Technology meets clinical practice: Keel Mind as a digital therapy platform

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Received 15 February 2024
Revised 17 March 2024
Accepted 18 March 2024

Abstract

Purpose – The purpose of this paper is to highlight current utilizations of advanced technology within the digital mental health platform Keel Mind.

Design/methodology/approach – Keel Mind, based out of Ontario, Canada is a therapeutic delivery platform that dually functions to train clinicians and deliver virtual therapy to clients.

Findings – From personalizing client and therapist matching to using natural language processing (NLP) and artificial intelligence (AI)-driven features Keel Mind supports clinician decision-making to meet the growing mental health needs of the population. Keel Mind functions to provide accessible service, efficiently train high-quality clinicians and enhance clinical outcomes for clients. In a preliminary study within post-secondary students from Ontario, Canada, 90.1% of clients reported liking the platform, and 83.4% reported that they experienced positive mental health outcomes as a result of using Keel Mind.

Practical implications – Keel Mind is a leader within the rapidly developing field of telepsychology and aims to promote positive mental health outcomes worldwide.

Originality/value – This digital showcase is the first published piece of work highlighting the technological capabilities of Keel Mind as a digital therapeutic platform. The intention of this work is to highlight current uses of digital technology within the field of therapeutic practice and to promote technological growth within the field.

Keywords Mental health, Natural language processing, Artificial intelligence, Telepsychology, Virtual therapy, Telemental health

Paper type Technical paper

The current state of mental illness

Mental health challenges are a significant and growing issue worldwide (Vigo *et al.*, 2022; Patel *et al.*, 2018). Until recently, the general understanding was that 1 in 5 individuals would experience at least one mental illness within their lifetime (Smetanin *et al.*, 2011). However, new data indicates that by age 75, half of all individuals (1 in 2) will experience at least one mental illness during their lifetime (McGrath *et al.*, 2023).

Barriers to help-seeking differ across groups and across geographic regions, but an overarching obstruction continues to be the lack of access to service (World Health Organization (WHO), 2020). Accessibility barriers include long wait times, not knowing

Conflict of interest: Sydney Austin was an intern at Keel Mind, Ahad Bandealy is the Chief Executive Officer of Keel Mind and Dr Elizabeth Cawley is the Vice President, Mental Health of Keel Mind.

Mental Health and Digital Technologies

2976-8756
DOI 10.1108/MHDT-02-2024-0006

where to go for help, a shortage of accessible mental health professionals, culture and language barriers, stigma and cost of services (Moroz *et al.*, 2020). Not only do these barriers prevent help-seeking in the first place, but many of these same barriers also contribute to a loss of motivation to continue therapy after deciding to seek support (Cohen *et al.*, 2022). In addition, travelling to an office for an appointment, the expense of public transit or gas, and the stigma of being seen in the therapist's office are barriers that lead to a lack of attendance to in-person services (Moroz *et al.*, 2020). As mental health challenges continue to be pervasive, and accessibility barriers continue to prevent individuals worldwide from seeking support, it is clear that a new solution must be sought.

Digital therapy: a new technology

The world of technology is growing at a rapid pace. In recent years, technology has become widely used in health care for both clients (e.g. appointment booking and checking results) and care professionals (e.g. note-taking and symptom referencing; Torous *et al.*, 2021). Technology has additionally become a resource in the field of psychology and mental health care – leading to the world of tele-psychology. One such tool of tele-psychology is digital therapeutic platforms.

Broadly, digital therapy refers to mental health care that is delivered using electronic devices such as a mobile phone, tablet or computer (Hadler *et al.*, 2021). With continuous development of new technologies, digital therapy is constantly evolving as a new and effective method of mental health service delivery.

This virtual method of service delivery has particular significance for those who are isolated or living in rural areas, as it provides the opportunity to seek help from any location (Hadler *et al.*, 2021). During the COVID-19 pandemic, psychological practice began the shift to a virtual environment to accommodate physical distancing parameters. Post-pandemic, digital therapy continues to be a powerful tool in increasing accessibility and availability of psychological services. The American Psychological Association and Canadian Psychological Association have acknowledged the importance of tele-psychology, and have released specific guidelines to support its use (American Psychological Association (APA), 2013; Canadian Psychological Association (CPA), 2023).

