

Do Adult Attention Deficit Hyperactivity Disorder Quality-Of-Life (AAQoL) scale and the SF-36 scale measure the same construct of health-related quality of life?

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Abstract It has never been investigated whether the assessment tools of Adult Attention Deficit Hyperactivity Disorder Quality-of-Life (AAQoL) scale and the SF-36 measure the same construct. The participants were 101 parents of children with ADHD and 243 parents of school children. The parents completed both the Persian version of the AAQoL and the SF-36 questionnaires. The present study revealed that the Persian version of both AAQoL and SF-36 for the assessment of HRQoL in parents of children with ADHD has convergent and discriminant validity and internal consistency. Multitrait–multimethod correlation matrix showed that the domains of two questionnaires were moderately correlated. Current results support that AAQoL and SF-36 in parents of children with ADHD measure the same HRQoL constructs. Hence, for assessing the HRQoL of parents of children with ADHD, one of the two questionnaires can be used regard to the objective of study. The Persian version of the AAQoL loaded on four domains which were in line with the original version. HRQoL of parents of children with ADHD is markedly less than the community sample of children.

Keywords Attention deficit hyperactivity disorder · Health-related quality of life · SF-36 · AAQoL · Parent · Children

Introduction

Attention deficit hyperactivity disorder (ADHD) is a very common psychiatric problem in children and adolescents. Its main symptoms are inattentiveness, hyperactivity, and impulsivity. Its prevalence in school-age children is about 3–5 percent (Wolraich et al. 1996; Ghanizadeh 2008; Rowland et al. (2013); Barkley 2014). Longitudinal studies with children having ADHD and retrospective studies with adults having this disorder indicate that ADHD symptoms usually persist into adulthood (Murphy and Barkley 1996; Ramos-Quiroga et al. 2013). The rate of full remission is about 10 %, while 30–70 % of children with ADHD would have some symptoms of this disorder even in adulthood (Faraone et al. 2000; Biederman 2004). Some studies reported unfavorable consequences of ADHD on the future of these children and adolescents (Ghanizadeh et al. 2012). For example, ADHD impacts educational, occupational, psychological, and social functioning. Adults with ADHD are exposed to a higher risk of unemployment, sick leave, substance abuse, and convictions (Ghanizadeh et al. 2011, 2012). On the other hand, comorbidity patterns reveal that ADHD is transmitted independently in families (Biederman et al. 1992). The risk of ADHD in children of parents with ADHD is 75 % (Biederman et al. 1995), and hence, many parents of children with ADHD themselves suffer from ADHD (Ghanizadeh et al. 2008). Moreover, there is a high rate of abuse of parents by children having ADHD. More than half of these parents are victims of physical, financial, verbal, and psychological abuse

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committed by their children with ADHD (Ghanizadeh and Jafari 2010). We intend to assess the HRQoL of parents of children with ADHD.

Several instruments are available for the assessment of adults with ADHD. These are diagnostic interviews, brief screening instruments, and self-reported scales (Kessler et al. 2005; Magnússon et al. 2006). However, these measures were designed to assess symptoms rather than the effect of ADHD on adults' health-related quality of life (HRQoL). Brod and colleagues developed the 68-item Adult ADHD Quality-of-Life Measure (AAQoL) to assess the HRQoL of adults (Brod et al. 2005). They also psychometrically validated the AAQoL by developing a formal measurement model. They explored the reliability and validity of the AAQoL as well. After some modifications, the AAQoL changed to a 29-item questionnaire (Brod et al. 2006). Since there is no specific health-related quality-of-life questionnaire available for parents of children with ADHD, we intend to employ the AAQoL to assess the HRQoL of parents of children with ADHD.

As part of the Medical Outcomes Study (MOS), a multi-year and multi-site study to explain variations in patient outcomes, RAND developed the 36-Item Short Form Health Survey (SF-36). The SF-36 is a set of generic, coherent, and easily administered quality-of-life measures. These measures rely upon self-reporting of patients; they are now widely utilized for routine monitoring and assessment of care outcomes in adult patients (Ware and Sherbourne 1992). Montazeri and colleagues translated this questionnaire into Persian. They found its reliability and validity to assess the health-related quality of life among Iran's general population (Montazeri et al. 2005). The main objective of the present study was to check whether the AAQoL and the SF-36 for assessing the HRQoL of parents of children with ADHD measure the same construct. It was assumed that for assessing the HRQoL of parents of children with ADHD, the AAQoL domains would be moderately correlated with the related SF-36 domains. In this case, the SF-36 can be used instead of the AAQoL. To the best of our knowledge, this topic has not been explored yet. Also, we used control group to show a lower HRQoL among parents of ADHD children than those of general population.

