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INVESTIGATIONS



Need Fulfillment and Resilience Mediate the Relationship between Mindfulness and Coping in Medical Students

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ABSTRACT

Theory: Medical programs have turned to mindfulness-based initiatives to help reduce student distress and promote healthy coping within the learning environment. However, little attention has been paid to how fulfillment of medical students' basic psychological needs (autonomy, competence, and relatedness) impacts their capacity to be mindful and cope with stress. Self-Determination Theory (SDT) posits that mindfulness facilitates adaptive coping and wellness, in large part because of need fulfillment. *Hypotheses:* Using SDT as a lens, it is hypothesized that medical students' resilience and, to a greater extent, need fulfillment in medical school, will mediate the relationship between their mindfulness and coping reactions to stress. *Method:* One-hundred-ninety-seven medical students from the University of Saskatchewan were recruited to participate in this study: 71 first year, 58 second year, and 36 third and fourth year, each. Students completed an anonymous survey, measuring need fulfillment in medical school, mindfulness, resilience, and frequent use of various adaptive and maladaptive coping strategies. We assessed the extent that need fulfillment and resilience mediated the relationship between mindfulness and coping styles. *Results:* Need satisfaction and resilience fully mediated the relationship between mindfulness and adaptive coping. Conversely, need frustration and resilience partially mediated the relationship between mindfulness and maladaptive coping. Need fulfillment was a stronger mediator than resilience in both coping models. *Conclusions:* Findings suggest that increased supports for medical students' resilience and basic psychological needs may promote their mindfulness, and in turn, their ability to respond more adaptively and less maladaptively to stressors they face in medical school.

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Introduction

During medical school, students' motivation and well-being are at risk of deteriorating.^{1,2} In light of this, medical educators are progressively exploring ways to reduce distress and support learner well-being. Accordingly, many institutions have started to implement mindfulness-based training for medical students: to buffer stress, promote resilience, and facilitate healthy coping. Little is known, however, about the roles that resilience and, in particular, psychological need fulfillment (autonomy, competence, and relatedness) play in shaping students' mindfulness and coping behaviors. Self-Determination Theory (SDT) considers environmental supports or barriers to meeting these needs as essential for wellness. Grounded in SDT, this study explores the extent that medical students' resilience and need fulfillment mediate the relationship

between their mindfulness and adaptive versus maladaptive coping. Studying this is important for understanding the processes involved in medical student stress and how they deal with it during their medical education. In turn, this research may help medical programs to develop wellness curriculums and teaching approaches that promote medical students' motivation, development, and well-being.

Coping in medical school

Medical school can be highly stressful and requires learners to cope in healthy ways.^{3,4} Coping is defined here as a conscious effort to regulate emotions, cognition, behavior, and the environment, in response to stress.⁵ Coping is a process that can be divided into two broad categories: problem-focused and

emotion-focused.^{6,7} Within emotion-focused coping, we then find two types of strategies: active (e.g., venting, seeking social support) and avoidant (e.g., denial, self-blame, substance use). Of note, there is also evidence of a meaning-focused type of coping, in which people draw on their beliefs and values (e.g., religious or spiritual) to generate positive emotions during difficult circumstances.⁸ As such, an important quality in stress-related research is coping reactions.⁹

It is generally accepted that active, problem-focused coping (e.g., planning) is more adaptive for well-being than passive, emotion-focused coping (e.g., denial). The exception is if the person has little or no control over the stressor, when emotion-focused coping may become adaptive.^{6,7} Research on learner coping in medical education supports these principles. For instance, studies among medical students have found that more active (e.g., seeking social support) versus passive (e.g., drinking alcohol) coping strategies were associated with lower levels of burnout, less moral distress, and greater resilience.^{10–12} The latter study also highlighted that, while the prevalence of burnout is well-established among medical students, still little is known about the types of coping strategies they use to mitigate distress, and whether those strategies might predispose certain subsets of students to experience mental health disturbances.

