Addressing Mental Health in Orthopedic Care

CPMH R03: Protocol

Principal Investigator:

Abby Cheng, MD

Version Date/Number:

January 11, 2022/ Version 4

TABLE OF CONTENTS

A Introduction

A1 Study Abstract

Depression and anxiety heighten musculoskeletal pain and negatively impact outcomes after orthopedic surgery. This phenomenon is especially prevalent in older adults. Our ongoing pilot work demonstrates promise that an established digital mental health intervention (Wysa) can improve orthopedic patients' mental health symptoms, but we also encountered implementation barriers related to discussing mental health in an orthopedic setting. The long-term goal of this line of research is to enable the provision of true comprehensive care to improve both the physical and mental health of orthopedic patients. The goals of this project are to address the implementation barriers we encountered in our ongoing pilot work and to prepare for a definitive trial to assess the effectiveness of a digital mental health intervention in the context of orthopedic care.

The specific aims are to:

1.) identify the contextual determinants of implementation success for addressing patients' mental health in the context of orthopedic care ;

2.) conduct usability testing for two mental health interventions which can feasibly be implemented in a real-world orthopedic setting: a digital mental health intervention (Wysa) and a novel printed resource guide; and

3.) identify the intermediate mechanisms through which a digital mental health intervention (Wysa) improves mental health symptoms in orthopedic patients. Using standard qualitative methods and guided by the Consolidated Framework for Implementation Research (CFIR) and the COM-B model of behavior change, two stakeholder groups will be interviewed: orthopedic providers and older adult orthopedic spine patients.

In addition to addressing specific needs and preferences related to discussing mental health in the setting of orthopedic care, patient stakeholders will complete usability testing of Wysa and of the novel printed guide of local and online mental health resources.

Next, the patient stakeholders will receive one month of access to Wysa. They will complete measures of clinical effectiveness (self-reported depression, anxiety, pain interference, physical function) and hypothesized behavioral targets (behavioral activation, pain acceptance, sleep quality) at baseline and one-month

follow-up. The study findings will facilitate design of a subsequent clinical effectiveness trial that is designed for equitable dissemination and effective implementation of mental health intervention within the context of orthopedic care.

A2 Primary Hypothesis

The expected results of this project are:

1.) identification of stakeholder-informed implementation strategies for mental health interventions tailored for the orthopedic setting,

2.) refined digital and printed mental health interventions that are scalable and acceptable to older patients, and

3.) requisite planning data to facilitate successful completion of a subsequent clinical trial.

A3 Purpose of the Study Protocol

The goals of this project are to:

1.) identify effective implementation strategies to introduce mental health intervention in the context of real-world orthopedic care,

2.) optimize the usability of two mental health interventions (Wysa and a novel printed resource guide) for older adult orthopedic patients, and

3.) identify the intermediate mechanisms through which Wysa has an effect.

B Background

B1 Prior Literature and Studies

Depression and anxiety heighten musculoskeletal pain and negatively impact outcomes after orthopedic surgery.[1-5] Targeted mental health treatment can improve both physical and mental health in these patients,[6-8] but a gap remains in effectively and routinely engaging orthopedic patients in mental health care in an acceptable, sustainable, and scalable fashion. Barriers include: 1.) limited orthopedic provider time and knowledge to discuss mental health resources,[9] 2.) patient concerns regarding cost, transportation, and time necessary for mental health treatment,[10-13] and 3.) a national shortage of mental health professionals.14 These barriers disproportionately affect minority groups of all types.[15]

Our ongoing, funded pilot work suggests that an established digital mental health intervention (Wysa) based on behavioral activation, mindfulness, and sleep health meaningfully improves PROMIS Depression and Anxiety scores in orthopedic patients across the adult age spectrum at one- and two-month follow-up. However, the clinical context (e.g., team member leading the discussion, words used to discuss mental

health, volume of information already discussed during the encounter) influences providers' likelihood of discussing the intervention and patients' interest in trying it.

