	Standardized $\beta$	$P$ -value	Change $R^2$
Self-perception*	0.226	< 0.001	0.301
Psychological well-being*	0.173	< 0.001	0.088
Parent relations and home life*	0.194	< 0.001	0.041
Financial resources*	0.075	0.001	0.013
School environment*	0.117	< 0.001	0.010
SDQ (1 – normal, 0 – above)	0.076	0.001	0.008
Perceived family wealth (ridit)	0.076	0.001	0.005
Moods and emotions*	0.075	0.013	0.003
Social class (ridit)	0.047	0.025	0.002
Total $R^2$			0.471

\*KIDSCREEN-52 dimensions, SDQ – Strengths and Difficulties Questionnaire.

**Table IV.** Significant predictors of Cantril score according to stepwise linear regression models specific for age and gender subgroups

Independent variable	Change in $R^2$			
	Gender		Age	
	Boys $N = 654$	Girls $N = 769$	10–13 years $N = 712$	14–17 years $N = 711$
Psychological well-being*	0.086	0.040	0.036	0.242
Moods and emotions*	0.005	–	0.009	–
Self-perception*	0.335	0.305	0.341	0.043
Autonomy*	0.004	–	–	–
Parent relations and home life*	0.032	0.083	0.097	0.083
School environment*	0.004	0.010	0.007	0.016
Financial resources*	0.026	–	–	0.007
SDQ	–	0.013	0.013	0.005
Perceived family wealth (ridit)	0.008	0.006	0.006	0.018
Social class (ridit)	–	0.005	–	0.006
Age	–	0.003	–	–
Total $R^2$	0.500	0.465	0.509	0.420

\*KIDSCREEN-52 dimensions, SDQ – Strengths and Difficulties Questionnaire.

in boys. Among girls, the influence of some variables reported by parents was noted, such as social class membership and objective assessment of child mental health condition according to the SDQ. In analyzing specific models for the two age groups (10–13 years vs. 14–17 years), significant differences were found. In the case of younger children, 7 factors explained 50.9% of the CS variability, while 8 factors explained 42.0% in the older group. Self-perception remains the main CS predictor only in the younger group. In adolescents above 13 years of age, self-perception came third in the CS predictor ranking; Psychological Well-being was dominant. The impact of the relationship with parents remained significant through the teenage years. However, the older group also showed a strong influence of the school environment. It should be pointed out that the model assessed for the older age group included three variables related to socioeconomic factors (total  $\Delta R^2 = 0.031$ ), but only one in the younger group ( $\Delta R^2 = 0.006$ ).

Linear regression models were estimated separately for healthy adolescents and for those experiencing health problems according to the CSHCN and the SDQ criteria (data not shown). Among adolescents with special health care needs, the influence of negative emotions was found to be dominant; relationships with parents, family affluence and school environment followed in the ranking of the CS predictors, while self-image came fifth. The estimated models for adolescents

whose results were within the norm and outside the norm according to the Strengths and Difficulties Questionnaire (SDQ) were not as different. In both, self-perception was found to be dominant.

Table V shows the results of two logistic models indicating factors that increase the chances of relatively high (> 5 points) and definitely positive (> 8 points) life satisfaction. A strong influence of the three factors which proved to be the most important in the linear model (Self-Perception, Parent Relations, Psychological Well-being) was found in both. Nevertheless, neither came first. In the first model, the impact of the lack of negative emotions was dominant. In the second one, it was the positive perception of the school environment. The models differ in terms of the impact of socioeconomic factors. A positive change in living conditions will have a protective effect against finding oneself in the group of those definitely dissatisfied with life (Model 1), and will not have any impact on a very high CS score (Model 2).

## Discussion

The goal of this study was to find an optimal set of predictors of general life satisfaction measured by the Cantril score in the sample of healthy adolescents. It was assumed that life satisfaction depends on good functioning in many areas, considering the current life situation, earlier experiences and expectations related to the future [16]. Usually, respondents assessed what is currently

**Table V.** Predictors of high life satisfaction according to stepwise logistic regression and two cut-off points

Independent variables	Model 1 CS score > 5 points				Model 2 CS score > 8 points			
	Rank	OR	CI (OR)	P-value	Rank	OR	CI (OR)	P-value
Moods and emotions*	1	1.022	1.008–1.037	0.002	–	–	–	–
Self-perception*	2	1.022	1.011–1.034	< 0.001	2	1.032	1.021–1.043	< 0.001
Financial resources*	3	1.012	1.004–1.020	0.003	5	1.012	1.007–1.018	< 0.001
Psychological well-being*	4	1.020	1.008–1.033	0.002	3	1.029	1.018–1.041	< 0.001
SDQ (1 – normal, 0 – above)	5	1.945	1.251–3.024	0.003				
Parent relations*	6	1.019	1.008–1.030	0.001	4	1.026	1.015–1.037	< 0.001
Perceived family wealth (ridit)	7	5.635	2.071–15.337	0.001	–	–	–	–
School environment*	8	1.018	1.006–1.031	0.004	1	1.015	1.006–1.025	0.002
Social acceptance/bullying*	9	1.012	1.002–1.023	0.022	–	–	–	–
Social class (ridit)	10	2.874	1.196–6.909	0.018	–	–	–	–
Age	–	–	–	–	6	0.896	0.835–0.960	0.002
R <sup>2</sup> Nagelkerke	0.461				0.416			
Hosmer and Lemeshow (p)	0.202				0.723			

\*KIDSCREEN-52 dimensions, CS – Cantril Scale, SDQ – Strengths and Difficulties Questionnaire, OR – odds ratio, CI (OR) – confidence interval.

most important in their lives, taking into account their own internal standards.

