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BASIC RESEARCH ARTICLE

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The impact of intimate partner violence on facial emotion recognition among Korean baby boomers

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ABSTRACT

Background: Intimate partner violence (IPV) can have lasting psychological and cognitive effects, potentially impairing facial emotion recognition (FER). This study examines the accuracy of FER among IPV survivors compared to individuals without IPV experience within the Korean baby boomer generation, aged 60-69, exploring the relationship between IPV, post-traumatic stress disorder (PTSD) symptoms, and FER abilities.

Objective: To assess whether IPV impacts FER accuracy and intensity and to investigate whether symptoms of PTSD moderate this relationship.

Method: The study included 80 participants, with 31 % identified as IPV survivors. A self-administered survey collected information on lifetime experiences of physical, emotional, and sexual abuse, as well as assessments for PTSD symptoms. Participants completed the Korean Montreal Cognitive Assessment (K-MOCA) and performed 70 FER tasks to evaluate accuracy and intensity of facial emotions. Logistic regressions were used to analyse the relationship between IPV, PTSD symptoms, and FER performance.

Results: IPV survivors demonstrated 0.64 times lower accuracy in recognizing overall facial emotions, including anger, sadness, surprise, and neutral expressions Additionally, IPV survivors exhibited significantly lower intensity scores for overall facial expressions. Significant interaction terms between IPV and PTSD symptoms indicate that PTSD symptoms moderate the effect of IPV on the FER, as well as neutral and sad facial expressions.

Conclusions: IPV can disrupt one's ability to recognize facial emotions, and PTSD symptoms may moderate this impairment. This highlights the potential benefits of assisting IPV survivors with emotion recognition as part of their recovery process, which could enhance both social connections and their safety.

El impacto de la violencia de pareja en el reconocimiento de emociones faciales en la generación baby boomer de Corea

Antecedentes: La violencia de pareja (IPV, por sus siglas en inglés) puede tener efectos psicológicos y cognitivos duraderos, potencialmente afectando el reconocimiento de emociones faciales (FER por sus siglas en ingles). Este estudio examina la precisión del FER entre sobrevivientes de IPV en comparación con individuos sin experiencia de IPV dentro de la generación baby boomer de Corea, de entre 60 y 69 años, con el objetivo de explorar la relación entre IPV, síntomas de trastorno de estrés postraumático (TEPT) y las habilidades de FER.

Objetivo: Evaluar si la IPV impacta la precisión e intensidad del FER e investigar si los síntomas de TEPT moderan esta relación.

Método: El estudio incluyó 80 participantes, de los cuales el 31% fueron identificados como sobrevivientes de IPV y el 69% como individuos sin experiencia de IPV. Se utilizó una encuesta autoadministrada para recopilar información sobre experiencias de abuso físico, emocional y sexual a lo largo de la vida, así como evaluaciones de síntomas de TEPT. Los participantes completaron la Evaluación Cognitiva de Montreal en su versión coreana (K-MOCA) y realizaron 70 tareas de FER para evaluar la precisión e intensidad de las emociones faciales. Se emplearon regresiones logísticas para analizar la relación entre IPV, síntomas de TEPT y el desempeño en FER.

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PALABRAS CLAVE
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HIGHLIGHTS

- IPV survivors demonstrated 0.64 times lower accuracy in recognizing overall facial emotions, including anger, neutral, surprise, and sad expressions, compared to individuals without IPV experience.
- IPV survivors exhibited significant lower intensity scores for overall emotional expressions.
- Symptoms of post-traumatic stress disorder (PTSD) moderate the ability of IPV survivors to recognize emotions.
- Enhancing FER skills through intervention may reduce IPV survivors' vulnerability to further victimization and improve their social interactions.

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Resultados: En comparación con los individuos sin experiencia de IPV, los sobrevivientes de IPV mostraron una precisión 0.64 veces menor en el reconocimiento de emociones faciales en general, incluyendo expresiones de ira, tristeza, sorpresa y neutralidad. Además, los sobrevivientes de IPV presentaron puntuaciones de intensidad significativamente más bajas en todas las expresiones faciales. Los términos de interacción significativos entre IPV y los síntomas de TEPT indican que estos últimos moderan el efecto de la IPV en el desempeño del FER para las expresiones faciales en general, así como para las expresiones neutras y tristes.
Conclusiones: Los hallazgos indican que la IPV puede afectar la capacidad de reconocer emociones faciales y que los síntomas de TEPT pueden moderar esta alteración. Esto resalta los posibles beneficios de ayudar a los sobrevivientes de IPV en el reconocimiento de emociones como parte de su proceso de recuperación, lo que podría mejorar tanto sus conexiones sociales como su seguridad.

1. Introduction

Intimate partner violence (IPV), one of the most prevalent forms of violence against women, represents a significant global burden (Ma et al., 2023). According to the World Health Organization (WHO), approximately one-third of women have experienced IPV in their life time (World Health Organization (WHO), 2012). IPV refers to 'behavior within an intimate partner relationship that causes physical, sexual or psychological harm, including acts of physical aggression, sexual coercion, psychological abuse and controlling behaviors' (World Health Organization (WHO), 2021). The Korean domestic violence survey of 2022 revealed that the rates of victimization for physical, sexual, emotional, and financial violence over the past year were 9.4% for women and 5.8% for men (Korean Women's Development Institute, 2022).

