Equivalence of Telehealth and Face-To-Face Administration of the Weschler Adult Intelligence Scale Fourth Edition (WAIS-IV)

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Equivalence of Telehealth and Face-To-Face Administration of the Weschler Adult Intelligence Scale Fourth Edition (WAIS-IV)

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Author Note

This article is intended for submission to Psychological Assessment (nominated journal), which adheres to the APA-7th reference style. At present, the article has been written according to the Master of Psychology (Clinical) thesis requirement of 6,000 – 8,000 words but will be edited prior to submission to meet the 40 page word limit specified by Psychological Assessment (journal).

Table of Contents

List of Figures

List of Tables

Abstract

Telehealth administration of cognitive tests like the Weschler Adult Intelligence Scale Fourth Edition (WAIS-IV) have the potential to significantly increase access to important assessments for individuals in remote locations or where psychological services are limited. However, there is limited empirical evidence for the equivalence of telehealth and face-to-face administration. At present test publishers recommend not administering subtests with stimulus materials that need to be manipulated via telehealth. Therefore, the present study evaluated the equivalence of a telehealth administration procedure of the WAIS-IV with face-to-face administration. This randomised repeated measures design included a sample of N = 28 participants with typical cognitive functioning. The Two One Sided T-Tests (TOST) procedure was used to examine statistical equivalence between administration modes. Results showed that while mean differences were smaller than the standard error of measurement, the TOST procedure indicated that the Full-Scale Intelligence Quotient (FSIQ) and the majority of subtests were no statistically equivalent across administration modes. Overall, these findings show that this telehealth mode of administration is a viable and pragmatic option for remote cognitive testing. However, psychologists are advised to use clinical judgement and be mindful of the benefits and limitations when interpreting scores obtained from telehealth administration.

Keywords: telehealth, online testing, test administration, Weschler Adult Intelligence Scale-IV

Public Significance Statement: This article evaluates whether the Wechsler Adult Intelligence Scale, Fourth Edition, given in a online format produces equivalent results as the traditional face-to-face administration of the test. The findings reveal how psychologists can use the test in a telehealth context, to continue cognitive evaluations for individuals with limited access to health services.

Declaration

This dissertation contains no material which has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, contains no materials previously published except where due reference is made.

I give permission for the digital version of my dissertation to be made available on the web, via the University's institutional digital repository, the Library Search and also through web search engines, unless permission has been granted by the School to restrict access for a period of time.

October 2022

Statement of Contribution

Dr [redacted], Miss [redacted], and Dr [redacted] were involved in planning and supervised the work of VB. VB and NC carried out the formal assessments, supervised by Miss [redacted]. Dr [redacted] provided support for analysis of data and drafting of results sections. VB performed analysis and designed the figures. VB took lead in writing the manuscript with input from Dr [redacted], Dr [redacted] and Miss [redacted].

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Telehealth, the provision of healthcare through telecommunication technologies, is a prevalent alternative to traditional face-to-face interactions. Specifically, in the field of psychology, Telehealth facilitates digital provision of psychological services to address community mental health needs. For instance, continuing advances in this area have enabled rural and remote communities to access previously limited or unavailable psychological services like cognitive assessments (Brealy et al., 2017; Burke & Hall, 2015; Luxton et al., 2014; Zhou et al., 2020). Further, the recent Coronavirus (COVID-19) pandemic has provided renewed impetus for the effective and valid delivery of psychological services via telehealth. The many benefits of telehealth, discovered over the years of the pandemic, will likely see psychological services administered via telehealth remain in health service frameworks post-pandemic (Fisk et al., 2020; Reay et al., 2021). To date, however, there has been limited evaluation of psychological assessment services, which is only just beginning to be addressed. Continued evaluation of telehealth psychological services is therefore imperative to ensure that individuals receive safe, cost-effective, and quality services in the years to come (Jayawardana & Gannon, 2021; Reay et al., 2021).

Further, psychologists in clinical practice and researchers who use telehealth need to be aware of factors that influence the validity of assessments. Luxton et al. (2014) emphasised that clinical psychologists should consider psychometric properties of an assessment when selecting measures for telehealth use. An assessment tool may be valid and reliable in its original modality; however, this does not mean the tool will be equally valid via telehealth administration. When testing procedures are adapted from their standardised form various factors can influence participants' performance during assessments. For example, an individual's performance may be overestimated if provided with extra instruction than what is outlined in the administration manual. Likewise, a participant's performance may be underestimated if standardised prompts, instructions, or examples are omitted. It is

imperative then for examiners, before test administration, to be familiar with available scientific literature on the strengths and weaknesses of an administrative mode (APA, 2020).

The WAIS-IV

The Wechsler Adult Intelligence Scale Fourth Edition (WAIS-IV; Weschler, 2008) is a widely used measure of cognitive functioning in individuals aged 16 to 90 years. In clinical practice, the WAIS-IV is used to aid psychological assessment, diagnostic processes, and treatment design. Specifically, this measure is used to identify and classify learning disorders, understand barriers to learning and education, and examine older adults and individuals with brain injuries on their cognitive functioning and possible decline (Donders & Strong, 2015; Erododi et al., 2017; Hammers et al., 2018; Holdnack et al., 2011; Theiling & Petermann, 2016). The current and previous versions of the WAIS were traditionally designed to be administered in a face-to-face setting with scoring to be completed using paper record forms. However, in response to the COVID-19 pandemic the test publishers Pearson (2020) developed online materials that enable the administration of the test via telehealth.

Previous research on the telehealth administration of the WAIS-IV is scarce. However, a number of studies have examined the children's version of the WAIS-IV, the Weschler Intelligence Scale for Children version five (WISC-V; Cullum & Grosch, 2014; Hodge et al., 2019; Wright, 2020). The majority of these studies have examined the equivalence of telehealth administration when using a trained facilitator to present materials to the client. A trained facilitator physically present with an examinee during testing provides support for assessment set up, manipulation of physical stimuli, and maintaining a level of security for test materials. For example, trained facilitators were adopted in Wright's (2020) study comparing telehealth administration of the WISC-V with face-to-face administration in a sample of 256 children aged 6–16. With the exception of one complementary subtest all scales administered via telehealth were considered equivalent with face-to-face

administration. However, this type of administration method presents various challenges when trained facilitators are unavailable. For example, strict protocols were used for facilitator coaching including how to set up equipment, when to physically manipulate or support participant with access to tangible materials (e.g., blocks for the 'Block Design' subtest), and where to sit at certain times of assessment. Strict facilitator training limits testing environments like remote or isolated communities where facilitators are not available.

Equivalence of the WAIS-IV

To date there have only been two studies that have examined the equivalence of the WAIS-IV when administered via telehealth (Harder et al., 2020; McMahon et al, 2022). Of these studies only one has examined the equivalence and feasibility of administering the full WAIS-IV via telehealth without a facilitator compared to traditional, face-to-face administration (Mahon et al., 2021). A randomised counter-balanced design was employed in which 30 typically developing university students from New Zealand, aged 18–40, were assigned to either a telehealth or face-to-face administration mode first. The researchers employed a series of repeated measures one-way ANOVAs to examine between-group differences for each subscale and major indices. No between-group differences were found (all test were nonsignificant, $p > .05$; p range: .23–.94). However, this study had several limitations. First, these finding may not be generalisable to a wider population or in an Australian context as the sample was limited to New Zealand university students. Second, the authors did not provide explicit details about how the WAIS-IV was adapted for administration without a facilitator. These details are necessary so these procedures can be replicated and implemented in both research and clinical practice. Finally, the methodology employed evaluated whether subscale means were statistically different with repeated measures one-way ANOVAs. This is a limitation as this analysis only focuses on whether scores are statistically significantly different, without consideration of the size of the score

differences and their clinical or practical implications. Therefore, in the present study, we will use equivalence testing focusing on both, whether differences between means are statistically significant, and also practically significant. Practical significance places more importance on the magnitude of the difference rather than the existence *of* a difference. For instance, research has shown that there is a high risk of error when interpreting small score differences in IQ assessments which have potentially critical implications for clients (Belk et al., 2002). Therefore, for clinical assessments, knowing the degree of score variability between modalities and whether differences between modalities are meaningful can guide decisions related to score interpretation and applicability of norms (Committee on Psychological Testing, 2015).

