Case Study on Partnering with Rett Syndrome Patients and Caregivers Throughout the Drug Development Process

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Outline

- VivoSense- who we are
- Rett Syndrome case study
  - Caregiver engagement throughout study design
- Patient centric approaches
  - Alzheimer's
  - Oncology
  - Return of wearable data

VivoSense **develops and validates** digital clinical measures and provides **end-to-end services and solutions** for their delivery in **regulated** clinical trials

Experts in real-world digital data analyses & interpretation

13 years' experience collecting, aggregating, and analyzing high-resolution wearable sensor data

Develop context- and population-specific measures

R&D dept focused solely on development and validation of novel digital clinical measures

Software developed specifically for use with high-resolution sensors

Quick and easy outsourcing of high-resolution data, providing custom insights and data transfers

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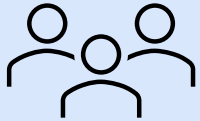
Rett Syndrome

- Rare neurodevelopmental disorder
  - 1:10,000 Female births
  - normal early development followed by developmental delay & regression of acquired skills
- Clinical diagnosis with genetic confirmation
  - 95% of cases MECP2 mutation
- Life-long symptoms
  - Autonomic dysfunction, sleep disturbances, GI dysmotility, scoliosis, contractures, seizures, movement disorders, limited communication, repetitive hand movements, others

Patient Centric - Digital Measures that Matter

Meaningful Aspects of Health
Aspect of a disease that a person a) doesn't want to become worse, b) wants to improve, or c) wants to prevent



Concept of Interest

Simplified or narrowed element that can be practically measured

Outcome to be measured

Specific measurable characteristic

Endpoint

Precisely defined, statistically analyzed variable

Patient Centric- Meaningfulness

- VivoSense further explored meaningful aspects of health as defined by caregivers of individuals with Rett syndrome
- 13 Semi-structed, in-depth interviews with caregivers

Meaningfulness

- “I think seizures were like the front seat for so long because it was the most sort of life threatening if that makes sense. And like the scariest one and also could poke its head out wherever it wanted to in a way that is incredibly disruptive.”

- “It's painful to watch her hold her breath involuntarily so long that she absolutely has a panicked look on her face. It's so difficult. It affects so much.”

- “She has indicated to us that she, you know through her communication devices, that it’s hard for her to breathe and that she wishes breathing was more easy.”

Concepts of Interest and Sensor Technology

- Seizures:
  - EEG: wired caps, wireless headsets, in-ear EEG
- Breathing:
  - Respiratory Inductance Plethysmography
  - ECG

Patient Centric- Digital Measures that Matter

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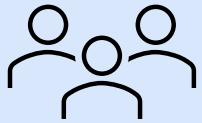

Concept of Interest

Simplified or narrowed element that can be practically measured

Seizures and Breathing irregularity

Outcome to be measured

Specific measurable characteristic

Seizure frequency/severity
Breathing irregularity: hyperventilation, apnea, hypopnea

Endpoint

Precisely defined, statistically analyzed variable

Patient Centric- Digital Measures that Matter

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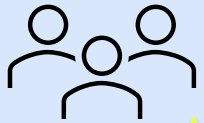

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Seizures and Breathing irregularity

Outcome to be measured

Specific measurable characteristic

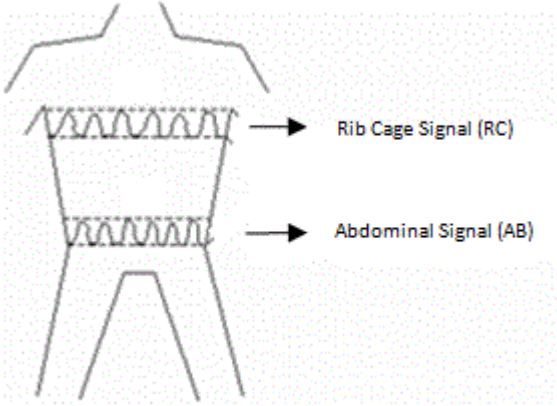
~~Seizures~~
Breathing irregularity: hyperventilation, apnea, hypopnea

Endpoint

Precisely defined, statistically analyzed variable

Breathing Irregularities: respiratory inductive plethysmography

- Thoracic and Abdominal belts obtain waveforms during breathing, with the change in signal/frequency from the belts being proportional to the change in volume during breathing.



