



Transforming Care Management Through AI-Driven Analysis of Calls for Depression

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A shifting healthcare landscape is moving towards personalized and data-driven care management.

Within this care transformation, Ceras Health and Ellipsis Health began a partnership to better understand and support the mental health of chronically ill patients by using artificial intelligence (AI). [Ceras Health](#) is a renowned player in the healthcare industry, known for its commitment to improving patients' lives through innovative approaches and technologies.

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With an extensive track record of serving a vast number of patients with its Digital Transitions of Care and AI/ML-enabled monitoring technologies, Ceras Health excels in patient engagement. [Ellipsis Health](#) is a healthcare technology company that uses AI-generated vocal biomarker technology to harness the human voice for earlier and better identification, assessment, and monitoring of clinical anxiety and depression. Its proprietary models and AI solutions – that use both the words people say and their acoustic properties – have been developed to accurately identify and assess depression and anxiety symptom severity from patient phone calls. The companies have partnered to analyze patient calls at scale to identify and address undiagnosed depression in individuals participating in care management.

“By tapping into voice, Ellipsis Health anchors into a physiological marker that is readily available, time efficient, and valid,” said Victor Carrion, MD, a clinical leader at Ellipsis Health and Vice-Chair of the Department of Psychiatry and Behavioral Sciences at Stanford University School of Medicine. “This approach will contribute to improved access to care for vulnerable populations.”

The Problem with Detecting Depression

A multitude of barriers exist that make early detection and monitoring of mental health conditions extraordinarily challenging. These challenges lead to lengthy delays and gaps in care, negatively impacting healthcare organizations and, ultimately, patients and their families.

- A substantial portion of individuals with chronic diseases silently wrestle with undiagnosed depression and anxiety globally. The prevalence of comorbidities of mental disorders with chronic diseases in the US is 27%, highlighting the pervasiveness of these silent struggles.¹ The relationship between mental and physical health is clear; Individuals with chronic diseases have higher rates of mental health disorders, while individuals suffering from mental health disorders have a greater risk of developing chronic diseases.²
- Mental health disorders within chronically ill populations significantly contribute to increased morbidity and mortality rates.³ Studies show that patients with major depressive disorder live 25 to 30 years less than the general population.⁴ Individuals with untreated mental health conditions face an increased risk of premature death, frequent hospitalizations, and a diminished quality of life.⁵
- Individuals with depression are less likely to engage with care management programs, follow their total care plan, and participate in health behaviors. The literature states that social isolation – a common symptom of depression and anxiety that affects 20-34% of older people globally⁶ – leads to increased hospital utilization, longer stays, and adverse outcomes.⁷



- The stigma surrounding mental illness continues to persist and exists in multiple forms, impacting individuals in various ways. Self-stigma affects how individuals perceive themselves and their condition, while public stigma affects how others think about or act towards a person with mental illness. Institutional stigma refers to the systemic issues and discrimination towards individuals with mental health diagnoses. In a 2018 study involving over 1,000 individuals, over 31% expressed the belief that a weak personality leads to depression, and the associated stigma may hinder them from seeking help or continuing with treatment.⁸ Recognizing the extensive impact of stigma is crucial because it significantly contributes to many individuals avoiding the essential help they desperately require. Not only are numerous individuals hesitant to disclose symptoms of depression to a care manager over the phone, but some may even struggle to acknowledge it within themselves.⁹
- Existing tools for screening for mental health, such as the Patient Health Questionnaire (PHQ) and the Generalized Anxiety Disorder (GAD) scale, are imperfect tools. Surveys have limitations that lead to over-reporting or underreporting symptoms.¹⁰ Furthermore, these measures take time to administer and score verbally and are often incorrectly delivered. Ellipsis Health has found that it can take an average of 20% of a call to verbally administer the PHQ, which is valuable time a care manager could spend engaging the patient in healthy behaviors and care planning. Verbal administration of such surveys also disrupts conversational flow and rapport due to the requirement of verbatim delivery and answer format.

The bottom line is that until now, there has been no efficient, objective, reliable, and scalable way to screen for depression and anxiety in this population.



