Ambiguous Microaggressions and Stress?
Linking Process, Person and Context: An Experience Sampling Study

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Abstract

Objective. This study aimed to observe the occurrence and type of microaggressions (MAs) in daily life and their association with stress response in the European context for student populations. As most microaggression (MA) research has been conducted in the United States (US), the experience of Europeans is of interest. The sample entailed 22 European students, with the majority being female, young, and visible ethnic minorities. Since stress responses and MAs are dynamic and fluctuate in daily life, the association between the factors process, context, and person and their momentary association with stress responses in individuals were investigated. The factors analyzed were perceived ambiguity of MA (context), perceived intensity and frequency of MA (process), and Black Lives Matter (BLM) Activism support (person).

Method. This study examined the stress associated with microaggressions using the Experience Sampling Method (ESM) and linear mixed models (LMM). ESM is a method of repeatedly assessing individuals in their natural environment at various times throughout the day, whereas LMM is a statistical technique for analyzing the collected data. The sample was recruited for this study via social networks. Participants were asked to complete ESM assessments via mobile devices, reporting on instances of racial discrimination and their associated stress levels five times per day for one week. The ESM data were analyzed using LMM to examine the ambiguity and intensity of the MA experiences and their relation to stress levels.

Results. The results showed that most reported microaggressions were related to participants feelings' of being treated as outsiders/foreigners and as low-achieving. The study also found that the average perceived stress level was significantly lower for individuals who did not experience any MA than for those who did experience at least one MA during the study period. In addition, MA frequency was relatively rare in the sample and accounted for 10% of the observations.

LMM analyses were conducted for three participants with at least five MA observations. State of ambiguity and intensity were significantly associated with higher state stress in the two high BLM supporters. Further, state of indicators was associated with higher state stress for one high BLM supporter. Last, high BLM supporters had significantly lower average state stress and showed patterns of tolerable stress responses compared to the low BLM supporter. However, it should be noted that the results should be interpreted with caution due to the small sample size of only three individuals who met the study requirements for LMM analysis.

Conclusion. This is the first study to implicate that state ambiguity may be a factor characterizing MA in real life. Further, intensity of MA and ambiguity of MA fluctuated within persons in daily life, marking ESM as meaningful in MA research. Furthermore, high support for the Black Lives Matter (BLM) movement may be a protective factor against chronic stress and promote tolerable stress responses. Future studies could investigate which underlying coping mechanisms underlie BLM support in response to stress and whether BLM support protects against allostatic load.

Keywords: Microaggression, Stress response, Ambiguity, Intensity, Frequency, Experience Sampling Method

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Beliefs about stigmatized groups are hypothesized to have led to unconscious and biased attitudes of people, manifested in often unintentionally biased behaviors (Möschel, 2011; Abelson, Dasgupta, Park & Banaji, 1998, Banaji, Hardin & Rothman, 1993, as cited in Sue et al., 2007). One example could be, "Oh, you look good! Have you lost weight?". Perhaps you have heard such a comment or even said something like this to compliment someone before. However, what if the recipient interprets what you said differently, like "Good that you lost weight, because before you were fat and ugly". What does this mean for the recipient's mental health? What if this was not the first comment on the person's weight, and what if they do not feel comfortable talking about their body and appearance?

These unintentional (sometimes intentional) behaviors (Sue et al., 2007) were first coined by Pierce as 'microaggressions' (MAs) (1970). MAs refer to subtle derogations and dismissals communicated face-to-face or [online] at a personal level (Lui & Quezada, 2019). MAs are hypothesized to be addressed to individuals based on their perceived membership in a stigmatized group (e.g., based on weight, religion, race, or gender) (Sue & Spanierman, 2020). For clarification, MAs are understood as micro because they arise during interpersonal (i.e., micro-level) moments between an initiator and recipient in conjunction with situational factors. So, the term "micro" should not be understood as a measure of harm (Lazarus & Folkman, 1984; Spanierman et al., 2021). Researchers have theorized that the harmful nature of MAs stems from their subtle, brief, recurring, and hence, cumulative properties, which is why MAs are seen as a chronic stressor to marginalized persons (see Sue et al., 2008).

Microaggression and Mental Health

Current MA research has mainly been conducted in the United States (US), with some additional research in Canada (see Lui & Quezada, 2019; Matheson et al., 2021; Williams, 2019), using between-person methodologies, such as cross-sectional designs (Lilienfeld, 2017; see, e.g., King et al., 2022). According to the Whole Trait Theory, a person's average of daily experience over time corresponds (referred to as average state) to a person's trait level (Fleeson, 2001; Fleeson & Jayawickreme, 2015; Jayawickreme et al., 2019 as cited in Horstmann, 2021). Between-person methodologies can explain between-subject variance based on these average-level/trait-like measures of stable individual differences (Myin-Germeys & Kuppens, 2021). Therefore, questions addressed by a between-persons comparison can be whether people who, on average, experience more microaggressions also experience poorer adjustment outcomes (e.g., negative and positive affect, depression, and

anxiety symptoms) (Ong, 2021). For example, using a between-subject retrospective self-report design, Nadal et al. (2014) found that higher frequencies of MAs negatively predicted participants' mental health.

However, retrospective self-reports are inherent to retrospective bias and may lead to over-and underrepresentation of perceived discriminatory events (limited ecological validity) (Hoggard et al., 2012; Lilienfeld, 2017; Myin-Germeys & Kuppens, 2021). In addition to between-person research, within-person research related to MA has also been conducted.

For example, in a within-person experimental design in which one person tests all conditions and serves as their own control, ambiguous microaggression was associated with higher intensity of negative emotions (e.g., anxiety) when Persons of Color (PoCs) interpreted that disparate treatment based on race was directed at them (rather than general disparate treatment not based on race) (Wang et al., 2011). Thus, microaggression and non-group-based general incivility might differ significantly in both quantity and quality (Torino et al., 2018). Moreover, researchers and clinicians wish to understand within-person phenomena regarding individuals' psychological adaptation to MAs in daily life (Ong & Burrow, 2017; Sue et al., 2007).

Still, longitudinal data linking MAs to mental health has remained limited (Lilienfeld, 2017). One way to investigate these within-person phenomena in daily life is through daily diary studies that study these phenomena over time (Ong, 2021). Initial daily diary studies associated MA with decreased mental health, such as poorer sleep (Ong et al., 2017). Similarly, daily diary designs have associated daily discrimination as a predictor for decreased mental health outcomes such as increased depressive symptoms, higher levels of distress, and lower self-esteem (Huynh & Fuligni, 2010; Ong & Burrow, 2018; Seaton & Douglass, 2014). However, as MA is seen as a chronic stressor, the association between MA, stress, and related health outcomes still needs to be established (Sue et al., 2008).

Stress in Daily Life and Chronic Stress

The term stress needs to be differentiated between stress exposure and stress response: Stress exposure (stressor) refers to the challenges persons face in their environment. These challenges can be understood as objectively observable external pressures (such as frequency, as mentioned later). The stress response describes a person's reaction to a stressor. Different levels of analysis of internal perturbations, such as negative affect or, as in this study, perceived stress, can measure this reaction (Dohrenwend & Dohrenwend, 1974, as cited in Harkness & Hayden, 2019; Harkness & Hayden, 2019).

A state stress variable can capture psychological (perceived) stress, is specific to the present

moment, and can capture between- and within-person variation (Almeida, 2005; Myin-Germeys & Kuppens, 2021; Wälde, 2018).

From a neurobiological stance, stress responses are inherently natural and balanced through allostasis. *Allostasis* is an adaptive process that maintains physiological and behavioral stability (homeostasis) during stress (Karatsoreos & McEwen, 2011; McEwen, 2005). Allostasis regulates both positive stress and chronic stress responses. Positive stress refers to normal, short-lived, and appropriately deactivated stress responses (Bucci et al., 2016; Shonkoff et al., 2009). In contrast, prolonged exposure to chronic stress may affect individuals' resources and ability to adapt (leading to either adaptive or maladaptive coping styles) (Long & Bonanno, 2019; Muscatell et al., 2009, as cited in Monroe & Slavich, 2019).

Allostatic Load Model

Allostatic load or allostatic overload has been defined as the 'wear and tear' (McEwen & Stellar, 1993 as cited in Schetter & Dolbier, 2011; McEwen, 2005) from chronic overactivity and/or constant adaptation to stressors (McEwen, 1998; Schetter & Dolbier, 2011). Prior studies have implicated allostatic load to explain the association between chronic stress responses and negative mental health (Juster et al., 2010). In line with Minority Stress Theory, stigmatized individuals are hypothesized to experience additive stress levels because of prejudice and discrimination due to their stigmatized identity (Harrell, 2000; Meyer, 2003). Longitudinal studies have identified levels of chronic stress to be higher in persons of color (PoCs) than in non-PoCs (Rodriquez et al., 2018) and have associated chronic stress (measured with allostatic load markers) in PoCs to future elevated depressive symptoms (Rodriquez et al., 2021). However, chronic stress patterns can be altered by resilience (Bucci et al., 2016; Karatsoreos & McEwen, 2011; Oken et al., 2015).

Resilience. Currently, theoretical frameworks lack a universal definition of resilience (Aburn et al., 2016). However, adversity and positive adaptation/adaptive coping have frequently been linked to resilience (Fletcher & Sarkar, 2013; Lazarus & Folkman, 1984). Further, resilience has been defined as a trait as well as a process (*APA Dictionary of Psychology*, 2023; Wagnild & Young, 1993). Resilience can be viewed as a dynamic process promoting positive adaptation (coping) among individuals to allostatic load (Lazarus & Folkman, 1984; Cicchetti & Garmezy, 1993; Luthar et al., 2000; Masten, Best & Garmezy, 1990; Rutter, 2012 as cited in Juster et al. 2016; McEwen & Stellar, 1993 as cited in Schetter & Dolbier, 2011; Wälde, 2018). In other words, positive adaptation can be a process in which a protective factor may protect against or buffer the negative impact of current or future stressors.

Hence, chronic stress may become *tolerable stress* (Bucci et al., 2016; Fullerton et al., 2021; Masten & Reed, 2002; Shonkoff et al., 2009). A person with higher resilience and adaptive coping style may show a higher probability of returning to baseline after a state stress response occurred. In comparison, a person with lower resilience may stay at elevated state stress responses for longer or may not return to baseline (Bucci et al., 2016; Karatsoreos & McEwen, 2011; Oken et al., 2015). Lower resilience in the context of chronic stress is considered as *toxic stress* associated with negative mental health, such as depression (Oken et al., 2015). Toxic stress refers to recurrent and unhealthy stress responses occurring under stressful conditions, with no internal or external coping resources (Bucci et al., 2016; Shonkoff et al., 2009). Consistent this hypothesis, in a one-year longitudinal study, past-year discrimination was associated with allostatic load for the PoC group with low cultural continuity (CC) but not for the PoC group with high CC. CC was defined as the level of engagement in cultural practices and values of their cultural heritage. Therefore, it was concluded that CC served as a buffer promoting resilience against the negative effects of racial discrimination on the physiological stress response among PoCs (Currie et al., 2020).