Present Study

The present study aimed to evaluate the equivalence of two methods of administration of the WAIS-IV: the standardised, traditional, face-to-face administration and digital telehealth administration (without a facilitator). Specifically, the study aimed to evaluate the equivalence of the Full Scale Intelligence Quotient (FSIQ) scores and associated subtest standard scores across the two administration methods. This is important for clinical psychology, as valid FSIQ scores obtained through telehealth administration of the WAIS-IV may in future support clinical decisions related to diagnosis and treatment. In addition, the present study will examine the user experience and feasibility of the telehealth mode of administration compared to face-to-face administration. This will contribute to understanding further the important practical considerations when testing in this modality.

Method

Equivalence Study Design

For the present study, a within-subjects repeated measures design was used, in which examinees took the WAIS-IV twice in two formats (traditional face-to-face and telehealth

without a facilitator). To account for any influence of the order of administration (traditional face-to-face or telehealth first), participants were randomly assigned to which assessment method they participated in first and second (face-to-face vs. telehealth). Chen's (1999) Maximum Tolerated Imbalance (MTI) procedure was employed to randomise participants to ensure similar group sizes throughout the data collection. Simple randomization was not used due to the likelihood of obtaining imbalanced groups due to the small sample size. Likewise block randomisation was not used due to possible issues with allocation concealment and influences of selection bias (Berger & Grant, 2016). For example, if a block of four participants were allocated to the telehealth administration mode first, researchers would be aware that the next four participants would be allocated to the face-to-face administration. This posed an issue as it may bias the way in which the researchers interacted with the participants.

Instead, MTI procedures were used to ensure researchers could determine the maximum imbalance between groups. Such a randomization procedure has its advantages. That is, an imbalance tolerance is predetermined, which means when imbalanced participant allocation occurs, participants are more likely to be allocated to the group containing fewer participants. Likewise, even if the MTI is not reached, balance is brought back to allocation selection through biased probabilities. The number of participants in each group (face-to-face or Telehealth) directly influences the probability of next participants allocation. For example, if the telehealth group has one participant more than the face-to-face group, a 70% probability (instead of 50% used when groups are balanced as in simple randomization) is used allocate the next participant to the face-to- face group is used.

Participants

A sample of $N = 30$ adults aged 16 or above were recruited between December 2021 and May 2022 from the Australia's National Child Oral Health Study (NCOHS, Do &

Spencer, 2016) participant pool and the University of Adelaide first year undergraduate psychology students participant pool. Participants were screened for inclusion and exclusion criteria: Selection criteria included: 1) aged 16 years or older; 2) English fluency; 3) had not received a formal diagnosis which could impair cognitive functioning including; (a) neurodevelopmental disorder e.g., ADHD, autism, dyslexia, dyscalculia; (b) mental illness e.g., major depressive disorder, generalised anxiety; and (c) other special needs e.g., epilepsy, physical impairment; and 4) had not completed an standardised intelligence test in the last two years prior to the testing date. Two participants that were selected and randomised indicated post-randomisation that they had not met inclusion criteria (i.e., had received a formal diagnosis that could impair cognitive functioning) and so were excluded from analysis bringing the final sample to n = 28 participants. Demographic characteristics of the sample (n = 28) included a mean age of 21 years (SD = 3.65) and the majority identified as Female (n = 17). The majority of the sample identified as Australian (n = 22), the remainder identified broadly as European, South American, African, Asian and Aboriginal and Torres Strait Islander Fifty percent of participants reported household income to be over $140,000 per year, four participants did not provide income and the rest of participants reported household income between $60,000 and $120,000 per year.

Measures

Wechsler Adults Intelligence Scales, Fourth Edition (WAIS-IV). The WAIS-IV (Wechsler, 2008) is an individually administered performance-based intellectual ability test that is comprised of multiple subtests and used with adults aged 16 to 90. The widely used measure produces an overall Full Scale Intelligence Quotient (FSIQ) as well as multiple index scores for domains of intellectual functioning including verbal comprehension, perceptual reasoning, working memory, and processing speed. The WAIS-IV has

demonstrated construct validity and excellent reliability in its standardised face-to-face format (Benson et al., 2010; Canivez, & Watkins, 2010; Weschler, 2008).

Telehealth Assessment Survey. At the end of both assessments participants were asked to complete a three-part Telehealth Assessment Survey (See Appendix A). The first part of the survey consisted of a Likert scale, where participants were asked to rate their experience and attitudes towards the telehealth assessment on a scale from 1 (strongly disagree) to 5 (strongly agree). An example item being "I felt comfortable using the telehealth equipment". The second part of the survey asked participants to provide general comments about their telehealth assessment and to compare their telehealth experience with the face-to-face assessment. Twenty-seven participants provided responses to this part of the survey. The final part of the Telehealth Assessment Survey asked participants to rate on a Likert scale from 1 (poor) to 5 (excellent), the quality of technology used for the telehealth assessment. An example item being "Audio quality (e.g., how easily could you hear the examiner?)".

Procedures

For the present study test administrators were trained provisional psychologists working under supervision to ensure valid administration and accurate scoring. Supervising psychologists were experienced in administrating the WAIS-IV and using the online platform Coviu. Participants were randomly allocated to their first WAIS-IV assessment format (face-to-face or Telehealth) using the MTI (Chen, 1999) procedure. Each WAIS-IV assessment followed the standard sequence for face-to-face or telehealth, respectively. For instance, in the telehealth administration, different rooms were used in the same setting (at the University of Adelaide). Both the examiner and participant were connected to the same internet connection to reduce the possibility of technological malfunction during assessment. The same examiner administered the first and second WAIS-IV assessment with a 1-hour break

between them (regardless of format), to ensure practice effects were standardised across groups. Upon completion of two test administrations all participants were asked to give feedback via the Telehealth Assessment Survey. NCHOS (2012–14) participants were given a $60 gift voucher and a dental gift pack. First year undergraduate students were awarded course credit. All participants in the study were then provided access to a one-page summary of their first test administration results.

Face-to-face administration procedures. Standard face-to-face administration of the WAIS-IV (as outlined in the administration and scoring manual, Weschler, 2008) used traditional materials including hard copies of record forms, stimulus books, and materials.

Telehealth administration procedures. For telehealth, administration stimulus books were administered via the digital platform Coviu (www.coviu.com/en-au/). Telehealth administration used an adapted WAIS-IV (2010) to enable administration via Coviu without a facilitator on the participant side. Provisional psychologists followed an adapted manual of the WAIS-IV created by the research team of the present study, which included a neuropsychologist experienced in telehealth cognitive testing. Adaptions of the WAIS-IV manual were focussed on making administration possible in a telehealth format without a facilitator. For example, in the WAIS-IV block design subtest verbal instructions were included to perform the demonstration item on screen "*please look on screen I will show you a demonstration…now please take out only two blocks…*" and also enable scrambling of blocks between items, i.e., "*now please scramble all blocks, make sure only two blocks are showing a half red/half white side facing up.*" Likewise, for answer booklets used in Symbol Search and Coding subtest instructions, participants were guided to first view a demonstration on screen, then access their prefilled form and complete sample items, i.e., "*please look on screen for a demonstration…now take out the booklet with the subtest*

Symbol Search facing up, the demonstrated items are prefilled in your booklet…please complete the sample items now."

For telehealth administration of the WAIS-IV two sets of stimulus materials were used including: (1) a block set placed into an envelope labelled "1" and positioned on the examinee table in a location accessible to the participant, and (2) hard copies of response booklets prefilled with participant details, examiner details, and demonstration items placed into an envelope labelled number "2"; also positioned onto the examinee table. Envelopes were used to ensure participants were not able to see materials prior to administration and to protect confidentiality post administration. During telehealth assessment examiners used a second copy of stimulus materials to demonstrate items via a document camera linked to the telehealth platform Coviu

Regardless of administration format, scores of each assessment were entered into the WAIS-IV online scoring program via Q-Global immediately after each assessment was conducted. For the test administrators a supervising neuropsychologist reviewed the administration and scores to ensure test administration was valid and scoring was entered correctly.