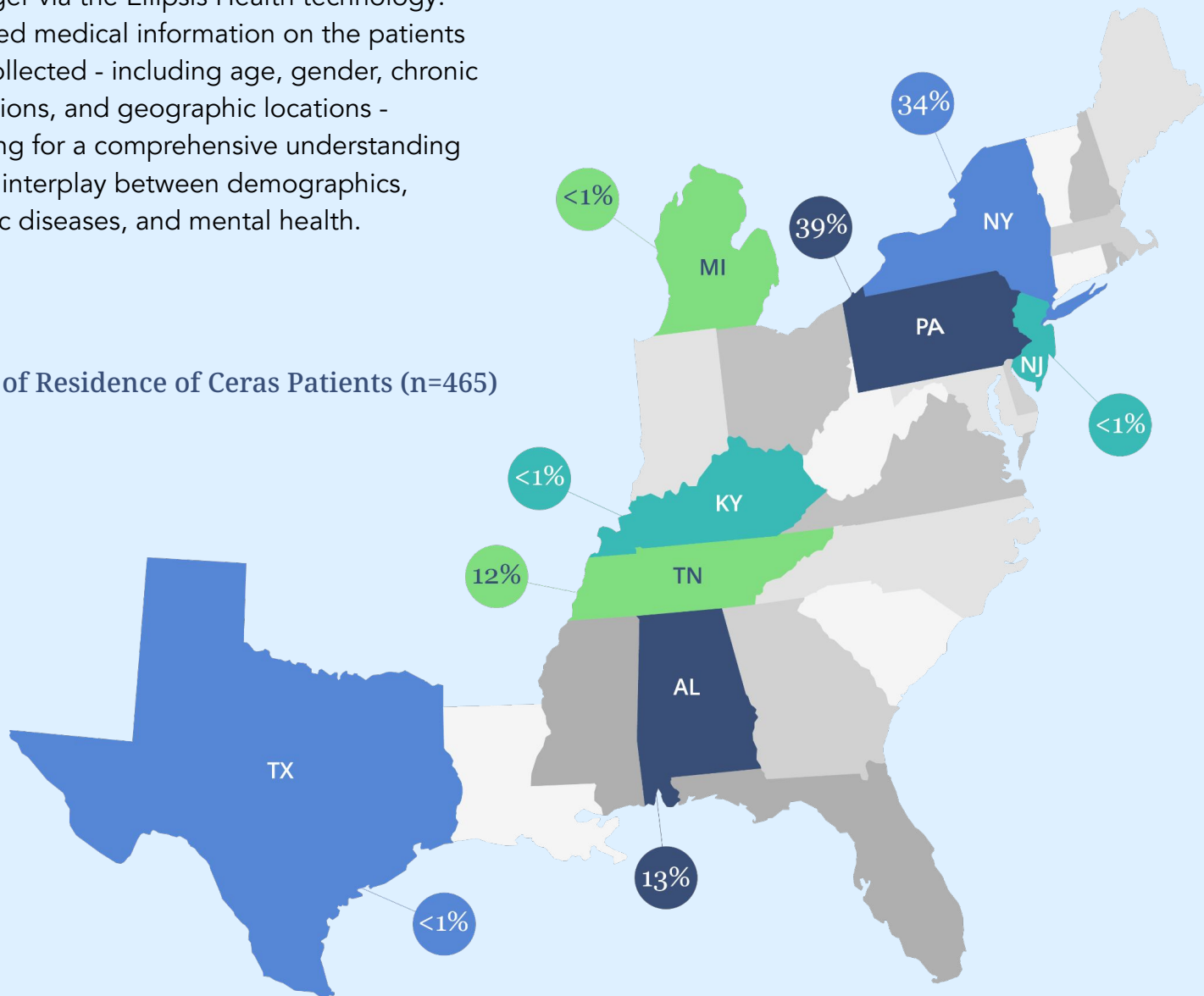
The Solution in Action

In response to these challenges, the partnership between Ceras Health and Ellipsis Health harnesses the power of AI to provide a revolutionary solution for detecting signs of depression at scale. Through the partnership, a significant number of patients in care management have been evaluated, shedding light on the true prevalence of undiagnosed depression within this population and opening the door for patients to heal sooner.

