

# Clinical Research

Talkspace has an extensive research program focused on studying the efficacy of virtual care modalities. With over 25 research partners, including Harvard, Yale, NYU, Columbia and Stanford, we have published more than 20 studies with proven outcomes of virtual behavioral healthcare. Recipient of 4 NIH grants, Talkspace is leading the industry in exploring the impact virtual behavioral healthcare can have on clinical innovation and accessibility. The following highlights a sample of our latest publications.



## Studies

### Outcomes for Depression and Anxiety in a 10,718 Sample

In the largest study to date, more than 10,000 participants received treatment for three months using the Talkspace platform's asynchronous messaging modality. The research demonstrates messaging to be an effective therapeutic modality in decreasing symptoms of depression and anxiety.

#### Key Outcomes:

- **Improvements**
  - **67.6%** of patients showed sustained decreases in anxiety and depression symptoms that approach or surpass thresholds defining recovery
- **Recovery**
  - **53%** recovered from depression
  - **48%** recovered from anxiety

#### Publication:

Hull, T.D., Malgaroli, M., Connolly, P.S., Feuerstein, S., & Simon, N. (2020). NYU School of Medicine, Columbia University, and Yale University. <https://bmcpsy psychiatry.biomedcentral.com/articles/10.1186/s12888-020-02721-x> (Paper available)

### Outcomes for Trauma and PTSD in a 425 Sample

Participants receiving PTSD treatment used Talkspace's asynchronous messaging modality. Multimedia message delivery for PTSD treatment demonstrated symptom-reduction rates similar to traditional forms of treatment delivery.

#### Key Outcomes:

- 4 trajectories of PTSD symptoms were identified using growth mixture modeling (GMM)
  1. Moderate Improvement = **41.4%**
  2. High Symptoms = **41.4%**
  3. Chronic Symptoms = **12.9%**
  4. Acute Improvement = **4.3%**
- Patients with a clinically significant reduction in PTSD symptoms (48.6%) were more likely to communicate via video, demonstrate a higher working alliance with their therapist, and be at their first treatment experience.

#### Publication:

Malgaroli, Matteo, Hull, Thomas D., Wiltsey-Stirman, Shannon, & Resick, Patricia. (2020). *Journal of Medical Internet Research*. Duke University, Stanford University, and NYU School of Medicine. <https://www.jmir.org/2020/4/e15587/> (Paper available)

## System for Detecting and Responding to Risk 24/7

Risk for suicide can be reliably identified by Talkspace's Natural Language Processing (NLP) algorithm. The risk detection model could assist telehealth clinicians in providing crisis resources right when they're needed, making it the industry-leading detection tool.

### Key Outcome:

- The final NLP model identified risk-related content from non-risk content with 80% accuracy (AUC=82.78)

### Publication:

Bantilan, N., Malgaroli, M., Ray, B., & Hull, T.D. (2020). *Psychotherapy Research*. NYU Grossman School of Medicine <https://www.tandfonline.com/doi/abs/10.1080/10503307.2020.1781952?journalCode=tpsr20> (Paper available)

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## Improving Detection and Treatment of Mental Health Challenges During the COVID-19 Pandemic

Research confirms a significant increase in anxiety symptoms identified from participants seeking care on the Talkspace platform pre- to post-COVID. The true cost of the pandemic is underestimated as this study uncovered more than 20 symptoms, outside of anxiety and depression, causing members to seek treatment in response to the stress of the pandemic.

### Key Outcomes:

- 20% increase in anxiety reported post-COVID
- A significant increase in the incidence of COVID-19 related intake anxiety symptoms
- Transcript analysis identified 24 symptoms outside of those included in the diagnostic criteria for anxiety and depression

### Publication:

Hull, T.D., Levine, J., Bantilan, N., Desai, A.N., & Majumder, M.S. (2021). *JMIR: Formative Research*. Harvard Medical School, UC Davis, Columbia. <https://formative.jmir.org/2021/2/e26190> (Paper available)

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## Monitoring Therapeutic Approaches Used in Messaging Therapy

This study analyzed the underlying techniques used by therapists who provide care through a messaging-based modality. Intervention profiles have been proven useful in predicting participant retention and outcomes across a variety of clinical needs.

### Key Outcome:

- 16 profiles consisting of therapy interventions and client responses led to an **80%** accuracy rate

### Publication:

Lee, Fei-Tzin, Hull, Thomas, D., Levine, Jacob, Ray, Bonnie, & McGowan, Katherine. (2019). *North American Computational Linguistics*. Columbia University. <https://www.aclweb.org/anthology/W19-3002/> (Paper available)

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## Outcomes for Rural Populations

Results were analyzed for 460 participants receiving treatment on the Talkspace platform over three months. Participants represented multiple diagnoses. Virtual care can be an effective treatment solution for rural populations.

