

Characterization of the Association Between Mindfulness, Metapersonal Awareness, and
Mental Health Outcomes

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Abstract

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Abstract

Introduction: Depression and anxiety are increasing common mental health conditions in the United States. Interventions intended to improve mindfulness are often utilized to treat and prevent depression and anxiety. This study aimed to improve the understanding of how mindfulness improves mental health outcomes by analyzing metapersonal awareness (a self-construal characterized by feeling connected to all things) as a mediator between mindfulness and mental health outcomes.

Methods: Cross-sectional demographic and survey data was collected on 1,512 college students and amazon Mechanical TURK participants. All participants were over 18 and American English speakers. 1,086 surveys met inclusion criteria for analysis (survey completed within reading rate of under 300 words per minute). The Five Facet Mindfulness Questionnaire (FFMQ) was used to measure mindfulness. The Metapersonal Self Scale (MPS) was used to measure metapersonal awareness. The Depression, Anxiety, and Stress Scale (DASS) was used to measure both total mental distress, and depression, anxiety, and stress, separately. Mediation analysis was performed using FFMQ as the predictor, MPS as the mediator, and DASS total as well as the subscale scores for depression, anxiety, and stress as the outcomes. Stratified analyses were performed by age (younger than 25 vs. 25 and older) and by gender.

Results: Mindfulness was positively correlated with metapersonal awareness, and negatively correlated with both DASS total and individual outcomes. When not adjusted for mindfulness, metapersonal awareness was negatively correlated with overall mental distress and depression. After adjustment for FFMQ, metapersonal awareness became positively associated with anxiety, overall mental distress, and stress. No evidence was found for metapersonal awareness as a mediator between mindfulness and mental health outcomes.

Discussion: The absence of mediation found in this analysis may be due to temporality issues as cross-sectional data was used. Future studies should focus on how metapersonal awareness and mental health outcomes change overtime in response to interventions.

I. Specific Aims:

This study examined the relationship between mindfulness and mental health outcomes and whether this relationship is mediated by a self-construal construct known as metapersonal awareness. The overall goal was to better understand the mechanisms through which mindfulness may lead to improved mental health outcomes so that future research and interventions can be tailored to maximize the effects of mindfulness on wellness.

Aim 1: Characterize the relationships between the Five Facet Mindfulness Questionnaire (FFMQ), Metapersonal Self Scale (MPS), and Depression, Anxiety, Stress Scales (DASS) within the study sample population.

The null hypothesis is that no associations exist between FFMQ, MPS, and DASS. The alternative hypothesis is that high MPS and high FFMQ scores are associated with lower DASS scores, and that there is a positive correlation between FFMQ and MPS.

Aim 2: Evaluate metapersonal self-construal as a mediator between mindfulness and depression, anxiety, and stress.

The null hypothesis is that metapersonal self-construal is not a mediator between mindfulness and depression, anxiety, and stress. The alternative hypothesis is that individuals with high FFMQ scores and low DASS scores will also be more likely to have a high MPS score than those with high FFMQ scores and low DASS scores.

II. Background

Mental illness is a highly prevalent and growing issue in the United States. According to the National Institute of Mental Health as of 2017, 7.1% of U.S. adults have had at least one episode of major depression,¹ and 31.1% of U.S. adults have experienced an anxiety disorder at some point in their lifetime.² Further, data from the National Survey on Drug Health use and Health shows that among youth age 18-25 the rates of major depressive episode within the past year increased 63% from 2009 to 2017.⁴ Suicide incidence has also increased by 24% from 1999 to 2014 according to the Center for Disease Control and Prevention(CDC).³

One emerging method to prevent mental illness and promote mental health is through interventions intended to increase mindfulness. Mindfulness is generally defined in the literature as a state of intentional awareness of the present moment, without judgement of the current circumstances.⁵⁻⁷ Interventions such as mindfulness based stress reduction programs are thought to improve mental health outcomes by increasing participants tendencies towards states of mindfulness in daily life.⁸ Interest in using mindfulness based interventions has increased due to the potential of mindfulness interventions to be used to address mental health in the population level among non-clinical populations,^{9,10} and the interest in finding a more cost effective approach to improve wellness.^{11,12} The effectiveness of mindfulness interventions on mental health has been studied previously with mixed results. Some studies which tested interventions to improve mindfulness showed impressive improvements in outcomes such as pain management¹³, stress reduction^{14,15}, and depression¹⁶, while other studies showed either null results or no benefit over standardized therapies.^{17,18}

