

BMJ Open Protocol for a between-group experimental study examining cultural differences in emotion processing between Malay and Caucasian adults with and without major depressive disorder

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ABSTRACT

Introduction: Depression is a mood disorder that affects a significant proportion of the population worldwide. In Malaysia and Australia, the number of people diagnosed with depression is on the rise. It has been found that impairments in emotion processing and emotion regulation play a role in the development and maintenance of depression. This study is based on Matsumoto and Hwang's biocultural model of emotion and Triandis' Subjective Culture model. It aims to investigate the influence of culture on emotion processing among Malaysians and Australians with and without major depressive disorder (MDD).

Methods and analysis: This study will adopt a between-group design. Participants will include Malaysian Malays and Caucasian Australians with and without MDD (N=320). There will be four tasks involved in this study, namely: (1) the facial emotion recognition task, (2) the biological motion task, (3) the subjective experience task and (4) the emotion meaning task. It is hypothesised that there will be cultural differences in how participants with and without MDD respond to these emotion tasks and that, pan-culturally, MDD will influence accuracy rates in the facial emotion recognition task and the biological motion task.

Ethics and dissemination: This study is approved by the Universiti Putra Malaysia Research Ethics Committee (JKEUPM) and the Monash University Human Research Ethics Committee (MUHREC). Permission to conduct the study has also been obtained from the National Medical Research Register (NMRR; NMRR-15-2314-26919). On completion of the study, data will be kept by Universiti Putra Malaysia for a specific period of time before they are destroyed. Data will be published in a collective manner in the form of journal articles with no reference to a specific individual.

Strengths and limitations of this study

- This will be one of the first studies to systematically investigate cultural influences on emotion processing in major depressive disorder (MDD).
- The stimuli that will be used in this study have been used in previous studies and been found to have good psychometric properties.
- The simple random sampling technique ensures that the sample is representative of the target population.
- The study will be carried out in the urban area; hence, the sample may not be representative of the whole Malay and Caucasian Australian community.
- Participants may provide answers that are socially desirable when answering the questionnaires.

INTRODUCTION

Major depressive disorder (MDD) is a mood disorder that affects 350 million people around the globe.¹ Currently, the number of Malaysians and Australians suffering from depression is on the rise. The Institute for Public Health reported in the National Health Morbidity Survey that the number of Malaysians suffering from depression in 2015 had increased by 17% since 2011.² Additionally, there has been a significant increase in suicide rates, where 28.7% of the suicide victims had a history of mental illness and 47.2% of them were suffering from depression.³ A similar concern has been reported by the Australian Bureau of Statistics; whereby they have found that in

any 1 year there are around 1 million Australian adults suffering from depression⁴ and that, on average, 8 adults commit suicide every day due to depression.⁵

One of the factors that influences depression is culture. In Western individualistic cultures like the USA, UK, Germany and Australia, importance is given to self-achievement, personal freedom and personal qualities.^{6 7} In contrast, in Eastern collectivist cultures, such as Japan, Turkey, China and Malaysia, emphasis is given to viewing the self as being linked to others in a group.^{6 7} These differences affect MDD in terms of the factors involved in the development and maintenance of MDD, the way in which MDD symptoms are manifested, and how MDD is expressed, discussed and managed.^{8–16} Studies have also found that culture influences physical health and medical conditions.^{17 18} In terms of reporting the symptoms of MDD, Chinese and Malaysian Chinese patients tend to focus on the somatic symptoms, while patients from American, European Canadian and European Australian cultural backgrounds tend to focus on the psychological symptoms.^{19–21} Depression is also termed differently, with some Asian cultures using metaphors and terms like ‘pressure on my mind’ to express MDD symptoms.^{22–24}

