

Reliability of the Columbia Impairment Scale (C.I.S.) for adolescents: Survey among an Italian sample in Lazio Region

Alessandra Zanon⁽¹⁾, Rosella Tomassoni⁽¹⁾, Maria Laura Gargano⁽¹⁾, Maria Gabriella Granai⁽¹⁾

(1) Department of Human, Social and Health Sciences, University of Cassino and Southern Lazio

CORRESPONDING AUTHOR: Alessandra Zanon, Department of Human, Social and Health Sciences, University of Cassino and Southern Lazio - email: a.zanon@unicas.it

DOI: 10.2427/11650

Accepted on February 17, 2016

ABSTRACT

Objective: The objective of this pilot study was to evaluate the reliability and internal consistency of the *The Columbia Impairment Scale* questionnaire, as a tool to provide a global measure of impairment functioning in an Italian adolescents sample.

Methods: The questionnaire is composed by 4 sections of functioning (interpersonal relations, broad psychopathological domains, functioning in schoolwork, use of leisure time) for a total of 13 items. It was administered twice in a sample of adolescents of a Professional School in Frosinone (Central Italy). Reliability analysis was performed and Cronbach's alpha was used as a measure of internal consistency. The intra-class correlation (ICC) coefficients were calculated. The statistical analysis was performed using SPSS 19.0.

Results: The questionnaire was administered to 120 adolescents the first time and to 108 in a following moment. Considering all 13 items, Cronbach's alpha amounted to 0.762 on the first time and to 0.826 on the second time, showing a very satisfactory internal validity. The ICCs were 0.550 for the first section (items 1-4), 0.420 (95% CI 0.201-0.594) for the second section, 0.627 (95% CI 0.345-0.672) for the third section (items 8-10), and 0.5253 (95% CI 0.123-0.778) for the fourth section (items 11-13).

In the sample selected, the answers to the questionnaire showed adolescents have a low impairment functioning.

Conclusion: The results of the pilot study indicate that the questionnaire shows a good reliability property and in terms of internal consistency and validity presents a good performance. The results are promising and suggest that this tool could be used in the Italian setting for future research targeted to adequately capture the impaired functioning in adolescents.

Key words: Internal consistency, Measurement, adolescents, questionnaire, Columbia Impairment Scale, Cronbach's alpha

INTRODUCTION

Medical research looks over time with more interest at measuring functional impairment in a diminished

ability to perform at develop mentally expected levels. Functional impairment refers to the consequences or impact that psychological symptoms or disorders have on the life of the children/adolescents with respect to

performance of everyday functions [1].

Impairment in daily life activities can include dysfunction or an absence of adaptation in social, emotional, psychological, or academic domains with the consequence for the health of the adolescent as well as of his/her families. Lower level of functioning in different domains may impact negatively on quality of life of the adolescents and on their school performance, it is the failure of academic classes in school, disrupts classroom routines and it's the best predictor of problems throughout development and in adult life. As a matter of fact, longitudinal studies have demonstrated that functional impairment in childhood is predictive of future adolescent problems [2], so that "diagnosis" and potential intervention should be advanced and already performed in childhood [3] as a socially valid target of intervention.

There is need to emphasise the measurement of impairment in the scholastic context, and especially for specific problems that the adolescent is experiencing (e.g., failing academic classes, don't get along with parents, being rejected by peers), so that schools/teachers/parents can orient their educational approach with the adolescent and can measure and evaluate over time progress/changes [3]. The Columbia Impairment Scale-Parent and Child was already validated in the children population on a sample of 182 children aged 9-17 years [4].

The aim of this study was to assess the reliability and reproducibility of *The Columbia Impairment Scale* (C. I. S.) [4] questionnaire in particular among Italian adolescents of the Lazio region attending schools, as a tool to provide a global measure of level of functioning concerning some areas such as interpersonal relations, broad psychopathological domains, functioning in schoolwork and use of leisure time.

METHODS

Study design and population

This cross sectional study was carried out in a sample of adolescents attending the Professional Training Centre School of Frosinone in the Lazio Region (Central Italy). The questionnaire was translated in Italian language from an expert in English-Italian language translation followed by an independent backward translation into English and subsequent lay panel testing, with final endorsement from the originators. This tool is composed by 4 major sections of functioning: 1) interpersonal relations, 2) broad psychopathological domains, 3) functioning in schoolwork and 4) use of leisure time, for a total of 13 items. It was administered subsequently to a subscription of an informed consent.