This study screened 465 patients who had a care management call with a Ceras care manager via the Ellipsis Health technology. Detailed medical information on the patients was collected - including age, gender, chronic conditions, and geographic locations - allowing for a comprehensive understanding of the interplay between demographics, chronic diseases, and mental health.

The patients' ages ranged from 37-98 ($M = 75$, $SD = 9.52$), with 59% female ($n=276$) and 41% males ($n=189$), over a range of social vulnerabilities as expressed using the Social Vulnerability Index.¹¹ These individuals lived in the northeast and southern regions of the United States, with 98% of the study sample from four states (Pennsylvania, New York, Alabama, and Tennessee).

State of Residence of Ceras Patients (n=465)

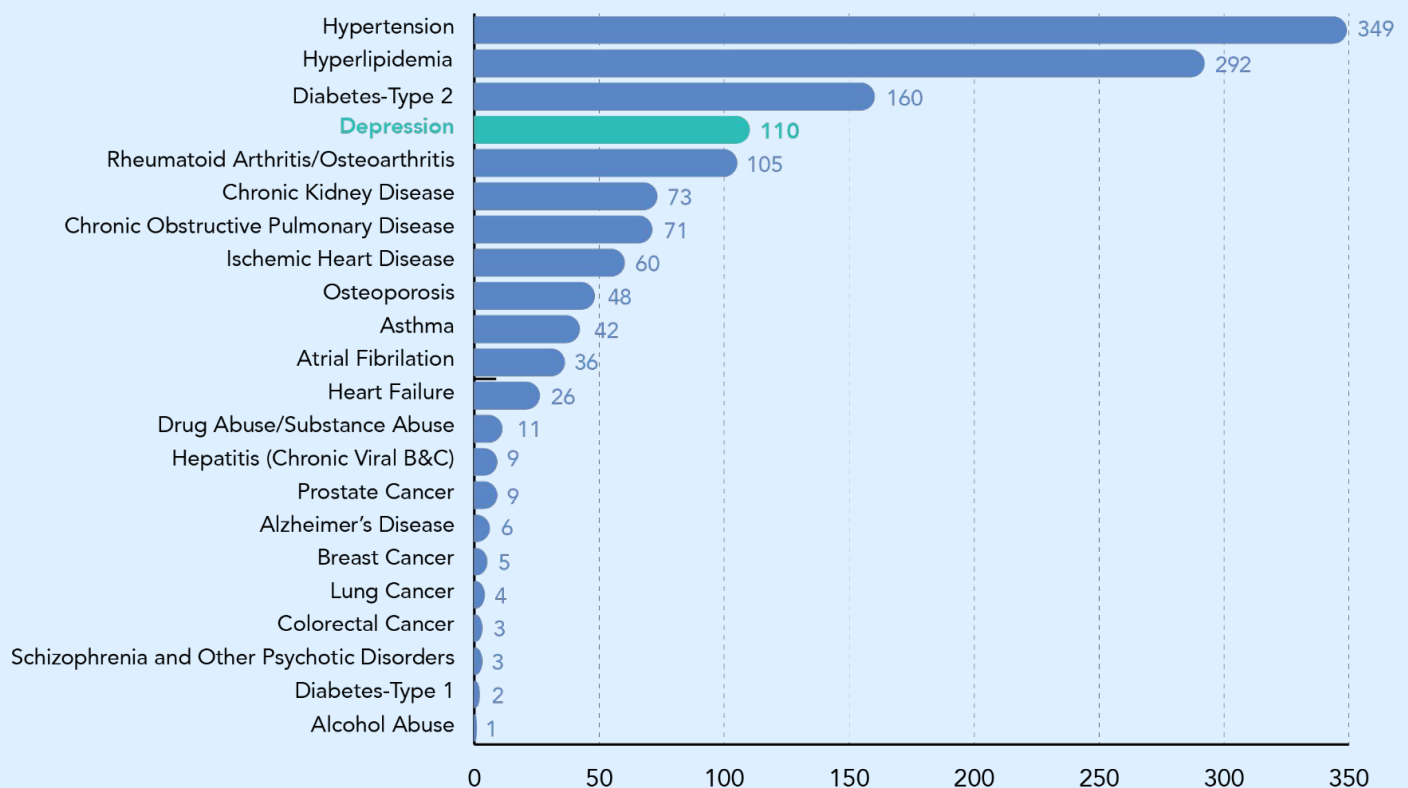


Based on the companies' analysis, many patients had more than one chronic condition and as many as ten. The most common chronic conditions experienced by patients were Hypertension, Hyperlipidemia, Diabetes, Rheumatoid Arthritis, and Depression.

Number of Chronic Conditions Experienced by Patients

# of chronic conditions	Total patients (n=465)	Percent
1	53	11.4
2	129	27.7
3	138	29.7
4	83	17.8
5	38	8.2
6	16	3.4
7	3	0.65
8	4	0.86
9	0	0
10	1	0.22

Types of Chronic Conditions Experienced by Patients



Number of Patients (n=465)

Depression symptom severity was obtained using Ellipsis Health AI-enabled technology that takes into consideration the words people say (Natural Language Processing model) and how they say them (acoustic model).

Of the 465 individuals screened by Ellipsis Health using just patient voice, 24% (110) were identified as having signs of depression that could potentially be contributing to poor health outcomes and high costs of care.

Of these individuals with depression, 79% had two additional chronic conditions and 22.7% had between four to six additional chronic conditions.

Combination of Comorbidities with Ellipsis Health Identified Depression

# of chronic conditions in addition to depression	# of people	% of sample with depression (n=110)	% of total sample size (n=465)
1	23	20.9	4.9
2	35	31.8	7.5
3	27	24.5	5.8
4	14	12.7	3.0
5	8	7.3	1.7
6	3	2.7	0.6