1. Tunks ER, Crook J, Weir R. Epidemiology of chronic pain with psychological comorbidity: prevalence, risk, course, and prognosis. Can. J. Psychiatry. 2008;**53**(4):224-34.
2. Cheng AL, Schwabe M, Doering MM, Colditz GA, Prather H. The Effect of Psychological Impairment on Outcomes in Patients With Prearthritic Hip Disorders: A Systematic Review and Meta-analysis. The American journal of sports medicine 2019:363546519883246-46.
3. Edwards RR, Klick B, Buenaver L, et al. Symptoms of distress as prospective predictors of pain-related sciatica treatment outcomes. Pain 2007;**130**(1-2):47-55.
4. Lee H, Hübscher M, Moseley GL, et al. How does pain lead to disability? A systematic review and meta-analysis of mediation studies in people with back and neck pain. Pain 2015;**156**(6):988-97.
5. Alattas SA, Smith T, Bhatti M, Wilson-Nunn D, Donell S. Greater pre-operative anxiety, pain and poorer function predict a worse outcome of a total knee arthroplasty. Knee Surg. Sports Traumatol. Arthrosc. 2017;**25**(11):3403-10.
6. Archer KR, Devin CJ, Vanston SW, et al. Cognitive-Behavioral-Based Physical Therapy for Patients With Chronic Pain Undergoing Lumbar Spine Surgery: A Randomized Controlled Trial. J. Pain 2016;**17**(1):76-89.
7. la Cour P, Petersen M. Effects of mindfulness meditation on chronic pain: a randomized controlled trial. Pain Med. 2015;**16**(4):641-52.
8. Kamper SJ, Apeldoorn AT, Chiarotto A, et al. Multidisciplinary biopsychosocial rehabilitation for chronic low back pain: Cochrane systematic review and meta-analysis. BMJ 2015;**350**:h444.
9. Vranceanu AM, Beks RB, Guitton TG, Janssen SJ, Ring D. How do Orthopaedic Surgeons Address Psychological Aspects of Illness? The archives of bone and joint surgery 2017;**5**(1):2-9.
10. Andrade LH, Alonso J, Mneimneh Z, et al. Barriers to mental health treatment: results from the WHO World Mental Health surveys. Psychol. Med. 2014;**44**(6):1303-17.
11. Kozloff N, Sommers BD. Insurance Coverage and Health Outcomes in Young Adults With Mental Illness Following the Affordable Care Act Dependent Coverage Expansion. The Journal of clinical psychiatry 2017;**78**(7):e821-e27.
12. Appelbaum PS, Parks J. Holding Insurers Accountable for Parity in Coverage of Mental Health Treatment. Psychiatr. Serv. 2020;**71**(2):202-04.
13. Abraham J, Meng A, Siraco S, et al. A Qualitative Study of Perioperative Depression and Anxiety in Older Adults. Am. J. Geriatr. Psychiatry 2020;**28**(10):1107-18.
14. Weil TP. Insufficient dollars and qualified personnel to meet United States mental health needs. The Journal of nervous and mental disease 2015;**203**(4):233-40.
15. Asada Y, Whipp A, Kindig D, Billard B, Rudolph B. Inequalities in multiple health outcomes by education, sex, and race in 93 US counties: why we should measure them all. Int J Equity Health 2014;**13**:47.