One possible explanation for the mixed results of mindfulness is that certain populations may have baseline characteristics such as a greater ability to observe without judgement and to stay focused on the present moment, which make them more amenable to the beneficial effects of mindfulness interventions than other populations. This may be because a certain baseline level of skill may be necessary to make the most use out of mindfulness tools. These characteristics are often measured with the FFMQ (Five Facet Mindfulness Questionnaire). Scientific literature in this area has shown FFMQ scores are negatively correlated with depression, anxiety and stress.^{19,20} For example, one study showed that for individuals with high baseline FFMQ scores, when given mindfulness cues had lower stress responses to stimulated stressful scenarios, compared to those with low baseline FFMQ scores who had higher stress responses, as shown by measured biomarkers in both groups.²¹ A systematic review of the literature also found that although many individuals benefit from meditation, adverse events such as symptoms of anxiety, depression, stress, hallucinations (visual and auditory) and other cognitive anomalies such as thought disorientation may also occur as part of meditation practices. The prevalence of these events among those receiving a mindfulness intervention was 3.7% within experimental studies, and 33.2 % for observational studies (which were often more intensive environments such as meditation retreats).²² What these results suggest is that although meditation is beneficial for many individuals, there may be certain individuals who are vulnerable to having negative side effects from these interventions. Further research into the mechanisms behind how mindfulness works may help improve understanding of not only who stands to benefit the most from these interventions, but also which populations may be more susceptible to unintended consequences because of more intensive mindfulness and meditation practices. To maximize the benefits of mindfulness interventions and prevent harm, it is important to further analyze the mechanisms through which the practice of mindfulness impacts mental health outcomes.

One important mechanism may be through improving metapersonal self-construal. There are many ways of constructing awareness of oneself that have been studied in psychology (self-construal). Traditionally, two main types of self-construal are recognized. The first type is independent self-construal, which characterizes the self and others by independent characteristics, such as “He is intelligent, and he is charming”. Independent self-construal is common in Western cultures. The other type is interdependent self-construal, which characterizes self and others by relational characteristics such as “I am a mother, and he is my son”. Interdependent self-construal is common in Asian cultures. Meta-personal self-construal has more recently been identified as a third type of self-construal in which a person reflects on others or things and sees them as part of self, for example, “I am part of nature”.²³ Mindfulness interventions have been shown to lead to increased states of metapersonal awareness, theoretically by training individuals to be more aware of the present moment, and therefore more aware of their connection to the environment and other beings.^{24,25} Similar states of feeling connected to all things and dissolution of the boundaries of the body (measured by scales such as body salience scales) have been showed to be positively correlated with positive affective states, and to help mediate the effects of meditation on reaching positive affective states.²⁶

Given that past research shows the association between metapersonal awareness and mindfulness, and that different states of consciousness, which may reflect metapersonal awareness, may help mediate the relationship between mindfulness and mental health outcomes, it is reasonable to hypothesize that successful obtainment of metapersonal awareness may contribute to the positive mental health outcomes that are obtained through mindfulness. This information may provide another way of evaluating mindfulness interventions, especially if such states are found to be important for mindfulness interventions to be effective. Current literature on MPS is scarce, and so our study will further expand the literature in this area by characterizing the relationship between MPS and mental health outcomes.

III. Methods

Study Subjects and Setting: This cross-sectional study included 859 participants who were recruited from Amazon's crowd surfing website (Mechanical Turk) and 653 participants who were recruited from a large Southern university in 2016 for a total of 1,512 recruited participants. Participants recruited from Mechanical Turk were given 25 cents for their participation, and the recruited college students were awarded 0.5 hours of research credit towards the 2-hour research requirement at their university. Since literature suggests that most adults read under 300 words per minute, respondents that finished the survey in less time may have been answering the questions without reading the items.²⁷ Therefore, only surveys that were completed in their entirety at a reading rate of under 300 words per minute were included for final analysis. Three-hundred twenty-eight individuals were excluded for not finishing the survey, and 98 individuals were excluded for finishing the survey too quickly. This reduced the sample size from 1,512 individuals to 1,086 individuals.

Measures:

Five Facet Mindfulness Questionnaire (FFMQ) is the exposure of interest. The FFMQ consists of 39 items and the following 5 facets: "Observe", "Describe", "Nonjudge" (non-judging of inner experience), "Actaware" (acting with awareness), and "Nonreact" (non-reactivity to inner experience). It uses a 5 point Likert scale format from 1 (never or very rarely true) to 5 (very often or always true), with higher scores corresponding to higher levels of mindfulness.²⁸ Multiple studies conducted among a variety of populations confirmed the validity and reliability of the FFMQ scale for measuring mindfulness.^{29,30} This measure showed strong internal consistency (Cronbach's $\alpha = 0.88$).

Metapersonal Awareness was assessed as the mediator of interest using the Metapersonal Self Scale (MPS). The MPS consists of 10 items with response options on a Likert scale from 1 (strongly disagree) to 7 (strongly agree).²³ Examples of items include "my sense of identity is based on something that unites me with all other people" and "I see myself as being extended into everything else". The MPS scale was tested to ensure reliability, validity, and freedom from social-desirability bias. The MPS was found to be distinct from both independent and interdependent self-construal types, although there was some correlation between independent and metapersonal self-constructs. MPS was also found to be negatively correlated with anxiety and intolerance of ambiguity, and positively correlated with forgiveness.²³ The MPS showed strong internal consistency in this sample ($\alpha = 0.89$).

