

Can Online Assessment Be Trusted? A Pilot Study of Computer-based – vs. ‘Paper and pencil’ – Version of the Adult Self-Report 18-59

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Abstract.

In the last few years, the technology-based approach in psychology for clinical intervention, assessment, and scientific research has shown the several advantage. Researchers typically use the digital versions of existing pen and paper instruments. Therefore, the study of psychometric properties of the measures appears necessary. The present study aimed to compare the density distribution and scale results of the Adult Self Report 18-59 self-report instrument.

40 Italian young adults were involved and randomly associated to one of two conditions. The first group ($n = 20$) completed the ASR through paper-and-pencil protocol. The second group ($n = 20$) completed a computer-based version of the questionnaire. Bayesian correlations and Bayesian independent sample t-tests were performed. The results show the possibility of using the ASR through computer-based assessment. The relevance of testing the psychometric properties of the self-report questionnaire before their online use is discussed.

Keywords: Psychological assessment, Adult Self Report 18-59, Online survey

1 Introduction

In the last two decades, several studies advocated an improvement of a ‘technology-based’ approach in psychology through the use of computer-based tools – for clinical intervention, assessment, and scientific research [1-3]. Indeed, on the one hand, ‘telemedicine’ as well as ‘telepsychology’ (*i.e.*: online psychotherapies and/or online psychological interventions) may help to facilitate psychological help seeking [4, 5], thus reducing the stigma towards mental illness [6-8]. On the other hand, most of the current research recruits the research participants through the Internet, and the participants complete the questionnaire through the ‘online’ form [1-3, 9-12] – allowing to obtain a huge amount of data. It is undoubtedly that – during the last few years – the use of web-

based survey tools (*i.e.*, Qualtrics, SurveyMonkey, Google Forms, etc.) is increasingly preferred.

When psychological data are collected through ‘computer-based’ survey tools, researchers usually use the digital versions of already existing ‘paper and pencil’ self-report questionnaires [13]. However, despite the positive results supporting ‘computer-based’ assessment, the study of psychometric properties of the measures appears necessary: ‘online’ research protocols do not often consider that an ‘online’ administered self-report questionnaire may not be equivalent to its ‘paper-and-pencil’ form [14]. Indeed, the ‘computer-based’ format could affect the psychometric properties of established self-report scales – such as factorial structure, the stability of the results, and internal consistency.

Considering this background, the present pilot study aimed to compare density distribution and scale results of one of the most used questionnaires in clinical psychology: the Achenbach Adult Self Report 18-59 (ASR) [15-16]. Indeed, according to the Manual of ASEBA [15], the ASR should be completed with different assessment methods such as ‘paper and pencil’, ‘online’, or through an interview. Moreover, although the manual of ASEBA provides for the use of the online format, there are no Italian studies that confirm the equivalent to its ‘paper and pencil’ use.

2 Materials and Methods

2.1 Participants and Procedure

Forty Italian young adults were enrolled from the general population and were randomly associated to one of two conditions. The first group ($n = 20$) completed first the original paper-and-pencil protocol of the ASR, and the second group ($n = 20$) completed a ‘computer-based’ version of the questionnaire. The two samples were matched for age, sex, years of education, and income. Moreover, each participant referred no previous diagnosis of psychological/psychiatric condition. Also, each participant was screened for the actual presence of psychological/psychiatric and/or medical pathology.

The final sample comprised 40 participants: 18 males (45%) and 22 females (55%) aged from 20 to 31 years ($mean = 25.08$, $SD = 3.533$). More in detail, the sample of participants who completed the ASR with ‘paper and pencil’ assessment ($n = 20$) was composed of 9 males (45%) and 11 females (55%) aged from 20 to 30 years ($mean = 25.10$, $SD = 3.611$). The second sample of participants who completed the ASR with an ‘online’ assessment ($n = 20$) was composed of 9 males (45%) and 11 females (55%) aged from 20 to 31 years ($mean = 25.05$, $SD = 3.546$). Regarding the time spent to complete the questionnaire, the minutes of the ‘computer-based’ format appears on average lower than ‘paper and pencil’ format (‘paper and pencil’: $mean = 13.27$, $SD = 3.114$, range = 9-05-19.41; ‘computer-based’: $mean = 7.02$, $SD = 1.496$, range = 4.05-9.59).

