

# Decoding of Pain through Facial Expressions: Influences of Sufferers' Race and Gender on Chinese Observers' Intensity Estimation and Treatment Recommendations

Zhiyuan Liu<sup>a</sup>, Tzu-Ying Chuang<sup>a</sup>, Shan Wang<sup>b</sup>

<sup>a</sup> Undergraduate Program, Duke Kunshan University, Kunshan, China

<sup>b</sup> Division of Natural and Applied Sciences, Duke Kunshan University, Kunshan, China



## Background

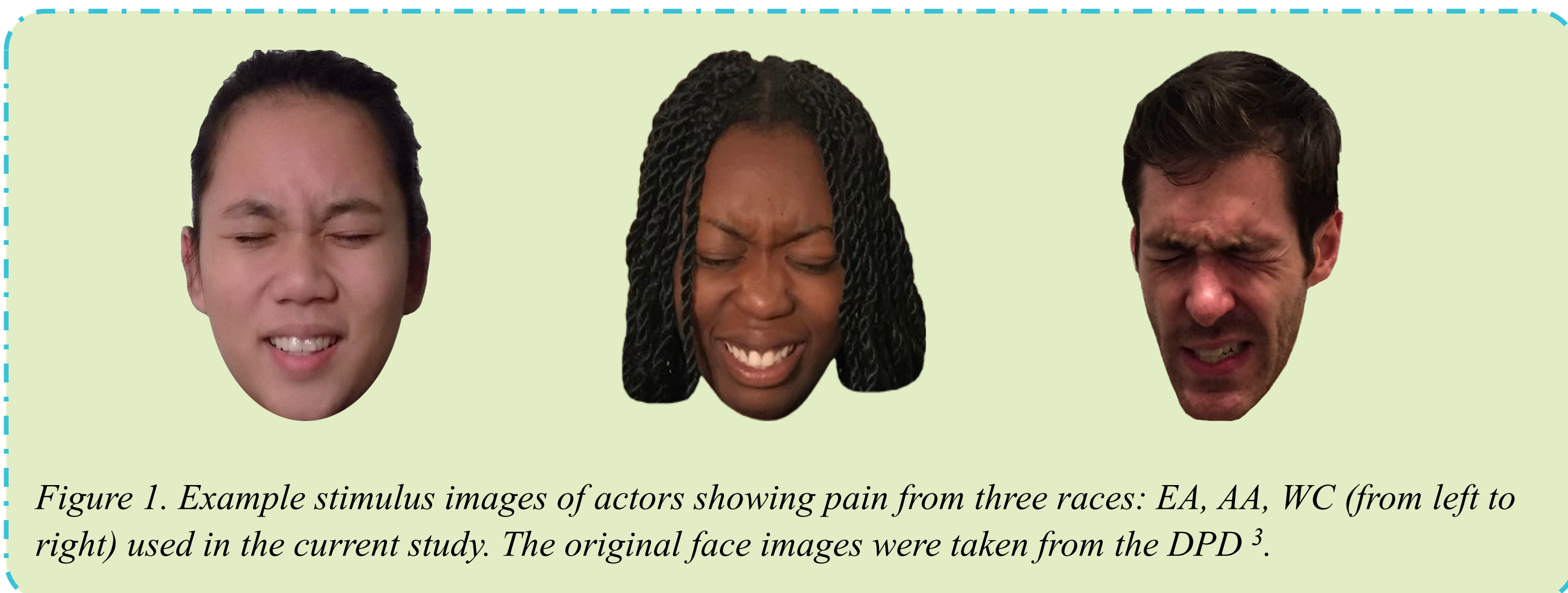
Facial expression is a key channel for nonverbal pain communication often incorporated in clinical assessment and treatment.<sup>1</sup> It is known that sufferers' race affects pain assessment and management. Previous research has primarily focused on disparities in the interpretations of Black and White sufferers' pain expressions by White Caucasians, where Black sufferers' pain is more likely to be underestimated and, accordingly, undertreated.<sup>2</sup>

However, little is known about other races or the decoding of pain expression in other social cultures. Therefore, the primary goal of this research is to address the gap by investigating how the Chinese decode pain expressions of different races for intensity estimation and treatment recommendation.

## Methods

An online experiment was conducted to examine 162 Chinese (105 females; aged 18-51) participants' evaluation of pain intensity, the necessity of painkillers and pain authenticity for East Asians (EA), African/African Americans (AA) and White Caucasians (WC).

