Telehealth Equivalence of the Perceptual Reasoning Index and Processing Speed Index of the WAIS-IV

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Author Contributions

AS contributed to the study conceptualisation and methodology design, interpretation of results, supervision to the team and manuscript draft and revisions; PHRS assisted with design and implementation of research, advised the statistical analysis and data curation, interpretation of results, and manuscript draft and revision; JS was involved with study conceptualisation and design, as well as supervision of data collection; VB and NC were jointly responsible for sample preparation study conceptualisation and design and data collection; NC was also responsible for independent data analysis and interpretation, as well as manuscript drafting and preparation.

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Telehealth Equivalency of the Perceptual Reasoning Index and Processing Speed Index of the WAIS-IV

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Author Note

This article is intended for submission to *Psychological Assessment,* which adheres to the APA (7th edition) reference style. At present, the article has been written according to the Master of Psychology (Clinical) thesis requirement of 6,000-8,000. The article also meets the *Psychological Assessment* publication requirements of no longer than 40 pages (including all elements of the manuscript, with the exception of any supplemental material).

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Abstract

The telehealth validity literature to date has mostly investigated brief cognitive screeners, or test batteries with primarily verbal instructions that do not rely on physical materials or measure visual skills. This has inhibited the adoption of telehealth assessment in clinical practice. Recent literature has shown promise for the telehealth validity of the Weschler Adult Intelligence Scale, Fourth Edition (WAIS-IV), provided a trained test facilitator is present with the participant, however, more evidence is needed. The necessity of a trained facilitator further limits the ubiquitous access to psychological services that telehealth can offer. We aimed to investigate the telehealth equivalency of the WAIS-IV delivered through telehealth without a facilitator, with the standardised face-to-face administration. Equivalency of the Processing Speed Index (PSI) and Perceptual Reasoning Index (PRI) were of particular interest, given their subtests require physical materials and visual skills. A within-subjects randomised counterbalanced design was utilised to assess 28 healthy participants (age range 17 - 37, who mostly identified as Australian). A two-one-sided-tests procedure was employed to determine statistical equivalence. Findings indicated that most mean differences were smaller than the expected standard error of measurement of the subtests and indices, suggesting that score differences would likely have little clinical significance. There may be small administration effects for the PRI and PSI, but these effects are not extreme enough to make their telehealth administration invalid. As such, there is modest validity evidence for a telehealth administration of the WAIS-IV with no facilitator, but further research is needed for widespread adaption.

Keywords: Telehealth, Psychological Assessment, WAIS-IV, Equivalence Testing

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The delivery of telehealth services has been increasing across healthcare settings in recent years (Burke & Hall, 2015; Schoen et al., 2012). With the onset of the COVID-19 pandemic, the pace of telehealth adoption has increased as the need for safe and remote services became urgent (Marra et al., 2020b; Zane et al., 2021). A psychological service that can yield the benefits of telehealth is psychological assessment, which is essential for diagnosis and treatment design. Despite the essential nature of psychological assessment, there exists a reluctance among psychologists to conduct telehealth assessments. For instance, multiple surveys of psychologists reported an increase in telehealth to conduct interviews, interventions and feedback during the pandemic, but the frequency of telehealth assessment remained largely unchanged (Marra et al., 2020b; Zane et al., 2021). The scepticism to adopting telehealth assessment is understandable considering that complex standardised cognitive and performance-based measures are harder to adapt to telehealth, often require physical materials, and have a limited empirical basis to apply the respective normative and psychometric data to telehealth administrations. One such measure is the Weschler Adult Intelligence Scale-Fourth Edition (WAIS-IV; Weschler, 2008a), which is one of the most widely used measures of cognitive function in adults aged 16-90. The WAIS-IV is often used to classify learning disorders, understand barriers to learning and education, examine older adults' cognitive functioning or possible decline, and for the assessment of deficits after brain injury. To date, little is known about the capacity to deliver a full administration of the WAIS-IV via telehealth, particularly for elements of the test that require participants to interact with physical materials. Therefore, the present study aims to validate the equivalency of the full WAIS-IV via telehealth with no facilitator present with the participant.

The increases in service availability that telehealth assessment offers can benefit individuals with inadequate access to healthcare resources, with disabilities or mobility issues, and those working remotely. However, in a geographically vast country such as Australia, individuals in rural and remote communities can benefit the most. Highlighting the disparity in service availability in rural and remote communities, the Australian Institute of Health and Welfare (2019) reported 82.2% of registered psychologists were employed in major cities. Utilising telehealth assessment can also reduce travel time for both consumers and providers, reduce overall costs and potentially increase treatment engagement and retention (Bashshur et al., 2016; Benavides-Vaello et al., 2013; Russo et al., 2016).

There is growing evidence for the equivalency of a number of psychological assessments via telehealth, such as Digit Span, Clock Drawing, the Boston Naming Test, Letter Fluency, the Mini-Mental State Examination, Category Fluency, the Montreal Cognitive Assessment and the Hopkins Verbal Learning Test-Revised, to name a few (Brearly et al., 2017; Cullum et al., 2006, 2014; DeYoung & Shenal, 2019; Galusha-Glasscock et al., 2016; Grosch et al., 2015; Kirkwood et al., 2004; Marra et al., 2020a; Parks et al., 2021; Stain et al., 2011; Temple et al., 2010; Wadsworth et al., 2016, 2018). Telehealth assessment also appears to be well accepted by both consumers and providers (Hildebrand et al., 2004; Hodge et al., 2019; Mahon et al., 2022; Parikh et al., 2013; Sutherland et al., 2017). The majority of evidence so far has examined brief cognitive screeners or test batteries with primarily verbal instructions. Comprehensive cognitive tests that include visual tasks and tests with stimuli manipulation or many standarised procedures have often been excluded from investigation (e.g., DeYoung & Shenal, 2019: Cullum et al., 2006, 2014; Grosch et al., 2015; Parks et al., 2021; Stain et al., 2011; Wadsworth et al., 2016, 2018). The paucity of research has resulted in some cognitive tests having little to no evidence of validity for telehealth administration. For example, a review of telehealth assessment research to date

(Marra et al., 2020a) included only three studies examining executive functioning and one study of processing speed. Furthermore, tests that do involve visual and motor components have often shown the most inconsistent evidence, such as the Clock Drawing test which is a measure of executive functioning and visuo-spatial abilities (Brearly et al., 2017; Marra et al., 2020a). Testing overall cognitive functioning encompasses a broad range of abilities, many of which require visual and/or motor input. The lack of research inhibits the practical utility of telehealth assessment of overall cognitive functioning, or the administration of a comprehensive cognitive assessment. Investigation of a telehealth WAIS-IV administration can begin to bridge this research gap.

Currently, a limited number of studies have provided direct or indirect evidence for the equivalency of the full WAIS-IV when administered via telehealth, to the standard face-to-face administration (Mahon et al., 2022; Temple et al., 2010; Wright, 2020). For example, Temple et al. (2010) was one of the first to investigate a full administration of a Weschler test, when they compared a face-to-face and telehealth administration of the Weschler Abbreviated Scale of Intelligence, Third Edition (WASI-III; Weschler, 1999), in a small sample of adults with intellectual disabilities. During the telehealth administration a trained facilitator was present with the participant. Importantly, the WASI-III includes subtests that require visual construction skills, visual reasoning, and manipulation of test materials. Results from Temple et al. showed that scores were not impacted by differences in administration method, suggesting that a cognitive assessment with physical materials can be administered via telehealth. More recently, Wright (2020) used a case control matched design to examine the between-groups equivalence of a face-to-face and telehealth administration of the Weschler Intelligence Scale for Children, Fifth Edition (WISC-V; Weschler, 2014). Again, a facilitator was present with the participant during the telehealth administration. The sample consisted of 256 children recruited from schools across the United States, with an age

range of 6 – 16 years old. Participants first completed either the face-to-face or telehealth version of WISC-V, and were then matched on age, gender and IQ scores on the Kaufman Brief Intelligence Test, Second Edition. A robust statistical procedure, two-one-sided-tests (TOST), observed statistical equivalence between all major indices, and all but one of the fifteen subtests (Letter-Number Sequencing), across administration methods. This study provides good evidence for the equivalency of the telehealth WISC-V administration method, and suggests that the normative and psychometric data of a comprehensive intelligence test can be applied to a telehealth format, provided a facilitator is present. Given the subtest overlap, the results also show promise that similar observations could be found with a telehealth administration of the WAIS-IV.