Data Analysis Plan

A two-one-sided-tests (TOST; Lakens, 2017) procedure was used to evaluate the equivalence of the two administration methods in the present study. To determine equivalence between the methods, the TOST procedure evaluates whether the 90% Confidence Intervals (CI) (given an alpha level of 5%) around the mean difference (between groups) overlaps with predefined bounds, labelled the smallest effect size of interest (SESOI). The 90% CI's are used instead of the 95% CI's because two one sided tests are performed (Lakens, 2017). The SESOI determined for the current study was based on substantive knowledge in the relevant literature. Norman and colleagues (2003)

recommended that for health and psychosocial characteristics the SESOI should equal to 0.5 Standard Deviations (SD). When equivalence is examined between alternative forms of psychological assessment, the SESOI should be smaller than the standard error of measurement (SEM). The reason for this is that the SEM is the variability of the scores expected due to measurement error alone. For the WAIS-IV, a SESOI of 0.3 SD is smaller than the SEM (Weschler, 2008), and so was employed for this study similarly to previous research (Wright, 2020). In this study, for indices (M = 100, SD = 15) to be considered equivalent, the paired mean difference 90% CI needed to fall within the lower and upper bound of -4.5 and 4.5; and for the subtest scaled scores (M = 10, SD = 3) to be considered equivalent, the paired mean difference 90% CI needed to fall within the lower and upper bound of -0.9 and 0.9. We also conducted null hypothesis significant testing (NHST) to evaluate whether the mean differences were statistically different from zero with an alpha level of 5%. For the NHST, 95% CIs are reported.

Results

WAIS-IV Equivalence

We began by inspecting the means and SDs for the WAIS-IV (Table 1). We then completed the Two One Sided Tests (TOST) analysis comparing the face-to-face method with the telehealth method of administration (Table 2).

Table 1.

Descriptive Statistics for the Wechsler Adult Intelligence Scale, Fourth Edition (WISC-IV) Full Scale Intelligence Quotient (FSIQ) and Core Subtest Scores by Administration Format

WAIS-IV	Telehealth administration (N = 28)		Face-to-Face administration (N = 28)		Full Sample (N = 28)	
	M	SD	*M*	SD	*M*	SD
FSIQ	118.36	17.78	116.79	12.05	117.57	15.07
Similarities	12.25	2.65	12.75	2.58	12.50	2.60

Vocabulary	13.29	2.59	13.29	2.43	13.29	2.49
Block Design	13.18	2.83	13.32	3.31	13.25	3.05
Information	11.18	3.31	11.11	3.27	11.14	3.26
Matrix Reasoning	11.71	1.76	11.32	2.07	11.52	1.92
Visual Puzzles	13.32	2.21	12.89	2.50	13.11	2.35
Arithmetic	11.00	3.55	10.96	2.40	10.98	3.00
Digit Span	11.25	3.09	11.07	3.15	11.16	3.09
Coding	12.82	2.42	13.18	2.78	13.00	2.59
Symbol Search	13.11	2.97	14.21	3.61	13.67	3.33

Note. FSIQ scores are standard scores (M = 100, SD = 15); all subtest scores are scaled scores (M = 10, SD = 3).

To ascertain if telehealth administration was comparable with face-to-face administration we first tested for equivalence on the FSIQ score. The equivalence test was not significant, ($t(27) = -1$, $p = .164$) and the associated 90% CIs of the mean score difference (refer to Figure 1) fell outside the upper equivalence bound (+4.5) but not the lower equivalence bound (-4.5), indicating that the scores from the two administration methods were not statistically equivalent. Further, the difference between point estimates for the FSIQ were not significantly different ($t(27) = .53$, $p = .598$), and fell inside the lower and upper bounds (±4.5).

We proceeded to test equivalence across subtests. Figure 2 displays the equivalence testing across the subtests. For the first subtest Similarities, the equivalence test was not significant, ($t(27) = .94$, $p = .178$) and the associated 90% CIs of the mean score difference fell outside the lower (-0.9) but not the upper equivalence bound (+0.9), indicating the scores from the two administration methods were not statistically equivalent. Further, the difference between point estimates for Similarities were not significantly different ($t(27) = -1.18$, $p = .250$), and fell inside the lower and upper bounds (±0.9).

For the second subtest Vocabulary, the equivalence test was significant, ($t(27) = -5$, $p < .001$) and the associated 90% CIs of the mean score difference fell inside the lower and upper equivalence bound (±0.9), indicating the scores from the two administration methods were statistically equivalent. Further, the difference between point estimates for Vocabulary were not significantly different ($t(27) = .00$, $p = 1.00$), and fell inside the lower and upper bounds (±0.9).

For the third subtest Information, the equivalence test was significant, ($t(27) = -2.5$, $p < .05$) and the associated 90% CIs of the mean score difference fell inside the lower and upper equivalence bound (±0.9), indicating the scores from the two administration methods were statistically equivalent. Further, the difference between point estimates for Information were not significantly different ($t(27) = .21$, $p = .833$), and fell inside the lower and upper bounds (±0.9).

For the fourth subtest Block Design, the equivalence test was not significant, ($t(27) = 1.37$, $p = .092$) and the associated 90% CIs of the mean score difference fell outside the lower (-0.9) but not the upper equivalence bound (+0.9), indicating the scores from the two administration methods were not statistically equivalent. Further, the difference between point estimates for Block Design were not significantly different ($t(27) = -.25$, $p = .803$), and fell inside the lower and upper bounds (±0.9).

For the fifth subtest Matrix Reasoning, the equivalence test was not significant, ($t(27) = -1.36$, $p = .093$) and the associated 90% CIs of the mean score difference fell outside the upper (+0.9) but not the lower equivalence bound (-0.9), indicating the scores from the two administration methods were not statistically equivalent. Further, the difference between point estimates for Matrix Reasoning were not significantly different ($t(27) = 1.04$, $p = .309$), and fell inside the lower and upper bounds (±0.9).

For the sixth subtest Visual Puzzles, the equivalence test was not significant, ($t(27) = -1.23$, $p = .114$) and the associated 90% CIs of the mean score difference fell outside the upper (+0.9) but not the lower equivalence bound (-0.9), indicating the scores from the two administration methods were not statistically equivalent. Further, the difference between point estimates for Visual Puzzles were not significantly different ($t(27) = 1.13$, $p = .269$), and fell inside the lower and upper bounds (±0.9).

For the seventh subtest Digit Span, the equivalence test was not significant, ($t(27) = -1.69$, $p = .051$) and the associated 90% CIs of the mean score difference fell outside the upper (+0.9) but not the lower equivalence bound (-0.9), indicating the scores from the two administration methods were not statistically equivalent. Further, the difference between point estimates for Digit Span were not significantly different ($t(27) = .42$, $p = .675$), and fell inside the lower and upper bounds (±0.9).

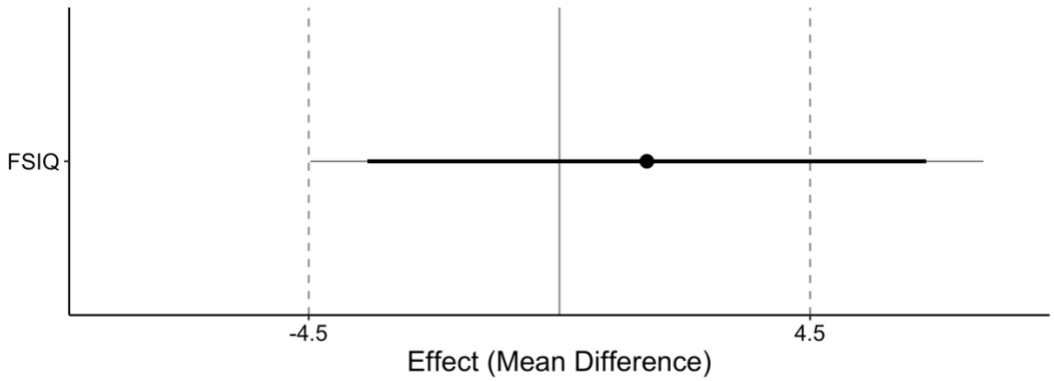
For the eighth subtest Arithmetic, the equivalence test was significant, ($t(27) = -1.96$, $p < .05$) and the associated 90% CIs of the mean score difference fell inside the upper and lower equivalence bound (±0.9), indicating the scores from the two administration methods were statistically equivalent. Further, the difference between point estimates for Arithmetic were not significantly different ($t(27) = .09$, $p = .928$), and fell inside the lower and upper bounds (±0.9).

For the ninth subtest Coding, the equivalence test was not significant, ($t(27) = 1.53$, $p = .069$) and the associated 90% CIs of the mean score difference fell outside the lower (-0.9) but not the upper equivalence bound (+0.9), indicating the scores from the two administration methods were not statistically equivalent. Further, the difference between point estimates for Coding were not significantly different ($t(27) = -1.02$, $p = .317$), and fell inside the lower and upper bounds (±0.9).