16. Initiative USBaJ. The Burden of Musculoskeletal Diseases in the United States (BMUS). 4th ed. Rosemont, IL, 2020.
17. Brooke J. SUS - A quick and dirty usability scale. Usability Eval Ind 1996;**189**(194):4-7.
18. Haggerty AF, Hagemann A, Barnett M, et al. A Randomized, Controlled, Multicenter Study of Technology-Based Weight Loss Interventions among Endometrial Cancer Survivors. Obesity (Silver Spring, Md.) 2017;**25 Suppl 2**(Suppl 2):S102-s08.
19. Cella D, Yount S, Rothrock N, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS): progress of an NIH Roadmap cooperative group during its first two years. Med. Care 2007;**45**(5 Suppl 1):S3-S11.
20. Fuhr K, Hautzinger M, Krisch K, Berking M, Ebert DD. Validation of the Behavioral Activation for Depression Scale (BADS)-Psychometric properties of the long and short form. Compr. Psychiatry 2016;**66**:209-18.
21. Fish RA, Hogan MJ, Morrison TG, Stewart I, McGuire BE. Willing and able: a closer look at pain Willingness and Activity Engagement on the Chronic Pain Acceptance Questionnaire (CPAQ-8). J. Pain 2013;**14**(3):233-45.
22. Fish RA, McGuire B, Hogan M, Morrison TG, Stewart I. Validation of the chronic pain acceptance questionnaire (CPAQ) in an Internet sample and development and preliminary validation of the CPAQ-8. Pain 2010;**149**(3):435-43.
23. Baranoff J, Hanrahan SJ, Kapur D, Connor JP. Six month post-treatment deterioration in acceptance (CPAQ-8) and cognitions following multidisciplinary pain treatment. J. Behav. Med. 2014;**37**(3):469-79.
24. Baranoff J, Hanrahan SJ, Kapur D, Connor JP. Validation of the Chronic Pain Acceptance Questionnaire-8 in an Australian pain clinic sample. Int. J. Behav. Med. 2014;**21**(1):177-85.
25. Soldatos CR, Dikeos DG, Paparrigopoulos TJ. The diagnostic validity of the Athens Insomnia Scale. J. Psychosom. Res. 2003;**55**(3):263-7.
26. Soldatos CR, Dikeos DG, Paparrigopoulos TJ. Athens Insomnia Scale: validation of an instrument based on ICD-10 criteria. J. Psychosom. Res. 2000;**48**(6):555-60.
27. Guglielmo D, Hootman JM, Boring MA, et al. Symptoms of Anxiety and Depression Among Adults with Arthritis - United States, 2015-2017. MMWR Morb. Mortal. Wkly. Rep. 2018;**67**(39):1081-87.
28. Murphy LB, Sacks JJ, Brady TJ, Hootman JM, Chapman DP. Anxiety and depression among US adults with arthritis: prevalence and correlates. Arthritis Care Res. (Hoboken) 2012;**64**(7):968-76.
29. Bartels SJ, Coakley EH, Zubritsky C, et al. Improving access to geriatric mental health services: a randomized trial comparing treatment engagement with integrated versus enhanced referral care for depression, anxiety, and at-risk alcohol use. Am. J. Psychiatry 2004;**161**(8):1455-62.
30. Firth J, Torous J, Nicholas J, Carney R, Rosenbaum S, Sarris J. Can smartphone mental health interventions reduce symptoms of anxiety? A meta-analysis of randomized controlled trials. J. Affect. Disord. 2017;**218**:15-22.
31. Davies EB, Morriss R, Glazebrook C. Computer-delivered and web-based interventions to improve depression, anxiety, and psychological well-being of

