Exploring the Feasibility and Acceptability of Remote Neuropsychological Assessments

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Chapter 1: Systematic Review

A Systematic Review Examining Remote Assessment of Executive Functioning

Prepared in accordance with the author requirements for Journal of Neuropsychology

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Abstract

This systematic review evaluates the acceptability and feasibility of remote neuropsychological assessments for executive functioning (EF). As telehealth adoption increases, it is important to assess whether remote EF assessments provide a valid and effective alternative to in-person testing.

A literature search identified studies assessing EF remotely via video-based methods. Inclusion criteria required studies to focus on adults (18+), use real-time video assessments, and report EF-specific outcomes. Studies were screened and assessed for methodological quality using the QualSyst tool. Data was narratively synthesised following Popay et al.'s (2006) framework.

The review included thirteen studies, encompassing diverse clinical and non-clinical populations. Findings indicated high acceptability of remote EF assessments, with participants valuing convenience and accessibility. Feasibility varied depending on technical requirements, device compatibility, and participant familiarity with digital platforms. Reliability was test-dependent, with pen-and-paper Trail-Making Test-B (TMT-B) and oral verbal fluency demonstrating strong reliability in remote settings. However, some tasks, such as category fluency and the Brixton Spatial Anticipation Test, showed lower reliability. Barriers included technological challenges, inconsistent testing environments, and reduced interpersonal engagement. Advantages of the remote format included improved accessibility and reduced travel burden.

Remote EF assessments show promise as a viable alternative to in-person testing, particularly for individuals with mobility challenges or limited access to in-person care. However, test selection and standardisation remain critical to ensure validity. Future research should explore multilingual adaptations, and hybrid approaches to optimise accessibility and accuracy across diverse populations.

Introduction

Neuropsychological assessment (NPA) objectively explores cognitive; emotional; and behavioural symptoms, using reliable and valid psychometric tools according to their test manuals and administered by a practitioner with the appropriate competencies (Lezak, 2012). This process allows for the selection of specific measures to differentiate between possible conditions associated with different patterns of cognitive impairment (Harvey, 2022), alongside case-specific considerations, such as the person's cultural background and the test's normative data.

Cognitive domains represent areas of cognitive functioning that are interrelated. The DSM-5 identifies six key domains: perceptual-motor function, language, learning and memory, social cognition, complex attention, and executive functioning (Sachdev et al., 2014). Each domain includes subdomains that reflect more specific processes within the larger constructs (Lezak et al., 2012). In clinical practice, the NPA of one or more of these domains is guided by individual presentation and helps clinicians form, test and refine hypotheses about the underlying causes of cognitive difficulties, integrating biopsychosocial information to inform diagnosis and treatment (Palazzoli et al., 1980).

EF includes problem-solving, decision-making, attentional control, working memory, and cognitive flexibility, essential for complex tasks (Diamond, 2013; Lezak et al., 2004). Impairments in EF, often referred to as executive dysfunction or dysexecutive syndrome, can lead to difficulties with day-to-day activities and reduce an individual's ability to manage complex tasks (Diamond, 2013). NPAs can provide an objective and in-depth analysis of executive dysfunction, offering valuable insights for clinicians to understand the individual's specific challenges (Lezak et al., 2012).

Despite the widespread use of NPAs for assessing executive function, there is limited research on the acceptability and feasibility of these assessments when conducted in-person. Most studies focus on the psychometric properties of neuropsychological tests rather than the experiences of service

users or clinicians administering them. This gap makes it difficult to directly compare remote and in-person assessments in terms of patient satisfaction, clinician confidence, and practical challenges. Furthermore, traditional executive function tests may not fully capture real-world cognitive difficulties, as performance on one executive function test may not reliably predict performance on another test or in complex, everyday tasks (Burgess et al., 2006; Chan et al., 2008). This has led to an increased emphasis on incorporating ecologically valid measures that better capture executive dysfunction as it manifests in daily life (Borgnis et al., 2023).

Before COVID-19, there was emerging interest in the feasibility of conducting NPAs remotely, particularly for populations in remote or underserved areas with limited access to in-person evaluations (Brearly et al., 2017). The pandemic necessitated rapid changes in clinical practice, leading clinicians to transition from in-person to remote assessments, such as via phone or video, to maintain continuity of care (British Psychological Society, 2020). This shift provided an opportunity to further assess the feasibility and acceptability of remote NPAs (rNPAs). Emerging evidence suggests that remote assessments can offer similar diagnostic value to in-person assessments, facilitating accurate clinical formulations (Duricy et al., 2023; Sumpter et al., 2022).

However, not all cognitive domains are equally suited to remote assessment. EF assessments often require visual stimuli, complex instructions, or manual responses, making remote administration harder to facilitate through remote technology (Sumpter et al., 2022; Mahon et al., 2022). Many widely used EF tests, such as the Trail Making, Clock Drawing, Stroop, and Wisconsin Card Sorting Tests, require hands-on interaction, complicating remote delivery (Faria et al., 2015).

Acceptability can be measured through satisfaction surveys and qualitative feedback, capturing participants' perceptions of the ease of use and comfort with remote assessments (Orrange et al., 2021). Feasibility assesses practical aspects, including technical issues, ease of use, and the reliability of neuropsychological tests when administered remotely compared to traditional in-person settings

(Watt et al., 2021). A comprehensive assessment of acceptability and feasibility is essential for understanding the overall effectiveness of rNPAs.

In addition, some demographic groups may face unique challenges or benefits when participating in remote assessments. Age, level of cognitive impairment, travel distance, and internet access can significantly influence the experience of remote assessments (Cernich et al., 2007; Hewitt et al., 2022; Turkstra et al., 2012). Therefore, it is important to explore which populations have been researched and whether any barriers or facilitators specific to these groups have been identified.

Given the growing interest in rNPAs, this review synthesises research on remote EF assessments, comparing their reliability to in-person assessments and identifying barriers and facilitators. The findings provide an evidence overview to help clinicians navigate practical constraints and tailor assessments to the needs of diverse populations.

Methods

This systematic review was guided by The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Checklist (Page et al., 2021) and registered on Prospero (CRD42024547995) to ensure transparency and reproducibility.

Review Questions:

The following review questions guided the data extraction and synthesis process:

1. What is the level of acceptability of current NPAs for EF via remote methods?
    - Acceptability was assessed through satisfaction surveys and qualitative feedback from clinicians and service users regarding their experiences with the remote assessments.
2. What is the feasibility of current NPAs for EF via remote methods?
    - Feasibility was evaluated by examining perceptions of ease of use, technical challenges, and adherence to remote assessments from both clinicians and service users.
3. Which neuropsychological measures have been administered remotely to assess EF, and how do they compare to in-person assessments?
    - This question focused on reviewing the types of tests used, the methods of administration, and comparing the reliability of results from remote and in-person formats.
4. Which demographics or populations have been included in studies on rNPAs of EF?
    - Demographic characteristics, such as age, gender, ethnicity, and specific clinical or non-clinical populations, were identified and reviewed.
5. What barriers are associated with rNPAs for EF?

- Barriers were identified through an exploration of technical challenges, accessibility issues, and concerns regarding the validity and reliability of remote assessments.

6. What facilitators or benefits are reported for rNPAs for EF?
    - Facilitators and benefits were assessed by reviewing factors such as convenience, broader accessibility, and positive experiences reported across studies.

Search Strategy

A systematic search of peer-reviewed papers was conducted without any date restrictions on 23rd September 2024. The following databases were searched: MEDLINE (EBSCOhost), CINAHL (EBSCOhost), PsycInfo (EBSCOhost), and Psychology and Behavioural Science Collection (EBSCOhost). In addition, forward and backward citation searching of included articles was completed and the reference lists were searched. The search strategy was developed with guidance from a specialist librarian (see Appendix 1.1 for full details of the search terms used per database).

Eligibility criteria

The following criteria were used to select studies for this review:

Inclusion criteria

- Adults aged 18 or over who had completed an NPA.
- The NPA was completed in real-time using video, connecting the clinician and service user in different locations (including hybrid studies where in-person testing may have formed part of the assessment). In-person testing was not a requirement
- The study reported the results of EF tests separately and distinctly, ensuring that data specific to this cognitive domain were not combined with results from other domains.
- Original studies published in peer-reviewed journals.

- Qualitative or quantitative reports
- Studies written in English.

Exclusion criteria

- Mixed age samples including participants aged 17 or under
- Studies using only global cognitive tools, such as the MoCA, without reporting EF subtests separately.
- Computerised NPA conducted without a clinician present.
- NPAs conducted entirely in person, where the clinician and service user were in the same location.
- NPAs conducted via telephone (e.g. without video connection)
- Studies published in a language other than English.
- Studies published in a non-peer-reviewed publication.
- Study type: Systematic review, meta-analysis, review, case study, dissertation.

Screening Stage

Screening was conducted in two stages. Initially, the primary reviewer screened titles and abstracts of all identified articles, removing duplicates using the screening tool Rayyan (Polanin et al., 2019). Articles not meeting eligibility criteria were excluded during this stage.

Next, the primary reviewer obtained, downloaded, and reviewed in detail full-text versions of potentially eligible studies. To ensure rigour, a second reviewer independently screened 10% of titles, abstracts and full texts. No third reviewer was required to resolve any disputes.

Quality Assessment

Following data extraction, two reviewers independently assessed the methodological quality using the Standard Quality Assessment Criteria for Evaluating Primary Research Papers

(QualSyst; Kmet, Lee & Cook, 2004; see Appendix 1.2 for full criteria). Each study was evaluated on a scale where items were scored as Yes = 2, Partial = 1, No = 0, or Not Applicable (N/A). The maximum possible raw score for the tool is 28, though this varies depending on the applicability of specific items. To ensure fair comparisons, scores were calculated as a percentage of the maximum achievable score for each study (see Table 1).

Study quality was classified as: strong (>80%), good (70-80%, adequate (50-70%), or limited (<50%) (Lee et al., 2008). A detailed breakdown is in Appendix 1.3.

To check reliability, a second reviewer, a trainee clinical psychologist, independently appraised 10 of the included papers using QualSyst. Before rating, the checklist was reviewed and discussed to ensure consistency. Discrepancies were resolved through discussion, with no disagreement exceeding a two-point difference per item. Two reviewers independently rated the studies to assess the consistency of the quality assessment, resulting in an intraclass correlation coefficient (ICC) of 0.85. The ICC calculated using a two-way random effects model for absolute agreement (ICC (2,1)) with ANOVA: Two-Factor Without Replication on Excel, indicates 'good reliability' between raters (Koo & Li, 2016).

Data Extraction and Synthesis

Given study heterogeneity, data was narratively synthesised following recommended guidelines (Popay et al., 2006). Findings were organised to identify patterns in populations and test types, followed by analysis of relationships, particularly video assessment methods and test administration differences. Results were grouped by neuropsychological test type, population demographics, and key outcomes (e.g., acceptability, feasibility).

This synthesis followed three key stages (Popay et al., 2006):

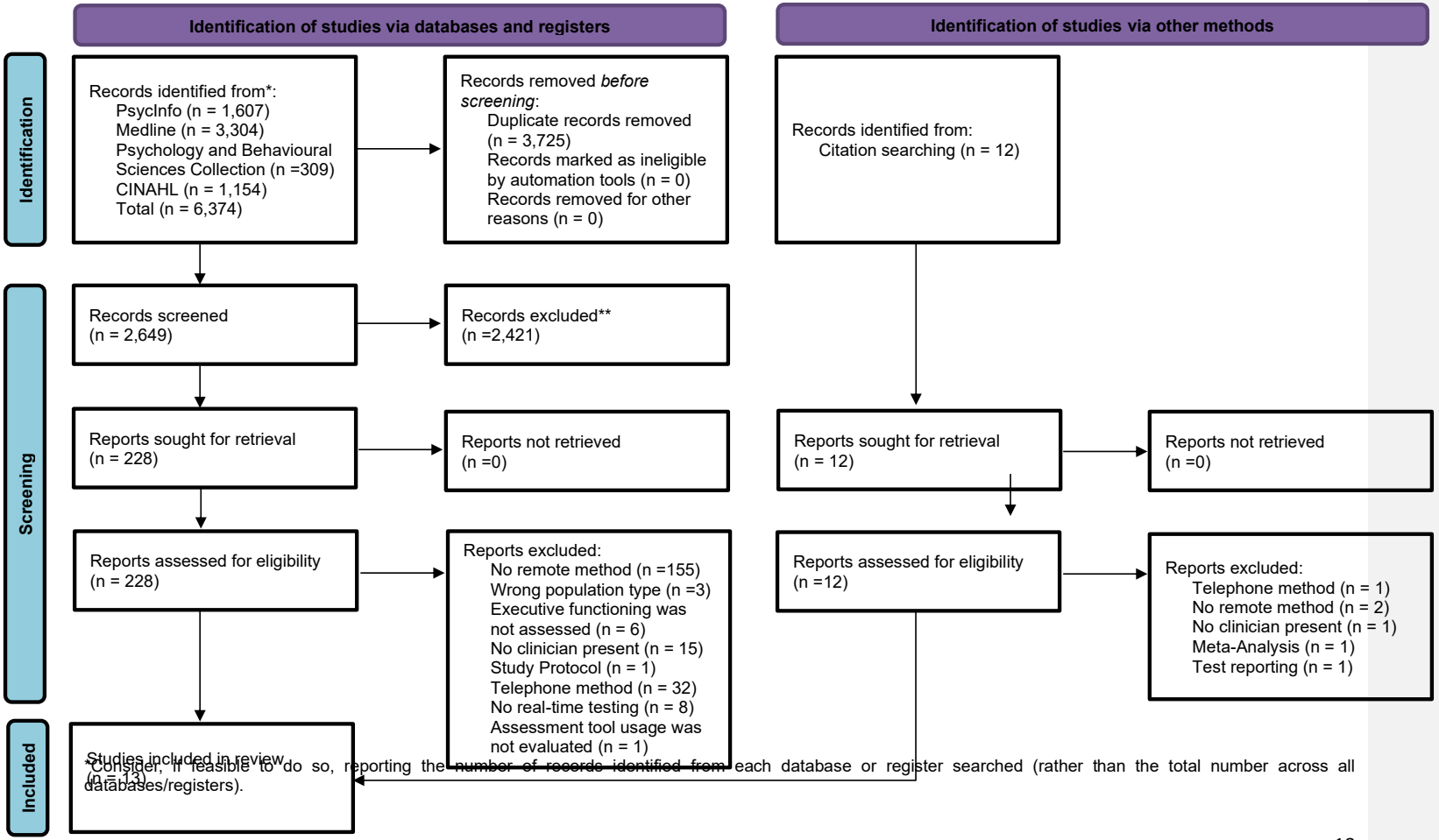
1. Preliminary synthesis – Organising and summarising extracted data to provide an initial understanding of participants' experiences with NPA.

2. Exploring relationships – Examining relationships within and between studies to identify patterns and themes
3. Assessing the robustness of the synthesis – Assessing the strength of evidence across studies to support conclusions

Results

An overview of the search results and article selection process is provided in Figure 1. The initial search identified 6,374 studies, which were then exported to EndNote. After removing duplicates (n = 3,725), 2,649 unique records remained and were systematically screened using Rayyan based on the predefined inclusion and exclusion criteria. Seven studies met the eligibility criteria at this stage. Forward and backward citation searches of these studies were then conducted, resulting in an additional six studies that were reviewed in full and deemed eligible for inclusion.

Figure 1: PRISMA Flow Diagram



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.
From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/

1. Preliminary synthesis

Study characteristics

Table 1 summarises the thirteen included studies, published between 2016 and 2024, including their quality appraisal ratings. Across all studies, a total of 9,540 participants were included, aged 18 to 95.45 years. Gender was reported for 1,277 participants, of which 56.47% were female, though this average does not account for varying sample sizes. Ethnicity and race were reported in nine studies, with Caucasian participants comprising the majority (46% to 100%), followed by Asian (1.67% to 82.4%), and Black participants (4.5% to 21.1%). Latinx (1.8% to 6.8%) and African American participants (4.5% to 13.33%) were the least represented.

Studies varied in methodology, particularly between remote and in-person testing. Some used only remote testing (Abdolahi et al., 2016; Fox-Fuller et al., 2022; Gallagher et al., 2023; Krynicki et al., 2022; Sarno et al., 2022), while others included both, sometimes drawing from historical neuropsychological records (Alegret et al., 2021). Studies utilised mixed methodologies, with some being within-subjects (i.e. the same participants completing tests in both remote and in-person settings, e.g. Chapman et al., 2019; Chapman et al., 2021), whereas others had between-subjects designs (i.e. separate participant groups for each mode, e.g. Parks et al., 2021; Rogers et al., 2023). The cognitive assessments used varied, with frequent use of well-established tests measuring EF (e.g. Trail Making Test, Stroop Test, Verbal Fluency and Digit Span), often adapted for remote administration. Appendix 1.4 provides a breakdown of participant distribution across testing modalities.

Study Timing and Pandemic Context

Three studies were published pre-COVID-19, while ten were published during or after the pandemic. The pre-COVID-19 studies primarily compared remote and in-person NPAs (Abdolahi et al., 2016; Alegret et al., 2021; Chapman et al., 2019). Two of these studies

(Chapman et al., 2019; Chapman et al., 2021) used counterbalancing to address potential order effects, such as practice effects.