Experience Sampling

In order to analyze momentary stress responses that may be indicative of allostatic load, they must be observed over an extended period of time. Experience Sampling (ES) allows for real-world observations over time. ES is a longitudinal research method that captures rapid moment-to-moment (daily life) fluctuations of individuals (within-variation) in their natural environments. These fluctuations (or micro-level processes) are then assessed as they occur in real-time or close to real-time in daily life processes (Conner & Lehman, 2012; Myin-Germeys & Kuppens, 2021). Besides, ES surveys can be conducted several times a day, whereas daily diary studies entail a survey once a day (mostly at the end of the day) (Horstmann, 2021; Myin-Germeys & Kuppens, 2021). According to Myin-Germeys and Kuppens (2021), the terms ESM and ecological momentary assessment (EMA) can be used interchangeably.

Importantly, retrospection bias is minimized through the ESM. Causal inference can be strengthened by establishing temporal precedence, increasing the precision of the characteristics of changes in fluctuations (Affleck et al., 1999, West & Hepworth, 1991 as cited in Ong & Burrow, 2017; Myin-Germeys & Kuppens, 2021). Moreover, ESM allows for simultaneously accounting for within and between sources of variation in data (Myin-Germeys & Kuppens, 2021; Ong, 2021). As ESM research focuses on the individual (within-person variance), the proportion of both between and within variances can be calculated

using the intraclass correlation coefficient (ICC) (Bolger & Laurenceau, 2013; Myin-Germeys & Kuppens, 2021).

The association of MA with stress is conceptualized as a micro-level dynamic process, such that within a person, the dependent variable (e.g., stress) covaries with situational features (Ong, 2021; Spanierman et al., 2021; Whitsett & Shoda, 2014). With ESM, experiences or behavior are observed in relation to the context, compared to laboratory studies, which is why ES studies are claimed to have high ecological validity (Lobo et al., 2018 as cited in Myin-Germeys & Kuppens, 2021).

Ecological validity can be divided into representativeness and generalizability. Representativeness refers to the match of content and experience of a sample with the population it represents. Thus, ES studies are highly representative as experiences are measured in the real world. Generalizability refers to how well a sample predicts an associated behavior in real-life for a wider population (Hermans et al., 2019 as cited in, Myin-Germeys & Kuppens, 2021; Statista (n.d.)). Generalizability "to specific contexts in ES studies depends heavily on both adequate sampling of stimuli, persons, situations, and time (i.e., study design and data collection) and defensible statistical inference (i.e., data analysis)" (Ram et al., 2017, p.2).

According to the *Transactional model of stress and coping*, a stressor's (stress exposure) effect on an individual's stress level is theorized to be a transactional *process* (Lazarus & Folkman, 1984). According to this theory, *person* factors and *situational* factors (*context*) account for the individual differences in stress response ('perceived severity' Cohen, Kessler, & Gordon, 1997, as cited in Almeida, 2005) and coping (risk or protective factor) with a stressor (Lazarus & Folkman, 1984; Masten & Reed, 2002).

Person factors refer to dispositions, such as personality traits (or average state) (Masten & Reed, 2002; Zimmerman et al., 2002), which result in between-person variation in how individuals appraise and cope with similar events (Lazarus & Folkman, 1984; Sefidgar et al., 2019). Situational factors refer to situation characteristics (e.g., novelty, chronicity, and duration), that influence individuals' stress response (Lazarus & Folkman, 1984). Last, person and situational factors are hypothesized to have, besides direct, also interactional (moderator) effects on the individual's stress experience (stressor) and stress response (perceived stress) (Lazarus & Folkman, 1984; Masten & Reed, 2002; Wälde, 2018; Zimmerman et al., 2002). In other words, an individual's stress level is hypothesized to increase when situations are perceived as stressful, and may decrease via positive mechanisms/resources such as adaptive coping (Wälde, 2018).

Potential Factors of MA

Process: Frequency, intensity and indicators

Frequency refers to the number of MA occurrences (Sue & Spanierman, 2020). Frequency seems to be an important indicator of how a stressor (such as MA) is primarily appraised (perceived intensity of stress) (Almeida, 2005). In line with this hypothesis, first, a prior ecological momentary assessment study (EMA) measured the frequency of daily racial discrimination, including MA items and 14-day depressive symptoms slope in a U.S. sample of adolescents. The findings revealed that MAs were associated with changes in affective states (depressive symptoms) over time. Additionally, the per-participant average MA discrimination was 70 experiences in 14 days (daily online discrimination experience was included, which they found to be the most frequent type) (English et al., 2020).

Next, daily diary studies assessing frequency have been applied to MAs. Smith et al. investigated the influence of MAs on bisexual women's health, including PoCs, in a daily diary study. Within-person and between-person analyses have revealed that a higher frequency of MAs was associated with lower well-being (Smith et al., 2022). In support of this finding, stressor "pile up" (i.e., exposure to stressors for minimum 3-day period/chronicity (Grzywacz & Almeida, 2008, p.369) was linked to higher maladaptive coping in a daily diary study (Grzywacz & Almeida, 2008). Maladaptive coping was higher on days when individuals experienced more severe stressors (frequent and intense) than on non-stress days. Thus, cumulative exposure may lead to more severe psychological outcomes (Grzywacz & Almeida, 2008). In addition, a 13-day daily diary revealed a 1-day lagged effect in which increases in depression were associated the day after the discrimination experience (diminished recovery). This finding indicated that a lagged effect might contribute to the chronic nature of discrimination (Torres & Ong, 2010).

Similarly, a daily diary study found that experiencing above-average stressful MAs on any given day was associated with poorer mood on the same day. Therefore, higher stressor frequency on the same day may influence an individual's stress response (within-day association) (Cook et al., 2019). Furthermore, this study defined higher stressor frequency in the moment as *indicators,* a measure of MA sentences in the moment of occurrence.

Then, it was hypothesized that individuals who perceive MAs as more intense might be more likely to experience more severe psychological impacts (Sue & Spanierman, 2020). In line with this hypothesis, the sole association between stress intensity and individual stress responses was assessed in an ES study. It was found that stressor intensity predicted emotion regulation (ER) (Blanke et al., 2021). They found adaptive ER was used less, and

maladaptive ER (rumination) was used more when stressors were perceived as more intense. Moreover, rumination was associated with higher negative affect (NA) (Blanke et al., 2021).

Finally, only few daily designs have examined MA and its 'direct' association with stress as a direct stress response. A daily diary analysis of MA and perceived stress focusing on bisexual mental health found, that MA frequency was not substantially associated with daily stress reports. Flanders (2015) hypothesized that recording the moderator (positive identity) daily for this study may have confounded the results. However, a recent EMA study focused on PoC Mental health by observing associations between MA occurrence and physiological stress responses. When individuals reported significantly more MAs than usual, a flatter diurnal cortisol slope was observed (lower morning cortisol and higher bedtime cortisol) (Nam et al., 2022).

Context: Ambiguity

A situational factor of interest for this study was 'attributional ambiguity', which was first coined as the difficulty members of stigmatized groups may have interpreting feedback (Crocker & Major, 1989). In the context of MAs, ambiguity is seen as uncertainty regarding the meaning of MA messages (Zeiders et al., 2018). This uncertainty is hypothesized to lead to a cognitive and resource-demanding thought cascade (King et al., 2022; Sue et al., 2008).

In line with this theory, prior studies have revealed detrimental effects of ambiguous messages on mental health. First, a survey revealed passive e-mail incivility (omission of respect and consideration) was perceived as more ambiguous than active e-mail incivility (commission of disrespect). Here, ambiguity was defined as unclarity of the recipient about the sender's intent (whether sender wanted to send an uncivil e-mail or whether it happened by chance) (Yuan et al., 2020). Second, in a daily diary study, daily passive (ambiguous) e-mail incivility was found to be related to insomnia. Additionally, insomnia was associated with next-morning negative affect (whereas daily active e-mail incivility was not a significant predictor) (Yuan et al., 2020). Similarly, subtle or ambiguous racism experiences (microaggressions) of POCs were more strongly related to depressive affect than explicit racism in a between-person experimental study (Matheson et al., 2021). These effects of MAs may be explained by anger-in maladaptive coping (internalizing) ambiguity of MAs may provoke. In contrast, explicit racism was found to be related to anger-out adaptive coping (externalizing) in a survey study (Matheson et al., 2021).

Last, between-person experimental studies found ambiguous prejudice (MA) was associated with higher cognitive impairment than blatant prejudice (Murphy et al., 2012;

Salvatore & Shelton, 2007). Consequently, dealing with the ambiguity of an MA is hypothesized to be cognitively and emotionally exhausting (Torino et al., 2018).

Person factor: Activism

The person factor of interest in this study is activism. Higher levels of activism may moderate the association between stress response and MA. Activism refers to advocating for a political or social cause through various possible means, such as signing petitions or participating in civil disobedience (Klar & Kasser, 2009). The influence of activism on well-being may be multifaceted, as revealed in a longitudinal study by Hope et al. (2018), in which activism was identified as a moderator between MAs and mental health. Interestingly, higher political activism was identified as a protective and risk factor, depending on racial group (activism was associated with higher or lower symptoms of stress and anxiety related to MA).

Similarly, an autoregressive and cross-lagged association between racial discrimination and depressive symptoms across two time points over six months was found. Black Lives Matter (BLM) moderated the cross-lagged associations between racial discrimination and depressive symptoms. Based on this finding, Watson-Singleton et al. (2021) hypothesized that activism might reduce stress responses in PoCs by diverting attention from unpleasant past encounters to reflect on hopeful possibilities for the present and future. In conclusion, partaking in BLM activism may represent an adaptive response (protective factor) to one's own unjust treatment as a PoC by promoting (in part) resilience through adaptive coping by transforming distress into self-respect and dignity (Hoffman et al., 2016; Lazarus & Folkman, 1984; Watson-Singleton et al., 2021).The Current Study

Prior studies on MA have mainly focused on between-person variation (Lilienfeld, 2017). Research focusing on coping and protective predictors with MA and associated mental health outcomes has remained limited (Ong, 2021). Therefore, this study focused on trait activism as a potential coping strategy predictor for reduced or increased average stress (Watson-Singleton et al., 2021). Similarly, MA research in daily life has remained limited (Ong, 2021), even though MAs were defined as an unfolding dynamic process re-occurring (chronic) in daily life, and researchers call for investigating with the ESM (Ong, 2021; Spanierman et al., 2021; Sue et al., 2007). ESM was chosen as it allows for multiple measurements per day and may capture more fluctuations concerning MA (Myin-Germeys & Kuppens, 2021). Moreover, next to MAs chronicity, ambiguity of MAs is theorized to be the stem of their harmful nature (Matheson et al., 2021; Sue et al., 2008).

However, to the best of our knowledge, no ESM study has assessed the association between MA ambiguity and stress response (measured by perceived stress in this study).

Moreover, only one daily analysis analyzed the direct association between MA and perceived stress (Flanders, 2015). Last, no current ESM research has focused on MAs in a European context regarding their prevalence, short-term association with frequency/indicator, intensity, coping (activism), and context (ambiguity). In sum, this study aimed to better understand MAs in daily life, their association with mental health, and their occurrence in the European context.

Hypotheses

RQ1: The between and within-person variability of MA and (perceived) stress will be explored. H1: More variation of stress is expected to be explained by within-person variances than between-person variances, as within-person variance accounts for the individual experience (Ideally ICC between .2 and .4) (Bolger & Laurenceau, 2013; Myin-Germeys & Kuppens, 2021)

RQ2: How is average state (perceived) stress associated with trait BLM activism? H2: Higher trait activism levels are hypothesized to be associated with stress levels. As previous studies were not in agreement, the research question was now explored in a European sample (Hope et al., 2018; Watson-Singleton et al., 2021).

