Impact of 'Brain in Hand' digital support services: Tracking changes in anxiety and health related quality of life

Working Paper No. 008 (January 2025)

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Abstract

Background: Worldwide, autistic people, people with ADHD, and those living with mental health conditions often face significant difficulties in managing anxiety due to the lack of comprehensive support systems tailored to their everyday needs. Despite the proliferation of digital tools aimed at assisting neurodivergent populations, robust evidence supporting their efficacy remains limited. This study examines the impact of the Brain in Hand (BiH) digital support service on health-related quality of life and anxiety, focusing on those with autism, ADHD, and anxiety in the UK.

Methods: This longitudinal research utilised quantitative survey data collected through structured interviews at baseline, three months, and six months post-intervention. A total of 149 participants, aged 18 and older, were recruited between June and December 2023, with 107 completing the study.

Results: Using internationally recognised metrics (WHODAS 2.0 for health-related quality of life and GAD-7 for anxiety) we find statistically significant improvements in both domains. Controlling for other factors, participants experienced an estimated 2.27-point reduction in the WHODAS 2.0 score (95% CI: 0.89, 3.64) and a 1.57-point reduction in the GAD-7 score (95% CI: 0.60, 2.55) over six months. Additionally, participants reported enhanced abilities to manage overwhelm and social anxiety respectively. These benefits were observed across demographic groups, suggesting the service's broad applicability.

Conclusion: The study faced limitations, including sample attrition and the absence of a control group, which precludes us from drawing definitive causal inferences. Furthermore, the sample was not fully representative of the broader neurodivergent population, being disproportionately young, female, and identifying as LGBTQ+. Despite these constraints, our findings offer promising evidence that the BiH digital support service can contribute to improved health outcomes for neurodivergent individuals, particularly those with elevated baseline levels of anxiety and ill health.

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Disclaimers/ Notes

- This research was partly funded by Innovate UK (grant code 10027424).
- The authors thank all users of Brain in Hand digital support services, particularly research participants who gave so generously their time and agreed to take part in this study. The authors also thank the interviewers and other support staff within Brain in Hand, in particular Karen Moffatt and Michelle Caine, as well as ethics reviewers at the Behavioural Insights Team for providing a robust and informative assessment of the planned research. Finally, we thank Innovate UK for partly funding the study.
- The views expressed herein are those of the authors and do not necessarily reflect the views of the Behavioural Insights Team or Innovate UK.
- BIT working papers are circulated for discussion and comment purposes. They have been reviewed internally following BIT's quality assurance guidelines. This review is conducted at various stages of the project by senior researchers and advisors external to the project team who hold expertise in the topic/ research area.
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- To cite this paper: Daly, N., O'Keeffe, T., & Tagliaferri, G. (2025). Impact of *'Brain in Hand' digital support services: Tracking changes in anxiety and health related quality of life* (BIT Working Paper Number 008).

JEL codes: I14, I31

Keywords: Autism; ADHD; Anxiety; Digital Therapeutic Tools

1. Introduction

In the UK and globally, there remains a lack of comprehensive support for autistic individuals, people with ADHD, and people living with anxiety, leading to substantial challenges for individuals to manage these conditions effectively in the context of their daily lives.[1,2,3] This lack of holistic support exacerbates mental health struggles and diminishes the quality of life for many neurodivergent individuals, as they face the additional challenge of navigating environments that are often ill-equipped to meet their needs.[4] Consequently, the interplay between the conditions themselves and often inadequate support systems contributes to a cycle of reduced well-being and poor mental health outcomes for these individuals.

In recent years, there has been a proliferation of digital tools, such as computer software and smartphone applications, designed to help neurodivergent individuals, including those with ADHD, autism, and anxiety, better manage their daily lives. However, despite their growing popularity, there is a lack of robust evidence to support the efficacy of these tools in improving outcomes for these populations.[5,6,7] A significant challenge in evaluating the impact of these digital tools lies in determining appropriate metrics for success.[8,9] Standard tools for assessing health and quality of life, while widely used, may not fully capture the unique needs and lived experiences of neurodivergent individuals. These conventional metrics often overlook the nuanced ways in which conditions like anxiety manifest in neurodivergent populations, potentially leading to misestimation of the tools' effectiveness or misalignment with their users' priorities.

Brain in Hand is a unique support service based in the United Kingdom that seeks to assist people experiencing anxiety and neurodivergent people, in particular autistic and those with ADHD, to be in control of their own lives. Founded in 2009, Brain in Hand combines on-demand human support, personalised coaching and digital tools to help people cope with anxiety, manage overwhelm and overcome barriers

to participation in society. As part of this service offering, Brain in Hand launched an eponymous digital support service (the 'Brain in Hand' app, henceforth referred to as 'BiH'), which has over 7,500 users as of July 2024. As part of its evidence-driven approach, BiH partnered with the Behavioural Insights Team, an independent research organisation based in the UK, to evaluate the potential impact of BiH digital support services on health outcomes, specifically quality of life and anxiety.

2. Methodology

The study design was a quantitative survey with one-to-one structured interviews between BiH digital support service users and trained interviewers. Interviews also contained some qualitative 'open-text' questions, however this data was not used in the performance of the quantitative analysis presented in this research and may instead be used in a qualitative thematic analysis at a later date. The use of structured interviews, conducted by specialists with mental health training and expertise in dealing with neurodivergent individuals, was deemed the most appropriate research method. Participants were invited to participate in three separate interviews: a first at 'baseline', and a second and third respectively three and six months later. Interview data was analysed using both fixed effects and first differences regression analysis.

The research underwent a formal internal ethical review by the Behavioural Insights Team (review number BIT.UK002136.230503.HB.CJ), given the vulnerable nature of research participants and the sensitive nature of the data being collected. The research received ethical approval from ethics reviewers on the 3rd of May 2023.

2.1 Participants

All new users of BiH digital support services (i.e. those who newly received a BiH digital support 'licence') who were newly registered between June and December 2023 (inclusive) were invited to participate in the research on a rolling basis,

meaning that individuals could enter the study at any time during this period. The BiH digital support service is available for use by those aged 14 and over, with parental or guardian consent if under 18. To enable self-consenting, the sole inclusion criterion for this study was that participants must be aged 18 or older. Participants therefore were individuals who were 18 years or older, users of BiH digital support service, and had consented to participate in a 1:1 'baseline' interview with an interviewer in English.

149 BiH digital support service users participated in a 'baseline' interview between June and December 2023. The second round of ('3-month') interviews took place between October 2023 and April 2024, with the third and final round of ('6-month') interviews taking place between January and June 2024. Table 1 displays their demographic characteristics at the time of the first interview, as well as the characteristics of those participants who 'returned' for a second (n = 102) and third (n = 107) interview after three and six months respectively. The mean age at baseline (n = 149) was 27.1 years old, with the sample being predominantly female (78%), student as their sole or main occupation (75%), and identifying as autistic due to either clinical or self-diagnosis (74%). 65 (44%) baseline participants identified as LGBTQ+, 30 (20%) as being from a minority ethnic group ('MinEthGrp'), while 51 (34%) were categorised (by postcode) as being in the lowest two quintiles on the Index of Multiple Deprivation ('IMD').

Table 1: Demographic statistics of the sample

	First interview	Second interview	Third interview
Age (mean in years)	27.1	27.1	26.9
Sex at birth			
Female	116 (78%)	76 (75%)	81 (76%)
Male	31 (21%)	26 (25%)	26 (24%)
Prefer not to say	2 (1%)	0 (0%)	0 (0%)
Identifies as LGBTQ+	65 (44%)	41 (40%)	45 (42%)
Identifies as Minority Ethnic Group	30 (20%)	24 (24%)	23 (22%)
Index of Multiple Deprivation (IMD)			
IMD quintiles 1 and 2	51 (34%)	37 (36%)	39 (36%)
Occupation: Student	111 (75%)	75 (74%)	76 (74%)
Autistic: Clinical or self-diagnosis	110 (74%)	73 (72%)	81 (76%)
ADHD: Clinical or self-diagnosis	77 (52%)	53 (52%)	57 (53%)
Both Autistic and ADHD	61 (41%)	41 (40%)	45 (42%)
Used Brain in Hand app?	N/A	96 (94%)	87 (81%)
WHODAS 2.0 Summary Score (baseline)			
WHODAS quintile 1	32 (21%)	25 (25%)	25 (24%)
WHODAS quintile 2	31 (21%)	23 (23%)	25 (24%)
WHODAS quintile 3	29 (19%)	21 (21%)	22 (21%)
WHODAS quintile 4	30 (20%)	17 (17%)	17 (16%)
WHODAS quintile 5	27 (18%)	16 (16%)	16 (17%)
GAD-7 Total Score (baseline category)			
GAD-7: No anxiety (0-4)	14 (9%)	12 (12%)	12 (11%)
GAD-7: Mild anxiety (5-9)	34 (23%)	24 (24%)	28 (26%)
GAD-7: Moderate anxiety (10-14)	51 (34%)	29 (28%)	30 (28%)
GAD-7: Severe anxiety (15-21)	50 (34%)	37 (36%)	37 (35%)
Total N	**149 (100%)**	**102 (100%)**	**107 (100%)**

All figures displayed as a percentage of the 'Total N' at each interview, apart from Age, which is displayed as the mean age in years of the sample at each interview. 'WHODAS 2.0' refers to the World Health Organization Disability Assessment Schedule 2.0. 'GAD-7' refers to the Generalized Anxiety Disorder 7-item scale.