Questionnaires were administered in anonymous, voluntary and self administered form and the answers were in close types. Respondents were instructed to rate each item on a scale from zero (no problem) to four (very big problem)

and five (don't know the answer). The questionnaires were administered in two different time periods (t1 and t2) in the same sample of adolescents, in a 16-18 years old age range, that gave the approval to participate into the study. Adolescents were in the whole classes during the time that they were attending the school's classrooms laboratory awaiting the start of the lesson. All the adolescents (100% of the sample) have agreed to collect information and cross linked in t1 and t2 through a code in order to verify the compliance to the questionnaire and the reliability. The pilot survey included 120 adolescents for the first administration and 108 at a later time. Data were collected during the month of January 2015 for the first administration and in May 2015 at a later stage.

Questionnaire

The first part of the questionnaire included questions that captured the main information of interest such as year of attending (1st, 2nd, 3rd year) and the specific school address (mechanics and hairdressers).

The second part of the questionnaire was related to the translation tool that include four sections, for a total of 13 items, related to specific aim:

1. interpersonal relations (D1-D4)
2. broad psychopathological domains (D5-D7)
3. functioning in job/schoolwork, (D8-D10)
4. use of leisure time/General Internet use (D11-D13)

The answers were all in a close type. The questionnaire is shown in figure 1.

Statistical analysis

The survey has been approved by the Director of the school. Data were recorded in a Excel file created ad hoc, subsequently statistical analysis was performed through SPSS 19.0 - statistical software for Windows (IBM Corp. Released 2010. IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp, USA).

a Descriptive and univariate analyses

Descriptive analyses were performed using frequencies, percentages and frequency table for categorical variables. Chi-square tests were used to evaluate differences for categorical variables.

The level of statistical significance was set at $p \leq 0.05$.

b Reliability analysis and Cronbach's alpha analysis

Reliability analysis was performed and Cronbach's

alpha analysis was used as a measure of the internal consistency that refers to the degree of correlation between the items - belonging to each of the 1-4 sections of the questionnaire - forming a scale. In each domain of the questionnaire, the items should be correlated moderately with each other but should contribute independently to the overall score in that domain. When the Cronbach's alpha is 1, it means that questions are measuring an almost identical construct, resulting redundancy. A commonly-accepted rule is that an alpha of 0.7 indicates acceptable reliability and 0.8 or higher indicates good reliability. Very high reliability (0.95 or higher) is not necessarily desirable, as this indicates that the items may be entirely redundant [5]. Intraclass Correlation Coefficients and related 95% confidence intervals were also calculated.

RESULTS

Study population

The questionnaire was administered for two times: the second administration was performed after four months from the first one. In both times, the population resulted completely homogeneous in relation to the main socio-demographics variable considered (see table 1).

In both periods the vast majority of adolescents had no problem or had few problems with getting into trouble: in the first time of administration, 53 (71.6%) answered the rating 0, 1, 2 and 3 (no or little problem), on the other hand 14 (18.9%) answered rating 4 (have some problem) and 7 (9.5%) did not know how to answer. 36 students (81.8%) got along with his/her mother/mother figure and 27 (67.5%) with their father while 6 (13.6%) answered a rating of 4 that is having some problem with mother and 9 (22.5%) with his/her

father/father figure (the rest of the sample answered that they don't know).

It can be noted that 54 students (71.1%) answered they do not feel unhappy or sad, while 15 (19.7%) answered yes and 7 (9.2%) did not know.

For all the other question the results are roughly superimposed on the above, on the first as well as on the second time, most often in response to the first three items and a lower prevalence of adolescents who meet the fourth and fifth items. For details see table 2.

Reliability of the questionnaire

Cronbach's alpha was calculated to assess the internal validity.

Considering all 13 items of the questionnaire the Cronbach's alpha value amounted to 0.762 on the first time and to 0.826 in the second time of administration.