Facial expression stimuli were selected from the Delaware Pain Database (DPD<sup>3</sup>; see Figure 1 for sample stimuli). Twenty-four models were selected with four males and four females of each race (EA, AA, WC). For each model, two pain photos were used (4\*2\*3\*2 = 48 stimulus images in total).



**Procedure:** The online experimental procedure is shown in Figure 2.

## Results

### Racial bias exists in pain estimation through sufferers' facial expressions.

- Mixed-effect repeated measures ANOVA revealed that Chinese observers rated AA pain > WC > EA ( $F(1.33, 212.93) = 106.48, p < .001, \eta_p^2 = .40$ ). The underestimation for EA's pain is particularly strong for female sufferers ( $F(1, 160) = 27.38, p < .001, \eta_p^2 = .15$ ).

### The racial effect is not due to differences in facial expressiveness but rather to racial bias.

- Facial Action Coding Score (FACS) was used as an objective measure of facial expressiveness and entered as a covariate into General Linear Mixed-effects Models. FACS is indeed different across the three races, and a significant predictor of pain intensity estimation ( $\chi^2_{\text{Change}}(1) = 82.26, p < .001$ ).
- However, after accounting for the effect of FACS, the racial disparities are still significant ( $\chi^2_{\text{Change}}(2) = 341.04, p < .001$ ), which means when the same pain

