Clinical Research Summary

Background

Depression is one of the most common mental health disorders among adolescents with continued increases in prevalence.[1] Pediatric primary care guidelines recommend that all adolescents be screened for depression annually,[2] but effective treatment options and immediate access to specialized mental healthcare are often limited. Limbix SparkRx[a] is a 5-week, self-guided, cognitive behavioral therapy (CBT)-based, digital therapeutic mobile application designed to adjunctively treat depressive symptoms in adolescents within primary care settings. To evaluate the clinical effectiveness of Limbix SparkRx as a treatment for depressive symptoms during the COVID-19 pandemic, a virtual randomized controlled trial (RCT; NCT04524598) was conducted to compare Limbix SparkRx to an active control mobile app.

Methods

A community sample of 121 eligible adolescents (81 female; 26 male; 14 non-binary), aged 13-21, with self-reported moderate to severe symptoms of depression were recruited nationwide to participate in the virtual RCT.[b] Participants were randomly assigned to use either the SparkRx (N=63) or the control app (N=58) for the five week intervention period. Participants and their legal guardians (if under 18) completed pre and post-intervention questionnaires evaluating depression and anxiety symptoms and global health. Participants also completed weekly in-app PHQ-8 assessments. Intervention-related changes in depression symptoms (PHQ-8) and app usage were evaluated.

a These claims have not been validated by the US FDA with regard to the safety or efficacy of Limbix SparkRx. Limbix plans to release the initial version of SparkRx per https://www.fda.gov/media/136939/download in 2021

b 40 additional participants were enrolled to provide access to the device during COVID-19 but they were not a part of the pre-specified target population.

Clinical Research Summary (cont.)

Results

Efficacy: Participants who received SparkRx showed a clinically meaningful reduction[3,4] in depression symptoms (Figure 1a). At the end of the study, 24% of SparkRx participants showed a treatment response[c] and 17% were in remission.[d] For participants that consistently engaged with their assigned program (N=83), SparkRx led to a statistically significant reduction in depression symptoms compared to Control ($p = 0.023$) and a 21% remission rate compared to a 4% remission rate for Control at the end of treatment (Figure 1b). Treatment response rates were 29% and 16%, respectively, for SparkRx and Control. The intention-to-treat analysis comparing SparkRx to Control was not significant.

Adherence- SparkRx participants only: There was high engagement with SparkRx compared to depression apps evaluated in research and real-world settings (Figure 2). Mean participant adherence was 3.17 (63.5%) of 5 expected program modules.

Safety - SparkRx participants only: No participants experienced a serious adverse event or unanticipated adverse device effect.

Conclusion

Limbix SparkRx reduces depression symptoms in adolescents and is a safe and engaging means of treating depression. As adjunct treatment, Limbix SparkRx can serve as an immediate and readily available treatment for depression symptoms and increase critical early access to mental health care for adolescents.

c Treatment response defined as a post-intervention PHQ score < 10 and 50% less than baseline PHQ score.[5,6]
d Remission defined as a post-intervention PHQ-8 score < 5.[5,7]

Clinical Research Summary (cont.)

Figure 1. Clinical Outcomes: Treatment related change in depression symptoms (PHQ-8)

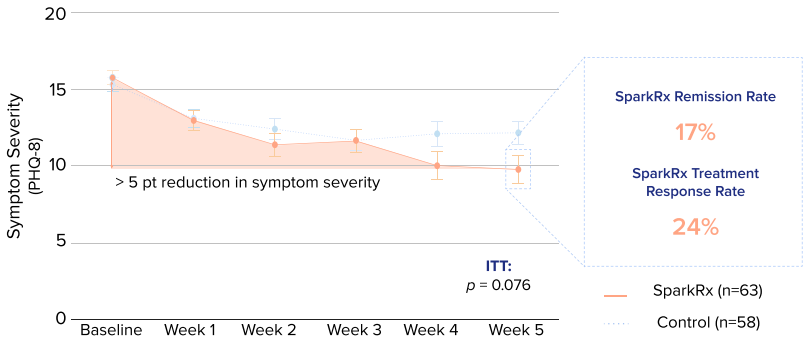

Figure 1a: Participants who received SparkRx showed a clinically meaningful reduction in depression symptoms. At the end of the study, 24% of SparkRx participants had a treatment response and 17% were in remission (intention-to-treat analysis).

