



M-Sense

GROUP

*Empowering patients with **digital health** technologies*

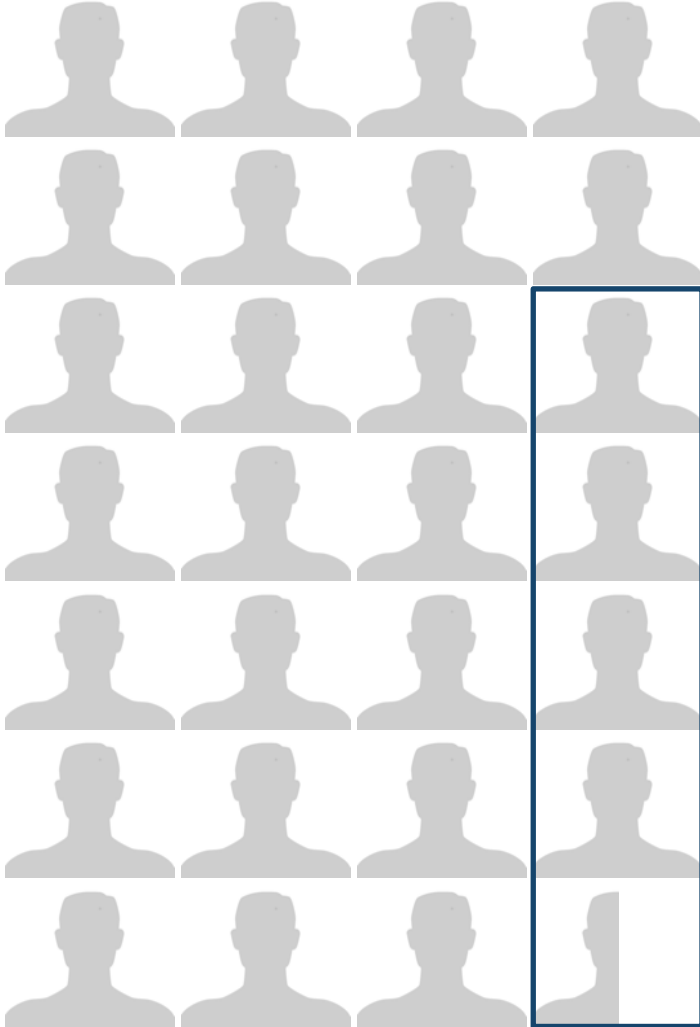
Mobile Biofeedback Therapy for the Treatment of Panic Attacks: A Pilot Feasibility Study

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Signs of a Panic Attack





27.5 million Americans, have at least one panic attack/year

- Only 16% of panic attack sufferers seek treatment
- Barriers include:
 1. Long wait times for outpatient services
 2. Inability to receive treatment in real time during an attack
- Untreated panic attacks predict onset of mental illness:
 - Social and specific phobias
 - Generalized Anxiety Disorder
 - Depression
 - Substance Use Disorders
- Also predicts increased impact of mental disorders including:
 1. Persistence
 2. Co-morbidity
 3. Functional impairment



Pharmacological Intervention

- Antidepressants, benzodiazepines
- Significant side effects
- High patient drop-out
- Only prevent panic attacks while taken



Psychotherapeutic Intervention

- Cognitive behavioral therapy
- When used alone, only improves symptoms in 2/3 of patients
- Efficacy declines as treatment intensity decreases or therapy ends

Need new therapies that can prevent future panic attacks

Active ingredient of successful panic attack therapy is **reappraisal of bodily sensations**:

1. Decreases catastrophic beliefs
2. Decreases urgent attempts to avoid sensations
3. Increases patient's sense of perceived control
4. Increases efficacy of CBT-based psychotherapy