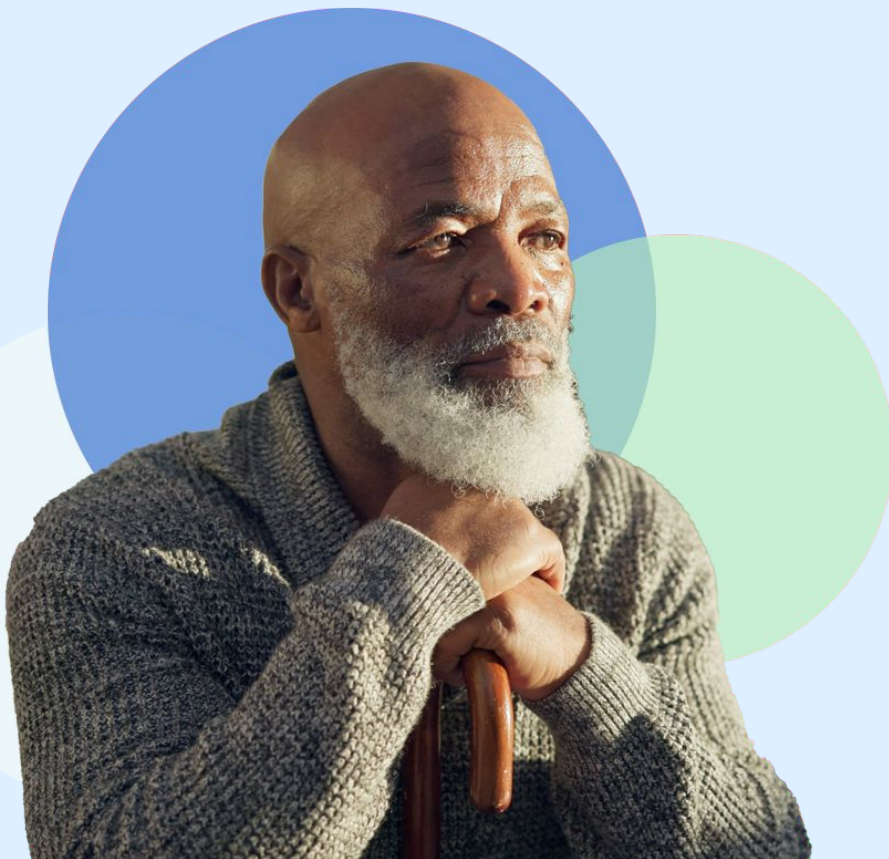


Mimicking depression severity distribution of the general US population, a higher number of individuals were identified with mild depression symptom severity and the fewest with severe symptom severity. It is important to note that mild depression is still serious as it can be debilitating and negatively impact individuals' ability to function.

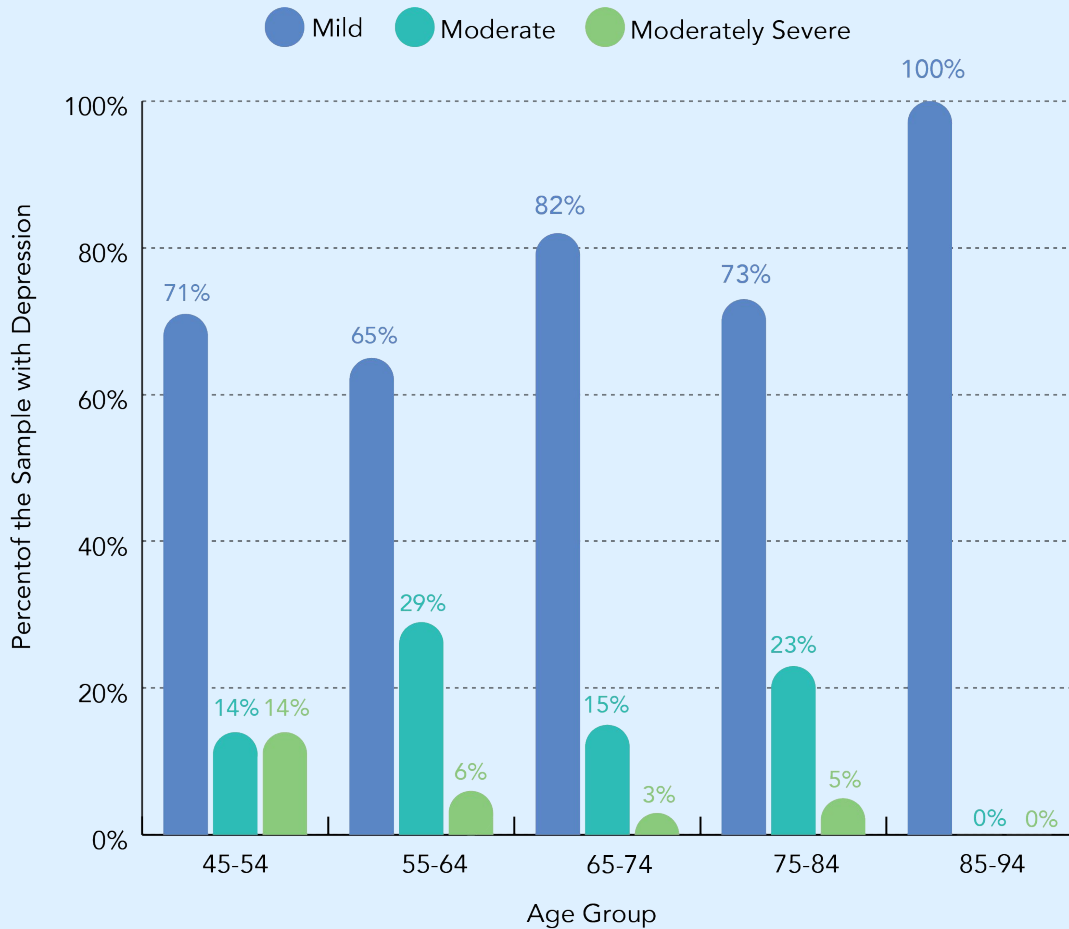
Co-morbid depression and chronic conditions increase with age. According to Dr. Jules Rosen, a renowned psychiatrist, geriatric psychiatrists are aware of the concept of masked depression. He explains, "Instead of complaining of sadness, hopelessness or anhedonia, these elderly patients complain of worsening physical symptoms such as pain, GI distress, or weakness. Seniors complain of 'feeling sick' when they are depressed because that is what they actually feel. Identifying a mood disorder in seniors complaining of worsening symptoms of chronic illness is a clinical challenge that could benefit from AI and other technological advances."