RQ3: How is state (perceived) stress associated with (state) MA (ambiguity, intensity, frequency/indicators)? H3: State stress would increase in association with ambiguity, intensity and frequency/of indicators of the MA experience (see Blanke et al., 2021; Nam et al., 2022; Sue et al., 2007).

Methods

Ethics statement

The study was approved by the ethics committees of the Faculty of Social Sciences Studies (BMS lab), University of Twente, and participants provided informed consent.

Participants

76 participants registered for this study. Participants with less than 1/3 of valid observations were excluded from the analysis (Christensen et al., 2003; Myin-Germeys & Kuppens, 2021). The participants were recruited using the SONA system of the University of Twente as well as through social media (WhatsApp, Instagram). Eligibility requirements included: being a student or in secondary educational training in the EU, having a minimum age of 18 years, and self-reported non-majority social categorization (ethnic minority). Finally, participants who did not fulfill the inclusion criteria were excluded from the study or later from the analysis.

Procedure

Participants were requested to download the Ethica app (https://ethicadata.com) and enter the study ID after giving consent and carefully reading the instructions. The first questionnaire in the app assessed the demographics (see Table 1). If participants fulfilled the inclusion criteria, they were allowed to continue with the survey the next day, at which the ESM data collection started. A signal-contingent sampling scheme was used in this study, and assessments were conducted at semi-random times (intervals) indicated by a signal (beep). This sampling scheme was applied because it exhibits higher ecological validity than a fixed sampling scheme. In addition, the scheme was associated with relatively lower participant burden and smaller compliance issues than a random sampling scheme (Myin-Germeys & Kuppens, 2021).

To further lower participant burden, a maximum of six items for the questionnaire was chosen, and the signal was received five times daily (from 9.00-10.00, 11.00-12.00, 13.00-14.00,15.00-16.00, and 17.00-18.00) for 14 consecutive days (Eisele et al., 2020). The questionnaire allowed for a yes/no option for the first question related to MA; therefore, subsequent questions related to MA and ambiguity were not posed if no was indicated. This decision was made only to burden participants with sensitive content if necessary. However, this decision may have posed a risk to compliance, because responding with “no” is only followed by one question, participants may have learned to avoid the first option (Myin-Germeys & Kuppens, 2021). Each questionnaire was allowed to be completed within 30 minutes after the respective beep, as allowed in most ESM studies (Scollon et al., 2009).

Measures

Trait questionnaire

First, self-reported non-majority social categorization was assessed by asking: “Please indicate your agreement with this statement with yes or no: “My ethnical heritage is different from most people in the country I live in and is visibly noticeable”. Persons who chose the “no-answer” option were excluded from the study. Second, self-reported PoC-identity was assessed by asking: “Please indicate your agreement with this statement with yes or no: Me or persons who look similar to me, experience discrimination in the country I live in”. Third, Black Lives Matter (BLM) activism support was assessed by asking three questions: “How much do you support the Black Lives Matter movement?”, “So far, how much do you think the Black Lives Matter movement has helped communities of color?” “In the future, how much do you think the Black Lives Matter movement will help communities of color?” (Watson-Singleton et al., 2021, p.30). BLM support level was indicated using a 5-point Likert scale in this study (1 = not at all to 5 = very much). Cronbach’s alpha for BLM activism was computed to check for reliability (internal consistency). Results revealed that excluding the BLM support item and solely including the two items of BLM help and BLM future increased the raw Cronbach’s alpha score from questionable (.66) to acceptable (.73) (see Appendix A).

Daily Diary

Last, an optional daily open answer was set from 18:00-19:00 to gain deeper insights into the participant’s experience. Within a 2-hour time slot, participants were allowed to answer the question: “Describe today's (potentially) discriminatory situation/comment that felt particularly striking to you and why. Please describe the situation/comment in detail”. Participants were allowed to fill out the diary in English, German or French.

Momentary Measures

Momentary Measure	Category	Items	Scale	Frequency	Chronbach's alpha
Stress Numerical Rating Scale-11 (SRNS-11) (Karvounides et al., 2016).	Intensity	"On a scale of 0 to 10, with 0 being no stress and 10 being worst stress possible, what number best describes your level of stress right now?" (Karvounides et al., 2016).	0-10	5 times a day	
Microaggression (1)	Occurrence	In the past two hours, I might have been subjected to discriminatory situation(s) or comment(s). Please indicate agreement with this statement.	Participants had to indicate YES (coded 1) or NO (coded 0) to the question	5 times a day	

Momentary Measure	Category	Items	Scale	Frequency	Chronbach's alpha
(Adapted) Racial Microaggression Scale (RMAS) (Torres-Harding et al., 2012) (2)	Type	Indicate how the situation(s)/comment(s) made you feel (multiple answers possible) Invisible Like a criminal Like an outsider/foreigner Objectified or Sexualized Stupid Other "Do you think the situation(s)/comment(s) happened, because of … (Please fill in the gap)." your race/ethnicity Other characteristic (Torres-Harding et al., 2012).		If yes indicate at Q1, Q2 was posed (max. 5 times)	In the original 32-item RMAS scale, the Cronbach's alphas for the factors were found to be very good: Invisibility (α = .89) Criminality (α = .85) Foreigner/Not Belonging (α = .78) Sexualization (α = .83) Low-Achieving/Undesirable Culture (α = .87) (Torres-Harding et al., 2012).

Momentary Measure	Category	Items	Scale	Frequency	Chronbach's alpha
Microaggression Frequency Within Prompt (3)	Indicators	"How many sentences stated toward you in the last two hours may have been discriminatory?"	1 = one 2 = two 3 = three or more	If yes indicate at Q1, Q3 was posed (max. 5 times)	
Microaggression (4) (Adapted) (Blanke et al., 2021).	Intensity	"How much did the situation(s)/comments affect you?" (Blanke et al., 2021).	1 = not at all 2 = a little 3 = moderately 4 = quite a bit 5 = very much	If yes indicate at Q1, Q3 was posed (max. 5 times)	
Microaggression (5)	Open question	"Describe today's (potentially) discriminatory situation/comment that felt particularly striking to you and why? Please describe the situation/comment in detail."		Once a day between 18-19 p.m.	

Momentary Measure	Category	Items	Scale	Frequency	Chronbach's alpha
Ambiguity level (6)	Intensity	"How sure are you that the situation(s)/comment(s) were discriminatory?"	1 = Very unsure 2 = Unsure 3 = Neither sure or unsure 4 = Sure 5 = Very sure	If yes indicate at Q1, Q5 was posed (max. 5 times)	

Data analysis

The data downloaded from Ethica (https://ethicadata.com) was analyzed with the statistical program R version 4.2.2 (https://cran.r-project.org). The program was used for all analyses: First, baseline demographics and compliance were computed. As the frequency of MA occurrence in the daily lives of students could not be predicted for a European sample, the measurement frequency was set relatively high prior to the study. Further, the analysis of the raw data revealed that participant retention was extremely low after seven days. Thus, the limits set a priori were adjusted: only the first seven-day answered prompts were analyzed using the prior set minimum of 1/3 of 35 prompts, hence 12 prompts. The current study included 22 students who had at least 1/3 of valid prompts (age range 21-42 years; women 68.2%; men 22.7%; other 9.1%).

For the exploration of RQ1, several steps were undertaken: First, the proportion of reported MAs in line with the classification of Torres-Harding et al. (2012) was calculated. Second, the average stress state between persons with MA experience in the study was compared to those with no MA experience using a two-sample t-test. After this comparison, individuals with no MA experience during the study period were excluded from further analyses. Third, the raw data were visualized using boxplots for every participant with MA experience regarding stress, intensity, ambiguity, and indicators (sentence frequency of MA within-prompt).

Moreover, the check for the independence of the independent variables ambiguity and intensity was computed using Pearson's Product-Moment Correlation. Results revealed a negative and non-significant correlation between the independent variables intensity and ambiguity ($r = -.22$; $p = .20$). Further, results revealed a significant correlation between intensity and indicators ($r = .46$; $p = .007$), and ambiguity and indicators ($r = -.49$; $p = .003$). However, the correlation was too small to indicate dependence (Mukaka, 2012) (see Appendix B). In addition, the results for the exploration of RQ1 were visualized using boxplots and histograms. Moreover, trait BLM activism (support) was computed for each person to differentiate between low and high BLM supporters (0,1).

To prepare the Linear-Mixed Model (LMM) analysis, frequency was excluded from analysis because only one participant experienced three MAs in three consecutive days, which would have allowed for analyzing pile-up of stress. Besides, to analyze an LMM, at least five observations of MA per participant are required (Bolger & Laurenceau, 2013). Therefore, only the three participants who reported at least five MA occurrences during the study period were included in the model.

The LMM (Model 1) further answered RQ1. For Model 1, the dependent variable was state stress and the independent variable was MA. In addition, by including the time point, Model 1 was controlled for time trends (to check for potential pile-up in stress over the study period). The time point refers to the difference between the date and time of the current prompt minus the date and time of the first prompt of the respective individual. To test for the within- and between-person variability, the intraclass correlation coefficient (ICC), marginal R^2, and conditional R^2 were calculated for the dependent variable of stress. The proportion of both variances can be calculated using the ICC (between-person variance divided by total variance (total variance = between-subject variance plus within-subject variance)) (Bolger & Laurenceau, 2013). For a typical ES study an ICC between .2 and .4 is expected. ICC values between .2 and .4 imply that the dependent variable (stress) fluctuates more within (60-80%) than between persons (20-40%) (Bolger & Laurenceau, 2013; Myin-Germeys & Kuppens, 2021). Additionally, the marginal R^2 describes the proportion of variance explained by the fixed factor(s) alone and the conditional R^2 describes the proportion of variance explained by both fixed and random factors (Johnson, 2014).

Moreover, RQ2 and RQ3 were answered using three linear regression analyses for the respective three participants. The *F*-test was used to check for significance of results. The raw scores for intensity, ambiguity, and indicators of MA and stress were used.

Both models were checked for normality of residuals (Shapiro-Wilk normality test) (see Appendices C and E). Furthermore, the LMM model was checked for multicollinearity (VIF score), autocorrelation (Durbin-Watson-test), and linearity (visual representation). The residuals appeared to be independent, and all criteria mentioned above were met (see Appendix C). Finally, the linear regressions were checked for linearity (Ramsey RESET test). The residuals appeared to be independent and all the criteria mentioned above were met (see Appendix C).

Results

Demographics

Table 1

Sociodemographic Characteristics of Participants at Baseline

Baseline characteristic	Full sample				
	n	Mean	Std. Dev.	Min	Max
Age					
		26.36	5.57	21	42
Gender identity					
Female	15	68.2%			
Male	5	22.7%			
Other	2	9.1%			
Nationality					
German	13				
Dutch	2				
French	2				
Other	5				
EU residency (incl. UK, Norway & Switzerland)	22	100%			
Current Education					
Bachelor	11	50%			
Master	7	31.8%			
P.h.D	2	9.1%			
Apprenticeship	10	25			
PoC identity					
Yes	20	90.9%			
No	2	9.1%			
Ethnic minority					
Yes	20	90.9%			
No	2	9.1%			
BLM activism support					
BLM Activism Mean	22	4.068	0.776	2	5
BLM activism level					
High	11				
Low	11				

Note. $N = 22$.