Mental health and stress were assessed using the DASS. The DASS scores are based on 21 questions with response options for each question based on a 4-point Likert scale (0: "Did not apply to me at all", 3: "Applied to me very much, or most of the time"). DASS consists of 3 sub-scores (depression, anxiety, and stress).³¹ The overall reliability and validity of DASS has also been confirmed with multiple studies.^{32,33} The Cronbach's α for the total DASS score in this study was 0.95. Internal consistency was also high for each of the subscales ($\alpha = 0.85$ for anxiety, $\alpha = 0.88$ for stress, and $\alpha = 0.91$ for depression).

Data analysis: To examine associations among variables and mediation, path analyses were run with the "lavaan" package in R statistical software. The hypothesized paths between FFMQ, MPS, and DASS are shown in Figure 1. Coefficients were standardized by converting variables into z-scores, where means were set to 0 and standard deviations were set to 1. First, we looked at the paths in separate regression models. A standardized coefficient was reported using MPS score as the dependent variable and FFMQ as the independent variable. This was equivalent to the (a) path in figure 1. Standardized coefficients were then calculated using DASS (total composite

score as well as individual scores) as the dependent variable and MPS as the independent variable. Both direct (green arrow in figure 1), indirect (blue arrows in figure 1), and total effects of FFMQ on DASS and subset scores were reported. The direct path refers to the relationship between FFMQ and DASS that is independent of MPS. The indirect path refers to the relationship between FFMQ and MPS which is attributable to MPS. Analyses were also conducted with each of the following groups: females only, males only, individuals 25-years or older, and individuals under 25-years old. This was done because most of the sample was under 25 and female, and so to increase generalizability of the study it was important to see if the overall trends found differed among different gender or age groups. The practice of being mindful may have a different impact on men and on older individuals than it has on younger individuals and woman.

Results

Most participants in this study were female (72%), below age 25 (82%), white (74%), and single (88%). 48% of participants made less than \$75,000 annually. Missingness was less than 1% for all categories (Table 1).

Individuals who scored higher on mindfulness (as measured by FFMQ) also scored higher on metapersonal awareness (as measured by MPS), ($B = .364$; 95% CI: 0.309, 0.419). The overall direction of this trend was similar among the different age and gender groups tested (see tables 2A-2E). There was a negative direct association (defined as the path that does not occur through metapersonal awareness, the c path in figures 2A-2D) between mindfulness and overall mental distress (as measured by DASS total) of ($B = -0.475$, 95% CI: -0.532, -0.418). This negative association was consistent for individual scores for depression ($B = -0.450$; 95% CI: -0.507, -0.393), anxiety ($B = -0.403$; 95% CI: -0.462, -0.344), and stress ($B = -0.447$, 95% - 0.506, -0.388), separately. This means that individuals who scored higher on mindfulness consistently scored lower on measurements of depression, anxiety, and stress. The total association between mindfulness and total mental distress (defined as the sum of both the direct and indirect paths as modeled in fig 2A-2D) was also negative ($B = -0.437$, 95% CI: - 0.490, -0.384). The total association can also be thought of as the association between mindfulness and mental distress that does not control for metapersonal awareness. This negative association was consistent for subscale scores for depression ($B = -0.436$; 95% CI: - 0.489, -0.383), anxiety ($B = -0.339$; 95% CI: -0.396, -0.282) and stress ($B = - 0.418$; 95% CI: - 0.473, -0.363). The direction of these overall trends was generally consistent across individual age and gender groups, with no large variation noted in the magnitude of associations (see tables 2A-2E).

The associations between metapersonal awareness and mental distress were less consistent with the hypothesized associations. There were statistically significant negative associations of metapersonal awareness with total mental distress, depression, and stress scores ($B = -0.069$, 95% CI: -0.137, -0.001, for DASS total; $B = -0.124$, 95% CI: -0.192, -0.056 for depression; and $B = -0.083$, 95% CI: -0.149, -0.017 for stress). This was consistent with the hypothesis; however, the remaining results were inconsistent with the hypothesis. Anxiety had a non-significant positive association with metapersonal awareness with a coefficient of ($B = 0.028$, 95% CI: -0.039, 0.094). When mindfulness scores were included in the model, all associations between metapersonal awareness and mental distress outcomes became positive such that it appeared that individuals with higher metapersonal awareness had higher mental distress. The positive associations of metapersonal awareness with total mental distress, anxiety, and stress were all statistically significant ($B = 0.104$, 95% CI: 0.047, 0.161 for DASS total; $B = 0.175$, 95% CI: 0.116, 0.234 for anxiety; and $B = 0.079$, 95% CI: 0.020, 0.138 for stress).

There was a non-statistically significant positive association between depression and metapersonal awareness within the model ($B=0.039, -0.018, 0.096$).