Notably, in both Temple et al. (2010) and Wright (2020) a trained facilitator was present with the participant to prepare the cognitive tests and manipulate test materials. In doing so, the assessment integrity is maintained as the participant can interact with the test stimuli as per the standarised instructions. In accordance with the current research the WAIS-IV test publisher, Pearson (2020), released guidelines in response to COVID-19 that stipulate that the psychometric and normative data of the WAIS-IV can be applied to a telehealth administration, as long as a facilitator is present with the participant to manipulate test materials. However, the caveat of needing a trained facilitator creates practical limitations. Finding and adequately training facilitators to adhere to modified standardisation procedures is yet another barrier to ubiquitous access to services, and a further cost and time burden on consumers and providers.

To date, the only known study that has examined the equivalency of the WAIS-IV via telehealth without a facilitator is Mahon et al. (2022). The validity of home-based telehealth administration in a sample of New Zealand university students (n = 30), was investigated using a within-subjects randomised counter-balanced design. This research design, where all

participants are tested under both conditions with condition order varying across the sample, is considered robust in telehealth equivalency research for its ability to control for administration order (face-to-face or telehealth first) and counterbalance practice effects across groups (Brearly et al., 2017). A series of repeated measures one-way ANOVAs found no statistically significant differences for all indices and subtests across administration methods, and all intraclass correlation coefficients (ICCs) were above 0.90. However, the analysis of repeated measures one-way ANOVAs only tests whether the observed differences were statistically significant, and not whether the observed score differences were clinically meaningful. For instance, the limitations of using repeated measures one-way ANOVA are that: firstly, in case of a non-significant test result ($p > 0.05$), the ANOVA does not indicate that there is no difference between administration methods (i.e. evidence of absence is not absence of evidence); and secondly, even in case of a statistically significant difference, the difference can be so small that it does not have any clinical implications (Amrhein et al., 2019; Greenland et al., 2016). The reason is that the repeated measures one-way ANOVA typically assumes the null hypothesis that there is *no difference* between the groups; however, due to the impact of random measurement error, differences between WAIS-IV scores over repeated assessments are expected. Given that (at least small) score differences are expected, using a statistical procedure that considers these differences and examines whether these differences are meaningful (such as equivalence testing), as opposed to an approach that usually assumes there is no difference (such as one-way ANOVA or t-tests), is warranted. As such, evaluating the telehealth equivalency of the WAIS-IV with no facilitator using equivalence testing is an important next step to elucidate how equivalent the two administration modes are.

The Present Study

The current article aims to add to Mahon et al.'s (2022) results, and more broadly the telehealth assessment evidence base. The equivalency of the standardised face-to-face administration of the WAIS-IV, to a telehealth administration without a facilitator present with the participant will be assessed. A standardised adapted administration procedure for the WAIS-IV will be utilised, with participants directed to manage manipulable materials. Specific analytical focus and interpretation will be given to the Perceptual Reasoning Index (PRI) and Processing Speed Index (PSI) and their respective subtests. The PRI is a measure of fluid reasoning, spatial processing and visual-motor integration, while the PSI is a measure of short-term visual memory, attention, visual-motor coordination and discrimination of visual information (Weschler, 2008b). The respective subtests require the most adaptation to be administered without a facilitator, often use visual stimuli and require visually based skills. Participants will also be administered a brief survey regarding their experiences and opinions during the telehealth assessment. Ensuring consumers have an acceptable experience during telehealth assessment is an important aspect to facilitate telehealth assessment in practice. It is hypothesised that all major indices and subtests of the WAIS-IV will be found to be statistically equivalent. If equivalency can be demonstrated, then existing normative and psychometric data can be applied to a telehealth administration of the WAIS-IV with no facilitator present. This has the potential to increase access to psychological assessments service availability to rural and remote communities with limited psychological services.

Method

Study Design

The present study utilised a within-subjects randomised counter-balanced design to control for practice effects due to the order of administration. Participants were randomly assigned to either the face-to-face or telehealth administration of the WAIS-IV first. Chen's

(1999) Maximum Tolerated Imbalance randomisation procedure was utilised, which employs biased randomisation probabilities to ensure that the groups remain balanced in size throughout recruitment. In Chen's procedure, a participant has a 50% probability of being allocated to either group when the group sizes are equal. As the groups become imbalanced the probabilities then become biased, so a participant has a 70% probability of being allocated to the smaller group. When the maximum tolerated imbalance of three participants is reached, the next participant then has a 100% probability of being randomised to the smaller group. Biased randomisation probabilities are beneficial with smaller sample sizes because using normal randomisation could result in imbalanced group sizes by chance alone (Lachin, 1988)

Participants

A total of 34 participants were recruited and randomised for the study between November 2021 and May 2022. Participants were recruited from two different participant pools; a subset of participants within the Australian National Child Oral Health Study (NCOHS; Do & Spencer, 2016) 2012–14 (n = 22), and from the University of Adelaide's first-year psychology research participation pool (n = 12). Participants who were recruited through the NCOHS received a $60 gift voucher, and participants recruited through the University of Adelaide received course credit. Participants were excluded on the basis of having a current formal diagnosis of cognitive impairment, intellectual disability or mental illness diagnosable by the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM–5; American Psychiatric Association, 2013). Participants were also required to be fluent in the English language. The exclusion criteria were considered to be characteristics that could influence how a participant would respond to the test instructions, under the different administration methods. Three participants withdrew before their data collection and were unable to be rescheduled. Another participant randomised into the study was deemed

ineligible based on the study inclusion criterion, as they were not fluent in the English language and were subsequently not assessed. A further two participants were excluded post-data collection as their demographic information revealed that they met the exclusion criteria. The final sample for analysis consisted of 28 participants, with ages ranging from 17-37 and a mean age of 20.6. The number of participants randomised to the telehealth administration first group was 15 (54%), while the number of participants who received the face-to-face administration first was 13 (46%). The sample was 61% females (n = 17), and 39% males (n = 11). Table 1 shows demographic characteristics of the sample.

Measures

Weschler Adult Intelligence Scale Fourth Edition – The WAIS-IV is a standardised measure of cognitive functioning for adults. Testing involves ten primary subtests (Vocabulary, Information, Similarities, Digit Span, Arithmetic, Block Design, Matrix Reasoning, Visual Puzzles, Coding, and Symbol Search), which yield four index scores. Each index score represents a separate domain of cognitive functioning. The index scores are the PRI, PSI, Verbal Comprehension Index (VCI), and the Working Memory Index (WMI). A full scale intelligence quotient (FSIQ) score is also derived that represents overall cognitive ability. The PRI and the PSI are the primary indices of interest in the present study. The respective subtests that comprise these indices are Block Design, Matrix Reasoning and Visual Puzzles, and Coding and Symbol Search.

Telehealth User Experience Survey – A brief self-report survey was administered to evaluate participants' satisfaction and attitudes regarding telehealth administration, as well as their preference of testing modality. A five-point Likert scale was used in which participants rated a series of statements based on the response categories "Strongly Agee/Agree/Neither Agree Nor Disagree/Disagree/Strongly Disagree". Participants were also asked to rate technological aspects of the telehealth administration as "Poor", "Fair", "Good", "Very

Good" and "Excellent". Open-ended questions were also provided for additional feedback on the different test administration modes.

The survey questions were developed based on the recommendations for telehealth testing outlined in Luxton, Pruitt and Osenbach (2014), the satisfaction and preferences of telehealth-based assessment survey provided in Parikh et al. (2013), and the parents/carers comfort with telehealth testing survey given in Hodge et al. (2019).

Procedure

Participants attended University testing rooms to complete both WAIS-IV testing methods. To reduce the risk of attrition and the risk of confounding factors (e.g., differential sleep, differential testing intervals etc.) between testing occasions, both testing methods occurred on the same day. All participants were given a 1-hour break between each assessment. Examiners were two provisional psychologists who were trained to administer the WAIS-IV. Training involved the examiners passing administration and scoring hurdle tests, that were supervised by a registered psychologist and a neuropsychologist who were both experienced with the WAIS-IV (i.e., also including observation of first telehealth administration, and video review of second and third administration) to further ensure adherence to the WAIS-IV testing protocols. Record forms and response booklets were also audited by the supervisors to confirm accurate scoring.

The face-to-face administration followed the traditional paper and pencil standardised format of the WAIS-IV, as outlined in the Administration and Scoring Manual (Weschler, 2008a). COVID-19 safe protocols were used during the face-to-face administration, which involved both the participant and examiner wearing a mask, and a Perspex screen being placed in between the participant and examiner. All participants were assessed using the ten core subtests of the WAIS-IV. For each individual testing session, participants were placed in the same quiet room with minimal distraction during both testing methods. During the

telehealth assessment the examiner moved to a different room to conduct testing via telehealth.