The analysis for each section was as follows:

- a. **Concerning the first time of administration**, a value of 0.499 resulted for the first section, 0.425 for the second one, 0.397 for the third and 0.394 for the last one.
- b. **Concerning the second time of administration**, a value of 0.642 resulted for the first section, 0.508 for the second one, 0.480 for the third and 0.585 for the last one.

Item-total correlation and variability of Cronbach's alpha, if one item was deleted, are shown in Tables 3 and 4.

Intraclass Correlation Coefficients and related 95% confidence intervals were performed in relation to each section of the questionnaire.

For the first section: (items 1-4), the ICC resulted in an average measure of 0.550 (95% CI 0.385-0.684), while for the second section (items 5-7), the ICC was 0.420 (95% CI

TABLE 1. Characteristics of the sample population.

VARIABLE ADMINISTERED ON THE 1 ST TIME (N.120)		P VALUE (CHI SQUARE TEST)	VARIABLE ADMINISTERED ON THE 2 ST TIME (N.108)		P VALUE (CHI SQUARE TEST)
Address School N. (%)	Years of attendance N. (%)		Address School N. (%)	Years of attendance N. (%)	
Mechanic 26 (21.7)	1 st n.8 (30.8)	0.61	Mechanic 22 (20.4)	1 st n.7 (31.8)	0.68
	2 nd n.11 (42.3)			2 nd n.9 (40.9)	
	3 rd n.7 (26.9)			3 rd n.6 (27.3)	
Hairdresser 94 (78.3)	1 st n.34 (36.2)		Hairdresser 86 (79.6)	1 st n.30 (34.9)	
	2 nd n.30 (31.9)			2 nd n.27 (31.4)	
	3 rd n.30 (31.9)			3 rd n.29 (33.7)	

TABLE 2. Answers to the questionnaire.

VARIABLES IN THE QUESTIONNAIRE	RATING	FIRST TIME OF ADMINISTRATION N (%)	P VALUE (YEARS OF ATTENDANCE)	P VALUE (SCHOOL ADDRESS)	SECOND TIME OF ADMINISTRATION N (%)	P VALUE (YEARS OF ATTENDANCE)	P VALUE (SCHOOL ADDRESS)
In general, how much of a problem do you think you have with:							
D1 getting into trouble?	0	29 (28.2)	0.12	0.03*	36 (39.1)	0.45	0.12
	1	26(25.2)			21 (22.8)		
	2	17 (16.5)			17 (18.5)		
	3	10 (9.7)			4 (4.3)		
	4	14 (13.6)			13 (14.1)		
	5	7 (6.8)			1 (1.1)		
	Missing	17 (14.2)			16 (14.8)		
D2 getting along with your mother/ mother figure.	0	60 (57.7)	0.30	0.63	56 (60.0)	0.37	0.01*
	1	17(16.3)			17 (18.5)		
	2	14 (13.5)			10 (10.9)		
	3	5 (4.8)			5 (5.4)		
	4	6(5.8)			3 (3.3)		
	5	2 (1.9)			1 (1.1)		
	Missing	16 (13.3)			16 (14.8)		
D3 getting along with your father/ father figure.	0	62 (60.8)	0.07	0.08	49 (53.3)	0.71	0.04*
	1	13(12.7)			16 (17.4)		
	2	9(8.8)			12 (13)		
	3	5 (4.9)			2 (2.2)		
	4	9 (8.8)			8 (8.7)		
	5	4 (3.9)			5 (5.4)		
	Missing	18 (15)			16 (14.8)		
D4 feeling unhappy or sad?	0	27 (26.2)	0.20	0.08	32 (35.2)	0.05*	0.15
	1	20 (19.4)			18 (19.8)		
	2	16 (15.5)			22 (24.2)		
	3	18 (17.5)			8 (8.8)		
	4	15 (14.6)			10 (11)		
	5	7 (6.8)			1 (1.1)		
	Missing	17 (14.2)			17 (15.7)		
How much of a problem would you say you have:							
D5 with your behavior at school?	0	64 (62.1)	0.49	0.25	52 (56.6)	0.13	0.98
	1	8 (7.8)			20 (21.7)		
	2	16 (15.5)			13 (14.1)		
	3	5 (4.9)			5 (5.4)		
	4	4 (3.9)			1 (1.1)		
	5	6 (5.8)			1 (1.1)		
	Missing	17 (14.2)			16 (14.8)		
D6 with having fun?	0	84 (81.6)	0.04*	0.26	68	0.05*	0.59
	1	7(6.8)			12		
	2	8 (7.8)			9		
	3	0			3		
	4	3 (2.9)			0		
	5	1 (1)			0		
	Missing	17 (14.2)			16 (14.8)		
D7 getting along with adults other than (your mother and/or your father)?	0	45 (43.3)	0.53	0.04*	48 (52.2)	0.60	0.02*
	1	27 (26)			18 (19.6)		
	2	19 (18.3)			17 (18.5)		
	3	5 (4.8)			6 (6.5)		
	4	7 (6.7)			3 (3.3)		
	5	1 (1)			0		
	Missing	16 (13.3)			16 (14.8)		