Research has extensively documented the various consequences of IPV, including physical and mental health issues, as well as behavioural problems, compared to individuals without IPV experiences (Bosch et al., 2017; Gobin et al., 2013; Smith et al., 2022; Weaver & Resick, 2014). Women who experienced IPV exhibit significantly higher levels of post-traumatic stress disorder (PTSD), and 'alexithymia' characterized by difficulties in identifying and labelling emotional states compared to controls matched for socio-economic status, employment, and educational attainment (Pico-Alfonso, 2005; Signorelli et al., 2020). These emotional states are associated with alterations in facial emotion recognition (FER) (Couette et al., 2020; Fieker et al., 2016; Grynberg et al., 2012; Krause et al., 2021).

Numerous studies have found patients with PTSD who experienced traumatic events (e.g. war, torture, physical and sexual assault, natural disasters, automobile accidents) exhibit altered FER processing. According to a recent systematic review of 17 studies ($n = 378$ PTSD patients), while five studies ($N = 99$) did not find any alterations in FER (Bell et al., 2017; Dunkley et al., 2016; Felmingham et al., 2010; Fonzo et al., 2010), but approximately 75% of PTSD patients demonstrated impairments (Couette et al., 2020). Specifically, PTSD patients showed reduced accuracy and slower matching for negative, threatening expressions (anger, fear, sadness) (DiGangi et al., 2017; MacNamara et al., 2013; Poljac et al., 2011). They also perceived happy faces as less intense or interpreted them more negatively (Felmingham et al., 2014; Mazza et al., 2012). Additionally, alexithymia has been linked to impaired FER, particularly for sad faces(Mann et al., 1994; 1995). Differences in traumatic experiences, cultural and ethnic backgrounds, assessment methods, and sample characteristics contribute to the heterogeneity of study findings. Nonetheless, difficulties in recognizing facial expressions suggest that PTSD may negatively influence social perception.

Research on FER among survivors of IPV and the evidence of differences in emotional information processing between those who experienced IPV and non-experienced is limited. One study reported that IPV victims among college female students exhibited a bias toward fearful faces and had poorer recognition of happy faces compared to non-victims (Clauss & Clements, 2021). Eye-tracking studies indicated that IPV victims with higher level of PTSD symptoms spend significantly longer fixating on angry faces compared to both controls and survivors with lower symptom levels, suggesting difficulties disengaging attention from trauma-related stimuli (Lee & Lee, 2014). Furthermore, other studies propose that IPV survivors may experience alexithymia as a result of trauma-related stress or psychological impacts (Cloitre & Rosenberg, 2006).

While IPV prevention efforts should primarily focus on perpetrators to address the root causes of abusive behaviour, it is equally important to understand the consequences of IPV survivors to help them avoid potential risks and future revictimization. FER is particularly important for survivors of IPV because accurately identifying threatening situations can serve as a protective factor against revictimization (Sherrill et al., 2015; Whiting et al., 2012). A qualitative study found that IPV survivors often rely on their

partner's facial expressions, especially angry expressions, as key situational cues to anticipate potential aggression or violence (Sherrill et al., 2015). The ability to recognize these facial cues of threat enables IPV survivors to engage in protective behaviours or de-escalation strategies. Additionally, Whiting et al. (2012) noted that perceptions of safety and threat within relationships involve complex appraisal processes that include attending to facial expressions and other non-verbal cues from one's partner. Developing skills in accurately interpreting these facial and emotional signals may help IPV survivors better assess risk and maintain safety in their relationships.

The purpose of this study was to examine the association between IPV experiences and FER among Korean baby boomers born between 1955 and 1963. This generation, now in their 60s had experienced extreme poverty alongside rapid material prosperity in the aftermath of Korean War (Han et al., 2011). Korean baby boomers have distinct characteristics compared to other generations. While they were the first to receive formal higher education, they grew up in a society governed by patriarchal norms rooted in Confucianism, which reinforced traditional gender roles. Gender-based violence has been highly prevalent, with 34.1% of individuals reporting physical violence in 1999 (Kim et al., 2010). Additionally, 21.4% of male Baby Boomers reported experiencing IPV in 2010 (Nam et al., 2015). However, such issues often remain hidden and untreated, reflecting similar trends observed in other low- to middle-income countries (Kim & Emery, 2003; Ma et al., 2023). Furthermore, this generation faces significant mental health challenges, with high levels of stress, depression, and suicidal ideation as they approach retirement (Jeong, 2023). Nevertheless, limited research has been conducted on this topic in this context. This study is expected to offer unique insights into a population that has been exposed to long-term abusive interpersonal relationships in a society where IPV is prevalent.