During the COVID-19 pandemic, restrictions led to exclusively remote assessments in three studies (Fox-Fuller et al., 2022; Gallagher et al., 2023; Sarno et al., 2022), and mixed method designs in five (Barraclough et al., 2023; Krynicki et al., 2022; Leong et al., 2022; Rogers et al., 2023; Sachs et al., 2024). Three of these used within-subjects designs, and some incorporated retrospective data (Barraclough et al., 2023; Sachs et al., 2024). However, studies like Barraclough et al. (2023) were designed retrospectively due to pandemic limitations, preventing counterbalancing methods, a potential methodological issue.

Methods and Designs

Krynicki et al. (2022) counterbalanced within-subjects design, to mitigate practice effects, while Leong et al. (2022) employed a between-subjects design, resulting in discrepancies in task completion rates. For example, all participants in the remote testing group completed their tasks, but only 53.7% of in-person participants completed the full set due to variations in testing conditions pre- and post-lockdown.

Rogers et al. (2023) used a mixed-method design, comparing pre- and post-pandemic groups. Within-group comparisons were also conducted for participants who completed both in-person and virtual assessments, with efforts to minimise practice effects through a six-month delay between testing sessions.

Finally, Alegret et al. (2021) and Parks et al. (2021) compared remote NPAs to historical control groups whose in-person data were collected pre-COVID. Parks et al. (2021) reviewed the medical records of 154 telehealth patients evaluated from January to June 2020 and compared them to in-person assessments conducted pre-pandemic. Similarly, Alegret et al.

(2021) compared remote assessments with historical in-person assessments performed at the same memory clinic from 2006 to 2020.

Study Locations and Settings

The studies included were conducted across seven countries, with the majority conducted in the USA (N = 6), followed by Australia (N = 2,) and one each from Canada, Ireland, Singapore, Spain, and UK. In terms of assessment settings, in-person testing occurred in nine studies (Abdolahi et al., 2016; Alegret et al. 2021; Chapman et al., 2019; Chapman et al., 2021; Krynicki et al., 2022; Leong et al., 2022; Parks et al., 2021; Rogers et al., 2023; Sachs et al., 2024). Of these, four were conducted in a university setting or laboratory setting (Abdolahi et al. 2016; Chapman et al., 2019; Chapman et al., 2021; Leong et al., 2022), while two assessments took place in a medical centre or memory unit (Alegret et al. 2021; Parks et al., 2021). In three studies, the location of in-person assessments was unclear or not reported (Krynicki et al., 2022; Rogers et al., 2023; Sachs et al., 2024).

Remote assessments were most commonly conducted from a clinician's home or clinics to participants' homes (Abdolahi et al., 2016; Alegret et al., 2021; Barraclough et al., 2023; Fox-Fuller et al., 2022; Leong et al., 2022; Parks et al., 2021; Rogers et al., 2023; Sachs et al., 2024; Sarno et al., 2022). Two studies indicated that remote assessments occurred at the participant's home or a community location (Chapman et al., 2019; Chapman et al., 2021), while two studies did not report the specific locations for remote assessments (Gallagher et al., 2023; Krynicki et al., 2022).

Clinical Populations

The thirteen studies covered various populations, with four studies focusing on multiple populations (Abdolahi et al., 2016; Alegret et al., 2021; Parks et al., 2021; Sachs et al., 2024), reflected in the population-specific counts where applicable. Six studies examined healthy

participants (Alegret et al., 2021; Fox-Fuller et al., 2022; Krynicki et al., 2022; Leong et al., 2022; Parks et al., 2021; Sachs et al., 2024), while three studies focused on individuals with Parkinson's disease (Abdolahi et al., 2016; Gallagher et al., 2023; Sarno et al., 2022).

Mild Cognitive Impairment (MCI) was examined in three studies (Alegret et al. 2021; Sachs et al., 2024; Parks et al., 2021), while stroke and dementia were each studied in two (Chapman et al., 2019; Chapman et al., 2021; Alegret et al., 2021; Sachs et al., 2024). Additional populations included individuals with Huntington's disease (Abdolahi et al., 2016), Systemic Lupus Erythematosus (Barraclough et al. 2023), and Multiple Sclerosis (MS) (Rogers et al., 2023). One study categorised participants under 'Other' (Sachs et al., 2024).

Parks et al. (2021) further categorised participants into cognitively normal, mild neurocognitive disorder (MiNCD), and major neurocognitive disorder (MaNCD), with MiNCD and MaNCD including conditions such as Alzheimer's, Parkinson's and vascular disease.

Platforms and Devices

Zoom was the most commonly used platform (Chapman et al., 2019; Chapman et al., 2021; Fox-Fuller et al., 2022; Parks et al., 2021; Rogers et al., 2023; Sachs et al., 2024; Sarno et al., 2022), alongside others like Skype, Google Hangouts, BlueJeans, Microsoft Teams, and Whatsapp (Alegret et al., 2021; Gallagher et al., 2023; Krynicki et al., 2022; Leong et al., 2022). Some studies didn't report the platform used (Abdolahi et al. 2016; Barraclough et al., 2023).

Most studies used laptops (Chapman et al., 2019; Chapman et al., 2021; Fox-Fuller et al., 2022; Gallagher et al., 2023; Krynicki et al., 2022; Leong et al., 2022; Sarno et al., 2022). Some studies specified that participants needed a certain type of device while others didn't state. Some simply requested that the individual have a device with a webcam (Abdolahi et al., 2016; Sachs et al., 2024). The most common device listed in the studies' criteria was a laptop (Chapman et al., 2019; Chapman et al., 2021), while others allowed a mix of devices, such as

desktops, tablets, and phones (Fox-Fuller et al., 2022; Gallagher et al., 2023; Krynicki et al., 2022; Leong et al., 2022; Sarno et al., 2022). One study specified a minimum screen size (Krynicki et al., 2022), while others didn't report any description of the device used (Alegret et al., 2021; Barraclough et al., 2023; Parks et al., 2021; Rogers et al., 2023).

Administration and Language

Various professions administered the assessments including neuropsychologists (Alegret et al., 2021; Gallagher et al., 2023; Sarno et al., 2022), psychometrists (Barraclough et al., 2023; Parks et al., 2021; Sachs et al., 2024), research assistants (Fox-Fuller et al., 2022; Gallagher et al., 2023; Rogers et al., 2023), postdoctoral fellow (Sarno et al., 2022) and experimenters/researchers (Leong et al., 2022). In three studies researchers administered the tests (Chapman et al., 2019; Chapman et al., 2021; Krynicki et al., 2022), with some studies not reporting who administered the tests (Abdolahi et al., 2016).

The majority of assessments were conducted in English (Abdolahi et al., 2016; Barraclough et al., 2023; Chapman et al., 2019; Chapman et al., 2021; Fox-Fuller et al., 2022; Gallagher et al., 2023; Krynicki et al., 2022; Leong et al., 2022; Rogers et al., 2023; Sachs et al., 2024), except one which was administered in English and Spanish (Sarno et al., 2022). Two papers didn't report the language they were administered in (Alegret et al., 2021; Parks et al., 2021).

Table 1: Study Characteristics

Citation	Study Location & Setting	Timeline & Design	rNPA Method, Device Used & Administrator	Neuropsychological Assessment Tools for Executive Functioning	Clinical Diagnoses (N)	Age Mean or Median (Range)	Ethnicity / Race & Language	Gender % Female	QualSyst Summary Score
Abdolahi et al. (2016)	USA IP: University Movement Disorder Clinic (Baseline) rNPA: Participant homes	Pre-COVID Feasibility Study	Video call with printed resources Platform: NR Device: with a webcam NR	MoCA: Alternating trail making task, Copying the Cube, and Drawing the clock	PD = 8 HD = 9	M with PD = 65.1 (53.2-77.0) M with HD = 57.7 (32.5-82.9)	Ethnicity/Race NR English	PD = 12.5% HD = 55.6%	0.73
Alegret et al. (2021)	Spain IP: Memory Unit of Fundacio ACE rNPA: Home-to-Home	IP: Pre-COVID rNPA: During COVID Experimental Study	Video call Platforms: Skype, FaceTime, GoogleDuo, or WhatsApp Device: NR Neuropsychologists	NBACEtn Executive function tests: Letter Fluency, Category Fluency, Similarities	CH = 66 MCI = 192 MD = 80	M = 74 (46 – 93)	NR NR	60.1%	0.71

Barraclough et al. (2023)	Canada IP: NR rNPA: Home-to-Home	During COVID Longitudinal Study	Video-call Platform: NR Device: NR Psychometrist	ACR-NB: Stroop Interference, WAIS letter-number sequencing, SDMT (verbal version of WAIS-III digit symbol), Trails B (verbal), Consonant trigrams	SLE = 328	Mdn = 39 (31 - 53)	Caucasian = 46%, Black = 15%, Asian = 20%, Other = 19% English	92%	0.79
Chapman et al. (2019)	Australia IP: Monash University rNPA: Participant's home, or community location	Pre-COVID Randomised crossover design	Video call Platform: Zoom Device: Laptop A researcher (J.Chapman)	MoCA: - Alternating Trail Making, - Cube/rectangle copy, - Clock Drawing	Stroke = 48	M = 64.6 (35-88)	Australian = 68.7%, English = 20.8%, Other = 10.4% English	45.8%	0.75
Chapman et al. (2021)	Australia IP: Monash University rNPA: Participant's home, or community location	Pre-COVID Randomised crossover design	Video call Platform: Zoom Device: Laptops One researcher and one research assistant	Letter Fluency (FAS) Stroop Test Trail Making Test WAIS-IV Similarities	Stroke = 48	M = 64.6 (35-88)	NR English	45.8%	0.79

Fox-Fuller et al. (2022)	United States of America rNPA: Home-to-Home	During COVID Reliability Study	Video call Zoom Laptop or desktop computer Research Assistant (trained)	Controlled Oral Word Association Test (FAS), Category Fluency, WAIS-IV Digit Span Backward	CH = 44	M = 34.0 years (19 – 49)	Non-Hispanic white = 56.8% Asian American = 31.8% Latino/a = 6.8% African American = 4.5% English	NR	0.75
Gallagher et al. (2023)	United States of America IP: NR rNPA: Participant's home	During COVID Pilot Study	Videoconference Platform: BlueJeans or Zoom Device: Laptop (19), Desktop (6), Tablet (8), Phone (2) A neuropsychologist and two research coordinators	Clock Draw Test, Trails A & B, Symbol Digit Modalities Test, Letter-Number Sequencing, Verbal Fluency (FAS and Animals)	PD= 35	M = 69.1 (53.5 – 84.7)	White = 100% English	38.1%	0.75
Krynicki et al. (2022)	United Kingdom IP: Unclear rNPA: NR	During – COVID Within-subject's	Videoconference Platform: Zoom or Microsoft Teams	The Oral Trail Making Test, Two DKEFS sub-tests (Verbal Fluency and Colour-Word Interference), The	CH = 28	M Male = 41.27 (26.12 – 56.42)	White = 25 Asian = 2 Mixed = 1 English	60.71 %	0.71

		experimental design	Device: Laptop or desktop (with a minimum screen size of thirteen inches) Study authors	Hayling Sentence completion test, Brixton Spatial Anticipation test		M Female = 39.12 (26.98 - 51.26)			
Leong et al. (2022)	Singapore IP: Psychology lab rNPA: Participant's home	During COVID Development and usability study	Videoconference Platform: Zoom or Microsoft Teams Device: Laptops or desktops (sufficient storage, webcam, microphone, a reliable internet connection, and compatibility with specific web browsers) Experimenter (not specified)	Wisconsin Card Sort Test, Probabilistic learning and reversal, Trail-making task, Intra-extra dimensional set shift, Spatial working memory, WAIS-IV (Backward Digit span), Stroop task (Stop Signal Task), Structure Learning, WASI-II vocabulary	CH = 85 IP = 41 rNPA = 44	IP M = 21.54 (18.11 – 29.22) rNPA M = 22.14 (18.51 – 26.83)	Chinese = 82.4% Malay = 11.8% Indian = 4.7% NR = 1.2% English	IP = 70.7% rNPA = 75%	0.68
Parks et al. (2021)	United States of America IP: Academic medical centre outpatient	During and post-COVID Quasi-experimental Design	Videoconference Platform: Zoom Device: NR	Oral Trail Making Test-B, Digit Span Backward, Calibrated Ideational Fluency Assessment (CIFA) - S&P word, CIFA	MiNCD; N = 46, MaNCD; N = 13, and CH; N = 52	rNPA: M = 58.91 (30.31 – 87.51)	rNPA: Caucasian = 84.69% African American = 9.91%	rNPA = 59.46 % IP= 50.83 %	0.75

	neuropsychology clinic rNPA: Clinic–to–Home		Neuropsychologists completed the clinical interviews, trained psychometrists administered the assessments.	Animals and Supermarket Items		IP M = 61.65 (27.85 – 95.45)	Asian American = 3.60% Latinx = 1.8% IP: Caucasian = 82.50% African American = 13.33% Asian American = 1.67% Latinx = 2.50% NR		
Rogers et al. (2023)	Ireland IP: NR rNPA: Home-to-Home	During COVID Feasibility study	Videoconference Platform: Zoom Device: not controlled Research assistants	Trail Making test - A & B	MS IP = 34 rNPA = 34	IP M = 48.59 (39.63 – 57.55) rNPA: M = 47.56 (37.66 – 57.46)	NR English	IP = 67.65 % rNPA = 70.59 %	0.71

Sachs et al. (2024)	United States of America IP: Unclear rNPA: Participants at home	During COVID Feasibility Study	Videoconference Platform: Zoom Device: capable of video with audio (No smartphones) Staff psychometrists (trained)	Verbal Fluency, Trail-Making Test, Oral Trail Making Test, Number Span	MCI = 35 Dementia = 11 CH = 44 Other = 3	Overall = 72.8 (63.9-81.7) Video M = 69.4 (54 – 85)	White = 79.0% Black = 21.1% English	65.8%	0.57
Sarno et al. (2022)	United States of America rNPA: Home-to-Home	During COVID Feasibility Study	Videoconference Platform: Zoom Device: Desktop, laptop or large tablet Neuropsychologist or postdoctoral fellow	WAIS-IV: Similarities & Oral Trails B	Movement Disorders (being evaluated for deep brain stimulation) PD= 73	M = 62.5 (45 – 80)	Hispanic = 46.9% English = 40 Spanish = 24 English and Spanish	32.8%	0.64

Note. Study quality was colour coded by QualSyst Summary Score: ■ Strong (>80%), ■ Good (70-80%), ■ Adequate (50-70%), ■ Limited (<50%)

Abbreviations: QualSyst = Standard Quality Assessment Criteria for Evaluating Primary Research Papers; In-Person = IP; rNPA = Remote Neuropsychological Assessment; NR = Not Reported; MoCA = Montreal Cognitive Assessment; PD = Parkinson's Disease; HD = Huntington's Disease; M = Mean; NBACEtn = Teleneuropsychology Battery of Fundacio ACE; CH = Cognitively Healthy; MCI = Mild Cognitive Impairment; MD = Mild Dementia; ACR-NB = ACR-neuropsychological battery; WAIS-IV = Weschler Adult Intelligence Scale, Fourth Edition; SLE = Systemic Lupus Erythematosus; Mdn = Median, ; WASI-II = Wechsler Abbreviated Scale of Intelligence, Second Edition; MiNCD = Mild neurocognitive disorder; MaNCD = Major neurocognitive disorder; MS = Multiple Sclerosis

2. *Exploring relationships between studies*

Study characteristics were examined to identify patterns and relationships related to the acceptability, feasibility, barriers and facilitators of remote NPA for EF.

Quality appraisal

Methodological quality was assessed using the Standard Quality Assessment Criteria for Evaluating Primary Research Papers (QualSyst; Kmet, Lee & Cook, 2004; Appendix 1.3, see Table 1 for summary scores and Appendix 1.3 for individual item ratings), with most studies demonstrating strong rigour. Ten studies (>0.70) were classified as 'Good Quality', while three (0.50 - 0.70) were 'Adequate Quality'. All studies were quantitative.

Common methodological limitations included sampling approaches, limited recruitment details, and incomplete reporting, affecting transparency and replicability. Some studies lacked information on the reliability of the NPAs, particularly subtest details.

Despite these limitations, most studies were classified as 'Good quality', and their synthesis provides valuable insights into this emerging field.

Analysis of Key Themes in Remote Neuropsychological Assessments for Executive Functioning

A summary of the extracted data included in the synthesis is presented in Appendix 1.5. Key extracted information includes how acceptability and feasibility were measured, barriers and facilitators identified and the key findings of each paper.

How was acceptability measured?

Six studies evaluated acceptability through self-report questionnaires, which varied in length and content, to capture participants' perspectives on remote NPAs. However, seven studies did not report specific measures of acceptability (Alegret et al., 2021; Chapman et al., 2019; Fox-Fuller et al., 2022; Krynicki et al., 2022; Leong et al., 2022; Parks et al., 2021; Rogers et al., 2023). Some of these studies had moderate quality appraisal scores (e.g. Krynicki et al., 2022), potentially reflecting gaps in reporting transparency. Two studies (Abdolahi et al., 2016; Gallagher et al., 2023) reported informal feedback from service users and clinicians, gathered during or after the assessment sessions.