The telehealth assessment was delivered via the web-application Coviu, which provided a digital version of the WAIS-IV stimulus book. The examiner's setup included a desktop computer with a webcam and two monitors (one for the stimulus book and one to view the participant's table top), and a separate laptop to display the examiner's table top during demonstrations. The participant's setup included a laptop with an in-built webcam, which displayed the examiner and stimulus book, and a tripod and second webcam for the examiner to observe the participant's table top. On the left side of the participant's laptop were two large yellow envelopes that contained either blocks for Block Design, or the response booklets. Responses during the telehealth administration were manually recorded by the examiner.

A telehealth administration protocol was developed to ensure the examiners delivered the same instructions, and to allow the WAIS-IV to be smoothly administered without a facilitator present (see Appendix B for amended protocol, full protocol available on request). The protocol was a slightly adapted version of the standardised WAIS-IV instructions, and adaptations were only made for tests that used stimuli manipulation or visual stimuli (e.g., Block Design, Matrix Reasoning, Symbol Search, Visual Puzzles, and Coding). Most adaptations to the instructions were minor and involved changing the nature of the language so it was suitable for a telehealth administration. The most notable change was during Block Design, in which participants were asked to scramble the blocks in between items. Where possible, the standardised instructions were strictly followed.

Technical Information

Coviu is a peer-to-peer video communication application accessible through the internet, that was developed by the Commonwealth Scientific and Industrial Research

Organisation in Australia. Coviu provides full-encryption, synchronised image viewing and visible click-markers for pointing at the stimulus book. The internet connection was through the University of Adelaide's wireless connection. The examiner's main computer was a HP EliteDesk 800 G1 Mini. The main monitor was a HP EliteDisplay E231, and the monitor for the zoom call was a HP EliteDisplay E221. The laptop used by the examiner for demonstrations was a HP EliteBook 840 G4. An Asus VivoBook 15 laptop with a 15.6 inch display was used by the participant. This screen size was sufficiently large to ensure the stimulus book was displayed at the recommended size of 9.7 inches, measured diagonally (Pearson, 2020). Finally, the examiner's webcam was a Microsoft LifeCam HD-300, and the participant's second webcam was a Logitech C930c.

Statistical Analysis

Following Wright (2020), a TOST procedure was used to evaluate the equivalency of the two administration methods (face-to-face assessment vs. telehealth assessment) (Lakens et al., 2018; Schuirmann, 1987). A TOST procedure tests whether the null hypothesis, that the mean score difference between groups is large enough to be considered meaningful, can be rejected. In the procedure, predefined (lower and upper) bounds based on the smallest effect size of interest (SESOI) are specified and the procedure evaluates whether the 90% confidence interval (CI) of the mean difference falls within these predefined bounds. If the 90% CI around the mean score difference between administration methods falls within the upper and lower bounds of the SESOI, then the null hypothesis is rejected and the conditions are considered statistically equivalent. Alternatively, if the 90% CI overlaps with either the upper or lower bounds, then the null hypothesis that the mean score difference between groups is large enough to be considered meaningful cannot be rejected and the administration methods are not considered statistically equivalent. Equivalence is tested at an alpha level of $p = 0.05$. Overall, the TOST procedure can inform whether score differences between

administration methods are meaningful, considering that small non-meaningful differences between scores are expected due to measurement error.

Consistent with Wright (2020), the present study will use a rigorous SESOI of 0.3 *SD*. This SESOI indicates a mean difference that is smaller than the mean difference that would be expected from the standard error of measurement (SEM) of the WAIS-IV (Wechsler, 2008b). As such, the 90% CI of the difference between administration modes for index scores ($M = 100$, $SD = 15$) must fall within an upper bound of 4.5 and a lower bound of -4.5 for the administration methods to be considered statistically equivalent. Similarly, for scaled scores ($M = 10$, $SD = 3$), the 90% CI must fall within an upper bound of 0.9 and a lower bound of -0.9 for the administration methods to be considered statistically equivalent.

Results

Table 1 indicates that most participants had parents with university education, completing some or all years of university (85%). Most of the sample had not previously completed an IQ test prior to the study (89%), and the majority of participants identified as Australian (75%). Table 2 shows the descriptive statistics for the WAIS-IV index and subtests scores, for each administration mode and the total sample. The sample demonstrated above-average IQ with a total sample mean FSIQ score of 117.57, representing a score that is slightly greater than 1 standard deviation above the average (100). Only the WMI total sample mean score fell into the average range for the index scores, with a score of 104.75.

Table 3 displays the mean differences and 90% CIs between administration modes from the TOST procedure. Figures 2 and 3 visually represent the mean difference and CIs for the indices and subtests between administration mode. The results initially described are the point estimates (mean differences) for index, and then subtest scores. All point estimates for the index scores, excluding the PSI, fell within the established equivalence bounds, indicating the mean difference was smaller than the SESOI (-4.5 - 4.5). The range of point estimates,

excluding the PSI, were from -1.57 – 1.08. For the subtests, nine out of ten point estimates fell within the established equivalence bounds, again indicating the mean difference was smaller than the SESOI (-0.9 – 0.9). Symbol Search was the only subtest to have a point estimate fall outside the equivalence bounds. The range of point estimates, excluding Symbol Search, were -0.39 – 0.50.

Next, the index scores for the PRI and PSI are reported, and we then examined any differences in the subtest scores that make up these indices. The mean score difference 90% CIs of the PRI fell within the bounds, $t(27) = 1.852$, $p = 0.075$, indicating that the index is statistically equivalent between administration modes. However, the mean score difference 90% CIs of Block Design, Visual Puzzles and Matrix Reasoning (subtests of PRI) did not fall within the equivalence bounds, indicating that these subtests were not statistically equivalent across the two groups. The PSI yielded mean score difference 90% CIs outside of the equivalence bound, $t(27) = 0.225$, $p = 0.58$, showing that the index is not statistically equivalent across the two groups. Coding and Symbol Search (subtests of the PSI) were also not statistically equivalent.

Finally, we reviewed all remaining indices and subtests, including the FSIQ, to examine whether these findings are unique to the indices that rely on physical materials and visual skills. The mean score difference 90% CIs for the FSIQ and WMI fell outside of the bounds and thus were not statistically equivalent. Whereas, the mean score difference 90% CIs of the VCI fell within the equivalence bounds and were statistically equivalent across the groups. The largely verbally administered subtests of Vocabulary, Information, Digit Span and Arithmetic all had mean score difference 90% CIs that were within the equivalence bounds, demonstrating statistical equivalence. Lastly, Similarities was not statistically equivalent, as the mean score difference 90% CIs fell outside the equivalence bounds.

A traditional null hypothesis significance test (NHST), which tests whether the score difference is equal to 0, was also conducted when running the TOST procedure. All index score differences yielded a nonsignificant result (p value's > .05, p value range .91 - .57). Similarly, all subtest score differences were nonsignificant (p value's > .05, p value range 1.0 - .14). For the indices and subtest that did not demonstrate statistical equivalence, the NSHT and TOST results in conjunction present a case of "not statistically equivalent and not statistically different" (Lakens et al., 2018, p. 263).

Table 4 shows results from the Telehealth User Experience Survey. Nearly all participants indicated that they were comfortable during the telehealth administration (96%), and that the instructions were easy to follow (96%). Test instructions and demonstrations using physical materials were reportedly easily understood (96%). Most participants did not believe it was necessary to have a facilitator present to assist with the test administration (75%). Participants generally viewed telehealth assessments as a worthwhile service (79%), while the remaining participants indicated neutral feelings towards telehealth (21%). Survey responses did show a preference for face-to-face administration (44%), but many respondents indicated no preference for either testing modality (56%). No participant indicated a preference for the telehealth assessment. Qualitative responses further highlighted that participants had a good understanding of the instructions. Participants often stated that any misunderstandings that arose were easily clarified. However, six participants (21%) did report that instructions were harder to follow over telehealth. The main issue noted was poor audio quality, however, audio quality was generally acceptable as indicated by a mean score of 3.5 out of 5 in the Technology Quality section of the user experience survey. The remaining Technology Quality scores are reported in Table 5. These indicated that generally, participants rated the quality of the speaker, microphone, video, internet and overall laptop performance as Good or Very Good.