university students: a systematic review and meta-analysis. J. Med. Internet Res. 2014;**16**(5):e130.
32. Mayberry LS, Lyles CR, Oldenburg B, Osborn CY, Parks M, Peek ME. mHealth Interventions for Disadvantaged and Vulnerable People with Type 2 Diabetes. Curr. Diab. Rep. 2019;**19**(12):148.
33. Lee AC, Driban JB, Price LL, Harvey WF, Rodday AM, Wang C. Responsiveness and Minimally Important Differences for 4 Patient-Reported Outcomes Measurement Information System Short Forms: Physical Function, Pain Interference, Depression, and Anxiety in Knee Osteoarthritis. J. Pain 2017;**18**(9):1096-110.
34. Beleckas CM, Prather H, Guattery J, Wright M, Kelly M, Calfee RP. Anxiety in the orthopedic patient: using PROMIS to assess mental health. Qual. Life Res. 2018.
35. Guattery JM, Dardas AZ, Kelly M, Chamberlain A, McAndrew C, Calfee RP. Floor Effect of PROMIS Depression CAT Associated With Hasty Completion in Orthopaedic Surgery Patients. Clin. Orthop. Relat. Res. 2018.
36. Dy CJ, Brogan DM, Rolf L, Ray WZ, Wolfe SW, James AS. A qualitative study of life satisfaction after surgery for adult traumatic brachial plexus injury. Bone & joint open 2021;**2**(1):9-15.
37. Dy CJ, Brogan DM, Rolf L, Ray WZ, Wolfe SW, James AS. Variability in Surgeon Approaches to Emotional Recovery and Expectation Setting After Adult Traumatic Brachial Plexus Injury. Journal of hand surgery global online 2021;**3**(1):30-35.
38. Prather H, Cheng A, May KS, Maheshwari V, VanDillen L. Hip and Lumbar Spine Physical Examination Findings in People Presenting With Low Back Pain With or Without Lower Extremity Pain. J. Orthop. Sports Phys. Ther. 2017:1-36.
39. Prather H, Cheng A, Steger-May K, Maheshwari V, VanDillen L. Association of Hip Radiograph Findings With Pain and Function in Patients Presenting With Low Back Pain. PM & R : the journal of injury, function, and rehabilitation 2017.
40. Burkhardt HA, Alexopoulos GS, Pullmann MD, Hull TD, Areán PA, Cohen T. Behavioral Activation and Depression Symptomatology: Longitudinal Assessment of Linguistic Indicators in Text-Based Therapy Sessions. J. Med. Internet Res. 2021;**23**(7):e28244.
41. Fortuna KL, Torous J, Depp CA, et al. A Future Research Agenda for Digital Geriatric Mental Healthcare. Am. J. Geriatr. Psychiatry 2019;**27**(11):1277-85.
42. Sharpe L, McDonald S, Correia H, et al. Pain severity predicts depressive symptoms over and above individual illnesses and multimorbidity in older adults. BMC Psychiatry 2017;**17**(1):166.
43. Cheng AL, Calfee R, Colditz G, Prather H. PROMIS Physical and Emotional Health scores are worse in musculoskeletal patients presenting to physiatrists than to other orthopedic specialists. PM & R : the journal of injury, function, and rehabilitation 2019.
44. Wysa. Secondary Wysa 2021. wysa.io.
45. Jensen MP, Ehde DM, Day MA. The Behavioral Activation and Inhibition Systems: Implications for Understanding and Treating Chronic Pain. J. Pain 2016;**17**(5):529.e1-29.e18.

46. Beaton DE, Clark JP. Qualitative research: a review of methods with use of examples from the total knee replacement literature. J. Bone Joint Surg. Am. 2009;**91 Suppl 3**:107-12.
47. Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implementation science : IS 2011;**6**:42.
48. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implementation science : IS 2009;4:50.

B2 Rationale for this Study

Depression and anxiety worsen musculoskeletal pain and reduce the effectiveness of traditional orthopedic treatments. Nevertheless, addressing mental health is not currently a part of standard treatment for orthopedic conditions. The purpose of this study is to identify strategies to address mental health in the context of orthopedic care in a manner that is feasible, effective, and acceptable to patients and clinicians.

C Study Objectives

C1 Primary Aim

Aim 1: Identify the contextual determinants of implementation success for addressing patients' mental health in the context of orthopedic care.

Using standard qualitative methods, two stakeholder groups will be interviewed: WU orthopedic providers and orthopedic spine patients ≥ 18 years old, with a focus on patients 65 years and older. Using purposive sampling, a goal of at least half of patient stakeholders will be women, and one quarter will identify as an under-represented minority. In semi-structured interviews guided by the Consolidated Framework for Implementation Research (CFIR) and the COM-B model of behavior change, providers and patients will describe needs and preferences related to addressing mental health in a clinical and research context (e.g., recruiting and retaining orthopedic patients in a mental health related randomized controlled trial).

Aim 2: Conduct usability testing for two mental health interventions which can feasibly be implemented in a real-world orthopedic setting: a digital mental health intervention (Wysa) and a novel printed resource guide.

Using semi-structured interviews and the System Usability Scale (SUS), orthopedic patients will participate in an iterative user design process to refine the delivery of Wysa and a printed guide of local and online mental health resources. The printed guide is being prepared as an "enhanced usual care" control intervention for a subsequent R01 randomized controlled trial proposal.[17,18]

Aim 3: Identify the intermediate mechanisms through which a digital mental health intervention (Wysa) improves mental health symptoms in orthopedic patients.