Cultural differences also influence the way in which adults with MDD process their emotions. For instance, adults with MDD have been found to have impaired emotion processing abilities, especially in terms of facial emotion recognition (FER) of disgust, as compared to healthy adults (Grant FAL. Emotion recognition in chronic treatment resistant depression: Before and after neurosurgical treatment. (Unpublished Master’s Dissertation). UK: University of St. Andrews, 2013). In China, researchers have found a bias in perception, where depressed patients were quicker to identify negative expressions compared to the healthy control group.²⁵ Researchers using the biological motion (BM) paradigm have also demonstrated that adults with MDD have been less accurate in identifying the correct emotions, especially those that involve happiness and they tend to rate the emotion expressed in BM paradigms as more negative, and the negative BMs as more intense than adults without MDD.^{26 27} Some cross-cultural research has suggested that perception of BM is spontaneous and universal.²⁸ However, other research has presented conflicting findings.²⁸ Differences have also been found in the area of subjective experience of emotions (ie, self-reports of feelings and affect).²⁹ In collectivistic cultures, opposite emotions (eg, happy and sad) or two similar emotions (negative-negative or positive-positive) can be experienced by an individual at the same time.^{30–33} However, this combination of subjective experience of emotion is less likely in individualistic cultures (eg, America).^{30–33} Research has found that Japanese participants encountered engaging emotions (ie, emotions dependent on others in a relationship, eg, respect, shame), while American participants are more likely to experience disengaging emotions (ie, emotions

independent of others, eg, pride, anger).^{34 35} Emotion meanings are the values, beliefs, attitudes, concepts and theories of emotion that require language and higher order cognition.³⁶ For members of an individualistic culture, emotions are regarded as individual experiences and events. Thus, pride is viewed as a positive emotion that has the ability to achieve congruence between identity and goals. On the other hand, for those who belong to collectivistic cultures, emotions are more likely to be interpreted as social events and positive emotions are identified based on relationships and their connectedness to others.^{35 37} In terms of language, every language has specific words to express emotion. However, languages can differ significantly in terms of the specific emotions described (ie, some languages do not have a term for particular emotions).^{29 38} Hence, it is evident that culture plays a significant role in shaping one’s emotion meaning.

Despite an increasing understanding of the role of emotion processing in MDD and the cross-cultural research indicating that culture shapes emotion processing in healthy controls, relatively little is known about how culture influences emotion processing in adults with MDD. This study will investigate four specific areas where culture and MDD have been found to result in differences in terms of how emotions are processed and perceived, namely facial emotion recognition, biological motion, subjective experience of emotion and emotion meaning.

Conceptual framework

This study will be based on two cultural models of emotion, namely the biocultural model of emotion that was developed by Matsumoto and Hwang,²⁹ and Triandis’ subjective cultural model.³⁸ Matsumoto and Hwang²⁹ proposed that emotions are universally elicited by certain situations that are accompanied by specific and universal patterns of subjective feelings and bodily changes. However, they have stressed that these emotions are not just biological. Rather, they are socially constructed and thus need to be also understood and analysed on a social and cultural level. In their model, emotions are classified into three domains, namely priming reactions, subjective experience and emotion meaning. Priming reactions are instantaneous emotional reactions to stimuli and include physiological changes and expressive behaviour (such as facial expressions). An example of a priming reaction is someone smiling in response to a baby laughing. These reactions are immediate and do not tend to rely on language ability or conscious deliberation. Subjective experiences, which are self-reports of feelings and affect, require language and some higher-order cognition. An example of a subjective experience is where two people are watching the same movie but may not necessarily like the movie to the same degree or one may like it and the other may not. Finally, emotion meaning refers to concepts, preferences, representations and beliefs about emotions (eg,

preferences as to which emotion is best to display within a certain context, what the emotion denotes). For example, in some cultures (eg, individualistic cultures), emotions are internal states while in others (eg, collectivist cultures) they may be used to represent relationships with others. These processes require language and higher-order thinking. In Matsumoto and Hwang's model, it is argued that culture has the strongest influence on those emotional domains that require higher-order thinking and language. Hence, culture has the greatest influence on emotion meaning and less influence on priming reactions. On the other hand, biological influences are strongest for priming reactions and weakest for emotion meaning and subjective experiences.

