Addressing the Kaleidoscope of Pain using Digital Health & Patient-Reported Outcomes

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Treating pain safely and adequately has become a significant undertaking in the medical community. This undertaking has required us to answer the questions: What exactly is pain? What factors contribute to it? How do we treat underlying issues concurrently with pain? With these questions in mind, the University of Colorado at Boulder Cognitive Affective Neuroscience Laboratory began a study into the correlation between emotions and chronic back pain through a jointly developed digital platform, cliexa-EASE. The goals of the study were to develop a pure pain tracking application that went beyond traditional pain scales and diaries and to understand interactions between pain medications, emotions, and bodily experience to optimize chronic pain patients' treatment.

The Problem

Chronic pain affects 30% of the current U.S. population, costs us $600 billion annually in lost productivity, and is a main cause of opioid use disorder. Mental health disorders are also pervasive. Recent scientific advances have made it clear that these different conditions are not independent, and are caused by common brain systems underlying emotion, mood, and motivation. Chronic pain patients show an abnormal and maladaptive response to life stressors, resulting in depression, anxiety, and a reduction in positive emotion. These changes, in turn, amplify pain, creating a vicious cycle of increasing disability (1-4). Early detection of dysregulated emotion patterns and their monitoring over time is a key to treating mental illness and chronic pain while they are still reversible. At the forefront of these efforts will be technologies for allowing healthy individuals and patients to easily make multidimensional assessments of pain and emotion.

For physicians, the management of chronic pain and mental health is increasingly involved with a wide range of treatments to manage, some requiring extensive oversight, while also treating psychological symptoms. This process creates a web of electronic desk work, regulatory procedures, and an increased time commitment from physicians and medical staff. One study found that physicians are spending 49.2% of their typical day on EHR and desk work and only 27% is spent on patient interactions (5). In 2015, a Mayo Clinic study found physician burnout to be at 54%, a 10% increase from 2011 (6). Apart from this, regulatory mandates for physicians have increased due to the opioid crisis, thus prescribing liabilities and patient monitoring are both a growing part of physician's lives who treat and manage pain.
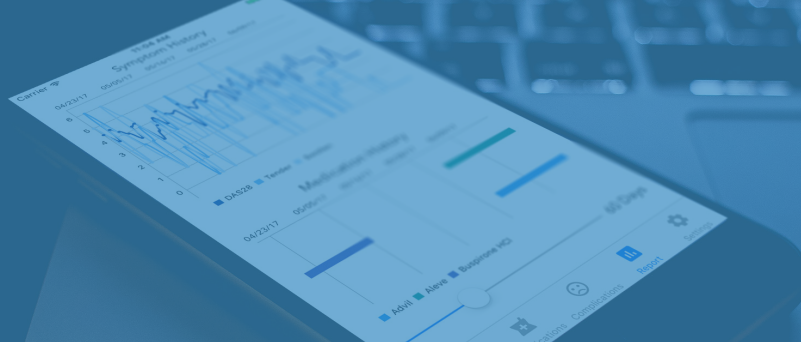
Approach

cliexa-EASE utilized four metrics to identify these interactions. 1) Self-reported assessments to track pain and emotional status. 2) Video and voice detection of emotions using AI. 3) Emotion and pain body maps to allow patients to assign feeling and pain to specific parts of the body. 4) Medication tracking and adherence.

Results

In current collaborative research, we test the efficacy of novel psychological treatment for chronic back pain. Patients use **cliexa-EASE** app to report their pain and various emotions, showing also their body location by drawing. Our current analysis of the data collected by **cliexa-EASE** (N=68) shows a significant decrease in pain levels, negative emotions with an increase in positive emotions in the treatment group (Fig. 1).
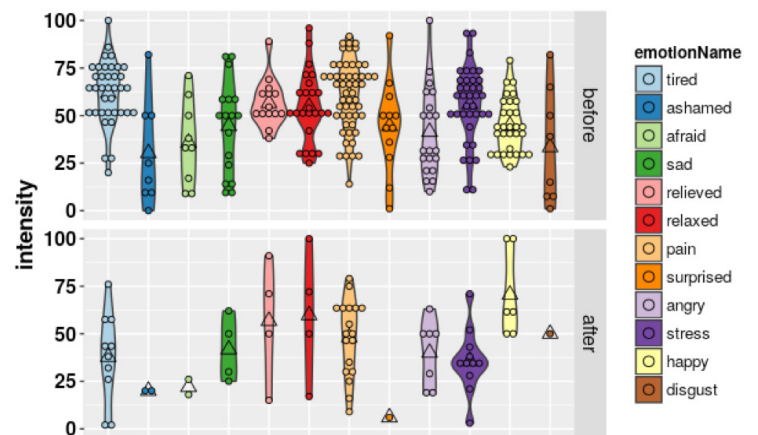

Figure 1. This figure is a representation of cliexa-EASE data from the first feasibility study (68 chronic pain patients). The ratings of pain, "tired", and "stress" decreased but "happy" goes up as a result of a novel pain therapy. Upper/low subfigure: reported emotions and pain levels.

Benefits

Utilizing patient reported outcomes (PRO) and advanced pain detection technology to make intelligent correlations about underlying causes of pain has the potential to improve clinical decision-making regarding treatment choices for pain significantly. The benefits of remotely monitoring patients are long understood, and now by providing a tool that allows patients to communicate pain in their terms, patient engagement can also be addressed.

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