### Key Outcome:

- In rural areas, Talkspace individuals saw a **50%** recovery rate, with slightly better outcomes and higher alliance scores early in treatment.

### Publication:

Hollan, J.M., Bowling, W., Murphy, E., Clements-Hickman, A., Redmayne, K., Reese, R., Leibowitz, N., & Hull, T.D. (accepted at APA, under review for publication) University of Kentucky Medical Center. <https://psycnet.apa.org/record/2021-39068-001> (Paper available)

## The Effect of Messaging Therapy for Depression and Anxiety on Employee Productivity

This study analyzed the impact Talkspace's messaging therapy has on employee productivity and engagement. Participants self-reported progress in both their mood and work performances after three months of treatment through clinical questionnaires: PHQ-9, GAD-7, and Work Productivity and Activity Impairment scale.

### Key Outcome:

- 50% of participants missed fewer hours of work, translating to 90 reclaimed work hours per employee per year
- 36% of participants reported an increase in productivity, measured by employees' reported ability to complete tasks
- 39% of participants reported greater work-life balance and an increase in quality of life outside of work

### Publication:

DellaCrosse, Meghan, Hull, Thomas D., & Mahan, Kush. (2018). *Journal of Technology in Behavioral Science*. Columbia University. <https://doi.org/10.1007/s41347-018-0064-4> (Paper available)

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## Digital and Artificial Intelligence for PTSD: Improving treatment delivery through personalization

This academic paper discusses how clinical information gathered through digital health technologies can be analyzed using artificial intelligence to enhance prediction of PTSD, monitoring, and ad hoc treatment interventions.

### Key Outcome:

- Identify ways in which digital care can advance trauma treatment through tailoring treatment to individual needs and symptom profiles

### Publication:

Malgaroli, M., Hull, T.D. & Schultebraucks, K. (2021). *Psychiatric Annals*. NYU, Columbia. <https://journals.healio.com/doi/abs/10.3928/00485713-20201203-01> (Paper available)

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## Behavioral Activation and Depression Symptomatology: Longitudinal assessment of linguistic indicators in text-based therapy

The increasing use of online, chat-based mental health counseling presents an unparalleled resource for automated longitudinal linguistic analysis with the depression condition. This study proved a successful method for identifying progress in patients struggling with depression using only their textual reports to their therapists of the activities they engaged in.

### Key Outcomes:

- Engagement in rewarding activities was found to be a critical component of effective therapy for depression
- Strategies for working with patient reluctance were examined

### Publication:

Burkhardt, H., Alexopoulos, G., Pullmann, M., Hull, T.D., Are n, P., Cohen, T. *Journal of Medical Internet Research (JMIR)*. University of Washington and Weill-Cornell. <https://www.jmir.org/2021/7/e28244> (Paper available)

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## Linguistic Measures of Psychological Distance Track Symptom Levels and Treatment Outcomes in a Large Set of Psychotherapy Transcripts

Talkspace continues to identify key elements of effective therapy. In this study, a specific type of emotion regulation strategy, cognitive distancing, was associated with more successful outcomes in messaging therapy.

### Key Outcomes:

- Working through focus on oneself and turning more attention to others predicted better outcomes
- Bringing attention from memories of past negative experiences and worries about future experiences into the present predicted better outcomes

### Publication:

Nook, E., Hull, T.D., Nock, M.K., & Somerville, L.H., *Proceedings of the National Academy of Sciences (PNAS)* Harvard University. Paper won the Smadar Levin Award from the Society for Psychopathology Research. <https://www.pnas.org/doi/10.1073/pnas.2114737119> (Paper available)

## Modifiable Predictors of Suicidal Ideation During Psychotherapy for Late-Life Major Depression: A machine-learning approach

This study focused on data from 221 participants aged 60, with a depression diagnosis. Data identified the participants' lack of social connection, hopelessness, and emotional reactivity, which proved to be predictors of worsening depression and suicidal ideation.

### Key Outcomes:

- Older adults at risk for depression and suicidal thoughts are less socially connected, less able to get out and do things they enjoy, and likely to report more pain
- Therapy can help reduce 4 out of 5 risk factors for depression in older adults
- By increasing social connection (even with therapists), the study found a reduction in feelings of hopelessness, calmer emotional reactivity, increased participation in rewarding activities, and a willingness to address pain

### Publication:

Arean, P., Hull, T.D., Pullman, M., & Heagerty, P. *Translational Psychiatry*. Weill-Cornell, U of Washington.