In a pilot prospective cohort study, patients will receive one month of access to Wysa. Measures of clinical effectiveness (self-reported PROMIS Depression, Anxiety, Pain Interference, and Physical Function[19]) and hypothesized behavioral targets (Behavioral Activation for Depression Scale-SF, Chronic Pain Acceptance

Questionnaire-8, and Athens Insomnia Scale) will be collected at baseline and one-month follow-up.[20-26]

C2 Rationale for the Selection of Outcome Measures

Depression and anxiety can worsen musculoskeletal pain and reduce the effectiveness of traditional orthopedic treatments. Nevertheless, addressing mental health is not currently a part of standard treatment for orthopedic conditions. The purpose of this study is to identify strategies to address mental health in the context of orthopedic care in a manner that is feasible, effective, and acceptable to patients and clinicians.

D Study Design

D1 Overview or Design Summary

This study will utilize qualitative cross-sectional and quantitative longitudinal methods. In semi-structured interviews, orthopedic providers and patients with spine conditions will discuss their overall perspectives, specific needs, and preferred solutions to addressing mental health impairment in the context of orthopedic care and research. In these sessions, patient stakeholders will also user test two specific mental health interventions: a customized version of a commercial digital mental health intervention (Wysa) and a prototype of a print-based mental health resource guide. The patient stakeholders will be provided one month of Wysa access, and they will complete baseline and follow-up measures related to usability, clinical effectiveness, and intermediate behavioral mechanisms through which Wysa is hypothesized to act. Wysa usage data will be obtained from the app company. Delivery of Wysa and the printed resource guide will be iteratively refined based on user feedback. [13,29,34-42]

D2 Subject Selection and Withdrawal

Inclusion Criteria

- WU Orthopedics patients who are presenting to a spine specialist for neck and/or back pain (spine surgeon, physiatrist, or APP within either of those two divisions) for new or return evaluation
- 18+ years old
- Musculoskeletal pain for 3+ months

Exclusion Criteria

- Routine post-op visit, with no plans for further surgery at this time
- Endorses mental health crisis (active suicidal or homicidal ideation, psychosis)
- Cognitive impairment which would interfere with meaningful engagement with research interview, questionnaires, and/or intervention

2.a Subject Recruitment Plans and Consent Process

Providers:

- Eligible providers are already known, through departmental contacts
- E-mail will be sent to eligible providers in batches until enough interviews have been scheduled and performed to reach data saturation

- *Verbal consent (waiver of written consent) requested for providers, since they will just be participating in semi-structured interviews.

Patients:

- Prospectively and/or retrospectively review clinic schedules for surgical and non-operative orthopedic spine providers
- To reach purposive sampling goals, some potentially eligible patients may be called prior to appointment date to notify them of the study, assess preliminary interest, and ask to plan staying 60-90 minutes after clinic visit in order to participate in study. Also offer to assist with parking expenses (eg parking validation ticket at CAM).
- Patients will officially be screened at the time of and/or after their orthopedic clinic visit to verify eligibility.
- *Written consent for patients when consent is obtained in clinic. Request the option for verbal consent if the participant is consented over the phone/Zoom.

Contact procedures / permission:

Providers:

- Participants will be e-mailed to be invited to participate.
- They will be asked to complete a brief “demographics” descriptive questionnaire.

Patients:

- Participants will be called or approached in person to be invited to participate.
- During the consent process, they will be asked whether they agree for e-mail and/or text messages to be sent to them. Based on their response, a link to the follow-up REDCap survey will be sent via e-mail and/or text message. Participants will also be called, e-mailed, and/or text messaged as necessary for reminders to complete the survey.

2.b Randomization Method

No randomization method. No control group.

2.c Risks and Benefits

Risks:

You may experience one or more of the risks indicated below from being in this study. In addition to these, there may be other unknown risks, or risks that we did not anticipate, associated with being in this study.

Although very unlikely, subjects participating in this study may feel inconvenienced from completion of multiple surveys and/or uncomfortable answering some of the survey questions. This risk is minimal because participants will be informed of the estimated time commitment and general content of the survey questions before they consent to participate. The seriousness of this risk is low because participants can withdraw from the study at any time.

