Supporting the Self-Management of Chronic Pain Conditions with Tailored Momentary Self-Assessments

Phil Adams, Elizabeth Murnane, Michael Elfenbein, Elaine Wethington, Geri Gay
Chronic Pain
Chronic Pain

20%
Chronic Pain

20% 30%
Chronic Pain

20%

30%

50-80%
Traditional Instruments

No Pain

0 1 2 3 4 5 6 7 8 9 10

Moderate Pain

Worst Pain


Traditional Instruments

- Recall bias
- Low test-retest reliability
- Insensitive to temporal & situational changes in pain
Traditional Instruments

- Recall bias
- Low test-retest reliability
- Insensitive to temporal & situational changes in pain

- Adherence
- Misreporting
- Insensitive to participant preferences and idiosyncrasies
DESIGN PROCESS

Ideation & Review
Sketching & Prototyping
In-Lab Studies
Field Trial
Design Constraints:

- High usability
- Smartphone medium
- In-situ use
- Repeated use
- Cognitive translation processes
- Eliciting potentially distressing content
Design Constraints:

- High usability
- Smartphone medium
- In-situ use
- Repeated use
- Cognitive translation processes
- Eliciting potentially distressing content
Design Constraints:

- High usability
- Smartphone medium
- In-situ use
- Repeated use
- Cognitive translation processes
- Eliciting potentially distressing content
Design Constraints:

- High usability
- Smartphone medium
- In-situ use
- Repeated use
- Cognitive translation processes
- Eliciting potentially distressing content
Design Constraints:

- High usability
- Smartphone medium
- In-situ use
- Repeated use
- Cognitive translation processes
- Eliciting potentially distressing content
Design Constraints:

- High usability
- Smartphone medium
- In-situ use
- Repeated use
- Cognitive translation processes
- Eliciting potentially distressing content
Design Constraints:

- High usability
- Smartphone medium
- In-situ use
- Repeated use
- Cognitive translation processes
- Eliciting potentially distressing content
1. Please touch and hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever).

4. Please tap on the image that best represents your current pain level.

5. Please tap on the image that best represents your current pain level.

6. Please indicate your current pain level with the following visual bar.

7. Please indicate your current pain level by moving this bar.

8. Please indicate your current pain level with the following NRS:

9. Please tap or swipe up/down to change the face such that it best represents your current pain level.
Please touch and hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).

Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

Please touch the screen with 1 to 5 fingers to report your current pain intensity level (1 = worst pain ever).

Please tap on the image that best represents your current pain level.

Please tap on the image that best represents your current pain level.

Please indicate your current pain level with the following scale bar.

Please indicate your current pain level by moving this bar.

Please indicate your current pain level with the following NRS.

Please tap to swipe up/down to change the face such that it best represents your current pain level.
1. Please touch and hold the screen to report your current pain level from: empty circle (no pain) to the full circle (worst pain possible). Reset Submit

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen. Submit

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever). Submit

4. Please tap on the image that best represents your current pain level. No pain at all Submit

5. Please tap on the image that best represents your current pain level. No pain at all Submit

6. Please indicate your current pain level with the following seek bar. No pain at all Submit

7. Please indicate your current pain level by moving this bar: No pain at all Submit

8. Please indicate your current pain level with the following NRS: No pain at all Submit

9. Please tap or swipe up/down to change the face such that it best represents your current pain level. Submit
1. Please touch and hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (9 = worst pain ever).

4. Please tap on the image that best represents your current pain level:
   - No pain at all
   - Worst pain imaginable

5. Please tap on the image that best represents your current pain level:
   - No pain at all
   - Worst pain imaginable

6. Please indicate your current pain level with the following scale:
   - No pain at all
   - Worst pain imaginable

7. Please indicate your current pain level by moving this bar:
   - No pain at all
   - Worst pain imaginable

8. Please indicate your current pain level with the following NRS:
   - 10
   - 9
   - 8
   - 7
   - 6
   - 5
   - 4
   - 3
   - 2
   - 1
   - 0

9. Please tap or swipe up/down to change the face such that it best represents your current pain level.
1. Please touch and hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).  