For the final subtest Symbol Search, the equivalence test was not significant, ($t(27) = -28$, $p = .608$) and the associated 90% CIs of the mean score difference fell outside the lower (-0.9) but not the upper equivalence bound (+0.9), indicating the scores from the two administration methods were not statistically equivalent. Further, the difference between point estimates for Symbol Search were not significantly different ($t(27) = -1.53$, $p = .139$), and fell inside the upper bound (+0.9), but outside the lower bound (-0.9)

Figure 1.

Difference between means for the Weschler Adult Intelligence Scale (WAIS-IV) Full Scale Intelligence Quotient (FSIQ).



Note. The thick horizontal line shows the 90% confidence intervals from the two one-sided tests procedure, the thin horizontal line shows the 95% confidence intervals from null-hypothesis significance tests, the solid vertical line shows the null hypothesis, and the dashed vertical lines lines show the equivalence bounds.

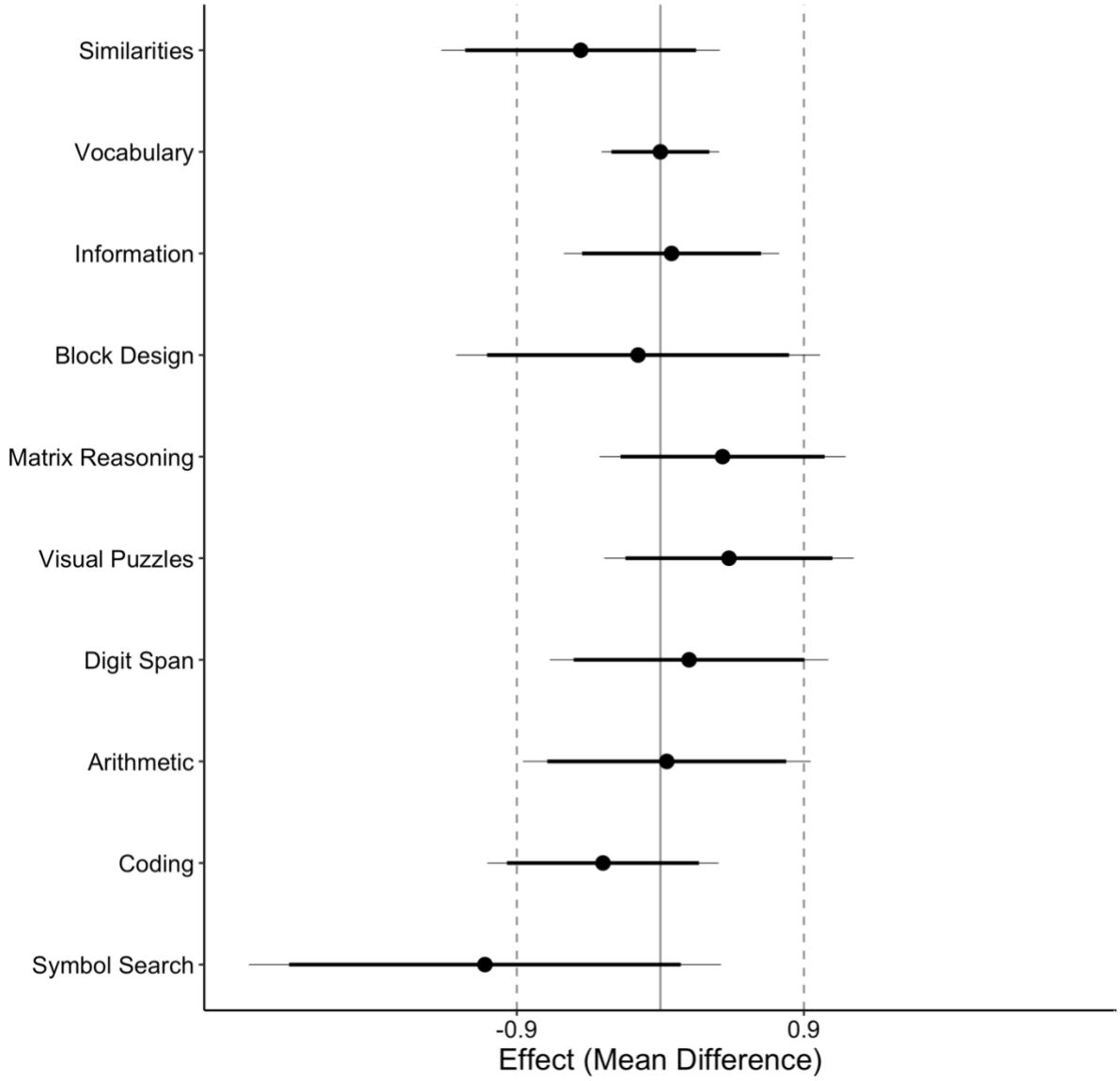
Table 2.

Confidence Intervals (90% CIs) for Mean Score Differences for Wechsler Adult Intelligence Scale, Fourth Edition (WAIS-IV) Full Scale Intelligence Quotient (FSIQ) and Core Subtests Between the Telehealth Administration Group and the Face-to-face Administration Group

		95% CI		90% CI	
WAIS-IV Index/Subtest	Mean Difference	Lower	Upper	Lower	Upper
Full-Scale IQ	1.57	-3.446	6.586	-4.472	7.612
Similarities	-0.50	-1.224	0.224	-1.377	0.373
Vocabulary	0.00	-0.307	0.307	-0.369	0.369
Information	0.07	-0.491	0.631	-0.605	0.745
Block Design	-0.14	-1.087	0.807	-1.281	1.001
Matrix Reasoning	0.39	-0.25	1.03	-0.381	1.161
Visual Puzzles	0.43	-0.219	1.079	-0.352	1.212
Digit Span	0.18	-0.544	0.904	-0.693	1.053
Arithmetic	0.04	-0.709	789	-0.826	0.942
Coding	-0.36	-0.962	0.242	-1.085	0.365
Symbol Search	-1.1	-2.328	0.128	-2.58	0.38

Figure 2.

Difference between means for the Weschler Adult Intelligence Scale (WAIS-IV) Core Subtest



Note. The thick horizontal lines show the 90% confidence intervals from the two one-sided tests procedure, the thin horizontal lines show the 95% confidence intervals from null-hypothesis significance tests, the solid vertical line shows the null hypothesis, and the dashed vertical lines lines show the equivalence bounds.

Telehealth Feasibility Analysis

To assess the feasibility of the telehealth administration method we asked participants to complete a three-part survey in person following both assessments. The first part of the survey asked participants to indicate the strength of their agreement with statements about their experience during the telehealth testing mode (refer to Table 5). The majority of participants indicated strong agreement with statements about their comfort using the equipment, ease of following telehealth instructions, comfort with not requiring additional in person support during testing, overall assessment satisfaction, and comfort with the examiner. Likewise, the majority of participants believed the test environment was suitable and were not concerned about their privacy during testing. While most participants did not report feeling distracted during the telehealth testing, a small but distinct percentage indicated that they were distracted.

The second part of the telehealth feasibility survey asked participants to compare their telehealth assessment experience with the face-to-face assessment experience. First, participants were asked which assessment method they preferred, just over half (56%) reported preference for the face-to-face method. Second, participants were asked if they had previous experience with telehealth testing, 93% reported no prior experience. Finally, participants were asked to provide written details about the presence and outcome of miscommunications during testing, and positive and negative aspects of telehealth testing compared to in person testing. From participants responses 33% reported that if miscommunication occurred, participants were able to ask for a repeat or for the examiner to clarify. For example, one participant stated, “If I misheard or forgot, most of the time I was able to ask to hear the question again.” A positive aspect of telehealth administration reported by five participants was that there was less pressure to perform during the telehealth method compared with the face-to-face assessment. However, five participants said that instructions

were more difficult to understand during the telehealth administration method compared with face-to-face. One participant mentioned it was “tempting to use the numbers on the laptop keyboard to trace the numbers during memory sections”, another also mentioned “the keyboard was a little distracting when doing the number tests”.