2.2 Measures

Adult Self Report (ASR) 18-59. The ASR is part of the Achenbach System of Empirically Based Assessment (ASEBA) – one of the most widely used assessment tools for psychopathology [15-16], very popular among both clinicians and researchers [17-18]. The ASR is composed of 6 Syndromic scales that allow assessing Internalizing and Externalizing problems. More in detail, ‘internalizing problem’ scales are (A) Anxious/Depressed, (B) Withdrawn, and (C) Somatic Complaints. Also, ‘externalizing problem’ scales are (D) Aggressive Behavior, (E) Rule-Breaking Behavior, and (F) In-trusive. Besides, the independent scale of (G) Personal Strengths was used to assess the adaptive functioning of the individuals.

A normalized T score (weighted for sex and age) was assigned for the Syndromic scale and to broadband scales. Recommended cut-off scores were used: ‘borderline clinical attention’: $65 \leq \text{T-score} \leq 69$; ‘significant clinical attention’: $\text{T-score} \geq 70$.

2.3 Data analysis

Statistical analyses were performed with the ‘overlapping’ package [19] for R software and with JASP software.

The data analysis procedure was used. First, for each ASR scale, the overlapping index (η) was calculated by overlapping the Kernel-Gaussian density distribution of each sample. The η -index quantifies the similarity between groups – it ranges from 0 (= perfect separation) to 1 (= perfect overlap) – and it should be interpreted as an effect size. Thus, it should not be used to assess the inference of hypotheses [19].

Second, considering the small sample size of each group ($n_1 = n_2 = 20$), Bayesian statistics were used. Bayesian correlations and Bayesian independent sample t-tests were performed to assess (1) relationships between variables and (2) mean comparisons, respectively. More in detail, the prior distribution was set to a zero-centered Cauchy distribution with a default scale – γ (width parameter) – of 0.707: [$\delta \sim \text{Cauchy}(0, 0.707)$] [20].

Considering that the ASR can be used with different methods indiscriminately – then larger evidence for the null hypothesis was expected (H_0 = no difference between assessing method). Evidence for the null hypothesis was observed by means of the Bayes Factor (BF). According to the Jeffery’s scheme [21] BF_{01} values can be considered as “*anecdotal*” ($1 \leq \text{BF} < 3$), “*moderate*” ($3 \leq \text{BF} < 10$), “*strong*” ($10 \leq \text{BF} < 30$), “*very strong*” ($30 \leq \text{BF} < 100$), or “*extreme*” ($\text{BF} > 100$) relative evidence for a hypothesis (H_0 or H_1).

3 Results

As reported in Figure 1, the η -index suggests a moderate-to-large overlap between ‘paper and pencil’ and ‘online’ assessment method for all of the ASR scales. More in detail, the ‘Anxious/Depressed’ scale showed an η -index of 0.843, the ‘Withdraw’ scale showed an η -index of 0.601; the ‘Somatic Complaints’ scale showed an η -index of

0.724; the 'Aggressive Behaviors' scale showed an η -index of 0.784; the 'Rule-Breaking Behavior' scale showed an η -index of 0.656; the 'Intrusive' scale showed an η -index of 0.604; the 'Internalizing problems' scale showed an η -index of 0.782; the 'Externalizing problems' scale showed an η -index of 0.805; the 'Personal Strengths' scale showed an η -index of 0.670.