Methods

Participants and instruments

The study was carried out at a child psychiatric clinic affiliated with Shiraz University of Medical Sciences, Fars, Iran. The participants were 101 parents of children with ADHD and 243 parents of healthy school children (control

group). They completed both the Persian version of both AAQoL and SF-36 questionnaires. The parents in control group were selected in a two-stage cluster random sampling from the four educational districts of Shiraz in Southern Iran. The study was approved by the ethics committee of the university, and all the participants gave informed written consent. Most parents in the case group (86 %) were mothers. Thus, case and control groups were matched in terms of gender. The mean (\pm SD) ages of the case and control groups were 34.75 (\pm 6.086) and 37.25 (\pm 7.129), respectively, and they were statistically significant ($P = 0.002$).

The SF-36 consisted of 36 items with eight subscales including *Physical Functioning* (PF, ten items), *Role limitations due to Physical health problems* (RP, four items), *Bodily Pain* (BP, two items), *General Health perceptions* (GH, five items), *Vitality* (VT, four items), *Social Functioning* (SF, two items), *Role limitation due to Emotional problems* (RE, three items), and *Mental Health* (MH, five items) (Ware and Sherbourne 1992).

The AAQoL comprised 29 items, which were divided into four subscales including *Life Productivity* (eleven items), *Psychological Health* (six items), *Life Outlook* (seven items), and *Relationships* (five items). Individual items were scored on a five-point Likert scale ranging from 'Not at all/Never' = 1 to 'Extremely/Very Often' = 5. In the two questionnaires, all the subscales were transformed into a 0–100 score, where a higher score indicated a better HRQoL.

Development of Persian version of the AAQoL

First, we contacted the developer of the AAQoL and obtained permission to translate the questionnaire. We conducted a forward–backward translation according to a standardized guideline (Beaton et al. 2000). Two independent bilingual translators, whose native language was Persian, translated the AAQoL into Persian. After reconciliation of the two Persian versions, the questionnaire was translated back into English. Next, the two English versions were sent to the developer. The developer's comments were then used to make necessary changes. Finally, a focus group was used for more in-depth investigations to finalize the Persian version of the AAQoL.

Statistical analysis

Internal consistency for each domain of the AAQoL and the SF-36 was assessed using Cronbach's alpha coefficient. An $\alpha > 0.70$ was considered as an acceptable internal consistency (Chassany et al. 2002). We used the exploratory factor analysis to examine the construct of the Persian version of the AAQoL by using a varimax rotation for all

items. The number of factors extracted was determined by eigenvalues >1 (Sharma 1995). The multitrait–multimethod correlation matrix and factor analysis with a varimax rotation were performed to check whether the AAQoL and the SF-36 measure the same constructs. If the two questionnaires measure the same construct, then there should be moderate-to-large correlations between subscales of similar constructs across the two instruments. In contrast, domains intended to measure different constructs in the two instruments should have ignorable-to-small correlations. Spearman correlations of <0.1 , $0.1–0.29$, $0.3–0.49$, and >0.5 were considered as ignorable, small, moderate, and large, respectively (Cohen 1988).

The spearman correlation was used to test convergent and discriminate validity. A correlation coefficient >0.4 between an item and its own subscale is considered an evidence of

convergent validity. Discriminate validity confirmed if the correlation between an item and its hypothesized subscale was significantly higher than its correlation with other subscales (Fayers and Machin 2013). Independent sample *t* tests were performed to compare the case and control groups for both AAQoL and SF-36 domains.

Results

Reliability and validity

As shown in Table 1, Cronbach's α for the overall and each domain of both AAQoL and SF-36 questionnaires was more than 0.7, except for *Relationship* (0.57), and *Role-Physical* (0.69). It ranged from 0.57 (*Relationship*) to 0.88

Table 1 Item scaling tests: Cronbach's α and convergent and discriminate validity analysis for the AAQoL domains