With the rapid growth in the use of digital technologies among the global population (United Nations, 2020) we are provided with a unique opportunity to utilize digital counseling to decrease costs, promote service accessibility and strive to enhance clinical outcomes (Broglia *et al.*, 2017; Torous *et al.*, 2021).

Effectiveness of digital therapy

Though some individuals report hesitation to try digital therapy at first (Batterham and Calear, 2017), overall satisfaction with digital therapy sessions is generally high (Hadler *et al.*, 2021; Cohen *et al.*, 2022). Digital therapy has been demonstrated to be effective in improving subjective well-being and mental health outcomes in adults (Prescott *et al.*, 2022), young adults (Larsson *et al.*, 2022), adolescents and children (Lehtimaki *et al.*, 2021), and for those in low- and middle-income countries (Fu *et al.*, 2020). As use continues to grow, research on the development, efficacy and implications of these technologies grow in relevance and importance.

Keel Mind as a digital therapeutic platform

Keel Mind is an industry-leading mental health training and service delivery platform. Keel Mind was crafted to support aspiring mental health professionals, offering deeper insights

into their sessions, simplifying the supervision process and offering a secure, user-friendly platform for clients to conveniently access virtual care from wherever they are.

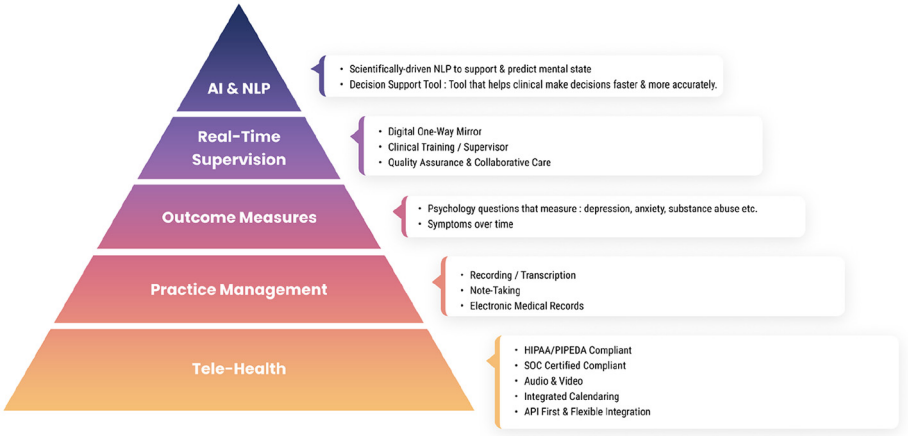
Using cutting-edge natural language processing (NLP) technology, Keel Mind is at the crossroads of mental health care and artificial intelligence (AI). The Keel Mind digital therapeutic platform assists in all aspects of the therapeutic process, from matching client to therapist, all the way to using AI and NLP technology to support clinician decision-making in therapeutic practice.

In outlining Keel Mind, Figure 1 is a helpful visual representation of the platform's features organized in terms of complexity and uniqueness. At the bottom of the pyramid are the privacy and security compliances that should be the basis of all tele-health platforms, moving to the top of the pyramid with Keel Mind's one-of-the-kind use of AI and NLP to assist in the therapeutic process, and inform clinician decision-making. Each of these features will be described in detail.

Tele-health service delivery, practice management and outcome measures

Keel Mind connects those in need of mental health support with a diverse range of mental health service providers through audio and video sessions. The matching algorithm, session delivery, in-session chat and outcome measures function to support Keel Mind in using digital technology to support positive clinical outcomes. Security is also integral to the platform which is Health Insurance Portability and Accountability Act (HIPAA), Personal Information Protection and Electronic Documents Act (PIPEDA) and Service Organization Control Type 2 (SOC2) compliant.