The third part of the telehealth survey asked participants to rate and give optional written feedback on the technology used in the telehealth administration. Overall, 28 participants gave feedback. Participants rated the technology for the telehealth administration method to be good quality with no participants rating the technology as poor quality. For speaker quality, 86% of participants rated good to excellent, three participants provided qualitative feedback that the speaker volume could have been louder. For internet connection and microphone quality, 96% of participants rated this as good or excellent. For laptop video quality, 100% of participants rated it good or excellent. For laptop performance, 93% of participants rated it as good or excellent.

Table 5.

Percentages of Participants attitudes and experiences of the telehealth assessment method (n=28)

Item	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Item 1 (Comfort with equipment)	0%	0%	4%	14%	82%
Item 2 (Overall easy instructions)	0%	0%	4%	11%	86%
Item 3 (Easy instructions during demonstrations)	0%	0%	4%	11%	86%
Item 4 (Comfort with absence of instructor)	0%	4%	21%	7%	68%
Item 5 (Satisfied with administration)	0%	0%	4%	14%	82%
Item 6 (Distracted by equipment)	21%	46%	14%	14%	4%
Item 7 (Privacy concerns)	64%	18%	11%	7%	0%
Item 8 (Believe telehealth worthwhile)	0%	0%	21%	39%	39%
Item 9 (Recommend telehealth to others)	4%	4%	25%	29%	39%
Item 10 (Test environment suitable)	0%	0%	11%	29%	61%
Item 11 (Comfort with examiner)	0%	7%	7%	4%	61%

Note. See Appendix A for Item wording.

Discussion

The present study aimed to evaluate the equivalence of a telehealth administration method with the traditional face-to-face administration of the WAIS-IV. To determine equivalence, we used the TOST procedure (Lakens et al., 2017; 2018) which evaluated whether the observed mean differences and their associated 90% CIs were meaningful by comparing them with predefined bounds, labelled the smallest effect size of interest (SESOI).

First, we analysed the 90%CIs around the mean difference for the FSIQ and subtests. This analysis showed that three subtests were statistically equivalent (Vocabulary, Information, and Arithmetic), while the FSIQ and other seven subtests were not statistically equivalent. For the NHSTs, the FSIQ and all subtests were not significantly different from zero (considered "Not Statistically Equivalent and Not Statistically Different" (Laken et al., 2018). These findings are analogous to Mahon and colleagues (2021) who used repeated measures one-way ANOVAs and reported that subscale means were not statistically different between telehealth and face-to-face administration.

Next, our analysis showed that observed point estimates (mean score differences) for the FSIQ and the majority of subtest (except for symbol search) all fell within the predefined bounds, indicating that the observed difference between telehealth and face-to-face administration were smaller than the SESOI. That is, the point estimates (the best estimates of the mean difference between groups given our data) were smaller than the variability that would be expected between telehealth and face-to-face administration from measurement error alone.

Overall, while the point estimates indicated that differences were small and not statistically different from zero, we were not able to reject the hypothesis that the true effect (i.e. the true difference between telehealth and face-to-face administration) is at least as extreme as the SESOI. These findings needs to be interpreted with caution, given that the

TOST procedure is conservative in small sample sizes (i.e. it is more likely to indicate lack of statistical equivalence even when administration methods are in face equivalent) (Linde, et al., 2021). Taken together, our findings provide initial support for equivalence between telehealth and face-to-face administration, but more research in the area is required.

Factors Impacting Equivalence

There are several explanations for the disparity observed between the findings suggested by the comparison of point estimates and analysis of the 90% CIs.

The influence of standard error in testing. The standard error of measurement (SEM) is the natural variation in test scores that is expected when using the WAIS-IV (Cappelleri et al. 2014). This natural variation will account for some of the variation that we observed across modes of assessment in this study (captured both in point estimates and 90% CIs) and is one explanation for why the 90% CIs crossed the pre-defined bounds. For example, a participant's score is an estimate only of their intelligence and in clinical practice is commonly reported to fall within a 95%CI in recognition of the influence of the test reliability and external factors on this score (Weiss, 2017). As a result a participants score will vary within the same administration mode simply due to measurement error in the test itself. It is possible that the variation seen between the two testing modes, giving the small differences, could in part be due to this issue.

Limitation of the TOST for small samples. Secondly, the large 90% CIs and the subsequent lack of equivalence that they indicated may be due to the sample characteristics of the present study. This study had many benefits including testing conducted in strict laboratory settings and specific inclusion criteria. However, as a result only a small number of participants were recruited and included in the final sample. The large 90% CIs indicate that the precision of our estimates of differences could be improved, and this can potentially be achieved with larger samples in future studies. Also, the TOST procedure is conservative

for small samples, indicating lack of equivalence even in cases when groups are equivalent. Future studies should also evaluate equivalence without methodological alternative, such as the Bayes Factor. However, given this is only the second study that has examined equivalence of the WAIS-IV, it provides a good indication that it is likely possible to successfully adapt the WAIS-IV to a telehealth context.

Adaptions to testing procedure. Finally, it is possible that the variations between the two assessment modalities were caused by a genuine influence from telehealth adaptions. However, there was no clear pattern for subtests that did not achieve statistical equivalence and the extent to which administration procedures had been adapted to telehealth. For example the subtests similarities and digit span both underwent only minor adaptions (as they were presented verbally) and yet were not statistically equivalent. On the contrary, vocabulary, information, and arithmetic also had minor adaptions but these subtests were statistically equivalent across modalities. In short, while we did not observe a pattern regarding stimuli alteration and statistical equivalence (or lack of statistical equivalence) of scores across modalities, administration mode may be the cause of some of the variation between modalities observed here.

Feasibility of Telehealth

In addition to equivalence testing, we administered a survey to obtain information regarding the feasibility or practical aspects of telehealth testing. This information may provide insight into the variables that may have influenced individuals' experiences and test scores across administration modes. Overall participants reported a generally positive experience with the telehealth testing mode and high satisfaction with the assessment process. These findings replicate those of Mahon and colleagues (2021). Just over half of participants preferred the face-to-face administration over telehealth administration. Free text responses revealed a small number of participants expressed feeling less pressure to perform in a

telehealth environment. Free text responses also revealed some participants experienced miscommunications during the telehealth testing, and a higher degree of difficulty understanding instructions. These findings align with a recent cross-sectional survey exploring Australians' experience and satisfaction with telehealth during COVID-19 (Isautier et al., 2020). More so a small portion of participants reported being easily distracted in the telehealth condition, with two participants providing information that the laptop keyboard was a source of distraction or temptation during number tests. This insight on participants experience provides future research directions on possibly influential variables when using telehealth methodology.

Implications for Clinical Psychology Practice

Psychologist in clinical practice need to balance a number of considerations when interpreting the findings presented here. Our findings indicate that, while the point estimates were smaller than variability expected due to measurement error alone, the large 90% CIs reveal that these estimates could have been more precise and that there was no statistical equivalence between face-to-face and Telehealth administration of the WAIS-IV. These findings, however, need to be weighed against considerations of the benefits of Telehealth and within the context of the broader psychological assessment process. First, there are many benefits to delivery of health care services, of which cognitive testing is part, via telehealth. For instance, these benefits include improved access for individuals in rural or remote locations where health professionals are scarce; high levels of acceptance and satisfaction reported by patients; improved cost-effectiveness; reduced wait times; and alleviating concerns of time and transportation (Madigan et al., 2020; Moffatt & Eley, 2010; Nelson et al., 2017).

Second, psychological assessment is a multifaceted process with profound implications for individuals. For example, when determining if an individual meets DSM-V

criteria for intellectual disability, clinicians need to consider a range of factors. These include scores on standardised testing, developmental history, the individual's adaptive functioning and any other information obtained through interviews or previous reports from other allied health professionals that may shed light on the individuals functioning (Brue & Wilmshurst, 2016; Luckasson & Schalock, 2015; Tasse et al., 2016). Clinical decision making can be comprised if there is an over-reliance on one area. That is, only considering scores obtained from standardised testing, particularly, if there are variations in a test takers performance that renders a single score like the FSIQ invalid. The implications of poor clinical decisions can result in missed opportunities for support or treatment access, waste of scare public resources, and reduced client motivation for work (Reschly et al., 2002; Srasuebkul et al., 2021). It is crucial that standardised test scores should be interpreted in the context of supporting information when making clinical decisions in either face to face or telehealth context.

Given the many benefits of delivering health services via Telehealth and the fact that psychological testing is a part of a broader psychological assessment process, when delivering the WAIS-IV testing via Telehealth, clinicians should interpret scores cautiously, similarly to a face-to-face context. They should also draw on the supporting information captured in the broader assessment process to ensure accurate decision-making and reduce the likelihood of negative outcomes.