Discussion

The present study aimed to determine the equivalency of a telehealth administration of the WAIS-IV with no facilitator present with the participant. More broadly, we also intended to examine whether a comprehensive cognitive assessment, including measures of visual skills and physical materials, is valid when administered over telehealth. Overall, the observed differences between face-to-face and telehealth administrations were small, as indicated by the point estimates (except the PSI and Symbol Search) falling within the SESOI. Nearly all point estimates also fell within the expected SEM of the WAIS-IV subtests and indices (Weschler, 2008b), implying that score differences of the observed magnitude would likely have little clinical significance. As such, our results contribute to previous research which has provided direct evidence for the validity of a full telehealth administration of the WAIS-IV, with and without a facilitator (Mahon et al., 2022; Wright 2020). Our results also suggest that there may be small administration mode effects (face-to-face vs telehealth) for the subtests of the PRI and PSI, relative to verbal subtests. None of the individual subtests that rely on physical materials or visual skills demonstrated statistical equivalency. Contrastingly, the four subtests that demonstrated equivalency (Vocabulary, Information, Digit Span and Arithmetic) were all verbally administered, and the point estimate sizes for these tests were generally smaller. It is possible that while there may be some subtests where a telehealth WAIS-IV administration without a facilitator, may slightly over or under estimate scores, but these effects are not significant enough to have a substantial impact on interpretations of scores. Therefore, it is likely that with further research these tests can be successfully adapted to telehealth administration.

Despite point estimate sizes, many of the indices and subtest were not statistically equivalent, and had 90% CIs overlapping the equivalence bounds. The wide CIs are likely due to a lack of precision resulting from our small sample size. A TOST procedure's

sensitivity to determine equivalence when estimating means scores is negatively impacted by sample size constraints (Linde et al., 2021). Furthermore, a NHST found all indices and subtests to be not statistically different. Subsequently, some score discrepancies in our sample were neither statistically equivalent nor different. When combined, these results suggest that the NHST did not detect a meaningful difference between administration modes, but the TOST procedure was also unbale to reject a score difference at least as large as the SESOI, for those indices and subtests that were not statistically equivalent. This seemingly paradoxical finding is likely attributable to either a lack of statistical power from the NSHT to detect a meaningful difference, or the lack of precision from the TOST procedure, both of which are influenced by sample size (Lakens et al., 2021; Linde et al., 2018). Given Mahon et al. (2022) made similar observations with a NHST, and Wright (2020) found strong equivalency evidence for the WISC-V with a large sample, the research suggests that the TOST's procedures precision is the more plausible explanation.

In isolation, observing the PRI to be equivalent across administration methods aligns with previous research supporting the telehealth equivalence of this index (Mahon et al., 2022; Wright 2020). Furthermore, this finding supports complementary literature showing index scores of other measures, that use visual skills or using physical materials, are reliable when comparing face-to-face and telehealth administrations (Galusha-Glasscock et al., 2011; Temple et al., 2010). Excluding Mahon et al. (2020), the key differentiation between our study and the aforementioned studies is the removal of a facilitator to assist with subtest administration. A subtest-level comparison reveals that subtests of the PRI did not demonstrate equivalency. Such a finding is made possible by the point estimates of the subtests cancelling each other out. The Matrix Reasoning and Visual Puzzles point estimates slightly over estimated scores, while the Block Design point estimate was a slight under estimate, relative to the face-to-face administration (see Figure 2 for visualisation of this

effect). This variability in scores may suggest the presence of an administration effect, and is reflective of the broader telehealth assessment research that notes visual tests or test with physical materials, have the most inconsistent results (Brearly et al., 2017; Marra et al., 2020). Potential factors contributing to an administration effect are discussed below. Interestingly, the telehealth administration group's mean scores exhibited a small but superior performance on Matrix Reasoning and Visual Puzzles. The Block Design mean score difference was in favour of the face-to-face group but was the smallest difference out of all the subtest of both the PRI and PSI. If a true administration effect is present then these findings are counter-intuitive, given the departure from standarised procedures and difficulties associated with telehealth administration (particularly for Block Design). It would be expected for the face-to-face group to display consistent superior performance and the magnitude of differences to be larger. Subsequently, it is unclear if a true administration effect was exhibited, or if variation in scores is due to chance or measurement error alone. This warrants further investigation.

The PSI and associated subtests (Coding and Symbol Search) did not demonstrate equivalency. In fact, the largest mean score differences were evident within the PSI relative to all index and subtest comparisons in the study. These result did not replicate Wright's (2020) equivalency study, however, the null hypothesis significance test does concur with Mahon et al. (2022), and other studies that have observed no significant differences in measures of processing speed attributable to their method of administration (Barcellos et al., 2021; Parks et al., 2021). Given the size of the point estimates there is stronger evidence to suggest the presence of an administration effect for the PSI. Several factors could contribute to administration effects on the subsets of the PSI, and potentially the PRI. Adapting the WAIS-IV for telehealth without a facilitator required minor changes to the standarised procedures, which impacts how a participant experiences and interacts with test stimuli.

Watching the examiner demonstrate items through telehealth, rather than having the examiner or a facilitator demonstrate in person, could lead to minor changes in a participant's understanding of the task requirements. For example, during testing participants often reported confusion about which way to present blocks during Block Design. Technological factors such as audio quality, visual clarity or internet speed may interrupt item instructions and lead to further misunderstanding on the participant's end. Although difficulties were not reported, watching demonstrations of Symbol Search and Coding is much clearer in face-to-face testing. More subtle factors such as not having an examiner or facilitator physically present could also influence participant behaviour. For example, participants are clearly timed during the face-to-face Coding and Symbol search tests which may increase motivation to perform as quickly as possible, whereas timing is not so evident over telehealth.

Factors such as practice effects and participant fatigues may have confounded our results, and be possible alternative explanations. For the PRI subtests, participants can learn strategies over repeated assessment to solve the novel items presented. For the PSI, the short testing interval of 1-hour may have enabled participants to benefit from task familiarity, procedural learning, remembering the order of correct items on Symbol Search, or remembering the symbol-digit association on Coding. Indeed, the PRI and PSI are most susceptible to practice effects as shown in the WAIS-IV standardisation sample (Cullum & Larrabee, 2010; Weschler, 2008b). Some of the lowest ICCs within Mahon et al. (2020) were from Matrix Reasoning, Visual Puzzles, Coding and Symbol Search, which infers weaker test-retest reliability possibly due to practice effects. Similarly, the Block Design, Matrix Reasoning, Coding and Symbol Search subtests of the WISC-IV have exhibited some of the largest score differences, relative to the other subtests, at retest intervals between 13 – 63 days (Watkins & Smith, 2013). Considering our short testing interval, it is likely that the degree of practice effects evident in our study would be greater. Counterbalancing was used

to control practice effects, but the sample size may not have been large enough to evenly disperse the effects between groups; however, we cannot know for sure whether the sample size was large enough to make it balanced. Finally, participants were subjected to both assessments on the same day, likely increasing fatigue levels during the second administration. It is possible that high levels of participant fatigue lead to reductions in motivation and subsequent changes in scores.

Inherent in any psychological measure is the SEM which is the estimated error in an observed test score due to random measurement error. That is, the SEM represents how much an individual's observed scores deviate from their 'true score' due to random measurement error. The equivalence bounds of the present study were deliberately set within the SEM of the WAIS-IV, as reported in the Technical and Interpretive Manual (Weschler, 2008b). To provide rigorous evidence, we attempted to demonstrate that score differences between administration methods would be less than the expected error of scores due to measurement error alone. All but one point estimate (the PSI) fell well within their respective SEM, indicating that the observed score difference was less than what would be expected from measurement error over repeated assessments. As such, the score differences between the face-to-face and telehealth administrations within the present sample would not have any clinical implications in most instances. Therefore, in the face of accepted measurement error of the WAIS-IV, the point estimates mostly falling within a rigours SESOI, and practice effects potentially confounding our results, there is still modest evidence to suggest that a telehealth administration of the WAIS-IV with no facilitator is valid.

Clinical judgement must be used before administration and interpretation of telehealth WAIS-IV with no facilitator present, which is not without its limitations. Caution has been advised when making interpretations, as decreased precision in scores could be important if close to clinical thresholds, such as when testing for cognitive impairment (Brearly et al.,

2017; Hildebrand et al., 2004). Telehealth also poses limitations in a clinician's capacity to observe and document behaviour during administration, which can provide useful information. Less control over the testing environment could also create difficulties with non-compliant consumers. Clinicians also have an ethical responsibility to ensure client characteristics are suitable, there is an acceptable environment and adequate access to technology is available before administration of all telehealth assessments. Nonetheless, for those with little access to services, the benefits of modifying standardised procedures and applying normative data to a telehealth administration may outweigh the risks.