Discussion

Summary

Overall, the individual bivariate associations observed in this study were as expected. Mindfulness was consistently associated with more favorable mental health outcomes for depression, anxiety, stress, and overall mental health. Metapersonal awareness and mindfulness were also consistently associated with each other in expected ways. The overall direction and magnitude of these associations did not differ among individual age and gender groups. Prior to accounting for mindfulness, metapersonal awareness was significantly associated with better overall scores for mental health, and lower levels of stress, anxiety, and depression. In contrast, results from the full mediation model that accounted for levels of mindfulness, associations between metapersonal awareness and mental health outcomes became positive and statistically significant. If metapersonal awareness were to mediate the relationship between mindfulness and mental health outcomes, adjusting for metapersonal awareness should make the association between mindfulness and mental health outcomes weaker. Instead, the relationship between mindfulness and mental health outcomes became stronger after adjusting for metapersonal awareness, suggesting no mediation is present. This was inconsistent with the hypothesis. All these discussed relationships were statistically significant for all paths and all outcomes except for the indirect relationship between FFMQ, MPS, and depression and the path between MPS and depression.

One potential explanation for the lack of evidence for mediation is that since metapersonal awareness and mindfulness were associated with each other the impact of high metapersonal awareness on mental health would be difficult to detect beyond mindfulness. Therefore, the non-statistically significant indirect effect that was found for the mediation of metapersonal awareness between mindfulness and depression may not be surprising. What was of greater surprise was the statistically significant positive associations that were observed between metapersonal awareness and anxiety, stress, and overall mental distress after adjusting for mindfulness. This is contrary to expectations based on previous literature looking at measures similar to MPS that shows dissolution of perceived body boundaries mediates the relationship between meditation and increased happiness.²⁶ However, this study differs notably from this previous research in that this study used a cross sectional sample rather than evaluating the effect of an intervention meant to influence metapersonal awareness. The cross-sectional design and the lack of ability to establish temporality may be at least partially responsible for the unexpected positive associations that occurred between metapersonal awareness and mental health outcomes in this study after adjusting for mindfulness. It has been speculated that individuals with anxiety may experience their emotions more intensely. This experience of emotional intensity may lead to a greater awareness of one's emotional state both on a physical and mental level. Feeling these intense emotions may inform certain thought processes. For example one of the items on the MPS scale is "I believe that no matter where I am or what I am doing, I am never separate from others".²³ Someone who experiences emotions more intensely may be more likely to notice their connections towards others due to this state of hyperawareness and may rely on this feeling of connection to soothe their anxiety. This would then result in a positive cross-sectional association between metapersonal awareness and anxiety, but anxiety levels may still decrease if an intervention successfully

increased metapersonal awareness. This is supported in the literature by previous studies which have shown a positive relationship between interoceptive awareness and anxiety, meaning that individuals with higher levels of anxiety at baseline tend to have greater interoceptive awareness. Interoceptive awareness is one's ability to perceive visceral signals such as heartbeat in response to emotional stimuli.³⁴ There is also literature that shows that increased levels of emotional awareness in response to emotionally stimulating scenarios is positively associated with anxiety.³⁵

Similar differences in baseline characteristics may influence the relationship between MPS and depression. There is evidence in previous literature that a specific type of empathy called affective empathy is associated with increased depressive symptoms.^{36,37} Affective empathy refers to one's ability to feel an emotional response in response to the emotions of others. This is different than cognitive empathy, the intellectual ability to understand the emotions of others, which is not increased among individuals with depression. It is possible that some metapersonal awareness traits such as "I am aware of a connection between myself and all living things" and "My sense of identity is based on something that unites me with all other people" may be related to increased levels of affective empathy.²³ Although the indirect relationship between FFMQ, MPS, and depression was not statistically significant, this literature does offer a possible explanation for why mediation was not found.

Limitations

Due to the nature of this study as a preliminary look at a scale and topic that needs much further research and evaluation, there are several limitations that must be considered when interpreting this data. Most importantly, again, the data in this study is cross-sectional. This means that temporal order cannot be established, and therefore causal relationships cannot be definitively concluded from this analysis.

Another important limiting factor to note is possible confounding by socio-economic factors. Students who are not stressed financially may have more time to spend on mindfulness, and so this confounding would be expected to make the relationship between mindfulness and mental health appear stronger than it is. Although data on income was available for this sample, income data in a population of young college attendees may not be a true indicator of socio-economic status, as many participants are likely full-time students who have not started their careers yet. True socio-economic situation for this population is likely influenced by factors such as parental support and access to scholarships and government funding which was not measured in this survey.

Demographics of this sample may also limit the generalizability of this study, as our study sample consisted of an overall young, Caucasian and mostly female population. This was compensated for by running subset analysis. No differences in overall trends were noted when stratifying by gender or age; however, some associations did become statistically insignificant, likely due to lower power levels with the reduced sample size. The generalizability may also be limited by the fact that both Mturk and University samples were volunteer samples rather than randomly selected, and so there may be other differences which limit generalizability such as personality or social differences in people who are willing to volunteer for this study as opposed to individuals who would not volunteer for this study. For example, individuals who volunteer for this type of psychological study may have a greater interest in mental health and wellness than those who chose not to volunteer, and that interest could influence how they respond to questions. Another limitation is that this study relies on self-reported survey data, and therefore, as with all survey data may imperfectly measure both exposure, mediator, and outcome.