Tele-health: Privacy, confidentiality and security. Privacy and data protection are a focal point of Keel Mind. The platform is HIPAA compliant, with a commitment to protecting both personal identifiable information and personal health information. Keel Mind is committed to providing the best security frameworks to safeguard against data breach. Carefully constructed protections against hacking and data breaches are additionally put into place, for example, protection against hacking attempts is facilitated by creating



Source: Created by Keel Mind

Figure 1. Visual representation of the features of Keel Mind

unique tokens with each virtual room, which are destroyed upon the care provider leaving the room.

Practice management. When an individual enters the Keel Mind platform seeking support, a complex algorithm is used to match the client to a care provider based on client preference and clinician availability. Matching questions include client preference for clinician gender, age, ethnicity and area of therapy specialization (Figure 2). This matching algorithm allows those seeking help to customize their therapeutic experience and to feel more comfortable with their mental health-care provider. The self-selected matching ability used by the platform relates to the therapeutic alliance being matched on certain demographic factors, such as ethnicity, has been shown to improve responsiveness to therapy (Meyer and Zane, 2013).

Once the therapist and client are matched, a virtual chat and shared calendar are opened where preliminary communication can be facilitated, or an appointment can be made immediately. In the shared calendar, sessions can be booked, rescheduled or cancelled by either the therapist or the client.

Before a session, the therapist decides if a session will be recorded. Clients are made aware that sessions may be recorded when they initially sign up and provide informed consent to the terms of using Keel Mind. Recording is not a requirement and this feature can be turned off. If turned on along with transcription, this recording feature allows the clinician to revisit a session at a later date, and allows for the transcript of the session to be automatically generated.

When a session is started within Keel Mind, an in-session chat is opened where text communication can be facilitated or resources (e.g., psychology education content such as worksheets, website links and so on) can be shared (see Figure 3). For the care provider, in-session notes can be taken within the platform, which are time-stamped and can be later referred to. Information sent via chat or in-session notes is automatically saved to the client's digital record, which is kept directly within the Keel Mind platform, and can be accessed at any point along with client clinical outcome measures.

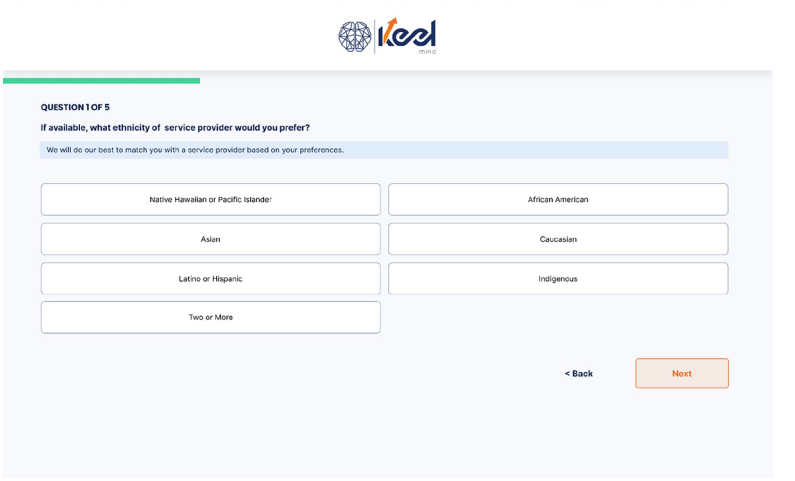


Figure 2.
Example matching question to assist in client–care provider pairing

Source: Created by Keel Mind

Source: Created by Keel Mind

Figure 3.
View of video meeting and chat feature

Clinical outcome measures. Prior to, or after a session, the care provider can assign a client a selection of validated measures, such as the Generalized Anxiety Disorder 7th Edition, the Patient Health Questionnaire (PHQ-9) and many others. The scores of these measures are calculated within the platform, and can be used to track progress and symptom changes over time. Figure 4 outlines the clinician's view of a clinical outcome measure completed by a client. Figure 5 shows how these measures can be used to track symptom reduction over time.