*statistically significant difference ($p < 0.05$)

TABLE 2 (CONTINUED). Answers to the questionnaire.

VARIABLES IN THE QUESTIONNAIRE	RATING	FIRST TIME OF ADMINISTRATION N (%)	P VALUE (YEARS OF ATTENDANCE)	P VALUE (SCHOOL ADDRESS)	SECOND TIME OF ADMINISTRATION N (%)	P VALUE (YEARS OF ATTENDANCE)	P VALUE (SCHOOL ADDRESS)
How much of a problem do you have:							
D8 with feeling nervous or afraid?	0	17 (16.5)	0.47	0.07	16 (17.6)	0.70	<0.001*
	1	19 (18.4)			27 (29.7)		
	2	37 (35.9)			31 (34.1)		
	3	14 (13.6)			8 (8.8)		
	4	15 (14.6)			9 (9.9)		
	5	1 (1)			0		
	Missing	17 (14.2)			17 (15.7)		
D9 getting along with your sister(s) and/or brother(s)?	0	43 (42.2)	<0.001*	0.36	48 (52.2)	0.12	0.77
	1	25 (24.5)			17 (18.5)		
	2	15 (14.7)			14 (15.2)		
	3	5 (4.9)			6 (6.5)		
	4	6 (5.9)			3 (3.3)		
	5	8 (7.8)			4 (4.3)		
	Missing	18 (15)			16 (14.8)		
D10 getting along with other kids your age?	0	62 (60.2)	0.41	0.26	56 (62.2)	0.27	0.24
	1	16 (15.5)			17 (18.9)		
	2	14 (13.6)			12 (13.3)		
	3	5 (4.9)			3 (3.3)		
	4	4 (3.9)			2 (2.2)		
	5	2 (1.9)			0		
	Missing	17 (14.2)			18 (16.7)		
How much of a problem would you say you have:							
D11 getting involved in activities like sports or hobbies?	0	68 (65.4)	0.71	0.64	59 (64.1)	0.03*	0.88
	1	9 (8.7)			21 (22.8)		
	2	14 (13.5)			6 (6.5)		
	3	4 (87.5)			1 (1.1)		
	4	4 (91.3)			2 (2.2)		
	5	5 (95.2)			3 (3.3)		
	Missing	16 (13.3)			16 (14.8)		
D12 with your school work	0	43 (41.7)	0.18	0.42	34 (37)	0.07	0.16
	1	27 (26.2)			28 (30.4)		
	2	18 (17.5)			17 (18.5)		
	3	7 (6.8)			8 (8.7)		
	4	7 (6.8)			5 (5.4)		
	5	1 (1)			0		
	Missing	17 (14.2)			16 (14.8)		
D13 with your behavior at home?	0	58 (56.3)	0.33	0.10	52 (56.5)	0.89	0.35
	1	20 (19.4)			23 (25)		
	2	11 (10.7)			10 (10.9)		
	3	9 (8.7)			6 (6.5)		
	4	5 (4.9)			1 (1.1)		
	5	0			0		
	Missing	17 (14.2)			16 (14.8)		

*statistically significant difference (p<0.05)

0.201-0.594), for the third section (items 8-10), the ICC was 0.627 (95% CI 0.345-0.672) and finally for the fourth section (items 11-13), the ICC was 0.5253 (95% CI 0.123-0.778).