Among the studies using structured questionnaires (Barraclough et al., 2023; Chapman et al., 2021; Sachs et al., 2024; Sarno et al., 2022), it was often unclear if the measures were pre-established or specifically developed for the studies. None of the questionnaires had been formally validated. Two studies (Barraclough et al., 2023; Chapman et al., 2021) provided supplementary materials detailing their questionnaires, enhancing transparency. These studies also received high-quality appraisal scores, reflecting strong methodological rigour.

Findings from acceptability measures indicated positive attitudes toward remote NPAs, with participants often reporting convenience and ease of access as key benefits. However, some concerns were noted, including technology difficulties and a preference for in-person assessments among certain subgroups (Sachs et al., 2024; Sarno et al., 2022). One study (Sachs et al., 2024) extended acceptability measures to participants and staff, finding that while participants

appreciated the flexibility of remote assessments, clinicians raised concerns about maintaining engagement and ensuring standardisation across different settings. This highlighted the need for further refinement in remote testing protocols to enhance usability and reliability. Notably, Sachs et al. (2024) and Sarno et al. (2022) received low-quality ratings, which should be considered when interpreting their findings.

How was feasibility measured?

Feasibility was evaluated using a variety of approaches, including informal feedback, structured questionnaires, and reliability metrics. These methods assessed technology stability, testing environment suitability, and test-retest consistency.

Informal feedback typically addressed technology stability, environmental conditions, and participants' technical confidence (Abdolahi et al., 2016; Alegret et al., 2021; Fox-Fuller et al., 2022; Gallagher et al., 2023; Leong et al., 2022; Rogers et al., 2023; Sarno et al., 2022). One study used the Teleneuropsychology battery of Fundacio ACE (NBACEtn) protocol to ensure diagnostic reliability across settings (Alegret et al., 2021).

Reliability assessments for specific neuropsychological tools used in rNPA settings varied. Some tools demonstrated higher reliability than others. A summary of the reliability estimates and delivery modes of the neuropsychological tools used in the reviewed studies is provided in Appendix 1.6. For the MoCA Visuospatial/Executive subtests, Abdolahi et al. (2014) found strong reliability between in-person and remote assessments (ICC = 0.80 for the total sample). However, reliability varied between clinical groups, with the Parkinson's Disease (PD) group showing moderate reliability (ICC = 0.68), and the Huntington's Disease (HD) group exhibiting higher reliability (ICC = 0.92). This suggests that the consistency of remote EF assessments may vary across different populations.

Ten studies utilised a combination of oral (Barraclough et al., 2023; Krynicki et al., 2022; Parks et al., 2021; Sachs et al., 2024; Sarno et al., 2022) and pen-paper (Chapman et al., 2019; Chapman et al.,

2021; Gallagher et al., 2023; Leong et al., 2022; Rogers et al., 2023; Sachs et al., 2024) versions of the TMT. Sachs et al. (2024) used both formats. Chapman et al. (2021) reported strong reliability for the TMT-B in remote settings (ICC = 0.85). Similarly, Rogers et al. (2023) found a strong positive correlation ($r = .76$, $p < .001$) between in-person and remote administrations of TMT-B. Additionally, Krynicki et al. (2023) found minimal variance between in-person and remote administration of Oral TMT times, with an F-value of .0095 ($p = .760$), suggesting no significant differences between the two modes of administration. However, Barraclough et al. (2023) found some variability in the reliability estimates, with a p-value of <0.001 for in-person and virtual visit comparisons. Similarly, Gallagher et al. (2023) reported a 95% Confidence Interval (0.341 – 0.866) around the correlation coefficient for TMT-B, indicating some variability in the reliability across different administration modalities.

The Stroop test was included in two studies, with varying results across its subtests. Barraclough et al. (2023), which received a high-quality rating, found Stroop colour naming to have a p-value of 0.003 for all visits and a p-value of <0.001 for intra-individual participant comparisons between in-person and virtual visits, indicating significant differences in performance across testing modes. Specifically, intra-individual comparisons revealed worse performance on the virtual test (Mdn = -0.47) compared to the in-person test (Mdn = 0.47), indicating a negative shift in performance when using the virtual modality. In contrast, Chapman et al. (2021), also rated highly for quality, reported strong reliability for Stroop Colour Words (ICC = 0.86), suggesting that these subtests maintain high reliability between remote and in-person assessments.

Verbal Fluency tests were used in six studies (Alegret et al., 2023; Chapman et al., 2021; Fox-Fuller et al., 2022; Gallagher et al., Krynicki et al., 2022; Sachs et al., 2024). Subtests of this, particularly phonemic fluency tasks like the FAS test, demonstrated good reliability across remote settings. Both Fox-Fuller et al. (2022) and Gallagher et al. (2023) found high reliability for phonemic fluency (ICC = 0.76–0.81), indicating that tasks requiring verbal processing and fluency are generally stable in

remote formats. However, Animal Fluency, a category fluency task, showed poorer reliability (ICC = 0.52) in Fox-Fuller et al. (2022), suggesting that category fluency tasks may not perform as consistently as phonemic fluency tasks in remote assessments of EF.

Finally, other executive functioning tasks, such as the Digit Span and Hayling Sentence Completion, showed minimal differences in performance between remote and in-person administrations (Krynicki et al., 2022; Leong et al., 2022). These tasks, which assess working memory and cognitive flexibility, appear to be less affected by the modality of assessment, suggesting that they are suitable for remote administration without significant reliability concerns. However, tests like the Brixton Spatial Anticipation Test showed performance variability influenced by age, suggesting that age-related factors may influence task performance irrespective of the testing modality (Krynicki et al., 2022).

Barraclough et al. (2023) gathered feedback through preference questionnaires on technical difficulties encountered and their overall experience with remote assessments. In contrast, others used the Computer Proficiency Questionnaire (CPQ; Chapman et al., 2019; Chapman et al., 2021) to assess baseline technical skills. Test-retest measures further confirmed performance consistency in remote assessments (Fox-Fuller et al., 2022). Motivation and performance validity assessments, using tools like the Test of Memory Malingering (TOMM), showed no significant differences found between remote and in-person formats, indicating consistent performance across settings (Krynicki et al., 2022).

Additionally, studies that monitored participant fatigue, technical issues, and session completion times found comparability between formats (Abdolahi et al., 2016; Barraclough et al., 2023; Chapman et al., 2019; Chapman et al., 2021; Gallagher et al., 2023; Leong et al., 2022; Sarno et al., 2022).

What barriers were identified?

Quality of Technology and Equipment Use

Technical difficulties were commonly reported across studies, particularly issues with internet connectivity and audio/video quality. For example, Abdolahi et al. (2016) and Gallagher et al. (2023) noted problems like slow internet speeds and audio/video lag, which impacted task performance. Participants also experienced device and screen variability and incompatibility between different operating systems and hardware (Leong et al., 2022), affecting the consistency of data collection. Some participants, especially older adults, struggled with using the technology itself, increasing their anxiety and frustration (Gallagher et al., 2023). Barraclough et al. (2023) highlighted the need for more technical support and clearer information on the equipment required, which might reduce these difficulties.

Distractions and Concentration

Several studies highlighted distractions in the home environment as a significant barrier to effective remote assessments. Rogers et al. (2023) and Sachs et al. (2024) noted that external interruptions, such as family members, affected participant focus and engagement. Fatigue during longer assessments was another reported issue, with Sarno et al. (2022) observing reduced attention and difficulty completing tasks in these conditions. Anxiety related to remote testing settings was also identified, with Barraclough et al. (2023) reporting increased stress among participants during virtual visits.

Relationship and Communication with the Clinician

The lack of in-person interaction appeared to affect the quality of rapport and communication for some participants. Chapman et al. (2021) found that 19% of participants preferred face-to-face assessment, citing better interpersonal connections as one reason and fewer technical difficulties as another. Rogers et al. (2023) noted that the inability to adjust testing approaches and lack of non-

verbal feedback were limitations, as they impacted the clinician's ability to assess participants effectively during remote sessions.

Impact on Standardised Task Administration

Several studies reported challenges in administering standardised tasks remotely, particularly those requiring visual observation or manual manipulation. Krynicki et al. (2022) found that DKEFS Colour Naming showed lower reliability in remote formats. Alegret et al. (2021) noted that certain tasks, like Block Design, required adaptations or could not be administered remotely at all. Leong et al. (2022) observed that technical failures led to excluded data sets. Variability in performance between clinical subgroups and the No Diagnosis (ND) subgroup suggested potential accessibility challenges in remote testing for some populations (Parks et al., 2021).

What facilitators were identified?

Quality of Technology and Equipment Use

The success of remote testing was perceived as highly dependent on high-quality devices and reliable internet connections. Gallagher et al. (2023) noted that these factors helped minimise technological issues, and the use of oral versions of tests also provided an effective adaptation to address potential technology issues. Additionally, participants' personal equipment often closely matched or exceeded lab standards, with remote participants even demonstrating superior internet speeds (Leong et al., 2022).

Accessibility and Convenience

Remote testing reduced the burden on caregivers and eliminated the need for commuting and waiting in offices, enhancing the convenience for participants and their support networks (Abdolahi et al., 2016; Barraclough et al., 2023).

Satisfaction and Engagement

Many participants reported high levels of satisfaction with remote testing when this was measured via questionnaires and informal feedback. Chapman et al. (2019) found that all participants completed all MoCA items via the remote method, with no significant differences between MoCA scores across modalities. This finding suggests that participants were equally engaged with both remote and in-person testing methods. Chapman et al. (2021) observed similar satisfaction ratings for both methods and 24.4% found videoconferencing to be more interesting or fun. Fox-Fuller et al. (2022) noted that none of the 44 participants were excluded due to issues during remote testing, and reliable internet connections helped ensure a smooth testing process.

Clinical Utility and Comparability to In-Person Testing

Remote testing provided results comparable to in-person assessments, as evidenced by studies using equivalence testing (Abdolahi et al., 2014; Alegret et al., 2021; Chapman et al., 2019; Chapman et al., 2021; Krynicki et al., 2022; Leong et al., 2022; Park et al., 2021; Rogers et al., 2023; Sachs et al., 2024). Chapman et al. (2019) found that most cognitive domains assessed via MoCA had similar means and ranges across methods, indicating no significant differences. Video modality was rated as more convenient and valid than telephone, with video assessments providing stronger correlations with in-person testing compared to phone assessments (Sachs et al., 2024). Strong positive correlations after a 6-month interval suggested the potential reliability of remote testing (Rogers et al., 2023).

Technological Comfort and Supportive Environment

Prior computing confidence and videoconferencing experience did not significantly impact remote testing performance (Chapman et al., 2019; Chapman et al., 2021). A supportive home environment also contributed to successful remote testing, helping participants feel more comfortable and engaged during assessments (Sarno et al., 2022).

3. Assessing the robustness of the synthesis

The strength of evidence across the included studies was assessed to support the review's conclusions. Authors were not contacted to request additional information, such as access to satisfaction surveys or qualitative feedback tools when these were not explicitly provided. While most studies included sufficient details about their methodologies and outputs, enabling a reasonable assessment of study quality, the lack of standardised information regarding participant experiences and perceptions of remote NPAs posed challenges for data synthesis. This gap limited the ability to draw comprehensive conclusions about participant satisfaction and experience, highlighting a need for more consistent reporting in future research.

Notably, the quality ratings of studies varied. The most notable studies, such as Barraclough et al. (2023) and Chapman et al. (2021), received the highest quality ratings (0.79), suggesting that their findings may be more reliable compared to those with lower ratings. Conversely, Sachs et al. (2024) (0.57) and Sarno et al. (2022) (0.64) received somewhat lower scores, which indicates that there may be some methodological concerns when interpreting the findings from these studies.

Discussion

This systematic review synthesised research on remote NPAs of EF, exploring acceptability, feasibility, assessment types, and populations while identifying barriers and facilitators. Studies varied in methodological quality, with differences in sample characteristics and design. Heterogeneity in populations, modalities (e.g., video, telephone, and in-person), and measures made it difficult to draw definitive conclusions on effectiveness and user experience.

Acceptability

Studies consistently reported high acceptability for remote NPAs, with participants valuing convenience and flexibility, particularly for reducing travel-related burdens and enhancing accessibility for those with mobility challenges or who relied on caregivers for transport. However, some participants preferred in-person assessments due to greater interpersonal connection and fewer technical issues. This variability highlights the importance of context, such as technological proficiency, in shaping acceptability.

Varying acceptability evaluation methods, from informal feedback to structured surveys, limited comparability. Informal feedback risked overrepresenting positive experiences, while structured surveys can impose constraints on the types of feedback provided. Additionally, some studies reported incomplete participation in acceptability evaluations, further limiting the generalisability of these findings.

Feasibility

Feasibility was assessed by exploring the ease of use, technical challenges, and adherence to remote assessments. Variability in study designs and participant engagement influenced interpretations of feasibility. Within-subjects designs, where participants experienced both methods, offered more reliable insights into preferences and performance differences.

Conversely, between-subject designs or exclusively remote assessments limited direct comparisons and potentially risked bias from participant expectations or contextual factors.

Device variability was a key factor, some studies required minimum screen size, while others allowed smartphones. This lack of standardisation potentially impacted engagement and performance.

Adherence to remote assessments was generally high, with most studies reporting full participant completion rates for remote EF tests. However, specific assessments, such as Trails B, highlighted challenges in remote administration, including task-specific errors. These limitations emphasise the importance of adapting protocols for remote contexts.

Neuropsychological Measures and Their Reliability

Reliability varied across neuropsychological measures. While tasks like TMT-B and verbal fluency tasks (e.g. FAS) demonstrated strong reliability, others such as Animal Fluency (ICC = 0.52) and Digit Span Backward (ICC = 0.66), showed lower reliability, highlighting the challenges of adapting certain measures to remote formats. Several factors likely contributed to lower reliability, including the complexity of task demands, variations in remote administration methods, and differences in participant engagement. For example, tasks requiring sustained attention, such as Digit Span Backward, may have been more susceptible to external distractions in home environments, leading to inconsistent performance. Additionally, variations in screen size, audio quality, and internet connectivity may have impacted participant responses. It is also important to consider that the reliability of cognitive tests may vary across different populations. For instance, Digit Span Backward may exhibit higher reliability in younger individuals with stronger working memory capacity, but greater variability in older adults due to age-related cognitive changes. Some demographic differences, combined with the likelihood that studies used diverse samples, may help explain

the variability in reliability estimates across tests. Future research should focus on standardising remote administration protocols, integrating real-time performance monitoring, and developing adaptive testing methods to mitigate these issues.

Reliable assessment of EF is critical, as EF plays a pivotal role in personal independence, the ability to work, educational success and social relationships (Burgess et al., 2006; George & Gilbert, 2018). It has even been linked with high-stakes social outcomes such as violent crime, though the evidence for this is somewhat inconsistent (Jansen & Franse, 2024). Furthermore, EF can be impaired in a wide range of conditions, it is commonly impaired in traumatic brain injury and other brain injuries particularly those with frontal lobe involvement (Stuss, 2011) and in neurodegenerative conditions, where EF assessment can be needed as part of differential diagnostic assessment (Kudlicka et al., 2011), and/or early identification of those at risk of PD dementia (Azuma et al., 2003). Therefore, reliable EF assessment is essential for identifying individuals at risk and tailoring appropriate interventions.

Populations Studied

The studies included a wide demographic range, from young adults to individuals up to 95 years old, encompassing clinical populations (e.g. Parkinson's, MCI) and healthy participants. However, studies were less inclusive regarding language and cultural context, with most conducted in English, limiting generalisability. Expanding research to include multilingual and multicultural populations is essential for more inclusive remote assessments.

These limitations are particularly relevant through the lens of Fujii's (2018) ECLECTIC framework, which emphasises the impact of cultural and contextual factors on neuropsychological test performance. By considering these influences, the framework provides a foundation for developing more inclusive and culturally sensitive assessments.

Expanding research to incorporate multilingual and multicultural perspectives will help ensure remote assessments are equitable and effective across diverse populations.

Barriers

Barriers to remote NPAs for EF included a range of technological, logistical, and participant-related factors. Technological barriers, including internet connectivity issues, audio/video lag, and device variability, were recurrent themes. These issues sometimes required task repetition or data exclusion, particularly when the testing environment was incompatible with certain assessments (e.g. Trail Making Test requiring visual observation). For older participants or those with motor impairments (e.g. tremors), using technology added complexity, highlighting the need for additional support or adapted protocols.

Logistical barriers included delays in data collection due to reliance on physical test packets and variability in participants' access to compatible devices or adequate screen sizes. Participant fatigue, time constraints, and language impairments further impacted test completion rates. Additionally, the lack of control over home testing environments introduced distractions and disruptions, which could interfere with task performance, and the establishment of rapport.

Facilitators

Despite barriers, remote NPAs reduced caregiver burden improved accessibility, and eliminated travel and waiting times. High-quality devices, reliable internet, and adapted tests enhanced usability, with smoother experiences for those with compatible personal equipment.

Videoconferencing offered other factors with some participants describing it as more engaging or enjoyable. Completion and satisfaction rates for remote methods were comparable to in-person assessments, with no significant differences in most test scores.

Strengths and Limitations of the Systematic Review

This systematic review offers valuable insights into the feasibility and acceptability of remote NPAs for EF. Additionally, the focus on EF, a critical domain in cognitive assessment, addresses a timely and relevant topic given the growing reliance on telehealth services.