We hypothesized that there would be differences in the accuracy of recognition and associated intensity scores for facial expressions when comparing IPV survivors to individuals without IPV experience. Specifically, we expected IPV survivors to demonstrate lower accuracy and intensity in FER compared to individuals without IPV experience. Additionally, we hypothesized that IPV survivors would exhibit heightened sensitivity to negative expressions, such as fear, sadness, and anger, compared to positive expressions like happiness. Finally, we anticipated that the severity of PTSD symptoms would moderate emotional recognition abilities, with higher PTSD symptoms further impairing the ability to accurately recognize facial emotions.

2. Method

2.1. Study participants

This sub-study is part of a broad trauma study aimed at examining lifetime exposure to trauma among Korean baby boomers. Study participants were recruited through snowball sampling (Goodman, 1961) and completed either online or paper version of the trauma survey ($N = 355$). From these participants, 80 healthy individuals were further recruited based on their suicide risk to evaluate brain function during FER using functional near-infrared spectroscopy. These participants were excluded: (1) those with skin allergies to disposable sensors; (2) difficulty following instructions to open and close their eyes; (3) low corrected vision that impedes distinguishing picture stimuli; (4) a history of neurological diseases. For the current study, a total of 80 participants completed the Montreal Cognitive Assessment (MOCA) and the Patient Health Questionnaire (PHQ-9), (Kroenke et al., 2001) before proceeding with the FER tasks.

The study was approved by the Institute Review Board of Korea University Ansan hospital in Korea (2022AS0129) and written informed consent was obtained from all participants.

2.2. Data collection/measures

Intimate Partner Violence (IPV): Experiences of IPV were assessed using questionnaires that included the following three survey items: 'Has your partner ever abused you physically?'; 'Has your partner ever abused you emotionally?'; and 'Has your partner ever abused sexually?' Participants who answered 'yes' to any of these questions were classified as survivors, while those who answered 'no' to all questions were categorized as individuals without IPV experience.

Facial Emotional Recognition (FER) and Intensity task: The Yonsei Face Database (YFace DB) was used to assess facial images, displaying six basic expressions (happy, sad, anger, disgust, fear, and surprise) along with a neutral facial expression. This database completed a thorough validation process, demonstrating an overall picture accuracy of 76%, and a mean intensity of the stimuli was 4.89 out of 7, both of which are comparable to other databases (Chung et al., 2019). Several studies have used this data in their FER tasks, such as those involving social anxiety (Yang & Baek, 2022) and autism spectrum disorder (Chung & Chung, 2023). For current study, 10 models (five female and five male) with high accuracy and intensity scores were selected. The intensity of each face's emotional expression was measured on a scale from 1 (very low) to 5 (very high).

Korean version of the Montreal Cognitive Assessment (K-MOCA): All participants completed the

Korean version of the Montreal Cognitive Assessment (K-MOCA), administered by qualified research staff. The K-MOCA is a 10-minute screening tool used to assess cognitive function (Nasreddine et al., 2005). It has demonstrated high internal consistency, reliability, and sensitivity for detecting cognitive impairment in Korean population (Kang et al., 2009; Ko et al., 2013). Participants were classified based on their global K-MOCA score, with a cutoff of 23 used to distinguish between those with and without cognitive impairment.

Post-Traumatic Stress Disorder (PTSD): The PTSD checklist for DSM-5 (PCL-5) was used to assess the symptoms of PTSD, which is a 20-item self-report measures (Blevins et al., 2015). A sample item of this includes: 'In the past month, how much have you been bothered by repeated, disturbing, and unwanted memories of the stressful experience?' responses were on a 5-point Likert scale from 0 (Not at all) to 4 (Extremely).

2.3. Study design

The facial expression recognition (FER) task was conducted in a quiet room at the hospital with participants wearing earplugs to minimize distraction. Seven emotional facial images for both male and female models, were randomly presented in each trial. Each face was displayed for 2 s, during which participants were instructed to identify the type of emotion shown on the screen and rate its intensity on a scale from 1 (very low) to 5 (very high) using buttons on a PC. Each trial was followed by a fixation point ('+') displayed for 2 s (Figure 1). The accuracy of correct emotional recognition (correct vs. incorrect response) and intensity scores for each facial emotion were calculated. A total of 5600 observations were used for analysis (10 models × 7 facial expression × 80 participants = 5600).

2.4. Statistical analysis

Chi-square tests and analysis of covariance (ANCOVA) were conducted to assess group differences in demographic characteristics based on IPV status. The accuracy rate for each facial emotion, categorized by IPV status was displayed in a confusion matrix using MATLAB (Figure 2). Logistic regression analyses were employed to examine whether IPV status influences accuracy of FER, controlling for age, sex, educational attainment cognitive impairment, PTSD score, and the interaction term between IPV status and PTSD symptoms. Statistical significance was set at $p < .05$. All statistical analyses were performed using SAS software.