RQ1: *What is the between- and within-person variability of microaggression (MA), ambiguity and stress?*

Table 2

Descriptives of Stress and Microaggression variables

Variable	N	Mean	Std. Dev.	Min	Max
Stress	440	3.61	2.38	0	10
Microaggression	440				
... 0	395	90%			
... 1	45	10%			
Indicators	45	1.38	0.65	1	3
Intensity	45	3.31	1.16	1	5
Ambiguity	45	2.64	1.3	1	5

Note. N = 22. The 22 participants answered to a total of 440 prompts.

Table 2 gives an overview of the frequency and nature of MAs in a student population living in Europe. In 45 out of 440 (10.2%) occurrences, participants reported perceived potential discrimination (the word discrimination was used to represent the concept of MA). In 395 out of 440 (89.8%) occurrences, participants did not perceive any potential discrimination towards themselves.

Figure 1

Pie Chart showing Frequency Distribution of Types of Microaggressions

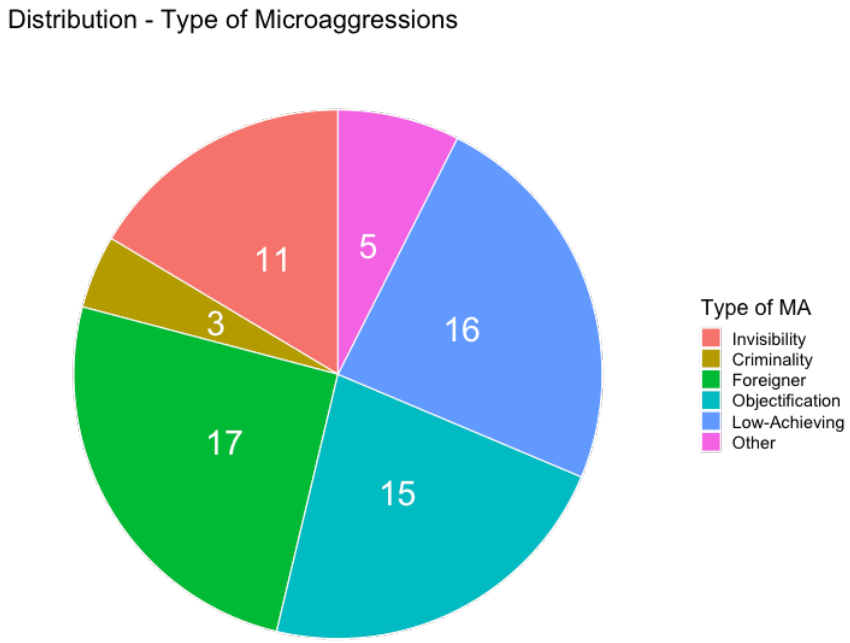


Figure 1 shows how participants felt, when it was asked what kind of MA they experienced. 89% of the reported MAs matched the proposed classification. Notably, an MA could be accompanied by different feelings at the same time: Being treated as a foreigner/outsider 17 times, as low-achieving in 16 cases, as objectified or sexualized in 15 cases, as criminal in three cases and five times participants marked 'other' as a feeling. Further, out of 45 occurrences, 23 were marked as being due to reasons other than the participant's race or ethnicity. This particular finding, combined with participants' diary reports, shows that participants experienced other types of MAs due to disability and gender (intersectionality). So, participants in this study were not only affected by one particular type of MA.

Figure 2

Comparison between Average State Stress of Persons with MA experience and no MA experience in moments of non-MA occurrence.

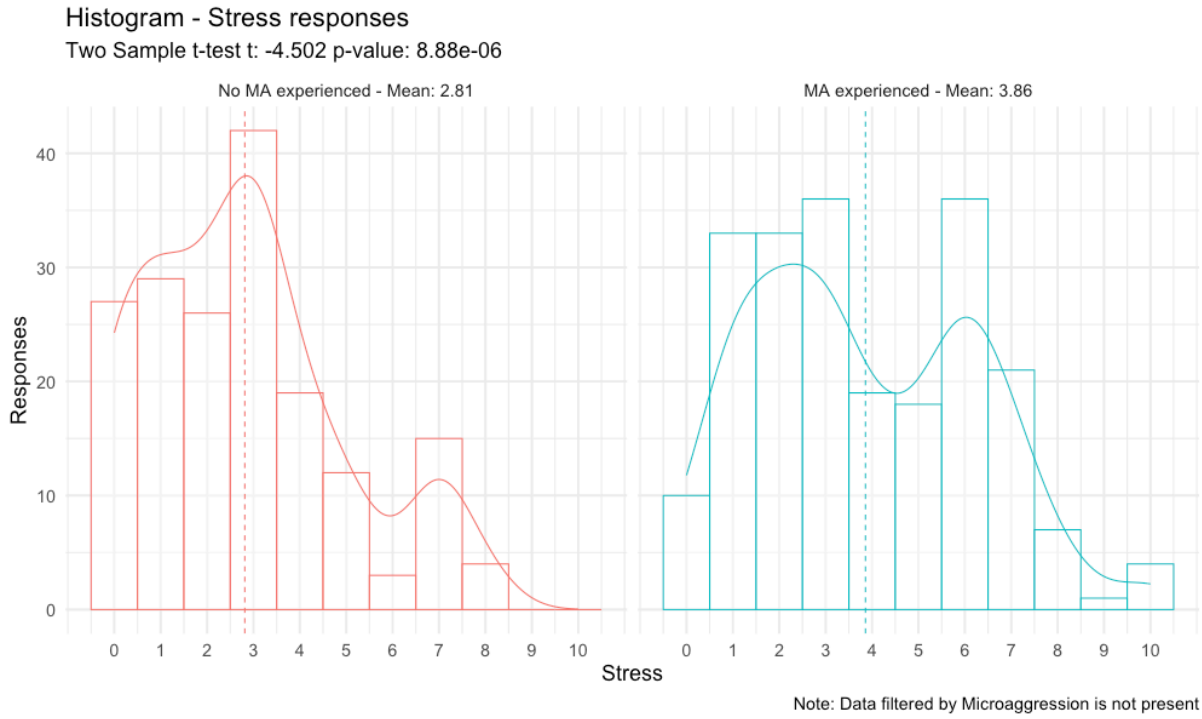
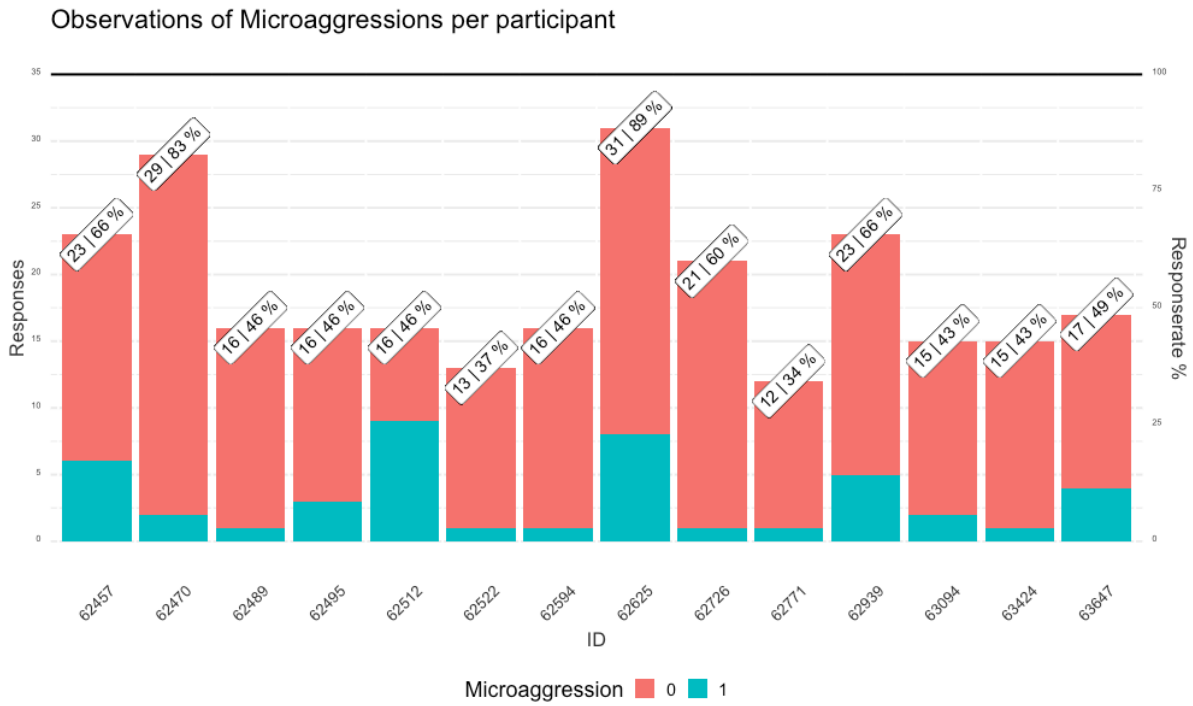


Figure 2 The histogram shows average state stress when MA was not present for the two groups. Namely, the group who did not experience any MA (N = 8) throughout the study period compared to the group (No MA group) who did experience at least one MA (Yes MA group) (N = 14). Findings show that the No MA group's average state stress (2.81) was significantly lower ($t = -4.50$, $p < .001$) than for the Yes MA group (3.86).

Figure 3

Observations of MA per participant throughout the 7-day period, including response rate.

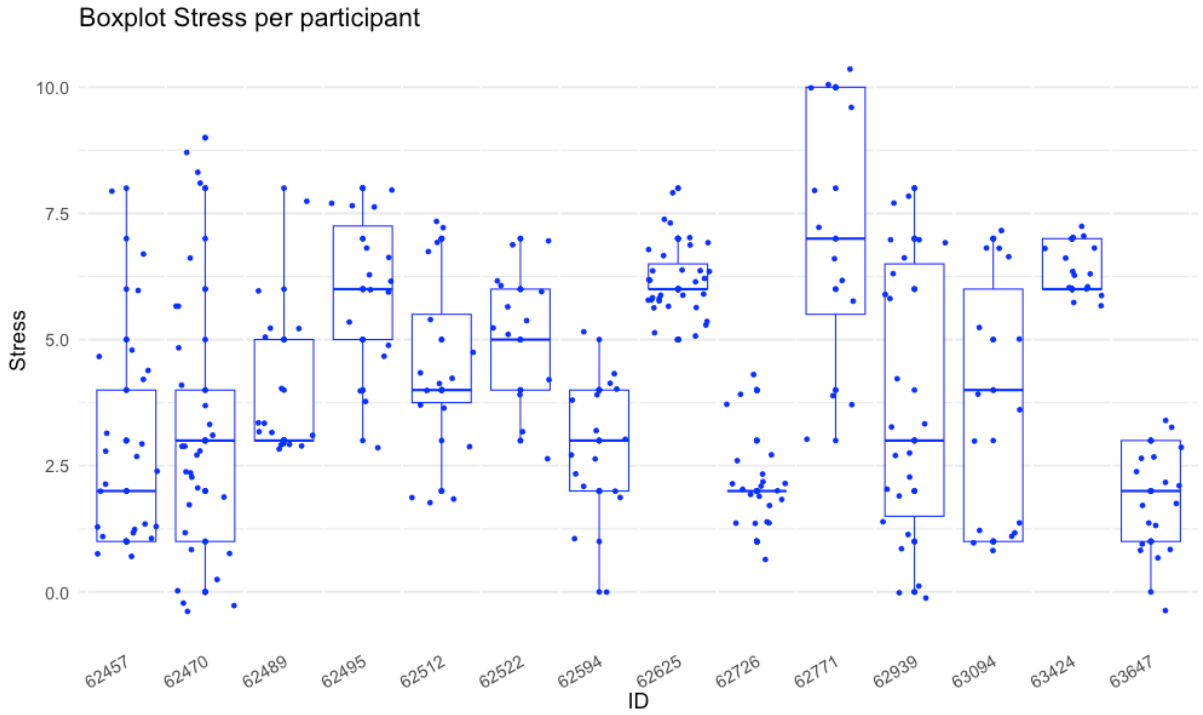


Note. The two participants who indicated not being a visible ethnic minority (62470; 62512) were incl. in this representation.

