Validating a Single-Item Stress Scale for mHealth Interventions

Wonchan Choi[1], Sherry L. Pagoto[2], Edwin D. Boudreaux[3], Bengisu Tulu[4]
[1]University of Wisconsin-Milwaukee, [2]University of Connecticut,
[3]University of Massachusetts Medical School, [4]Worcester Polytechnic Institute

Background

- Stress is associated with increased risk for obesity and cardiovascular disease.[1]
  - Stress affects disinhibited eating, junk food consumption.[2]
  - Stress is a major factor in weight loss treatment failure.[3]
- Mobile health applications (mHealth apps) enable delivery of health services through mobile devices such as smartphones.
  - Given the increasing ownership of smartphones (68% of American adults owned a smartphone as of 2015),[4] mHealth apps running on smartphones have the potential to play an important role in monitoring and managing stress continuously without interrupting daily routines.
- Existing stress measurement instruments are typically lengthy and not suitable for the mobile platform.

Objective

- The goal of this study was to validate a single-item stress scale that can be used in health care interventions targeting stress management, especially in the mHealth context.

Research Design

- During February and March in 2017, we conducted an online survey to test our stress scale (Figure 1)
- We used an online crowdsourcing site, Amazon Mechanical Turk, to recruit large samples of participants.
- Of the 315 participants, 56.8% were males. In terms of racial background, a majority of them (76.8%) were White Caucasians.

Single-Item Stress Scale Development

- Our scale has six anchors with numerical values and visual indicators (faces that represent different levels of stress) corresponding to the six anchors (Figure 1).
- We used the item wording of a validated measure of stress symptoms, which includes a definition of stress in it:[4]

  "*Stress means a situation in which a person feels tense, restless, nervous or anxious or is unable to sleep at night because his/her mind is troubled all the time. Are you experiencing this kind of stress currently?*"

- Based on a pilot study we conducted in 2016,[5] we made minor modifications to some of the visual indicators that seemed relatively less intuitive for users to distinguish the indented levels of stress—we adjusted the angles of eyebrows in the faces for "A Little Stress" and "A Whole Lot of Stress"

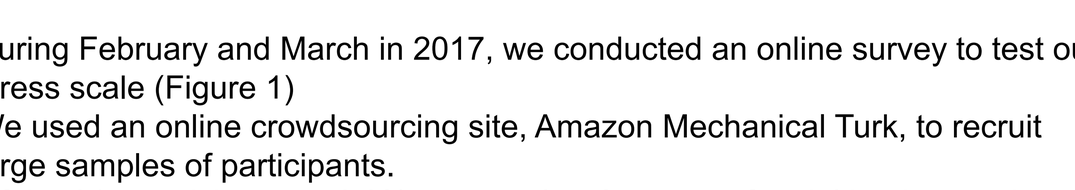


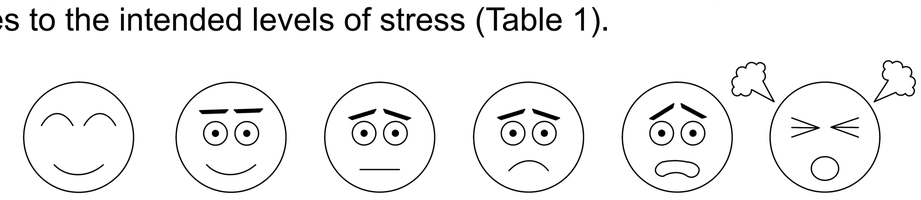
Figure 1. Revised stress scale having six visual indicators and anchors of stress

Tasks

1. Participants matched six different visual indicators (faces) we created with six anchors of stress (Figure 1).
2. Participants ranked seven stressful events, which were selected from a validated stressor scale,[5] in the order of intensity of stress.
   - Death of close family
   - Personal injury or illness
   - Change in health of family member
   - Gain of new family member
   - Change in financial states
   - Change in living conditions
   - Change in residence
3. Participants rated each of the seven stressful events using our stress scale.

Results

- Overall, 80.3% (253 out of 315) of the participants matched all the six faces to the corresponding levels of stress as intended.
- Nearly the 90% or grater proportion of the participants successfully matched each of the faces to the intended levels of stress (Table 1).



No Stress	**295 (93.7%)**	20	0	0	0	0
A Little Stress	20	**288 (91.4%)**	5	2	0	0
A Little More Stress	0	3	**296 (94.0%)**	14	2	0
Even More Stress	0	3	13	**280 (88.9%)**	17	2
A Whole Lot of Stress	0	1	0	19	**283 (89.8%)**	12
Worst Stress	0	0	1	0	13	**301 (95.6%)**
Error	***20 (6.3%)***	***27 (8.6%)***	***19 (6.0%)***	***35 (11.1%)***	***32 (10.2%)***	***14 (4.4%)***

Table 1. Distributions of errors

- A Spearman's rank order correlation indicated that there was a statistically significant, strong negative correlation between the rank orders of and the ratings on the seven stressful events (r_s = − .773, n = 2205, p < .001)—i.e., the higher the stressful events were ranked, the more likely they received higher ratings on the stress scale (Figure 2).
- The results indicated a good concurrent validity of our single-item stress scale.

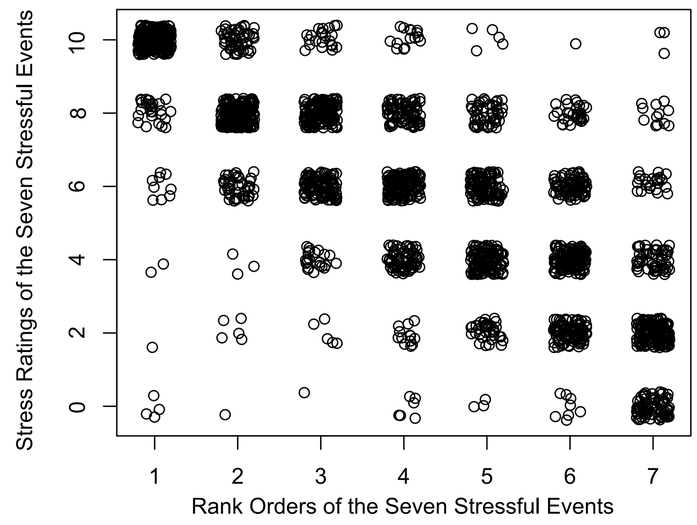


Figure 2. Correlation between ranks and ratings

Conclusions & Future Plans

- The results show that our single-item stress scale has the potential to be implemented on mobile devices, especially mHealth apps, to capture patients' stress levels quickly and accurately.
- In a following study, we will examine the visual indicators whether they can capture users' stress levels consistently and accurately without the numerical values or text labels (or both), which will be particularly useful for space-efficient mobile platforms.

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