However, several limitations should be acknowledged. One is that all but one of the included studies used English-language assessments, limiting the generalisability of findings to non-English-speaking populations. This linguistic homogeneity neglects the potential barriers and facilitators affecting non-English-speaking or multilingual individuals. Furthermore, the heterogeneity of study designs and outcome measures complicates direct comparisons. Differences in device types, testing protocols, and measures of feasibility and acceptability also create variability, which could influence the reliability of conclusions. Finally, the review predominantly included studies conducted during the COVID-19 pandemic, a period marked by unique circumstances that may have heightened the acceptability of remote methods due to restrictions on in-person contact.

In general, these findings are consistent with broader telehealth research across multiple medical specialities, where studies report high levels of satisfaction with remote healthcare services (Pogorzelska & Chlabicz, 2022). However, as the majority of research was conducted before or during the COVID-19 pandemic, further post-pandemic studies are needed to evaluate long-term trends in telehealth adoption and effectiveness.

Implications for Practice

The findings of this review have important implications for clinical practice, particularly as remote assessments become more integrated into routine care. Clinicians should prioritise standardised tools with demonstrated reliability and validity in remote settings, such as TMT-B and phonemic fluency tests (e.g. FAS). However, tests with low test-retest reliability or

complex interactions, such as Digit Span Backward, require careful consideration. Adapting protocols, such as using oral versions or incorporating visual aids, can enhance usability and mitigate technological challenges.

Clinicians should also account for technological barriers identified in this review. Providing clear device requirements, offering technical support, and ensuring reliable internet access are critical for minimising disruptions and maintaining test validity. Additionally, some participants prefer in-person assessments, highlighting the need for a hybrid approach. Offering remote assessments alongside in-person methods ensures accessibility for individuals in remote geographical areas or those with mobility challenges while preserving the interpersonal aspects of traditional assessments.

Finally, the linguistic and cultural homogeneity of the studies underscores the need for greater inclusivity in future research and practice. Developing and validating remote neuropsychological tools in multiple languages and adapting them for diverse cultural contexts will be essential to broadening their applicability.

Conclusion

The systematic review examined the acceptability, feasibility, barriers, and facilitators of remote EF NPAs. Participants valued their convenience and flexibility, particularly those with mobility challenges. Despite variability in study quality, methodology, and populations, remote assessments proved generally feasible, with high adherence rates and no significant differences compared to in-person methods for most tests. However, technical barriers, device variability, and internet issues remained challenges.

Validity concerns, especially for complex measures, highlight the need for standardisation and protocol adaptations. While the studies included diverse age groups and clinician conditions, linguistic and cultural inclusivity was lacking. Future research should address these gaps,

develop culturally sensitive tools, and explore hybrid models to enhance accessibility and assessment quality.

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Chapter 2: Major Research Project

The feasibility and acceptability of remote and hybrid format neuropsychological assessment methodology in a rural context

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Plain Language Summary

Neuropsychological tests assess cognitive functions such as memory, problem-solving, and attention. These can be conducted in-person and via video call. This study explored factors influencing experiences of both formats to inform future improvements.

Structured questionnaires gathered feedback from clinicians and service users. Eight clinicians completed questionnaires on 88 assessments, while 50 service users provided feedback. Questionnaires assessed satisfaction, experience, and psychological distress. Feasibility was defined as more than 50% service user participation, and acceptability as clinician and service user satisfaction exceeding 50%. The study also explored factors affecting satisfaction, such as confidence and experience with remote methods, service users' travel distance, psychological distress, and seasonal variations. Data were analysed using SPSS to identify patterns and relationships.

The study aimed for over half of the assessments to be conducted remotely, but only 46.6% met this criterion. Despite this, clinicians and service users expressed high satisfaction with remote assessments. Key findings included a negative relationship between service users' technological confidence and satisfaction. Clinicians with more experience using remote methods reported higher satisfaction. Service users found remote assessments more convenient, but 60% still preferred in-person assessments. Satisfaction was not significantly affected by prior healthcare experience, psychological distress, or the time of year.

This study highlights the acceptability of remote neuropsychological assessments despite not meeting feasibility criteria. Participation rates were lower than expected, suggesting personal preferences and environmental conditions may influence format choice. Flexible assessment options are needed to meet diverse needs.

Abstract

This study explored the experiences of service users and clinicians completing neuropsychological assessments in geographically remote settings, aiming to identify factors influencing these experiences to inform service delivery. Structured questionnaires gathered feedback from eight clinicians on 88 assessments and 50 service users. The questionnaires assessed satisfaction, experience, and psychological distress. The study evaluated the feasibility and acceptability of remote neuropsychological assessments, defining feasibility as the proportion of referred service users able to participate (50% engagement threshold) and acceptability as satisfaction levels among clinicians and service users (50% satisfaction as the success criterion). Additionally, the study explored factors hypothesised to influence acceptability ratings, such as confidence and experience with remote methods, service users' travel distance, psychological distress, and seasonal variations. Data was analysed using SPSS to identify trends and relationships.

The feasibility criteria was not met (46.6%, n = 41), but clinicians and service users reported satisfaction levels exceeding 50%, indicating strong acceptability of remote assessments. Higher clinician experience with remote methods correlated with greater satisfaction, while lower technological confidence was linked to reduced satisfaction among service users. No significant relationships were found between satisfaction and psychological distress, prior healthcare experience, or seasonal variations.

These findings highlight the acceptability of remote neuropsychological assessments but suggest personal preferences and environmental factors influence participation rates. Future research should explore reasons behind in-person preferences, the impact of assessment location, and additional factors affecting satisfaction. Offering flexible assessment options may better accommodate diverse needs.

Keywords: Neuropsychological assessment, remote assessments, acceptability, feasibility

Introduction

Neuropsychological assessment is recognised as an objective approach used to explore cognitive, emotional, and behavioural symptoms, employing psychometric tools, ideally with established reliability and validity according to their test manuals and administered by a practitioner with the appropriate competencies (Wright & Fisher, 2012). Each psychometric tool employed for a neuropsychological assessment depends on the clinical question being addressed, and therefore, varies case by case.

Before the COVID-19 pandemic, most research on remote neuropsychological testing was based in geographically isolated regions, including parts of the USA, Canada, and Australia. Studies conducted before and during the COVID-19 pandemic found that referrers and clinical psychologists reported that remote neuropsychological assessments allowed them to answer the clinical question (Allott et al., 2012) and contribute to appropriate formulations comparable to in-person assessments. Notably, post-pandemic research by Duricy et al. (2023) supported these findings, emphasising the continued efficacy of remote assessments in addressing clinical needs. Overall, studies have demonstrated numerous benefits of remote neuropsychological testing and support future research in this area. Despite the support as a viable alternative, pre-pandemic studies indicated limited adoption of remote methods for neuropsychological assessment (Chapman et al., 2020). This was linked to factors such as clinician knowledge and confidence.

When COVID-19 occurred, clinicians were forced to significantly change their practice to continue providing care to those who needed it. In the case of neuropsychological assessments, this involved administering via phone or video call. This adjustment for departments allowed an opportunity to try a new method of practice and has produced further evidence supporting remote neuropsychological assessments as an acceptable and feasible method of administration (Sumpter et al., 2023). However, some referrers and clinicians still have reservations about the use of remote

neuropsychological assessments (Young., 2024), citing concerns about how factors such as rapport-building, clinician and service-user confidence, technological limitations, and access to healthcare services might impact decision-making.

The ability to build rapport via remote methods is a common concern for clinicians and service users (Batastini et al., 2020). Research suggests that service user self-report satisfaction with remote assessments, including rapport, can be high (Appleman et al., 2021). In-person settings can also make rapport-building difficult due to environmental distractions such as noise, which can hinder cognitive processing (Pope et al., 2013; Delaney et al., 2018), or the use of masks during the pandemic, which may have interfered with interpersonal communication (Mheidly et al., 2020). These distractions can be particularly problematic for individuals with sensory impairments, further highlighting the importance of a quiet, undisturbed environment for assessments (BPS, 2020). Consequently, the method used for neuropsychological assessment should consider whether it can provide such an environment.

Another consideration is clinician and service user confidence with the method chosen for neuropsychological assessment. Both the clinician and service user must be reasonably confident using the necessary tools or have support available. Clinicians' and service users' confidence in the method for a neuropsychological assessment can influence their level of anxiety, which in turn can impact the method chosen and service user performance (Dorenkamp & Vik, 2021). Some individuals feel more at ease using remote methods as they are in familiar surroundings (Appleman et al., 2021), whereas others prefer in-person meetings (Lacritz et al., 2020). These differences in preference highlight the importance of tailoring assessment approaches to individual needs and ensuring both clinicians and service users are comfortable with the method chosen to enhance the overall quality of the neuropsychological assessment.

Clinicians' and service users' confidence in remote assessment methods is often linked to their experience using such methods (Lam et al., 2014). During the COVID-19 pandemic, many were forced to provide and access healthcare via remote methods more than ever before. During this time an advantage cited for remote neuropsychological assessment was service accessibility for those attending with high rates of cognitive and physical difficulties (Rizzi et al., 2022), a critical consideration for our service context, in NHS Highland. Serving a population of approximately 310,000 across the most remote and sparsely populated region in the UK, NHS Highland faces particular challenges in delivering in-person neuropsychological services. These challenges are not unique to NHS Highland but are reflected in international research on remote healthcare delivery. Studies from countries with geographically dispersed populations, such as Canada (Jong et al., 2019), Italy (Scalvini et al., 2004), and Australia (Wade et al., 2014), have similarly highlighted barriers to accessing specialist services, including long travel distances, clinician shortages and logistical difficulties. For service users in remote areas of NHS Highland, the journey to attend in-person neuropsychological assessments can be lengthy and costly, involving multiple forms of transport. For many, this can lead to delays in assessment, increased anxiety, and missed appointments. For individuals with physical or cognitive impairments, these logistical challenges are even more pronounced, making remote or hybrid formats a potentially more accessible alternative. Remote neuropsychological assessments may offer a more patient-centred approach by delivering care at times, places, and in formats suited to the needs of individuals, aligning with updated HCPC guidelines (2023) that emphasise the integration of digital technologies into professional practice (BPS, 2021).

However, the COVID-19 pandemic also highlighted a potential digital divide, where access to technology is limited by unreliable internet connections and challenges accessing technical support, particularly in rural areas like the Highlands (Watts, 2020). Technological barriers such as unreliable broadband connections, limited access to personal devices, and a lack of digital literacy among

certain age groups may exacerbate these disparities. These factors must be considered when evaluating the feasibility of remote neuropsychological assessments, as they could limit access for certain segments of the population.

For many, a neuropsychological assessment can result in feeling transient increases in fatigue, pain, and anxiety (Dorenkamp & Vik, 2021). Each of these can impact an individual's ability to concentrate during an assessment. The distance and time travelled to the clinic base can further impact this. Therefore, the distance an individual is required to travel for a neuropsychological assessment should be considered when deciding whether to complete the assessment in person or remotely via video call. Additionally, in the Scottish Highlands, seasonal weather variations can play a significant role. During winter months, snow and ice can compromise travel safety and comfort in accessing healthcare services.

Existing research demonstrates the advantages and disadvantages of remote and in-person neuropsychological assessments, however, there remain gaps in the remote assessment literature. Therefore, this research aimed to evaluate the acceptability and feasibility of remote assessment by collecting feedback from clinicians and service users who have experienced remote and face-to-face assessment formats. It is important to note that this study differs from most research on remote neuropsychological assessment conducted during COVID-19 as the setting in which it was based provides clinicians and service users with the option of remote or in-person assessment formats, or a mix of both. The assessments that use both remote and in-person assessment formats are referred to as a hybrid method. This research also took place post-pandemic, where people have become more familiar with providing and receiving healthcare services via less traditional methods.

Research Aims

The current study aimed to explore and describe the experiences of service users and clinicians who had completed a neuropsychological assessment in geographically remote settings. Specifically, the study sought to identify the factors perceived as positively and negatively impacting their experience with the chosen assessment method. The findings provide insights to inform and enhance clinicians' approaches and delivery of neuropsychological assessments in such settings.

Research Questions:

The primary research question guiding the investigation was as follows:

1. What is the feasibility and acceptability of the remote and/or hybrid assessment format?
    a. Feasibility was operationalised as the percentage of referred service users able to participate in a remote or hybrid-format assessment, with 50% engagement considered the threshold for success.
    b. Acceptability was operationalised in terms of clinician and service user satisfaction with their remote and/or hybrid-format assessments, and again the criteria for success was defined as 50% of respondents from each group indicating satisfaction with the assessment.

The secondary research questions concern the factors hypothesised to influence acceptability ratings:

1. Clinicians' acceptability ratings for remote assessment will be associated with the following factors:
    a. Increased confidence using remote methods.
    b. More experience using remote methods to provide healthcare.
    c. Service user having physical or mobility impairments.
    d. Service user with no visual or sensory impairments.
    e. Assessment taking place during winter months.

2. Service user's acceptability ratings for remote assessment will be associated with the following factors:
    a. Increased distance from home and travel time to the assessment site.
    b. Increased confidence with using technological devices.
    c. Previous experience accessing healthcare services remotely.
    d. Higher levels of self-reported psychological distress.
    e. Service user being of younger age.
    f. Assessment taking place during Winter months.

Method

Ethical Approval

Ethical approval was obtained from the Cornwall and Plymouth Research Ethics Committee on 1st May 2024 (Rec24/SW/0041) (Appendix 2.1) and sponsorship was obtained from NHS Highland Research and Development Department on 18th June (NHS Highland RD&I Ref: HIGHLAND 1923) (Appendix 2.2).

Design

This study employed an observational, mixed-methods survey design. Questionnaires with closed questions for quantitative data were used to explore the experiences of clinicians and service users with remote and face-to-face neuropsychological assessments (Appendix 2.3 and 2.4).

Participants

The study participants included Clinical Psychologists who delivered neuropsychological assessments both remotely and in person, as well as service users who were referred for neuropsychological assessment.

A total of eight clinicians, with varying levels of experience and qualifications, reported on 88 individual referrals for neuropsychological assessment; and 50 service users participated.

Research Procedures

Recruitment took place between May and November 2024. Clinical psychologists in the NHS Highland Neuropsychology Department who conducted neuropsychological assessments were informed about the research project via an email that included an information sheet detailing the study (Appendix 2.5). The researcher then attended a team meeting on June 4th to present the study and address clinician questions. Both the information sheet and presentation emphasised that

participation was voluntary and that choosing not to participate would have no adverse consequences for either clinicians or service users.

The researcher also provided information on how service users could participate in the study (Appendix 2.6). As part of standard procedure, service users who completed a neuropsychological assessment were routinely asked if they were willing to be contacted for potential participation in ongoing research projects. If they agreed, a clinician requested that the individual sign a 'Consent to contact' form (Appendix 2.8). Once consent was given, service users were contacted retrospectively within two months of completing their assessments. If any new clinical concerns arose that required review, this was provided by the named clinician.

Service users who consented to be contacted in the future were provided the research information sheet and questionnaire via their preferred method: phone call, post, or email. If the service user opted for a phone call, the researcher contacted them to explain the research and ask if they would like to participate. Given the straightforward nature of the study, service users could opt to participate immediately or schedule another suitable time. At the agreed time, the researcher conducted the questionnaire via the phone.

Materials

The questionnaires gathered insights from Clinical Psychologists and service users about their experiences with neuropsychological assessments. In addition to the questionnaires, the service user's scores from the Clinical Outcomes in Routine Evaluation (CORE-10; Barkham et al., 2013), an objective and validated measure of psychological distress, were collected from clinical records.

To assess the representativeness of the participants within the target population, routine practice also collected descriptive information for each service user, including age, sex, reason for referral,

diagnosis for referral, Scottish Index of Multiple Deprivation (SIMD), and distance to the NHS Highland Neuropsychological Department.

Measure

A questionnaire was developed, using Microsoft Forms, to assess experiences with neuropsychological assessments for this study (Appendix 2.3 and 2.4). It featured a 5-point Likert scale ranging from 'Strongly Disagree' to 'Strongly Agree' and from 'No Confidence' to 'High Confidence'), along with binary Yes/No responses where relevant. Additionally, some questions allowed for qualitative elaboration in free text format where appropriate.

The design of the questionnaire aimed to gather experiences across various formats of neuropsychological assessments. This approach enabled the collection of data directly relevant to the research questions and provided broader insights into the overall experience of each assessment method.

Statistical Analysis

Quantitative analysis was conducted using SPSS (v20, 2023). Responses to demographic and forced-choice items were summarised as counts and percentages and descriptive statistics were generated to summarise participants' responses directly related to the research questions and to characterise the overall experience.

For satisfaction data, numeric values were assigned to Likert scale responses, where 1 indicated 'strongly disagree' and 5 indicated 'strongly agree'. Clinicians responded to the statement, "I was satisfied with the service I provided," while service users responded to, "I am satisfied with the service I received."