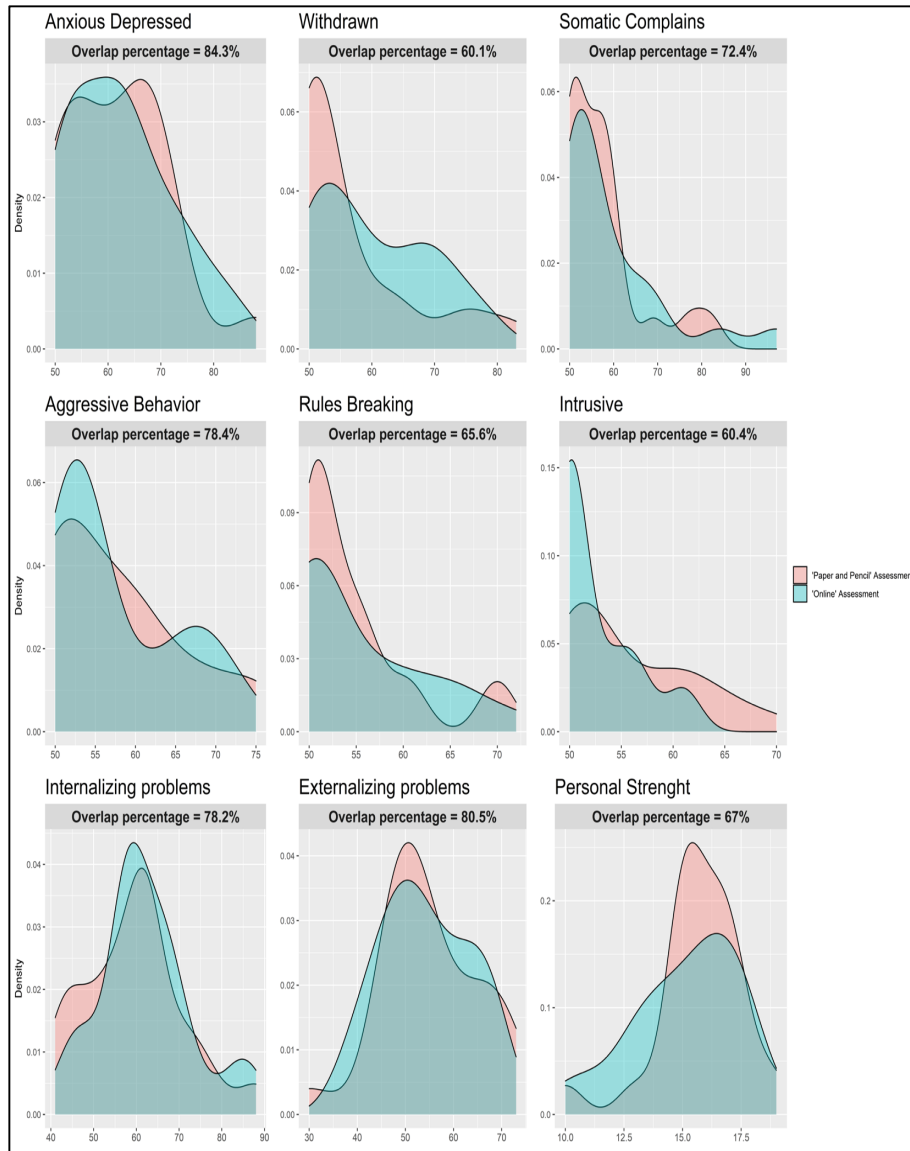


Figure 1. Overlapping between density distributions of the 'paper and pencil' assessment group and the 'online' assessment group.

In Figure 2 were reported Bayesian correlations between scales in each sample.

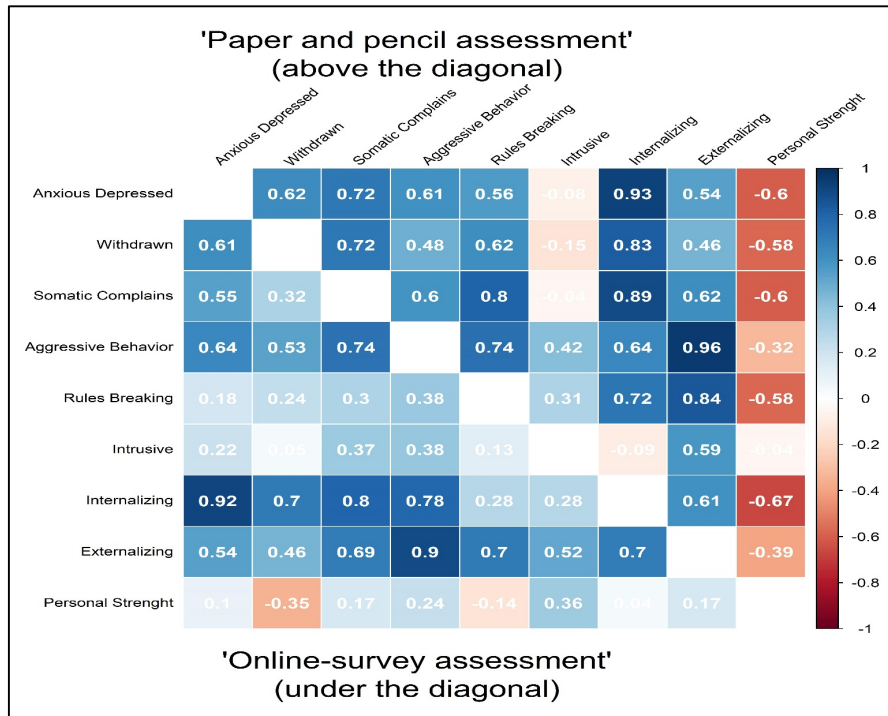


Figure 2. correlation matrix between scales split by sample.

Finally, as reported in Table 1, the Bayesian independent sample t-test suggests a greater evidence for the null hypothesis (H_0) in most of the comparisons.