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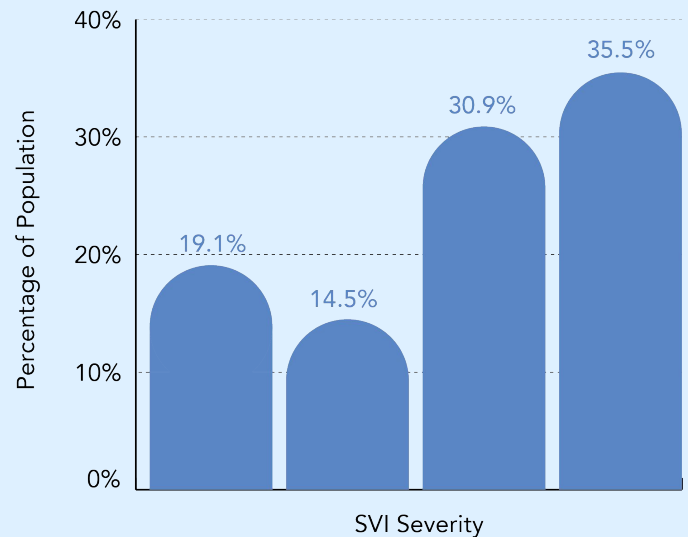


Ellipsis Depression Classification within Age Group



Astoundingly, 66.4% of the 110 individuals identified with signs of depression live in communities that are in the third and fourth tier of SVI as seen in the graph to the right.

In other words, a majority of the individuals identified live in a community that makes them vulnerable to poor health outcomes. The number of chronic conditions and type of living environment indicated by the SVI distribution indicates difficulties patients face in not only getting to their appointments, obtaining their medications, and having a safe place to live but also in dealing with their depression, which makes it more difficult to think clearly, have energy, and perform basic activities of daily living.



Looking Towards the Future

This AI-powered analysis has yielded crucial insights into the prevalence and severity of depression. The population health implications of implementing this solution on a larger scale are far-reaching.

Scaling this solution could prevent a significant number of hospitalizations, reducing the burden on healthcare systems and improving patient quality of life. Moreover, a reduction in hospitalizations could lead to substantial cost savings. Ceras Health has proven outcomes in reducing hospital readmissions from 20.1% to 13.1% and length of patient hospital stay from 5.9 to 3.2 days, thereby delivering significant financial savings for the patients and the hospital systems. The World Health Organization estimates that for every \$1 invested in treating depression and anxiety, there is a return of \$4 in improved health and productivity.¹² Additionally, behavioral utilization is associated with medical and pharmacy savings of up to \$2,565 in the 15 months post-diagnosis.¹³ The numbers speak for themselves but the impact of early detection also has unquantifiable and significant effects on the individual, caregiver, family, and community who care for the individual.

Supporting the behavioral health of a person supports their overall health and wellness. Identifying and treating depression contributes to increased life expectancy among individuals with chronic diseases, enabling them to enjoy more years of good health. The literature also reveals that treating depression and anxiety can lead to an increase in life expectancy for individuals with comorbid chronic diseases.^{14 15}



This collaborative process demonstrated by Ceras Health and Ellipsis Health can be utilized by healthcare organizations to provide additional information and resources to care teams managing patients with chronic conditions. This project may be used as a blueprint, helping providers to understand their patient populations better by identifying those who may be dealing with depression and anxiety along with chronic conditions, and thus, offering much-needed support to those who are not raising their hands for help or do not even realize they are struggling with mental health.