3. Results

3.1 Demographic characteristic of the study sample

Table 1 summarizes the demographic characteristics of the study sample, categorized by IPV status. Eighty participants answered the questions related to IPV, with 31.25% belonging to the IPV-survivor group and 68.75% to the group without IPV experience. The average age of participants was 63.70 years for the IPV-survivor group and 64.88 years for group without IPV experience ($p = .07$). There were no significant differences between the IPV survivors and group without IPV experiences in terms of sex, educational attainment, marital status, monthly household income, and cognitive function. However, IPV

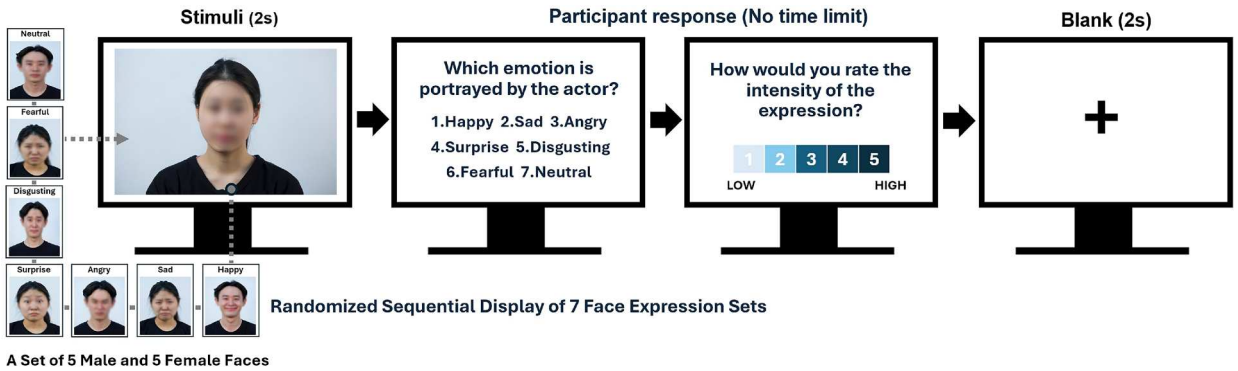


Figure 1. Procedure of Facial Emotional Recognition Task. Each participation completed a short version of the Korean Montreal Cognitive Assessment (K-MoCA). For the FER task, 70 facial images by each gender (5 females and 5 males x 7 expressions) were prepared for random selection. A facial photo was displayed on the PC screen for 2 s. On the subsequent screen, participants were asked to identify each face which represented seven different types of emotions. After identifying the type of emotion, participants rated the intensity of each face on a scale from 1 (very low) to 5 (very high). There was no time limit for selecting the emotion type or rating the intensity. Following a 2-second blank screen displaying a fixation point ('+'), the next trial began with a randomly selected photo.

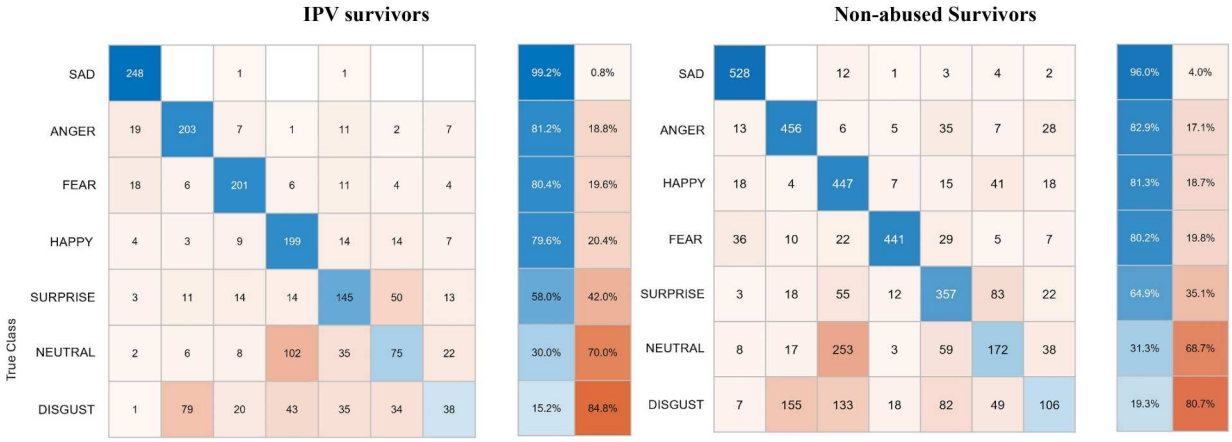


Figure 2. Confusion Matrix of Facial Emotion Recognition by IPV Status. Each column of the matrix represents the actual emotion (true class), while each row represents the predicted emotion (predicted class). The diagonal cells of the matrix indicate the number of correct identifications for each emotion, while the off-diagonal cells show misclassifications. Accuracy is calculated by dividing the number of correct identifications by the total number for each facial emotion, categorized by IPV status. The colour intensity in the matrix indicates accuracy: darker blue signifies higher accuracy, while darker red indicates higher inaccuracy.

survivors had significantly higher levels of PTSD symptoms (14.36 in survivors vs. 7.78 in the individuals without IPV experience, $p = .001$).

Table 1. Characteristics of study participants by IPV status ($N = 80$).