Limitations and Future Research

The present study had several limitations. The first limitation is the generalizability of the findings. Specifically, the present sample consisted of healthy individuals from predominantly a younger age bracket, Anglo ethnicity, higher education, and higher socio-economic status. Thus, these findings might not generalise to people from different backgrounds. For example, it is possible that these findings may not generalise to older

Australians who present with less knowledge and lower confidence using technology (Vaportzis et al., 2017).

Also, the sample was not clinical, and so these findings cannot be applied to individuals with various clinical presentations, who may also face certain difficulties with using telehealth platforms. For example, individuals with Autism Spectrum Disorder may experience hypersensitivity or hyposensitivity to sensory inputs, visual and auditory stimuli (e.g bright or flashing screens, and loud sounds) which can lead to distraction during a telehealth interaction (Zolyomi et al., 2019). Additionally, the telehealth method required participants to use a laptop, and locate the provided physical materials like blocks, pencils and record books. This additional complexity may prove challenging for individuals with lower cognitive functioning like those with Dementia or Intellectual Disability (Krysta et al., 2021; Julie et al., 2021). Future research should be undertaken to establish the equivalence of the WAIS-IV with clinical samples. Further, a feasibility analysis with clinical samples may lead to insights into the necessary modifications that enable valid Telehealth administration of cognitive tests like the WAIS-IV.

Moreover, the present study used specific protocols for examiner training, and standardised administration modification; and therefore, may not be applicable to all types of telehealth administrations of the WAIS-IV. To remediate this test publishers or health service settings could develop standardised ways of administering cognitive assessments like the WAIS-IV via telehealth. Further, the present study was conducted in a laboratory setting to help control the impact of extraneous variables during telehealth testing, and as such we cannot comment on the feasibility of our telehealth administration in a home context. However, the present findings taken together with those of Mahon et al., (2021) demonstrates initial evidence that telehealth testing is likely a feasible approach that has the potential to reach a variety of settings. A future research comparing telehealth administration of the

WAIS-IV in both a home and clinical setting will provide further insight into contextual similarities and differences that influence participants' performance.

Finally, another limitation pertains the self-report nature of the feasibility survey administered to participants after sitting both WAIS-IV administration methods. Responses given by participants regarding positive and negative aspects of telehealth testing may contain potential sources of bias. For example, while all participants sat both testing modes on the same day, selective memory may skew participants perceptions of their telehealth experience compared to face-to-face testing and what they decided to report. To address this limitation, future studies could record participants during testing that are later examined for indicators of distraction or confusion.

Conclusion

Telehealth has the potential to significantly increase access to important psychological services for individuals in remote locations or where services are limited. COVID-19 has only emphasised this need, especially when distancing measures are in place. In this study we have established that a telehealth mode of administration of the WAIS-IV provides scores that are similar to those collected in face-to-face administration and observed differences were smaller than difference expected due to measurement error. However, the limitations of the TOST procedure for small sample sizes indicate that more research is needed to provided conclusive evidence on the equivalence between the two administration modes (by including larger samples to improve precision or using methodological alternative to the TOST procedure). Therefore, when conducting psychological assessments clinical psychologists are cautioned not to solely rely on test scores when formulating outcomes. Instead, clinical judgement should be used with the explicit awareness of potential (albeit small) errors introduced by telehealth testing. Many individuals who take part in psychological assessments are faced with life-altering outcomes including the possibility of

diagnosis, intervention, and access to funding. Therefore, valid telehealth administration of cognitive tests like the WAIS-IV has an important role to play for quality online psychological services now and into the future.

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Authors are also encouraged to justify their sample demographics in the Discussion section. If Western, educated, industrialized, rich, and democratic (WEIRD) or all-White samples are used, authors should justify their samples and describe their sample inclusion efforts (see Roberts, et al., 2020 for more information on justifying sample demographics).

In a subsection of the discussion titled "Constraints on Generality," authors should include a detailed discussion of the limits on generality (see Simons, Shoda, & Lindsay, 2017 (http://journals.sagepub.com/doi/abs/10.1177/1745691617708630)), explicitly stating limitations of the sample in regard to diversity factors and directly noting that study findings may not generalize to the broader population, if the sample was not sufficiently diverse.

Further, the examination of sex/gender, race, and ethnicity should not be reified as a biological factor, and authors should incorporate and explicitly discuss how race and ethnicity may be proxy measures for systemic racism, as well as cultural, social, environmental, economic, and structural factors. For more information, please refer to the standards for publishing on racial health inequalities (https://www.healthaffairs.org/do/10.1377/hblog20200630.939347/full) (Boyd, Lindo, Weeks, & McLemore, 2020).

Abstract and keywords

All manuscripts must include an abstract containing a maximum of 250 words typed on a separate page. After the abstract, please supply up to five keywords or brief phrases.

Public significance statements

Psychological Assessment publishes public significance statements in addition to regular abstracts. This new feature provides authors an opportunity to communicate their findings to general audiences who access online content.

The public significance statement should be 1–2 sentences (30-70 words) written in plain English for the educated public. The text should summarize the article's findings and why they are important. Please refer to Guidance for Translational Abstracts and Public Significance Statements (/pubs/journals/resources/translational-messages) to help you write your statement.

Your public significance statement should be placed below the abstract in the manuscript file you upload during the submission process.

Author contributions statements using CRediT

The APA *Publication Manual* (7th ed.) (https://apastyle.apa.org/products/publication-manual-7th-edition) stipulates that "authorship encompasses ...not only persons who do the writing but also those who have made substantial scientific contributions to a study." In the spirit of transparency and openness, *Psychological Assessment* has adopted the Contributor Roles Taxonomy (CRediT) (http://credit.niso.org/contributor-roles-defined/) to describe each author's individual contributions to the work. CRediT offers authors the opportunity to share an accurate and detailed description of their diverse contributions to a manuscript.

Submitting authors will be asked to identify the contributions of all authors at initial submission according to this taxonomy. If the manuscript is accepted for publication, the CRediT designations will be published as an author contributions statement in the author note of the final article. All authors should have

reviewed and agreed to their individual contribution(s) before submission.

CRediT includes 14 contributor roles, as described below:

Conceptualization: Ideas; formulation or evolution of overarching research goals and aims.

Data curation: Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse.

Formal analysis: Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data.

Funding acquisition: Acquisition of the financial support for the project leading to this publication.

Investigation: Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection.

Methodology: Development or design of methodology; creation of models.

Project administration: Management and coordination responsibility for the research activity planning and execution.

Resources: Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools.

Software: Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components.

Supervision: Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.

Validation: Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs.

Visualization: Preparation, creation and/or presentation of the published work, specifically visualization/data presentation.

Writing—original draft: Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation).

Writing—review and editing: Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision—including pre- or post-publication stages.

Authors can claim credit for more than one contributor role, and the same role can be attributed to more than one author.

Journal Article Reporting Standards

Authors should review the APA Style Journal Article Reporting Standards (https://apastyle.apa.org/jars) (JARS) for quantitative, qualitative, and mixed methods. The standards offer ways to improve transparency in reporting to ensure that readers have the information necessary to evaluate the quality of the research and to facilitate collaboration and replication.

The JARS:

recommend the division of hypotheses, analyses, and conclusions into primary, secondary, and exploratory groupings to allow for a full understanding of quantitative analyses presented in a manuscript and to enhance reproducibility;

offer modules for authors reporting on replications, clinical trials, longitudinal studies, and observational studies, as well as the analytic methods of structural equation modeling and Bayesian analysis; and

include guidelines on reporting of study preregistration (including making protocols public); participant characteristics (including demographic characteristics); inclusion and exclusion criteria; psychometric characteristics of outcome measures and other variables; and planned data diagnostics and analytic strategy.

The guidelines focus on transparency in methods reporting, recommending descriptions of how the researcher's own perspective affected the study, as well as the contexts in which the research and analysis took place.

Transparency and openness

APA endorses the Transparency and Openness Promotion (TOP) Guidelines by a community working group in conjunction with the Center for Open Science (Nosek et al. 2015 (https://science.sciencemag.org/content/348/6242/1422.full)). The TOP Guidelines cover eight fundamental aspects of research planning and reporting that can be followed by journals and authors at three levels of compliance.