Figure 3 This bar graph depicts the number of MA reported per participant throughout the study period. Of the 22 participants included in the analysis, 14 (63.6%) reported a MA at least once in the study period, and eight experienced no MA. Out of the 14 participants, six (42.9%) reported only one MA. Further, the response rate for each participant is depicted in the figure.

Figure 4

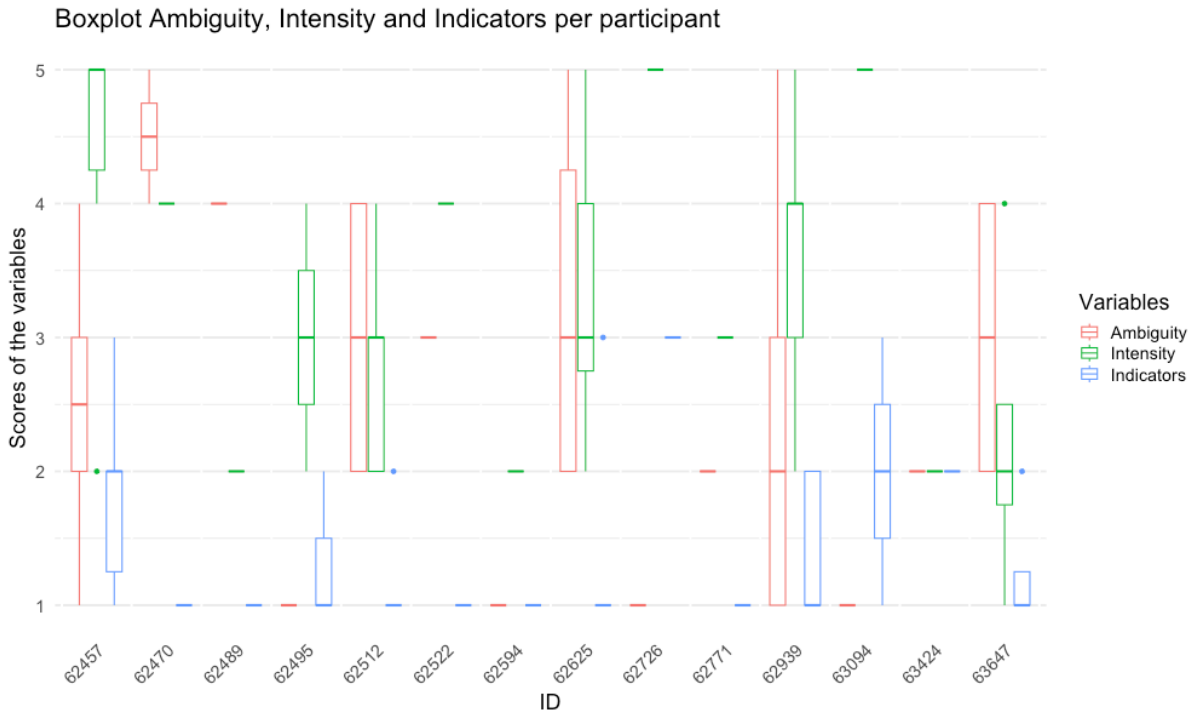
Boxplots showing Within-Variation of Stress of Each Participant and Between-Variation of Stress



Note. Figure 4 displays the stress scores of the 14 participants (incl. two non-visible ethnic minority participants (62470; 62512)). The score ranges for state stress from 0 to 10.

Figure 5

Boxplot using Scores of Ambiguity, Intensity and Indicators per participant



Note. Figure 5 displays the scores of ambiguity, intensity, and indicators of the 14 participants (incl. two non-visible ethnic minority participants (62470; 62512). The score range for state ambiguity and intensity was 1 to 5, and indicators went from 1 to 3. Note that 50% of participants only experienced a MA once in the study period; therefore, only lines were displayed.

Table 3

Linear-Mixed Model 1: Within- and Between-person variability

	Stress		
Predictors	Estimates	CI	p
(Intercept)	4.14	2.38 – 5.91	< .001
Time Point	-0.00	-0.01 – 0.00	.411
Microaggression	1.85	0.91 – 2.78	< .001
Random Effect			
σ2	3.13		
τ00 ID	1.75		
ICC	0.36		
N ID	3		
Observations	77		
Marginal R2 / Conditional R2	.123 / .437		

Note. *N = 3* The analysis refers to three participants with at least five observations of MA for the 7-day study period.

Table 3 displays the results of the first LMM analysis. First, time effects were tested to check for stress pile-up. Results indicated a very small (almost 0), negative, and non-significant (p = .411) time trend for the 7-day period. So, stress levels remained almost the same throughout the study and showed negative trends for a few participants on average. Most importantly, MA occurrence was significantly associated with an increase in state stress in this sample (B = 1.85; p < .001). Furthermore, as expected, the ICC value was between .2 and .4, namely .36. State stress varied more within than between individuals, with 64% of the variability attributed to within-person variation. Consequently, as indicated by the ICC, the LMM analysis appears appropriate for this study. Last, the marginal R^2 and conditional R^2 values were calculated. As indicated by the marginal R^2, 12.3% of variance was explained by

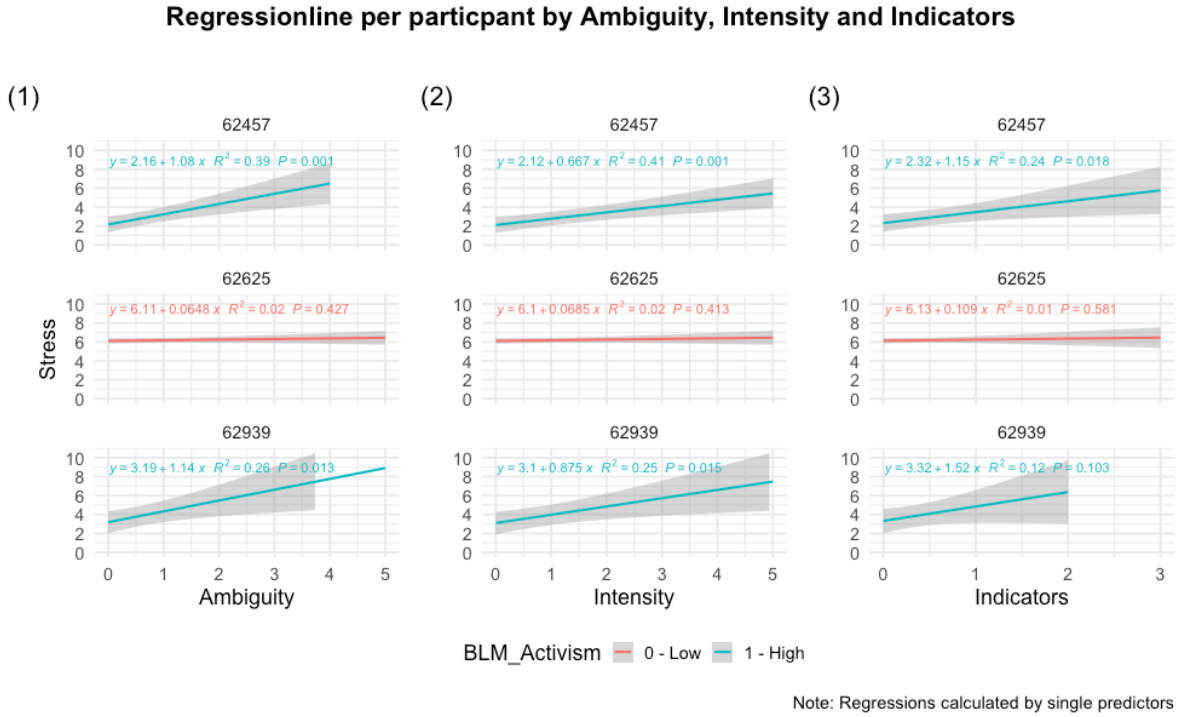
the fixed factor MA alone. Further, the conditional R^2 indicates that 43.7% of variance explained by both the fixed factor of MA and random factor of person.

RQ2*: How is average state (perceived) stress associated with trait activism?*

RQ3*: How are state stress associated with perceived (state) microaggression?*

Figure 6

State Ambiguity, Intensity and Indicators on State Stress

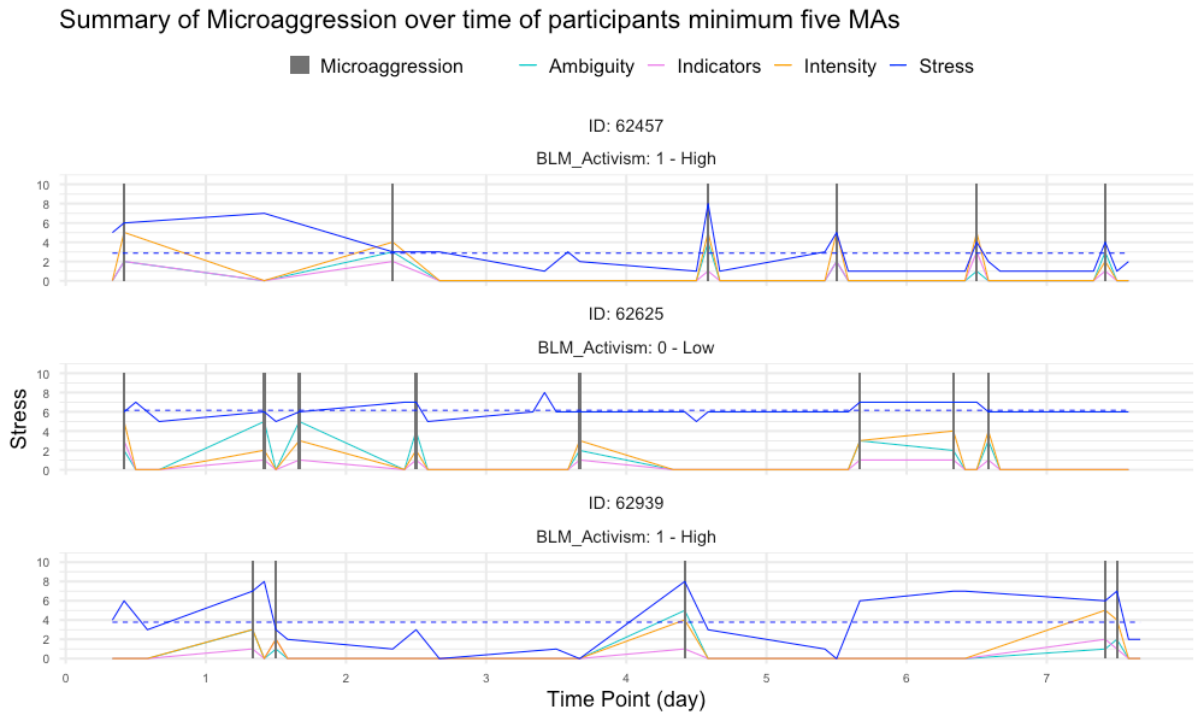


Note. N = 3. The raw scores of state stress and state MA were used to compute the regression analysis.