In addition, both frequencies and percentages resulting from the different time of administration were absolutely

overlapping, demonstrating the before-after reproducibility. The measures utilised should lend themselves to efficient, reliable repeated assessments to permit the monitoring of outcomes.

CONCLUSION

In the present research, two main results were achieved. Firstly, as far as concerns the reliability of the CIS instrument the internal consistency of the questionnaire,

measured through Cronbach's alpha, was very high in both periods of administration, suggesting that it may be a reliable tool in the Italian context.

Secondly, comparing the results deriving from the first and subsequent administration, they absolutely coincide in

TABLE 3. Item-Total Statistics: Item-total correlation and variability of Cronbach's alpha, if one item was deleted (CONCERNING THE 1ST TIME ADMINISTRATION)

ITEM-TOTAL STATISTICS				
	SCALE MEAN IF ITEM DELETED	SCALE VARIANCE IF ITEM DELETED	CORRECTED ITEM-TOTAL CORRELATION	CRONBACH'S ALPHA IF ITEM DELETED
In general, how much of a problem do you think you have with:				
D1_ getting into trouble?	13,42	71,983	0,356	0,752
D2_ getting along with your mother/mother figure.	14,27	71,674	0,486	0,737
D3_ getting along with your father/father figure.	14,18	71,644	0,401	0,746
D4_ feeling unhappy or sad?	13,19	72,277	0,349	0,752
How much of a problem would you say you have:				
D5_ with your behavior at school?	14,19	70,923	0,438	0,742
D6_ with having fun?	14,81	80,277	0,182	0,764
D7_ getting along with adults other than (you and/or your mother/father)?	14,10	69,424	0,635	0,723
How much of a problem do you have:				
D8_ with feeling nervous or afraid?	13,25	74,149	0,395	0,747
D9_ getting along with your [sister(s)/brother(s)]?	13,93	71,945	0,387	0,748
D10_ getting along with other kids your age?	14,36	73,889	0,410	0,745
How much of a problem would you say you have:				
D11_ getting involved in activities like sports or hobbies?	14,35	77,018	0,216	0,765
D12_ with your school work (doing [her/his] job)?	14,03	74,635	0,370	0,749
D13_ with your behavior at home?	14,32	74,078	0,424	0,744

TABLE 4. Item-Total Statistics: Item-total correlation and variability of Cronbach's alpha, if one item was deleted (CONCERNING THE 2ST TIME ADMINISTRATION)

ITEM-TOTAL STATISTICS				
VARIABLES	SCALE MEAN IF ITEM DELETED	SCALE VARIANCE IF ITEM DELETED	CORRECTED ITEM-TOTAL CORRELATION	CRONBACH'S ALPHA IF ITEM DELETED
In general, how much of a problem do you think you have with:				
D1_ getting into trouble?	11,10	65,771	0,422	0,819
D2_ getting along with your mother/mother figure.	11,70	67,452	0,461	0,815
D3_ getting along with your father/father figure.	11,35	62,484	0,529	0,810
D4_ feeling unhappy or sad?	11,06	64,169	0,531	0,809
How much of a problem would you say you have:				
D5_ with your behavior at school?	11,73	70,913	0,335	0,823
D6_ with having fun?	12,07	71,834	0,394	0,820
D7_ getting along with adults other than (you and/or your mother/father)?	11,57	64,064	0,688	0,798
How much of a problem do you have:				
D8_ with feeling nervous or afraid?	10,90	69,633	0,360	0,822
D9_ getting along with your [sister(s)/brother(s)]?	11,44	68,365	0,319	0,828
D10_ getting along with other kids your age?	11,82	67,116	0,596	0,806
How much of a problem would you say you have:				
D11_ getting involved in activities like sports or hobbies?	11,86	69,728	0,379	0,820
D12_ with your school work (doing [her/his] job)?	11,34	64,664	0,634	0,802
D13_ with your behavior at home?	11,78	68,010	0,557	0,809

term of answer's rate for each areas of domains and for each rating assigned to each single question, so that it's evident that the questionnaire has a high reproducibility, giving a faithful image of what is psychosocial functioning including interpersonal relationships, academic functioning, and use of leisure time, in addition to some questions on broad areas of psychopathology (e.g. feeling sad or unhappy) in a particular population such as adolescents. Nevertheless, the proportion of the total variation in the values, in this case the two time periods T1 and T2, is moderate for all the sections and high in the specific of the

broad psychopathological domains.