For example:

Level 1: Disclosure—The article must disclose whether or not the materials are available.

Level 2: Requirement—The article must share materials when legally and ethically permitted (or disclose the legal and/or ethical restriction when not permitted).

Level 3: Verification—A third party must verify that the standard is met.

As of July 1, 2021, empirical research, including meta-analyses, submitted to *Psychological Assessment* must, at a minimum, meet Level 1 (Disclosure) for all eight aspects of research planning and reporting. Authors should include a subsection in their methods description titled "Transparency and openness." This subsection should detail the efforts the authors have made to comply with the TOP guidelines.

The list below summarizes the minimal TOP requirements of the journal. Please refer to the Center for Open Science TOP guidelines (https://www.cos.io/initiatives/top-guidelines) for details, and contact the editor (mailto:psychassessjournal@gmail.com) (Julie A. Suhr) with any further questions. APA recommends sharing data, materials, and code via trusted repositories (http://re3data.org/) (e.g., APA's repository (https://osf.io/meetings/apa/) on the Open Science Framework (OSF)), and we encourage investigators to preregister their studies and analysis plans prior to conducting the research. There are many available preregistration forms (e.g., the APA Preregistration for Quantitative Research in Psychology (https://docs.google.com/spreadsheets/d/1vlp5GN-H0rrjCdjE2lf_3tT6RwhQD2VVeDZGOeFsQled/edit#gid=0) template, ClinicalTrials.gov (http://www.ClinicalTrials.gov/), or other preregistration templates available via OSF (https://osf.io/zab38/wiki/home/)). Completed preregistration forms should be posted on a publicly accessible registry system (e.g., OSF (https://osf.io/prereg/), ClinicalTrials.gov, or other trial registries in the WHO Registry Network).

A list of participating journals (https://www.apa.org/pubs/journals/resources/transparency-openness-promotion) is also available from APA.

The following list presents the eight fundamental aspects of research planning and reporting, the TOP level required by *Psychological Assessment*, and a brief description of the journal's policy.

Citation: Level 1, Disclosure—All data, program code, and other methods developed by others should be appropriately cited in the text and listed in the references section.

Data Transparency: Level 1, Disclosure—Article states whether the raw and/or processed data on which study conclusions are based are available and, if so, where to access them.

Analytic Methods (Code) Transparency: Level 1, Disclosure—Article states whether computer code or syntax needed to reproduce analyses in an article is available and, if so, where to access it.

Research Materials Transparency: Level 1, Disclosure—Article states whether materials described in the method section are available and, if so, where to access them.

Design and Analysis Transparency (Reporting Standards): Level 1, Disclosure—The journal strongly encourages the use of APA Style Journal Article Reporting Standards (JARS-Quant, JARS-Qual, and/or MARS). The journal encourages the use of the 21-word statement, reporting a) how the sample size was determined, 2) all data exclusions, 3) all manipulations, and 4) all study measures. See Simmons, Nelson, & Simonsohn (2012) for details.

Study Preregistration: Level 1, Disclosure—Article states whether the study design and (if applicable) hypotheses of any of the work reported was preregistered and, if so, where to access it. Authors may submit a masked copy via stable link or supplemental material or may provide a link after acceptance.

Analysis Plan Preregistration: Level 1, Disclosure—Article states whether any of the work reported preregistered an analysis plan and, if so, where to access it. Authors may submit a masked copy via stable link or supplemental material or may provide a link after acceptance.

Data, materials, and code

Authors must state whether data and study materials are available and, if so, where to access them. Recommended repositories include APA's repository (https://osf.io/meetings/apa/) on the Open Science Framework (OSF), or authors can access a full list of other recommended repositories (http://re3data.org/).

In both the author note and at the end of the method section, specify whether and where the data and material will be available or include a statement noting that they are not available. For submissions with quantitative or simulation analytic methods, state whether the study analysis code is available, and, if so, where to access it.

For example:

> All data have been made publicly available at the [repository name] and can be accessed at [persistent URL or DOI].
>
> Materials and analysis code for this study are available by emailing the corresponding author.
>
> Materials and analysis code for this study are not available.
>
> The code behind this analysis/simulation has been made publicly available at the [repository name] and can be accessed at [persistent URL or DOI].

Preregistration of studies and analysis plans

Preregistration of studies and specific hypotheses can be a useful tool for making strong theoretical claims. Likewise, preregistration of analysis plans can be useful for distinguishing confirmatory and exploratory analyses. We encourage investigators to preregister their studies and analysis plans prior to conducting the research (e.g., ClinicalTrials.gov or the Preregistration for Quantitative Research in Psychology (https://docs.google.com/spreadsheets/d/1vlpSGN-HXmjCdjE28t_3rT6RwhQO2vWr0ZGOeFsGec/edit#gid=0) template) via a publicly accessible registry system (e.g., ClinicalTrials.gov (https://clinicaltrials.gov/) or the Preregistration for Quantitative Research in Psychology (https://docs.google.com/spreadsheets/d/1vlpSGN-HXmjCdjE28t_3rT6RwhQO2vWr0ZGOeFsGec/edit#gid=0) template) via a publicly accessible registry system (e.g., OSF (https://osf.io/prereg/), ClinicalTrials.gov, or other trial registries in the WHO Registry Network).

Articles must state whether or not any work was preregistered and, if so, where to access the preregistration. If any aspect of the study is preregistered, include the registry link in the method section and the author note.

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>
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>
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Display equations

We strongly encourage you to use MathType (third-party software) or Equation Editor 3.0 (built into pre-2007 versions of Word) to construct your equations, rather than the equation support that is built into Word 2007 and Word 2010. Equations composed with the built-in Word 2007/Word 2010 equation support are converted to low-resolution graphics when they enter the production process and must be rekeyed by the typesetter, which may introduce errors.

To construct your equations with MathType or Equation Editor 3.0:

> Go to the Text section of the Insert tab and select Object.
>
> Select MathType or Equation Editor 3.0 in the drop-down menu.

If you have an equation that has already been produced using Microsoft Word 2007 or 2010 and you have access to the full version of MathType 6.5 or later, you can convert this equation to MathType by clicking on MathType Insert Equation. Copy the equation from Microsoft Word and paste it into the MathType box. Verify that your equation is correct, click File, and then click Update. Your equation has now been inserted into your Word file as a MathType Equation.

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If you would like to include code in the text of your published manuscript, please submit a separate file with your code exactly as you want it to appear, using Courier New font with a type size of 8 points. We will make an image of each segment of code in your article that exceeds 40 characters in length. (Shorter snippets of code that appear in text will be typeset in Courier New and run in with the rest of the text.) If an appendix contains a mix of code and explanatory text, please submit a file that contains the entire appendix, with the code keyed in 8-point Courier New.

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Use Word's insert table function when you create tables. Using spaces or tabs in your table will create problems when the table is typeset and may result in errors.

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LaTex files (.tex) should be uploaded with all other files such as BibTeX Generated Bibliography File (.bbl) or Bibliography Document (.bib) together in a compressed ZIP file folder for the manuscript submission process. In addition, a Portable Document Format (.pdf) of the manuscript file must be uploaded for the peer-review process.

References

List references in alphabetical order. Each listed reference should be cited in text, and each text citation should be listed in the references section.

Examples of basic reference formats:

Journal article

McCauley, S. M., & Christiansen, M. H. (2019). Language learning as language use: A cross-linguistic model of child language development. *Psychological Review, 126*(1), 1–51. https://doi.org/10.1037/rev0000126 (https://doi.org/10.1037/rev0000126)

Authored book

Brown, L. S. (2018). *Feminist therapy* (2nd ed.). American Psychological Association. https://doi.org/10.1037/0000092-000 (https://doi.org/10.1037/0000092-000)

Chapter in an edited book

Balsam, K. F., Martell, C. R., Jones, K. P., & Safren, S. A. (2019). Affirmative cognitive behavior therapy with sexual and gender minority people. In G. Y. Iwamasa & P. A. Hays (Eds.), *Culturally responsive cognitive behavior therapy: Practice and supervision* (2nd ed., pp. 287–314). American Psychological Association. https://doi.org/10.1037/0000119-012 (https://doi.org/10.1037/0000119-012)

Data set citation

Alegria, M., Jackson, J. S., Kessler, R. C., & Takeuchi, D. (2016). *Collaborative Psychiatric Epidemiology Surveys (CPES), 2001–2003* [Data set]. Inter-university Consortium for Political and Social Research. https://doi.org/10.3886/ICPSR20240.v8 (https://doi.org/10.3886/ICPSR20240.v8)

Software/Code citation

Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software, 36*(3), 1–48. https://www.jstatsoft.org/v36/i03/ (https://www.jstatsoft.org/v36/i03)

Wickham, H. et al., (2019). Welcome to the tidyverse. *Journal of Open Source Software, 4*(43), 1686. https://doi.org/10.21105/joss.01686 (https://doi.org/10.21105/joss.01686)

All data, program code, and other methods must be appropriately cited in the text and listed in the references section.