Interoceptive exposure – behavioral supplement to CBT

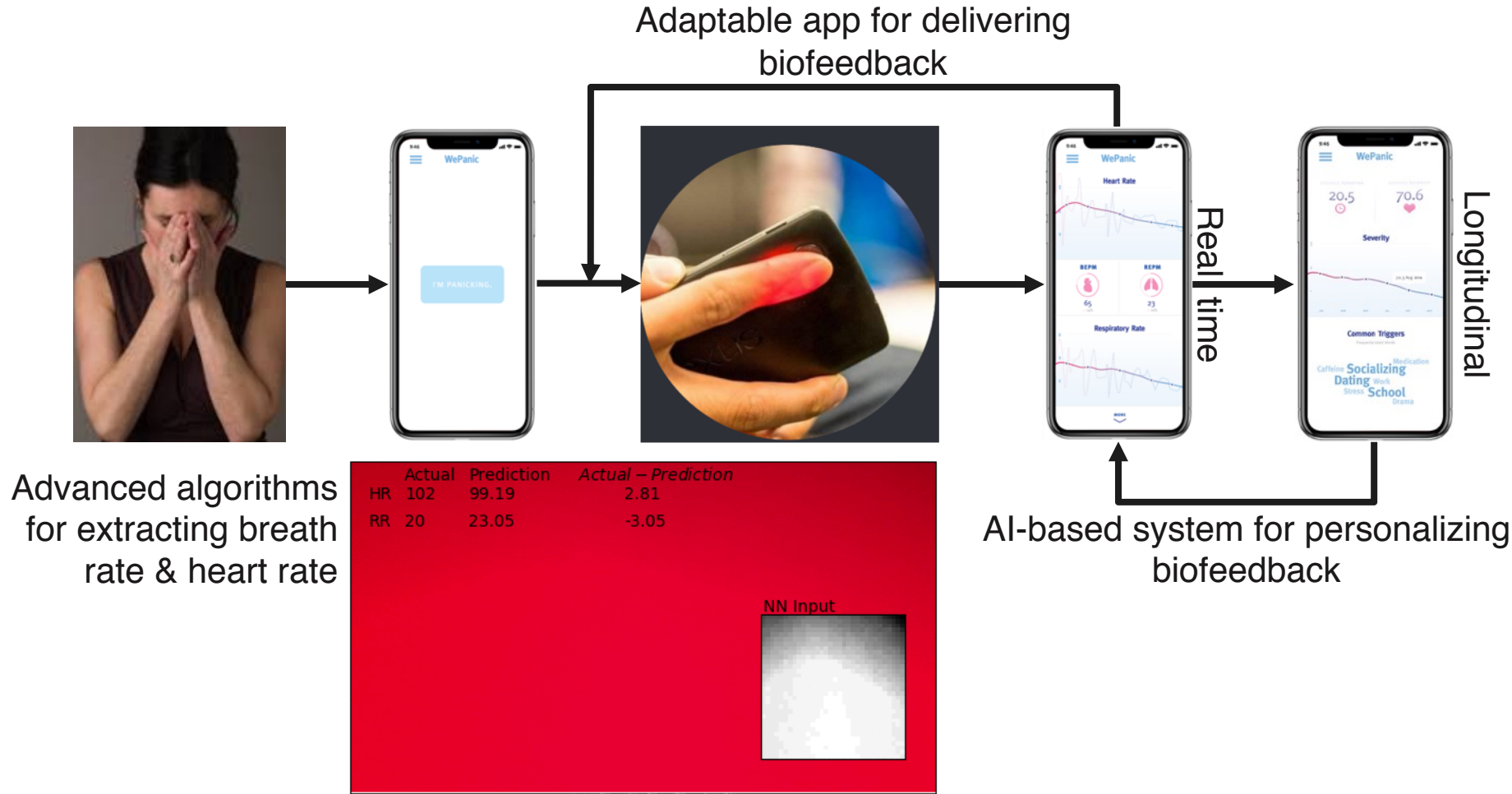
- Induce physiological symptoms associated with panic attacks
- Practice reappraisals under realistic conditions
- Improves outcomes - 81% of patients remained panic free at 2 yr f/u

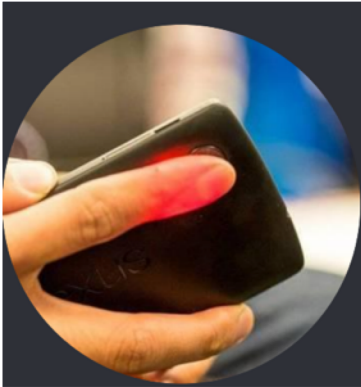


Biofeedback Therapy – behavioral supplement to CBT

- Provides in-vivo information about physiological arousal during a panic attacks
- Helps patient's achieve **reappraisal of bodily sensations** faster
- Requires specialized equipment for making measurements and providing feedback

Need a way to deploy biofeedback therapy wherever and whenever
panic attacks occur