	IPV-survivors	Non-abused	Group difference
	Freq/Mean (%/SD)	Freq/Mean (%/SD)	
	$N = 25$ (31.25%)	$N = 55$ (68.75%)	*p*-value
Age	63.70(2.42)	64.88 (2.62)	.07
Sex			.39
Male	$N = 5$ (20%)	$N = 16$ (29.09%)	
Female	$N = 20$ (80%)	$N = 39$ (70.91%)	
Educational Attainment			.32
Primary	$N = 1$ (4.0%)	$N = 1$ (1.82%)	
Middle	$N = 4$ (16.0%)	$N = 8$ (14.55%)	
High school	$N = 5$ (20.0%)	$N = 22$ (40.00%)	
College	$N = 4$ (16.0%)	$N = 3$ (5.45%)	
University or Higher	$N = 11$ (44.0%)	$N = 21$ (38.18%)	
Marital status			.68
Married	$N = 18$ (72%)	$N = 41$ (75.93%)	
Widowed	$N = 5$ (20.00%)	$N = 7$ (12.96%)	
Divorced/ Separated	$N = 2$ (8.00%)	$N = 6$ (11.11%)	
Monthly household income*			.44
Low = <$1,200	$N = 1$ (4.0%)	$N = 5$ (9.09%)	
Middle $1,200-$3,200	$N = 14$ (56.0%)	$N = 35$ (63.64%)	
High > = $,3200	$N = 10$ (40.0%)	$N = 15$ (27.27%)	
K-MOCA	24.24 (4.20)	24.20 (4.49)	.72
Cognitive Impairment	$N = 9$ (34.62%)	$N = 16$ (29.63%)	.65
PTSD	14.36 (7.98)	7.78 (8.00)	.001

*Converted from Korean currency to US $ @exchange rate of 1250.

3.2. Recognition accuracy of facial emotional expression by IPV status

Table 2 presents the descriptive frequency test for the overall correct recognition rates of each facial expression by IPV status, while Figure 2 displays the confusion matrix illustrating these results. The overall accuracy in FER across all seven emotions combined was 64.57% for all participants. The highest accuracy in FER was observed for happy expressions (97%), followed by surprise (82.38%), sadness (80.75%), and neutral expressions (80.25%). Conversely, the lowest accuracy rates were particularly noted for fear (18.00%), followed by disgust (30.88%), and anger (62.75%). No significant group difference in overall FER accuracy was observed by IPV status (63.37% for IPV-survivors vs. 65.12% for the group without IPV experience, $p = .21$). Among the individual emotions, the significant group differences by IPV status were observed for happy expressions (99.2% in IPV survivors vs. 96.07% in group without IPV experience, $p = .01$).

Additionally, we examined whether there are significant differences in FER based on the gender of the person in the stimuli photos (see Supplementary Tables S1-S2). Table S1 presents the accuracy rate of FER with female photos while Table S2 presents the accuracy rate of FER with male photos among the female participants. We found the overall accuracy rate for all facial images combined was higher when female participants tested male photos(65.38%) compared to female photos(62.48%). For female photos, a significant group difference between IPV-survivors and group without IPV experience was observed only for happy expressions, with survivors achieving 100% accuracy compared to 95.5% for individuals without IPV experience ($p = .03$). For male photos,

Table 2. Recognition accuracy of facial emotion expression by IPV status.

	Overall $N = 80$		IPV Survivors $N = 25$ (31.25%)		Non-abused $N = 55$ (68.75%)		Group Diff
	Correct *N* (%)	Incorrect *N* (%)	Correct *N* (%)	Incorrect *N* (%)	Correct *N* (%)	Incorrect *N* (%)	*p*-value
All Images	3616 (64.57%)	1984 (35.43%)	1109 (63.37%)	641 (36.63%)	2507 (65.12%)	1343 (34.88%)	$p = .21$
Anger	502 (62.75%)	298 (37.25%)	145 (58.00%)	105 (42.00%)	357 (64.91%)	193 (35.09%)	$p = .06$
Disgust	247 (30.88%)	553 (69.13%)	75 (30.0%)	175 (70.00%)	172 (31.27%)	378 (68.73%)	$p = .72$
Fear	144 (18.00%)	656 (82.00%)	38 (15.20%)	212 (84.80%)	106 (19.27%)	444 (80.73%)	$p = .16$
Happy	776 (97.00%)	24 (3.00%)	248 (99.20%)	2 (0.80%)	528 (96.07%)	22 (4.00%)	$p = .01$
Neutral	642 (80.25%)	158 (19.75%)	201 (80.40%)	49 (19.60%)	441 (80.18%)	109 (19.82%)	$p = .94$
Sad	646 (80.75%)	154 (19.25%)	199 (79.60%)	51 (20.40%)	447 (81.07%)	103 (18.73%)	$p = .58$
Surprise	659 (82.38%)	141 (17.63%)	203 (81.20%)	47 (18.80%)	456 (82.91%)	94 (17.09%)	$p = .56$