We asked a question about the extent to which the assessment of life satisfaction, measured with the Cantril Scale, depends on physical and mental health, material resources and a broader developmental context. A comparison with the KIDSCREEN-52 QoL questionnaire seems to be justified, especially considering that both tools belong to the so-called generic group. KIDSCREEN has recently been described as one of the best patient-reported outcome research tools designed for children [17]. Arnold *et al.* conducted similar analyses in adults; the general CS index was compared with three dimensions of the SF-20 questionnaire [18].

Our analyses explained nearly half of the CS variability. A strong correlation between the CS and the mental condition of adolescents was confirmed. While all the dimensions of KIDSCREEN-52 correlated with the CS, the strongest relationship was found for those related to mental health. The dimension of negative emotions appeared to be a weaker CS predictor. It should be pointed out that the assessment of general life satisfaction is not used to monitor psychopathology despite the fact that chronic dissatisfaction is a depressive symptom. Indicators such as the CS are treated mainly as positive aspects of mental health. We found that a positive mood and good self-image are very important CS predictors. The significance

of the latter is confirmed by the results of research carried out on a group of Iranian students who were culturally different and several years older. The focus was on two factors: a positive correlation with self-esteem and a negative correlation with loneliness were assumed [19]. Borges *et al.* also found evidence of the influence of self-image on the life satisfaction of Portuguese adolescents [20]. The advantage of our analyses is that they take into account a range of confounding factors alongside the main correlation.

In the discussed paper, a stronger influence of age over gender on the general life satisfaction was demonstrated, which is in accordance with the results obtained by Weber and Huebner [21]. A lower level of life satisfaction in girls is sometimes emphasized in the literature [22]. In the studies relating to the complex profile of QoL (KIDSCREEN-52), attention is drawn to growing gender-related differences in older age groups. This kind of interaction between age and gender as predictors of QoL becomes visible in the following dimensions: Physical Health, Moods and Emotions, and Self-Perception [23].

Contrary to expectations, we also identified a weak association between life satisfaction and physical health. However, we examined a population of generally healthy adolescents who are mostly not concerned with the functional limitations and psychosocial problems related to a temporary or permanent deterioration of health. In

the previously cited paper by Arnold *et al.*, the correlation between the CS and the physical health dimension of the SF-20 questionnaire was very strong in a group of elderly people with chronic diseases, yet did not occur in healthy individuals [18].

The impact of socioeconomic factors was found to be significant, though they had little influence over CS variability. The link between life satisfaction and the students' perception of family financial resources appeared to be stronger than with the objectified parental assessment. When examining the questions from the KIDSCREEN questionnaire that relate to affluence, it can be assumed that an awareness of unfulfilled needs may reduce life satisfaction. An increased significance of material factors in older adolescents may stem from the fact that children at this age can better understand the family's material problems and they experience a growing need to have their own funds.

The objective of our paper was also to draw further attention to the influence of family, school and peers on quality of life, which has been discussed in the literature. Relationships with parents were found to be high in the hierarchy of factors that determine the CS. A fall in its significance in older adolescents was noted, along with the growing influence of the school environment, which should be linked with the developmental process [24].

In our analyses, the dominating impact of the *School Environment* domain should be emphasized in the logistic model explaining the chance of a very positive CS level (9–10 points), as well as its greater influence on the group of adolescents with chronic diseases than among their healthy peers. The positive correlation between school environment and life satisfaction was confirmed in research conducted by Dogan and Celik [25]. Due to scarce related research [26] and the value of school health promotion programs [27], the obtained results are important.

Despite the fact that our research was conducted nearly 12 years ago, we assume that most correlations are universal in character. By disseminating these results we provide guidelines regarding aspects of adolescent life that should not be omitted (such as self-perception). The advantage of the study is the multifaceted approach, as well as the use of data obtained from adolescents of various ages in relation to the information collected from their parents. Another advantage is that it combines various analytical approaches. In the linear regression analysis, it is assumed that the influence of a given factor is constant. Along with an increase in its value by a unit, an identical change in the quality of life will occur in the whole range of CS variability. Through a parallel demonstration of the results of two logistic regression models, we showed that different factors have an impact

on moving from 'unsatisfied with life' to 'relatively satisfied', and different ones apply when moving to 'very satisfied'.

In reference to Poland's low position in international rankings, the practical significance of the obtained results should be emphasized. The relatively high percentage of adolescents who are unsatisfied with life in Poland may result from lower self-esteem and difficulties in expressing positive emotions, which had been previously found in the KIDSCREEN research [28]. Therefore, more attention should be given to intervention programs aimed at strengthening positive emotions, positive self-image and positive relations with others [29].

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### Conflict of interest

The authors declare no conflict of interest.

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