

Development and evaluation of a facial-action based pain assessment tool



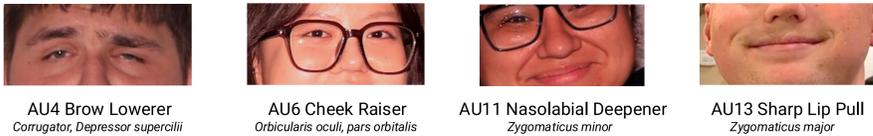
Elisabeth Chai, EMT-B • Stony Brook Volunteer Ambulance Corps
elisabeth.chai@stonybrook.edu • Stony Brook University, Stony Brook, NY

Introduction

Accurate pain assessment is a critical skill for EMS providers, yet traditional training paradigms emphasize verbal self-report and physical behaviours. These methods may be unreliable in patients who are nonverbal, cognitively or neurologically impaired, emotionally distressed, or have chronic pain, and are further complicated by provider biases.

Existing pain assessment tools:

- Target specific populations (FLACC: pediatric, BPS: adult ICU)
- Are subjective (what is the threshold for a grimace? a smile?)
- Are not specific to pain and are not sensitive to transient or procedural pain (physical behaviours may represent other experiences, such as anxiety, agitation, or delirium)
- Fail to account for cultural or social norms of behaviour



The **Facial Action Coding System (FACS)** is recognized as a valid and reliable method to objectively describe facial expressions, as well as monitor pain-related facial expressions in various patient populations.



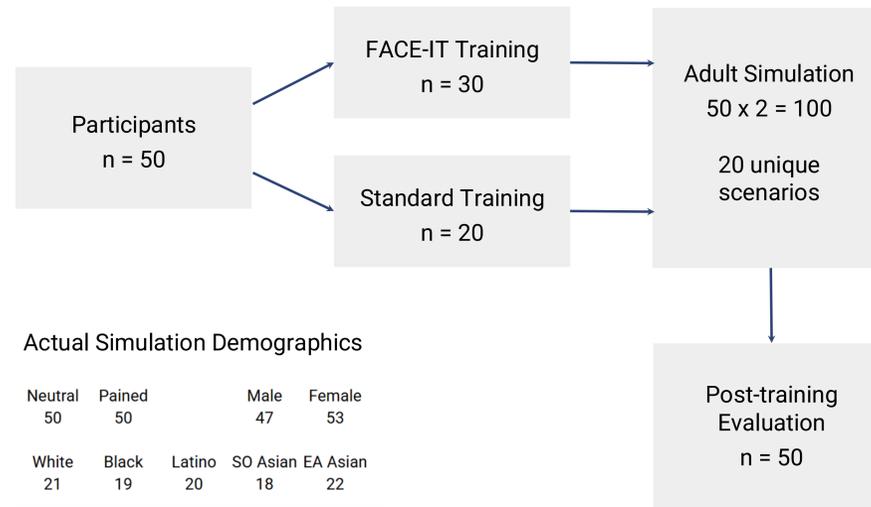
A combination of pain-related action units define a pained expression made when a splint is applied too tightly.

Pain estimation is a composite of pain-related action units and their intensity, which are used to differentiate pain from other expressions (e.g. sadness, fear).

Methods

Fifty New York State EMTs were randomly assigned to participate in one hour of didactic instruction in either standard patient assessment or FACE-IT, which included: (1) foundations in FACS and pain-related action units and (2) image-based exercises using the SynPAIN facial expression dataset.

Then, participants were randomly assigned to two adult simulation scenarios varied by pain expression (neutral, pained), gender (male, female), and race (White, Black, Latino, East Asian, South Asian). Cohort outcomes were compared for differences in accuracy, demographic effects, and perceived confidence.