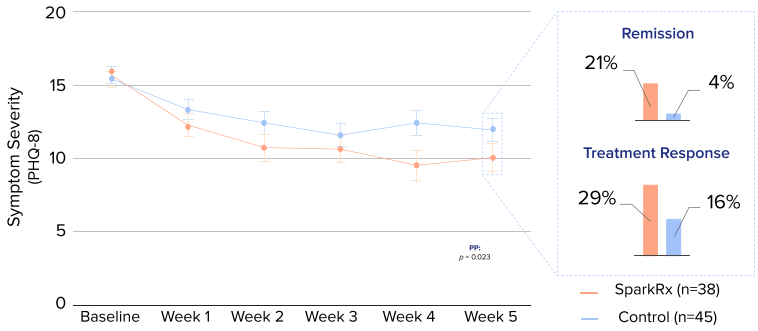

Figure 1b: For participants that consistently engaged, SparkRx led to a statistically significant reduction in depression symptoms compared to Control (p = .023) and a 21% remission rate compared to a 4.1% remission rate for Control at the end of treatment (per-protocol analysis).

Clinical Research Summary (cont.)

Figure 2. SparkRx engagement and adherence

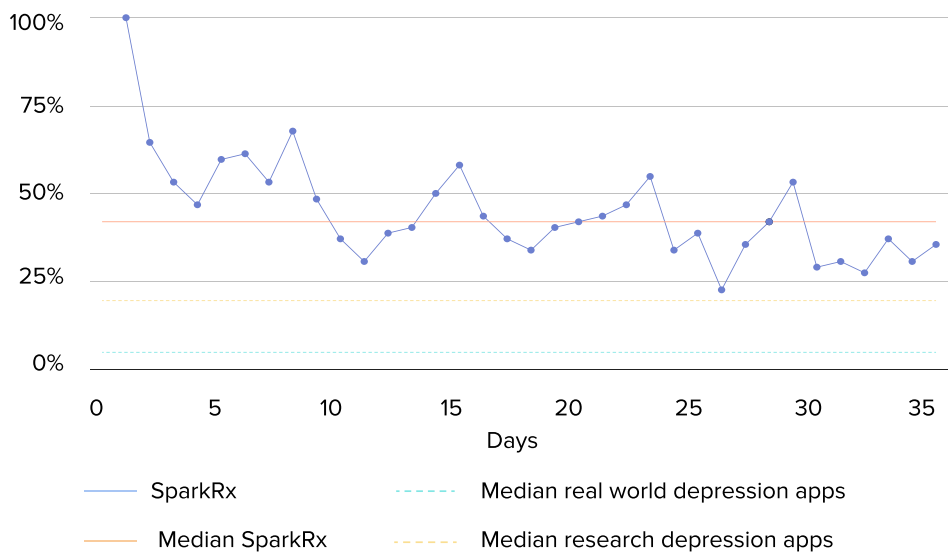

Figure 2: Percent Daily Usage. SparkRx app usage was higher than depression apps both in research and real-world.

References

1. Keyes, K. M., Gary, D., O'Malley, P. M., Hamilton, A. & Schulenberg, J. Recent increases in depressive symptoms among US adolescents: trends from 1991 to 2018. Soc Psychiatry Psychiatr Epidemiol **54**, 987-996, doi:10.1007/s00127-019-01697-8 (2019).

2. Cheung, A. H., Zuckerbrot, R. A., Jensen, P. S., Laraque, D. & Stein, R. E. K. Guidelines for Adolescent Depression in Primary Care (GLAD-PC): Part II. Treatment and Ongoing Management. Pediatrics **141**, e20174082 (2018).

3. Löwe, B., Unützer, J., Callahan, C. M., Perkins, A. J., & Kroenke, K. Monitoring depression treatment outcomes with the patient health questionnaire-9. Med Care, **42**, 1194–1201 (2004).

4. Donkin, L., et al. Rethinking the dose-response relationship between usage and outcome in an online intervention for depression: randomized controlled trial. J Med Internet Res, **15**, e231 (2013).

5. Forman-Hoffman, V. L., et al. Significant reduction in depressive symptoms among patients with moderately-severe to severe depressive symptoms after participation in a therapist-supported, evidence-based mobile health program delivered via a smartphone app. Internet Interv, **25**, 100408 (2021).

6 Kroenke, K., Spitzer, R. L., & Williams, J. B. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med, **16**, 606–613 (2001).

7. Coley, R. Y., Boggs, J. M., Beck, A., Hartzler, A. L., & Simon, G. E. Defining success in measurement-based care for depression: A comparison of common metrics. Psychiatr Serv, **71**, 312–318 (2020).