Figure 6 illustrates the regression lines of all three participants for their association of state stress and state MA of ambiguity, intensity and indicators. First, participant 62457, a high BLM supporter, showed significant positive state associations between ambiguity and stress (p = .001), intensity and stress (p = .001) and indicators and stress (p = .018). Second, participant 62939, a high BLM supporter, showed significant positive state associations between ambiguity and stress (p = .013) and intensity and stress (p = .015). State indicators and state stress was not significantly associated for this participant (p = .581). Third, participant 62625, a low BLM supporter, showed non-significant state associations between ambiguity and stress (p = .427), intensity and stress (p = .413), indicators and stress (p = .581).

Figure 7

Within-Person Fluctuations the Three Participants Analyzed using Raw Scores on Ambiguity, Indicators, Intensity, Frequency and Stress.



Note. A day of measurement was computed as a 24-hour period starting with the individual's first answered prompt (which explains the deviations from the x-axis to the right).

Figure 7 shows the within-person fluctuations of the three participants over the study period for stress, intensity, ambiguity, and indicators. Participant 62457 was a high BLM supporter. They displayed notable within-person fluctuations, including a low average state stress level fluctuating between stress scores of 1 and 8 (PM = 2.86) and an increase in ambiguity, indicators, and intensity with state stress within one interval. Participant 62625 was a low BLM supporter and displayed noticeable within-person fluctuations. Their stress scores fluctuated between 5 and 8. However, in moments of MA non-occurrence, their stress levels did not significantly decrease (PM = 6.0). Participant 62939 was also a high BLM supporter. They displayed notable within-person fluctuations, including a low average state stress level fluctuating between stress scores of 0 and 8 (PM = 3.6) and an increase in ambiguity, indicators, and intensity with state stress within one interval, but also a decrease in stress at moments of MA non-occurrence. Overall, the stress levels of these three participants fluctuated in response to different experiences of MA.

Discussion

This ES study aimed to observe the occurrence of MAs in the daily lives of university students. Specifically, it was intended to observe the between- and within-person variability of MA and stress, how average state stress is associated with trait BLM activism, and how state stress is associated with state microaggression.

Within- and Between-person variability (RQ1)

First, concerning the exploration of between- and within-person variability (RQ1), it was found that MA occurrence appeared to be rare for this sample, as 10% of the answered beeps recorded MA occurrence. Second, the per-participant average MA frequency was 10.7% compared to the average MA frequency found by English et al. (2020). This high discrepancy may be due to two possible reasons. The study by English et al. (2020) was conducted in the US, and it is plausible that MA frequency may be lower in Europe. Further, the sampling time frame during the fall season may have altered findings. A few participants also reported not having been out of the house much, for example, due to weather conditions or home office (which explains why MA frequency may have been relatively rare for this sample). Besides, as frequency of MA was low for this sample and the study period analyzed had to be shortened, stress pile-up could not be analyzed in this study.

Next, participants mostly experienced an MA (89%) as defined by Torres-Harding et al. (2012) (Invisible, Criminal, Foreigner/Not Belonging, Sexualized/Objectified, Low-Achieving/Undesirable Culture). This result indicates that the features classified by Torres-Harding et al. indeed occurred for the participants, for this sample, in daily life and that these categories may capture the feelings of what MAs evoke in PoCs (2012). In a few instances, participants indicated the discrimination experience evoked feelings indicated as 'other'. It is possible that overt discrimination experiences were measured, which are different from subtle MA experiences, or that the scale may not cover all feelings direct MAs may evoke. Further, as hypothesized by Sue et al. (2008), ambiguity was a factor characterizing an MA experience in this study. This finding indicates that what is considered an MA was actually measured, namely an ambiguous/subtle disparagement (Sue et al., 2007).

Finally, more within-person variation (66%) than between-person variation (34%) explained the association between MA and stress in this sample, which shows that experiencing MAs is a unique and different experience for each individual (Bolger & Laurenceau, 2013). For example, one autistic PoC reported a striking experience of exclusion by other parents from the kindergarten their child attends to because they initially had difficulty interpreting messages from the other parents.

MA and Moderation by BLM Activism (RQ2)

First, the findings were in line with studies indicating that BLM activism might be a protective factor in terms of resilience. ES allowed observing the individual stress response, resilience and coping (person factor), when participants reported experiencing an MA (Lazarus & Folkman, 1984; Cicchetti & Garmezy, 1993; Luthar et al., 2000; Masten, Best & Garmezy, 1990; Rutter, 2012 as cited in Juster et al. 2016; McEwen & Stellar, 1993 cited in Schetter & Dolbier, 2011; Wälde, 2018).

Thus, it was possible to observe different changes in state levels of individuals in relation to their BLM support level. It appears that high BLM support negatively moderates the association between average state stress and average state MA, as high BLM supporters exhibited lower average state stress than the low BLM supporter in this sample. Further, high BLM supporters' average state stress levels were comparable to persons with no MA experience throughout the study (Oken et al., 2015).

The within-person fluctuations showed that BLM supporters were moderately stressed by MA occurrence but returned to baseline stress levels after the MA experience (or even lower levels). Thus, these findings may indicate that high BLM supporters may show patterns of tolerable stress responses. High BLM support may protect individuals from chronic stress by helping return to baseline (allostasis) after a state stress response occurs. Consequently, BLM supporters may exhibit a healthy stress response (allostasis) towards a stressor as they developed higher resilience through coping (Bucci et al., 2016; Karatsoreos & McEwen, 2011; Lazarus & Folkman, 1984; Oken et al., 2015).

Furthermore, this finding was in line with a longitudinal study, which found that BLM activism moderated the cross-lagged associations between racial discrimination and depressive symptoms (Watson-Singleton et al., 2021). In addition, this finding is in line with Hope et al. (2018) study in which activism was associated with lower symptoms of stress and anxiety related to MA. In conclusion, partaking in BLM activism may represent an adaptive response (protective factor) to one's own unjust treatment as a PoC by promoting resilience through learning how to transform distress into self-respect and dignity (Hoffman et al., 2016; Watson-Singleton et al., 2021).

Moreover, visual inspection of the within-person fluctuations of the low BLM supporter showed stable, moderate stress levels for the person studied, which were higher than the levels of the BLM supporters. In terms of chronic stress, the person may have had lower resilience than the high BLM supporters. Therefore, it may be that the low BLM supporter may risk developing allostatic load due to lower resilience in the face of daily

hassles and MA (Wright et al., 2019). Allostatic load may lead to toxic stress and later chronic stress. Consequently, low BLM supporters may be more vulnerable to chronic mental or physical health outcomes (Bucci et al., 2016; McEwen & Stellar, 1993 as cited in Schetter & Dolbier, 2011).

Thus, the findings support the understanding of MAs as a chronic stressor (Sue et al., 2008) and are in line with prior findings, which associated experiencing MAs has been associated with chronic stress (measured with allostatic load markers) (Rodriquez et al., 2018). Moreover, MA has been associated with chronic stress health outcomes, such as mental illness, such as depression, or physiological health, such as increased blood pressure (Rodriquez et al., 2021; Wong-Padoongpatt et al., 2017).

Last, participants were drawn from the general population. It was unclear whether participants had a history of mental illness. However, our finding was in line with prior findings, which found high CC, which may be a similar construct as high BLM support, may buffer or protect against allostatic load (Curie et al., 2020).

State MA (Intensity, Ambiguity and Indicators) (RQ3)

First, intensity was hypothesized to be a factor capturing chronicity next to frequency. Intensity was positively associated with state stress within the two high BLM supporters. This finding may show that perceived MA intensity may contribute to the individual stress response. This finding is in line with ES studies which associated higher rumination with higher stressor intensity and rumination with negative affect (Blanke et al., 2021). Further, this finding is in line with the hypothesis that individuals who perceive MAs as more intense may be more likely to experience more severe psychological impacts (Sue & Spanierman, 2020). In addition, one of the two BLM supporters' state indicators was positively associated with state stress. In support of this finding, Cook et al. (2019) found that experiencing above-average stressful MAs on any given day was associated with poorer mood on the same day.

Next, it was hypothesized that higher state ambiguity would predict higher state stress. The findings showed that ambiguity was positively associated with state stress within the two high BLM supporters. This finding is in line with the hypothesis that part of the harmful nature of MAs stems from their ambiguity (Sue et al., 2008). Further, this finding aligns with prior studies that found a positive association between ambiguous messages and stress responses, such as behavioral stress responses like insomnia from ambiguous but not clear e-mail messages (Yuan et al., 2020). In line with this finding, it was found by Matheson et al. (2021), in an experimental study that ambiguous MAs were more strongly associated with depressive affect than explicit racism.

In conclusion, to our knowledge, the study tested theoretical implications, which have never been tested before in any MA research. Namely, ambiguity and intensity were associated with MA for this sample, which was the first exploration that ambiguity and intensity may be considered as characteristics marking a MA compared to overt discriminatory behavior. Most importantly, the ESM allowed for measuring the momentary association between the state (ambiguity, intensity) of MA and stress, which would not have been possible in a cross-sectional design (Myin-Germeys & Kuppens, 2021). In other words, the ESM design allowed to assess the perception of MA of individuals in relation to the context and person, respectively, how ambiguous or intense the MA was perceived and how in turn, this affected their experience (Ong, 2021).

Strengths and Limitations

The results must be interpreted cautiously owing to some potential limitations. One limitation is that it cannot be guaranteed that the concept of MA was captured entirely by using the word 'discrimination' as a synonym, and the wording may have misled some participants. The word 'disparagement' may capture the concept of MA more accurately (Williams, 2019). Additionally, the study appeared to be burdensome for most participants (71.1%), as they did not reach the a priori set compliance rate (Myin-Germeys & Kuppens, 2021). The study may also have induced reactivity, as some participants reported actively seeking contact with PoCs when they realized they had experienced discrimination and were stressed. Further, some participants felt that writing in their diaries decreased their stress levels (Hoggard et al., 2012; Lilienfeld, 2017; Ram et al., 2017).

Furthermore, as the study period analyzed had to be shortened to seven days, and MA occurrence was relatively rare for this sample, it was impossible to check for any stress pile-up. Due to missing sufficient observations of MA per participant, it was only possible to perform LMM analyses with three participants. Therefore, generalizability is limited (Hermans et al., 2019 as cited in Myin-Germeys & Kuppens, 2021; Statista (n.d.)). Compliance for this sample may have been low, as some participants reported being very busy at the moment and feared the study reporting would interfere with their daily lives. Thus, they may have stopped filling in after reporting frequency felt too burdensome once they registered (Csikszentmihalyi & Larson, 2014).

In addition, the validity and reliability of the psychometric scales of MA, ambiguity, intensity, and indicators could not be computed due to low frequency of MA. The low compliance rate poses an issue to validity and reliability of the scales used, as it raises the question of whether participants fully understood the questions or had technical issues.

However, daily diary entries and later de-briefings did not offer insights into why participants had low compliance reasons, such as technical issues or understanding of questionnaires. Further, participants seemed to have understood the stress scale SRNS-11 and what it intended to measure, as some participants felt that the stress recording helped them reduce their stress (validity) (Csikszentmihalyi & Larson, 2014).

Finally, student populations may not represent the best sampling group for MA research, because university campuses may be more tolerant than places outside of university (Hopkins, 2010). Furthermore, the sample focused on (visible) ethnic minorities as an overall group. Therefore, group-specific associations with MA experiences could not be differentiated in this study. In addition, this study did not solely capture race-related MAs, as participants also described having experienced other types of MAs.