Conclusion

The results of this study showed that although mindfulness and metapersonal awareness are generally associated with each other and are both generally associated with improved mental health outcomes, metapersonal awareness was not found to act as a mediator between mindfulness and mental health outcomes. The relationship between mindfulness, mental health outcomes, and metapersonal awareness may be complicated by temporality issues caused by a multitude of baseline characteristics which may influence the association between mental wellness and metapersonal awareness. It would be most useful to explore how metapersonal awareness mediates the relationship between meditation and mindfulness in the setting of an intervention meant to improve mindfulness with both before and after scores, rather than looking at the cross-sectional data alone.

This study contributes to the body of literature that explores mechanisms underlying associations between mindfulness and mental health outcomes. It is important that the relationship between mindfulness, mindfulness interventions, and mental health outcomes continue to be explored. A better understanding of how meditation and states of mindfulness contribute to better mental health will help clinicians and other wellness practitioners decide how and to whom to prescribe mindfulness practices to.

VI. References

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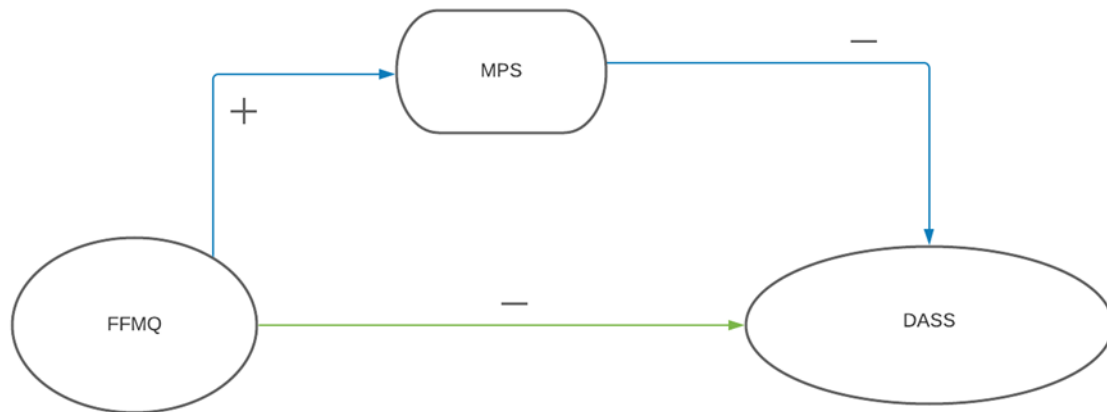


Fig 1.
Model of Hypothesis in secondary aim. Green arrow represents direct effect. Blue arrows represent indirect effect.

Table 1. Characteristics of study participants (total sample size n = 1086)

Demographic characteristic	Frequency (n)	Percent (%) ^a
Sex^b		
Male	304	28
Female	782	72
Age (years)		
18-20	492	45
21-24	398	37
25-40	122	11
41-74	73	7
Income (\$)		
Under \$25,000	123	11
\$25,000 - \$49,999	203	19
\$50,000 - \$74,999	193	18
\$75,000 - \$99,999	181	17
\$100,000 - \$149,999	189	18
\$150,000 - \$199,999	92	9
\$200,000 or more	97	9
Race		
American Indian or Alaskan Native	8	1
Black or African American	119	11
Multiracial	40	4
Asian or South Asian	36	3
Latino or Hispanic	54	5
Native Hawaiian or Pacific Islander	3	0.3
White	803	74
Other	22	2
Marital Status		
Single	959	88
Married	99	9
Divorced	25	2
Widowed	3	0.3

^aPercentages may not sum to 100 due to rounding. ^bSex is defined as assigned male or female at birth.

Overall sample (Table 2A) N=1,086	coefficient	p. value	95% Confidence Interval
DASS Overall (outcome)			
MPS	0.104	<0.0005	(0.047, 0.161)
FFMQ (direct)	-0.475	<0.0005	(-0.532, -0.418)
FFMQ (indirect)	0.038	0.001	(0.016, 0.060)
FFFMQ (total)	-0.437	<0.0005	(-0.490, -0.384)
Anxiety (outcome)			
MPS	0.175	<0.0005	(0.116, 0.234)
FFMQ (direct)	-0.403	<0.0005	(-0.462, -0.344)
FFMQ (indirect)	0.064	<0.0005	(0.040, 0.088)
FFMQ (total)	-0.339	<0.0005	(-0.396, -0.282)
Depression (outcome)			
MPS	0.039	0.189	(-0.018, 0.096)
FFMQ (direct)	-0.450	<0.0005	(-0.507, -0.393)
FFMQ (indirect)	0.014	0.191	(-0.008, 0.036)
FFMQ (total)	-0.436	<0.0005	(-0.489, -0.383)
Stress (outcome)			
MPS	0.079	0.007	(0.020, 0.138)
FFMQ (direct)	-0.447	<0.0005	(-0.506, -0.388)
FFMQ (indirect)	0.029	0.009	(0.007, 0.051)
FFMQ (total)	-0.418	<0.0005	(-0.473, -0.363)

MPS (outcome)			
FFMQ	0.364	<0.0005	(0.309, 0.419)