All four WAIS-IV subtests that did show equivalency required little to no adaptation to be administered through telehealth. These results were not surprising, and are in line with the broader telehealth assessment research showing measures of verbal skills or with only verbal instructions, are valid over telehealth (Brearly et al., 2017; Cullum et al., 2006, 2014, DeYoung & Shenal, 2019; Galusha-Glasscock et al., 2016; Grosch et al., 2015 Kirkwood et al., 2004; Marra et al., 2020a; Parks et al., 2021; Stain et al., 2011; Temple et al., 2010; Wadsworth et al., 2016, 2018). The similarities subtest, which required no adaption, was not equivalent. It is possible the subjective nature of scoring for similarities created score differences between administrations. The scoring of Similarities is also known to be susceptible to errors by inexperienced examiners (Belk et al., 2002); however, in the present study record forms and response booklets were regularly audited by an experienced neuropsychologist, reducing the likelihood that scoring errors may have been a factor. There may be an administration effect that occurred for similarities, though it is difficult to establish a compelling argument for what that would be. Regardless, the current results provide further evidence for the telehealth validity of verbally mediated psychological measures.

The Telehealth User Experience Survey revealed high levels of acceptability during telehealth administration**.** These findings replicate other studies that have exhibited levels of

satisfaction, understating of test instructions and comfort during testing above 90% (Harder et al., 2020; Hildebrand et al., 2004; Hodge et al., 2019; Parikh et al., 2013). The proportion of participants who reported no preference for either testing modality (56%) was also comparable to the literature (Harder et al., 2020; Hildebrand et al., 2004; Parikh et al., 2013). No participant in the current study indicated a preference for telehealth, while other studies have shown that at least a small minority of participants do prefer this testing modality. For example, 10% of participants preferred telehealth in Parikh et al. (2013), 26% indicated a preference for telehealth in Harder et al. (2020), and 17% displayed a similar preference in Hildebrand et al. (2004). Despite this, our results in conjunction with Mahon et al. (2022), provide a growing evidence base for the acceptability of a telehealth administration of the WAIS-IV, with no facilitator present. Furthermore, telehealth assessments that use physical materials and measure visual skills appeared to be well accepted, and for the majority easily understood via telehealth.

There were a number of limitations to consider in the present study. Firstly, the sample was relatively homogenous impacting the generalisability of results to the broader population. For example, participants were generally of similar age, most had parents with university education, and the majority identified as Australian. The demographic make-up and above average mean FSIQ scores suggest that many participants may have had a considerable degree of familiarity using technology, which could have contributed to the small differences between administration modes observed, and high levels of acceptability during telehealth. Future studies should investigate the administration method impacts with more diverse and clinical samples to ensure generalisability. For instance, older adults seeking cognitive assessment who are less familiar with technology may find the telehealth administration more challenging, or individuals with sensory impairments may differentially respond to the administration methods. Investigation within these samples is important as

valid scores are required for diagnostic purposes. Secondly, a larger sample would have led to more precise point estimates and, consequently, narrower confidence intervals. The increase in precision would provide more unambiguous evidence on the equivalence of the subtests across groups. However, where subtests were not equivalent the differences were small and unlikely to be clinically meaningful. Future studies with larger samples that take an equivalence testing approach could strengthen confidence in the ability to easily adapt the WAIS-IV to telehealth administration. Thirdly, the telehealth administration of the WAIS-IV followed very specific protocols including adaptions to the standarised instructions, specific training and supervision for examiners, and technological requirements. Therefore, caution is advised when generalising to other WAIS-IV administrations that do not adhere to these protocols. Finally, the study was conducted in a highly-controlled university setting with minimal extraneous variables and adequate internet speed. Promise of the feasibility and validity of the telehealth WAIS-IV across settings has been shown in a home-based telehealth model (Mahon et al., 2022), but environments with even less control may present additional challenges to testing that will impact validity. For example, in rural and remote communities, high-speed internet or the required technology may not be readily available, leading to impacts on scores or reductions in the acceptability of the telehealth WAIS-IV. As such, future studies should endeavour to find validity in diverse environments.

In summary, the results of the present study show that telehealth administration of the WAIS-IV with no facilitator, results in largely similar scores to a standardised face-to-face administration. Furthermore, tests requiring physical materials or measuring visual skills can be successfully adapted to a telehealth administration. While the majority of subtests were not statistically equivalent the differences appear to be negligible, and in most instance have little to no clinical meaning. An important next step to facilitate common usage of the WAIS-IV assessment via telehealth, is to develop and publish specific protocols for standardised

telehealth administration. These would include how stimulus materials are presented, which modifications to instructions are necessary and what prompts are given to ensure an assessment as close as possible to the standarised version. Replication of our findings within different clinical samples and populations with less familiarity with telehealth technology are still needed to build strong evidence for the administration method proposed. Future research also needs to better understand the underlying mechanism that contribute to any differences between administrations. In conclusion, when an in-person administration is not feasible, a telehealth administration of the WAIS-IV with no facilitator may be a useful and valid tool for psychologists.

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Table 1

Demographic Characteristics of the Sample

Demographic Characteristic	Total Sample (*n* = 28)
Age	
Mean (*SD*)	20.60 (3.65)
Range	17-37
Median	20
Ethnicity	
Australian	21 (75%)
Aboriginal and/or Torres Strait Islander	1 (4%)
Non-Australian	6 (21%)
Highest Parental Education	
Some or All Years of High School	0
Trade or Technical School	4 (15%)
Some or All Years of University	22 (85%)
Missing Data	2
Completed IQ Test Before	
Yes	3 (11%)
No	25 (89%)

Note. SD = Standard Deviation.

Note. Non-Australia included North American (*n* = 1), European (*n* = 1), African (*n* = 2),, South American (*n* = 1), Asian (*n* = 1).

Table 2

Descriptive Statistics for Weschler Adult Intelligence Scale Fourth Edition Index (WAIS-IV) and Subtest Scores by Administration Format

	Face-to-Face Administration		Telehealth Administration		Total Sample	
Index/Subtest	*M*	*SD*	*M*	*SD*	*M*	*SD*
Index						
Full-Scale IQ	116.79	12.05	118.36	17.78	117.57	15.07
Verbal Comprehension	113.07	11.28	111.14	12.16	112.11	11.66
Perceptual Reasoning	114.25	12.05	114.50	10.55	114.38	11.22
Working Memory	105.29	12.93	104.21	19.84	104.75	16.60
Processing Speed	120.04	15.23	114.79	15.68	117.41	15.54
Subtests						
Block Design	13.32	3.31	13.18	2.83	13.25	3.05
Similarities	12.75	2.58	12.25	2.65	12.50	2.60
Digit Span	11.07	3.15	11.25	3.09	11.16	3.09
Matrix Reasoning	11.32	2.07	11.71	1.76	11.52	1.92
Vocabulary	13.29	2.43	13.29	2.59	13.29	2.49
Arithmetic	10.96	2.40	11.00	3.55	10.98	3.00
Symbol Search	14.21	3.61	13.11	2.97	13.66	3.33
Visual Puzzles	12.89	2.50	13.32	2.21	13.11	2.35
Information	11.11	3.27	11.18	3.31	11.14	3.26
Coding	13.18	2.78	12.82	2.42	13.00	2.59

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

Table 3

Mean Difference and Confidence Intervals (CIs 90%) for Weschler Adult Intelligence Scale Fourth Edition (WAS-IV) Indices and Subtests Between the Face-to-Face Administration Group and the Telehealth Group

Index/Subtest	Mean difference	90% CI
Index		
Full-Scale IQ	-1.57	[-6.61, 3.46]
Verbal Comprehension	-1.07	[-4.21, 2.07]
Perceptual Reasoning	-0.25	[-4.16, 3.66]
Working Memory	1.08	[-3.64, 5.80]
Processing Speed	5.25	[-0.43, 10.93]
Subtests		
Block Design	0.14	[-0.81, 1.09]
Similarities	0.50	[-0.22, 1.22]
Digit Span	-0.18	[-0.89, 0.54]
Matrix Reasoning	-0.39	[-1.03, 0.25]
Vocabulary	0.00	[-0.31, 0.31]
Arithmetic	-0.04	[-0.79, 0.71]
Symbol Search	1.10	[-0.13, 2.33]
Visual Puzzles	-0.43	[-1.08, 0.22]
Information	-0.07	[-0.62, 0.48]
Coding	0.36	[-0.24, 0.96]

Note. 90% CI = 90% confidence interval.