All the three domains of Matsumoto and Hwang's model will be applied and assessed in this study. Two tasks, namely the facial emotion recognition task and the biological motion task, will be conducted to investigate the priming reactions. Subjective experience will be investigated using the questionnaires, a task assessing emotions associated with a positive and negative event recall, and the profile of mood states (POMS) questionnaire. The emotion meaning domain will be studied through a replication of Matsumoto and Hwang's²⁹ study.

When considering Triandis's,³⁸ subjective cultural model, culture is proposed to be the method by which the society understands and distinguishes its environment. The relationship between the individual's behaviour and the society can be identified through the environment, psychological processes (including emotion processing), social settings and values.

Matsumoto and Hwang's and Triandis's models are inter-related, whereby the meaning that one attaches to an emotion depends on one's current environment, the influence of the social setting, the values that the individual grew up with and one's internal processes. Therefore, if an individual comes from a culture that places importance on relationships with others and the group (ie, collectivist values), then the values, beliefs and attitudes of emotion will be related to their relationship with others and the group they belong to. The

conceptual model of this study is shown in the figure below (figure 1).

Aims of the current study

The aim of this study is to investigate the influence of culture on the emotion processing of adults with and without MDD. Specifically, the objective of this study is to investigate the cultural differences in facial emotion recognition, biological motion perception, subjective experience and emotion meaning between Malaysians and Australians, both with and without MDD.

The hypotheses of this study are:

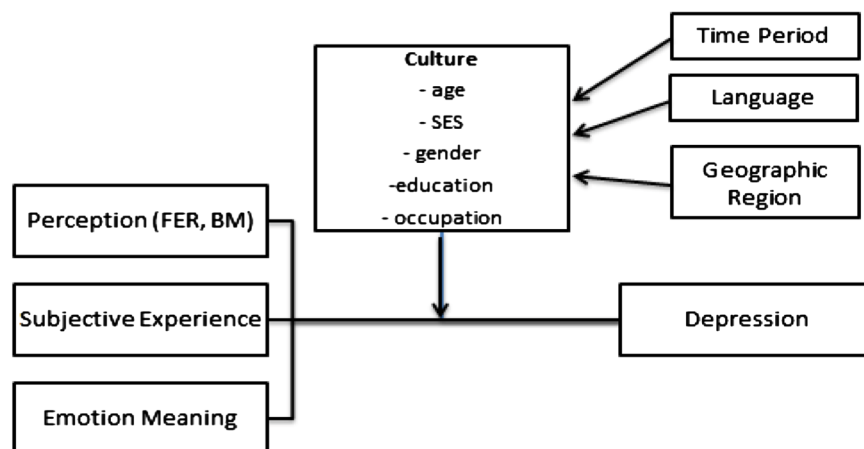
1. While there will be significant differences between Malaysian and Australian participants in facial emotion recognition, pan-culturally, participants with MDD will have significantly lower accuracy rates in recognising facial emotions when compared to participants without MDD
2. Pan-culturally, participants with MDD will have significantly lower accuracy rates on the biological motion perception task, when compared to participants without MDD
3. Culture and depression will interact in terms of subjective emotion and emotion meaning. Specifically, subjective emotions and emotion meanings associated with individualistic cultural values will differentiate between those with and without MDD in the Australian group, while subjective emotions and emotion meanings associated with collectivistic cultural values will differentiate between those with and without MDD in the Malaysian group
4. Cultural self-construals will moderate the relationship between depression and emotion processing.

METHODS

Study design

This study will employ a 2 (culture; Caucasian Australian vs Malay Malaysian) × 2 (depression status; MDD vs healthy control) group comparison design. The dependent variables will be the range of emotion processing tasks outlined below.

Figure 1 Conceptual model.
BM, biological motion; FER, facial recognition task; SES, socioeconomic status.