AAQoL and SF-36 domains	Items	Mean \pm SD			α	Convergent validity		Discriminate validity	
		Parents of children with ADHD (<i>N</i> = 101)	Parents of school children (<i>N</i> = 243)	<i>P</i> value		Range of correlation	Scaling ^a success (%)	Range of correlation	Scaling ^b success (%)
<i>AAQoL</i>									
Total	29	67.85 \pm 12.48	75.02 \pm 11.33	<0.0001	0.87	–	–	–	–
Life Productivity	11	77.84 \pm 12.53	80.85 \pm 12.37	0.040	0.78	0.36–0.73	10/11 (91)	0.04–0.54	29/33 (87)
Psychological Health	6	48.33 \pm 25.53	61.84 \pm 22.20	<0.0001	0.88	0.69–0.83	6/6 (100)	0.13–0.37	18/18 (100)
Life Outlook	7	71.36 \pm 16.24	77.36 \pm 15.96	0.002	0.81	0.66–0.77	7/7 (100)	0.15–0.61	20/21 (95)
Relationships	5	74.74 \pm 15.03	78.90 \pm 13.99	0.025	0.57	0.46–0.69	5/5 (100)	0.03–0.69	15/15 (100)
<i>SF-36</i>									
Total	36	43.05 \pm 7.84	45.50 \pm 7.26	0.007	0.94	–	–	–	–
Physical Functioning (PF)	10	46.69 \pm 8.91	47.28 \pm 8.37	0.572	0.86	0.49–0.74	10/10 (100)	0.02–0.51	67/70 (95)
Role-Physical (RP)	4	41.97 \pm 7.64	42.30 \pm 7.01	0.706	0.69	0.62–0.75	4/4 (100)	0.08–0.57	27/28 (96)
Bodily Pain (BP)	2	45.93 \pm 10.33	47.29 \pm 10.38	0.272	0.73	0.79–0.91	2/2 (100)	0.20–0.58	14/14 (100)
General Health (GH)	5	43.66 \pm 11.68	47.70 \pm 9.89	0.003	0.80	0.63–0.80	5/5 (100)	0.21–0.65	33/35 (94)
Vitality (VT)	4	47.05 \pm 10.69	50.57 \pm 9.75	0.004	0.78	0.69–0.77	4/4 (100)	0.10–0.67	25/28 (89)
Social Functioning (SF)	2	44.25 \pm 11.16	46.15 \pm 9.11	0.132	0.81	0.86–0.90	2/2 (100)	0.21–0.63	14/14 (100)
Role-Emotional (RE)	3	37.83 \pm 11.22	40.44 \pm 9.95	0.360	0.83	0.83–0.88	3/3 (100)	0.28–0.61	21/21 (100)
Mental Health (MH)	5	36.99 \pm 11.33	41.18 \pm 12.04	0.003	0.85	0.66–0.84	5/5 (100)	0.21–0.70	33/35 (94)

^a Number of correlation between items and hypothesized scale corrected for overlap ≥ 0.4 /total number of convergent validity tests

^b Number of convergent correlations significantly higher than discriminate correlations/total number of correlations

(*Psychological Health*) and from 0.69 (*Role-Physical*) to 0.86 (*Physical Functioning*) for AAQoL and SF-36 domains, respectively. The summarized results of convergent and discriminate validity for the Persian version of the AAQoL and the SF-36 are shown in Table 1. This table displays that the success rate of convergent validity in both questionnaires was 100 % for all domains, except for Life Productivity (91 %)—the first domain of the AAQoL. The success rate for discriminate validity ranged from 87 to 100 and 89 to 100 % for the AAQoL and the SF-36, respectively.

Factor analysis

The principal factor analysis with a varimax rotation was used to determine the structure of all questions of the Persian version of the AAQoL. The factors were divided into four domains: *Life Productivity* (eleven items), *Psychological Health* (six items), *Life Outlook* (seven items), and *Relationships* (five items). Table 2 shows that all of the items were properly loaded on its domains.

Table 2 Factor loadings of four construct solutions of the AAQoL instrument, for parents of children with ADHD ($N = 101$)

AAQoL domains	Component			
	1	2	3	4
<i>Life productivity</i>				
Get things done on time	0.570	0.037	0.324	0.055
Complete projects or tasks	0.541	−0.070	0.315	0.088
Balance multiple projects	0.601	0.079	0.207	0.114
Remember important things	0.671	0.185	−0.090	0.018
Get start with tasks you don't find interesting	0.081	0.222	0.253	0.191
Keep track of important items	0.605	0.059	0.227	−0.043
Keep house clean	0.498	−0.022	0.210	0.022
Manage finances	0.676	0.219	−0.099	0.147
Get your shopping done	0.595	0.148	0.145	−0.017
Pay attention	0.717	0.073	0.222	−0.090
Getting things done requires too much effort	0.289	−0.195	0.191	−0.242
<i>Psychological health</i>				
Anxious	0.031	0.780	0.095	0.130
Overwhelmed	0.152	0.775	0.033	−0.029
Fluctuations in emotions	0.105	0.729	0.115	0.112
Depressed	0.071	0.820	0.143	0.126
You have overreacted in difficult situations	0.145	0.817	0.019	0.068
Feeling fatigued	−0.003	0.617	0.205	0.152
<i>Life outlook</i>				
Your energy is well spent	0.386	0.187	0.466	0.042
Feel good about yourself	0.302	0.559	0.428	0.040
People enjoy spending time with you	0.109	0.057	0.713	0.158
You can successfully manage your life	0.538	0.175	0.488	0.133
Able to enjoy time spend with others	0.209	0.336	0.652	0.063
As productive as you would like to be	0.365	0.208	0.618	0.022
Your intimate relationship is going well emotionally	0.247	0.060	0.652	0.106
<i>Relationships</i>				
You annoyed people	0.135	−0.090	0.252	0.632
People are frustrated with you	0.302	−0.079	0.071	0.623
Tension in relationships	−0.075	−0.211	0.006	0.566
Not having quality time to spend with others	0.026	0.273	0.229	0.537
You have not been able to meet others expectations	−0.071	0.135	−0.007	0.521