Exploratory correlation analyses were conducted to investigate relationships between variables specified in the hypotheses. Pearson's correlation coefficients were used for normally distributed continuous variables, while Spearman's rank correlations were applied for variables that were not normally distributed, which tended to include those using Likert scales. Partial correlations were performed to assess hypothesised relationships within the clinician data, while controlling for responding clinician identify, as repeated responses from a limited set of participants was considered a potential source of systematic variation. Seasonal effects and other categorical variables were analysed using non-parametric tests, such as the Mann-Whitney U test**.**

Results

Descriptive Statistics (Figure 1)

Service User Responses: Fifty service users participated (ages 22 - 73 years, mean = 48.96, SD = 12.57). The sample was 60% females (n = 30) and 40% males (n = 20). Participants' diagnoses included: 60% (n = 30) had multiple sclerosis (MS), 26% (n = 13) had an acquired brain injury (ABI), including traumatic brain injury (TBI), stroke, and brain tumour, 10% (n = 5) had epilepsy, and 4% (n = 2) were classified as 'other', which included functional neurological disorder (FND), Huntington's disease (HD), and other neurological diagnoses. Regarding the reason for referral, 94% (n = 47) were for cognitive assessment in the context of a known diagnosis, while 12% (n = 6) were referred to aid differential diagnosis.

Participants' Scottish Index of Multiple Deprivation (SIMD) ratings ranged from 1 (most deprived) to 5 (least deprived), with a mean of 3.24 (SD = 1.153) and a median of 3.00. 12% (n = 6) were classified as SIMD = 1, 8% (n = 4) were SIMD = 2, 36% (n = 18) were SIMD = 3, 32% (n = 16) were SIMD = 4, and 12% (n = 6) were SIMD = 5.

The descriptive statistics for the participants' travel-related variables showed that the distance from home ranged from 0.9 to 120 miles, with a mean distance of 25.65 miles (SD = 31.61). The travel time ranged from 4 to 158 minutes, with a mean travel time of 37.78 minutes (SD = 40.15).

Clinician responses: A total of 88 clinician responses were collected. The service users for whom clinicians completed questionnaires were aged between 22 and 73 years (mean = 48.73, SD = 12.34), with 50% (n = 44) female and 50% (n = 44) male.

Diagnoses included: 37.5% (n = 33) had MS, 26% (n = 23) had an ABI, including TBI, stroke and brain tumour, 22.7% (n = 20) were classified as 'other' which included FND, HD, and other neurological

diagnoses and sixteen cases with unknown diagnoses and 10.2% (n = 9) had epilepsy. Most referrals (75%, n = 66) were for cognitive assessment in the context of a known diagnosis, while 18.2% (n = 16) were referred to aid differential diagnosis.

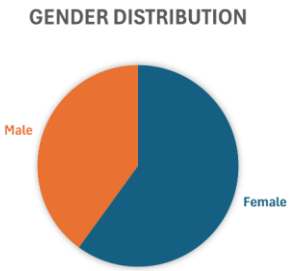
The SIMD ratings for the service users in this sample ranged from 1 to 5 (mean = 3.15, SD = 1.209) and a median of 3. Of the 88 cases, 14.8% (n = 13) were SIMD = 1, 10.2% (n = 9) were SIMD = 2, 31.8% (n = 28) were SIMD = 3, 31.8% (n = 28) were SIMD = 4, and 11.4% (n = 10) were SIMD = 5.

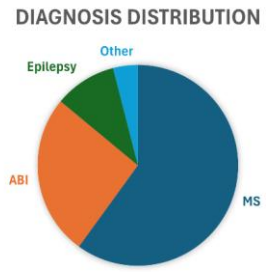
Clinicians also provided data on participants' geographical distances from Raigmore. The distances ranged from 0.9 to 133 miles, with a mean distance of 24.96 miles (SD = 32.53). The travel time for service users ranged from 4 to 191 minutes, with a mean of 37.02 minutes (SD = 42.11).

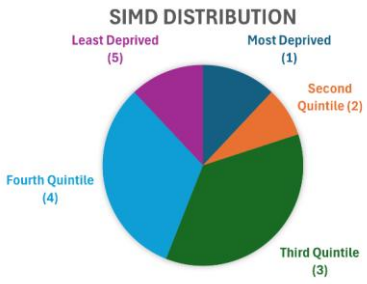
Figure 1: Descriptive Statistics

The SIMD data reflect responses from different participant groups.

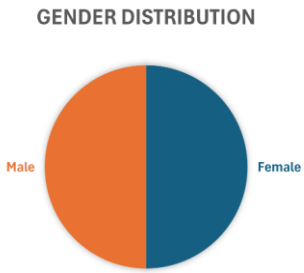
Service User Group

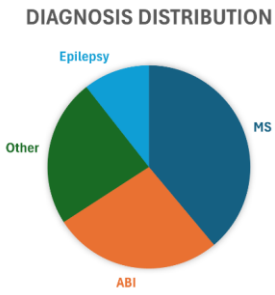


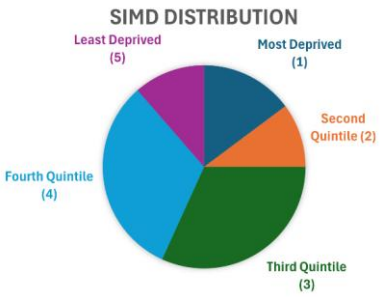




Clinician-Report Group







Feasibility of Remote and/or Hybrid Assessment Format

The feasibility of remote/hybrid assessment formats was assessed based on the percentage of referred service users able to participate in this method. The pre-defined criterion indicating feasibility (i.e. >50%) was approached but not met, as only 46.6% (n=41) of clinicians reported administering assessments remotely, including those with hybrid administration.

Of note, the majority of service users had the necessary technological resources to participate in remote assessments, with 96% (48 out of 50) reporting access to a computer and internet. Further, across the full sample, 76% (n=38) reported being able to use the technology independently, while 20% (n=10) required some support. Only 4% (n=2) indicated a lack of necessary IT equipment. These findings highlight that most service users had the technological capability to engage with remote assessments, supporting the feasibility of remote methods from a technological and 'in principle' standpoint. However, survey responses on assessment format selection indicated that many clinicians opted for the chosen method due to factors such as patient choice (46.3%), rather than considerations related to technology access or feasibility.

Acceptability of Assessment Format within the Remote and/or Hybrid Assessment Subgroups (Service Users: 48%, n = 24; Clinicians: 46.6%, n = 41)

Service User Satisfaction: Service users reported high satisfaction, with a mean satisfaction score of 4.79 (SD = 0.42, max. 5). Strong agreement with the satisfaction item was noted in 87.5% (n=21), agreement in 8.3% (n=2) and disagreement in 4.2% (n=1). Further, 100% of service users indicated they would recommend the remote format ($\bar{x}$= 4.92, SD = 0.30), with 91.7% (n = 22) strongly agreeing and 8.3% (n = 2) agreeing.

Both groups exceeded the >50% satisfaction threshold, strong evidence of the acceptability of remote assessments.

Clinician Satisfaction: Clinicians also expressed high satisfaction with remote assessments, with a mean satisfaction score of 4.44 (SD = 0.57, max. 5). Strong agreement with the satisfaction item was indicated in 48.8% (n=20), 46.3% (n = 19) indicated agreement, and 4.9% (n = 2) neutrality, with no dissatisfaction. Recommendation scores were also high (M = 4.49, SD = 0.62), with 61% (n = 25) strongly agreeing and 34.1% (n = 14) agreeing they would recommend remote assessments. However, a small proportion of clinician responses expressed disagreement, with 2.4% (n = 1) disagreeing and 2.4% (n = 1) strongly disagreeing.

Factors Influencing Service Users' Acceptability Ratings (Table 1)

Normality tests using the Shapiro-Wilk method revealed that all relevant variables significantly deviated from normality for the 24 participants who completed remote neuropsychological assessments. These variables included confidence in using technology, previous experience with remote healthcare, psychological distress (measured by the CORE-10), and distance from home and travel time to the assessment location. Consequently, non-parametric methods were used.

Service User Distance from Home and Travel Time

A moderate negative correlation was found between distance from home and satisfaction with the remote assessment (ρ (22) = -.332, p = .056) which did not reach statistical significance. Similarly, travel time and satisfaction were moderately negatively correlated (ρ (22) *= -.316, p = .067)*. These results indicate a trend where longer travel times might lead to reduced satisfaction, though the lack of significance means the findings should be interpreted with caution.

Service User Confidence Using Remote Methods

A moderate negative correlation was found between service users' confidence in using technology and their acceptability ratings of the remote assessment (r (22) = -0.376, p = 0.035). As this correlation

was statistically significant (p <.05), it suggests a meaningful relationship, though contrary to our expectations, higher confidence with technology was associated with lower satisfaction with the remote assessment process.

Non-Significant Correlations with Service User Satisfaction

There was no significant relationship between acceptability ratings and the users' prior experience with accessing healthcare services remotely (p (22) = 0.105, p = 0.312), suggesting that previous experience did not notably influence satisfaction. Similarly, service users' level of psychological distress, as measured by the CORE-10 score, did not have a significant impact on satisfaction ratings (p (22) = -0.019, p = 0.466), with the correlation being weak and non-significant. Finally, age also showed no significant correlation with satisfaction (p (22) = -0.074, p = 0.365), indicating that age did not play a role in determining the perceived acceptability of the remote assessment. All correlations presented weak effect sizes (r <0.3) and non-significant p-values (p > .05), further supporting the conclusion that these factors did not meaningfully influence service users' satisfaction with the remote method.

Winter Months

A small number of assessments took place during the winter months, with 16.7% (n = 4) of service user assessments occurring in this period. Correlational analysis indicated a weak positive relationship between the time of year and service user satisfaction, though it did not reach statistical significance (Spearman's rho = 0.163, p = 0.130). This suggests that the time of year, including winter months, did not have a meaningful impact on service user satisfaction with remote assessments.

Table 2: Service User Correlation Matrix *(Note n=24 for each correlation).*

			Satisfaction Rating	*Distance from home (miles)*	*Travel time (minutes)*	*Confidence in Video Assessments*	*CORE-10 Score*	*Previous Experience with Video Assessments*	*Age*
Spearman's rho	*Satisfaction Rating*	*Correlation Coefficient*	1.000	-.332	-.316	-.376*	.010	.105	-.074
		Sig. (1-tailed)	.	.056	.067	.035	.482	.312	.365
	Distance from home (miles)	*Correlation Coefficient*	-.332	1.000	.980**	.236	-.051	-.030	-.110
		Sig. (1-tailed)	.056	.	<.001	.134	.407	.444	.305
	Travel time (minutes)	*Correlation Coefficient*	-.316	.980**	1.000	.175	.055	-.067	-.104
		Sig. (1-tailed)	.067	<.001	.	.207	.400	.379	.314
	Confidence in Video Assessments	*Correlation Coefficient*	-.376*	.236	.175	1.000	-.168	-.167	.084
		Sig. (1-tailed)	.035	.134	.207	.	.216	.218	.348
	CORE-10 Score	*Correlation Coefficient*	.010	-.051	.055	-.168	1.000	.170	-.067
		Sig. (1-tailed)	.482	.407	.400	.216	.	.214	.377
	Previous Experience with Video Assessments	*Correlation Coefficient*	.105	-.030	-.067	-.167	.170	1.000	.269
		Sig. (1-tailed)	.312	.444	.379	.218	.214	.	.102
	Age	*Correlation Coefficient*	-.074	-.110	-.104	.084	-.067	.269	1.000
		Sig. (1-tailed)	.365	.305	.314	.348	.377	.102	.
*. Correlation is significant at the 0.05 level (1-tailed).									
**. Correlation is significant at the 0.01 level (1-tailed).									

Factors Influencing Clinicians' Acceptability Ratings

To assess the normality of the data, Kolmogorov-Smirnov tests revealed significant deviations from normality for clinicians' confidence and experience with remote methods ($p < .001$ for both), prompting the use of non-parametric analyses.

Clinician Confidence Using Remote Methods

Spearman's correlation analysis revealed no significant relationship between clinicians' satisfaction and their confidence in using remote methods (rs (62) = .098, p = .272 for both) (see Table 2). Partial correlations, controlling for clinician identity, similarly indicated no significant relationship (rs for both = −.023, p = .443) (see Table 3). The effect sizes were weak ($r < .3$) and non-significant ($p > .05$), suggesting that confidence with remote methods did not meaningfully influence acceptability ratings.

Clinician Experience Using Remote Methods

In contrast with the above, a significant positive correlation was found between clinicians' satisfaction and their experience with remote methods (rs (62) = .410, p = .004). This relationship remained significant when controlling for clinician identity (rs (61) = .384, p = .007). Additionally, confidence and experience were strongly correlated (rs (62) = .656, $p < .001$), suggesting that clinicians with more experience tend to feel more confident using remote methods. These results confirm the hypothesis that increased experience is positively associated with acceptability ratings.

Service User Mobility and Sensory Impairments

No significant relationship was found between clinician satisfaction and service user mobility impairments (r (62) = *.034, p* = .416) (see Table 4), suggesting that physical or mobility impairments did not influence clinicians' perceptions of remote assessment methods. The influence of service

user sensory impairments could not be assessed, as none of the clinicians reported these difficulties as a factor influencing their choice of assessment method.

Winter Months

Analysis indicated that a minority of assessments occurred during the winter months (19.3%, n = 17). Nonparametric correlation analyses revealed no significant relationship between clinician satisfaction and the time of year (rs (62) = .028, p = .398), indicating that winter months did not have a meaningful impact on clinician satisfaction with remote assessments.

Table 3: Clinician Response Correlation Matrix

(*Spearman's rho correlations between satisfaction, confidence, and experience with remote methods*)

Variable	*Satisfaction*	*Confidence (Administering Video)*	*Experience (Administering Video)*
Satisfaction	1.000	.098	.410**
Confidence (Administering Video)	.098	1.000	.656**
Experience (Administering Video)	.410**	.656**	1.000

Note. *N = 41. **. Correlation is significant at the 0.01 level (one-tailed)*

Table 3: Controlled Correlations for Clinician Factors

(*Spearman's rho correlations controlling for clinician*)

Variable	*Satisfaction*	*Confidence (Administering Video)*	*Experience (Administering Video)*
Satisfaction	1.000	-.023	.384*
Confidence (Administering Video)	-.023	1.000	.636**
Experience (Administering Video)	.384*	.636*	1.000

Note. *N = 41.* Degrees of freedom (df) = 38.

Table 4: Service User Mobility and Clinician Satisfaction Correlation

(*Pearson correlations between satisfaction and service user mobility impairments*)

Variable	*Satisfaction*	*Mobility*
Satisfaction	1.000	.034
Mobility	.034	1.000

Note. *N = 41.*

Additional Analyses

These analyses were planned after the approval of the initial research proposal but were outlined prior, as part of the comprehensive examination of both clinician and service user responses across different assessment formats (remote, hybrid and in-person). These supplementary analyses addressed several research questions related to the impact of assessment format on clinician and service user experiences. Specifically, we sought to explore whether factors such as convenience, confidence, satisfaction, and perceptions of service accessibility potentially differed between remote and in-person assessments and thereby provide a fuller picture of the acceptability and effectiveness of remote methods.

Service User Responses: Mann-Whitney U tests were conducted to compare remote (n = 24) and in-person (n = 26) assessments across several variables. Remote assessments were rated as significantly more convenient than in-person assessments (U = 198.00, z = -2.650, p = .008).

No significant differences between the remote and in-person groups were observed for age (U = 272.50, p = .443), travel distance (U = 250.50, p = .232), or travel time (U = 257.00, p = .285). Similarly, no significant difference was found in psychological distress between groups (CORE-10 scores; U = 275.00, p = .617).

Regarding perceptions of service accessibility, there were no significant differences in ratings for privacy (U = 306.00, p = .887), interruptions (U = 300.00, p = .785), distractions (U = 268.00, p = .317), or straightforwardness (U = 299.00, p = .775).

Service user confidence in video (U = 262.50, p = .314), telephone (U = 267.00, p = .312), and face-to-face assessments (U = 310.50, p = .971) did not differ significantly. No significant differences were observed in ratings of clinicians' listening skills (U = 289.00, p = .342), caring nature (U = 301.00, p =

.604), or respectfulness (U = 311.00, p = .954). Similarly, participant satisfaction (U = 305.00, p = .821) and willingness to recommend the service (U = 298.00, p = .509) were comparable between methods.

Finally, no significant differences were found in service users' perceptions of their ability to better understand (U = 287.00, p = .501) or cope with their difficulties (U = 286.00, p = .573) across assessment formats.

Future preferences for assessment format were also examined. The majority of service users (60%; n = 30) indicated a preference for face-to-face assessments, while 40% preferred remote assessments. Mann-Whitney U tests were conducted to compare future assessment preferences between those who had completed in-person (n = 26) and remote (n = 24) assessments. A significant difference was found, with service users who had undergone in-person assessments being significantly more likely to prefer the face-to-face method in the future (U = 152.00, Z = -3.661, p < .001).

Clinician Responses: Mann-Whitney U tests were conducted to compare remote (n = 41) and in-person (n = 47) assessments across several variables. Significant differences were observed for distance from home (U = 648.00, p = .008) and travel time (U = 637.50, p = .006), with assessments being more likely to be conducted remotely for service users who lived farther away or had longer travel times.

No significant differences were found for age (U = 877.00, p = .469), or psychological distress (CORE-10 scores; U = 896.50, p = .706). Similarly, clinicians' confidence in administrating neuropsychology assessments via the face-to-face (U = 873.00, p = .218) and telephone method (U = 772.50, p = .081) did not differ significantly, although the difference for the least-frequently used telephone method approached significance. However, there was a significant difference in clinicians' confidence in

video assessments, with remote assessments rated more favourably than face-to-face assessments (U = 730.50, p = .025). Clinicians were asked to provide confidence ratings for each assessment method regardless of whether they had used that method.