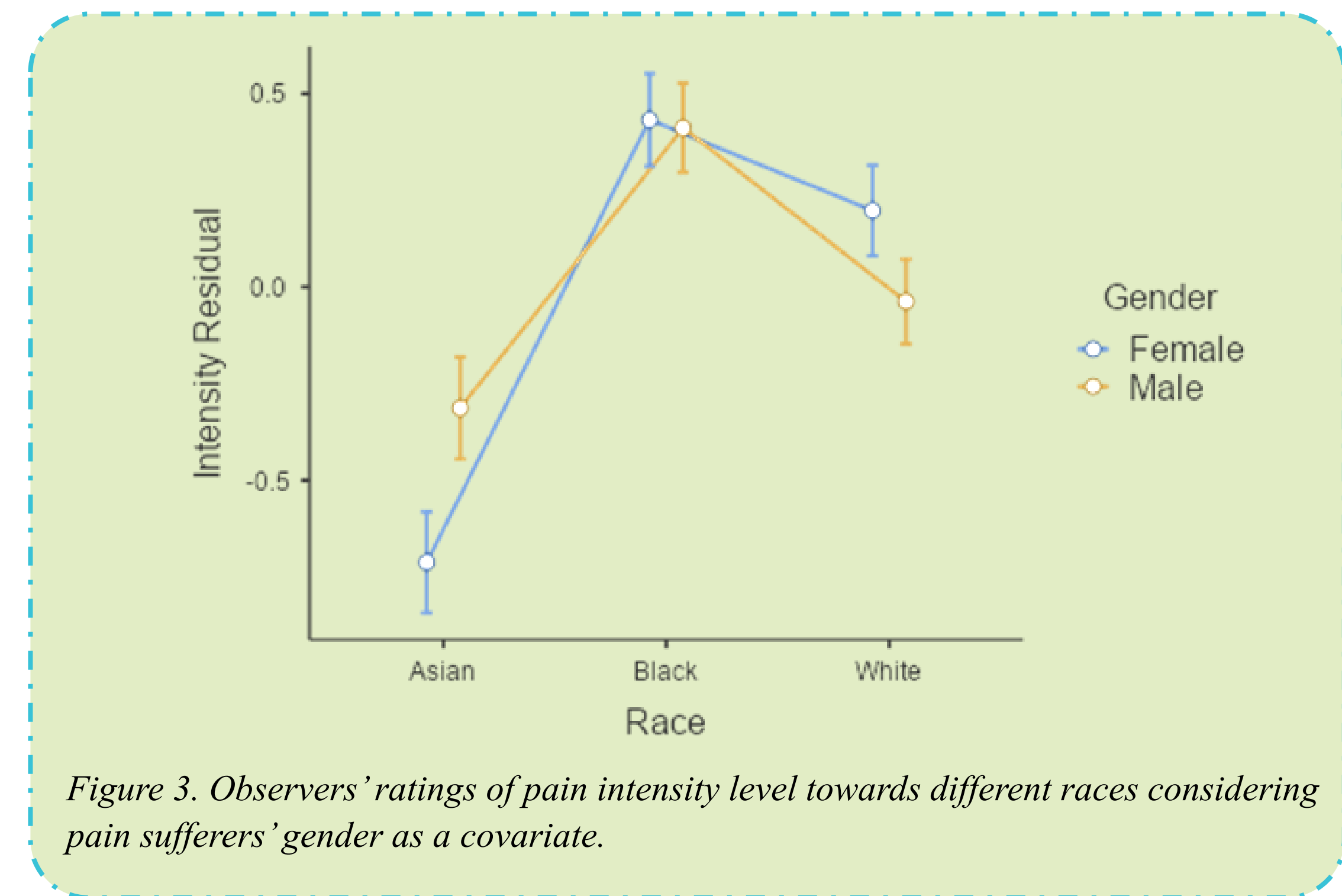


Figure 3. Observers' ratings of pain intensity level towards different races considering pain sufferers' gender as a covariate.

expressions were shown, EA females were most underestimated ( $p < .001$ , Cohen's  $d = -0.45$ ), whereas WC females' pain was perceived to be slightly stronger than WC males ( $p = .028$ , Cohen's  $d = 0.17$ ). AA's pain was still rated as the strongest among all races and had no gender differences (Figure 3).

### Biases in the estimation of pain lead to racial disparities in pain treatment.

- Pain intensity estimation significantly predicts pain treatment that will be provided and accounts for over 67% of the variance ( $R^2_{adj} = .67$ ), which means underestimation is likely to lead to under-treatment.
- The extent to which observers believe one is inhibiting or exaggerating his/her pain expressions shows no race differences, and it does not mediate the relationship between intensity estimation and pain treatment ( $ACME = 0.001, p = .16$ ).

## Conclusion

- Through facial expressions, Chinese observers most underestimated the pain of East Asians, in particular, East Asian females'. The estimation of pain intensity level significantly predicts the treatment of pain, which indicates East Asian females' pain is more likely to be inadequately treated.
- This result is contrary to previous findings, where White Caucasians are more likely to underestimate the pain of other racial groups than their own<sup>2</sup>.
- Questionnaire data on Chinese observers' pain beliefs, attitudes and empathy will be further analyzed to investigate possible underlying mechanisms.

## References

- Prkachin, K. M. Assessing Pain by Facial Expression: Facial Expression as Nexus. *Pain Research and Management* 14, 53–58 (2009).
- Hoffman, K. M., Trawalter, S., Axt, J. R. & Oliver, M. N. Racial bias in pain assessment and treatment recommendations, and false beliefs about biological differences between blacks and whites. *Proc Natl Acad Sci USA* 113, 4296–4301 (2016).
- Mende-Siedlecki, P., Qu-Lee, J., Lin, J., Drain, A. & Goharзад, A. The Delaware Pain Database: a set of painful expressions and corresponding norming data. *PR9* 5, e853 (2020).

## Acknowledgements

This study is funded by the DKU Health Humanities Lab, the Office of Undergraduate Studies, and the DKU Summer Research Scholars Program.

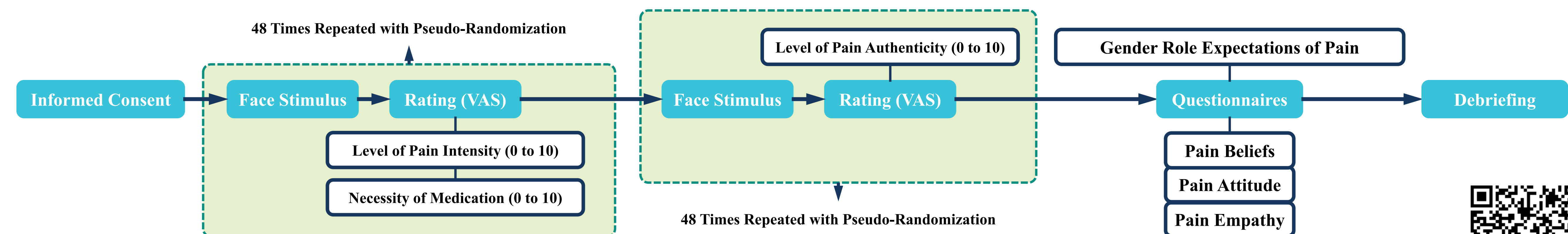


Figure 2. The overall experimental procedure of the current study

Find out more:

<https://sites.duke.edu/dkuhumanities/can-chinese-accurately-recognize-pain-from-foreigners-facial-expressions>