Pros:

- No additional equipment
- Already available at scale
- Simple for app development
- Ability to tune algorithms to application

Cons:

- Awkward to take measurement
- Issues with data quality



Pros:

- Easy to take measurements
- Additional equipment already available for some users
- Supported for app development

Cons:

- Expensive
- Limited access to raw data to tune algorithms to application
- Inconsistent data quality



Pros:

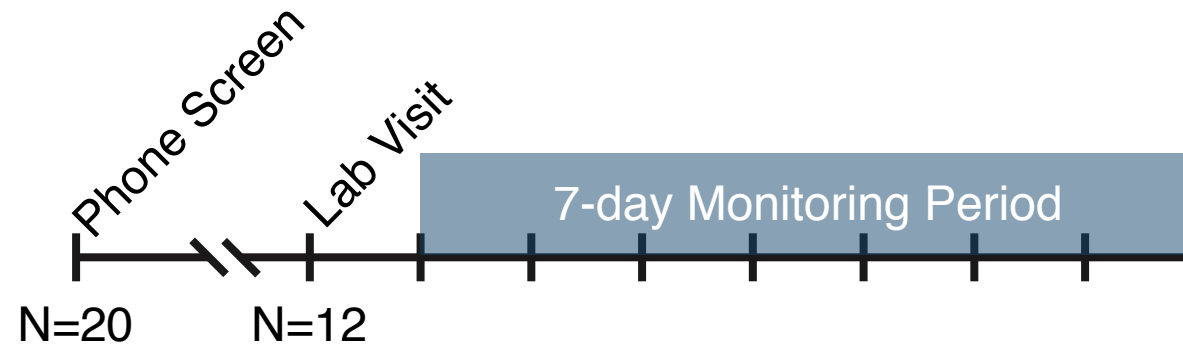
- Easy to take measurements
- Good data quality

Cons:

- Equipment not available to end users
- More challenging app integration
- Unclear technology reliability
- Unclear user adoption

Subjects –

- N=20 recruited recruited from community (19-34 y/o)
- Inclusion (smart phone, panic attack in the last two weeks, able to comply with protocol)
- Exclusion (psychosis or schizophrenia, opioid dependent)