Extraction method: principal component with varimax rotation

Items belonging to the postulated scales are shown in bold

Multitrait–multimethod

The factor analysis with a varimax rotation was conducted on the domains of both questionnaires in order to test whether the AAQoL and the SF-36 measure the same construct. Table 3 shows that all domains of the two questionnaires were loaded on Factor 1, except for two domains of the AAQoL questionnaire, namely *Life Productivity* and *Relationships*. These two domains are not only loaded on Factor 2 but also had acceptable load (near 0.4) on Factor 1. Moreover, Table 4 shows the correlations of the AAQoL

Table 3 Factor loadings of two construct solution for parents of children with ADHD ($N = 101$)

AAQoL and SF-36 domains	SF-36	AAQoL
<i>AAQoL</i>		
Life Productivity	0.480	0.616
Psychological Health	0.822	-0.046
Life Outlook	0.658	0.326
Relationships	0.343	-0.512
<i>SF-36</i>		
Physical Functioning (PF)	0.586	0.339
Role-Physical (RP)	0.606	-0.212
Bodily Pain (BP)	0.679	0.046
General Health (GH)	0.827	0.162
Vitality (VT)	0.825	0.077
Social Functioning (SF)	0.721	-0.338
Role-Emotional (RE)	0.770	-0.085
Mental Health (MH)	0.862	-0.196

Extraction method: principal component with varimax rotation

Items belonging to the postulated scales are shown in bold

and the SF-36 domains in the multitrait–multimethod correlation matrix. As we expected, similar domains of the two questionnaires were moderately correlated. *Mental Health*, *Role-Emotional*, *Vitality*, and *General Health* were highly correlated with *Psychological Health*.

Additional analysis

Table 1 shows that parents of children with ADHD have a significantly lower HRQoL than those of school children for total and each domains of the AAQoL. Also, parents of school children have a better HRQoL for total and each domains of the SF-36. However, according to this questionnaire, only *General Health*, *Vitality*, and *Mental Health* were statistically significant across these two groups. Moreover, the greatest mean differences between parents of children with ADHD and parents of school children were found in terms of *Psychological Health* in the AAQoL and in terms of *Mental Health* in the SF-36.

Discussion

The Persian version of the AAQoL has high internal consistency, except for the *Relationships* domain (Cronbach's $\alpha = 0.57$), which was in line with the results of two previous studies conducted in the USA (Brod et al. 2006; Matza et al. 2007). The present study reveals that the Persian version of the AAQoL has convergent and discriminant validity as well as internal consistency.

In order to provide more evidence to show that there is a better HRQoL among parents of school children than among parents of children with ADHD, we used the SF-36

Table 4 Multitrait–multimethod correlation matrix: AAQoL domain intercorrelations and correlations of AAQoL domains with SF-36 domains, ($N = 101$)

AAQoL and SF-36 domains	Life Productivity	Psychological Health	Life Outlook	Relationships
<i>AAQoL</i>				
Life Productivity	1			
Psychological Health	0.266**	1		
Life Outlook	0.660**	0.442**	1	
Relationships	0.157**	0.306**	0.326**	1
<i>SF-36</i>				
Physical Functioning (PF)	0.287**	0.395**	0.364**	0.160
Role-Physical (RP)	0.188	0.383**	0.252*	0.140
Bodily Pain (BP)	0.287**	0.477**	0.250*	0.167
General Health (GH)	0.266**	0.667**	0.448**	0.171
Vitality (VT)	0.350**	0.686**	0.481**	0.160
Social Functioning (SF)	0.344**	0.484**	0.377**	0.371**
Role-Emotional (RE)	0.397**	0.646**	0.492**	0.206*
Mental Health (MH)	0.308**	0.714**	0.470**	0.296**

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

questionnaire. It also showed that the SF-36 is internally consistent and proves validity for this questionnaire in parents of children with ADHD. The strength of the present study lies in the fact that it is the first study on the HRQoL of parents of children with ADHD and used two questionnaires simultaneously.