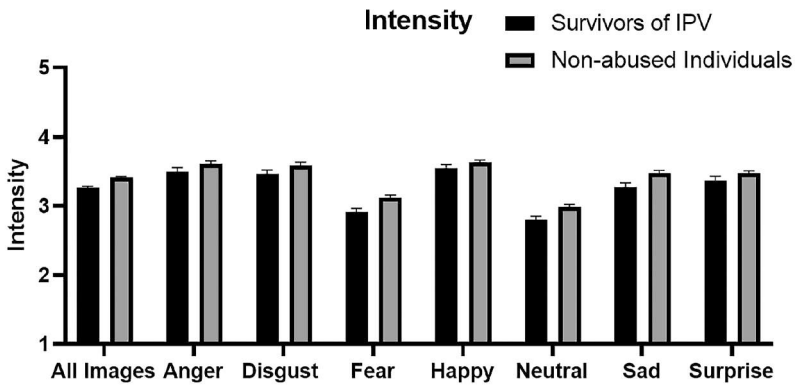
significant group differences were found for fear (12% of accuracy in survivors vs. 21.50% in the individuals without IPV experience, $p = .04$) and happy faces (99% in survivors vs. 94% in the individuals without IPV experience, $p = .04$).

3.3. Intensity of facial emotional expression by IPV status

Figure 3 presents the intensity scores of each facial emotion. The average intensity score was 3.37, indicating a moderate level of intensity on a scale ranging from 1 (very low) to 5 (very high). Among all participants, the highest intensity scores were observed for the happy expression (intensity = 3.60), followed closely by anger and disgust. In contrast, the lowest scores were noted for neutral, fear, sad, and surprise. Significant group differences were observed, particularly for expressions of fear, neutral, and sad ($p < .01$), but not for anger, disgust, happy, and surprise expressions. Survivors demonstrated lower intensity score for overall facial emotions compared to individuals without IPV experience (3.26 vs.3.42, $p \leq .001$) (See Supplementary Table S3).

3.4. Results of logistic regression

Tables 3 present the results of logistic regression models predicting the correct recognition of facial expressions. The model included IPV (dichotomized as survivors vs. individuals without IPV experience) as a predictor, adjusting for age, sex, level of educational attainment, PTSD score, cognitive impairment, and an interaction term of IPV and PTSD score. When controlled for these covariates, significant independent effects of IPV were observed for overall images ($\beta = -0.45$, $p < .001$), as well as for anger ($p = .02$), neutral ($p = .001$), sad ($p = .01$), and surprise faces ($p = .02$), but not for disgust, fear, and happy faces. An adjusted odds ratio (AOR) of 0.64 for IPV survivors for the overall images indicate that IPV survivors are 36% less likely to correctly identify facial emotions compared to individuals without IPV experience, after controlling other variables in the model. The adjusted odds ratio (AOR) for anger, neutral, sad, and surprise were 0.47, 0.32 0.41 and 0.41 respectively at the 95% significance level ($p < .05$). For fear, AOR was 0.45, which was marginally significant ($p = .06$). For the overall images, a medium effect size was indicated (Cohen's $d = -0.78$), according to Cohen's classification (Allen & Le, 2008).



Survivors of IPV	3.41	3.61	3.61	3.06	3.61	2.99	3.45	3.52
Non-abused Individuals	3.28	3.50	3.44	3.04	3.59	2.78	3.34	3.27

Figure 3. Intensity of Facial Emotion Recognition by IPV Status. The mean intensity scores with standard errors for each facial emotion was calculated, stratified by IPV status on a scale from 1 (very low) to 5 (very high). Significant group differences are indicated by * for $p < .05$, ** for $p < .01$, and *** for $p < .001$.

Table 3. Logistic regression for accuracy of facial emotion recognition.