Participants and recruitment

This study will involve a total of 320 participants, 160 from Malaysia and 160 from Australia. In each cultural group, 80 of the adults will be diagnosed with MDD and 80 will be healthy controls. The MDD diagnosis, history and other Axis I psychiatric comorbidities will be assessed using the Structured Clinical Interview for the Diagnostic and Statistical Manual Fourth Edition (DSM-IV) Axis I Disorders-Clinician Version (SCID, V.2.0).³⁹ The initial assessment using the SCID will be carried out by a research assistant, under supervision of a clinical psychologist, while the research session will be conducted by the researcher (SNM).

Malaysian participants with MDD will be recruited from Porta Kabin Universiti Putra Malaysia and Hospital Kuala Lumpur (HKL) while the participants without MDD will be recruited by posting advertisements on the university website for staff and on social media sites. Australian participants with MDD will be recruited from the Psychology Clinic at Monash University Clayton Campus, Melbourne and using advertisements and social media sites. The Australian participants without MDD will be recruited by posting advertisements on campus, social media sites and noticeboards in prominent places in the community. Participation will be on a voluntary basis and a consent form will be completed before the initial assessment.

Sampling

A simple random sampling method will be used to select the participants. First, data will be collected from those participants who volunteer to participate. Each participant will be put on a list (four lists for four groups) and assigned a number. Then four sets of random numbers, for the four groups of participants, will be generated from Randomizer.org. In each group, only the participants with the number generated by Randomizer.org will be analysed.

Study location

The initial assessment and experiment for the Malaysian participants will be conducted at the Behavioural Sciences Laboratory, Universiti Putra Malaysia (UPM), located in Serdang, Selangor. The assessment and experiment for the Australian participants will be conducted at the School of Psychological Sciences, Monash University Clayton Campus, Melbourne. The rooms used will be quiet and have optimal lighting. A laptop or computer will be used to run the stimuli for the facial emotion recognition and biological motion tasks.

Inclusion and exclusion criteria

All participants will be Malay Malaysians or Caucasian Australians between the ages of 18 and 60 years. They must be literate in Malay or English, respectively.

Those who have been diagnosed with substance dependence, have a history of psychosis, have organic brain injury, are unable to understand simple spoken or written English or Malay, have a permanent physical

injury/handicap, have non-corrected vision or have non-corrected hearing and who are of mixed parentage will be excluded from the study.

Sample size estimation

G*Power, a computerised statistical analysis program, was used to calculate the sample size for this study.^{40 41} Using a medium effect size of 0.30, an α level of 0.05 and a power of 0.80, the total sample size will be 240. Estimating the dropout rate to be 30%, the total number of participants, inclusive of the dropout rate, is 312. Hence, the total sample size for this study is (N=320) is adequate.

Measures and materials

Beck Depression Inventory (BDI)

In Australia, the BDI will be used.⁴² The BDI is a 21-item self-reporting tool for assessing the severity of depression. Each item has a four-point rating ranging from 0 (no symptoms) to 3 (severe symptoms). The BDI score is obtained by summing the scores of all 21 items (eg, 'sadness', 'guilty feelings'). The cut-off scores are 0–9 (minimal depression), 10–18 (mild depression), 19–29 (moderate depression) and 30–63 (severe depression). The BDI has an internal consistency reliability coefficient ranging from 0.76 to 0.92.⁴³ In Malaysia, the BDI-Malay will be used.⁴⁴ Examples of items in the BDI-Malay are 'rasa dihukum' and 'tidak suka diri sendiri'. The Malay version of this tool has internal consistency values ranging from 0.71 to 0.91.⁴⁴

The Self-Construal Scale (SCS)

The SCS⁴⁵ is a 30-item self-reporting questionnaire used to assess independent (ie, individualist aspects of self) and interdependent (ie, collectivist aspects of self) self-construals of individuals. Self-construals are the ways in which individuals describe themselves in terms of themselves and themselves in relationship with others.⁴⁵ Each item is rated on a seven-point Likert scale (1=strongly disagree to 7=strongly agree). The English version of the scale will be used in Australia (eg, "I try to do what is best for me, regardless of how that might affect others") while the translated Malay version will be used in Malaysia (eg, "Saya suka menjadi seorang yang unik dan lain daripada orang lain dalam pelbagai aspek"). This scale has good construct, face, content and predictive validity.⁴⁵ The items are equally divided into two subscales, namely the independent and interdependent subscales. The internal consistency values for both subscales are between 0.70 and 0.74.⁴⁵