Real-Time digital supervision

Parallel to operating as a therapeutic platform to provide support to clients, Keel Mind additionally functions as a clinical training and supervision platform for graduate-level students, who operate as service providers to those seeking support. Keel Mind facilitates this process through tele-supervision, with supervision capabilities resembling a digital one-way mirror. From the view of the care provider, both their client and supervisor are visible on-screen during sessions (Figure 6). The view of the supervisor is similar, as they are able to view both care provider and client. However, the care provider is the only person who is visible to the client (see Figure 3; above). The client is fully informed and has consented to this process. During the session, the care provider and their supervisor can communicate via chat when necessary. This means that communication between supervisor-supervisee can occur during sessions, in real time, with minimal to no disruptions to the therapeutic alliance being built between the trainee and their client, while receiving feedback and direction/supervision.

All interactions occurring on the platform are private, securely stored and collated for effortless evaluation by the supervisor, allowing the supervisor full ability to track a trainee's progress. Because supervision can occur silently via chat message during a counseling session or asynchronously after a session, stronger rapport can be built between therapist and client, and conversational flow can be unencumbered and autonomy cultivated as the trainee can decide how, when and what feedback they will use. This has the potential to significantly impact our future practitioners as it encourages the development of clinical judgement.

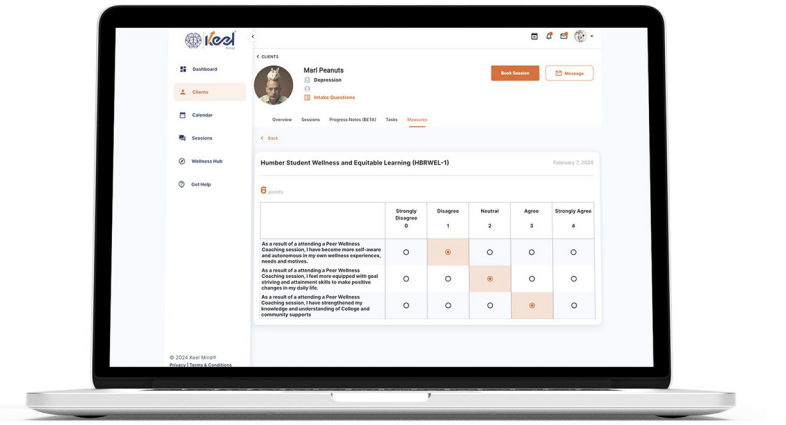


Figure 4.
Care provider view of completed client outcome measure

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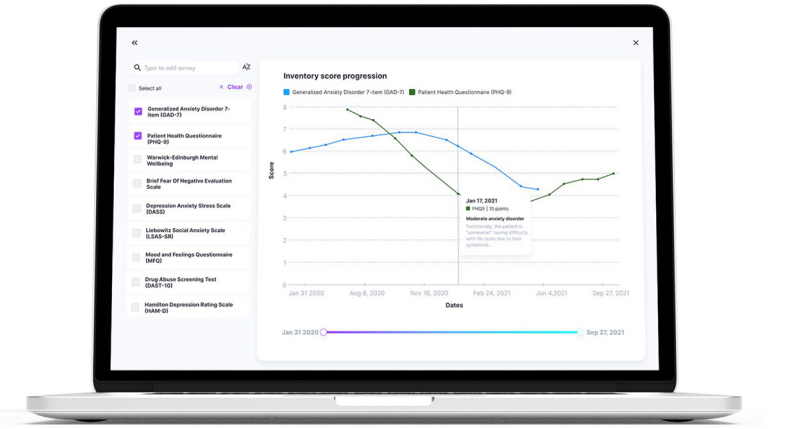

Figure 5.
Care provider view of outcome measures over time

Source: Created by Keel Mind

Natural language processing and artificial intelligence

Natural language processing within Keel Mind. The use of NLP is a feature that sets Keel Mind apart in the marketplace. Broadly, NLP refers to how words are used, how they are categorized, the frequency of word use within a conversation or body of text, and how these words allow us to discern what the text is about (LeCun *et al.*, 2015). This process is accomplished largely through linguistic inquiry and word count (LIWC), based on the work of Dr. Pennebaker at the University of Texas at Austin. Dr. Pennebaker's work is well-known in psychology as being at the forefront of language analysis related to emotions and psychosis, with over 30 years of empirical research and over 18,000 citations.