2.2. Procedure

Prospective participants were invited to attend an initial 'baseline' interview shortly after accessing the BiH support service, and subsequently invited to a second and third interview three and six months later respectively. Interviews took place online using Microsoft Teams audiovisual software, with interviewees able to complete the interview with their camera either on or off given their preference, and questions were also shared in writing to support with processing information. Interviewers inputted interviewee responses into a dedicated SurveyMonkey questionnaire in real time, to allow for standardised data collection across interviews.

All interviews were conducted by a pool of 14 interviewers with specialist training and experience in dealing with neurodivergent individuals. Each interviewer had one interview from each timepoint (i.e. 'baseline',' 3-month, 6-month) formally reviewed for quality assurance purposes using an internal Brain in Hand scoring matrix. Interview quality was deemed to remain satisfactory across time and across interviewers, and no interviewer was required to receive additional training. Where possible, for second and third interviews, research participants were given the opportunity to select the same interviewer as they had previously if they so wished.

The interviews were designed to place a minimal stress burden on participants, for example, using the shortest or least intensive versions of survey questionnaires. Interviewees were reminded at the start of each interview that they could have a break, exit the interview at any time, and/or decline to answer any question(s), without provisioning a reason in either instance. By definition, all interviewees were existing users of BiH digital support services, and so had access to a dedicated contact (a trained Brain in Hand employee personally assigned to them) on standby to assist them if they became overwhelmed with any aspect of day-to-day life (including the interview). See Table C1 in Appendix C for a complete list of questions in each interview (first, second, third).

Interviewee consent was obtained via consent forms sent to participants before their first interview. Prospective research participants (i.e. new users of BiH digital support services during the study recruitment period) were asked to participate in the interviews after being informed clearly of their voluntary nature, purpose, and content, as well as how interview data would be used, and how personal information would be protected. Given the nature of prospective research participants (i.e. BiH users, many of whom are autistic or have ADHD), there was a strong emphasis on ensuring the language used to describe the research to potential interviewees was as clear and accessible as possible.

In order to encourage their continued participation in the research, interviewees were informed that they would receive a £30 (30.00 GBP) voucher upon completion of the interview at six months (regardless of whether they completed the interview at three months). Interviewees were able to withdraw their consent up until the 30th of June 2024, after the final interviews had been conducted but before analysis of interview data had begun.

2.3 Measures

To best assess the potential impact of using the BiH digital support service on quality of life and anxiety specifically, we sought to utilise internationally and industry recognised metrics. Among those most widely recognised in this context are the World Health Organization Disability Assessment Schedule 2.0 ('WHODAS 2.0') for health and functioning in adults, and the Generalized Anxiety Disorder 7-item ('GAD-7') scale for assessing anxiety.[10]

Alongside this pair of internationally recognised measures, we prioritised the analysis of three further aspects of managing anxiety, corresponding to three questions that participants were asked at each interview. We refer to these as 'expert by experience' metrics, as they have been developed and included in interviews in

response to feedback of the users of BiH digital support services and the autistic community more generally. Namely, these three metrics are: 'I feel safe'; 'I feel able to manage overwhelm when it could act as a barrier'; and 'I feel able to manage social anxiety'.

The justification for the inclusion and prioritisation of these three metrics in particular as outcome measures arises from Brain in Hand's ongoing experiences in supporting neurodivergent individuals, as well as from feedback that users of the BiH digital support service have provided to Brain in Hand in recent years. This feedback specifically references to autistic individuals who note that "feeling safe" is a top priority, and that "managing overwhelm" is one of the key elements of life they may seek support with.[11]

Furthermore, when pre-testing the suitability of using the GAD-7 with the users of the BiH digital support service, research participants noted that none of the seven GAD-7 domains address social anxiety directly. This is despite the fact that many autistic people are particularly likely to develop fears of social situations. While prevalence of social anxiety is estimated to be approximately 12% in the general population based on statistics from the USA, estimates in autistic people are as high as one in two experiencing clinically elevated social anxiety.[12,13] For this reason, we chose to include a metric on managing social anxiety as a primary outcome measure in our analysis.

The interview questions relating to these metrics presented a 5-point categorical range of response options: "None of the time"; "Rarely"; "Some of the time"; "Often"; "All of the time". As described below, for ease of analysis and interpretability, we coded these three metrics as binary in our regression analysis, with the re-coded metrics taking a value of 0 if originally "None of the time" or

"Rarely", and a value of 1 if originally "Some of the time", "Often", or "All of the time".

WHODAS 2.0

The World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) is a standardised measure developed to assess the health status and functioning across various populations and health conditions. It is recommended by the UK's Wellcome Trust as a key metric for research studies on mental health alongside GAD-7.[10] It evolved from the original WHODAS and was designed to align with the International Classification of Functioning, Disability, and Health (ICF). WHODAS 2.0 is available in different versions: a 12-item, 36-item, and a hybrid "12+24 item" version, each varying in length and detail.[14] The 12-item version is a concise form that has been shown to capture most of the variation in disability measured by the more extensive 36-item version, making it a practical choice for large-scale surveys and clinical settings where brevity is essential.[15,16,17] WHODAS 2.0 assesses six domains of functioning: cognition, mobility, self-care, getting along with people, life activities, and participation in society. These domains provide a comprehensive overview of an individual's ability to perform activities in various aspects of life. The tool is intended for use across different cultures and settings, allowing for comparability of health related quality of life globally.

The WHODAS 2.0 "Simple" summary score for the 12-item version is a straightforward metric ranging from 12 to 60, representing the total sum of the item responses. Each item is scored on a 5-point Likert scale (1 = none, 2 = mild, 3 = moderate, 4 = severe, 5 = extreme/cannot do), and the scores are aggregated to reflect the overall level of disability.[18] This simple scoring method provides a quick, interpretable measure of functioning, ideal for use in settings where time or resources are limited. In contrast, the "complex" summary score involves more sophisticated scoring techniques, such as item-response theory (IRT) and standardisation to adjust for differences in item difficulty and discrimination. While the "complex" scoring method provides a more

nuanced understanding of disability levels, the "simple" score is favoured for its ease of use and ability to capture essential disability information efficiently.[14]

GAD-7

The Generalized Anxiety Disorder 7-item (GAD-7) scale is a widely used screening tool designed to assess the severity of generalised anxiety disorder (GAD) in clinical and research settings. Developed by Spitzer et al. (2006), the GAD-7 was created as a concise, self-administered questionnaire to facilitate the identification of individuals with GAD in primary care and mental health settings.[19] The measure comprises seven items, each reflecting one of the core symptoms of GAD as defined by the DSM-IV criteria, including excessive worry, restlessness, and irritability. Respondents rate the frequency of each symptom over the past two weeks on a 4-point scale ranging from "not at all" (0) to "nearly every day" (3), with total scores ranging from 0 to 21. Total scores for the GAD-7 can be used to represent clinical categorisations of anxiety levels as follows: 0–4 (no anxiety); 5–9 (mild anxiety); 10–14 (moderate anxiety); and 15–21 (severe anxiety). The GAD-7 not only serves as a screening tool but also aids in monitoring symptom progression and treatment response.[20] It is valued for its brevity, ease of use, and strong psychometric properties, including high internal consistency and construct validity, making it a robust tool for both clinical practice and research across diverse populations, suitable for use in examining the impact of BiH digital support service usage.