The Individualism-Collectivism Scale (IndCol)

The IndCol is a 32-item scale used to identify individualism and collectivism traits in an individual.⁴⁶ Each item is rated on a six-point Likert scale (1=strongly disagree to 6=strongly agree). The English version of the scale will be used in Australia (eg, "One should live one's life independently of others") while the translated Malay

version will be used in Malaysia (eg, “Saya suka berkongsi hal-hal kecil dengan jiran”). This scale has been used for various populations including Asian populations. The Cronbach α value for the collectivism items when used with Asian samples was 0.82 while the individualism subscale had a Cronbach α value of 0.80 (Su’udy R. Conflict management styles of Americans and Indonesians: exploring the effects of gender and collectivism/individualism. (Unpublished thesis). USA: University of Kansas, 2009).

Profile of Mood States

The POMS is a 65-item self-report measure assessing mood states.⁴⁷ Each item is rated on a five-point Likert scale (1=not at all to 5=extremely). The English version of the scale will be used in Australia (eg, ‘tense’, ‘sad’) while the translated Malay version will be used in Malaysia (eg, ‘tidak gembira’, ‘ceria’). This questionnaire has adequate internal consistencies ranging between 0.63 and 0.96.⁴⁷ It has also been found to have a good concurrent validity with the Psychological Well-Being Scale and the Functional Assessment of Cancer Therapy Scale. The POMS has been translated into several languages. The Malay version of the POMS has an internal consistency range of 0.78–0.94.⁴⁸

WHO Quality of Life—BREF Questionnaire (WHOQOL-BREF)

The WHOQOL-BREF is a 26-item questionnaire that examines the individual’s perceptions of their quality of life.⁴⁹ Four domains, namely (1) physical health (2) psychological health (3) social relations and (4) the environment are derived from the individual items. Each item is rated on a five-point Likert scale. The English version of the scale will be used in Australia (eg, “Have you enough money to meet your needs?”) while the translated Malay version will be used in Malaysia (eg, “Setakat manakah anda rasa hidup anda bermakna?”). The English version of the questionnaire has an inter-rater reliability of 0.56–0.95.⁴⁹ The Bahasa Malaysia version has good internal consistency values ranging between 0.64 and 0.80 while the test–retest reliability ranges from 0.49 to 0.88.⁵⁰

Emotion Regulation Questionnaire (ERQ)

The ERQ is a 10-item questionnaire that was developed to examine an individual’s use of two emotion regulation strategies, namely cognitive reappraisal (ie, changing thoughts/way of thinking that changes the meaning and emotional impact of the event) and expressive suppression (ie, withholding, blinding, inhibiting the expression of emotion related to an emotion eliciting event).⁵¹ Each item is rated on a seven-point Likert scale (1=strongly disagree to 7=strongly agree). The English version of the scale will be used in Australia (eg, “I control my emotions by changing the way I think about the situation I’m in”) while the translated Malay version will be used in Malaysia (eg, “Apabila saya merasa emosi positif, saya berhati-hati supaya tidak meluapkannya”).

The English version of the scale has a Cronbach α range of 0.73–0.79 while the test–retest reliability for a 3-month interval is 0.69.⁵¹ This measure has been used with Asian samples and the internal consistency has been found to be good (Cronbach α =0.77 for the reappraisal subscale and 0.78 for the suppression subscale).⁵²

FER task

This task will require participants to identify the emotion on various faces using pictures from the Montreal Set of Facial Displays of Emotion.⁵³ Participants will be shown two sets of pictures in random order on the computer: one set consisting of faces of individuals from their own culture, and the other set of faces from another culture (ie, Caucasian faces and Asian faces). The individual in the pictures will be expressing one of seven different emotions (neutral, happy, sad, angry, fear, disgust and shame). Participants will be required to correctly identify the emotion that will be expressed by the individual in the picture.