Image	Overall Images				Anger				Disgust				Fear			
	Est	Sd	OR[CI]	*p*-value	Est	Sd	OR[CI]	*p*-value	Est	Sd	OR[CI]	*p*-value	Est	Sd	OR[CI]	*p*-value
IPV (Ref = Non-abused)	−0.45	0.12	0.64 [0.50, 0.81]	.0001	−0.75	0.31	0.47 [0.26, 0.87]	.02	−0.09	0.33	0.91 [0.48,1.75]	.78	−0.80	0.43	0.45 [0.19,1.04]	.06
Sex	0.08	0.07	1.09 [0.95,1.25]	.23	0.18	0.18	1.20 [0.84,.1.72]	.32	−0.07	0.19	0.94 [0.65,1.35]	.73	0.40	0.24	1.49 [0.94,2.36]	.09
Age	0.01	0.01	1.01 [0.99,1.04]	.24	0.00	0.03	1.00 [0.94,1.06]	.95	−0.04	0.03	0.96 [0.91,1.02]	.20	0.00	0.04	1.00 [0.93,1.08]	.90
Education	−0.05	0.02	0.95 [0.91,1.00]	.05	−0.11	0.06	0.89 [0.79,1.01]	.08	0.12	0.07	1.12 [0.99,1.28]	.08	−0.09	0.08	0.92 [0.79,1.07]	.27
Impaired Cognition (ref = normal)	−0.57	0.07	0.56 [0.50,0.64]	<.0001	−0.81	0.18	0.45 [0.32,0.63]	<.0001	−0.67	0.20	0.51 [0.35,0.75]	.001	−0.56	0.23	0.57 [0.37,0.90]	.02
PTSD	0.00	0.00	1.00 [0.99,1.01]	.43	−0.01	0.01	0.99 [0.97,2.01]	.56	0.00	0.01	1.00 [0.98, 1.03]	1.00	−0.01	0.02	0.99 [0.95,1.03]	.65
IPV*PTSD	0.03	0.01	1.03 [1.01-1.05]	.001	0.04	0.02	1.04 [1.00,1.08]	.07	0.01	0.02	1.01 [0.97,1.05]	.74	0.04	0.03	1.04 [0.98,1.10]	.15
	Happy				Neutral				Sad				Surprise			
	Est	Sd	OR[CI]	*p*-value	Est	Sd	OR[CI]	*p*-value	Est	Sd	OR[CI]	*p*-value	Est	Sd	OR[CI]	*p*-value
IPV (ref = Non-abused)	−1.00	1.25	0.37 [0.03,4.28]	.42	−1.14	0.39	0.32 [0.15,0.69]	.00	−0.88	0.35	0.41 [0.21,0.82]	.01	−0.88	0.38	0.41 [0.20,0.87]	.02
Sex	−0.90	0.78	0.41 [0.09, 1.88]	.25	0.26	0.24	1.30 [0.82,2.06]	.27	−0.08	0.23	0.93 [0.59,1.45]	.74	0.21	0.24	1.24 [0.77,1.99]	.37
Age	−0.06	0.10	0.94 [0.77,1.14]	.52	0.13	0.04	1.14 [1.06,1.23]	.00	0.02	0.04	1.02 [0.95,1.10]	.56	0.07	0.04	1.08 [1.00,1.16]	.06
Education	−0.44	0.21	0.64 [0.43,0.97]	.04	−0.13	0.08	0.88 [0.75,1.03]	.10	−0.06	0.08	0.94 [0.81,1.10]	.45	−0.19	0.08	0.82 [0.70,0.97]	.02
Impaired Cognition (ref = normal)	−2.58	0.60	0.07 [0.02,0.24]	<.0001	−1.49	0.22	0.23 [0.15,0.35]	<.001	−0.40	0.21	0.67 [0.44,1.02]	.06	−1.17	0.22	0.31 [0.20,0.48]	<.0001
PTSD	0.08	0.04	1.08 [1.00,1.17]	.06	0.01	0.02	1.01 [0.97,1.05]	.61	0.01	0.02	1.01 [0.97,1.05]	.34	0.03	0.02	1.03 [0.99,1.07]	.08
IPV*PTSD	0.26	0.17	1.30 [0.93,1.81]	.12	0.08	0.03	1.08 [1.02,1.15]	.01	0.05	0.03	1.05 [0.99,1.12]	.04	0.04	0.03	1.04 [0.98,1.10]	.13

Cognitive impairment was a significant predictor for FER in across all images ($p < .001$) except marginal significance for sad faces ($p = .06$). While PTSD score did not show a significant independent effect on FER recognition, significant interactions between IPV and PTSD scores were found for overall images ($p = .001$), neutral ($p = .01$), and sad faces ($p = .04$). This interaction indicates that the impact of PTSD score on accurate recognition of facial emotions depends on IPV status. For example, the estimate of 0.03 for the interaction term for overall images suggests that the effect of PTSD symptoms on FER accuracy is stronger for survivors than for individuals without IPV experience. Specifically, with each one-unit increase in PTSD score, the odds of a correct response to FER increases by 1.03 for survivors compared to the individuals without IPV experience. In other words, the effect of PTSD symptoms on the odds of a correct response for all images is approximately 3% higher for survivors compared to individuals without IPV experience.

4. Discussion

In the current study, we explored the effect of IPV experience on the accuracy of FER by comparing survivors of IPV with individuals without IPV experience among the Korean baby boomer generation.

There was substantial variation in FER accuracy across different emotional expressions. Notably, happy expressions were recognized with the highest recognition rate among all other emotions (97%), which is consistent with previous studies that reported more accurate and faster recognition of happy expression than other basic emotions (Becker & Srinivasan, 2014; Juth et al., 2005; Poljac et al., 2011). The frequency tests indicated that IPV survivors demonstrated a 3% higher accuracy in recognizing happy expressions compared to individuals without IPV experience (99.2% vs. 96.07%, $p = .01$). This higher accuracy rate among survivors may reflect a compensatory attentional bias toward positive social cues. As an adaptive coping mechanism, IPV survivors may focus on happy expressions as indicators of safety and acceptance. Given the frequent negativity in their environments, survivors may become particularly attuned to rare displays of positive emotion, resulting in heightened sensitivity to happiness in facial expressions.

Of particular interest, the accuracy for recognizing fear was the lowest among the seven emotions, with only 18% of participants correctly identifying fearful expressions (15.2% of IPV survivors vs. 19.27% of individuals without IPV experience, $p = .16$). This finding aligns with previous research that found reduced accuracy and decreased sensitivity (intensity) to negative expressions such as fear and sadness, among PTSD patients (Montagne et al., 2005; Poljac et al., 2011). These lower recognition rates may reflect avoidance responses developed from chronic exposure to anger and aggression, consistent with emotional processing theories of PTSD that emphasize avoidance as a key maintaining factor (Foa & Kozak, 1986). Additionally, this may suggest alterations in threat detection mechanisms, making it difficult for IPV survivors to discriminate between threatening and non-threatening stimuli.