One risk of participating in this study is that confidential information about you may be accidentally disclosed. We will use our best efforts to keep the information about you secure. Please see the section in this consent form titled “How will you keep my information confidential?” for more information.

Benefits:
You will not benefit from being in this study.

However, we hope that, in the future, other people might benefit from this study because information obtained from this study may lead to a better understanding of how to treat patients in an orthopaedic clinic who also experience depression and/or anxiety.

2.d Early Withdrawal of Subjects

If a participant would like to withdraw from this study, they can contact the study coordinator who will document when the patient called to withdraw that their data will not be included in any future data analysis from the time of withdrawal.

2.e Treatment Regimen

After agreeing to participate, patient participants will continue their participation in their orthopedic care plan, as directed by their healthcare provider. We will also assist the participant in downloading the Wysa app to their smartphone or other electronic device, if desired. Through the Wysa app, participants can track and manage their emotions, and they can learn research-based techniques to help them feel better and manage any stress or pain they may be dealing with. Participants will have access to research-based wellness tools such as supportive listening, deep breathing techniques, guided meditation, yoga, and more. Participants can communicate with a virtual artificial intelligence (AI) chatbot, and/or they can message a highly trained and qualified human well-being coach. The intended use of the Wysa app is to encourage mental well-being as an early intervention tool in a self-help context. The Wysa app is considered investigational, which means that it has not been approved by the U.S. Food and Drug Administration.

Participants will have access to the Wysa app services for one month, and they can use any or all of the services as much or as little as they find useful. No one on the Washington University study team will read participants' chats to the Wysa chatbot. Any chats with a human Wysa well-being coach will remain between just the participant and their coach. The study team will only receive information on whether the participant used the Wysa app, how much they used each feature and/or found it helpful. Participants will be e-mailed and/or sent a text message to the follow-up survey link after one month. The surveys will ask them about their current level of wellness and whether they found the app helpful.

-

2.f Method for Assigning Subjects to Treatment Groups

No control group. Everyone in the provider group, gets the same treatment, and everyone in the patient group will get the same treatment.

E Study Procedures

E1 Screening for Eligibility

Recruitment of orthopedic provider stakeholders:
Three of the study investigators are faculty members within the WU Department of Orthopaedic Surgery. As such, they have professional and personal relationships with the vast majority of the 70+ orthopedic clinicians and their support staff at WU. These relationships will facilitate a high rate of rapid recruitment from this group of stakeholders into the study. In addition to universal secure, virtual meeting capabilities among this group (Zoom-HIPAA), all orthopedic faculty members have dedicated, secure academic office space in which private semi-structured interviews can be conducted in person.

Recruitment of orthopedic patient stakeholders:
The study PI (Dr. Cheng) is one of over 15 spine care subspecialists within the WU Department of Orthopaedic Surgery. She and her colleagues manage patients with a range of sociodemographic backgrounds at multiple clinic sites across the St. Louis metro region including the Barnes-Jewish Center for Advanced Medicine, Barnes-Jewish Hospital Center for Outpatient Health, Barnes-Jewish West County Hospital, and the Barnes-Jewish Center for Advanced Medicine – South County. Furthermore, all of the WU Orthopedics spine patients complete depression and anxiety measures as standard care during each clinical encounter (PROMIS CAT Depression and Anxiety), and Dr. Cheng's research coordinator has specifically enrolled older adult orthopedic patients with spine conditions into mental health related research studies by using these measures as screening items. This patient base and the mental health screening measures will facilitate seamless recruitment of patient stakeholders with a range of self-reported depression and anxiety symptom severity. Additionally, Dr. Cheng and several other spine providers have adequate clinical space to allow patient rooms to be used for research during clinic hours, and her team has experience recruiting, consenting, and enrolling patients into research studies in person and virtually (via phone or Zoom-HIPAA), from her own clinics and from those of her clinical colleagues. The in-person and virtual participation options will allow patients to participate in the semi-structured interview and usability testing in whichever format is preferred. When convenient for the participant, study recruitment, consent, and the interview can be completed within approximately one hour of the patient's clinical encounter.