BM task

The stimuli will consist of moving point-light displays (PLDs) portraying persons: (1) walking; (2) throwing; or (3) knocking on the door using the right hand. The emotional state of the actor in the PLDs will be neutral, happy, sad or angry.

The task will follow the procedure used in studies by Nackaerts *et al.*⁵⁴ and Alaerts *et al.*⁵⁵ Participants will watch a series of short movies (duration of 3 s), representing PLDs of white dots against a black background. They will then complete two testing sessions, one consisting of the biological motion recognition (BMR) task with a two-choice control-test with 112 trials. In this task, participants will be required to indicate whether the PLDs depict a human or not. In the other task, the emotion recognition (ER) task, participants are presented with PLDs depicting a figure performing one of the three tasks (ie, walking, throwing or knocking) and the emotional state of the actor will be neutral, happy, sad or angry. They will then be shown a second clip which will present an actor performing the same activity (ie, walking, throwing or knocking), but the emotional state of the actor will either be the same or different to that presented in the first clip. Participants are then given a four-choice control-test in which they indicate whether the actor in the second clip was (1) the same as, (2) happier, (3) sadder or (4) angrier than the one shown in the first clip. Participants will be presented with 144 trials. All the PLD movies will be presented on a computer. In addition, a set of practice trials will be presented (only for the BMR task).

Subjective experience (SE) task

For this task, participants will first complete a measure on emotion. They will be asked to rate on a five-point Likert scale (0=never to 5=always) how frequently they have experienced 47 different types of emotions. This is

adapted and modified from Kitayama, Markus and Kurokawa's study.³⁵ Next, participants will be asked to remember/recall the most recent event from 10 different categories which are divided into positive (eg, heard a comment about appearance or watched TV) and negative (eg, caught up in a traffic jam, getting ill) situations. For each situation, participants will be asked to rate the extent to which they experienced different emotions in that situation (a list of 25 different emotions will be presented) on five-point Likert scales (0=never experienced at all to 5=experienced very strongly).

Emotion meaning (EM) task

Participants will answer questions regarding two different experiences that they have experienced which will be either (1) a positive experience or (2) a negative experience. First, participants will be required to write a brief description of their experience. Then they will answer 52 questions in relation to each of these experiences. The questions will either be a fixed choice response (yes, no) or the questions can be answered on a nine-point Likert scale (1=not at all to 9=extremely).

There are five subtests in this questionnaire, namely (1) concerns, (2) appraisal, (3) source of appraisal, (4) shared emotion and (5) belief.