However, concerning the study's strengths, the ESM allowed gathering data on the within- and between-person level simultaneously. Therefore, the study allowed deeper insights into associations on the within-person level than in a laboratory (Myin-Germeys & Kuppens, 2021).(Myin-Germeys & Kuppens, 2021). The ESM allowed MA observation in natural occurrence using scaled questionnaires and the optional non-intrusive diary entry using mobile devices (Hektner et al., 2007; van Berkel et al., 2017). Thus, the data gathered can be considered representative of the students in this sample, as MAs were reported in their natural environments, and self-report is the only way to measure the subjective appraisal of the MA experience (Lazarus & Folkman, 1984; Myin-Germeys & Kuppens, 2021; Wright et al., 2019). Thereby, the occurrence of MA in European student samples was indicated. As such, the finding indicates that MA research is also meaningful in European contexts (Ram et al., 2017).

Moreover, by observing participants in their natural environment, the ESM has ethical strengths compared to experimental designs, as participants were not artificially subjected to MAs (Conner & Lehman, 2012). Moreover, although the ESM may have induced reactivity effects for participants, two participants reported the study helped them reduce their stress because they tracked their experience and could reflect on it through the diary (Myin-Germeys & Kuppens, 2021). In addition, deeper insight into the nature of MA was gained when participants described their experience of their most striking (potential) discrimination experience of the day in their diary. Last, recall biases were reduced using momentary measurements (Tversky & Kahneman, 1982 as cited in Bolger & Laurenceau, 2013).

Recommendations for implementation and future research

First, future studies may want to counteract the potential threats to ecological validity found in this study owing to compliance issues and potential reactivity effects. They may be eliminated by reducing interaction with the participant, hence by reducing sampling frequency (Ram et al., 2017). Thereby, the participant burden for student populations may also be minimized, and the sampling frequency may be adapted to the lower frequency of MA occurrence found in this sample (Myin-Germeys & Kuppens, 2021). Therefore, future studies may consider adapting the frequency of daily questionnaires on MA occurrence to a maximum of twice a day. The question remains open as to whether the frequency of MA in this sample was lower than that in English et al. (2020), because the study was conducted in the US and not Europe. Therefore, future MA daily life research is required to make more sophisticated claims.

Second, future studies may consider observing MAs in daily life in samples other than students who have more contact with direct contact with strangers (for example, medical staff) (Brooks et al., 2022). As such, future studies may be able to check for cumulative effects of MA on stress and thereby check for lagged associations between MA and stress (Myin-Germeys & Kuppens, 2021). Further, future studies may want to add objective measures of stress responses, such as biomarkers and sensors, to allow for continuous and unobtrusive monitoring of stress responses and checking for allostatic load in association with state MA (McEwen, 1998; Wang et al., 2017). Adding these measures may increase the generalizability of the findings (Hermans et al., 2019 as cited in Myin-Germeys & Kuppens, 2021; Ram et al., 2017).

Third, questionnaires should be tailored to the native language(s) of the target group(s) to avoid misunderstanding and to better capture the concept of MA; thus the reliability and validity of results can be increased (Abu-Shanab & Nor, 2013). Further, future studies may focus on MAs on a wider spectrum by including MAs based on other stigmas (Sue et al., 2007; Sue et al., 2008; Sue & Spanierman, 2020).

Fourth, this study found that visible and invisible minorities experienced direct and indirect MAs (due to ethnicity) and responded according to the RMAS scale (Torres-Harding et al., 2012). Indirect MA experiences describe, in this case, the experience of overhearing an MA directed to another PoC group or individual, or, in the case of a non-visible PoC, a person disclosing their biases to them as they appear to be a non-minority. An example in this study was an indirect MA directed to a non-visible PoC "There are too many Arabs in this region". Therefore, future studies may focus on what kinds of MAs non-visible PoCs

encounter and how they may be affected by them. Lastly, future studies may want to assess whether interventions such as biofeedback, stress tracking, or diaries may help reduce stress for persons with MA experience.

Conclusion

This study aimed to observe MA experiences in daily life and to identify person, context, and process factors contributing to the within- and between-person experience of MA. The results suggest that the association between stress and MA may be highly dependent of the individual experience in the moment and that experience sampling is meaningful for MA research. The findings support the notion that MAs predicted increased stress response and that, consequently, persons who experience MAs may be more vulnerable to health issues associated with chronic stress responses, such as depression (Rodriquez et al., 2021). Finally, high BLM support may be a protective factor against chronic stress and may promote tolerable stress responses. All findings should be interpreted with caution and substantiated in a wider sample. Future studies may want to assess the coping factors that may underlie the potential protection of high BLM support and how BLM support may protect from allostatic load in response to MA experiences.

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Appendices

Appendix A

Table A1 *Cronbach's alpha for BLM Activism*

```
Reliability analysis
Call: alpha(x = dfd[, c("BLM_support", "BLM_help", "BLM_future")])

  raw_alpha std.alpha G6(smc) average_r S/N  ase mean   sd median_r
      0.66      0.66    0.59      0.39 1.9 0.07  4.1 0.73     0.33

   95% confidence boundaries
        lower alpha upper
Feldt    0.49  0.66  0.77
Duhachek 0.52  0.66  0.80

 Reliability if an item is dropped:
            raw_alpha std.alpha G6(smc) average_r  S/N alpha se var.r
med.r
BLM_support      0.73      0.74    0.58      0.58 2.77    0.062    NA
0.58
BLM_help         0.50      0.50    0.33      0.33 1.00    0.117    NA
0.33
BLM_future       0.41      0.41    0.26      0.26 0.69    0.138    NA
0.26

 Item statistics
             n raw.r std.r r.cor r.drop mean   sd
BLM_support 73  0.69  0.69  0.40   0.33  4.5 0.94
BLM_help    73  0.79  0.80  0.66   0.51  3.7 0.94
BLM_future  73  0.83  0.83  0.72   0.58  4.0 0.95

Non missing response frequency for each item
                1    2    3    4    5 miss
BLM_support 0.01 0.04 0.11 0.11 0.73    0
BLM_help    0.01 0.08 0.29 0.41 0.21    0
BLM_future  0.01 0.05 0.22 0.38 0.33    0
```

Appendix B Correlation of Independent Variables Ambiguity, Intensity and Indicators

Table B1 *Correlation of Independent Variables Ambiguity and Intensity*

```
Pearson's product-moment correlation

data:  tmp$Ambiguity and tmp$Intensity
t = -1.3024, df = 32, p-value = 0.2021
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.5228650  0.1231371
sample estimates:
       cor
-0.2243716
```

Table B2 *Correlation of Independent Variables Indicators and Intensity*

```
Pearson's product-moment correlation: Indicators and Intensity

data:  tmp$Indicators and tmp$Intensity
t = 2.9084, df = 32, p-value = 0.006553
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.1408602 0.6888915
sample estimates:
      cor
0.4572454
```

Table B3 *Correlation of Independent Variables Ambiguity and Indicators*

```
Pearson's product-moment correlation: Ambiguity and Indicators

data:  tmp$Ambiguity and tmp$Indicators
t = -3.2154, df = 32, p-value = 0.002974
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.7131503 -0.1872884
sample estimates:
       cor
-0.4941569
```

Appendix C Check for Performance, multicollinearity and autocorrelation LMM1

Figure C1 *Performance LMM 1*

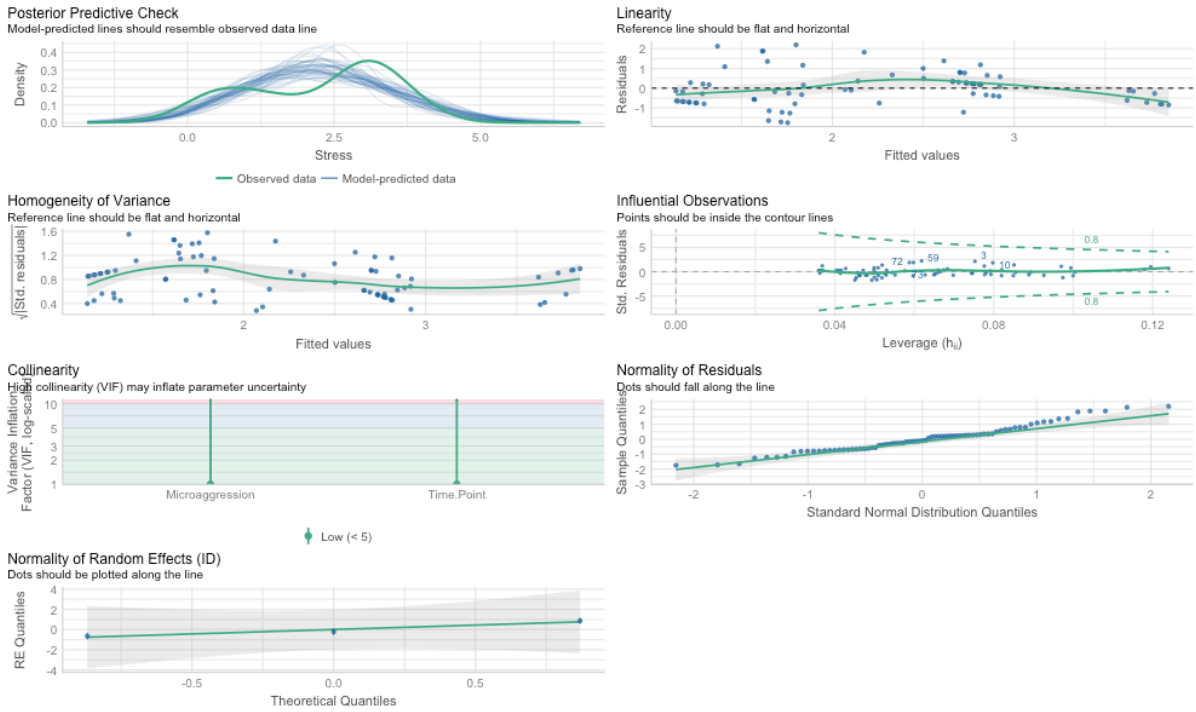

Table C1 *Check for Multicollinearity and Autocorrelation for LMM 1*

Low Correlation

Term	VIF	VIF 95% CI	Increased SE	Tolerance	Tolerance 95% CI
Time.Point	1.00	[1.00, Inf]	1.00	1.00	[0.00, 1.00]
Microaggression	1.00	[1.00, Inf]	1.00	1.00	[0.00, 1.00]

OK: Residuals appear to be independent and not autocorrelated (p = 0.136).