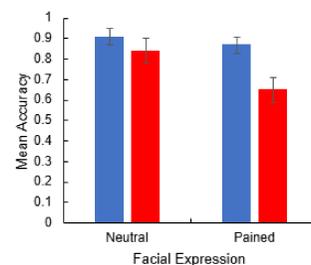


Actual Simulation Demographics

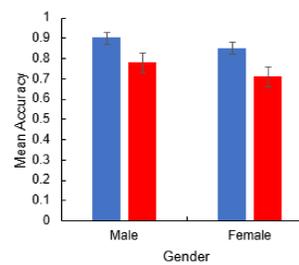
Neutral	Pained	Male	Female	
50	50	47	53	
White	Black	Latino	SO Asian	EA Asian
21	19	20	18	22

Evaluation

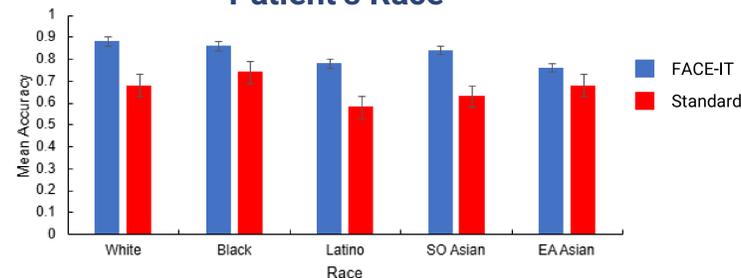
Facial Expression



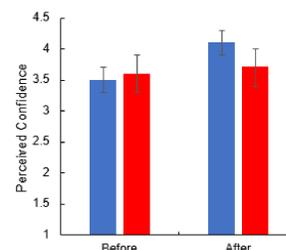
Patient's Gender



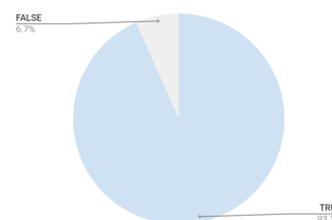
Patient's Race



Confidence



"I am confident in assessing pain when a patient cannot verbally self-report."



Conclusions

Participants who received the FACE-IT training demonstrated:

- Higher accuracy in identifying pain expressions, and consistently across all demographic categories (e.g. patient's gender, race)
- Decreased inter-rater variability, compared to the standard training

Survey data also indicated:

- Increased confidence in identifying and assessing nonverbal pain
- High participant satisfaction with FACE-IT content and structure

Integrating facial action units into standard assessment training may improve accuracy, equity, and confidence in pain evaluation.

Future Directions

- Is this program generalisable to non-adult patients? Can pain-related action units reliably assess pain across age groups?
- How about dynamic expressions and multimodal behavioral cues?
- Can pain-related action units accurately predict pain intensity?

References

- (1) Ekman, P., Friesen, W. V., & Hager, J. C. (2002). Facial Action Coding System: The Manual and Investigator's Guide. Research Nexus.
- (2) Nerella, S., Cupka, J., Ruppert, M., Tighe, P., Bihorac, A., & Rashidi, P. (2021). Pain Action Unit Detection in Critically Ill Patients. Proceedings: Annual International Computer Software and Applications Conference. COMPSAC, 2021, 645–651. <https://doi.org/10.1109/compsac51774.2021.00094>
- (3) Rojo, R., Prados-Frutos, J. C., & López-Valverde, A. (2015). Evaluación del dolor mediante el Sistema de Codificación de la Acción Facial. Revisión sistemática [Pain assessment using the Facial Action Coding System. A systematic review]. Medicina clinica, 145(8), 350–355. <https://doi.org/10.1016/j.medcli.2014.08.010>
- (4) Kunz, M., Meixner, D., & Lautenbacher, S. (2019). Facial muscle movements encoding pain—a systematic review. Pain, 160(3), 535–549. <https://doi.org/10.1097/j.pain.0000000000001424>

Acknowledgements

A special thanks to my peers at the Stony Brook Volunteer Ambulance Corps for their support. For all that they have done to shape me into the person and provider I am today, a "thank you" seems rather simple and utterly inadequate to convey the depth of my gratitude.