Regarding experience ratings, a combined analysis of video experience, telephone experience, and face-to-face experience revealed that video experience (U = 808.00, p = .001) and telephone experience (U = 725.00, p = .022) were rated significantly higher for remote assessments. Face-to-face experience (U = 615.00, p <.001) was rated significantly higher for in-person assessments.

In terms of service-related factors, interruptions (U = 345.00, p < .001) and distractions (U = 381.50, p < .001) were significantly higher for in-person assessments, indicating more challenges with these factors for face-to-face relative to online interactions. Privacy (U = 345.500, p <.001) was rated significantly lower for remote assessments, suggesting that participants felt more secure in terms of privacy during in-person sessions.

Finally, no significant differences were found in clinician satisfaction (U = 899.00, p = 537) or their willingness to recommend the method used (U = 910.50, p = .608) between the different assessment formats.

Qualitative Information from Service Users: Only twelve participants provided qualitative feedback regarding their experiences with remote and face-to-face assessments, as this was an optional component for those who wished to share more detailed information. Several themes emerged from responses across both formats.

Convenience and accessibility were frequently mentioned for remote assessments, with users appreciating the ease of access through NearMe software and the ability to schedule appointments

around their work or personal commitments. Some found the flexibility of remote assessments particularly valuable, especially those living far from the assessment centre or without access to transport. Additionally, service users noted that clinicians often took their travel distances into account, coordinating appointments with other scheduled medical visits to reduce the burden. However, some service users living more rurally reported being accustomed to travelling significant distances for healthcare services and expressed that they did not find this inconvenient. Some indicated that they often combined such appointments with other activities such as shopping, making travel a more integrated part of their routine rather than a standalone burden.

Clinician support emerged as a key theme, with many users reporting clinicians were understanding and accommodating, especially regarding anxiety or communication difficulties. In remote assessments, the rapport built with the clinician before the session was often highlighted as particularly helpful in establishing trust and easing any concerns about the format. Face-to-face users also emphasised how clinicians made them feel comfortable, offering reassurance and tools to manage anxiety during the session.

It was also consistently noted that some participants felt face-to-face interactions were easier for building rapport and relating to the clinician. Several service users simply preferred face-to-face, although they were not always able to elaborate on the reasons behind this preference. This seemed to be a strong personal preference that highlighted the perceived ease of connecting with another individual in person.

Technical issues and communication challenges were noted, particularly by remote users who experienced issues like poor signal or difficulty using devices. However, these issues were often resolved quickly, and the benefits of remote assessments outweighed the challenges for many.

Lastly, comfort with the format appeared to vary based on personal preferences and circumstances. Some service users felt more confident with face-to-face assessments, particularly when language or memory issues were involved. In contrast, others appreciated the convenience and reduced anxiety of remote assessments. Overall, both formats were viewed as effective, with the key difference being the level of comfort and convenience for the individual user.

Table 5: Descriptive Statistics and Statistical Comparisons of Service User Ratings for Remote and In-Person Assessments

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*Median*	*Mann-Whitney U*	*Z*	*p-value*
Convenience	4.46	0.930	2.00	5.00	5.00	198.00	-2.650	0.008
Age	48.96	12.565	22.00	73.00	47.00	272.50	-0.768	0.443
Distance from home	25.652	31.6125	0.90	120.00	15.50	250.50	-1.194	0.232
Travel Time	37.78	40.145	4.00	158.00	26.00	275.00	-1.069	0.285
CORE-10 score	9.9796	7.29866	0.00	28.00	9.00	275.00	-0.501	0.617
Privacy	1.56	0.993	1.00	4.00	1.00	306.00	-0.142	0.887
Interruptions	1.68	1.115	1.00	5.00	1.00	300.00	-0.273	0.785
Distractions	1.66	1.081	1.00	5.00	1.00	268.00	-1.001	0.317
Straightforward	4.36	0.942	2.00	5.00	5.00	299.00	-0.286	0.775
Confidence Video	3.72	1.371	1.00	5.00	4.00	262.50	-1.007	0.314
Confidence Face to Face	4.52	0.909	1.00	5.00	5.00	310.50	-0.037	0.971
Confidence Telephone	4.36	1.025	1.00	5.00	5.00	267.00	-1.011	0.312
Clinician Listened	4.92	0.274	4.00	5.00	5.00	289.00	-0.950	0.342
Clinician Cared	4.94	0.240	4.00	5.00	5.00	301.00	-0.519	0.604
Clinician Respected	4.96	0.198	4.00	5.00	5.00	311.00	-0.057	0.954
Satisfaction	4.82	0.523	2.00	5.00	5.00	305.00	-0.226	0.821
Recommend	4.94	0.240	4.00	5.00	5.00	299.00	-0.661	0.509
Understanding	4.74	0.527	3.00	5.00	5.00	287.00	-0.673	0.501
Coping	4.40	0.728	2.00	5.00	5.00	286.00	-0.563	0.573

Note: All variables are based on a total sample size of N = 50, with no missing data.

Table 6: Descriptive Statistics and Statistical Comparisons of Clinician Ratings for Remote and In-person Assessments

Note: All variables are based on a total sample size of N = 88, with no missing data.

Variable	Mean	Standard Deviation	Minimum	Maximum	Median	Mann-Whitney U	Z	p-value
Age	48.73	12.34	22.00	73.00	49.00	877.00	-0.724	0.469
Distance from Home	24.96	32.21	0.90	133.00	12.15	648.00	-2.639	0.008
Travel Time	37.02	42.11	4.00	191.00	20.50	637.50	-2.729	0.006
CORE-10 Score	8.44	8.40	0.00	32.00	5.00	896.50	-0.378	0.706
Confidence Video	3.48	0.73	1.00	4.00	4.00	730.50	-2.237	0.025
Confidence Telephone	3.28	0.84	1.00	4.00	3.00	772.50	-1.745	0.081
Confidence Face to Face	3.85	0.36	3.00	5.00	3.00	873.00	-1.232	0.218
Experience Video	3.24	0.73	1.00	5.00	3.00	725.00	-2.292	0.022
Experience Telephone	2.95	0.98	1.00	4.00	3.00	808.00	-1.382	0.167
Experience Face to Face	4.08	0.65	3.00	5.00	4.00	615.00	-3.290	0.001
Interruptions	2.60	1.28	1.00	5.00	2.00	381.50	-5.175	<0.001
Distractions	2.36	1.27	1.00	5.00	2.00	776.50	-1.636	0.101
Privacy	3.06	1.33	1.00	5.00	3.50	345.00	-5.391	<0.001
Satisfaction	4.49	0.55	3.00	5.00	5.00	899.00	-0.617	0.537
Recommend	4.51	0.68	1.00	5.00	5.00	910.50	-0.513	0.608

Discussion

This study explored the feasibility and acceptability of remote neuropsychological assessments in geographically remote and rural settings, considering service users' and clinicians' perspectives. It examined factors influencing experiences with different assessment formats and provided insights to help clinicians enhance their approach to neuropsychological assessments in remote settings.

Feasibility of Remote Assessments

While 96% of service users had access to the necessary technology, the study did not meet the feasibility criterion of achieving more than 50% participation. Although remote assessments are technologically feasible, lower participation suggests that factors beyond access, such as personal preference, may influence decisions for in-person assessments. Another consideration, particularly within NHS services, is the availability and suitability of physical spaces for conducting assessments. Previous studies have emphasised that environmental distractions, such as noise, can hinder rapport-building and cognitive processing (Pope et al., 2013; Delaney et al., 2018). Clinicians in this study reported significantly more interruptions and distractions during in-person assessments compared to remote assessments. However, rated privacy as significantly lower for remote assessments, indicating privacy concerns with remote formats.

Interestingly, service users did not report significant differences in their perceptions of service accessibility across the two assessment formats. Factors such as privacy, interruptions, distractions, and the straightforwardness of the process were perceived similarly for both methods, suggesting that both formats were viewed as equally accessible by service users.

Acceptability of Remote Assessments

In this study, both service users and clinicians expressed high satisfaction with remote assessments, surpassing the >50% satisfaction threshold. Notably, 100% of service users who completed remote assessments would recommend this approach to others and 95.2% of clinicians agreeing (61%

strongly agreeing and 34.1% agreeing) that they would recommend remote assessments to other clinicians.

Despite these high satisfaction ratings, 60% of service users expressed a preference for in-person assessments in the future. This preference was particularly evident among those who had completed in-person assessments, suggesting that the personal connection perceived in face-to-face assessments may continue to be valued. However, it is notable that rapport was also rated highly for remote assessments, indicating that meaningful clinician-service user connections can still be established virtually. While remote assessments were generally well-received, some individuals may still prefer direct human interaction and comfort, which they feel is integral to the overall experience.

Trends showed negative correlations between distance, travel time, and satisfaction, suggesting that geographical barriers might influence perceptions of remote assessments. However, the relationship was contrary to expectations, based on previous studies (Abdolahi et al., 2016; Gallagher et al., 2023), warranting further investigation with larger samples. In contrast, remote assessments were rated significantly more convenient by service users, highlighting the appeal of reduced travel time and logistical challenges. Qualitative comments also reinforced these findings, suggesting that while convenience was a key benefit, other factors may have influenced overall satisfaction.

Additionally, a higher level of confidence in technology was associated with lower satisfaction, indicating that challenges related to usability or expectations may have impacted service users' experiences.

For clinicians, the positive correlation between experience and satisfaction highlights the importance of training and familiarity with remote assessment methods. However, the lack of a significant relationship between clinician confidence and satisfaction suggests that confidence alone may not be a reliable predictor of the effectiveness or acceptability of remote assessments. This finding

implies that training, while important, may not be sufficient on its own. Since confidence is often an outcome of training, its weak association with satisfaction points to the value of hands-on clinical experience in real-world settings. In other words, direct experience with delivering remote assessments appears to have a stronger impact on clinician satisfaction than confidence. This distinction may be important when designing training or implementation strategies, suggesting that opportunities for supported practice and gradual exposure to remote delivery may be more helpful than confidence-building measure alone.

Although no data on service user sensory difficulties was collected, and no significant relationship was found between clinician satisfaction and service user mobility, these factors may still influence the choice of assessment method. These challenges are common in this population and clinicians may instinctively make adaptations during assessments, without consciously acknowledging them as factors that affect the choice of assessment method. Mobility and sensory difficulties might be considered in practice, but clinicians may not view them as distinct barriers since they are often accommodated as part of standard practice.

Service users reported that clinicians often considered their travel distances, coordinating appointments with other scheduled medical visits to reduce the burden. However, some service users reported being accustomed to travelling significant distances for healthcare services and expressed that they did not find this inconvenient. Some indicated that they often combined such appointments with other activities such as shopping, making travel a more integrated part of their routine rather than a standalone burden. This variation in perspectives may help explain the lower satisfaction ratings associated with greater travel distances among those who completed remote assessments. Consequently, the impact of travel distance on individual experiences may be highly dependent on personal circumstances and lifestyle.

The wide variation in travel distances (0.9 to 120 miles) and travel times (4 to 158 minutes) reflect the diverse geographical areas of participants. While this is a strength, large standard deviations in

these variables may have skewed preferences for assessments methods, potentially confounding analyses of satisfaction and preference.

The study's recruitment period (May to December) resulted in a small number of assessments occurred during the winter months (December, January, and February). This limited timeframe may have affected the ability to fully explore potential seasonal effects on satisfaction, which should be considered in future studies.

Strengths and Limitations

A strength of this study is its contribution to understanding both service user and clinician experiences with neuropsychological assessments, particularly in remote and rural geographical settings. The inclusion of clinicians with varying experience and qualifications ensures a broad range of perspectives on remote and in-person assessments. Additionally, the study included a relatively large sample of service users (50 participants), strengthening the external validity of the findings. The representation of different diagnoses further reflects the diversity of individuals attending neuropsychological services.

However, the findings may not be directly generalisable to other geographical areas or healthcare systems due to the specific NHS Highland context of this study. The small clinician sample size and limited recruitment period may restrict the findings' broader applicability. That said, the study raises important considerations for similar rural or resource-limited contexts internationally, such as parts of Ireland, the Global South, Canada or remote regions of Australia. In these settings, challenges around distance, clinician availability and infrastructure are comparable, suggesting that the findings may have broader relevance where digital health is being explored as a solution. However, careful contextual adaptation would be needed.

Additionally, the socio-economic impact of remote assessments warrants consideration. On one hand, remote delivery can reduce service costs, for example, by minimising clinician travel time and

associated expenses, and may increase efficiency in delivering care to geographically dispersed populations. However, this must be weighed against potential drawbacks. In lower income or underserved populations, access to devices, stable internet, or digital literacy may be limited. Without appropriate support, remote assessment models could inadvertently widen existing health inequalities. Future service planning should aim to capitalise on the efficiencies of remote delivery while ensuring that access remains equitable across all socioeconomic groups.

The use of consent forms for recruitment may have introduced self-selection bias, skewing the sample towards service users who were more satisfied or interested in the study. This should be considered when interpreting the satisfaction data.

The study found that clinician confidence did not significantly predict satisfaction with remote assessments, suggesting that other factors, such as experience, may play a more critical role. However, the study did not explore additional factors that influence clinician satisfaction, such as workload, job demands, or specific challenges faced in remote assessments.

Practical Applications

The findings provide valuable insights into the experiences of clinicians and service users during neuropsychological assessments. They highlight factors influencing assessment method selection and the overall service experience. Given the high acceptability ratings for remote assessments, it is evident that choice and flexibility in assessment methods are key to meeting the needs of both service users and clinicians. Offering a range of options is crucial to accommodating individual preferences and circumstances.

~~While preliminary correlations indicate important trends, the limited response variability (with most satisfaction ratings clustered around 4-5) suggests that future research should include a broader participant sample to more thoroughly assess the impact of remote assessments on user satisfaction and engagement.~~

Additionally, given the current challenges facing NHS services, including resource limitations in clinic room availability, the findings that remote assessments are acceptable to both service users and clinicians could be particularly valuable in guiding future service delivery models.

Future Research

Following this research, it remains unclear whether service users' preference for in-person assessment is due to ease of communication, familiarity with traditional assessment methods, or other factors. Future studies, particularly qualitative research, could provide deeper insight into these preferences by exploring the specific reasons behind service user choices.

A related avenue for research involves comparing remote assessments conducted at home versus in a remote clinical setting. Qualitative feedback from this study indicated that some service users preferred face-to-face interactions. For these individuals, attending a local remote hub clinic with the support of a clinician while still engaging in the neuropsychological assessment remotely may better meet their needs than travelling to a primary assessment centre. Investigating the impact of assessment location on user experience could provide valuable guidance for service delivery models.

The unexpected findings that higher confidence in technology and greater travel distance and travel time were associated with lower satisfaction warrant further exploration. Future research could examine whether usability issues, expectations, or other underlying factors contribute to this relationship. Additionally, service users living in very remote areas may feel they have no choice but to opt for remote assessments, which could influence their satisfaction. While preliminary correlations indicate important trends, the limited response variability (with most satisfaction ratings clustered around 4-5) suggests that future research should include a broader participant sample to more thoroughly assess the impact of remote assessments on user satisfaction and engagement.

Additionally, this study did not explore how workload, job demands, or administrative burdens impact clinicians' satisfaction with remote assessments. Examining these factors in future research could provide insight into how they influence clinician attitudes and effectiveness in delivering remote neuropsychological assessments.

Although no significant relationship was found between clinician satisfaction and service user mobility, and no sensory difficulties were reported as influencing assessment modality, future research could objectively examine whether these factors impact assessment choices and experiences. Understanding how accessibility needs interact with assessment preferences could help optimise service delivery. Furthermore, given the limited number of assessments conducted during winter, further research could explore whether seasonal factors, such as weather-related travel barriers, internet reliability, or comfort levels, affect service user and clinician experiences with remote assessments.

Conclusion

This study highlights the feasibility and acceptability of remote neuropsychological assessments in rural and remote settings. Both service users and clinicians view this approach positively. Remote assessments offer convenience and flexibility, but individual preferences, familiarity, and accessibility considerations play a role in assessment modality choices. Offering multiple assessment options is key to accommodating diverse needs. Future research should further explore factors influencing satisfaction, seasonal variations, and clinician workload to optimise the implementation of remote assessments within neuropsychological services.