Figure D2 *Performance LMM 2*

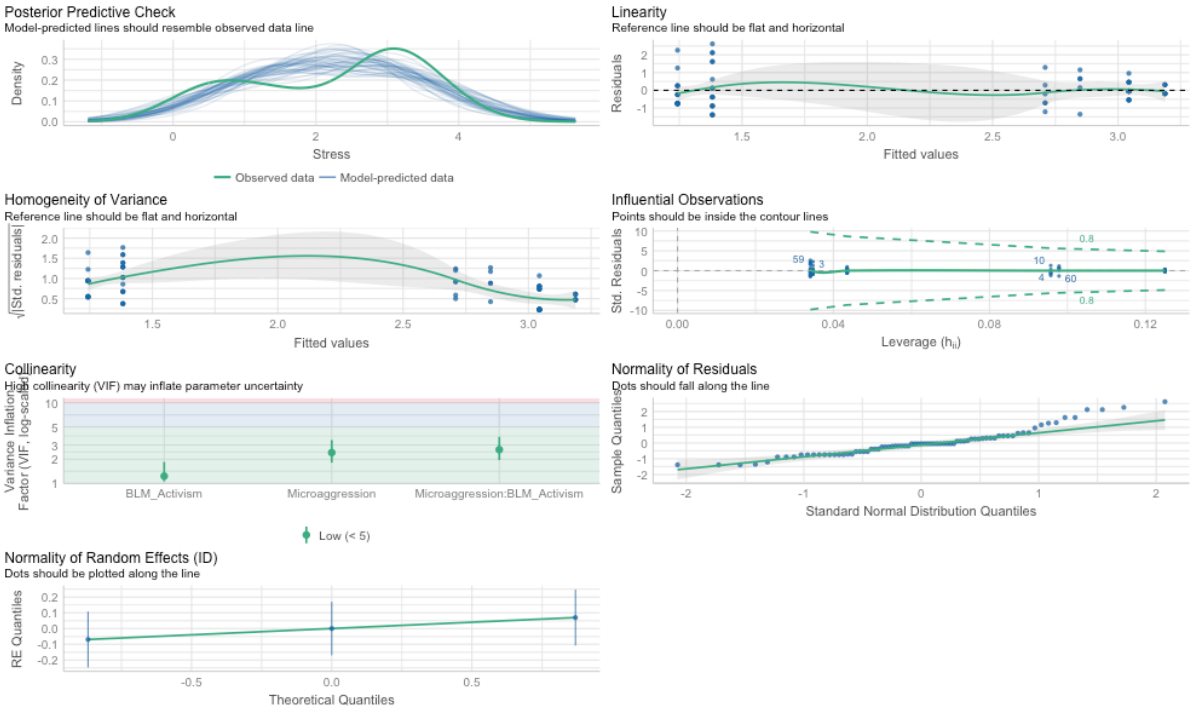

Table D2 *Check for Multicollinearity and Autocorrelation for LMM 2*

Low Correlation

Term	VIF	VIF 95% CI	Increased SE	Tolerance	Tolerance 95% CI
Microaggression	2.41	[1.81, 3.46]	1.55	0.41	[0.29, 0.55]
BLM_Activism	1.23	[1.06, 1.85]	1.11	0.81	[0.54, 0.94]
Microaggression:BLM_Activism	2.62	[1.95, 3.77]	1.62	0.38	[0.27, 0.51]

OK: Residuals appear to be independent and not autocorrelated (p = 0.128). Warning: Variances differ between groups (Fligner-Killeen Test, p = 0.000).

Appendix E

Table E1 Participant 624571 Ambiguity

```
###########   Summary ########

Call:
lm(formula = formula, data = filter(dfdq_5, ID == id))

Residuals:
    Min      1Q  Median      3Q     Max
-2.4110 -1.1636 -0.1636  0.8364  4.8364

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)      2.1636     0.4000   5.410 2.29e-05 ***
Ambiguity_nMA0   1.0825     0.2925   3.701  0.00133 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.686 on 21 degrees of freedom
Multiple R-squared:  0.3947,  Adjusted R-squared:  0.3659
F-statistic: 13.69 on 1 and 21 DF,  p-value: 0.001326

###########   shapiro-wilk.test normality distribution of residuals <
0.05 ########

Shapiro-Wilk normality test

data:  residuals(fit)
W = 0.86542, p-value = 0.005247

###########   resettest linearity given when p > 0.05 ########

RESET test

data:  fit
RESET = 1.6706, df1 = 2, df2 = 19, p-value = 0.2146
```

Table E2 Participant 624571 Indicators

```
###########   Summary ########
```

```
Call:
lm(formula = formula, data = filter(dfdq_5, ID == id))

Residuals:
    Min      1Q  Median      3Q     Max
-1.7745 -1.3186 -0.3186  0.6814  4.6814

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)       2.3186     0.4489   5.165 4.06e-05 ***
Indicators_nMA0   1.1520     0.4489   2.566    0.018 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.891 on 21 degrees of freedom
Multiple R-squared:  0.2387,  Adjusted R-squared:  0.2025
F-statistic: 6.585 on 1 and 21 DF,  p-value: 0.018

###########   shapiro-wilk.test normality distribution of residuals <
0.05 ########

Shapiro-Wilk normality test

data:  residuals(fit)
W = 0.79298, p-value = 0.0002965

###########   resettest linearity given when p > 0.05 ########

RESET test

data:  fit
RESET = 2.7049, df1 = 2, df2 = 19, p-value = 0.09253
```

Table E3 Participant 624571 Intensity

```
###########   Summary ########

Call:
lm(formula = formula, data = filter(dfdq_5, ID == id))

Residuals:
    Min      1Q  Median      3Q     Max
```

```
-1.7821 -1.1161 -0.4487  0.7176  4.8839

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)      2.1161     0.4000   5.290 3.03e-05 ***
Intensity_nMA0   0.6665     0.1751   3.806  0.00103 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.667 on 21 degrees of freedom
Multiple R-squared:  0.4082,  Adjusted R-squared:   0.38
F-statistic: 14.48 on 1 and 21 DF,  p-value: 0.001033

############   shapiro-wilk.test normality distribution of residuals <
0.05 ########

Shapiro-Wilk normality test

data:  residuals(fit)
W = 0.8155, p-value = 0.0006857

############   resettest linearity given when p > 0.05 ########

RESET test

data:  fit
RESET = 0.66966, df1 = 2, df2 = 19, p-value = 0.5236
```

Table E4 Participant 626251 Ambiguity

```
############   Summary ########

Call:
lm(formula = formula, data = filter(dfdq_5, ID == id))

Residuals:
    Min      1Q  Median      3Q     Max
-1.1070 -0.2365 -0.1070  0.2635  1.8930

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
```

```
(Intercept)     6.10696    0.14135  43.204   <2e-16 ***
Ambiguity_nMA0  0.06478    0.08032   0.807    0.427
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.6919 on 29 degrees of freedom
Multiple R-squared:  0.02194, Adjusted R-squared:  -0.01179
F-statistic: 0.6505 on 1 and 29 DF,  p-value: 0.4265

###########   shapiro-wilk.test normality distribution of residuals <
0.05 ########

Shapiro-Wilk normality test

data:  residuals(fit)
W = 0.87334, p-value = 0.00166

###########   resettest linearity given when p > 0.05 ########

RESET test

data:  fit
RESET = 0.76407, df1 = 2, df2 = 27, p-value = 0.4756
```

Table E5 Participant 626251 Indicators

```
###########   Summary ########

Call:
lm(formula = formula, data = filter(dfdq_5, ID == id))

Residuals:
    Min      1Q  Median      3Q     Max
-1.1263 -0.2349 -0.1263  0.3194  1.8737

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)       6.1263     0.1399  43.798   <2e-16 ***
Indicators_nMA0   0.1086     0.1947   0.558    0.581
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
Residual standard error: 0.6959 on 29 degrees of freedom
Multiple R-squared:  0.01061, Adjusted R-squared:  -0.02351
F-statistic: 0.311 on 1 and 29 DF,  p-value: 0.5813

###########   shapiro-wilk.test normality distribution of residuals <
0.05 ########

Shapiro-Wilk normality test

data:  residuals(fit)
W = 0.85451, p-value = 0.000633

###########   resettest linearity given when p > 0.05 ########

RESET test

data:  fit
RESET = 0.50106, df1 = 2, df2 = 27, p-value = 0.6114
```

Table E6 Participant 626251 Intensity

```
###########   Summary ########

Call:
lm(formula = formula, data = filter(dfdq_5, ID == id))

Residuals:
    Min      1Q  Median      3Q     Max
-1.1039 -0.2751 -0.1039  0.2592  1.8961

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)     6.10386    0.14217   42.93   <2e-16 ***
Intensity_nMA0  0.06847    0.08253    0.83    0.413
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.6914 on 29 degrees of freedom
Multiple R-squared:  0.02319, Adjusted R-squared:  -0.0105
F-statistic: 0.6884 on 1 and 29 DF,  p-value: 0.4135
```

```
      ############   shapiro-wilk.test normality distribution of residuals <
0.05 ########

      Shapiro-Wilk normality test

      data:  residuals(fit)
      W = 0.87568, p-value = 0.00188

      ############   resettest linearity given when p > 0.05 ########

      RESET test

      data:  fit
      RESET = 0.26387, df1 = 2, df2 = 27, p-value = 0.77
```

Table E7 Participant 629391 Ambiguity

```
      ############   Summary ########

      Call:
      lm(formula = formula, data = filter(dfdq_5, ID == id))

      Residuals:
          Min      1Q  Median      3Q     Max
      -3.1856 -1.7577 -0.1856  1.5979  4.8144

      Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
      (Intercept)      3.1856     0.5555   5.734 1.08e-05 ***
      Ambiguity_nMA0   1.1443     0.4213   2.716   0.0129 *
      ---
      Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

      Residual standard error: 2.447 on 21 degrees of freedom
      Multiple R-squared:   0.26,   Adjusted R-squared:  0.2248
      F-statistic: 7.379 on 1 and 21 DF,  p-value: 0.01293

      ############   shapiro-wilk.test normality distribution of residuals <
0.05 ########

      Shapiro-Wilk normality test
```

```
data:  residuals(fit)
W = 0.9365, p-value = 0.1511

###########   resettest linearity given when p > 0.05 ########

RESET test

data:  fit
RESET = 0.20039, df1 = 2, df2 = 19, p-value = 0.8201
```

Table E8 Participant 629391 Indicators

```
###########   Summary ########

Call:
lm(formula = formula, data = filter(dfdq_5, ID == id))

Residuals:
    Min      1Q  Median      3Q     Max
-3.3676 -2.3186 -0.3186  2.4191  4.6814

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)       3.3186     0.6192   5.360 2.58e-05 ***
Indicators_nMA0   1.5245     0.8953   1.703    0.103
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.666 on 21 degrees of freedom
Multiple R-squared:  0.1213,  Adjusted R-squared:  0.07948
F-statistic:   2.9 on 1 and 21 DF,  p-value: 0.1034

###########   shapiro-wilk.test normality distribution of residuals <
0.05 ########

Shapiro-Wilk normality test

data:  residuals(fit)
W = 0.91761, p-value = 0.05922

###########   resettest linearity given when p > 0.05 ########
```

```
RESET test

data:  fit
RESET = 2.0364, df1 = 2, df2 = 19, p-value = 0.158
```

Table E8 Participant 629391 Intensity

```
############   Summary ########

Call:
lm(formula = formula, data = filter(dfdq_5, ID == id))

Residuals:
   Min     1Q Median     3Q    Max
-3.098 -1.973 -0.098  1.340  4.902

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)      3.0980     0.5740   5.397 2.36e-05 ***
Intensity_nMA0   0.8748     0.3290   2.659   0.0147 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.46 on 21 degrees of freedom
Multiple R-squared:  0.2518,  Adjusted R-squared:  0.2162
F-statistic: 7.069 on 1 and 21 DF,  p-value: 0.01469
############   shapiro-wilk.test normality distribution of residuals <
0.05 ########

Shapiro-Wilk normality test

data:  residuals(fit)
W = 0.92912, p-value = 0.1047

############   resettest linearity given when p > 0.05 ########

RESET test

data:  fit
RESET = 0.62798, df1 = 2, df2 = 19, p-value = 0.5444
```