	BF ₀₁	BF ₁₀	%error	95%BCI [L; U]
Anxious/Depressed	3.205	0.312	0.007	-0.593; 0.508
Withdrawn	1.949	0.513	0.008	-0.868; 0.267
Somatic Complains	2.865	0.349	0.007	-0.700; 0.408
Aggressive Behaviors	3.219	0.311	0.007	-0.519; 0.582
Rule-Breaking Behavior	3.132	0.319	0.007	-0.627; 0.475
Intrusive	0.666	1.502	0.004	0.057; 1.145
Internalizing problems	2.594	0.385	0.008	-0.755; 0.361
Externalizing problems	3.182	0.314	0.007	-0.495; 0.606
Personal Strengths	2.326	0.430	0.008	-0.320; 0.803

Table 1. Mean comparisons (T-scores) between 'paper and pencil' and 'online' assessment.

Note: BF₁₀ = Bayes Factor in favor of the alternative hypothesis (H_1); BF₀₁ = Bayes Factor in favor of the null hypothesis (H_0); 95%BCI = lower and upper of Bayesian credible intervals.

4 Discussions

In the last few decades, the research community has started using the ‘computer-based’ approach to gather data. Several studies have used ‘paper and pencil’ questionnaires through ‘online’ forms. Nevertheless, only a few studies have investigated the psychometric quality of data collected on a ‘computer-based’ approach [22].

According to Alfonsson and colleagues [14], the ‘*interformat*’ reliability, that refers to the equality between different delivery formats of the administration, could be influenced by the characteristics of the formats [13, 23] and/or by the respondents’ perception of the formats (i.e., anonymity and security [24]). The scientific debate on the possible bias in responses in the use of the ‘computer-based’ approach, the reliability, validity, and the factorial structure of self-report questionnaires is still ongoing. Although some studies showed that specific psychological questionnaires maintain the psychometric characteristics [25-27], other studies showed several differences between the ‘paper and pencil’ administration and the ‘online’ ones [28-31]. Moreover, new instruments are being developed and investigated for validity specifically for use ‘online’ [32], and recent reviews have been conducted to provide an overview of ‘online’ instruments to considering when choosing measures for assessing common mental health problems ‘online’ [14, 33]. For example, in recent years, new methodologies of assessment were developed – becoming very used in social and health sciences – such as the Experience Sampling Methods (ESM; [34]) and Ecological Momentary Assessment (EMA; [35, 36]). ESM and EMA use the collection of self-reports or indices of behavior, cognition, or emotions in an individual's natural environment in real-time, through electronic devices [37-38].

Considering this background, the present pilot study aimed to compare the density distribution and scale results of the ASR 18-59 questionnaire [15].

The results show small-to-moderate evidence in favor of the null hypothesis (H_0) in most of the comparisons – no differences between the ‘paper and pencil’ and the ‘online’ assessment. These evidences suggest the possibility of using the computer-based assessment – despite more accurate studies were needed.

However, these results were consistent with other studies on anxiety and depression [26] evaluated both on ‘paper and pencil’ and ‘online’ formats. Moreover, the time spent to complete the questionnaire through ‘computer-based’ format appears on average lower than ‘paper and pencil’ format. These results were consistent with other studies that showed the amount of time that is saved compared to the traditional ‘paper and pencil’ test [39].

Overall, these results suggest that computer-based testing has some positive benefits relative to paper- and- pencil measures. In this sense, the technology-based interventions could be particularly useful for patients who struggle to turn to clinical services in person, such as people with severe obesity and other eating disorder [40-43], infective disease, and chronic progressively disabling disease [44-45], as well as several related psychological issues [46-55]. Alongside this, the computer-based assessment has

a significant advantage over the possibility of access to young people that are often vulnerable and far from circuits that can be reached [56-62]. Moreover, social media with new sampling methodologies (i.e.: snowball sampling) [1-3, 9-12] allow overcoming some common issues of psychological research (i.e.: small ‘sample size’).

Although the results discussed showed small-to-moderate evidences in favor of the expected hypothesis – indicating that the computer-based administration format can be reliable and useful – the study has several limitations. First of all, despite Bayesian analysis were used (advocated for studies with small samples [63]), the sample size was small ($n = 40$; $n_1 = n_2 = 20$). In further studies, the number of participants should be strongly increased. Moreover, the use of a larger and more representative sample allows the use of more sophisticated and complete research designs. Second, the study takes into consideration only the Syndromic scales of the ASR questionnaire. Third, the participants completed the questionnaire through PCs: thus, the use of other devices, such as mobile phones, tablets, has not been checked and tested.

In conclusion, it should be highlighted that the present pilot study does not claim to be considered as a validation study of the ‘online’ use of the ASR questionnaire – and it does not provide any definitive evidence of the equivalence between ‘paper and pencil’ and ‘online’ assessment. Indeed, this pilot study was meant only to show and focus the attention of both the research and clinical community on the importance of testing psychometric properties of questionnaires before their online use.

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