Table 4

Telehealth User Experience Survey Response

Survey Question	Mean (*SD*)	Strongly Disagree/Disagree *n* (%)	Neither Agree/Disagree n (%)	Strongly Agree/Agree *n* (%)
I felt comfortable using the telehealth equipment	4.79 (0.50)	0 (0%)	1 (4%)	27 (96%)
Overall, the telehealth testing instructions were easy to follow	4.82 (0.48)	0 (0%)	1 (4%)	27 (96%)
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	4.79 (0.63)	1 (4%)	0 (0%)	27 (96%)
It was not necessary to have anyone in the room with me to help explain the task during task demonstrations	4.40 (0.96)	1 (4%)	6 (21%)	21 (75%)
Overall, I was satisfied with the telehealth administration of the IQ test	4.79 (0.50)	0 (0%)	1 (4%)	27 (96%)
I was easily distracted by the telehealth equipment	2.32 (1.09)	19 (68%)	4 (14%)	5 (18%)
I was concerned about my privacy during testing	1.61 (0.96)	23 (82%)	3 (11%)	2 (7%)
I think telehealth assessments are a worthwhile service	4.19 (0.77)	0 (0%)	6 (21%)	22 (79%)
I would recommend telehealth-based testing to others for cognitive assessments	3.96 (1.07)	2 (7%)	7 (25%)	19 (68%)
I thought the test environment was suitable for a telehealth assessment	4.50 (0.69)	0 (0%)	3 (11%)	25 (89%)
My comfort with the examiner during the telehealth assessment was generally the same as it was in-person	4.39 0.92)	2 (7%)	2 (7%)	24 (86%)

Table 5

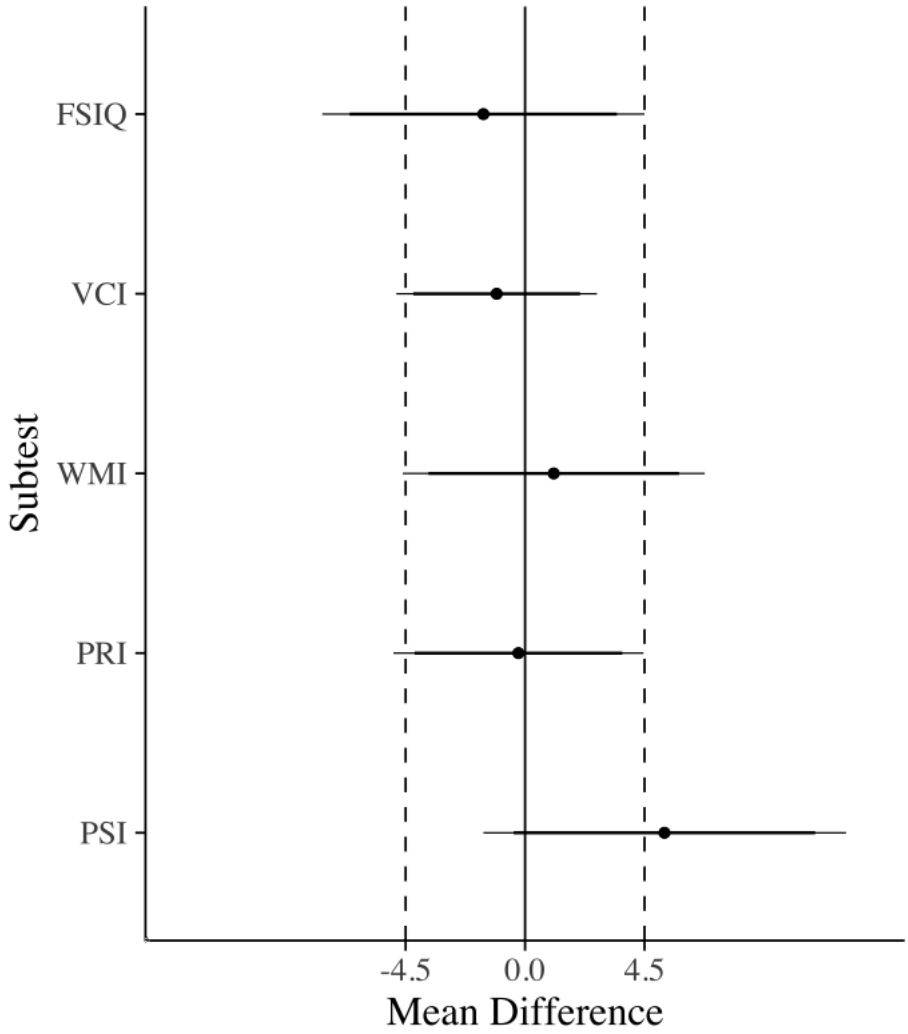
Technology Quality Questions from the Telehealth User Experience Survey

Survey Question	Mean (*SD)*
Speaker Quality	3.57 (1.03)
Microphone Quality	3.93 (0.81)
Video Quality	4.50 (0.75)
Internet Quality	4.36 (0.78)
Overall Laptop performance	4.21 (0.92)

Note. Survey response options were 1 (Poor), 2 (Fair), 3 (Good), 4 (Very Good), 5 (Excellent).

Figure 1

Mean Difference and Confidence Interval Plot for Weschler Adult Intelligence Scale Fourth Edition Indices Between the Face-to-Face Group and the Telehealth Group

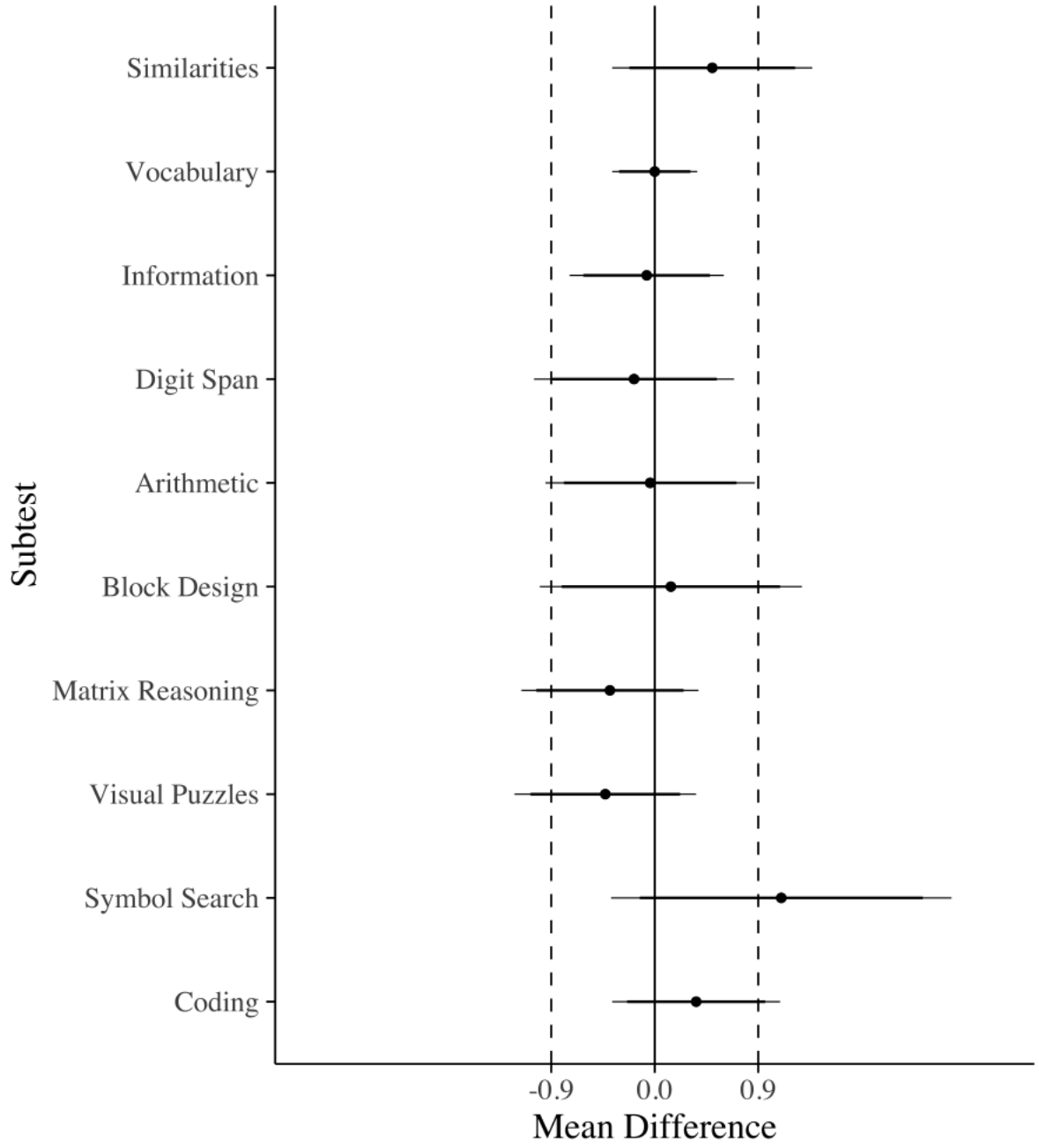


Note. Thick horizontal lines show the 90% confidence intervals (CIs) from the two one sided tests procedure. Thin horizontal lines show the 95% CIs from the null hypothesis significance tests. Dashed vertical lines show the equivalence bounds in raw scores.