However, in the scientific literature, both young people and their parents CIS show a good indices of reliability and validity [4-7] in different setting, population and ages, according to our results conducting in an Italian adolescents sample. On the other hand, when particular clinical setting, such as that of youth with autism spectrum disorder (ASD), is considered, the CIS appears to have important limitation in the convergent and discriminant validity [8].

Some limitations of this study should be acknowledged. First of all, there are several limits related to the cross sectional

FIGURE 1. Questionnaire.

Date _____

THE COLUMBIA IMPAIRMENT SCALE (C. I. S.)-- (Youth Version)

Please circle the number that you think best describes the child or youth's situation:	
01.....2.....3.....45	
No problem Some problem Very bad problem Not applicable/Don't know	
In general, how much of a problem do you think you have with:	
1)...getting into trouble?	0 1 2 3 4 5
2)...getting along with your mother/mother figure.	0 1 2 3 4 5
3)...getting along with your father/father figure.	0 1 2 3 4 5
4)...feeling unhappy or sad?	0 1 2 3 4 5
How much of a problem would you say you have:	
5)...with your behavior at school? (or at your job)	0 1 2 3 4 5
6)...with having fun?	0 1 2 3 4 5
7)...getting along with adults other than (your mother and/or your father)?	0 1 2 3 4 5
How much of a problem do you have:	
8)...with feeling nervous or afraid?	0 1 2 3 4 5
9)...getting along with your sister(s) and/or brother(s)?	0 1 2 3 4 5
10) ...getting along with other kids your age?	0 1 2 3 4 5
How much of a problem would you say you have:	
11)...getting involved in activities like sports or hobbies?	0 1 2 3 4 5
12)...with your school work (doing your job)?	0 1 2 3 4 5
13)...with your behavior at home?	0 1 2 3 4 5

study design, such as self-reported data that could lead to underreporting and recall bias and being a pilot study the small sample considered. In addition, the study is not a multicenter study and it is focused on adolescents attending a special School Professional Centre, with a particular population that is going to have a defined job prospects.

However, it's evident that the instrument here validated takes into account for future research targeted to adequately capture the impaired functioning in this specific field of school setting [9] and not, as well as monitoring it over the time (for example after some psychosocial intervention). The tool, in fact, could be useful for planning services, evaluating and planning of programs, in studies of treatment effectiveness, such as in epidemiological studies.

References

1. Üstun B, Chatterji S. Editorial: Measuring functioning and disability- a common framework. *International Journal of Methods in Psychiatric Research* 1997;7:79-83.
2. Costello EJ, Angold A, Keeler GP. Adolescent outcomes of childhood disorders: The consequences of severity and impairment. *Journal of the American Academy of Child and Adolescent Psychiatry* 1999;38:121-8.
3. Gregory A, Fabiano and William E, Pelham Jr. Impairment in Children S. Goldstein and J. In: Naglieri, editors. *Assessing Impairment: From Theory to Practice* 2009;9.
4. Bird HR, Shaffer D, Fisher P, et al. The Columbia Impairment Scale (CIS): Pilot findings on a measure of global impairment for children and adolescents. *International Journal of Methods in Psychiatric Research* 1993;3:167-76.
5. Nunnally J. *Psychometric theory*. New York: McGraw-Hill, 1978.
6. Ezpeleta L, Granero R, de la Osa N, Doménech JM, Bonillo A. Assessment of Functional Impairment in Spanish Children. *Applied Psychology: An International Review* 2006;55(1):130-43.
7. Goudie A1, Havercamp S, Jamieson B, Sahr T. Assessing functional impairment in siblings living with children with disability. *Pediatrics* 2013 Aug;132(2):e476-83.
8. Zielinski K, Wood JJ, Renno P, Whitham S, Sterling L. Examining the validity of the columbia impairment scale for assessing level of functioning in youth with autism spectrum disorder. *J Child Adolesc Psychopharmacol* 2014;24(9):509-12.
9. Lobato D, Kao B, Plante W, et al. Psychological and school functioning of Latino siblings of children with intellectual disability. *J Child Psychol Psychiatry* 2011 Jun;52(6):696-703.