Resilience

Resilience has been characterized in various ways, partly because it has been conceptualized as a trait, process, or outcome.¹³ Resilience is defined here as one's ability to thrive despite adversity (e.g., to tolerate experiences such as change, personal problems, illness, pressure, failure, and painful feelings).¹⁴ As these are common challenges that students may directly (i.e., themselves) or indirectly (i.e., through patients or peers) face during medical school, medical institutions have sought ways to bolster student resilience, to help them cope with stress more effectively.^{11,12,15} However, emerging research suggests that this may be less beneficial than once was thought. For example, a survey of 5,445 physicians showed that they had significantly higher resilience than the general US population, but even the most resilient doctors still had high rates of burnout.¹⁶ The authors of this study therefore recommended alternative solutions to address physician distress, beyond focusing on personal resilience, such as improving systems-level issues and workplace environments. Other studies are complimentary, showing that many

resilient physicians are still at high risk for burnout and maladaptive coping.¹⁷

Mindfulness

Given coping often relies on conscious volitional efforts, it follows that more mindful individuals would be more adept at accurately appraising and responding adaptively to stress, than those who function more unconsciously and reactively.¹⁸ Mindfulness is defined here, according to Brown & Ryan's¹⁹ definition, as a receptive awareness of and attention to present moment experiences. Indeed, studies suggest that mindfulness encourages well-being, in part by augmenting one's reasoning capacity and emotional regulation.^{18,20} In line with this theory, research shows that more mindful individuals are often more resilient and view stressful events as challenging rather than stressful.²¹ As a result, they tend to respond to stressors less defensively and engage in more adaptive versus maladaptive coping strategies.^{9,18,22} For instance, a study of undergraduates found that resilience partially mediated the relationship between mindfulness, positive and negative affect, and life satisfaction.²³ While support for these phenomena are well-documented,^{24–26} and mindfulness has garnered much interest in medical education,^{23,27,28} an important determinant of mindfulness that has received little attention is basic psychological need fulfillment, as described by Self-Determination Theory (SDT).²⁹

Basic psychological needs

SDT^{29,30} is one of the leading theories of human motivation and well-being. It posits that for individuals to function optimally and thrive, they universally require ongoing fulfillment of three basic psychological needs—autonomy (sense of volition), competence (sense of efficacy), and relatedness (sense of caring relationships).²⁹ According to SDT, environments that support these needs will promote well-being, while environments that thwart them will constrain it and provoke stress.^{29,31} Studies concerning basic psychological needs and learning environments, in the broader context of health professions and medical education, support this theory.^{32–35}

According to SDT, mindfulness is an important determinant of well-being because it facilitates autonomous functioning.^{18,19} Brown & Ryan¹⁹ suggest this is because individuals that are high in mindfulness—whom are more aware of and attentive to their internal and external experiences—are more attuned to

environmental cues associated with need fulfillment, which leads them to act in ways that are congruent with their intrinsic values and that buffer feelings of stress. Other educational studies support this notion, suggesting that need fulfillment is a key mechanism in the relationship between mindfulness and well-being.^{36,37} In contrast to SDT, emotional regulation, decreased rumination, and re-perceiving have also been proposed as mechanisms to explain the relation between mindfulness and lower distress levels.^{38,39}

Brown & Ryan¹⁹ explained that mindfulness tends to relate more strongly to lower levels of negative affect than higher levels of positive affect. Thus, the mechanism between mindfulness and need fulfillment may differ depending on whether the mental health outcome is positive or negative. A fitting example of this is a study of military college cadets, which concurrently investigated resilience and need satisfaction as mediators of the relationship between mindfulness and positive and negative affect.⁴⁰ They found that both mediators were significant but captured less variance in the model of negative versus positive affect, and that the cadets' need satisfaction was a stronger mediator of their mental health than their resilience was. Other studies have reported similar results, with negative affect and depression as outcomes.³⁶

Methods

Current study

Previous research has identified sources of medical student stress, and that mindfulness and resilience are important determinants of adaptive coping in medical school.^{41–43} Studies on medical students have also linked need fulfillment to resilience and well-being,^{34,35} and types of coping to rates of perceived stress and burnout.^{4,42} However, the relationship between mindfulness, resilience, and basic psychological needs, in coping with stress, has not been concurrently investigated in this context. From an SDT perspective, this is a key consideration, particularly in view that need fulfillment and mindfulness are central to healthy coping and wellness,^{18,19,27} and because learning environments in medicine are known to be uniquely demanding and potentially thwarting of students' psychological needs.^{44–46} To address this gap in the literature, the current study explores how resilience and need fulfillment in medical school mediate the relationship between students' mindfulness and adaptive versus maladaptive coping. It

extends our prior work on how medical students' mindfulness and need fulfillment impact their perceived stress.⁴⁷