Note. FSIQ = Full Scale IQ, VCI = Verbal Comprehension Index, WMI = Working Memory Index, PRI = Perceptual Reasoning Index, PSI = Processing Speed Index.

Figure 2

Mean Difference and Confidence Interval Plot for Weschler Adult Intelligence Scale Fourth Edition Subtests Between the Face-to-Face Group and the Telehealth Group



Note. Thick horizontal lines show the 90% confidence intervals (CIs) from the two one sided tests procedure. Thin horizontal lines show the 95% CIs from the null hypothesis significance tests. Dashed vertical lines show the equivalence bounds in raw scores.

Appendix A

Psychological Assessment Submission Guidelines

Prior to submission, please carefully read and follow the submission guidelines detailed below. Manuscripts that do not conform to the submission guidelines may be returned without review.

Submission

To submit to the editorial office of Julie A. Suhr, please submit manuscripts electronically through the Manuscript Submission Portal in Microsoft Word Format (.doc or .docx), or LaTex (.tex) as a zip file with an accompanied Portable Document Format (.pdf) of the manuscript file.

General correspondence may be directed to the editor's office.
Psychological Assessment is now using a software system to screen submitted content for similarity with other published content. The system compares the initial version of each submitted manuscript against a database of 40+ million scholarly documents, as well as content appearing on the open web. This allows APA to check submissions for potential overlap with material previously published in scholarly journals (e.g., lifted or republished material).

Masked review

This journal has adopted a masked review policy for all submissions. Authors should make every effort to ensure that the manuscript itself contains no clues to their identities, including grant numbers, names of institutions providing IRB approval, self-citations, and links to online repositories for data, materials, code, or preregistrations (e.g., Create a View-only Link for a Project). Authors' names and affiliations should not appear in the manuscript. Instead, please include this information in the separate title page file.

Please ensure that the final version for production includes a byline and full author note for typesetting.

Manuscript preparation

In general, manuscripts should be no longer than 40 pages (this includes all elements of the manuscript, with the exception of any supplemental material).

Prepare manuscripts according to the *Publication Manual of the American Psychological Association* using the 7th edition. Manuscripts may be copyedited for bias-free language (see Chapter 5 of the *Publication Manual*). APA Style and Grammar Guidelines for the 7th edition are available.

Review APA's Journal Manuscript Preparation Guidelines before submitting your article.

Double-space all copy. Other formatting instructions, as well as instructions on preparing tables, figures, references, metrics, and abstracts, appear in the *Manual*. Additional guidance on APA Style is available on the APA Style website.

Manuscripts concerned with the development of a new assessment instrument should include a copy of the instrument.

Reporting on sample of study and Constraints on Generality

All empirical manuscripts should report on sex and gender, and race and ethnicity of the included samples in both the abstract and the discussion section of the manuscript. If available, information on SES should also be reported.

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), 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 (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 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.) 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) 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 (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). 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 for details, and contact the editor (Julie A. Suhr) with any further questions. APA recommends sharing data, materials, and code via trusted repositories (e.g., APA’s repositor 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 template, ClininalTrials.gov, or other preregistration templates available via OSF). Completed preregistration forms should be posted on a publicly accessible registry system (e.g., OSF, ClinicalTrials.gov, or other trial registries in the WHO Registry Network).

A list of participating journals 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 on the Open Science Framework (OSF), or authors can access a full list of other recommended repositories.

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 template) via a publicly accessible registry system (e.g., ClinicalTrials.gov or the Preregistration for Quantitative Research in Psychology template) via a publicly accessible registry system (e.g., OSF, 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.

For example:

- This study's design was preregistered; see [STABLE LINK OR DOI].
- This study's design and hypotheses were preregistered; see [STABLE LINK OR DOI].

- This study's analysis plan was preregistered; see [STABLE LINK OR DOI].
- This study was not preregistered.

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.

Use Equation Editor 3.0 or MathType only for equations or for formulas that cannot be produced as Word text using the Times or Symbol font.

Computer code

Because altering computer code in any way (e.g., indents, line spacing, line breaks, page breaks) during the typesetting process could alter its meaning, we treat computer code differently from the rest of your article in our production process. To that end, we request separate files for computer code.

In online supplemental material

We request that runnable source code be included as supplemental material to the article. For more information, visit Supplementing Your Article With Online Material.

In the text of the article

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.

Tables

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.

LaTex files

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

Authored book

Brown, L. S. (2018). *Feminist therapy* (2nd ed.). American Psychological Association. 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

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

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/

Wickham, H. et al., (2019). Welcome to the tidyverse. *Journal of Open Source Software, 4*(43), 1686, 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.

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.

The same caption will appear on both the online (color) and print (black and white) versions. To ensure that the figure can be understood in both formats, authors should add alternative wording (e.g., "the red (dark gray) bars represent") as needed.

For authors who prefer their figures to be published in color both in print and online, original color figures can be printed in color at the editor's and publisher's discretion provided the author agrees to pay:

- $900 for one figure
- an additional $600 for the second figure
- an additional $450 for each subsequent figure

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Academic writing and English language editing services

Authors who feel that their manuscript may benefit from additional academic writing or language editing support prior to submission are encouraged to seek out such

services at their host institutions, engage with colleagues and subject matter experts, and/or consider several vendors that offer discounts to APA authors.

Please note that APA does not endorse or take responsibility for the service providers listed. It is strictly a referral service.

Use of such service is not mandatory for publication in an APA journal. Use of one or more of these services does not guarantee selection for peer review, manuscript acceptance, or preference for publication in any APA journal.

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 whenever 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.

If your manuscript involves a new translation (i.e., developed by you and previously unpublished):

1. Review Information For Authors of Translated Tests (PDF, 108KB). This document is for informational purposes only and does not need to be submitted.
2. Submit the Permission Form for Translated Tests (PDF, 31KB), to be completed by the copyright owner of the original test.
3. Submit the PsycTests Author Agreement for Translations (PDF, 56KB), to be completed by the translation test author.
4. Submit a copy of the translated test as supplemental material.

If your manuscript involves a previously published, existing translation:

- Access the APA Permissions Alert Form (PDF, 13KB).
- List the previously published translation on that form.
- Obtain a permission letter from the copyright holder. The copyright holder may be an individual but often is a publisher. The permission letter you obtain must grant permission (a) to reproduce the material in "both print and electronic formats" and (b) for the translated test to be deposited into PsycTests.
- Have the copyright owner of the translated test complete the PsycTests Agreement (PDF, 34KB)
- Submit a copy of the translated test as supplemental material.

Publication policies

APA policy prohibits an author from submitting the same manuscript for concurrent consideration by two or more publications.

See also APA Journals® 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).

- Download Disclosure of Interests Form (PDF, 38KB)

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.

Authors of accepted manuscripts are required to transfer the copyright to APA.

- For manuscripts **not** funded by the Wellcome Trust or the Research Councils UK
  Publication Rights (Copyright Transfer) Form (PDF, 83KB)
- For manuscripts funded by the Wellcome Trust or the Research Councils UK
  Wellcome Trust or Research Councils UK Publication Rights Form (PDF, 34KB)

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.

- Download Certification of Compliance With APA Ethical Principles Form (PDF, 26KB)

The APA Ethics Office provides the full Ethical Principles of Psychologists and Code of Conduct electronically on its website in HTML, PDF, and Word format. You may also request a copy by emailing 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 for more resources for writing, reviewing, and editing articles for publishing in APA journals

Appendix B

Telehealth WAIS-IV Without Facilitator Subtest Protocol

1. Block Design

Materials

With Examiner	With Participant
Administration and Scoring Manual Record Form Stimulus Book 1 (on screen via COVIU) Stopwatch Block Design Blocks Laptop for Table Top View	Block Design Blocks in envelope Tripod and Webcam

Start

Start as per manual instructions.

Reverse

Reverse as per manual instructions.

Discontinue

Discontinue as per manual instructions.

Timing

Timing as per manual instructions.