Male (Table 2B) N = 304	coefficient	p. value	95% Confidence Interval
DASS (outcome)			
MPS	0.070	0.215	(-0.042,0.182)
FFMQ (direct)	-0.487	<0.0005	(-0.605, -0.369)
FFMQ (indirect)	0.024	0.225	(-0.015,0.063)
FFFMQ (total)	-0.463	<0.0005	(-0.575, -0.351)
Anxiety (outcome)			
MPS	0.156	0.005	(0.046, 0.266)
FFMQ (direct)	-0.412	<0.0005	(-0.528, -0.296)
FFMQ (indirect)	0.053	0.011	(0.012, 0.094)
FFMQ (total)	-0.359	<0.0005	(-0.471, -0.247)
Depression (outcome)			
MPS	0.005	0.936	(-0.107 ,0.117)
FFMQ (direct)	-0.488	<0.0005	(-0.608, -0.368)
FFMQ (indirect)	0.002	0.936	(-0.035, 0.039)
FFMQ (total)	-0.487	<0.0005	(-0.599, -0.375)
Stress (outcome)			
MPS	0.041	0.461	(-0.067,0.149)

FFMQ (direct)	-0.432	<0.0005	(-0.548, -0.316)
FFMQ (indirect)	0.014	0.464	(-0.023, 0.051)
FFMQ (total)	-0.418	<0.0005	(-0.528, -0.308)
MPS (outcome)			
FFMQ	0.340	<0.0005	(0.226, 0.454)

Female (Table 2C) N = 782	coefficient	p. value	95% Confidence Interval
DASS Overall (outcome)			
MPS	0.118	0.001	(0.051, 0.185)
FFMQ (direct)	-0.472	<0.0005	(-0.537, -0.407)
FFMQ (indirect)	0.044	0.001	(0.018, 0.070)
FFMQ (total)	-0.428	<0.0005	(-0.489, -0.367)
Anxiety (outcome)			
MPS	0.184	<0.0005	(0.113, 0.255)
FFMQ (direct)	-0.401	<0.0005	(-0.470, -0.332)
FFMQ (indirect)	0.068	<0.0005	(0.039, 0.097)
FFMQ (total)	-0.332	<0.0005	(-0.397, -0.267)
Depression (outcome)			
MPS	0.055	0.106	(-0.012, 0.122)
FFMQ (direct)	-0.438	<0.0005	(-0.503, -0.373)

FFMQ (indirect)	0.021	0.109	(-0.193, 0.235)
FFMQ (total)	-0.417	<0.0005	(-0.478, -0.356)
Stress (outcome)			
MPS	0.093	0.008	(0.024, 0.162)
FFMQ (direct)	-0.454	<0.0005	(-0.519, -0.389)
FFMQ (indirect)	0.035	0.009	(0.009, 0.061)
FFMQ (total)	-0.419	<0.0005	(-0.482, -0.356)
MPS (outcome)			
FFMQ	0.372	<0.0005	(0.309, 0.435)

Under 25 (Table 2D) N=890	coefficient	p. value	95% Confidence Interval
DASS (outcome)			
MPS	0.122	<0.0005	(0.057, 0.187)
FFMQ (direct)	-0.478	<0.0005	(-0.545, -0.411)
FFMQ (indirect)	0.044	<0.0005	(0.020, 0.068)
FFMQ (total)	-0.435	<0.0005	(-0.500, -0.370)
Anxiety (outcome)			
MPS	0.184	<0.0005	(0.117, 0.251)

FFMQ (direct)	-0.406	<0.0005	(-0.477, -0.335)
FFMQ (indirect)	0.066	<0.0005	(0.039, 0.093)
FFMQ (total)	-0.340	<0.0005	(-0.407, -0.273)
Depression (outcome)			
MPS	0.062	0.055	(-0.001, 0.125)
FFMQ (direct)	-0.463	<0.0005	(-0.530, -0.396)
FFMQ (indirect)	0.022	0.059	(-0.002, 0.046)
FFMQ (total)	-0.441	<0.0005	(-0.504, -0.378)
Stress (outcome)			
MPS	0.097	0.003	(0.032, 0.162)
FFMQ (direct)	-0.440	<0.0005	(-0.509, -0.371)
FFMQ (indirect)	0.035	0.004	(0.011, 0.059)
FFMQ (total)	-0.405	<0.0005	(-0.470, -0.340)
MPS (outcome)			
FFMQ	0.357	<0.0005	(0.292, 0.422)

Over 25 (Table 2E) N=195	coefficient	p. value	95% Confidence Interval
DASS (outcome)			
MPS	0.046	0.483	(-0.082, 0.174)
FFMQ (direct)	-0.496	<0.0005	(-0.547, -0.445)
FFMQ (indirect)	0.018	0.485	(-0.033, 0.069)
FFFMQ (total)	-0.478	<0.0005	(-0.582, -0.373)
Anxiety (outcome)			
MPS	0.140	0.031	(0.012, 0.268)
FFMQ (direct)	-0.386	<0.0005	(-0.502, -0.270)
FFMQ (indirect)	0.056	0.039	(0.003, 0.109)
FFMQ (total)	-0.329	<0.0005	(-0.434, -0.224)
Depression (outcome)			
MPS	-0.030	0.664	(-0.166, 0.106)
FFMQ (direct)	-0.472	<0.0005	(-0.594, -0.350)
FFMQ (indirect)	-0.012	0.665	(-0.067,0.043)
FFMQ (total)	-0.484	<0.0005	(-0.594, -0.374)
Stress (outcome)			
MPS	0.025	0.712	(-0.107, 0.157)
FFMQ (direct)	-0.496	<0.0005	(-0.614, -0.378)
FFMQ (indirect)	0.010	0.712	(-0.043, 0.063)