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever).

4. Please tap on the image that best represents your current pain level.

5. Please tap on the image that best represents your current pain level.

6. Please indicate your current pain level with the following scale bar.

7. Please indicate your current pain level by moving this bar.

8. Please indicate your current pain level with the following NRS.

9. Please tap or swipe up/down to change the face such that it best represents your current pain level.
1. Please touch and hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever).

4. Please tap on the image that best represents your current pain level.

5. Please tap on the image that best represents your current pain level.

6. Please indicate your current pain level with the following seek bar.

7. Please indicate your current pain level by moving this bar.

8. Please indicate your current pain level with the following NRS:

9. Please tap or swipe up/down to change the face such that it best represents your current pain level.
1. Please touch and hold the screen to report your current pain level from an empty circle (no pain) to the full circle (worst pain possible).

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever).

4. Please tap on the image that best represents your current pain level:
   - No pain at all

5. Please tap on the image that best represents your current pain level:
   - No pain at all

6. Please indicate your current pain level with the following NRS:
   - No pain at all

7. Please indicate your current pain level by moving this bar:
   - Worst pain imaginable

8. Please indicate your current pain level with the following NRS:
   - No pain at all

9. Please tap or swipe up/down to change the face such that it best represents your current pain level.
1. Please touch and hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever).

4. Please tap on the image that best represents your current pain level - worst pain imaginable.

5. Please tap on the image that best represents your current pain level - worst pain imaginable.

6. Please indicate your current pain level with the following scale bar.

7. Please indicate your current pain level by moving this bar - worst pain imaginable.

8. Please indicate your current pain level with the following FAQ:
   - Worst pain imaginable
   - 10
   - 9
   - 8
   - 7
   - 6
   - 5
   - 4
   - 3
   - 2
   - 1
   - 0
   - No pain at all

9. Please tap or swipe up/down to change the face such that it best represents your current pain level.
1. Please touch and hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever).

4. Please tap on the image that best represents your current pain level.

5. Please tap on the image that best represents your current pain level.

6. Please indicate your current pain level with the following seek bar.

7. Please indicate your current pain level by moving this bar.

8. Please indicate your current pain level with the following NRS. Please tap or swipe up/down to change the face such that it best represents your current pain level.
In-Lab Studies

• N=10, half 55+ years old
• Interviews
• User-testing
• Open-ended feedback & compare-and-contrast
In-Lab Studies

- **N=10, half 55+ years old**
- Interviews
- User-testing
- Open-ended feedback & compare-and-contrast
In-Lab Studies

• N=10, half 55+ years old

• Interviews

• User-testing

• Open-ended feedback & compare-and-contrast
In-Lab Studies

• N=10, half 55+ years old

• Interviews

• User-testing

• Open-ended feedback & compare-and-contrast
In-Lab Studies

• N=10, half 55+ years old

• Interviews

• User-testing

• Open-ended feedback & compare-and-contrast
1. Please touch-and-hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever).

4. Please tap on the image that best represents your current pain level:
   - Worst pain imaginable
   - No pain at all

5. Please tap on the image that best represents your current pain level:
   - Worst pain imaginable
   - No pain at all

6. Please indicate your current pain level with the following seek bar:
   - Worst pain imaginable
   - No pain at all

7. Please indicate your current pain level by moving this bar:
   - Worst pain imaginable
   - No pain at all

8. Please indicate your current pain level with the following NRS:
   - Worst pain imaginable
   - No pain at all

9. Please tap or swipe up/down to change the face such that it best represents your current pain level.
1. Please touch-and-hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).