General Directions

Telehealth adaptions

Examiner Screen: Examiner to display sample items via a separate laptop that is logged into the COVIU call. The laptop to be angled downwards so that only the table top is visible to the participant. Examiner to instruct participant to watch the table top video when demonstrating items.
Participant Screen: Participant instructed to watch the table top video during sample items. The examiner will still be visible through the main desktop's webcam video.
- A tripod with an attached webcam will be placed directly behind the participant's laptop. This will provide a view of the participant's table top to the examiner.
- The examiner will use the mouse to click on the stimuli when instructed to point by the manual. Where the examiner clicked will be displayed on the participant's COVIU screen.
- If the participant makes a rotation error, say, **Do not rotate the blocks, the design should be exactly as pictured on screen.**
- After completion of an item the examiner will modify the scramble. Examiner to say, **Please scramble your blocks so that only one side facing up is half red and half white (two sides to be facing up when nine blocks are used)**. Examiner to check the participant's block scramble to confirm it is accurate before proceeding to the next item.

2. Similarities

Materials

With Examiner	With Participant
Administration and Scoring Manual Record Form	

Start
Start as per manual instructions.

Reverse
Reverse as per manual instructions.

Discontinue
Timing as per manual instructions.

General Directions
- Administer as per manual instructions.

Telehealth Adaptions
- **Participant Screen:** Video of examiner on participant screen.
- **Examiner Screen:** Video of participant on screen.

3. Digit Span

Materials

With Examiner	With Participant
Administration and Scoring Manual Record Form	

Start

Start as per manual instructions.

Discontinue

Discontinue as per manual instructions.

General Directions

- Administer as per manual instructions.

Telehealth Adaptions

- **Participant Screen:** Video of examiner on participant screen.
- **Examiner Screen:** Video of participant on screen.

4. Matrix Reasoning

Materials

With Examiner	With Participant
Administration and Scoring Manual Record Form Stimulus Book 1 (on screen via COVIU)	Stimulus Book 1 (on screen via COVIU)

Start

Start as per manual instructions.

Reverse

Reverse as per manual instructions.

Discontinue

Discontinue as per manual instructions.

General Directions

Telehealth adaptions

- **Participant Screen:** Stimulus Book 1 and video of examiner on participant screen.
- **Examiner Screen:** Video of participant, Examiner to use cursor instead of physical pointing.
- When required to point to the visual stimuli, the response options and the box with the question marks, the examiner will use the cursor on screen to “point”, will appear on the participant’s screen.

- The participant must indicate his or her choice by either saying the number or using the cursor to point to the selected response option. If the participant responds with any other type of verbalisation, say, **show me by clicking on the response.**
- If the participant selects multiple response options for an item or self-corrects after his or her initial response, score only the intended repones. If it is not clear which one is the intended response, say, **you (said, clicked on)** [*insert examinee's response*] **and you (said, clicked on)** [*insert examinee's response*]. **Which one did you mean?** Score the intended response.

5. Vocabulary

Materials

With Examiner	With Participant
Administration and Scoring Manual Record Form Stimulus Book 1 (on screen via COVIU)	Stimulus Book 1 (on screen via COVIU)

Start

Start as per manual instructions.

Reverse

Reverse as per manual instructions.

Discontinue

Discontinue as per manual instructions.

General Directions

Telehealth Adaptions

- **Participant Screen:** Stimulus Book 1 and video of examiner on participant screen.
- **Examiner Screen:** Video of participant. Examiner to use cursor instead of physical pointing.

6. Arithmetic

Materials

With Examiner	With Participant
Administration and Scoring Manual Record Form Stop watch Stimulus Book 1 (on screen via COVIU)	Stimulus Book 1 (on screen via COVIU)

Start

Start as per manual instructions.

Reverse
Reverse as per manual instructions.

Discontinue
Discontinue as per manual instructions.

Timing
Timing as per manual instructions.

General Directions
Telehealth adaption
- **Participant Screen:** Stimulus Book 1 and video of examiner.
- **Examiner Screen:** Stimulus Book 1 and video of participant.
- Items 1-5 are presented with corresponding Stimulus Book on screen.
- Examiner to instruct participant to look on screen for item 1-5, read each item to the participant, whilst pointing to the picture in the Stimulus Book on screen using the cursor.
- Item 6 -22 are verbal items that are read verbatim to the participant. Remove the Stimulus Book from the participant's view on screen when administering verbal items.

7. Symbol Search

Materials

With Examiner	With Participant
Administration and Scoring Manual Record Form Response Booklet 1 #2 Pencil Without Eraser Stop watch Symbol Search Scoring Key	Pre-filled Response Booklet 1 in envelope #2 Pencil Without Eraser

Start
Start as per manual instructions.

Discontinue
Discontinue as per manual instructions.

Timing
Timing as per manual instructions.

General Directions
Telehealth adaption
- **Examiner Screen:** Examiner to display sample items via a separate laptop that is logged into the COVIU call. The laptop to be angled downwards so that only the table top is

visible to the participant. Examiner to instruct participant to watch the table top video when demonstrating items. Examiner to take out response booklet ensuring the correct facing (response booklet is not mirrored for client, this should be checked prior to session). Follow manual instructions for demonstration items.

- **Participant Screen:** Participant instructed to watch the table top video during sample items. The examiner will still be visible through the main desktop's webcam video.
- Examiner to use own response booklet for demonstration items, sample items and to correct participant during test items. Examiner to instruct participant to look onscreen when required.
- A tripod with an attached webcam will be placed directly behind the participant's laptop. This will provide a view of the participant's table top to the examiner

Demonstration Items

- Instruct participant to look on screen for demonstration, follow manual instructions.
- Instruct participant to take out response booklet 1 and Indicate to participant demonstration items are pre-filled on their booklet saying **Please take out the Response Booklet 1 from the yellow enveloped labelled "1" and place on the table in front of you. The items I have demonstrated to you on screen are already prefilled in your booklet.** Ensure participant is on correct page before proceeding.

8. Visual Puzzles

Materials

With Examiner	With Participant
Administration and Scoring Manual Record Form Stop watch Stimulus Book 1 (on screen via COVIU)	Stimulus Book 1 (on screen via COVIU)

Start

Start as per manual instructions.

Reverse

Reverse as per manual instructions.

Discontinue

Discontinue as per manual instructions.

Timing

Timing as per manual instructions.

General Directions

Telehealth Adaptions

- **Participant Screen:** Stimulus Book 1 and video of examiner on participant screen.
- **Examiner Screen:** Video of participant. Examiner to use cursor instead of physical pointing.

- Adapt manual instructions to “point” using cursor on screen instead of physical pointing with hands when giving instruction for demonstration items.
- Instruct participant to look on screen saying **Now please look on screen** (follow manual instructions)

9. Information

Materials

With Examiner	With Participant
Administration and Scoring Manual Record Form	

Start

Start as per manual instructions.

Reverse

Reverse as per manual instructions.

Discontinue

Discontinue as per manual instructions.

General Directions

- Administer as per manual instructions.

Telehealth Adaptions

- **Participant Screen:** Video of examiner on participant screen.
- **Examiner Screen:** Video of participant on screen.

10. Coding

Materials

With Examiner	With Participant
Administration and Scoring Manual Record Form Response Booklet 1 #2 Pencil Without Eraser Stop watch Coding Scoring Template	Pre-filled Response Booklet 1 Envelope #2 Pencil Without Eraser

Start

Start as per manual instructions.

Discontinue

Discontinue as per manual instructions.

Timing

Timing as per manual instructions.

General Directions

Telehealth adaption

- **Examiner Screen:** Examiner to display sample items via a separate laptop that is logged into the COVIU call. The laptop to be angled downwards so that only the table top is visible to the participant. Examiner to instruct participant to watch the table top video when demonstrating items. Examiner to take out response booklet ensuring the correct facing (response booklet is not mirrored for client, this should be checked prior to session). Follow manual instructions for demonstration items.
- **Participant Screen:** Participant instructed to watch the table top video during sample items. The examiner will still be visible through the main desktop's webcam video.
- Examiner to use own response booklet for demonstration items, sample items and to correct participant during test items. Examiner to instruct participant to look onscreen when required.
- A tripod with an attached webcam will be placed directly behind the participant's laptop. This will provide a view of the participant's table top to the examiner

Demonstration Items

- Instruct participant to look on screen for demonstration. Examiner to open Examiner's response booklet to Coding subtest. Examiner to administers demonstration items as per manual instructions using Examiners response booklet.
- Instruct participant to take out response booklet 1 and Indicate to participant demonstration items are pre-filled on their booklet saying **"Please take out the Response Booklet 1 from the yellow enveloped labelled 1 and place on the table in front of you. The items I have demonstrated to you on screen are already prefilled on your booklet."** Instruct participant to turn to correct page before proceeding.

Appendix C

Telehealth User Experience Survey

Participant ID: _____

Date: _____

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.

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

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

☐ 1 Telehealth ☐ 2 Face-to-face ☐ 3 No preference

2. Do you have previous experience with telehealth?

☐ 1 Yes ☐ 2 No

3. 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?

4. 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:

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

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

Thank You!