FFMQ (total)	-0.486	<0.0005	(-0.593, -0.379)
MPS (outcome)			
FFMQ	0.401	<0.0005	(0.287, 0.515)

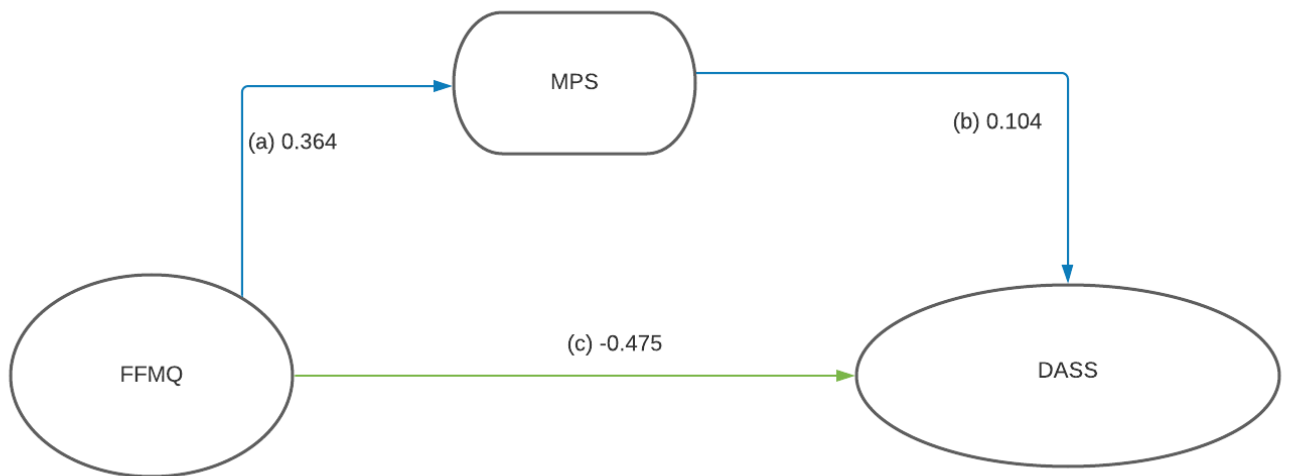


Fig 2A. green is direct path. Blue is direct path and can be calculated by multiplying the a and b path. The total effect is the sum of both the indirect and direct path.

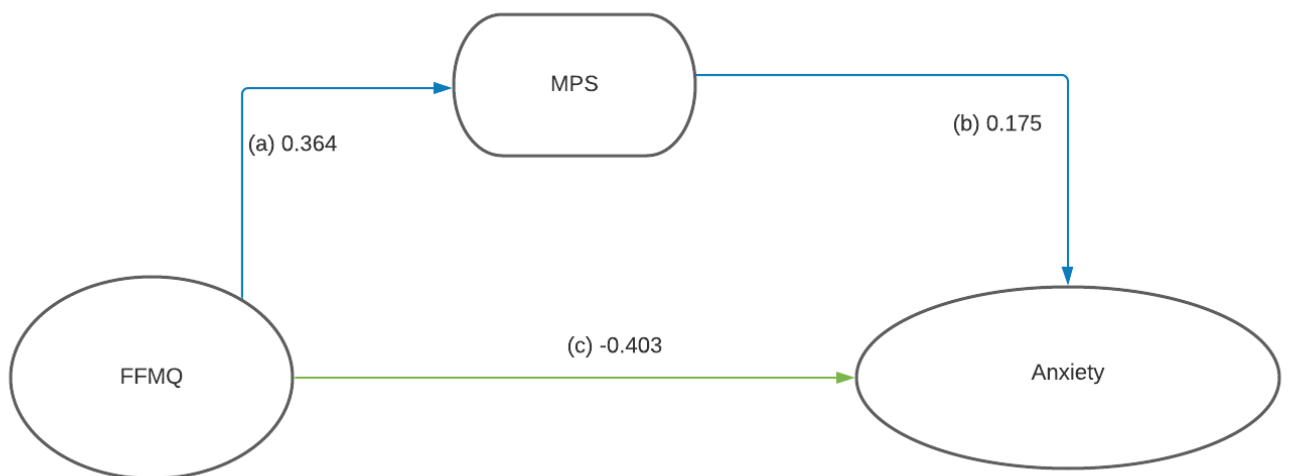


Fig 2B. green is direct path. Blue is direct path and can be calculated by multiplying the a and b path. The total effect is the sum of both the indirect and direct path.