2. Please report your current pain level (0 = no pain; 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever).

4. Please tap on the image that best represents your current pain level:
   - Worst pain imaginable
   - No pain at all

5. Please tap on the image that best represents your current pain level:
   - Worst pain imaginable
   - No pain at all

6. Please indicate your current pain level with the following seek bar:
   - Worst pain imaginable
   - No pain at all

7. Please indicate your current pain level by moving this bar:
   - Worst pain imaginable
   - No pain at all

8. Please indicate your current pain level with the following NRS:
   - Worst pain imaginable
   - 10
   - 9
   - 8
   - 7
   - 6
   - 5
   - 4
   - 3
   - 2
   - 1
   - 0
   - No pain at all

9. Please tap or swipe up/down to change the face such that it best represents your current pain level.
1. Please touch and hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever).

4. Please tap on the image that best represents your current pain level.

5. Please tap on the image that best represents your current pain level.

6. Please indicate your current pain level with the following seek bar.

7. Please indicate your current pain level by moving this bar.

8. Please indicate your current pain level with the following NRS:

9. Please tap or swipe up/down to change the face such that it best represents your current pain level.
1. Please touch-and-hold the screen to report your current pain level from empty circle (no pain) to the full circle (worst pain possible).

2. Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

3. Please touch the screen with 1 to 5 fingers to report your current pain intensity level (5 = worst pain ever).

4. Please tap on the image that best represents your current pain level.

5. Please tap on the image that best represents your current pain level.

6. Please indicate your current pain level with the following seek bar:

7. Please indicate your current pain level by moving this bar.

8. Please indicate your current pain level with the following NRS:

9. Please tap or swipe up/down to change the face such that it best represents your current pain level.
SAFESlider

SuperVASNumbered

Source: https://github.com/philadams/Meter
Demo for Android: https://goo.gl/qaJMSR
Field Trial

• N=12, one-third 50+ years old

• Experience Sampling (ESM)

• 3 weeks

• Off-boarding interviews
Field Trial

• N=12, one-third 50+ years old

• Experience Sampling (ESM)

• 3 weeks

• Off-boarding interviews
Field Trial

• N=12, one-third 50+ years old
• Experience Sampling (ESM)
• 3 weeks
• Off-boarding interviews
Field Trial

• N=12, one-third 50+ years old
• Experience Sampling (ESM)
• 3 weeks
• Off-boarding interviews
Usage Statistics

Response | Validity | Usability
---------|---------|---------
96%      | r=.93   | 76%     
84%      | r=.98   | 91%     

Please indicate your current pain level: No pain at all, Worst pain imaginable
# Usage Statistics

<table>
<thead>
<tr>
<th></th>
<th>Response</th>
<th>Validity</th>
<th>Usability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Response</strong></td>
<td>96%</td>
<td>r=.93</td>
<td>76%</td>
</tr>
<tr>
<td><strong>Validity</strong></td>
<td>r=.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Usability</strong></td>
<td></td>
<td>r=.98</td>
<td>91%</td>
</tr>
</tbody>
</table>

![Image of face pain scale](image1)

![Image of pain level scale](image2)
Usage Statistics

<table>
<thead>
<tr>
<th>Response</th>
<th>Validity</th>
<th>Usability</th>
</tr>
</thead>
<tbody>
<tr>
<td>96%</td>
<td>r=.93</td>
<td>76%</td>
</tr>
<tr>
<td>84%</td>
<td>r=.98</td>
<td>91%</td>
</tr>
</tbody>
</table>
# Usage Statistics

<table>
<thead>
<tr>
<th>Response</th>
<th>Validity</th>
<th>Usability</th>
</tr>
</thead>
<tbody>
<tr>
<td>96%</td>
<td>r=.93</td>
<td>76%</td>
</tr>
<tr>
<td>84%</td>
<td>r=.98</td>
<td>91%</td>
</tr>
</tbody>
</table>

**Response**

- **Usage Statistics**: 96%

**Validity**

- **Usability**: r=.93

- **Usability**: 76%

**Usability**

- **Usability**: 91%
THEMATIC ANALYSIS
Reporting Pain with Faces

Please tap on the image that best represents your current pain level:

Worst pain imaginable

No pain at all

Submit

Please indicate your current pain level:

Worst pain imaginable

No pain at all

Submit
“I can definitely imagine **feeling** the way this person **looks**.”
Reporting Pain with Faces

- Doubts about accuracy
- Difficulty interpreting
- Uncomfortable reactions

“I can definitely imagine feeling the way this person looks.”
Reporting Pain with Faces

- Doubts about accuracy
- Difficulty interpreting
- Uncomfortable reactions

“I can definitely imagine feeling the way this person looks.”