3. Analysis

We conducted a longitudinal fixed effects regression analysis to examine the relationship between using BiH digital support services and five key outcomes, controlling for individual-specific and interviewer-specific effects. Our outcomes of interest were: 1) the WHODAS 2.0 Summary score (range 12-60); 2) the GAD-7 Total score (range 0-21); 3) the "I feel safe" interview question (coded as binary); 4) the 'I feel able to manage overwhelm' interview question (coded as binary); and 5) the 'I

feel able to manage social anxiety' interview question (coded as binary). For each of these outcomes, our fixed effects model took the general form seen in Equation 1:

$$Y_{it} = \alpha + \beta_1 TimePoint_{it} + \beta_2 May_{it} + \beta_3 December_{it} + u_i + v_j + \varepsilon_{it} \quad \textbf{(1)}$$

where: Y_{it} is the outcome metric for participant *i* at time *t*; $TimePoint_{it}$ represents a 3-point categorical variable for the three interview time points ('baseline', 3-month, and 6-month); May_{it} and $December_{it}$ are dummy variables indicating whether the interview was taken in May or December, respectively; u_i represents unobserved, individual-specific effects; v_j represents unobserved, interviewer-specific effects; and ε_{it} is the error term.

The decision to include dummy variables indicating whether an interview was taken in May or December was based on two factors. Firstly, Brain in Hand has historically noticed heightened levels of anxiety among its service users in the month of December due to anxiety relating to the festive holiday period and chose to control for this in the analysis. Secondly, in a similar vein, given previous indications of heightened anxiety during the traditional period for academic examinations at the end of the traditional university year in May, and the fact that 75% of the 'baseline' sample identified as students, we also control for this. The model was clustered at the individual level to account for within-individual correlation over time, while the inclusion of interviewer fixed effects was also deemed to be important, as variations in interviewers could introduce systematic bias or variance in the key outcome measures.

We also performed an analysis of first differences for each of our five key outcome measures, in effect examining the relationship between participant characteristics and changes in the outcome measures observed during the 6-month study period.

For each of our outcomes, the 'first differences' model took the general form seen in Equation 2:

$$\Delta Y_i = \beta_0 + \beta_1 Age_i + \beta_2 Sex_i + \beta_3 LGBTQ_i + \beta_4 MinEthGrp + \beta_5 IMD_i + \beta_6 Student_i + \beta_7 Autistic_i + \beta_8 ADHD_i + \beta_9 AutisticADHD_i + \beta_{10} Anxiety_i + \varepsilon_i \quad \textbf{(2)}$$

where: ΔY_i is the change in the outcome metric for participant *i* over the 6 months; Age_i is the age of the participant as recorded in the data at the time of the 'baseline' first interview (using a series of dummy variables described below); Sex_i is biological sex at birth as recorded in the data at the time of the first interview; $LGBTQ_i$ is a dummy variable indicating whether the participant identified as LGBTQ+ at the time of the first interview; $MinEthGrp_i$ is a dummy denoting whether the participant identifies as belonging to a minority ethnic group at the time of the first interview; IMD_i is a dummy designating whether the participant is in the bottom two quintiles of deprivation (as measured postcode scores for the Index of Multiple Deprivation (IMD)) as recorded in the data at the time of the first interview; $Student_i$ is a dummy signifying whether the participant was a student at the time of the first interview; $Autistic_i$ and $ADHD_i$ are dummies reflecting whether the participant was either clinically diagnosed, or self-diagnosed, as respectively autistic and ADHD at the time of the first interview; $AutisticADHD_i$ is a dummy indicating whether the participant is identified (under the definitions of the *autistic* and *ADHD* variables) as both autistic and ADHD at the time of the first interview; $Anxiety_i$ is a dummy denoting whether the participant identifies as experiencing anxiety at the time of the first interview; and ε_i is the error term. We analysed age using a series of four dummy variables (for the ranges 20-29, 30-39, 40-49, and 50 and above), using the reference category '18-19' (into which 49% of the 'baseline' sample fell).

4. Results

As displayed in Table 2, we find evidence of an improvement in self-assessed overall health and anxiety over the six-month study period, as measured by the WHODAS 2.0 and GAD-7 metrics. In the case of the (12-60 point) WHODAS 2.0 scale, participants exhibited an overall change from baseline (mean = 27.75, sd = 8.01) to endline (mean = 24.34, sd = 8.33), resulting in an average reduction of 3.42 points. Our fixed effects regression analysis suggests an estimated reduction of 2.27 points [-0.89, -3.64], when controlling for other factors. This corresponds to a Cohen's d of 0.28 (using a pooled standard deviation), indicating a small to medium effect size. Similarly, service users experienced an overall reduction in the (0-21 point) GAD-7 Total score from baseline (mean = 11.62, sd = 4.93) to endline (mean = 9.99, sd = 5.20), with an average change of 1.63 points. Our fixed effects model estimated an adjusted reduction of 1.57 points [-0.60, -2.55]. This represents a Cohen's d d of 0.31, again implying a small to medium effect size. We further find evidence for improvements in users' ability to 'manage overwhelm' (OR = 6.16 [2.35, 16.13]) and ability to 'manage social anxiety' (OR = 5.64 [1.62, 19.63] over the six month period of using BiH digital support services. We do not find any statistically significant improvement in service users' feeling of safety, nor do we find any consistent impact of interviews being held in either May or December.

The reduction in the overall WHODAS 2.0 summary score appears in this case to be driven by improvements in self-assessed ability to wash one's self, ability to attend to household responsibilities, ability to concentrate, ability to join new activities, ability to deal with new people, and improvements in the emotion effects of health problems. Associated results tables for this secondary analysis of subcomponents of the WHODAS 2.0 summary score can be found in Table B4 in Appendix B (with subcomponents scored on a scale of 1-5).

The reduction in the overall GAD-7 Total score appears in this case to be especially driven by reductions in "worrying too much about different things", though encouragingly there are reductions observed across all seven subcomponents of the GAD-7 (though none of the other six meet the threshold for statistical significance). Associated results tables for this secondary analysis of subcomponents of the GAD-7 Total score can be found in Table B5 in Appendix B (with subcomponents scored on a scale of 0-3).

While we did not directly estimate the statistical significance of individual interviewer effects, the absorption of interviewer fixed effects in the model for estimating the impact on the WHODAS 2.0 and GAD-7 metrics ensures that variations attributable to different interviewers do not create bias in the estimates of these outcome variables, though it is worth noting that these results are qualitatively unaffected by estimation of the model without interviewer fixed effects.

Table 2: Results of fixed effects regression analysis

VARIABLES	(1) WHODAS 2.0: Summary Score	(2) GAD-7: Total Score	(3) Feeling safe	(4) Ability to manage overwhelm	(5) Ability to manage social anxiety
Time: 3 months	-1.993**	-1.259***	2.957	2.943**	10.44***
	(0.763)	(0.359)	(2.110)	(1.304)	(6.329)
Time: 6 months	-2.265***	-1.574***	1.689	6.159***	5.641***
	(0.696)	(0.493)	(1.258)	(0.491)	(3.589)
May interview	-1.545*	-0.865	-	0.817	-
	(0.914)	(0.810)	-	(0.790)	-
December interview	-0.162	0.063	3.200	1.420	0.550
	(0.982)	(0.442)	(4.717)	(1.196)	(0.532)
Mean at baseline	*27.75*	*11.62*	*0.879*	*0.541*	*0.658*
	(8.013)	*(4.930)*	*(0.327)*	*(0.500)*	*(0.476)*
Total observations	325	325	39	125	101
Unique participants	117	117	15	44	35
Individual participant fixed effects	Yes	Yes	Yes	Yes	Yes
Interviewer fixed effects	Yes	Yes	No	No	No
R-squared	0.866	0.867	N/A	N/A	N/A

Results for regressions (1) and (2) are reported as estimated coefficients. Results for regressions (3), (4), and (5) are reported as odds ratios. Coefficient and standard error for 'May interview' in models (3) and (5) omitted due to insufficient within-group variation. Standard errors in parentheses, other than for 'Mean at baseline', where standard deviation is in parentheses. [*** p<0.01, ** p<0.05, * p<0.1]

As can be observed in Table 3, despite some individual results of statistical significance, our analysis of 'first differences' (examining the relationship between participant characteristics and changes in the outcome measures observed during the study period), found no consistent relationship between participant characteristics (such as age, biological sex at birth, sexual identity, ethnicity, deprivation level, occupation, or diagnosis) and changes in outcome measures observed over this period.