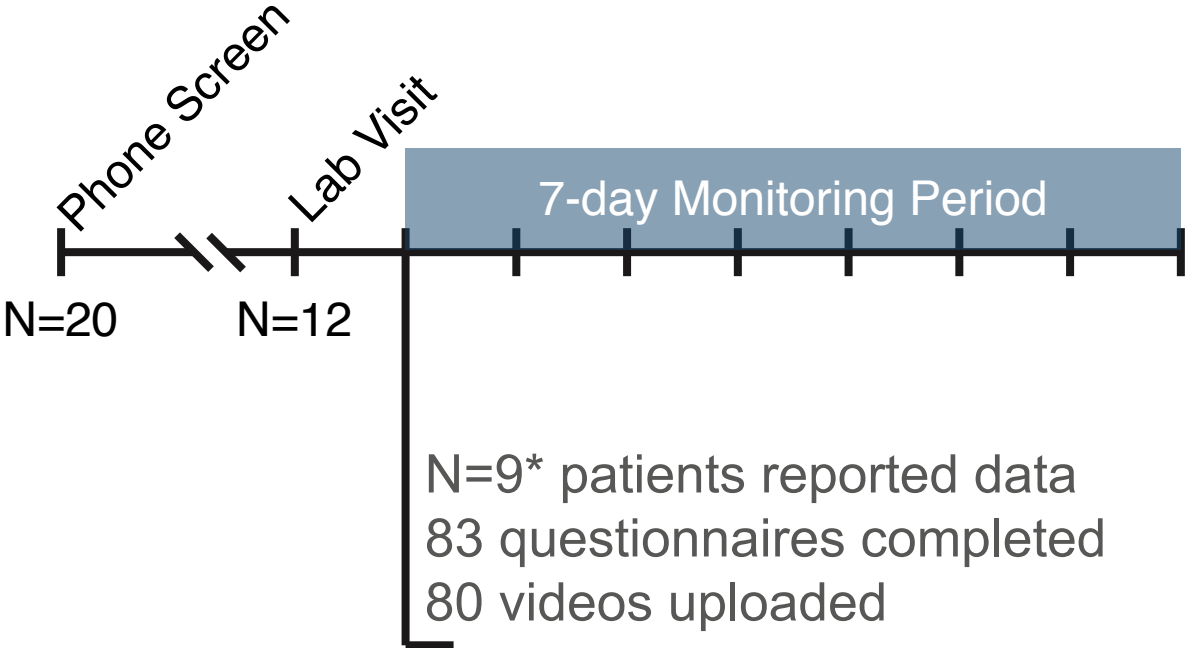


Lab Visit –

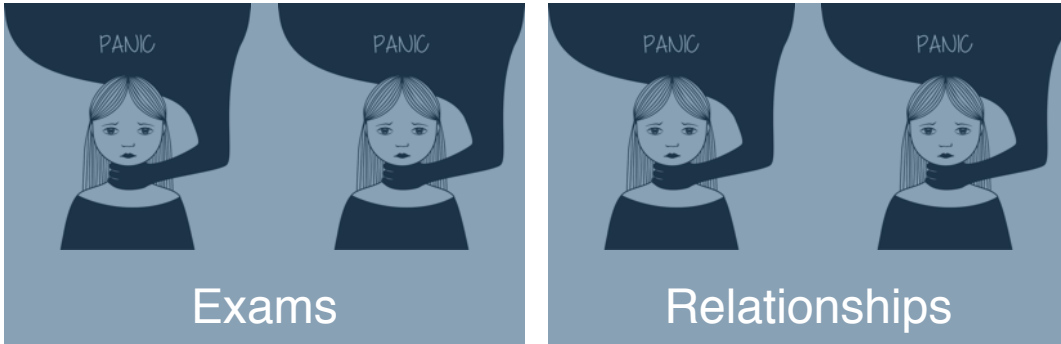
- Structured Clinical Interview (SCID Panic Module)
- Training for completing protocol

Monitoring –

- Record two 30-second videos/day and whenever a panic attack occurred
- Fill out online questionnaire and upload video to google drive

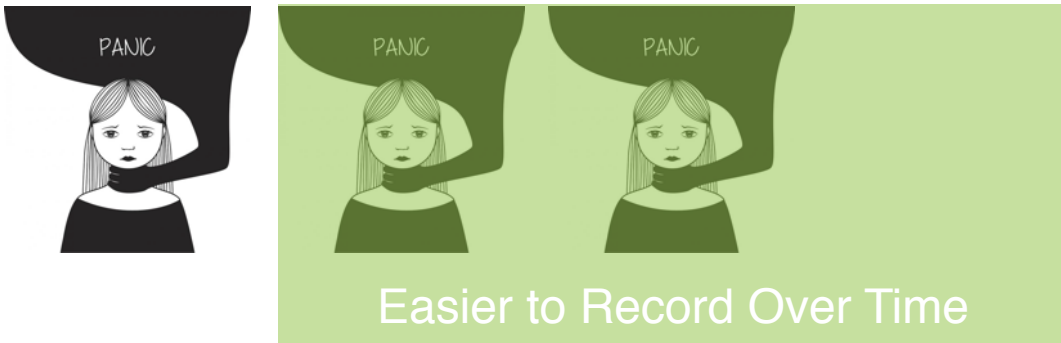


*Compliance issues (attrition of N=11) are common in studies of patients with heightened anxiety



“did not remember to record”