Breathing Irregularities in Rett

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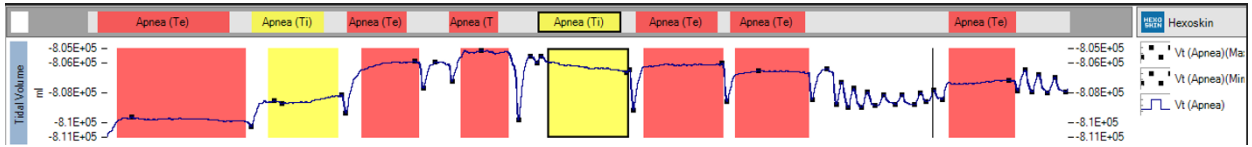
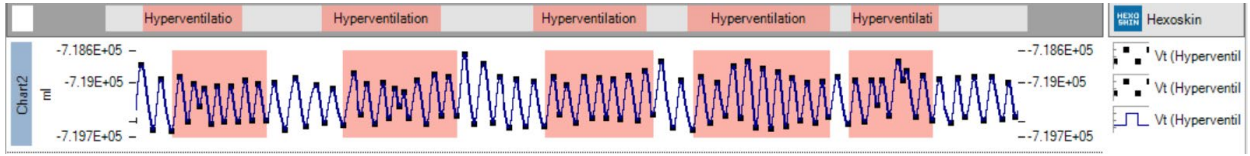
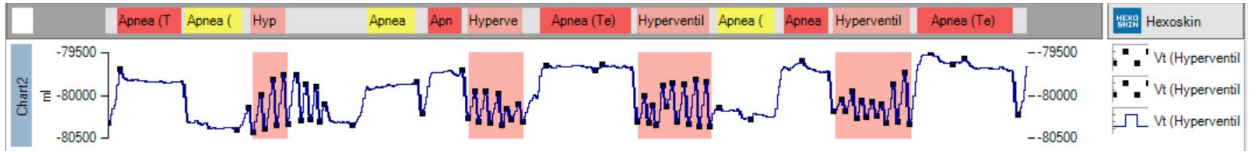
Apnea / breath holds



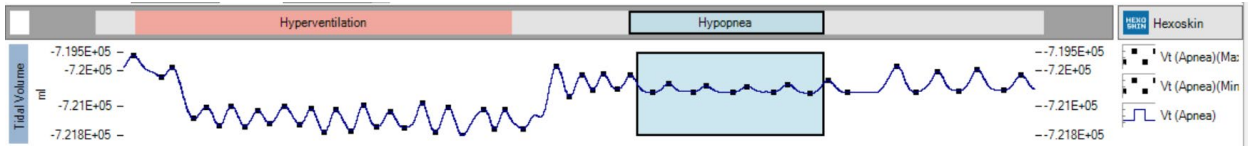
Hyperventilation (regular breath length)



Hyperventilation (variable breath length)



Hypopnea / shallow breaths



VivoSense analysis of Ket-101-RSRT Hexoskin breathing data

Other patient centric approaches: Alzheimer's Disease

- MEADOW-AD: meaningful ecological assessments derived from wearable sensors in Alzheimer's disease
  - **Identify meaningful aspects of health in AD (patient and caregiver interviews)**
  - **Acceptability and feasibility of digital health technologies in AD (patient and caregiver interviews).**
  - Develop and validate ML algorithms to assess walking behaviors in older adults and adults with mild AD.
  - Characterize real-world walking behavior in older adults and adults with mild AD.