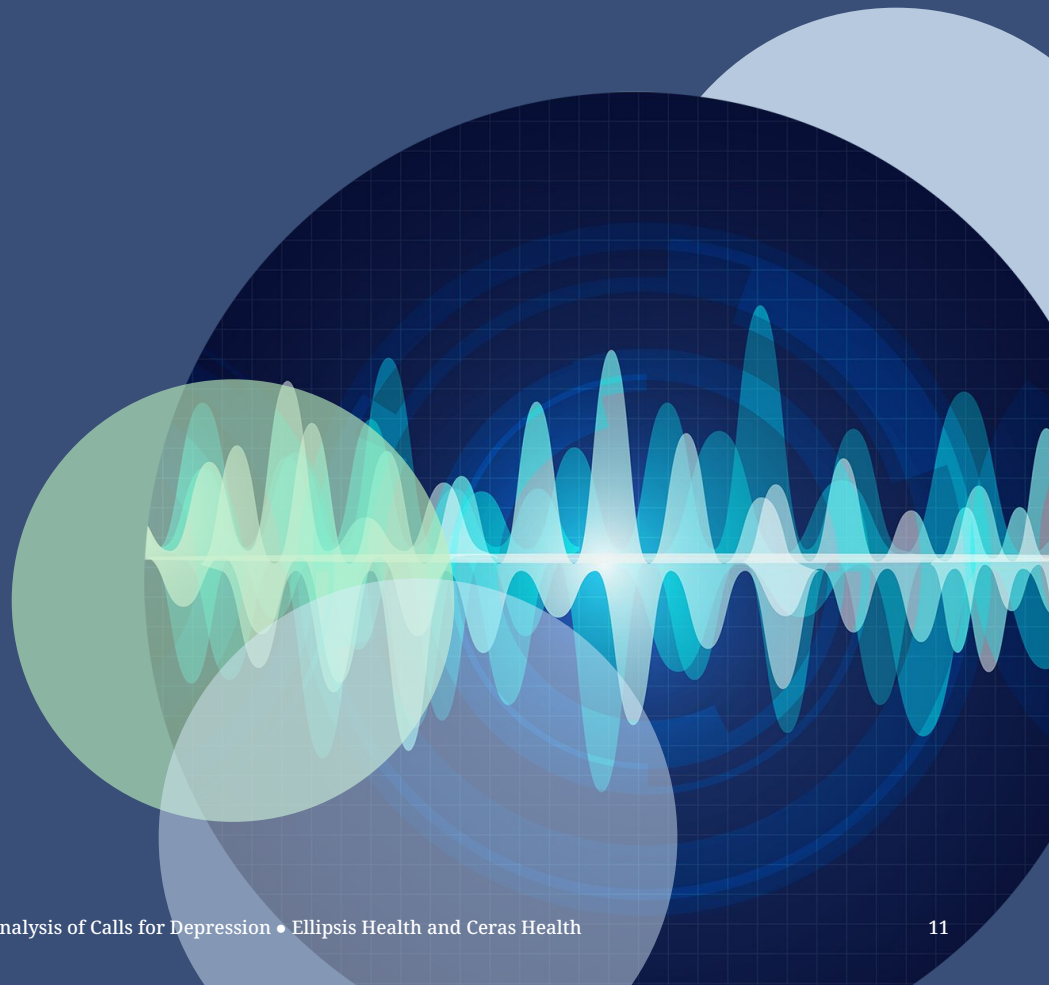
Illustrating the transformative impact of technology in healthcare, the partnership demonstrates how voice technology acts as an early detector and preventative tool to support not only behavioral health but whole-person care, specifically within the domain of care management for individuals with chronic diseases. By harnessing the power of AI to identify and address undiagnosed depression in individuals with chronic medical conditions, this partnership establishes a revolutionary new model for approaching mental health in healthcare.

The possibilities for improved patient outcomes, reduced healthcare costs, and enhanced quality of life are boundless.





Request a demo to learn more about how Ellipsis Health can transform patient care by identifying depression severity at scale.



Citations

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