We reported the results of the factor structure of the AAQoL in order to compare our findings with those from a previous study (Brod et al. 2006). The results of the exploratory factor analysis with a varimax rotation reveal that the Persian version of the AAQoL measures the same construct that the original version of the AAQoL intended to measure (Brod et al. 2006).

The multitrait-multimethod correlation matrix showed a significant association between the AAQoL domains and the corresponding domains of the SF-36. Table 4 indicates that the four domains of the AAQoL were more closely associated with the psychosocial SF-36 domains such as *Role-Emotional*, *Mental Health*, and *Social Functioning*. As expected, they assess the overlapping constructs: the *Psychological Health* domain of the AAQoL, in particular, is strongly correlated with the *Mental Health* scale of the SF-36. The results of the factor analysis for extraction of the AAQoL and the SF-36 domains reveal that the two domains of the AAQoL, namely *Psychological Health* and *Life Outlook*, and all the SF-36 domains have high loading on the first factor. Moreover, two other domains of the AAQoL, namely *Life Productivity* and *Relationships*, have acceptable load for that factor. An important finding is that the AAQoL and the SF-36 for the assessment of the HRQoL of parents of children with ADHD measure the same trait and they can be used instead of each other.

It seems that there are some advantages of using each instrument with regard to the objective of study. The AAQoL is more specific as the number of its questions is lower and they are directly related to ADHD symptoms. Other advantage of using the AAQoL is that all of its domains have been able to discriminate between two groups. On the other hand, the international validation of the SF-36 questionnaire previously checked in many diseases. It allows us to assess the HRQoL in a wide variety of diseases. So, it provides comparability of disease groups or of case and control groups.

In comparison with two US studies (Brod et al. 2006; Matza et al. 2007), and ‘diagnosed-ADHD’ and ‘undiagnosed-ADHD’ participants in another US study (Able et al. 2007), our study reports a better HRQoL for participants in all AAQoL domains, except for *Psychological Health*. Better condition could be attributed to the lack of clinical diagnose for the participants in our study. Participants in three American studies were adults with ADHD, but participants in our study were parents of children with ADHD

and some of them were probably without ADHD. Also, in comparison with ‘non-ADHD’ parents in the US studies (Able et al. 2007), parents of children with ADHD in our study showed a lower quality of life according to the AAQoL questionnaire domains.

In the USA (Brod et al. 2006), AAQoL scores in patients with ADHD were significantly lower than that of the control groups, which is similar to our finding. Moreover, the mean scores of all domains of the SF-36 in parents of our study were lower than those of parents of children with epilepsy in China (Lv et al. 2009), parents of children with autism spectrum disorder in Croatia (Benjak et al. 2009), and parents of children with pervasive developmental disorder in Japan (Yamada et al. 2012). In addition, parents of children with heart ailments in Egypt (Arafa et al. 2008) had a better HRQoL in all dimensions of the SF-36 compared to the parents of our study, except for *Role-Physical* and *Vitality* subscales.

The following limitations of the present study need to be considered. The major limitation is that we do not know how far cultural, language, and national traits contribute to the observed discrepancies. It could be rephrased as a future direction for a study measuring a range of factors that may contribute to cross-national/cross-cultural differences. Another limitation is that the sample of parents of children with ADHD was a clinical sample. The participants included those parents who visited the clinic and they were maybe more worried about the children. The AAQoL was made for adults with ADHD, but our participants were parents of children with ADHD. Hence, additional studies should assess the clinical diagnosis of these parents and other possible psychiatric diagnoses such as the number of mothers of children with ADHD. Furthermore, it is recommended that an instrument be devised for assessing the HRQoL of parents of children with ADHD. The final limitation is that in the present study, 86 % of these parents were mothers and so our finding could not be generalized to both parents.

Summary

In summary, the AAQoL and the SF-36 have good psychometric properties. For assessing the HRQoL of parents of children with ADHD, one of the two questionnaires can be used regard to the objective of study. Moreover, our findings provide evidence that the HRQoL of parents of Iranian children with ADHD was lower than that of the parents of children with chronic diseases in other countries.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Human and animal rights Research involved human participants.

Informed consent All participants signed an informed consent form that was specifically designed for the current study.

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