E2 Schedule of Measurements

E3 Visit 1

Providers:

- Interviews will occur face-to-face (in a private room) or via Zoom, whichever the participant prefers. Interviews will be audio and possibly video recorded, using WU-HIPAA Zoom technology, handheld audio recorder(s), and/or other similar device. The recordings will be used to transcribe the interview conversation. After the interview, the recording will then be reviewed by a study team member, and all personal identifiers will be removed prior to being uploaded into Rev.com to be transcribed into text for qualitative analysis.

Patients:

- Whenever possible, interviews will occur face-to-face immediately after the participant's orthopedic clinic visit (before the patient has left the clinic)
- If not possible, the participant will be given the option to return to campus for an in-person interview or to complete the study remotely via Zoom. Interviews will be audio and possibly video recorded, using WU-HIPAA Zoom technology, handheld audio recorder(s), and/or other similar device. The recordings will be used to transcribe the interview conversation. After the interview, the recording will then be reviewed by a study team member, and all personal identifiers will be removed prior to being uploaded into Rev.com to be transcribed into text for qualitative analysis.

Contact procedures / permission:

Providers:

- Participants will be e-mailed to be invited to participate.
-

Patients:

- Participants will be called or approached in person to be invited to participate.
- During the consent process, they will be asked whether they agree for e-mail and/or text messages to be sent to them. Based on their response, a link to the follow-up REDCap survey will be sent via e-mail and/or text message. Participants will also be called as necessary for reminders to complete the survey..

Proposed events chart:

Providers:

	Baseline	Follow-up
Intake survey	X	
Interview	X	X (If needed)

Patients:

	Baseline	1 Month
Intake survey	X	
Interview	X	
Usability testing of Wysa and	X	

printed guide		
System Usability Scale (printed guide)	X	
System Usability Scale (Wysa)	X	X
BADS-SF	X	X
CPAQ-8	X	X
Athens Insomnia Scale (AIS)	X	X
PROMIS measures	X (Standard care)	X
Follow-up survey		X

E4 Follow up.

A link to the follow-up REDCap survey will be emailed and/or text messaged to patient participants at one month. These surveys, listed in the chart above, will be the system usability scale (Wysa), BADS-SF, CPAQ-8, Athens Insomnia Scale (AIS), PROMIS measures, and a follow up survey. This will be for the patient participats only, and the only follow up that will occur.

E5 Safety and Adverse Events

5.a Safety and Compliance Monitoring

The research coordinator will document any adverse events reported and review these adverse events with the principal investigator as they arise.

If excessive adverse events are reported, the principal investigator will evaluate weather a participant should be removed from the study to ensure the study participants are not being injured.

5.b Definitions of Adverse Events

Any unfavorable medical occurrence in a human subject including any abnormal sign, symptom, or disease.

5.c Classification of Events

i Relationship

The adverse event will be considered related to the study if it was determined to be due to using the Wysa app.

ii Severity

Any adverse experience occurring at any time that results in any of the following outcomes:

- Death
- A life-threatening experience
- Inpatient hospitalization or prolongation of existing hospitalization
- A persistent or significant disability/incapacity (i.e., a substantial disruption of a person's ability to conduct normal life functions)

- A congenital anomaly/birth defect
- Any other experience which, based upon appropriate medical judgment, may jeopardize the subject and may require medical or surgical intervention to prevent one of the outcomes listed above

iii Expectedness

Any adverse event, the specificity or severity of which is not consistent expected risks in this study.

Risks:

Participants may experience one or more of the risks indicated below from being in this study. In addition to these, there may be other unknown risks, or risks that we did not anticipate, associated with being in this study.

Although very unlikely, subjects participating in this study may feel inconvenienced from completion of multiple surveys and/or uncomfortable answering some of the survey questions. This risk is minimal because participants will be informed of the estimated time commitment and general content of the survey questions before they consent to participate. The seriousness of this risk is low because participants can withdraw from the study at any time.