Procedures

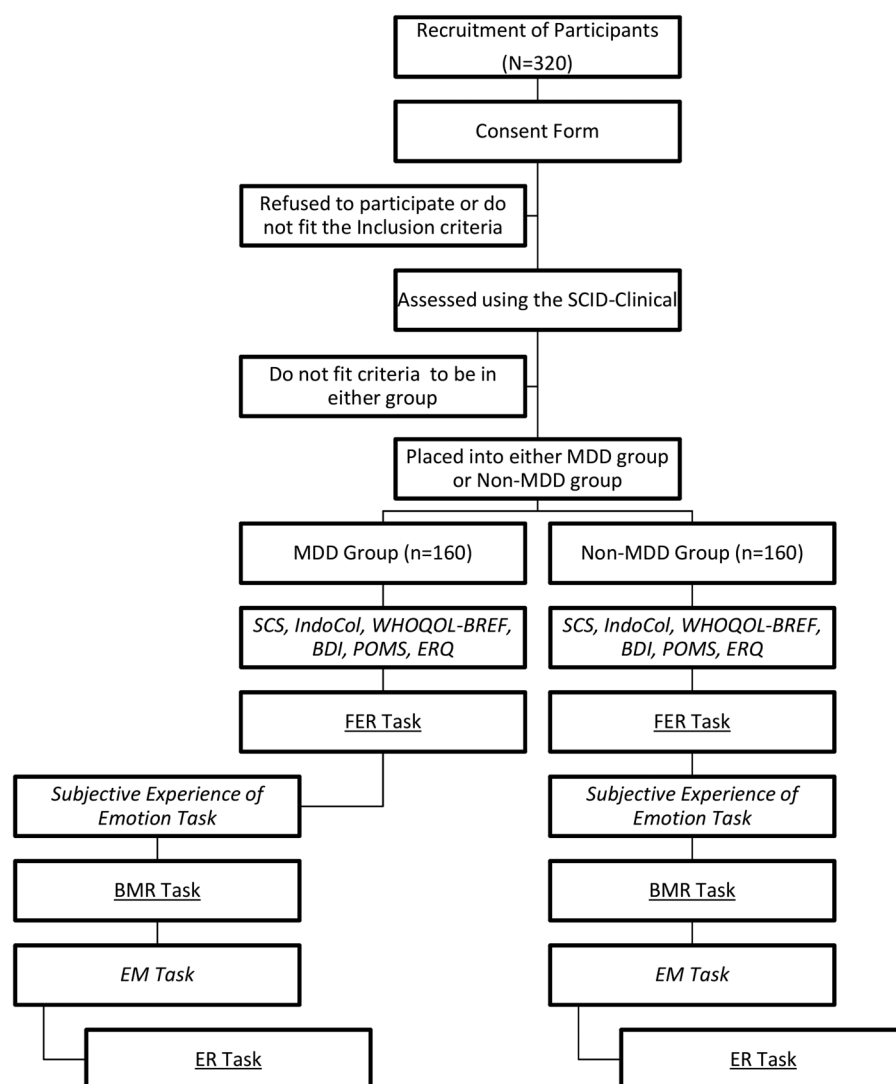
Data collection

The data collection in Malaysia will be carried out by the Malaysian researcher, while data in Australia will be collected by a research assistant. In both instances, the researchers will be supervised by registered clinical psychologists. The researcher and the research assistant will both possess an undergraduate psychology degree as their minimum qualification and all the experiments, questionnaires and assessments will be administered by them. The clinical psychologists will assess the participants using the SCID. These clinical interviews will be audio recorded to allow for later reliability assessments.

General procedure

A list of the participants with MDD will be obtained from the hospital or clinic while a list of those without MDD will be made from among those who volunteered.

Figure 2 General study procedures. BMR, biological motion recognition; BDI, Beck Depression Inventory; EM, emotion meaning; ERQ, Emotion Regulation Questionnaire; FER, facial recognition task; IndCol, Individualism-Collectivism Scale; MDD, major depressive disorder; POMS, profile of mood states; SCID, Structured Clinical Interview Disorder; SCS, Self-Constraint Scale.



Participants for the study will be selected randomly using the simple random sampling technique. Those participants who are willing and agree to take part in the study will be given a consent form to sign indicating their consent. First, they will be assessed using the Structured Clinical Interview for the DSM-IV Disorders-Clinical Version (SCID-Clinical). After a short break, they will be given the BDI, the SCS, the IndCol, the ERQ, the POMS and the WHO-QOL to complete. Next, they will be required to complete the FER, followed by the SE of Emotion task. Then they will complete the BM task (comprising the BMR task and ER task). Finally, they will complete the measures from the emotion meaning task. The E-Prime (Psychological Software Tools) will be used to develop and run the FER and BM tasks. On average, each participant will take 2–3 hours to complete the study. Participants will be given refreshments and breaks between tasks. Figure 2 shows the flow of the procedures of this study.

Ethics and dissemination

Permission to conduct the study has also been obtained from the National Medical Research Register (NMRR; NMRR-15-2314-26919). On completion of the study, data will be kept by Universiti Putra Malaysia for a specific period of time before they are destroyed. Data will be published in a collective manner in the form of journal articles with no reference to a specific individual.