Patient reported intensity median 7/10



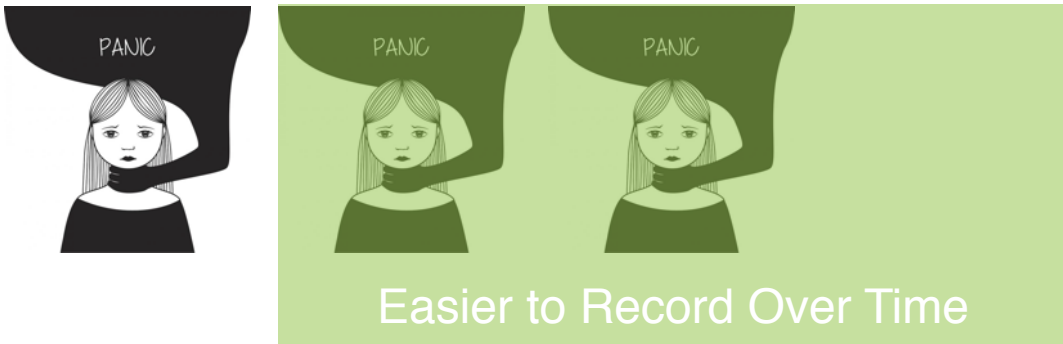
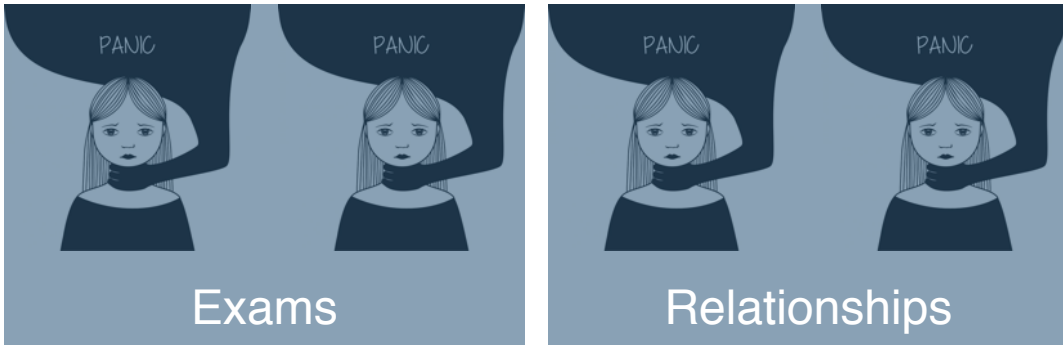
Difficult to make the recording
External: “other people being around wondering what I was doing”
Internal: “focusing on something else”