“These are real people who are different from me — that’s a disconnect... and it’s harder to pick that one, even if it’s the right degree in the scale.”
Numbers People

Please report your current pain level (0 = no pain, 10 = worst pain possible) by tapping the screen.

Selected level: 3/10

Please indicate your current pain level with the following NRS:

- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1
- 0

No pain at all

Submit

Please indicate your current pain level

Selected level: 3

Worst pain imaginable

Worst pain imaginable

Submit

No pain at all

Submit
“Everywhere you’re taught to think in: ‘one to ten, what’s your pain level.’”
“Everywhere you’re taught to think in: ‘one to ten, what’s your pain level.’”

“It’s hard to put a numerical value on something like discomfort.”
Pliable Interactions

“You’ve got the ability to move up and down while you think about it, until it kind of feels right.”
“This [on the left] is more fine-grained than I need. Jeez, I don’t know, I don’t know! [NRS-11 on the right] with 11 options is a relief, versus having to finagle with an unlimited number.”
Report Resolution

“This [on the left] is more fine-grained than I need. Jeez, I don’t know, I don’t know! [NRS-11 on the right] with 11 options is a relief, versus having to finagle with an unlimited number.”

“I want it to go happier too! If I had no pain, I’d be grinning ear to ear!”
No Evidence of Negative Reactivity
No Evidence of Negative Reactivity

“It almost felt like the scales were an outlet for me... Maybe like the way I might vent if I’m upset. Somehow reporting it — externalizing it — actually eased it. When I’m at 7 or 8, it’s not like the system is going to remind me I’m in pain — I’m not going to forget that!”
No Evidence of Negative Reactivity

“It almost felt like the scales were an outlet for me... Maybe like the way I might vent if I’m upset. Somehow reporting it — externalizing it — actually eased it. When I’m at 7 or 8, it’s not like the system is going to remind me I’m in pain — I’m not going to forget that!”

“I’ve been doing PT [physical therapy] at home... This reminder and filling out the measure didn’t make my perception of the pain different, but it kept it on my mind so I would do things about it [like my PT].”
FUTURE DIRECTIONS
Future Directions

• Integration with clinical care

• Novel assessment modalities

• Complementing self-report with passive sensing
Future Directions

• Integration with clinical care

• **Novel assessment modalities**

• Complementing self-report with passive sensing
Future Directions

• Integration with clinical care
• Novel assessment modalities
• Complementing self-report with passive sensing
Summary & Contributions

• Improving pain measurement and management
• Design constraints
• Novel, validated self-report tools
• A characterization of idiosyncratic preferences to design around
Summary & Contributions

- **Improving pain measurement and management**
- Design constraints
- Novel, validated self-report tools
- A characterization of idiosyncratic preferences to design around
Summary & Contributions

• Improving pain measurement and management

• **Design constraints**

• Novel, validated self-report tools

• A characterization of idiosyncratic preferences to design around
Summary & Contributions

• Improving pain measurement and management
• Design constraints
• **Novel, validated self-report tools**
• A characterization of idiosyncratic preferences to design around
Summary & Contributions

- Improving pain measurement and management
- Design constraints
- Novel, validated self-report tools
- A characterization of idiosyncratic preferences to design around
Summary & Contributions

• Improving pain measurement and management
• Design constraints
• Novel, validated self-report tools
• A characterization of idiosyncratic preferences to design around
Thank You! Questions?

- Improving pain measurement and management
- Design constraints
- Novel, validated self-report tools
- A characterization of idiosyncratic preferences to design around