Figures

Graphics files are welcome if supplied as Tiff or EPS files. Multipanel figures (i.e., figures with parts labeled a, b, c, d, etc.) should be assembled into one file.

The minimum line weight for line art is 0.5 point for optimal printing.

For more information about acceptable resolutions, fonts, sizing, and other figure issues, please see the general guidelines (https://www.kwglobal.com/digital-art-support).

When possible, please place symbol legends below the figure instead of to the side.

APA offers authors the option to publish their figures online in color without the costs associated with print publication of color figures.

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Brief Reports

Psychological Assessment will review brief reports of research studies in clinical assessment. The procedure is intended to permit the publication of carefully designed studies with a narrow focus or of specialized interest.

An author who submits a brief report must agree not to submit the full report to another journal of general circulation. The brief report should give a clear, condensed summary of the procedure of the study and as full an account of the results as space permits.

The brief report should be limited to 20 manuscript pages (1" margins, size 12 font). This includes the title page, abstract, author note, text, reference list, and any footnotes, tables, and figures. The number of tables and figures should be limited.

The author is encouraged to limit the number of headings within the brief report and to combine headings wherever possible. For example, the results and discussion sections can be combined. Also, subheadings under the method section can often be omitted.

Authors are encouraged but not required to have available an extended report. If one is available, the author note of the brief report should include the following statement:

> Correspondence concerning this article [and requests for an extended report of this study] should be addressed to [give the author's full name and address].

Replications

Psychological Assessment publishes direct replications. Submissions should include "A Replication of XX Study" in the subtitle of the manuscript as well as in the abstract.

Research on translations of tests

Psychological Assessment rarely publishes in print psychometric studies of translations of tests unless the papers also address some conceptual or methodological issue of broader interest to clinical assessment.

However, there is a special online-only publishing option for such research on translations of tests articles. With this option, manuscripts undergo our normal review process and are held to the same standards of review as all other submissions to the journal, but, if accepted, they would not appear in the print version of the journal but rather online only.

Studies appropriate for this option must have a focus consistent with the editorial scope of the journal, which emphasizes clinical assessment research.

These articles would be listed in all tables of contents (online and print) and would be clearly identified as published "online only". Also, full-text copies of the translated tests would go into PsycTests.

Translations of commercially published tests are not eligible for review in this category because, in addition to copyright constraints, such translations are not consistent with the goals of our research on translations of tests program or PsycTests. Translations of single scales also are not eligible.

Authors wishing to submit manuscripts in this category should select the "Research on Translations of Tests" article type when submitting their manuscript. Additional documents are required upon submission. Please follow the below guidelines.

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See also APA Journals® Internet Posting Guidelines (/pubs/journals/resources/internet-posting-guidelines) .

APA requires authors to reveal any possible conflict of interest in the conduct and reporting of research (e.g., financial interests in a test or procedure, funding by pharmaceutical companies for drug research).

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In light of changing patterns of scientific knowledge dissemination, APA requires authors to provide information on prior dissemination of the data and narrative interpretations of the data/research appearing in the manuscript (e.g., if some or all were presented at a conference or meeting, posted on a listserv, shared on a website, including academic social networks like ResearchGate, etc.). This information (2–4 sentences) must be provided as part of the author note.

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Ethical Principles

It is a violation of APA Ethical Principles to publish "as original data, data that have been previously published" (Standard 8.13).

In addition, APA Ethical Principles specify that "after research results are published, psychologists do not withhold the data on which their conclusions are based from other competent professionals who seek to verify the substantive claims through reanalysis and who intend to use such data only for that purpose, provided that the confidentiality of the participants can be protected and unless legal rights concerning proprietary data preclude their release" (Standard 8.14).

APA expects authors to adhere to these standards. Specifically, APA expects authors to have their data available throughout the editorial review process and for at least 5 years after the date of publication.

Authors are required to state in writing that they have complied with APA ethical standards in the treatment of their sample, human or animal, or to describe the details of treatment.

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The APA Ethics Office provides the full Ethical Principles of Psychologists and Code of Conduct (/ethics/code) electronically on its website in HTML, PDF, and Word format. You may also request a copy by emailing (mailto:ethics@apa.org) or calling the APA Ethics Office (202-336-5930). You may also read "Ethical Principles," December 1992, *American Psychologist*, Vol. 47, pp. 1597–1611.

Other information

Visit the Journals Publishing Resource Center (/pubs/journals/resources) for more resources for writing, reviewing, and editing articles for publishing in APA journals.

Appendix A

Participant ID: _____

Date: _____

THE UNIVERSITY of ADELAIDE

TOOTH for HEALTH - Telehealth Assessment Survey Instructions

Dear Participant,

Thank you for agreeing to help with this important study,

Please answer the following questions about your experiences and attitudes concerning the telehealth assessment. Some questions may ask you to compare your experiences between the face-to-face and telehealth administrations. Other questions will ask you to rate the technology used in the telehealth administration (i.e., webcam, computer, internet). You will also be given the opportunity to provide any additional thoughts about the different administrations.

Most of the questions will require you to give a rating. While some questions are open-ended and give you the opportunity to provide as much details as you wish.

Please make sure you **answer the questions on both sides** of this page.

Please answer all questions as accurately and honestly as you can, there **are no right or wrong answers.**

The information you provide is **strictly confidential.**

Part A: Rate your attitudes and experiences of the telehealth assessment

Please rate the degree to you which agree/disagree to statements regarding the telehealth assessment by circling the number

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. I felt comfortable using the telehealth equipment	1	2	3	4	5
2. Overall, the telehealth testing instructions were easy to follow	1	2	3	4	5
3. Some tasks required me to watch the examiner's hands while they explained and demonstrated the task. It was easy to understand the examiner's instructions during task demonstrations	1	2	3	4	5
4. It was not necessary to have anyone in the room with me to help explain the task during task demonstrations	1	2	3	4	5
5. Overall, I was satisfied with the telehealth administration of the IQ test	1	2	3	4	5
6. I was easily distracted by the telehealth equipment (e.g., webcam, mouse, computer)	1	2	3	4	5
7. I was concerned about my privacy during telehealth testing	1	3	4	4	5
8. I think telehealth assessments are a worthwhile service	1	2	3	4	5
9. I would recommend telehealth-based testing to others for cognitive assessments	1	2	3	4	5
10. I thought the test environment was suitable for a telehealth assessment (e.g., large enough room, quiet with little distractions)	1	2	3	4	5
11. My comfort with the examiner during the telehealth assessment was generally the same as it was in-person	1	2	3	4	5

Part B: Compare telehealth assessment to face-to-face assessment

Which testing modality did you prefer? *(tick one box only)*

1 Telehealth 2 Face-to-face 3 No preference

Do you have previous experience with telehealth?

1 Yes 2 No

Were there any moments during the telehealth assessment in which you did not understand what to do; if so were you able to communicate this to the examiner to resolve the misunderstanding?

Compared to the in-person administration, were there any positive or negative aspects of the telehealth administration that you can think of; if so please detail them below:

If you have any further comments and/or observations about the telehealth assessment, please detail them below:

Part C: Rate the quality of the technology used during the telehealth assessment

Please rate the following aspects of the telehealth session by circling the appropriate number for each category:

	Poor	Fair	Good	Very Good	Excellent
Audio quality (e.g., how easily could you hear the examiner?)	1	2	3	4	5
Speaker quality (e.g., how easily could the examiner hear you?)	1	2	3	4	5
Laptop video quality (e.g., was the video of the examiner clear?)	1	2	3	4	5
Internet Connection (e.g., was it stable?)	1	2	3	4	5
Laptop performance (were there any technical difficulties or disruptions e.g., slow loading times)	1	2	3	4	5

If you have any further comments and/or observations about the quality of the telehealth assessment, please detail them below:

Thank You!