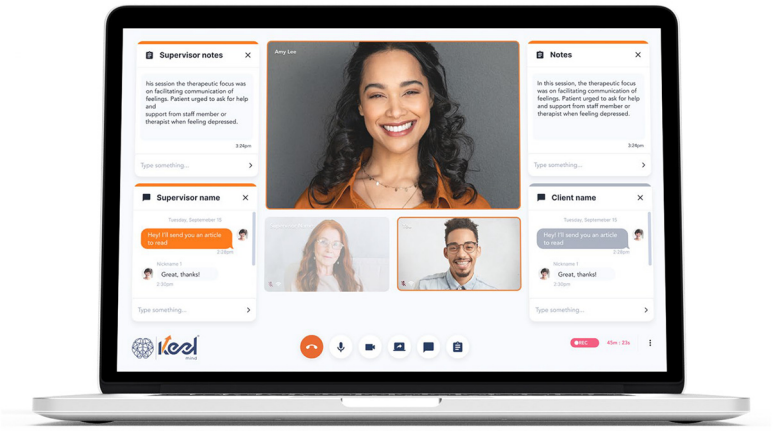

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Figure 6.
Supervisor view within a virtual session

LIWC is based on the theory that words reflect what is going on within the human. Dr. Pennebaker's work largely focuses on the creation of custom dictionaries built around word utilization to identify words that can offer insights into the expression of certain emotions – for example, anger words, sad words, words that are tied to depression and so on (Tausczik and Pennebaker, 2010). As an example, this type of language processing is able to determine if a client is dealing with depression based on the words that they use (Jones *et al.*, 2020). Those who are depressed use negative words and personal pronouns such as "me" and "I" significantly more than those who have never received a depression diagnosis (Jones *et al.*, 2020). LIWC has been established as a valid method for measuring verbal expression of emotion (Kahn *et al.*, 2007).

Keel Mind uses NLP and LIWC in the analysis of session transcripts to provide key therapeutic insights to support clinician decision-making. Following the completion of a session, a full transcript of the session is automatically generated in approximately 5 minutes. This transcript is broken down into increments and passively analyzed for linguistic patterns that provide valuable insights on the quality of care. After the session, messages and transcripts are automatically sorted, time-stamped and divided by speaker.

Keel Mind uses this NLP-driven data to provide Analytic Tabs, which provide objective insight and data visualization into key therapeutic factors throughout the session. Analytics are provided on rapport, empathy, inward/outward focus, authenticity and cognitive load.

Research into the science behind Keel Mind has been conducted across different age groups, including children and adolescents, however, analytical models and custom norms have not yet been established specifically for youth. Therefore, Keel Mind is currently being offered in adults world-wide.

Empathy. The *empathy* analytic provides a measure of how well each individual is able to understand and share the feelings of one another. To assess this, the language model assesses the degree to which the clinician identifies emotionality within the client, or expresses concern or sympathy. Additionally, language that indicates social detachment or

callousness is identified and used in creation of the *empathy* outcome variable score. Sharma *et al.* (2020) outline how this computational approach is used to understand how empathy is expressed. Empathy is an essential component in building rapport within the therapist–client relationship, and therefore has important implications for client outcomes (Sharpley *et al.*, 2006).

Inward/outward focus. *Inward focus* measures the degree to which a person's language is focused on themselves, whereas *outward focus* measures the degree to which a person is focused on others. Previous work demonstrates that a greater self-focus (inward focus) is indicative of depression and anxiety (Brockmeyer *et al.*, 2015; Jones *et al.*, 2020). The ability to track focus within language aids the clinician with the support tool to address mental health challenges more efficiently, functioning to save time, money and lead to reaching positive outcomes faster.

Authenticity. The *authenticity* measure evaluates when someone is speaking naturally and uninhibited or whether they are carefully curating their words. A person may change their language for multiple reasons, such as to be more easily understood, to align with expected tone or style, or to avoid mentioning specific subjects. When someone is communicating inauthentically they tend to distance themselves from their words. Authentic communicators tend to speak their mind, use their own language and care less about the specific words they choose to use. Understanding someone's reality at a given moment in the therapeutic session can provide crucial insight to their current mental state and their therapeutic journey.