Act of recording their fingertip stopped the panic attack



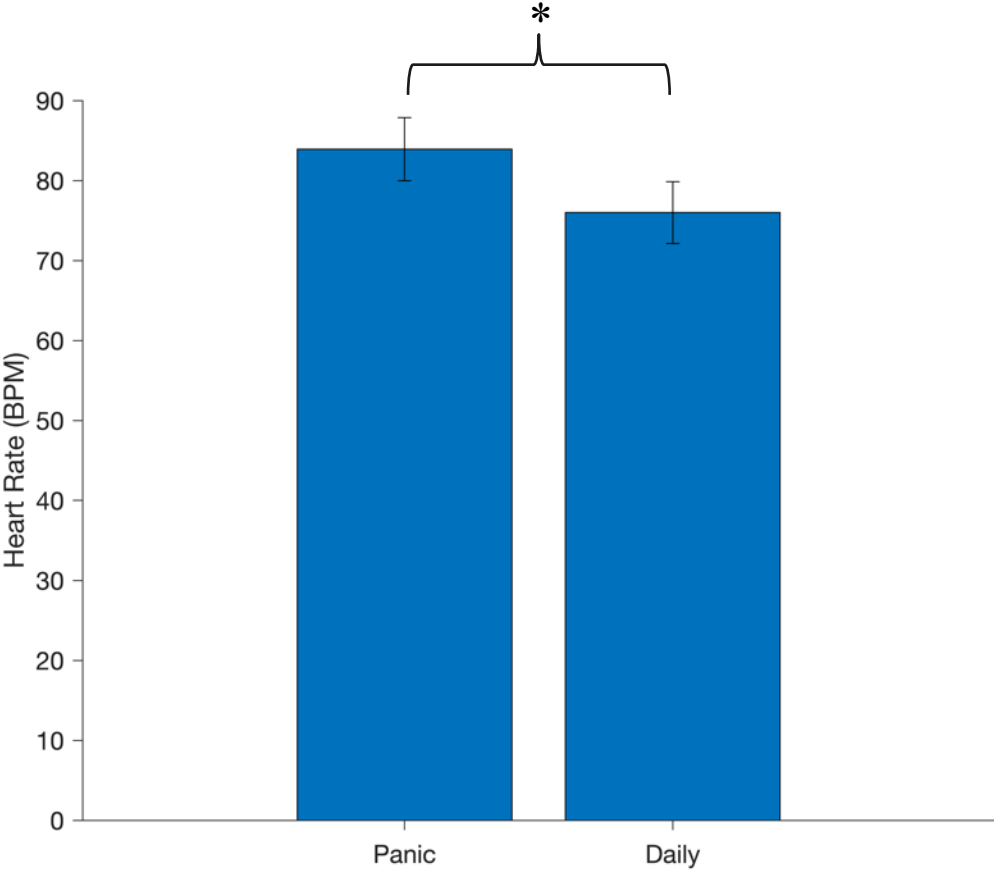
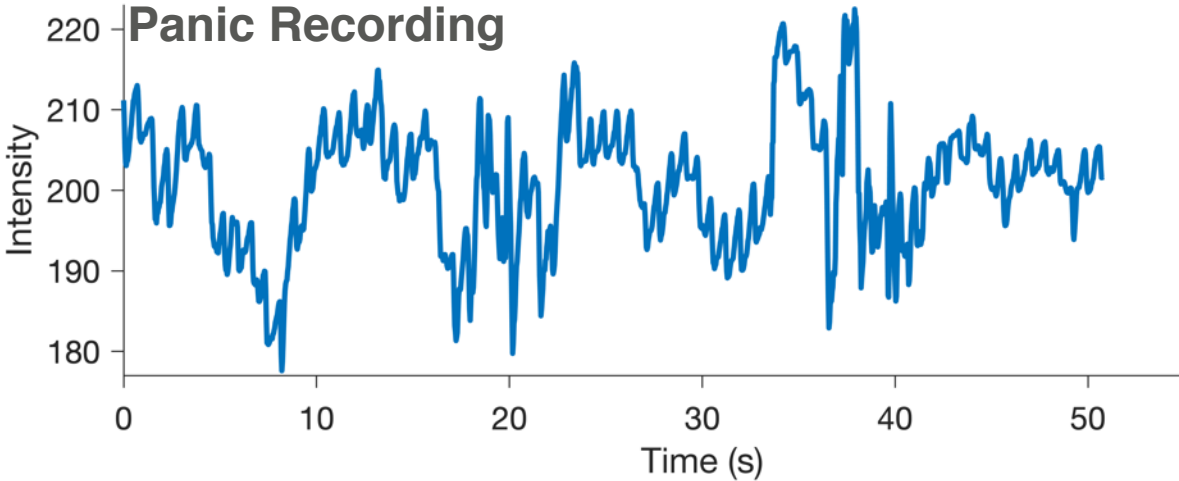
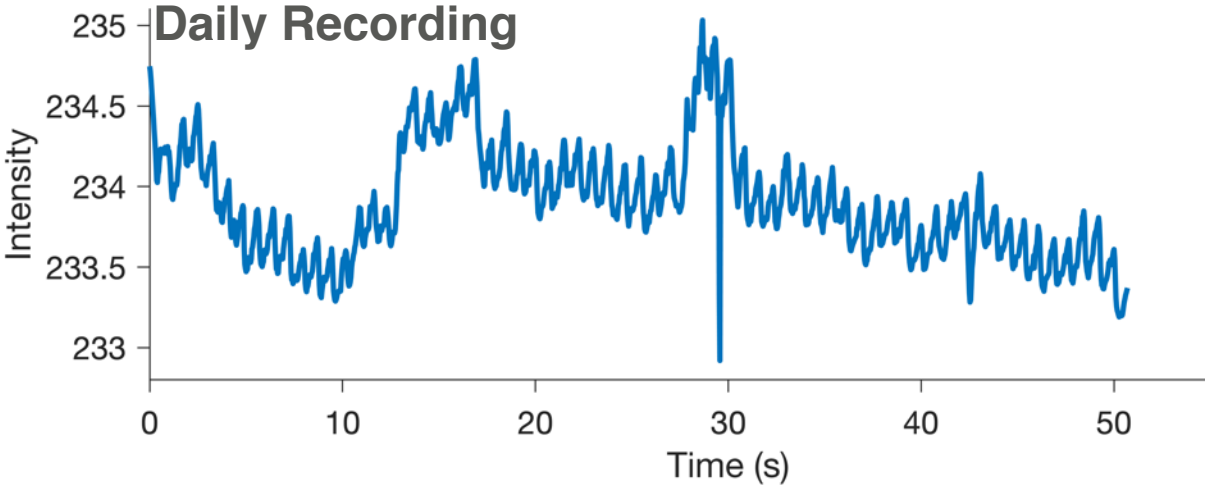
SCID results suggest we should have observed between 7 and 20 *Potential Placebo Effect*