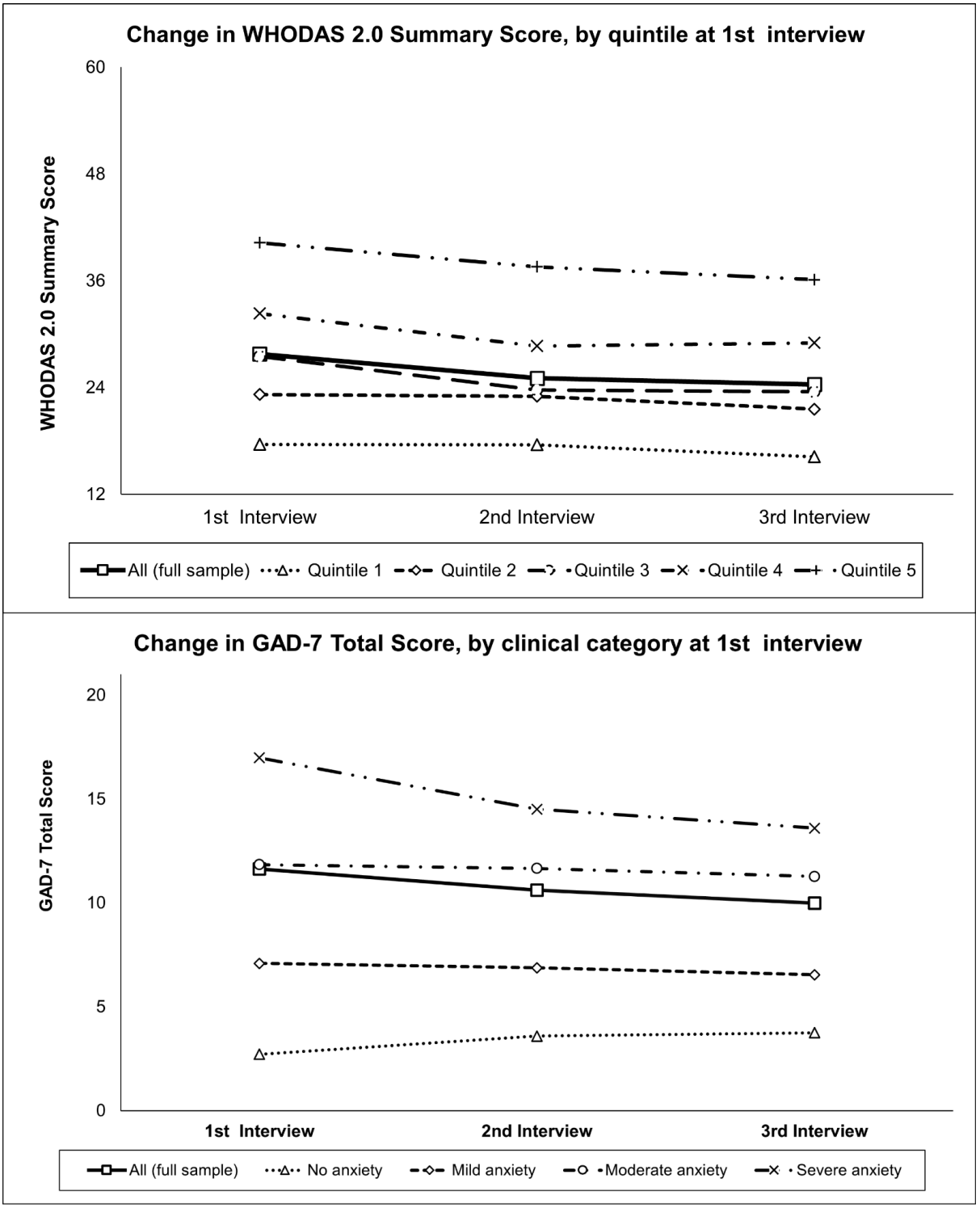
Table 3: Results of 'first differences' regression analysis

VARIABLES	(1) WHODAS 2.0: Summary Score	(2) GAD-7: Total Score	(3) Feeling safe	(4) Ability to manage overwhelm	(5) Ability to manage social anxiety
Age: 20s	-1.998	-0.789	0.022	0.003	0.231**
	(1.329)	(1.006)	(0.085)	(0.144)	(0.111)
Age: 30s	-2.096	-0.694	-0.052	0.190	0.112
	(1.771)	(1.341)	(0.114)	(0.191)	(0.148)
Age: 40s	-2.426	-2.141	0.095	-0.218	-0.027
	(2.358)	(1.785)	(0.152)	(0.255)	(0.197)
Age: 50 plus	0.701	-1.339	-0.150	0.029	0.141
	(2.305)	(1.745)	(0.148)	(0.249)	(0.192)
Sex at birth: Male	-0.619	0.893	0.037	-0.202	0.120
	(1.354)	(1.025)	(0.087)	(0.146)	(0.113)
Identifies as LGBTQ+	-0.698	0.537	-0.030	-0.241**	0.050
	(1.092)	(0.826)	(0.070)	(0.118)	(0.091)
Minority Ethnic Group	-1.201	0.109	0.060	-0.032	0.169
	(1.423)	(1.077)	(0.091)	(0.154)	(0.119)
IMD: Quintiles 1 and 2	-0.785	-1.652**	0.139**	-0.017	0.066
	(1.080)	(0.817)	(0.069)	(0.117)	(0.090)
Occupation: Student	2.588*	0.728	-0.014	-0.059	-0.136
	(1.447)	(1.095)	(0.093)	(0.156)	(0.121)
Autistic: Clinical or self-diagnosis	-1.151	1.838	0.117	0.187	-0.263*
	(1.763)	(1.335)	(0.113)	(0.190)	(0.147)
ADHD: Clinical or self-diagnosis	-2.468	3.029*	0.004	0.120	-0.324*
	(2.123)	(1.607)	(0.136)	(0.229)	(0.177)
Both Autistic and ADHD	3.845	-2.186	-0.087	-0.174	0.292
	(2.427)	(1.837)	(0.156)	(0.262)	(0.202)
Experience Anxiety	-2.253	-2.547	0.120	-0.299	-0.017
	(2.301)	(1.742)	(0.148)	(0.249)	(0.192)
Constant	-0.071	-0.826	-0.180	0.567	0.366
	(3.357)	(2.541)	(0.216)	(0.363)	(0.280)
Observations	106	106	106	106	106
R-squared	0.136	0.175	0.100	0.092	0.149

Age categories are with reference to 'Age: 18-19'. Coefficients for (1) and (2) are point estimates. Coefficients for (3), (4), and (5) represent the expected change in the primary outcome variable between participants who have the characteristic and those who do not, holding all other characteristics constant. Standard errors in parentheses [*** p<0.01, ** p<0.05, * p<0.1]

Figure 1 presents the changes in the WHODAS 2.0 summary score, and GAD-7 summary score, both for the overall sample and for certain cohorts as defined at baseline. For the WHODAS 2.0 summary score (top half), we disaggregate by quintile scores at the 'baseline' first interview, with 'Quintile 1' having the lowest WHODAS 2.0 summary score (i.e. the lowest level of self-assessed ill health). Based on the WHO's aggregation rules, the possible range for the WHODAS 2.0 summary score is between 12 and 60. While all quintiles experienced an overall fall in the summary score (with mean scores for the full sample falling from 27.8 to 24.3), the greatest decrease (i.e. the largest 'improvement') was experienced by those in 'Quintile 5' (from 40.3 to 36.1), who had the highest level of self-assessed ill health at baseline. For the GAD-7 summary score (bottom half), we disaggregate by clinical category at baseline, as follows: 0–4 (no anxiety); 5–9 (mild anxiety); 10–14 (moderate anxiety); and 15–21 (severe anxiety). While overall the full sample experienced an average reduction in anxiety of 1.6 points on this 21-point scale (11.6 falling to 10.0), this was not evenly felt across each of the categories. Those who were classed as having 'severe' anxiety at baseline experienced an average reduction in anxiety of 3.4 points (from 17.0 to 13.6), while those classed as having 'no' anxiety at baseline experienced an average increase in anxiety from 2.7 to 3.8 (which is still within the 0-4 range of 'no anxiety').

Figure 1: Change in WHODAS 2.0 Summary Score and GAD-7 Total Score



Change in WHODAS 2.0 Summary Score (top half, by quintile at first interview, scale 12-60) and GAD-7 Total Score (bottom half, by clinical category at first interview, scale 0-21)

5. Discussion and conclusions

In this study, participants experienced an improvement in health, as measured by the internationally validated WHODAS 2.0 and GAD-7 metrics, over a six-month period in which they used the BiH digital support service. While these metrics on health-related quality of life and anxiety were not designed to measure health outcomes for neurodivergent individuals specifically, their status as established measures means that these encouraging findings can be easily contextualised and compared to new and existing research. Furthermore, the trends presented in Figure 1, indicating that those with the worst health experienced on average the greatest improvements over time, offer further encouragement - namely that BiH digital support services might be most effective for those most in need of such support.