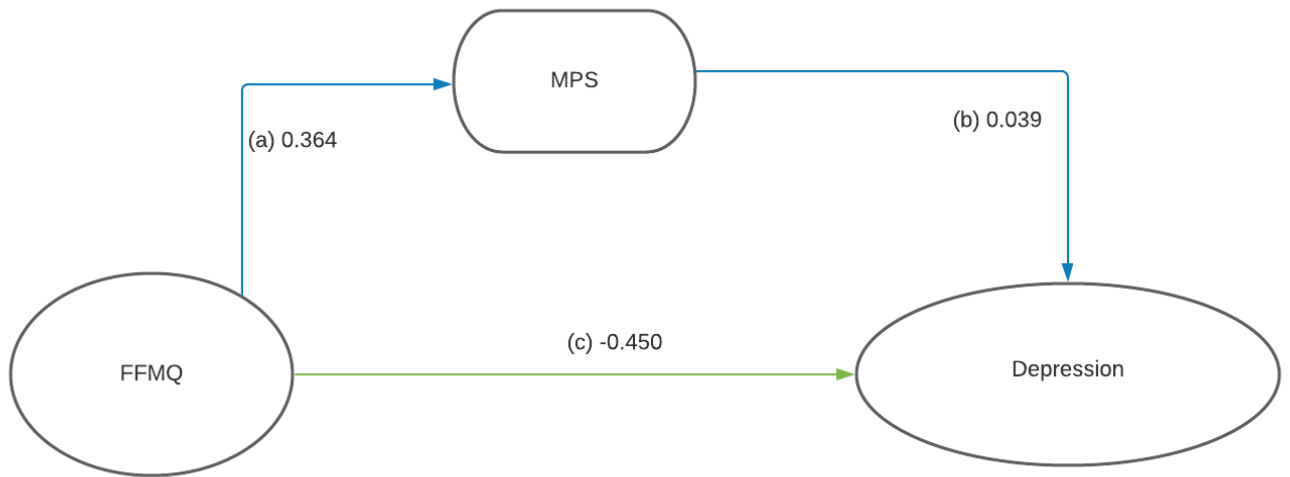


Fig 2C. green is direct path. Blue is direct path and can be calculated by multiplying the a and b path. The total effect is the sum of both the indirect and direct path.

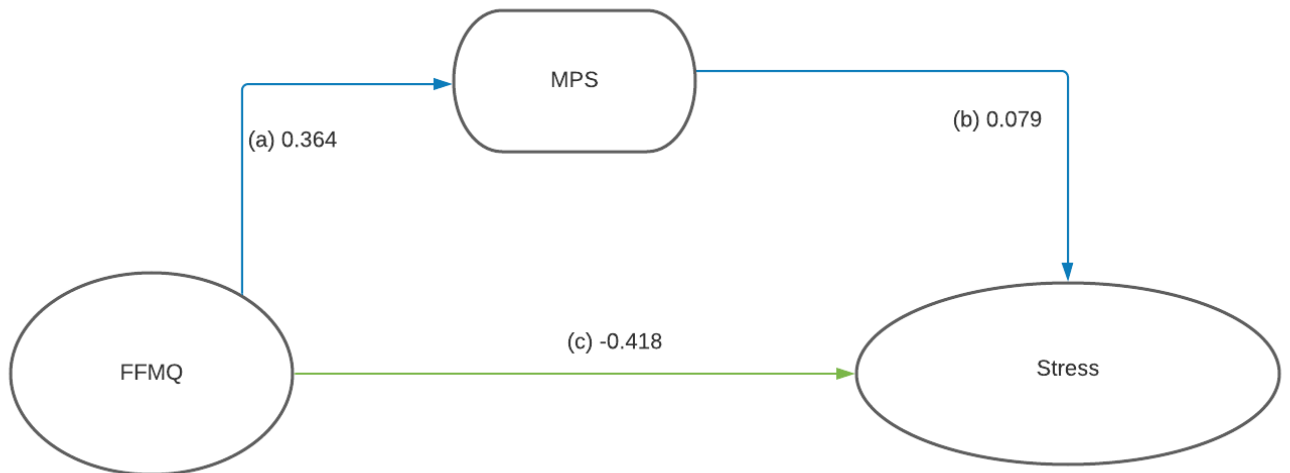


Fig 2D. green is direct path. Blue is direct path and can be calculated by multiplying the a and b path. The total effect is the sum of both the indirect and direct path.

MPS Associations (Table 2F) N= 1086	coefficient	p. value	95% Confidence Interval
Unadjusted			
DASS	-0.069	0.048	(-0.137, -0.001)
Anxiety	0.028	0.412	(-0.039, 0.094)
Depression	-0.124	<0.0005	(-0.192, -0.056)
Stress	-0.083	0.014	(-0.149, -0.017)
Adjusted for FFMQ			
DASS	0.111	0.001	(0.044, 0.179)
Anxiety	0.175	<0.0005	(0.108, 0.242)
Depression	0.039	0.243	(-0.026, 0.104)
Stress	0.079	0.017	(0.014, 0.144)