Based on SDT's postulates on mindfulness, coping, and basic psychological needs, our hypotheses are that: a) higher mindfulness will relate to more adaptive and less maladaptive coping, along with higher resilience and need satisfaction. Second, because stronger relationships have been reported between mindfulness and positive versus negative affect, b) need satisfaction will fully mediate the association between mindfulness and adaptive coping, whereas need frustration will partially mediate that between mindfulness and maladaptive coping. Finally, we hypothesize that: c) need fulfillment will be a stronger mediator of students' coping responses to stress, than their resilience. To test the validity of these hypotheses, two sets of mediation analyses were conducted. These examined whether mindfulness had a significant impact on adaptive coping because of the mediators, resilience and need satisfaction, and likewise for maladaptive coping because of the mediators, resilience and need frustration.

Participants & procedure

All 400 medical students from first to fourth year of the medical program at the University of Saskatchewan were invited to participate in the present study. Participants completed an anonymous online survey, which measured their basic psychological need satisfaction and frustration in medical school, mindfulness, resilience, and how frequently they used various coping strategies in response to different situational stressors (see Measures). The survey included information about the study and was open for eight weeks at the end of the academic year. Participation was voluntary, all provided informed consent, and all were assured their confidentiality would be maintained.

The response rate was 214 (54%). However, 17 participants were excluded from analysis for not completing at least half of the scales. This left a total of 197 (49%), including 92 males (47%) and 105 females (53%)—36% in first year, 29% in second year, 18% in third year, and 18% in fourth year. Students' mean age was 25.9 years ($SD=3.7$) and ranged from 21–44 years.

Ethical approval

This research received ethical approval from the University of Saskatchewan Research Ethics Board (BEH #18-130).

Measures

*Mindful Attention & Awareness Scale (MAAS).*⁴⁸ The MAAS is a 15-item scale that measures people's dispositional and state mindfulness. It has been validated and is widely used in health-related research. It consists of statements about everyday experiences and asks respondents to indicate how frequently they currently have each experience on a 6-point scale, from 1 (*almost always*) to 6 (*almost never*). Example statements include: "I could be experiencing some emotion and not be conscious of it until sometime later" and "I forget a person's name almost as soon as I've been told it for the first time." The wording of the original stem was modified slightly, to cue students to their experiences in medical school. For instance, whereas part of the original directions read, "Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience," we added the words "in medical school" to the end of this sentence.

*Basic Psychological Needs Satisfaction and Frustration Scale (BPNSF).*⁴⁹ This 24-item scale measures satisfaction and frustration of peoples' basic psychological needs for autonomy, competence, and relatedness, based on SDT. It has been validated and has demonstrated strong reliability and construct validity. The scale poses questions about the kinds of experiences people currently have in their lives. Participants then rate how true each statement is for them on a 5-point scale, from 1 (*not true at all*) to 5 (*completely true*). Some example statements are: "I feel that the people I care about also care about me," "I feel a sense of choice and freedom in the things I undertake," and "I feel confident that I can do things well." The wording of the stem was modified slightly, to reflect students' experiences throughout their year in medical school. For instance, to the original stem's directions: "...Below, we ask you about the kind of experiences you actually have in your life," and "...You can choose from 1 to 5 to indicate the degree to which the statement is true for you at this point in your life," we added the words "in medical school" at the end.

*Connor Davidson Resilience Scale (CD-RISC 10).*¹⁴ The 10-item CD-RISC measures peoples' resilience and has been validated in health sciences research. It includes a series of statements that deal with overcoming adversity, which is a common theme in medical school. Participants are then asked to consider how each statement applies to them over the past month and to indicate their level of agreement on a 5-point scale, from 0 (*not true at all*) to 4 (*true nearly all the time*). Several example statements include: "I try to see the humorous side of things when I am faced with

problems" and "I am able to handle unpleasant or painful feelings like sadness, fear, and anger." We modified the original stem to reflect students' experiences in medical school. For instance, the original directions: "For each item, please select the number that best indicates how much you agree with the following statements as they apply to you over the last month," were modified to read, "...as they apply to you over the last year in medical school."