Patient reported that measurements were easier to make in sequential panic attacks
Users Can Learn Modality Over Time

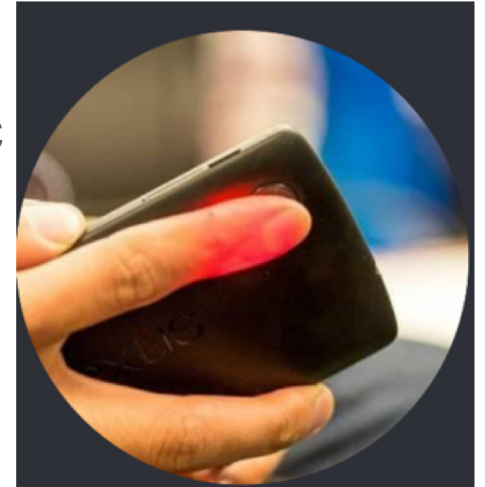


Just the Act of Recording Stops Attacks
Patient report supports cognitive-behavioral theories about confronting symptoms



Conclusions –

- Feasible measurement modality for this potential digital therapeutic
- Users may become more comfortable with the modality over time
- Potential placebo effect
 - Reduce the number of panic attacks observed
- Modality may reduce duration of panic attacks that occur

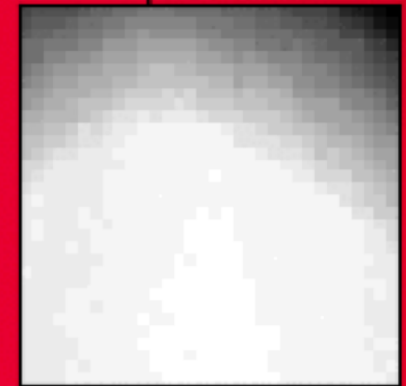


Developing new methods for estimating HR and RR

1. Data collected from N=111 participants
2. Coincident measurement of ground-truth HR and RR
3. Developing 3D convolutional neural network for estimating HR and RR (based off of C3D architecture)
4. Method provides quantitative measure of estimate trust

	Actual	Prediction	<i>Actual – Prediction</i>
HR	102	99.19	2.81
RR	20	23.05	-3.05

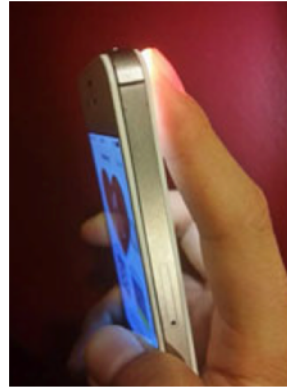
NN Input



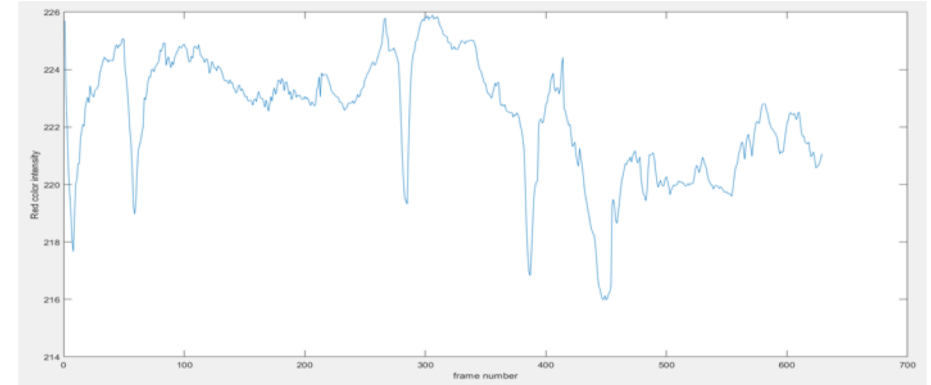
Data quality seems to depend on:

1. Finger location relative to camera lens and flash
2. Pressure applied to finger

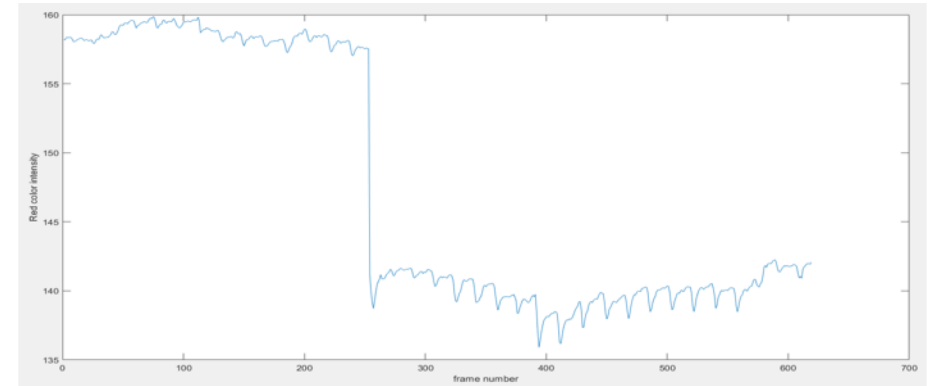
Need to make measurements more reliable!



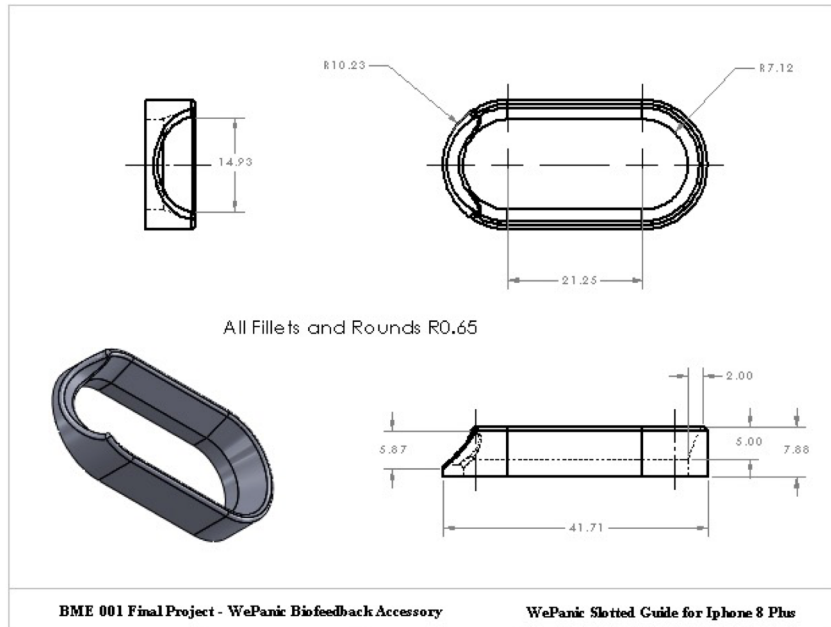
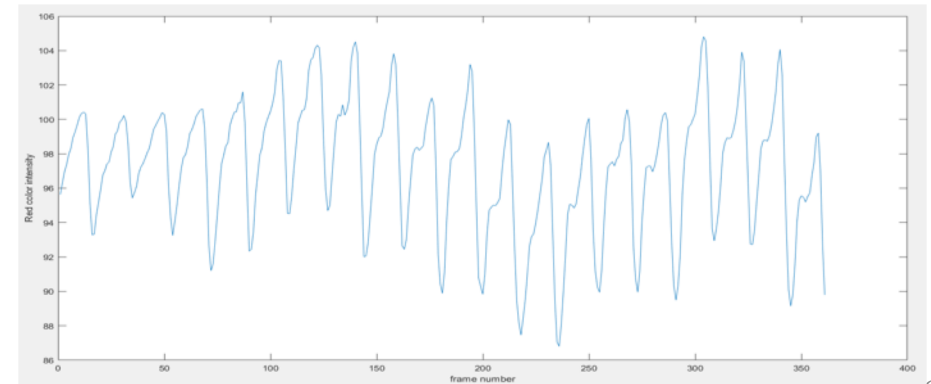
Chong et al., IEEE JBHI, 2015



Design Iteration 1

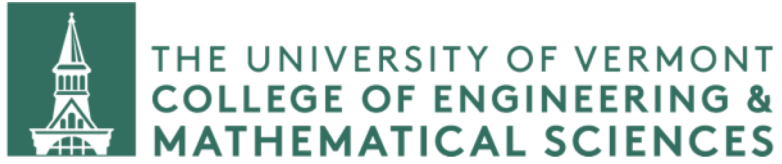


Design Iteration 2





Thanks!



Collaborators



Funding