STATISTICAL ANALYSIS

The IBM SPSS V.22 will be used to analyse the data obtained. To test Hypothesis 1, a 2 (Culture)×2 (Depression Status) analysis of variance (ANOVA) will be conducted with accuracy rates in recognising facial emotions as the dependent variable. To examine Hypothesis 2, two 2 (Culture)×2 (Depression Status) ANOVAs will be conducted with accuracy rates on the two BM tasks as the dependent variables. To examine Hypothesis 3, a series of 2 (Culture)×2 (Depression Status) multivariate analysis of variance will be conducted with subjective emotion and emotion meaning scores as the dependent variable. Finally, to examine Hypothesis 4, moderation analyses will be conducted to explore whether self-construal moderates the relationship between depression and emotion-processing for each of the tasks.

CONCLUSION

While substantial research demonstrates disruptions in the emotion processing of those with MDD and cross-cultural research indicates that culture impacts emotion processing, until now, research has not examined the influence of culture on emotion-processing in MDD. Therefore, this study will be one of the first to examine this area and thus has the potential to significantly enhance knowledge in this area. Furthermore, the results generated from this study can help healthcare

providers to better understand the deficits in emotion processing that exist and are specific to the Malaysian and Australian populations. Clinicians can be made aware of the specific linguistic terms and emotion-processing styles that are used in these two cultural groups. Additionally, it will highlight whether terms and styles in Malay samples differ from those that are generally used in the Western literature when describing depression, for example, the use of the term 'feeling down' instead of 'depressed'.^{22–24 56} This can improve practitioner cultural competency, which is of particular relevance for healthcare providers, especially those who are not from the same cultural background as the patient, leading to improved quality of the healthcare services provided.¹¹

We anticipate that the findings will have the potential to inform the development of an emotion recognition training component that could be developed as an adjunct to mainstream evidence-based treatment of MDD (eg, cognitive-behavioural therapy) to enhance therapy outcomes. Recently, several different researchers have developed similar kinds of emotion processing training programmes and these have been found to generate positive outcomes when applied in depressed young adults, schoolchildren, nurses and violent offenders.^{57–61} The capability to recognise emotions is important for successful social interaction and it facilitates social adjustment which inadvertently improves the quality of life.⁵⁸

Previous research has shown that those with MDD have difficulties with attention and information processing when an eye tracking device was used.^{62–64} Future studies can apply this method to investigate if culture influences the way in which adults with MDD process facial emotions. Furthermore, there is a wide range of medical research showing that MDD is linked to inflammatory response.^{65–67} Inflammatory response has been found to be associated with different clusters of symptoms, while ethnicity has been found to moderate the relationship between these two variables.¹⁸ Prospective studies can explore the moderating effects of ethnicity on MDD and inflammatory response in Malaysia and Australia.

There are limitations to this study. This study is only carried out in Selangor, Malaysia and Melbourne, Australia, which are urban areas. Thus, the sample may not be representative of the entire Malay and Caucasian Australian communities. There may also be response biases, especially for the subjective experience and emotion meaning questionnaires, which may influence the findings. Participants may provide answers which are socially desirable. Studies on Asian cultures have found that Asians tend to suppress the expression of positive emotions as they place importance on being modest.¹³

Contributors SNM prepared the study proposal, obtained ethical approval from UPM and MREC, drafted the manuscript and will execute the study. FM contributed to the conceptual framework, planning of the research activities, supervised and guided the execution of the study, and read and approved the

manuscript. LJ developed the idea for this study, provided funding, obtained ethical approval from Monash University and helped to execute this study in Australia, as well as read and approved the manuscript.

Competing interests None declared.

Ethics approval Universiti Putra Malaysia Ethics Committee (JKEUPM), Medical Research and Ethics Committee (MREC), Malaysia and Monash University Human Research Ethics Committee (MUHREC).

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement The data of this study are only shared between the authors and Universiti Putra Malaysia.

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