IPV survivors tended to underrate the intensity of facial emotions, indicating that emotional numbing or desensitization in survivors of chronic interpersonal trauma (Frewen et al., 2008). Repeated exposure to intense negative emotions may dampen emotional or sensory responsiveness over time as a coping mechanism. This diminished perception of emotional intensity could also have a negative impact on their overall social functioning and interactions.

We also observed differences in accuracy rates when female participants viewed female versus male facial photos. While acknowledging the importance of addressing male IPV survivors in research, it is crucial given that most perpetrators are male, and survivors are more likely to be female. Overall, recognition accuracy for overall images was higher (65.38%) when female participants viewed male photos compared to female photos (62.57%). However, significant differences between IPV survivors and individuals without IPV experience were found for male photos, particularly in recognizing fear (12% of survivors vs. 22.05% of individuals without IPV experience, $p = .04$) and happy images (99% of survivors vs. 93.85% of individuals without IPV experience, $p = .04$). Around a 10% difference in recognizing fearful male photos among female IPV survivors compared to individuals without IPV experience are concerning. This gap underscores a potential risk of revictimization, as challenges in recognizing unsafe situations may hinder their ability to respond appropriately. Research on gender differences in FER accuracy, as well as the influence of the photo model's gender, has yielded mixed findings (Kapitanović et al., 2022). These findings highlight the need for further research investigating the differential consequences for female versus male IPV survivors, as well as gender-specific accuracy in FER.

Our main finding demonstrated significant impacts of IPV experience on overall emotion recognition, as well as on the recognition of anger, neutral, sad, and surprise expression ($p < .05$), after adjusting for demographic covariates, symptoms of PTSD, cognitive impairment, and interaction between symptoms of PTSD and IPV. The adjusted odds ratio (AOR) less than 1 for IPV experience indicates a decreased likelihood of correctly identifying these emotions. Specifically, the AOR of 0.64 indicates that being an IPV

survivors are associated with a 36% decrease in the likelihood of correctly recognizing facial emotions. This suggests that IPV survivors generally struggle more with emotion recognition compared to individuals without IPV experience particularly for all expressions except disgust and happiness. However, significant interaction between symptoms of PTSD and IPV (OR = 1.03) indicates that correct emotion recognition actually increases by about 3% for each unit increase in PTSD score among survivors. This suggests that while IPV status negatively impact on FER, the presence of PTSD symptoms slightly modify the effect on recognition particularly for overall expressions, and specifically, neutral and sad expressions, even the recognition accuracy generally remains lower among survivors. Only a few studies have examined FER among IPV survivors (Clauss & Clements, 2021), making it difficult to compare findings due to differences in sample, cultural context, and age group.

Several limitations should be noted. The small sample size limits that the findings are exploratory in nature and would benefit from validation in future large-scale studies. Nevertheless, to our knowledge, this study is among the few to examine the life experiences of IPV and FER, as well as the moderating impact of these relationships, particularly within a Korean population. Given that many Asian countries are influenced by authoritarian, patriarchal cultural norms compared to Western countries, this study offers significant insights into understanding IPV within a distinct cultural context beyond the US and Europe. Although the questions regarding IPV were straightforward and captured general experiences broadly, using more validated diagnostic screening instruments commonly employed in clinical settings could provide a deeper understanding of the nature of IPV within the study sample. While this study limits our ability to draw causal conclusions about the relationship between IPV exposure and FER, retrospective assessment of lifetime IPV experience, combined with the FER task, evaluation of PTSD symptoms, and a neuropsychological assessment battery of cognitive functioning in old adults, provides comprehensive and unique contribution to the field.

Globally, IPV is a significant public health concern with substantial economic costs. There is a scarcity of research addressing deficits in FER among IPV survivors. Recently, interventions that incorporate components of FER, particularly for individuals with autism spectrum disorder, have been developed (Lee et al., 2018; Wells et al., 2021). Given that IPV survivors demonstrate lower accuracy in FER, even when controlling cognition and symptoms of PTSD, this study highlights the potential benefits of enhancing social perception skills in individuals whose cognitive and psychological well-being has been affected by traumatic IPV experiences. In summary, this study provides evidence that IPV negatively impacts on the accurate identification of others' facial emotions and tends to lead to an underestimation of emotional intensity. However, the relationship between FER and IPV is complex; while overall impairment exists due to IPV, psychological states such as PTSD can modify this effect under specific circumstances. The difficulties that IPV survivors face in recognizing emotions may be associated with increased vulnerability to future victimization, potentially due to impaired ability to detect threats. These findings highlight the importance of targeted interventions aimed at improving emotion recognition skills to better support IPV survivors.

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Data availability

Data is available on the reasonable request to corresponding authors, due to privacy/ethical restrictions.

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