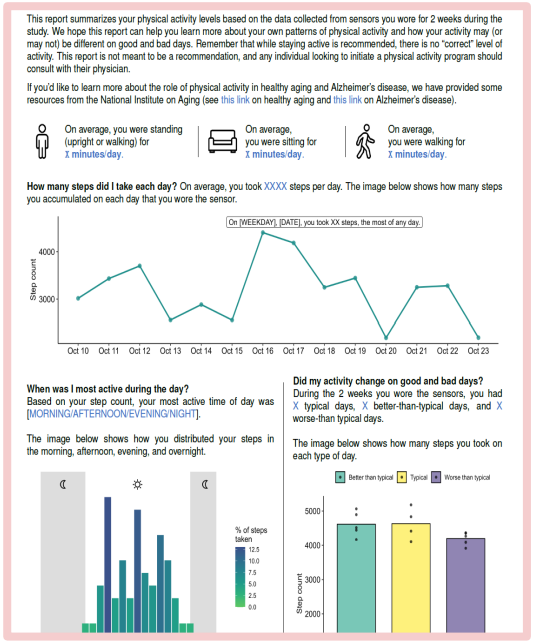
Other patient centric approaches: Oncology

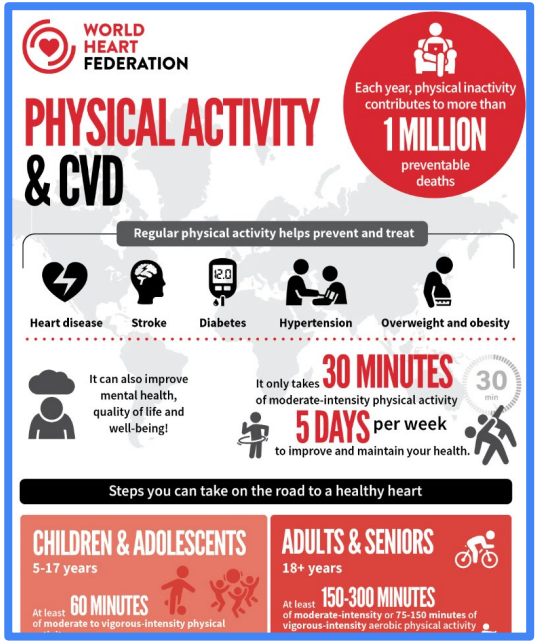
- MEADOW- PROMIS
  - **Identify meaningful aspects of health related to physical functioning in lung cancer patients: survey patients and caregivers.**
  - **Determine acceptability and feasibility of use of digital measures in lung cancer patients: interview/survey patients and caregivers.**
  - Development and validation of a digital measure of physical function in oncology.
  - Qualification of this digital measure of physical function as a clinical outcome assessment through the FDA drug development tool (DDT) qualification process.

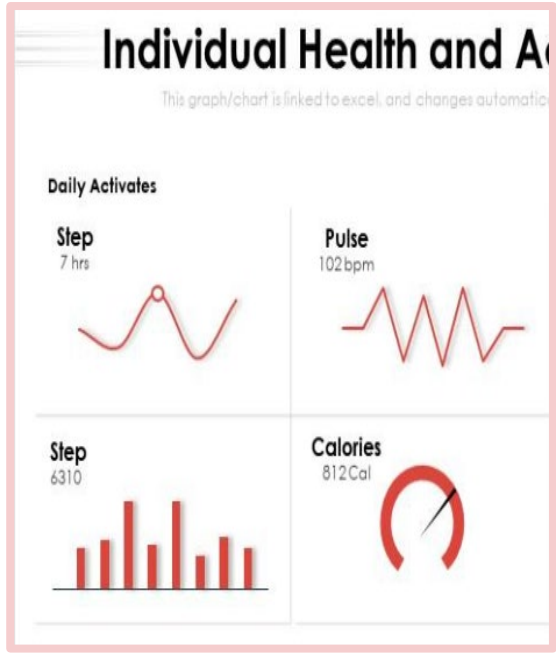
Other patient centric approaches: Returning Data

- By 2025, 50–70% of clinical trials are expected to incorporate wearable sensors which entails increased participation for older age group.
- Growing expectation for transparency on collected data and participants' willingness to have them returned.
- Lack of understanding on what and how participants want to have wearable sensor data returned to them.
- **Interview/Survey older adults' preference for receiving wearable sensor data**

Other patient centric approaches: Returning Data Prototypes







Prototype 1 Prototype 2 Prototype 3

Take home messages

- Thank you to participants.

- Patient and caregiver involvement can be a continuous process that can streamline the design and start up process and provide meaningful information to both patients and drug developers.

References

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Patient Centric- Digital Measures that Matter