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Appendices

Appendix 1.1 Search Strategies

PsycInfo:

1. DE "Telemedicine" OR DE "Teleconferencing" OR DE "Teleconsultation" OR DE "Telepsychiatry" OR DE "Telepsychology" OR DE "Digital Interventions" OR DE "Videoconferencing" (15,259)
2. TI ("tele*" OR "video*" OR "remote" OR "online" OR "cyber" OR "digital" OR "distance" OR "internet*" OR "computer*" OR "web*" OR "ehealth" OR "ehealth") OR AB ("tele*" OR "video*" OR "remote" OR "online" OR "cyber" OR "digital" OR "distance" OR "internet*" OR "computer*" OR "web*" OR "ehealth" OR "e-health") (514,832)
3. S1 OR S2 (516,468)
4. DE "Neuropsychological Assessment" OR DE "Cognitive Assessment" (23,554)
5. TI (("neuropsychol*" OR "cogniti*") n3 ("test*" OR "assess*" OR "batter*" OR "screen*" OR "evaluation" OR "task*")) OR AB (("neuropsychol*" OR "cogniti*") n3 ("test*" OR "assess*" OR "batter*" OR "screen*" OR "evaluation" OR "task*")) (95,574)
6. S4 or S5 (103,844)
7. S3 AND S6 (10,649)
8. DE "Executive function" (6,708)
9. TI (("executive functioning" OR "executive function*" OR "cognitive control")) OR AB (("executive functioning" OR executive function*" OR "cognitive control")) (54,704)
10. S8 OR S9 (54,738)
11. S7 AND S10 (1,649)
12. S7 AND S10 with English limiter (1,607)

MEDLINE

1. (MH "Telecommunications") OR (MH "Telepsychiatry") OR (MH "Telehealth") OR (MH "Remote Consultation") OR (MH "Teleconferencing") OR (MH "Telemedicine") OR (MH "Videoconferencing") OR (MH "Digital Health") OR (MH "Telephone") (63,586)
2. TI ("tele*" OR "video*" OR "remote" OR "online" OR "cyber" OR "digital" OR "distance" OR "internet*" OR "computer*" OR "web*" OR "ehealth" OR "ehealth") OR AB ("tele*" OR "video*" OR "remote" OR "online" OR "cyber" OR "digital" OR "distance" OR "internet*" OR "computer*" OR "web*" OR "ehealth" OR "e-health") (1,738,563)
3. S1 OR S2 (1,753,176)
4. (MH "Neuropsychological Tests") OR (MH "Neuropsychology") (107,667)
5. TI (("neuropsychol*" OR "cogniti*") n3 ("test*" OR "assess*" OR "batter*" OR "screen*" OR "evaluation" OR "task*")) OR AB (("neuropsychol*" OR "cogniti*") n3 ("test*" OR "assess*" OR "batter*" OR "screen*" OR "evaluation" OR "task*")) (115,658)
6. S4 OR S5 (186,887)
7. S3 AND S6 (16,969)
8. (TI (("executive functioning" OR "executive function*" OR "cognitive control")) OR (AB (("executive functioning" OR executive function*" OR "cognitive control")) (59,565)
9. (TI (("trail making" OR "verbal fluency" OR "stroop" OR "Hayling*" OR "Brixton" OR "DKEFS" OR "BADS"))) OR (AB (("trail making" OR "verbal fluency" OR "stroop" OR "Hayling*" OR "Brixton" OR "DKEFS" OR "BADS")) (64,334)
10. S8 OR S9 (116,774)
11. S7 AND S10 (3,304)

12. S7 AND S10 – with English limiter (3,304)

Psychology and Behavioural Sciences Collection:

1. DE "DIGITAL health" OR DE "TELEMEDICINE" OR DE "MOBILE health" OR DE "TELEPSYCHOLOGY" OR DE "VIDEOCONFERENCING" (2,447)
2. TI ("tele*" OR "video*" OR "remote" OR "online" OR "cyber" OR "digital" OR "distance" OR "internet*" OR "computer*" OR "web*" OR "ehealth" OR "ehealth") OR AB ("tele*" OR "video*" OR "remote" OR "online" OR "cyber" OR "digital" OR "distance" OR "internet*" OR "computer*" OR "web*" OR "ehealth" OR "e-health") (100,997)
3. S1 OR S2 (101,485)
4. DE "NEUROPSYCHOLOGICAL tests" (5,063)
5. TI (("neuropsychol*" OR "cogniti*") n3 ("test*" OR "assess*" OR "batter*" OR "screen*" OR "evaluation" OR "task*")) OR AB (("neuropsychol*" OR "cogniti*") n3 ("test*" OR "assess*" OR "batter*" OR "screen*" OR "evaluation" OR "task*")) (15,489)
6. S4 OR S5 (17,725)
7. S3 AND S6 (1,818)
8. DE ‘‘Executive function’’ (1,228)
9. TI (("executive functioning'' OR ''executive function*'' OR ''cognitive control'')) OR AB (("executive functioning'' OR executive function*'' OR ''cognitive control'')) (9,571)
10. S8 OR S9 (9,584)
11. S7 AND S10 (309)

CINAHL:

1. (MH "Telecommunications") OR (MH "Telepsychiatry") OR (MH "Telehealth") OR (MH "Remote Consultation") OR (MH "Teleconferencing") OR (MH "Telemedicine") OR (MH "Videoconferencing") OR (MH "Digital Health") OR (MH "Telephone") (60,405)
2. TI ("tele*" OR "video*" OR "remote" OR "online" OR "cyber" OR "digital" OR "distance" OR "internet*" OR "computer*" OR "web*" OR "ehealth" OR "ehealth") OR AB ("tele*" OR "video*" OR "remote" OR "online" OR "cyber" OR "digital" OR "distance" OR "internet*" OR "computer*" OR "web*" OR "ehealth" OR "e-health") (479,072)
3. S1 OR S2 (502,875)
4. (MH "Neuropsychological Tests") OR (MH "Neuropsychology") (41,573)
5. TI (("neuropsychol*" OR "cogniti*") n3 ("test*" OR "assess*" OR "batter*" OR "screen*" OR "evaluation" OR "task*")) OR AB (("neuropsychol*" OR "cogniti*") n3 ("test*" OR "assess*" OR "batter*" OR "screen*" OR "evaluation" OR "task*")) (37,261)
6. S4 OR S5 (66,529)
7. S3 AND S6 (6,051)
8. (TI (("executive functioning'' OR ''executive function*'' OR ''cognitive control'')) OR (AB (("executive functioning'' OR executive function*'' OR ''cognitive control'')) (18,999)
9. (TI (("trail making'' OR ‘‘verbal fluency’’ OR ‘‘stroop’’ OR ''Hayling*'' OR ''Brixton'' OR ''DKEFS'' OR ''BADS''))) OR (AB (("trail making'' OR ‘‘verbal fluency’’ OR ‘‘stroop’’ OR ''Hayling*'' OR ''Brixton'' OR ''DKEFS'' OR ''BADS'')) (20,497)
10. S8 OR S9 (37,316)
11. S7 AND S10 (1,164)
12. S7 AND S10 with English limiter (1,154)

Appendix 1.2: Standard Quality Assessment Criteria for Evaluating Primary Research Papers (QualSyst)

Checklist for assessing the quality of quantitative studies.

Criteria		YES (2)	PARTIAL (1)	NO (0)	N/A
1	Question / objective sufficiently described?				
2	Study design evident and appropriate?				
3	Method of subject/comparison group selection or source of information/input variables described and appropriate?				
4	Subject (and comparison group, if applicable) characteristics sufficiently described?				
5	If interventional and random allocation was possible, was it described?				
6	If interventional and blinding of investigators was possible, was it reported?				
7	If interventional and blinding of subjects was possible, was it reported?				
8	Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?				
9	Sample size appropriate?				
10	Analytic methods described/justified and appropriate?				
11	Some estimate of variance is reported for the main results?				
12	Controlled for confounding?				
13	Results reported in sufficient detail?				
14	Conclusions supported by the results?				

Appendix 1.3: QualSyst Scores for Papers

Citation	*Q 1*	*Q 2*	*Q 3*	*Q 4*	*Q 5*	*Q 6*	*Q 7*	*Q 8*	*Q 9*	*Q 10*	*Q 11*	*Total*
Abdolahi et al. (2016)	2	2	2	1	2	2	2	2	N/A	2	2	19
Alegret et al. (2021)	2	2	2	2	2	1	2	2	1	2	2	20
Barraclough et al. (2023)	2	2	2	2	2	2	2	2	2	2	2	22
Chapman et al., (2019)	2	2	2	2	2	2	2	2	1	2	2	21
Chapman et al., (2021)	2	2	2	2	2	2	2	2	2	2	2	22
Fox-Fuller et al., (2022)	2	2	2	2	2	2	2	2	1	2	2	21
Gallagher et al., (2023)	2	2	1	2	2	2	2	2	2	2	2	21
Krynicki et al., (2022)	2	2	1	2	2	2	2	1	2	2	2	18
Leong et al., (2022)	2	2	1	2	2	1	1	2	2	2	2	19
Parks et al., (2021)	2	2	2	2	2	2	2	2	1	2	2	21
Rogers et al., (2023)	2	2	2	2	2	1	2	2	1	2	2	20
Sachs et al., (2024)	2	1	2	2	2	1	2	0	0	2	2	16
Sarno et al., (2022)	2	2	2	2	2	2	1	1	2	0	2	18

Appendix 1.4. Summary of Neurocognitive Tests Administered in Reviewed Studies

Paper	*Total Participants (Remote; In-person)*	**Test administered**
Abdolahi et al., 2016	17 (17; 17)	MoCA: Alternating trail making task, Copying the Cube, and Drawing the clock.
Alegret et al. (2021)	8,328 (338; 7,990)	NBACEtn: Executive function tests: Letter Fluency, Category Fluency, Similarities
Barraclough et al. (2023)	801 (105; 696)	ACR-NB: Stroop Interference, WAIS letter-number sequencing, SDMT (verbal version of WAIS-III digit symbol), Trails B (verbal), Consonant trigrams
Chapman et al. (2019)	48 (24; 24)	MoCA: Alternating Trail Making, Cube/rectangle copy, Clock Drawing
Chapman et al. (2021)	48 (24; 24)	Letter Fluency (FAS), Stroop Test, Trail Making Test, WAIS-IV Similarities
Fox-Fuller et al. (2022)	150 (150; N/A)	Controlled Oral Word Association Test (FAS), Category Fluency, WAIS-IV Digit Span Backward, Telephone Interview for Cognitive Status (TICs not in follow-up)
Gallagher et al. (2023)	35 (35; 35)	Clock Draw Test Trails A Trails B Symbol Digit Modalities Test Letter-Number Sequencing Verbal Fluency (FAS and Animals)
Krynicki et al. (2022)	28 (28; 28)	The Oral Trail Making Test, Two DKEFS sub-tests (Verbal Fluency and Colour-Word Interference), The Hayling Sentence completion test,

		Brixton Spatial Anticipation test
Leong et al. (2022)	85 (4; 44)	Wisconsin Card Sort Test, Probabilistic learning and reversal, Trail-making task, Intra-extra dimensional set shift, Spatial working memory, WAIS-IV (Backward Digit span), Stroop task (Stop Signal Task), Structure Learning, WASI-II vocabulary
Parks et al. (2021)	213 (111; 120)	Oral Trail Making Test-B Digit Span Backward
Rogers et al. (2023)	68 (34; 34)	Trail Making test - A & B
Sachs et al. (2024)	93 (55; 38)	Verbal Fluency, Trail-Making Test, Oral Trail Making Test, Number Span
Sarno et al. (2022)	73 (73; N/A)	WAIS-IV: Similarities & Oral Trails B

Appendix 1.5. Summarised Participants' Experience Results

Citation	Study Aim	Acceptability Measurement	Feasibility Measurement	Neuropsychological Tool Reliability	Barriers Identified	Facilitators Identified	Key Findings
Abdolahi et al. (2016)	Evaluate the feasibility of conducting the MoCA remotely in individuals with movement disorders.	Informal feedback on: - Overall experience	Informal feedback on: - Technology connection - Testing Environment - Technical confidence	MoCA (Visuospatial/Executive subtests): ICC = 0.80 (strong reliability between in-person and remote); PD group ICC = 0.68 (moderate reliability); HD group ICC = 0.92 (high reliability).	- Minor technology issues (e.g. slow internet, audio/video lag) - Difficulty holding paper steady due to tremors. - Occasional login issues	- Positive experience reported by all. - Reduced burden on caregivers and less time commuting and waiting in offices	- MoCA is feasible for individuals with mild cognitive deficits. - Type of movement disorder had minimal impact on the remote administration of the MoCA.
Alegret et al. (2021)	To examine home to-home NBACE discriminant capacity by differentiating among CH, MCI, or mild dementia subjects and comparing it with its face-to-face NBACE version	NR	NBACEtn met diagnostic and clinical needs, ensuring reliability across different settings.	- Goodness-of-fit index acceptable for both home-to-home and IP versions under a four-factor model, including executive function.	When patients did not know how to use the technology, a close person could help them without interfering. Some tests like Block Design, couldn't be administered via remotely while others	The home-to-home NBACEtn provided comparable diagnostic and clinical needs as the face-to-face version.	MCI participants performed better in most tests with the home-to-home procedure. CH individuals and mild dementia patients showed similar performances across testing methods, reinforcing teleneuropsychology's validity for

					needed adaptations		cognitive assessments.
Barraclough et al. (2023)	To determine if the administration method of the ACR-NB impacts participant cognitive performance and classification	Preference Questionnaire: - Preferred assessment type - Feedback of difficulty and improvements	Preference questionnaire: - Feedback on technical difficulties and experience	- Stroop colour naming: significant differences were observed across modalities ($p< 0.001$) - Trails B (TMT-B): demonstrated good virtual reliability (ICC = 0.68), but exhibited variability between modalities with a significant $p<0.001$	- Five participants wished for more technical support. - 2 participants suggested more information on equipment needed. - Higher level of anxiety reported during virtual visits	Reduced participant anxiety levels in virtual administration method	- 42% of tests showed issues when transitioning to virtual administration (e.g. Trail B became easier, SDMT worse than WAIS-III) - 15% changed CI classification. - 7 tests were impacted by the administration method. - The tests most impacted were those most modified from written to verbal responses, those with a timed component, and those reliant on visual presentation.
Chapman et al. (2019)	To compare face-to-	NR	Computer Proficiency	- MoCA Visuospatial/Executive Function:	- Four participants had	- All participants completed	- Minimal difference was found between

	face and videoconference administrations of the MoCA in community-based survivors of stroke.		Questionnaire (CPQ).	F2F M (SD) = 4.06 (1.02), Video M (SD) = 4.04 (0.94), showing minimal differences between in-person and video formats for executive function tasks.	minor technical issues, such as pause or decreased synchronicity, which required task repetition.	all MoCA items via the remote method. - No significant differences between MoCA scores across the methods. - Each cognitive domain assessed by MoCA had similar means and ranges across methods	administration modes for Visuospatial/Executive tests. - No participant characteristics significantly influenced MoCA scores across conditions. Practice effects were observed in Letter Fluency and Digit Span Backward. Participants reported similar comfort with both methods, but 10 preferred in-person for connection, and 3 cited fewer technical issues.
Chapman et al. (2021)	To compare performance across in-person and video-conference-based administration	Acceptability survey: - Satisfaction ratings - Task understanding	Computer Proficiency Questionnaire (CPQ)	- Stroop Colour Words: ICC = 0.86 (strong reliability); TMT-B: ICC = 0.85 (strong reliability); Phonemic	- Participant fatigue, time constraints and language impairment	- Similar satisfaction ratings for both methods - 24.4% reported videoconfer	- Participants comfortable with both methods - 10 preferred in-person for connection, 3 for

	s of common neuropsychological tasks in community-based survivors of stroke	- Preference for method and reason		Fluency: ICC = 0.76 (high reliability for verbal fluency tasks); Trails B and Stroop interference: moderate to strong reliability.	- prevented some participants from completing all measures. - 19 preferred in-person due to better interpersonal connections and fewer technical issues	ence as more interesting - or fun.	fewer technical issues Videoconference was viewed as more engaging by some
Fox-Fuller et al. (2022)	Test-retest reliability of several widely used cognitive assessments	NR	Test-retest reliability measurement. Assessors noted any issues during remote cognitive testing (e.g. poor connectivity, environmental distractions).	- FAS had the highest reliability (ICC = 0.76) - Animal Fluency had poor reliability (ICC = 0.52) - No significant skewness in scores, except slight negative skewness for Digit Span Backward	Low test-retest reliability for Animal Fluency (ICC = 0.52) and WAIS-IV Digit Span (CCC = 0.61 – 0.67)	None of the 44 - participants were excluded due to issues during testing. Reliable internet connections helped smooth testing	- Practice effects observed in Letter Fluency and Digit Span Backward - Good reliability for FAS (ICC = 0.76) but poor for Animal Fluency - Digit Span showed marginal reliability

Gallagher et al. (2023)	Assess the reliability of virtual versus in-person administration of commonly used cognitive assessments in Parkinson's disease.	Informal feedback	Clinician feedback on: - Time taken for testing. - Technical difficulties - Administration errors	- Good reliability for Verbal Fluency (FAS) (ICC = 0.814) - Trails B and Category Verbal Fluency (Animals) demonstrated moderate reliability. - Letter-number sequencing also showed poor reliability	- Internet/audio-visual issues - Device and screen variability - Cheating concerns (e.g. premature test access) - Older participants struggled with technology. - Reliance on physical test packets delayed data. - Incompatibility with some tests (e.g. Trail Making Test requires observation)	- High-quality devices and reliable internet aided remote testing. - Oral versions of tests mitigated tech issues (e.g. Trails B) - Increased accessibility for non-local participants	- Cognitive test performance largely comparable between virtual and in-person - Moderate-to-good reliability for executive function assessments (e.g. FAS) - Variability in performance across methods