Cognitive load. The *cognitive load* measure looks at the markers present in language that indicate someone is using increased mental energy to process environmental or situational stimuli. Words in this category are broad, and include certain adjectives (i.e. obvious, essential, specific), verbs (i.e. distinguish, suppose, consider), nouns (i.e. secret, question, findings), that reflect increased levels of cognitive processing. When individuals are trying to understand the world around them, they often use words that demonstrate this behaviour. If this mental processing is continuous or rigorous, it can increase an individual's cognitive load. This increase can occur due to the complexity or format of a task, time pressure, a significant event or change that impacts them and other factors. Elevated attentional demands can have a significant and negative impact on analytical thinking, decision-making and one's ability to carry out complex mental tasks.

Rapport. Rapport stands as the key metric influencing therapeutic outcomes. The connection between client and care provider is the cornerstone of effective communication. Simply put, stronger rapport leads to better therapeutic results (Sharpley *et al.*, 2006). The *rapport* analytic is based on language style matching theory, which states that when two people meet and start to get along, they start to match each other's language (Aafjes-van Doorn *et al.*, 2020). This automatic process is often done without conscious awareness and can be difficult for the therapist to pick up on when they are actively involved in a session. The *rapport* analytic, in checking for matched language, can offer insight as to when in the session the client and therapist were getting along to the greatest extent, and when potentially rapport may have faltered. With the session being broken down into small increments, the therapist can then revisit when rapport might have dropped and assess the context surrounding this change. This tool can therefore function to identify areas of sensitivity within the client and offer insight into the therapeutic bond.

Outcomes of NLP-driven tools. Keel Mind's NLP-driven analytics can assist clinicians and trainees in informing decisions on the progress and delivery of therapy. This is not only done by the trainee, but can be assessed by the supervisor who is overseeing the trainee. Both trainee and supervisor can view these analytics, which provide objective

data on whether the client is successfully facilitating therapeutic progress within the client. Sharpley and colleagues (2006) state that over 80% of positive therapeutic outcomes may be due to critical elements such as the therapist exhibiting warmth, empathy, and respect for the client. The NLP-driven analytics elucidate these therapeutic factors that are sometimes difficult to assess from the parties involved. This means that if the analytics determine that rapport is low or does not exist, clinicians can be switched. This functions to save time on the part of both client and care provider, while promoting positive client outcomes faster.

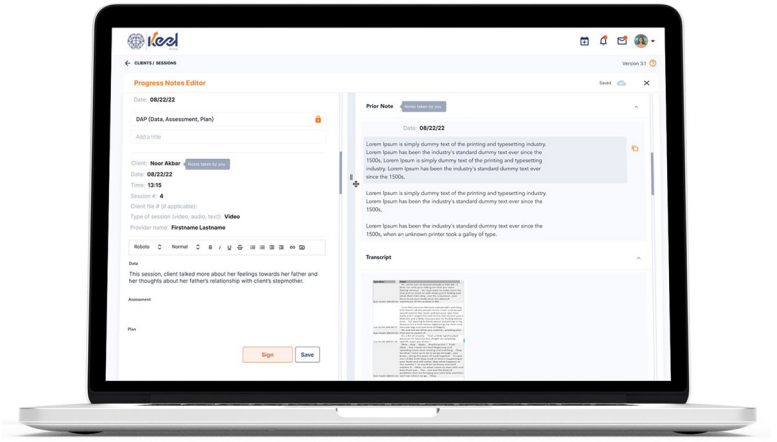
Keel Mind additionally holds the capability to track these trends over time. Training on how to interpret the analysis from a single session, as well how to interpret analytical trends over time from multiple sessions with the same client are provided to clinicians and trainees so they can derive the greatest value from this feature.

This automatic processing of transcripts and NLP-driven analytic tool function to not only strengthen clinical outcomes, but additionally decreases the burden on supervisors and trainees to rely on manual note-taking during a session or transcribing a session for their supervisor after the fact. This feature therefore reduces the laborious and time-consuming process of training and supervision, making it easier and more efficient.