One risk of participating in this study is that confidential information about you may be accidentally disclosed. We will use our best efforts to keep the information about you secure. Please see the section in this consent form titled *"How will you keep my information confidential?"* for more information.

Unanticipated problem involving risks to participants or others

- Are unexpected (in terms of nature, severity, or frequency) given (a) the research procedures that are described in the study-related documents, such as the IRB-approved research study and informed consent document; and (b) the characteristics of the subject population being studied; and
- Are related or possibly related to participation in the research; and
- Suggest that the research places participants or others at a greater risk of harm (including physical, psychological, economic, or social harm) than was previously known or recognized.

5.d Data Collection Procedures for Adverse Events

The research coordinator will document any adverse events reported in a spreadsheet that is password protected and only available to be viewed by the study team.

All adverse events will be reviewed by the principal investigator as they arise.

5.e Reporting Procedures

Events will be reported per the Washington University Institutional Review Board Procedures.

5.f Adverse Event Reporting Period

Events that qualify for immediate reporting described above will be reported within the following timeframe:

a. 10 working days of the occurrence of the event or notification to the PI or research team of the event.

b. The death of a research participant should be reported within 1 working day of the occurrence of the event or notification to the PI or research team of the event.

Adverse events/other events that do not require immediate reporting will be provided to the IRB in summary format at the time of continuing review.

F Statistical Plan

F1 Sample Size Determination and Power

No power calculation was performed for this study because the primary aim involves a qualitative analysis. The sample size will be determined by reaching data saturation from the provider and patient stakeholder interviews.

F2 Interim Monitoring and Early Stopping

The Principal Investigator will take responsibility for monitoring patient safety. Patients in the study will be monitored on an as needed basis to assure that they are doing well.

Adverse events will be assessed by Dr. Cheng to determine if they are serious, unexpected and related to the study procedures.

If a complication should arise, the patient would be previously instructed how to contact the research coordinator.

F3 Statistical Methods

Interviews will be audio recorded and professionally transcribed. Using inductive and deductive coding approaches based on CFIR and COM-B, a codebook will be developed by one team member, and one or more team members will code all transcripts using NVivo. Group discussion among the research team will be used to resolve coding discrepancies, confirm data saturation has been reached, and organize codes into themes. Scores on the System Usability Scale will be used to iteratively refine both mental health interventions under investigation. Longitudinal PROMIS score changes will be compared between “high” and “low” Wysa users (defined by total Wysa interactions), and associations between changes in behavioral targets (behavioral activation, pain acceptance, sleep quality) and clinical outcomes (depression, anxiety) will be assessed.
.

G Data Handling and Record Keeping

G1 Confidentiality and Security

Plans to protect the privacy interests of the participants during the conduct of the study:

1) Only the minimum necessary private information is collected for the purposes of the study
2) Any procedures or interventions conducted as part of the study will be conducted in private setting to the extent possible
3) Recruitment/consent will occur in a private setting
4) Participants will be able to ask questions in a private setting

Project uses paper and hard copy consents, surveys, data collection forms, research subject binders, or other hard copy materials:

1) All materials are stored in secured environment
2) Access is limited to research team members only
3) Transported securely/shipped with tracking mechanism

Project collects, stores and/or transmits electronic data on mobile devices, desktop computers, servers including cloud servers, email, or any other information in electronic form:

1) Password protected
2) Access is limited to research team only
3) Data in Redcap
4) Data in Box
5) eCRF system
6) Transmitted using recognized security for electronic submission
7) Recordings taken during interviews with providers and patients will be reviewed by a study team member, and all personal identifiers will be removed prior to being uploaded into Rev.com to be transcribed into text for qualitative analysis. Other

G2 Training

Study coordinator was trained in the Wysa software, and is able to explore the app with the participants in the patient population for use on their own. No formal training is necessary for this study.

G3 Records Retention

All research data will be retained in a locked office in a locked cabinet for 10 years after the closure of the study.

H Study Administration

H1 Funding Source and Conflicts of Interest

This study is funded by a WU Center for Perioperative Mental Health R03 Pilot and Feasibility Award. The study start date was 12/1/2021.