Participants also experienced statistically significant increases in their self-assessed ability to manage 'overwhelm' and social anxiety in their daily lives over the six-month study period, with each metric having an associated odds ratio of approximately 6. We included these two specific components of anxiety in participant interviews, and chose to analyse them as key outcome metrics, specifically because the WHODAS 2.0 and GAD-7 measures lack nuance for capturing some of the challenges and changes experienced by neurodivergent individuals. There have been some recent efforts to address this, for instance by developing measures specifically for autistic adults, and further research may be warranted to examine the impact of digital support services on the subcomponents of the WHODAS 2.0 and the GAD-7, which are presented in Tables B4 and B5 in Appendix B.[21]

These improvements were not concentrated amongst, or exclusively experienced by, participants of certain demographic characteristics or cohorts, but were experienced 'across the board' by users of the service. Although previous research has found evidence of both health-related quality of life and anxiety being

impacted differently based on characteristics such as age and biological sex, and based on neurological diagnosis, we do not find evidence for such relationships in this study.[22,23] The encouraging findings described above are not systematically weaker or stronger on the basis of a BiH service user's age, biological sex, identification as LGBTQ+ or ethnicity, level of deprivation, occupation, or diagnosis. This suggests both that the service is generally accessible to all users, and that the mechanisms through which the BiH digital support service impacts upon users (described below) are on average effective regardless of user characteristics. It is worth highlighting the potential effects of one such specific characteristic, namely deprivation, whereby users from the most deprived geographic areas (i.e. those whose postcode was in the lowest two quintiles of the Index of Multiple Deprivation) experienced statistically significant relative improvements in anxiety (GAD-7) and feelings of safety over the six-month study period. However, this statistical significance is not present for the other key outcomes in our analysis, and this potential relationship may require further research with a more specific focus and/or robust research method.

The findings of this study concur with a previous evaluation of BiH, which found reductions in anxiety and improvements to quality of life, but which was limited by a shorter follow up period (3 months), reliance on generic measures, and on exclusive focus on the autistic population.[24] Taken together the studies suggest that personalised, on-demand support enables some users to better manage their anxiety and do things that contribute to a better quality of life. Furthermore, the finding that the benefit is evenly distributed across condition and demographic could be explained by the high rates of co-occurrence of anxiety with many types of neurodivergence. Providing practical support to manage anxiety potentially makes the service relevant for any neurodivergence with anxiety at its core.

5.1 Limitations

The sample of users participating in the research via interviews was smaller than initially planned, due to difficulty in recruiting BiH digital support service users for interviews. The eventual sample of 149 users who completed an interview at baseline fell to 107 at the 6-month mark (with 102 participating in interviews at 3 months). As can be observed in Table 1, this attrition was not particularly concentrated on any specific user characteristic(s). The sample had a considerably higher proportion of females (78% at baseline), those identifying as LGBTQ+ (44%), and students (75%) than the general population (as recorded in the Census 2021 data for England & Wales (Female 51%; LGBT+ 3.2%; Student 7.7%)).[25,26,27] Similarly, a far higher proportion of the sample identified (either due to clinical- or self-diagnosis) as autistic (74%) and having ADHD (52%), relative to the UK population (estimated 0.8 - 2.1% of the English population being autistic; 3-4% of adults in the UK having ADHD).[28,29] The mean (27.1) and median (21) age of the sample at baseline was comparable to that of the full population of BiH digital support service users (26.9 and 22 respectively). However, the sample of interviewees for this evaluation appears to more heavily identify as autistic (74%) and having ADHD (52%) than the full population of BiH users (66% and 22% respectively).

The purely longitudinal, "pre-post", nature of the study means that the lack of a control group makes it difficult to attribute observed changes directly to BiH digital support service usage, as any improvements in outcome measures could be due to natural progression, external factors, or regression to the mean. In particular, regression to the mean in this case would refer to more extreme values (i.e. elevated levels of poor health as measured by the WHODAS 2.0, the GAD-7, and other metrics) tending to move closer to the average over time. In the context of users of BiH digital support services, those who seek out and start using the service likely have above-average mental health challenges relative to the population. Given the lack of a counterfactual, it is important to acknowledge that some improvement in their

health could occur naturally as they move towards their baseline or "average" level, regardless of using BiH. Therefore, observed improvements may not be entirely due to the service itself, but partially due to this natural regression to the mean.

Similarly, we cannot rule out the presence of selective attrition. That is, those who feel they are benefiting most from using the service are more likely to continue using it, and therefore may be more likely to participate in follow-up interviews. To explore the potential importance of selective attrition, we conducted a bounding exercise using the full baseline sample of participants. Table B6 in Appendix B presents the results of the fixed effects regression analyses (as in Table 2 above), but with imputed values for participants who did not participate in interviews at 3-months and/or 6-months. Specifically, we assume in these cases that a participant's scores for our five outcome variables take the value as at the first 'baseline' interview (i.e. we assume "no change" where data is missing). Using this approach, the observed temporal effects of BiH digital support service usage for four of the outcome variables remain statistically significant as before, albeit with smaller effect sizes in most cases. This admittedly rudimentary 'bounding' offers some indication that despite the potential inflation of some effect sizes, the positive changes we observe are nevertheless unlikely to be entirely 'explained away' by selective attrition.

However, of the 149 users who participated in an interview at baseline, only 92 participated in all three interviews (i.e. baseline, 3-months, 6-months). Having more than three data points per user in a pre-post longitudinal study such as this would enhance our ability to detect trends, assess the consistency of changes over time, and distinguish between short-term fluctuations and sustained effects for outcome measures of interest. It is worth noting that the "baseline" interview is not a strict baseline measure of using BiH digital support services. Almost all users (148 of 149, 99%) who participated in an interview at baseline had accessed (downloaded) the BiH digital tool and booked their first 'coaching' session before their baseline

interview, with the mean number of days between downloading the tool and the interview being 32 days (median 29 days).

5.2 Conclusions

Working with a sample of 149 users of Brain in Hand digital support services over a six month study period, we find some statistically significant evidence of usage of BiH services being associated with improvements in well-established international measures of overall health-related quality of life and anxiety, namely the WHODAS 2.0 Summary score and the GAD-7 Total score. Knowing that these metrics do not capture all the nuanced challenges and changes experienced by neurodivergent individuals, we also analysed users' feelings of safety, of managing overwhelm, and managing social anxiety - finding statistically significant positive changes over the course of the study period for the latter two measures. While BiH digital support services are not a substitute for all other services, in the context of constrained resources in the UK and globally for supporting mental health and neurodivergence, we find some evidence that they offer autistic and neurodivergent individuals support to manage their lives and schedules in an increasingly complex world.

Given that the purely longitudinal nature of our study limits our claims of causality, we recommend further evaluation of the impact of digital support services. Subsequent studies would benefit from a control/comparison group and an evaluation design that is more suitable to digital technologies that constantly iterate. As we further explore the potential positive impact of digital support services on a range of key outcomes for neurodivergent people, we seek to 'put these findings to work' to better understand and serve their individual and collective needs.

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Appendix

Appendix A: Supplementary descriptive statistics

Table A1: Descriptive statistics, Autism and ADHD by diagnosis type

	First interview	Second interview	Third interview
Autism			
Clinical diagnosis	67 (45%)	52 (51%)	55 (51%)
Clinical or self-diagnosis	110 (74%)	73 (72%)	81 (76%)
ADHD			
Clinical diagnosis	37 (25%)	26 (25%)	29 (27%)
Clinical or self-diagnosis	77 (52%)	53 (52%)	57 (53%)
Both Autism and ADHD			
Clinical diagnosis	17 (11%)	14 (14%)	14 (13%)
Both Autism and ADHD	61 (41%)	41 (40%)	45 (42%)
Total N	**149 (100%)**	**102 (100%)**	**107 (100%)**

Table A2: GAD-7 Total score, grouped by clinical category

	First interview	Second interview	Third interview
GAD-7 total score (0-21)			
No anxiety (0-4)	14 (9%)	15 (15%)	19 (18%)
Mild anxiety (5-9)	34 (23%)	29 (28%)	35 (33%)
Moderate anxiety (10-14)	51 (34%)	31 (30%)	30 (28%)
Severe anxiety (15-21)	50 (34%)	27 (26%)	23 (22%)
Total N	**149 (100%)**	**102 (100%)**	**107 (100%)**