Artificial intelligence within Keel Mind. At the intersection of mental health and technology, Keel Mind uses cutting-edge AI technology in the form of the Progress Note Assistant. The Progress Note Assistant is designed to streamline the process of creating client progress notes.

After a session, when the Progress Notes Editor is opened, client and session information is pre-filled (see Figure 7). The clinician can choose from a variety of standardized note templates (e.g. a SOAP note) to ensure that their notes are in the correct and preferred format. From the collapsible menu on the Editor, the clinician can review automatically populated information based on the transcript of the session.

Prior note allows the clinician to quickly refer to their prior session notes as a point of reference to the current session. *Transcript* allows the clinician to access the entire session transcript of the therapy session – divided by speaker (e.g. client and therapist).



Source: Created by Keel Mind

Figure 7.
Progress Notes Editor

The *transcript summary, subjective, objective* and *analytics* menus are where the power of AI is used most extensively. In *transcript summary*, Keel Mind's AI engine uses the full transcript to extract a concise summary of the therapeutic session. *Subjective* points will capture any statements made by the client referring to thoughts and behaviours. *Objective* points will capture observable, quantifiable and measurable data about the client. *Analytics* presents a summary of the NLP-driven insights mentioned in the "Natural Language Processing within Keel Mind" section, allowing the clinician to track trends, identify areas of improvement and make data-driven decisions to optimize care plans.

The intention of the Progress Note Assistant is to allow clinicians to spend less time with administrative tasks, and more time with their client. Not only does this promote the efficacy of the therapeutic process, but can additionally help to counter the ongoing issue of lengthy waitlists to receiving therapeutic services (Cohen *et al.*, 2022; Hadler *et al.*, 2021). The implementation of NLP and AI within the Keel Mind platform therefore does not only promote client outcomes within the platform, but assists in addressing the long-term supply and demand issue that exists within mental health services. In promoting the efficiency of the therapeutic process, and developing a platform to train high-quality clinicians, Keel Mind is addressing the global mental health crisis head-on.

Current impact and future directions

Following the pandemic and the increased need for digital mental health support tools, tele-psychology has emerged as a novel and valuable resource in the promotion of mental health service delivery. In the post-pandemic world, the field and practice of tele-psychology, and digital therapy in particular, continues to be a powerful tool in increasing accessibility and availability of psychological services.

The digital mental health platform Keel Mind functions to provide accessible service, efficiently train high-quality clinicians, and enhance clinical outcomes for clients. In a preliminary study based on a sample of post-secondary students from Ontario, Canada, 90.1% of clients reported liking the platform, and 83.4% reported that they experienced positive mental health outcomes as a result of using Keel Mind.

NLP and AI technology within the platform assist in informing clinician decision-making, as well as minimizing the time-consuming administrative burden faced by mental health service providers. Keel Mind ensures that clinicians are spending less time with paper, and more time with their client.

The further utilization of contemporary NLP and AI technology within the Keel Mind platform is in continuous development. The current next step for Keel Mind is investigating additional mechanisms beyond text and voice – particularly, looking at *how* words were spoken in the form of prosody and vocal intonation. A large body of literature demonstrates that frequency, intonation and pauses offer insight as to an individual's thoughts, feelings and mental state (see: Frick, 1985; Gaikwad and Venkatesan, 2024). Bringing the NLP-driven analytics and prosody analysis together offer multiple unique markers to develop a deeper understanding of client emotionality and well-being. With the addition of prosody analysis, Keel Mind's technology will go beyond simple spoken word, which may not always capture the full picture of client well-being. This fully-informed analysis can inform how the clinician makes decisions regarding their therapeutic practice and can promote client outcomes.

Summary

Keel Mind is a digital mental health platform at the intersection of mental health care and cutting-edge technology. From personalizing client and therapist matching to using NLP-

based clinical outcome variables and Note Assistant, Keel Mind supports clinician decision-making to meet the growing mental health needs of our population. In the rapidly developing field of tele-psychology, Keel Mind stands tall as a leader and aims to promote positive mental health outcomes worldwide.

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