[https://www.nature.com/articles/s41398-021-01656-5.epdf?sharing\\_token=ilkyUBwjeB9wweh-PM-EgNRgN0jAjWel9jnR3ZoTv00SfUZW0ZgJSCKth6DWFvIQD690iHPH8uqnTdrQEKYKo0\\_6ad3evCWACmFIGSenW7e055lmqZPav6NFgaRFQSR3yObEafwZHtB\\_zjzikXbCZH3Wbyl-HsweZd1vmYQZbg%3D](https://www.nature.com/articles/s41398-021-01656-5.epdf?sharing_token=ilkyUBwjeB9wweh-PM-EgNRgN0jAjWel9jnR3ZoTv00SfUZW0ZgJSCKth6DWFvIQD690iHPH8uqnTdrQEKYKo0_6ad3evCWACmFIGSenW7e055lmqZPav6NFgaRFQSR3yObEafwZHtB_zjzikXbCZH3Wbyl-HsweZd1vmYQZbg%3D). Paper available

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## The Moderating Role of Working Alliance in the Association Between Depression and Suicide Ideation in Messaging Therapy

4,388 participants, receiving a 2-3 month treatment of message-based therapy care for depression diagnosis, successfully reduced suicidal ideation by creating an effective bond with their therapist.

### Key Outcomes:

- Individuals can form a sufficiently strong relationship with their therapist through messaging
- Participants in the study reduced suicidal ideation\* by six weeks
- \*WAI measurement = working alliance inventory (agree on goals, have a good bond, etc.)

### Publication:

A. Brunstein-Klomek, A. Benistri, Y. Doron, T.D. Hull. *Telemedicine and eHealth*. <https://www.liebertpub.com/doi/abs/10.1089/tmj.2021.0272>. Paper available

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## Mental Health Counseling from Conversational Content with Transformer-based Machine Learning

Using AI modeling, the study coded 54-different dimensions of therapists' interventions. The findings of this study suggest that components of supportive counseling (ex: asking open-ended questions) may be key factors in the success of asynchronous text-based counseling.

### Key Outcomes:

- Study sample: 166,644 clients and 20,600,274 messages, 4,973 licensed therapists between 2014-2019
- The more supportive, empathetic and warm the therapist in text, the stronger the patients' outcomes (symptom improvement), engagement (length of time in therapy), and satisfaction with care

### Publication:

Zac E. Imel, PHD; Michael J Tanana, PHD; Christina S. Soma, PhD; Thomas D. Hull, PhD; Brian T. Pace, PhD; Sarah C. Stanco, MFA; Torrey A. Creed, PhD; Theresa B. Moyers, PhD; David C. Atkins, PhD. *Jama Network*. <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2814116>. Paper available.



## National Institute of Health (NIH) funded grants

Talkspace is privileged to have been awarded over \$10MM to further our research on virtual behavioral healthcare. The below studies are in progress.

### Message-Based Psychotherapy and Digital Treatment Sequences for Depression

The grant will support research over four years (began in 2021) to compare daily messaging-only therapy to weekly live video session therapy in a randomized controlled trial to evaluate the effectiveness of the different forms of care. The study will track outcomes, engagement, ratings of the therapist, type of treatment provided, and other important variables between the two forms of care.

### Enhancing Engagement with Digital Mental Health Care

In partnership with the University of Washington and Mental Health America (MHA), this research will investigate the traits of individuals who benefit most from digital therapy. The research will also identify ways to personalize the onboarding and orientation process to enhance client motivation and improve treatment completion and outcomes.

### Cognitive Processing Therapy for PTSD- RCT with Stanford, Duke, University of Texas Health Science Center San Antonio

This study focuses on the effectiveness of Cognitive Processing Therapy (CPT), a well-established treatment for post-traumatic stress disorder (PTSD) in a virtual setting. As millions of Americans-including veterans, sexual assault survivors, and others continue to battle PTSD and other trauma-related challenges, this research seeks to explore and unlock the potential of delivering CPT through digital channels, with the goal of dramatically expanding access to care for those most in need.

### Deep Learning Based on Natural Language Processing Markers of Anxiety and Depression

In partnership with New York University this study seeks to establish digital biomarkers - analyzing subjects' transcripts to find predictors in "speech" - for depression and anxiety to facilitate early detection and treatment monitoring and connect biomarkers to NIMH's Research Domain Criteria (RDoC) standards.

## Looking ahead

Clinical research at Talkspace remains a top priority to advance the field of virtual behavioral healthcare.

Additional clinical research topics underway include:

- Data suggesting the importance of flexible treatment options for addressing healthcare worker burnout, anxiety, and depression following COVID, with strong effects for messaging therapy
- The largest psychotherapy mechanisms study ever conducted, including nearly 120,000 patients receiving care, is underway. Initial results highlight the importance of tone and feel of messages on retention, as well as focused interventions on outcomes
- The impact of messaging therapy as a public health initiative in Reno, Nevada
- Methods for careful selection of effective therapists using specially designed patient vignettes and AI

**For more information, reach out to your Talkspace representative.**