Appendix B: Supplementary regression analysis

Table B1: Results of 'first differences' regression analysis, clinical diagnoses only

VARIABLES	(1) WHODAS 2.0: Summary Score	(2) GAD-7: Total Score	(3) Feeling safe	(4) Ability to manage overwhelm	(5) Ability to manage social anxiety
Age: 20s	-2.130*	-0.408	-0.002	0.008	0.194**
	(1.278)	(0.988)	(0.083)	(0.140)	(0.110)
Age: 30s	-1.059	-0.553	-0.066	0.195	0.076
	(1.775)	(1.372)	(0.116)	(0.194)	(0.153)
Age: 40s	-2.659	-1.937	0.077	-0.232	-0.050
	(2.316)	(1.790)	(0.151)	(0.253)	(0.199)
Age: 50 plus	0.332	-1.507	-0.198	0.005	0.134
	(2.226)	(1.721)	(0.145)	(0.243)	(0.191)
Sex at birth: Male	-1.153	1.213	0.026	-0.207	0.089
	(1.331)	(1.029)	(0.087)	(0.145)	(0.114)
Identifies as LGBTQ+	-0.664	0.827	-0.028	-0.223*	0.009
	(1.076)	(0.832)	(0.070)	(0.118)	(0.093)
Identifies as BAME	-0.957	0.087	0.023	-0.048	0.198*
	(1.347)	(1.041)	(0.088)	(0.147)	(0.116)
IMD: Quintiles 1 and 2	-0.828	-1.709**	0.123*	-0.010	0.057
	(1.093)	(0.845)	(0.071)	(0.119)	(0.094)
Occupation: Student	2.242	0.620	-0.021	-0.063	-0.125
	(1.436)	(1.110)	(0.094)	(0.157)	(0.123)
Autism: Clinical diagnosis	0.420	0.423	-0.059	0.088	-0.076
	(1.245)	(0.962)	(0.081)	(0.136)	(0.107)
ADHD: Clinical diagnosis	-0.038	1.511	-0.083	0.015	-0.014
	(1.759)	(1.360)	(0.115)	(0.192)	(0.151)
Both Autism and ADHD	3.105	-0.180	0.130	-0.002	-0.016
	(2.476)	(1.914)	(0.161)	(0.270)	(0.213)
Experience Anxiety	-2.432	-2.147	0.045	-0.314	-0.039
	(2.294)	(1.773)	(0.149)	(0.251)	(0.197)
Constant	-0.820	0.057	0.013	0.662*	0.217
	(3.225)	(2.493)	(0.210)	(0.352)	(0.277)
Observations	106	106	106	106	106
R-squared	0.152	0.156	0.092	0.088	0.112

Age categories are with reference to 'Age: 18-19'. 'Autism', 'ADHD', and 'Both' use clinical diagnosis only. Coefficients for (1) and (2) are point estimates. Coefficients for (3), (4), and (5) represent the expected change in the primary outcome between participants who have the characteristic and those who do not, ceteris paribus. Standard errors in parentheses [*** p<0.01, ** p<0.05, * p<0.1]

Table B2: Results of 'first differences' regression analysis, "occupation" at month 3

VARIABLES	(1) WHODAS 2.0: Summary Score	(2) GAD-7: Total Score	(3) Feeling safe	(4) Ability to manage overwhelm	(5) Ability to manage social anxiety
Age: 20s	-3.050**	-1.605	0.055	0.092	0.270**
	(1.522)	(1.185)	(0.094)	(0.164)	(0.130)
Age: 30s	-2.055	-1.533	-0.049	0.341	0.128
	(2.111)	(1.644)	(0.130)	(0.227)	(0.180)
Age: 40s	-1.697	-2.025	0.233	0.012	0.064
	(2.923)	(2.276)	(0.180)	(0.315)	(0.249)
Age: 50 plus	-0.840	-2.405	-0.101	0.207	0.176
	(2.496)	(1.944)	(0.153)	(0.269)	(0.213)
Sex at birth: Male	-2.041	0.815	0.060	-0.159	0.230*
	(1.494)	(1.163)	(0.092)	(0.161)	(0.127)
Identifies as LGBTQ+	-0.818	0.151	0.022	-0.163	0.076
	(1.204)	(0.938)	(0.074)	(0.130)	(0.103)
Identifies as BAME	-1.717	-0.256	0.049	0.003	0.136
	(1.567)	(1.220)	(0.096)	(0.169)	(0.134)
IMD: Quintiles 1 and 2	-0.247	-1.373	0.160**	-0.058	0.056
	(1.189)	(0.926)	(0.073)	(0.128)	(0.101)
Occupation: Student	0.981	-0.011	0.043	0.112	-0.035
	(1.738)	(1.353)	(0.107)	(0.187)	(0.148)
Autism: Clinical or self-diagnosis	-1.720	1.413	0.130	0.252	-0.290*
	(1.903)	(1.482)	(0.117)	(0.205)	(0.162)
ADHD: Clinical or self-diagnosis	-2.444	3.615**	-0.023	0.185	-0.337*
	(2.214)	(1.724)	(0.136)	(0.238)	(0.189)
Both Autism and ADHD	4.520*	-2.526	-0.091	-0.210	0.274
	(2.663)	(2.050)	(0.162)	(0.283)	(0.224)
Experience Anxiety	-5.548**	-3.507	0.191	-0.194	0.250
	(2.781)	(2.166)	(0.171)	(0.299)	(0.237)
Constant	5.330	-1.289	-0.330	0.161	0.036
	(4.140)	(3.224)	(0.254)	(0.446)	(0.353)
Observations	91	91	91	91	91
R-squared	0.158	0.182	0.147	0.090	0.169

Age categories are with reference to 'Age: 18-19'. 'Occupation: Student' coded based on participants' occupations at the 3-month interview. Coefficients for (1) and (2) are point estimates. Coefficients for (3), (4), and (5) represent the expected change in the primary outcome variable between participants who have the characteristic and those who do not, ceteris paribus. Standard errors in parentheses [*** p<0.01, ** p<0.05, * p<0.1]

Table B3: Results of 'first differences' regression analysis, "occupation" at month 6

VARIABLES	(1) WHODAS 2.0: Summary Score	(2) GAD-7: Total Score	(3) Feeling safe	(4) Ability to manage overwhelm	(5) Ability to manage social anxiety
Age: 20s	-3.152**	-1.380	0.048	0.071	0.282**
	(1.496)	(1.161)	(0.092)	(0.161)	(0.128)
Age: 30s	-2.255	-1.134	-0.062	0.301	0.149
	(2.036)	(1.579)	(0.125)	(0.219)	(0.174)
Age: 40s	-1.921	-1.162	0.216	-0.051	0.101
	(2.901)	(2.251)	(0.178)	(0.313)	(0.247)
Age: 50 plus	-1.011	-1.694	-0.115	0.156	0.206
	(2.492)	(1.933)	(0.153)	(0.268)	(0.212)
Sex at birth: Male	-2.114	0.913	0.056	-0.171	0.236*
	(1.482)	(1.149)	(0.091)	(0.160)	(0.126)
Identifies as LGBTQ+	-0.854	0.268	0.020	-0.172	0.081
	(1.202)	(0.932)	(0.074)	(0.129)	(0.102)
Identifies as BAME	-1.674	-0.383	0.052	0.014	0.130
	(1.564)	(1.214)	(0.096)	(0.169)	(0.133)
IMD: Quintiles 1 and 2	-0.266	-1.358	0.159**	-0.061	0.057
	(1.189)	(0.922)	(0.073)	(0.128)	(0.101)
Occupation: Student	0.767	0.929	0.025	0.046	-0.004
	(1.745)	(1.354)	(0.107)	(0.188)	(0.149)
Autism: Clinical or self-diagnosis	-1.764	1.458	0.128	0.245	-0.287*
	(1.901)	(1.475)	(0.117)	(0.205)	(0.162)
ADHD: Clinical or self-diagnosis	-2.423	3.609**	-0.022	0.188	-0.338*
	(2.215)	(1.719)	(0.136)	(0.239)	(0.189)
Both Autism and ADHD	4.562*	-2.547	-0.089	-0.204	0.272
	(2.632)	(2.042)	(0.162)	(0.284)	(0.224)
Experience Anxiety	-5.712**	-3.227	0.181	-0.225	0.265
	(2.744)	(2.129)	(0.169)	(0.296)	(0.234)
Constant	5.739	0.018	-0.301	0.264	-0.022
	(4.019)	(3.118)	(0.247)	(0.433)	(0.343)
Observations	91	91	91	91	91
R-squared	0.156	0.187	0.146	0.087	0.169