Krynicki et al. (2022)	To evaluate the equivalence of neurocognitive test scores using counterbalanced face-to-face and remote assessment methods.	NR	Motivational and effort testing - TOMM: No significant differences between face-to-face and virtual (F = <.001, p = .993).	DKEFS Colour Naming: Remote > in-person (Cohen's d = 0.19, F = 0.06 to 5.62, p = 0.02 to 0.809). No significant differences for Oral Trail Making (F = 1.224, p = 0.231) or Hayling Sentence Completion (F = 1.224, p = 0.231). Brixton Spatial Anticipation: Significant age effects on errors (F = 5.626, p = 0.026).	Significant differences were observed in the DKEFS Colour Naming task, and participants' age notably impacted performance on the DKEFS Colour–Word Interference task.	The use of equivalence testing indicated that most neuropsychological tests were statistically equivalent between administration modes.	- Overall equivalence was found between remote and face-to-face administration for most assessments. - Specific tests, such as Hayling, and Brixton showed no significant differences across modalities, supporting remote reliability for executive function tasks. - Some tests, e.g. DKEFS showed small effect sizes, indicating limitations in some cases
Leong et al. (2022)	To develop and validate a new supervised online testing methodology,	NR	Minimum technology requirements met by all participants,	No significant effect of testing modality on missed or excluded trials, RTs,	- Technical issues led to excluded data sets (RGT only), including OS	Leong et al., (2022) Participants' personal equipment	- RGT and IP participants demonstrated comparable performance

	remote guided testing (RGT)		comparable performance between RGT and face-to-face (IP) in missed trials, excluded trials, and reaction times (RTs).	or executive function tasks.	compatibility, hardware/software issues, and environmental disruptions. - RGT had more task-level exclusions (RGT = 10, IP = 2).	closely matched lab standards. - RGT participants showed superior internet speeds.	across tasks, through RGT faced more technical exclusions. - No significant differences in executive function tasks were found, but RGT participants scored higher on verbal intelligence.
Parks et al. (2021)	To examine the validity of an in-home rNPA model in a mixed clinical, adult outpatient sample during COVID-19.	NR	No significant differences in neuropsychological test scores for executive functioning between rNPA and IP groups	Executive Functioning: Digit Span Backward: rNPA M = 4.48, IP M = 4.35) a t value =-0.788, d = 0.10 Robust reliability indicates effective rNPA assessment of cognitive functioning.	While specific barriers were not detailed, variability in performance between clinical subgroups and the No Diagnosis (ND) subgroup suggests challenges unique to remote testing for clinical populations. Additionally, some patients'	rNPA testing could enhance the initial patient triaging process and allow clinicians to gather clinically useful information about cognitive and functional status.	- rNPA effectively identifies cognitive impairments across diverse populations, demonstrating strong reliability. The model is sensitive to changes in mild cognitive deficits and provides valuable clinical information for various patient groups.

					inability to complete tests during telehealth visits indicates potential accessibility issues with the rNPA modality.		
Rogers et al. (2023)	The study aims to assess the reliability and feasibility of administering the Brief International Cognitive Assessment for MS (BICAMS) and the Trail-Making Test (TMT) to individuals with MS in an online setting. Additionally, it seeks to replicate and extend previous research on the remote administration	NR	Feedback on administration of the BICAMS and the Trail-Making Test	Strong positive correlations found between in-person and virtual administrations of TMT-B ($r = .76$, $p < .001$).	Interruptions can distract participants, impede rapport, and affect understanding and responses. Inability to control the testing environment. Stability of internet connections and quality of technological equipment may impact testing.	Visual aids (e.g., using a red marker on-screen) can help pinpoint areas on test sheets. Similar attrition rates for in-person and virtual groups. Strong positive correlations after a 6-month interval suggest the potential reliability of remote testing.	- No significant differences in TMT-B scores between in-person and remote groups. Total recall scores on the BVMT-R were significantly higher in virtual administrations. Device type (laptop vs. phone) may affect performance. Practice effects could confound results.

	of the California Verbal Learning Test (CVLT) and the Symbol Digit Modalities Test (SDMT) by comparing test scores from in-person and virtual assessments.						
Sachs et al. (2024)	Assess the feasibility and concurrent validity of a modified Uniform Data Set version 3 for remote administration for individuals with normal cognition, mild cognitive impairment and early dementia	Participant and Staff Ratings of Remote Assessment experience	Comparison of completion times and correlations between in-person and remote administration	Strong correlation for Verbal Fluency between in-person and remote assessments. Number Span showed no significant differences between remote and in-person tests.	Hearing difficulties, distractions at home, missed human contact, occasional task completion failures.	- Video modality was perceived as more convenient and valid than telephone. - Video assessments provided stronger correlations with in-person testing compared to phone assessments. - Participants rated video as easier and more	- No significant differences in test scores for Verbal Fluency or Number Span between remote and in-person administrations. - Video assessments provided stronger correlations with in-person testing than telephone.

						pleasant than telephone.	
Sarno et al. (2022)	Review the implementation and feasibility of home-to-home TeleNP DBS evaluations and to evaluate the utility of employing TeleNP with a diverse sample	Telehealth satisfaction questionnaire (only 13 patients)	Evaluated the number of sessions required, technical issues and participant fatigue.	Remote testing demonstrated wide applicability for PD patients of varying ages, disease stages, and severity.	Patient fatigue was observed in just over a quarter of cases; Distractions during testing were noted in two cases.	Technological comfort and a supportive environment at home contribute to successful remote testing.	60% of TeleNP completed DBS successfully, with no surgical complications observed. - Remote evaluations effectively screened for candidacy, excluding those with severe cognitive issues.

Appendix 1.6: Summary of Executive Function Measures Used Across Included Studies

Test Name	Neuropsychological Assessment Tool	Reliability	Delivery Mode	Studies Using Test
MoCA	Alternating Trail Making, Cube/Rectangle Copy, Clock Drawing	In-person: ICC = 0.80 (strong), Remote: ICC = 0.68 (moderate)	In-person and remote	Abdolahi et al. (2016), Chapman et al. (2019), Chapman et al. (2021)
NBACEtn Executive Function Tests	Letter Fluency, Category Fluency, Similarities	Strong diagnostic capacity, ICC not specified	Remote	Alegret et al. (2021)
ACR-NB	Stroop Interference, WAIS Letter-Number Sequencing, SDMT, Trails B, Consonant Trigrams	Stroop: Significant modality differences, Trails B: ICC = 0.68	Mixed remote and in-person formats	Barraclough et al. (2023)
Letter Fluency (FAS)	Verbal Fluency Task (FAS)	ICC = 0.76 for test-retest reliability	Remote and in-person	Fox-Fuller et al. (2022), Chapman et al. (2021)
Stroop Test	Stroop Colour Naming	Strong (ICC = 0.86)	In-person and remote	Chapman et al. (2021), Gallagher et al. (2023)
Trail Making Test	Trails A & B	Moderate to strong reliability (ICC = 0.68 for TMT-B)	In-person and remote	Chapman et al. (2019), Chapman et al. (2021), Rogers et al. (2023)
WAIS-IV Similarities	WAIS-IV Similarities	Strong reliability for both face-to-face and remote methods	In-person and remote	Chapman et al. (2021), Gallagher et al. (2023)
SDMT	Symbol Digit Modalities Test	Marginal reliability (lower reliability in remote settings)	In-person and remote (technology-dependent)	Barraclough et al. (2023), Gallagher et al. (2023)

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Controlled Oral Word Association Test (FAS)	Verbal Fluency Test (FAS)	Moderate reliability	Both in-person and remote	Fox-Fuller et al. (2022), Chapman et al. (2021)
Brixton Spatial Anticipation Test	Brixton Test	No significant differences between modalities	In-person and remote	Krynicki et al. (2022), Leong et al. (2022)
Wisconsin Card Sort Test	WCST	Strong reliability across in-person and video methods	In-person and remote	Krynicki et al. (2022)
Probabilistic Learning and Reversal	Test for cognitive flexibility and learning	ICC = 0.70 for most cognitive flexibility tasks	In-person or remote	Krynicki et al. (2022)
Hayling Sentence Completion	Cognitive flexibility test	Moderate reliability	In-person and remote (via video)	Krynicki et al. (2022)
Oral Trail Making Test-B	Cognitive flexibility and task switching	Strong (ICC = 0.75)	Remote	Leong et al. (2022), Gallagher et al. (2023)
Digit Span Backward	WAIS-IV Digit Span (Backward)	Reliability: moderate, ICC = 0.61-0.67	Remote and in-person	Fox-Fuller et al. (2022), Gallagher et al. (2023)
CIFA (Calibrated Ideational Fluency Assessment)	Verbal fluency for Animals, Supermarket Items, S&P words	ICC not specified, but limited in remote formats	Remote delivery	Leong et al. (2022)

Appendix 2.1: Ethical Approval

NHS
Health Research Authority

South West - Cornwall & Plymouth Research Ethics Committee
2 Redman Place
Stratford
London
E20 1JQ

Telephone: 02071048071

01 May 2024

Miss Oisin Young
Trainee Clinical Psychologist
NHS Highland
New Craigs Psychiatric Hospital
Leachkin Road
Inverness
IV3 8PJ

Dear Miss Young

Study title:	**Feasibility and acceptability of remote and hybrid format neuropsychological assessment methodology in a rural context**
REC reference:	**24/SW/0041**
IRAS project ID:	337940

Thank you for responding to the Proportionate Review Sub-Committee's request for changes to the documentation for the above study.

The revised documentation has been reviewed and approved on behalf of the PR sub-committee.

Confirmation of ethical opinion

On behalf of the Research Ethics Committee (REC), I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Good practice principles and responsibilities

The UK Policy Framework for Health and Social Care Research sets out principles of good practice in the management and conduct of health and social care research. It also outlines the responsibilities of individuals and organisations, including those related to the four elements of research transparency:

1. registering research studies
2. reporting results
3. informing participants
4. sharing study data and tissue

Conditions of the favourable opinion

The REC favourable opinion is subject to the following conditions being met prior to the start of the study.

Confirmation of Capacity and Capability (in England, Northern Ireland and Wales) or NHS management permission (in Scotland) should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements. Each NHS organisation must confirm through the signing of agreements and/or other documents that it has given permission for the research to proceed (except where explicitly specified otherwise).

Guidance on applying for HRA and HCRW Approval (England and Wales)/ NHS permission for research is available in the Integrated Research Application System.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of management permissions from host organisations.

Registration of Clinical Trials

All research should be registered in a publicly accessible database and we expect all researchers, research sponsors and others to meet this fundamental best practice standard.

It is a condition of the REC favourable opinion that **all clinical trials are registered** on a public registry before the first participant is recruited and no later than six weeks after. For this purpose, 'clinical trials' are defined as:

- clinical trial of an investigational medicinal product
- clinical investigation or other study of a medical device
- combined trial of an investigational medicinal product and an investigational medical device
- other clinical trial to study a novel intervention or randomised clinical trial to compare interventions in clinical practice.

A 'public registry' means any registry on the WHO list of primary registries or the ICMJE list of registries provided the registry facilitates public access to information about the UK trial.

Failure to register a clinical trial is a breach of these approval conditions, unless a deferral has been agreed by the HRA (for more information on registration and requesting a deferral see: Research registration and research project identifiers).

Where a deferral is agreed we expect the sponsor to publish a minimal record on a publicly accessible registry. When the deferral period ends, the sponsor should publish the full record on the same registry, to fulfil the condition of the REC favourable opinion.

If you have not already included registration details in your IRAS application form you should notify the REC of the registration details as soon as possible.

Publication of Your Research Summary

We will publish your research summary for the above study on the research summaries section of our website, together with your contact details, no earlier than three months from the date of this favourable opinion letter. Where a deferral is agreed, a minimum research summary will still be published in the research summaries database. At the end of the deferral period, we will publish the full research summary.

Should you wish to provide a substitute contact point, make a request to defer, or require further information, please visit: Research summaries - Health Research Authority (hra.nhs.uk)

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

After ethical review: Reporting requirements

The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study, including early termination of the study
- Final report
- Reporting results

The latest guidance on these topics can be found at https://www.hra.nhs.uk/approvals-amendments/managing-your-approval/.

Ethical review of research sites

The favourable opinion applies to all NHS/HSC sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" above).

Approved documents

The documents reviewed and approved by the Committee are:

Document	Version	Date
IRAS Application Form [IRAS_Form_13032024]		13 March 2024
Non-validated questionnaire [Clinician Questionnaire; Version 2; 12.03.24]	2	25 April 2024
Non-validated questionnaire [Service User Questionnaire; Version 2; 12.03.24]	2	25 April 2024
Participant consent form [Consent to Contact; Version 1; 12.03.24]		
Participant consent form [Consent form; Version 3; 30.04.24]	3	30 April 2024
Participant information sheet (PIS) [Service User Info Sheet Version 3 30.04.2024]	3	30 April 2024
Participant information sheet (PIS) [Clinician Info Sheet; Version 3; 30.04.24]	3	30 April 2024
Research protocol or project proposal [Research Proposal; Version 2; 25.04.24]	2	25 April 2024
Summary CV for Chief Investigator (CI) [CI CV; Version 1; 12.03.24]		
Summary CV for student [CI CV; Version 1; 12.03.24]		
Summary CV for supervisor (student research) [Field Supervisor CV; Version 1; 12.03.24]		
Summary CV for supervisor (student research) [Academic Supervisor CV; Version 1; 12.03.24]		

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website:
http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/

HRA Learning

We are pleased to welcome researchers and research staff to our HRA Learning Events and online learning opportunities– see details at:
https://www.hra.nhs.uk/planning-and-improving-research/learning/

IRAS project ID: 337940	**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project.

Yours sincerely

pp Chair

Email: cornwallandplymouth.rec@hra.nhs.uk

Enclosures: "After ethical review – guidance for researchers"

Non CTIMP Standard Conditions of Approval

Copy to: Miss Anna McIver

approvals@hra.nhs.uk

Appendix 2.2: Sponsorship

TEMP009 Version 9 April 2024

Dr Beth Sage
Research, Development & Innovation Director
NHS Highland RD&I Office
UHI House
Old Perth Road
Inverness
IV2 3JH

E-mail: beth.sage@nhs.scot

NHS Highland

18th June 2024 (reissued)

NHS Highland RD&I Ref: **HIGHLAND 1923**
NRSPCC Ref: **NA**

Miss Oisin Young
New Craigs Psychiatric Hospital,
Leachkin Road,
Inverness,
IV3 8PJ.

oisin.young@nhs.scot

Dear Miss Young,

Management Approval for Non-Commercial Research

I am pleased to tell you that you now have Management Approval for the research project entitled: **'Feasibility and acceptability of remote and hybrid format neuropsychological assessment methodology in a rural context' [Protocol V2.0, dated 25 April 2024].**

I acknowledge that:

- The project is sponsored by NHS Highland.
- The project has no external funding.
- Ethics approval for the project has been obtained from the South West - Cornwall & Plymouth Research Ethics Committee (Reference Number: 24/SW/0041).
- The project does not require an Organisational Information Document.

The following conditions apply:

- The responsibility for monitoring lies with NHS Highland.
- The responsibility for auditing lies with Sponsor, NHS Highland (as per SOP Gov002)
- This study will be subject to ongoing monitoring for Research Governance purposes and may be audited to ensure compliance with the UK Policy Framework for Health

disability confident EMPLOYER

and Social Care Research (2018, V3.3 07/11/17, however prior written notice of audit will be given.

- Any researchers coming into NHS Highland for the purposes of carrying out research with patients will require a Letter of Access before starting the study at this site. Please contact a member of the RD&I Governance team at nhsh.nhshighlandresearchpassports@nhs.scot for further assistance, if this is required.
- All incidents, adverse events and serious adverse events, thought to be attributable to a NHS Highlands participant's involvement in this project, should be notified to the NHS Highland RD&I Governance team. Please email relevant documents to nhsh.RandD@nhs.scot.
- You are reminded that all amendments (substantial or non-substantial) to the protocol and associated study documents or to the REC application should be notified to the NHS Highland RD&I to obtain amerdment approval (nhsh.RandD@nhs.scot). Guidance can be found at https://www.nhsresearchscotland.org.uk/services/permissions-co-ordinating-centre/permissions
- If applicable, monthly recruitment rates should be notified to the NHS Highland RD&I Governance team, detailing date of recruitment and the participant trial ID number (please do not include names or other identifiable information). This should be done by e-mail on the first week of the following month, to Chris Cunningham, RD&I Facilitator at nhsh.RandD@nhs.scot. Please quote your RD&I Highland reference number (Highland 1923).
- Please report any other changes in resources used, or staff involved in the project, to myself at nhsh.RandD@nhs.scot.

Please quote your RD&I Highland reference number (Highland 1923) on all correspondence.

Yours sincerely,

Anna McIver
RD&I Governance Manager

cc

Jo Fraser, RD&I Governance Assistant, NHS Highland RD&I Division nhsh.randd@nhs.scot
Chris Cunningham, RD&I Facilitator, NHS Highland RD&I Division nhsh.randd@nhs.scot
Anna McIver, Governance Manager, NHS Highland RD&I Division anna.mciver@nhs.scot
Dr Jessica Fish, Mental Health and Wellbeing Research Group, Jessica.Fish@glasgow.ac.u
Dr Ruth Sumpter, Head of Neuropsychology, NHS Highland. ruth.sumpter@nhs.scot

Appendix 2.3: Clinician Questionnaire

The Clinician questionnaire can be accessed at: https://osf.io/zx8s6

Appendix 2.4: Service User Questionnaire

The Service User questionnaire can be accessed at: https://osf.io/9e2sy

Appendix 2.5: Clinician Information Sheet

https://osf.io/zs2d6

Appendix 2.6: Service User Information Sheet

https://osf.io/pk6ec

Appendix 2.7: Service User Consent Form

https://osf.io/7rx82

Appendix 2.8: Consent to Contact

https://osf.io/7upz2

Appendix 2.9: MRP Proposal

https://osf.io/mjdg6