Age categories are with reference to 'Age: 18-19'. 'Occupation: Student' coded based on participants' occupations at the 6-month interview. Coefficients for (1) and (2) are point estimates. Coefficients for (3), (4), and (5) represent the expected change in the primary outcome variable between participants who have the characteristic and those who do not, ceteris paribus. Standard errors in parentheses [*** p<0.01, ** p<0.05, * p<0.1]

Table B4. Results of fixed effects regression analysis for WHODAS 2.0 subcomponents

VARIABLES	(1) Standing	(2) Walking	(3) WashBody	(4) Dressing	(5) WorkSchool	(6) Household	(7) Concentrate	(8) LearnNew	(9) JoinActivities	(10) Strangers	(11) Maintain	(12) Affected
Time: 3 months	0.008	0.040	-0.148**	-0.069	-0.117	-0.202**	-0.231***	-0.108	-0.246**	-0.370***	-0.072	-0.403***
	(0.093)	(0.076)	(0.069)	(0.069)	(0.127)	(0.084)	(0.088)	(0.101)	(0.109)	(0.096)	(0.096)	(0.098)
Time: 6 months	-0.029	0.033	-0.231***	-0.075	0.074	-0.253***	-0.336***	-0.211*	-0.364**	-0.472***	0.064	-0.455***
	(0.107)	(0.087)	(0.079)	(0.079)	(0.146)	(0.097)	(0.101)	(0.116)	(0.125)	(0.109)	(0.109)	(0.112)
May interview	-0.073	0.081	0.146	0.063	-0.356	-0.193	0.003	-0.163	0.159	-0.152	-0.179	-0.204
	(0.190)	(0.155)	(0.140)	(0.141)	(0.259)	(0.172)	(0.179)	(0.206)	(0.222)	(0.195)	(0.195)	(0.200)
Dec interview	0.187	-0.042	0.038	0.029	0.245	-0.172	0.113	-0.235	-0.048	-0.036	0.191	-0.096
	(0.171)	(0.140)	(0.126)	(0.127)	(0.233)	(0.155)	(0.161)	(0.185)	(0.200)	(0.175)	(0.175)	(0.180)
Mean at baseline	1.846	1.732	1.671	1.544	2.168	2.500	2.644	2.443	2.819	2.886	2.336	3.168
	(1.218)	(1.082)	(0.948)	(0.826)	(1.373)	(1.082)	(0.994)	(1.074)	(1.191)	(1.075)	(1.024)	(1.176)
Total observations	358	358	358	358	*299*	358	358	358	358	358	358	358
Unique participants	149	149	149	149	*120*	149	149	149	149	149	149	149
R-squared	0.010	0.005	0.050	0.008	0.016	0.070	0.079	0.036	0.049	0.138	0.018	0.136

Results for regressions (1) through (12) are reported as estimated coefficients, with each subcomponent representing a scale of 1-5. Participants who were neither in full time education or employment were excluded from the analysis of (5), 'WorkSchool'. Standard errors in parentheses. [*** p<0.01, ** p<0.05, * p<0.1]

Table B5. Results of fixed effects regression analysis for GAD-7 subcomponents

VARIABLES	(1) Nervous	(2) Control	(3) Worry	(4) Relax	(5) Restless	(6) Annoyed	(7) Afraid
Time: 3 months	-0.118	-0.227***	-0.295***	-0.022	-0.087	-0.036	-0.038
	(0.085)	(0.087)	(0.082)	(0.096)	(0.100)	(0.085)	(0.101)
Time: 6 months	-0.069	-0.127	-0.301***	-0.081	-0.191*	-0.090	-0.214*
	(0.098)	(0.099)	(0.094)	(0.109)	(0.115)	(0.097)	(0.116)
May interview	-0.233	-0.338*	-0.262	-0.054	-0.079	-0.138	0.198
	(0.174)	(0.176)	(0.167)	(0.194)	(0.205)	(0.173)	(0.205)
Dec interview	0.055	0.093	0.071	-0.133	-0.036	0.045	-0.090
	(0.157)	(0.158)	(0.150)	(0.175)	(0.184)	(0.159)	(0.185)
Mean at baseline	2.034	1.852	2.040	1.792	1.302	1.419	1.203
	(0.933)	(1.016)	(1.006)	(1.042)	(1.137)	(0.904)	(1.050)
Total observations	358	358	358	358	358	357	357
Unique participants	149	149	149	149	149	149	149
R-squared	0.023	0.061	0.117	0.007	0.022	0.015	0.017

Results for regressions (1) through (7) are reported as estimated coefficients, with each subcomponent representing a scale of 0-3. Standard errors in parentheses. [*** p<0.01, ** p<0.05, * p<0.1]

Table B6. Results of fixed effects regression analysis with no attrition (imputed values)

VARIABLES	(1) WHODAS 2.0: Summary Score	(2) GAD-7: Total Score	(3) Feeling safe	(4) Ability to manage overwhelm	(5) Ability to manage social anxiety
Time: 3 months	-1.079**	-0.752***	2.751	2.685**	10.58***
	(0.486)	(0.229)	(1.842)	(1.153)	(6.508)
Time: 6 months	-1.312***	-0.856***	1.675	6.851***	6.477***
	(0.398)	(0.290)	(1.096)	(3.399)	(4.078)
May interview	-2.207**	-1.312*	-	0.847	-
	(0.855)	(0.740)	-	(0.812)	-
December interview	-0.028	0.164	1.888	1.299	0.415
	(0.952)	(0.425)	(2.862)	(1.068)	(0.385)
Mean at baseline	*27.75*	*11.62*	*0.879*	*0.541*	*0.658*
	(8.013)	*(4.930)*	*(0.327)*	*(0.500)*	*(0.476)*
Total observations	446	446	45	132	105
Unique participants	149	149	15	44	35
Individual participant fixed effects	Yes	Yes	Yes	Yes	Yes
Interviewer fixed effects	Yes	Yes	No	No	No
R-squared	0.898	0.890	N/A	N/A	N/A

Results for regressions (1) and (2) are reported as estimated coefficients. Results for regressions (3), (4), and (5) are reported as odds ratios. Coefficient and standard error for 'May interview' in models (3) and (5) omitted due to insufficient within-group variation, resulting in unreliable and inflated estimates. Standard errors in parentheses, other than for 'Mean at baseline', where standard deviation is in parentheses. [*** p<0.01, ** p<0.05, * p<0.1]

Appendix C: Interview questions

Table C1. Interview questions at 'baseline', 3-month, and 6-month interviews

Question / Variable name	Variable description / Answer options	Asked in the first interview?	Asked in the second interview?	Asked in the third interview?
How old are you?	Age in years	Y	N	N
What was your biological sex at birth?	(F / M / Prefer not to say)	Y	N	N
What is your gender identity?	(F / M / Non-binary / Gender fluid / Other (please specify))	Y	N	N
Do you identify as LGBTQ+?	(Y / N / Prefer not to say)	Y	N	N
If yes, please provide specific details	*[Open text option for more detail]*	Y	N	N
Do you identify as belonging to a minority ethnic group (sometimes referred to as BAME)?	(Y / N)	Y	N	N
Do you identify as belonging to a minority ethnic group (sometimes referred to as BAME)? [Yes]	*[Open text option for more detail]*	Y	N	N
Compared to people in general, would you describe yourself as coming from a lower socio-economic background (thinking to when you were around 14 years old)?	(Y / N / Don't know / Prefer not to say)	Y	N	N
Current Postcode IMD Decile	1-10	Y	N	N
What is your current main occupation/activity?	(Student / employed / unemployed)	Y	Y	Y
How long have you been in this current activity?	(<1 year / 1-2 years / 3-4 years / 4-5 years / >5 years)	Y	N	N
What best describes you in terms of	(Y / N)	Y	N	N

neurodiversity and mental health? [Autistic - Clinically diagnosed]				
I think I may be autistic/self-diagnosed	(Y / N)	Y	N	N
Clinically diagnosed ADHD	(Y / N)	Y	N	N
I think I may have ADHD/self-diagnosed	(Y / N)	Y	N	N
Experience anxiety	(Y / N)	Y	N	N
Another mental health difficulty	(Y / N)	Y	N	N
If the interviewee hasn't answered yes to ANY of the items, ask why they think they might be using BiH	*[Open text option]*	Y	N	N
If the interviewee identifies as autistic and is clinically diagnosed, please ask how long their diagnosis took i.e. how long were they on the waiting list? (Please enter in years (e.g. 6 months = 0.5 years). If not relevant type NA).	*[Open text option]*	Y	N	N
If the interviewee identifies as ADHD and is clinically diagnosed, please ask how long their diagnosis took i.e. how long were they on the waiting list? (Please enter in years (e.g. 6 months = 0.5 years). If not relevant type NA).	*[Open text option]*	Y	N	N
EQ-5D-5L: Do you have problems walking about?	[No / Slight / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
EQ-5D-5L: Do you have problems washing or dressing yourself?	[No / Slight / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
EQ-5D-5L: Do you have problems doing your usual activities e.g. work, study, housework, family or leisure activities)?	[No / Slight / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
EQ-5D-5L: Do you have pain or discomfort?	[No / Slight / Moderate / Severe / Extreme	Y	Y	Y

	(Can't Do)]			
EQ-5D-5L: Are you anxious or depressed?	[No / Slight / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
EQ-5D-5L VAS: How good or bad is your health TODAY on a scale of 0 to 100, where 100 is the best health you can imagine and 0 is the worst health you can imagine:	1-100	Y	Y	Y
WHODAS 2.0 (In the past 30 days how much difficulty did you have in the following areas of your life?): Standing for long periods such as 30 minutes?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
WHODAS 2.0: Walking long distances such as a kilometre [or equivalent]?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
WHODAS 2.0: Washing your whole body?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
WHODAS 2.0: Getting dressed?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
WHODAS 2.0: Your day-to-day work/school?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
WHODAS 2.0: Taking care of your household responsibilities?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
WHODAS 2.0: Concentrating on doing something for ten minutes?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
WHODAS 2.0: Learning a new task, for example, learning how to get to a new place?	[No / Mild / Moderate / Severe / Extreme	Y	Y	Y

	(Can't Do)]			
WHODAS 2.0: How much of a problem did you have joining in community activities e.g. festivities, religious or other activities) in the same way as anyone else can?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
WHODAS 2.0: Dealing with people you do not know?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
WHODAS 2.0: Maintaining a friendship?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
WHODAS 2.0: How much have you been emotionally affected by your health problems?	[No / Mild / Moderate / Severe / Extreme (Can't Do)]	Y	Y	Y
Overall, in the past 30 days, how many days were these difficulties present?	0-30	Y	Y	Y
In the past 30 days, for how many days were you totally unable to carry out your usual activities or work because of any health condition?	0-30	Y	Y	Y
In the past 30 days, not counting the days that you were totally unable, for how many days did you cut back or reduce your usual activities or work because of any health condition?	0-30	Y	Y	Y
GAD-7 (Over the last 2 weeks, how often have you been bothered by any of the following problems?): Feeling nervous, anxious or on edge	[Not at all / Several days / More than half the days / Nearly every day]	Y	Y	Y
Feeling nervous, anxious or on edge: Were you able to self manage this?	(none, some, most, all of the time)	Y	Y	Y
GAD-7 (Over the last 2 weeks, how often have you been bothered by any of the following problems?): Not	[Not at all / Several days / More than half	Y	Y	Y

being able to stop or control worrying	the days / Nearly every day]			
Not being able to stop or control worrying: Were you able to self manage this?	(none, some, most, all of the time)	Y	Y	Y
GAD-7 (Over the last 2 weeks, how often have you been bothered by any of the following problems?): Worrying too much about different things	[Not at all / Several days / More than half the days / Nearly every day]	Y	Y	Y
Worrying too much about different things: Were you able to self manage this?	(none, some, most, all of the time)	Y	Y	Y
GAD-7 (Over the last 2 weeks, how often have you been bothered by any of the following problems?): Trouble relaxing	[Not at all / Several days / More than half the days / Nearly every day]	Y	Y	Y
Trouble relaxing: Were you able to self manage this?	(none, some, most, all of the time)	Y	Y	Y
GAD-7 (Over the last 2 weeks, how often have you been bothered by any of the following problems?): Being so restless that it is hard to sit still	[Not at all / Several days / More than half the days / Nearly every day]	Y	Y	Y
Being so restless that it is hard to sit still: Were you able to self manage this?	(none, some, most, all of the time)	Y	Y	Y
GAD-7 (Over the last 2 weeks, how often have you been bothered by any of the following problems?): Becoming easily annoyed or irritable	[Not at all / Several days / More than half the days / Nearly every day]	Y	Y	Y
Becoming easily annoyed or irritable: Were you able to self manage this?	(none, some, most, all of the time)	Y	Y	Y
GAD-7 (Over the last 2 weeks, how often have you been bothered by any of the following problems?): Feeling afraid as if something awful	[Not at all / Several days / More than half the days / Nearly	Y	Y	Y

might happen	every day]			
Feeling afraid as if something awful might happen: Were you able to self manage this?	(none, some, most, all of the time)	Y	Y	Y
How difficult have these problems made it for you?	(Not difficult at all / Somewhat / Very / Extremely difficult)	Y	Y	Y
How good or bad has your anxiety been over the past 2 weeks on a scale of 0-100 where 100 is no anxiety, and 0 is the worst anxiety you can imagine:	1-100	Y	Y	Y
Over the past 2 weeks have you been bothered by the following problems: Little interest or pleasure in doing things.	(Not at all / Several days / More than half the days / Nearly everyday)	Y	Y	Y
Over the past 2 weeks have you been bothered by the following problems: Feeling down, depressed or hopeless?	(Not at all / Several days / More than half the days / Nearly everyday)	Y	Y	Y
What does feeling safe mean to you?	*[Open text option]*	Y	N	N
How have you felt over the past 2 weeks: I feel safe	(None of the time / Rarely / Some of the time / Often / All of the time)	Y	Y	Y
How have you felt over the past 2 weeks: I feel able to connect with my emotions.	(None of the time / Rarely / Some of the time / Often / All of the time)	Y	Y	Y
How have you felt over the past 2 weeks: I feel able to manage overwhelm when it could act as a barrier.	(None of the time / Rarely / Some of the time / Often / All of the time)	Y	Y	Y
How have you felt over the past 2	(None of the	Y	Y	Y

weeks: I feel able to manage social anxiety.	time / Rarely / Some of the time / Often / All of the time)			
How have you felt over the past 2 weeks: I feel able to ask for help.	(None of the time / Rarely / Some of the time / Often / All of the time)	Y	Y	Y
How have you felt over the past 2 weeks: I feel able to deal with any barriers that arise.	(None of the time / Rarely / Some of the time / Often / All of the time)	Y	Y	Y
How have you felt over the past 2 weeks: I feel able to cope with day-to-day stressors.	(None of the time / Rarely / Some of the time / Often / All of the time)	Y	Y	Y
How have you felt over the past 2 weeks: I feel able to complete day-to-day tasks independently e.g. cooking, shopping, attending appointments, cleaning, etc.	(None of the time / Rarely / Some of the time / Often / All of the time)	Y	Y	Y
How have you felt over the past 2 weeks: I feel able to try new things I haven't done for a long time.	(None of the time / Rarely / Some of the time / Often / All of the time)	Y	Y	Y
How have you felt over the past 2 weeks: I feel optimistic about the future.	(None of the time / Rarely / Some of the time / Often / All of the time)	Y	Y	Y
What are you hoping to achieve by using Brain in Hand?	*[Open text option]*	Y	N	N
What would be a measure of success for you personally?	*[Open text option]*	Y	N	N
What would tell you that BiH is working for you?	*[Open text option]*	Y	N	N
Is there anything that has happened	*[Open text*	Y	Y	Y

to you in the past 4 weeks that has affected how you feel or how you have been able to live your life?	*option]*			
Is there anything that is likely to be happening in your life in the near future?	*[Open text option]*	Y	Y	Y
Tell us about your experience of using Brain in Hand and any changes you have noticed in your life, study or work, and how Brain in Hand has enabled those changes.	*[Open text option]*	N	Y	Y
Since you got Brain in Hand, has there been a change in your health or wellbeing?	*[Open text option]*	N	Y	Y
Since you got Brain in Hand, have you experienced any personal growth and development?.	*[Open text option]*	N	Y	Y
Since you got Brain in Hand, have you noticed a difference in how you access support?	*[Open text option]*	N	Y	Y
Is there anything else you would like to share about Brain in Hand, or that you think we should know?	*[Open text option]*	N	Y	Y
Now that you have had some time using Brain in Hand, what are you hoping to achieve using it going forward?	*[Open text option]*	N	Y	Y
Is there any other support you have received in the past 3 months that you feel has contributed to the changes you have noticed in your life?	*[Open text option]*	N	Y	Y