*The Brief COPE.*⁹ The Brief COPE is a 28-item scale that consists of 14 two-item factors. It presents a series of situational statements and measures how frequently people use a range of distinct adaptive and maladaptive coping reactions to stress: active coping, planning, positive reframing, acceptance, emotional and instrumental support, humor, religion, denial, venting, self-distraction, behavioral disengagement, and self-blame. Participants rate how frequently they use each coping strategy on a scale from 0 (*I haven't been doing this at all*) to 3 (*I've been doing this a lot*). Some example statements are: For *planning*—"I've been thinking hard about what steps to take"; for *positive reframing*—"I've been trying to look for something good in what is happening"; for *self-distraction*—"I've been turning to work or other activities to take my mind off things"; for *venting*—"I've been expressing my negative feelings", etc. The original stem was modified to reflect the medical school context and items were presented in a retrospective manner. For instance, whereas the original Brief COPE directions read, "We want to know to what extent you've been doing what the item says," we added, "...since starting your year in medical school."

Statistical analyses

All statistical analyses were carried out with SPSS version 24.0 (SPSS Inc, Chicago, IL). Data were standardized and met the statistical assumptions of linear relationships, multivariate normality, and minimal collinearity. Based on prior studies,^{35,49} the basic needs subscales were aggregated into total mean scores for basic need satisfaction (BNSAT) and basic need frustration (BNFRUS). Similarly, the Brief COPE subscales were aggregated into *adaptive* (ADC) and *maladaptive* (MALC) coping variables, as in prior studies.⁵⁰⁻⁵² Using exploratory factor analysis, the coping factors were extracted and rotated with principal component analysis and Oblimin normalization, to produce the best possible fit to the data. The Kaiser-Meyer-Olkin (KMO) criteria were used for minimum sample adequacy (> 0.6), with a maximum factor cross-loading of 0.4. Based on these criteria, the coping subscales

Table 1. Matrix depicting adaptive and maladaptive coping factor loadings.

Coping Strategy	Adaptive (ADC)	Maladaptive (MALC)
Planning	0.74	-0.10
Positive Reframing	0.71	-0.21
Active Coping	0.68	-0.35
Instrumental Support	0.64	0.36
Emotional Support	0.63	0.33
Acceptance	0.60	-0.03
Humor	0.49	0.19
Religion	0.31	-0.07
Behavioral Disengagement	-0.30	0.67
Self-Blame	-0.03	0.67
Venting	0.34	0.59
Substance use	0.04	0.54
Denial	-0.13	0.43
Self-distraction	-0.04	0.38

Bolded items represent the factor each coping strategy loaded best onto.

loaded satisfactorily onto the *adaptive* or *maladaptive* factors ($KMO = 0.72$), with an acceptable degree of cross-loading (see Table 1).

Of note, several of the rotated factor loadings were relatively low (e.g., religion, denial, self-distraction). However, none of the loadings were very high ($M = 0.49$, $SD = 6.9$), and because the factor items were adopted from the literature and loaded adequately onto ADC or MALC, all were deemed to be acceptable. Following these steps, basic demographic and correlational analyses were conducted for all study variables, prior to proceeding with the mediation analyses. These were approached separately, as per the steps outlined by Baron and Kenny.⁵³ The indirect effects were tested by using a bootstrap estimation approach with 10,000 samples.⁵⁴

Results

Variable relationships

Table 2 shows the means, standard deviations, ranges, and intercorrelations for all study variables. Overall, correlations were in the moderate range and in the expected directions. Mindfulness positively correlated with resilience, need satisfaction, and adaptive coping, and negatively correlated with need frustration and maladaptive coping. Need satisfaction strongly negatively related to need frustration. Expectedly, adaptive and maladaptive coping both presented a similar but inverse pattern of correlation with resilience, need satisfaction, and need frustration.

Mediation model of adaptive coping

As seen in Figure 1a and b, supporting the mediational hypothesis, mindfulness significantly correlated with need satisfaction and resilience (a),

Table 2. Means, standard deviations, and intercorrelations among study variables.

	1	2	3	4	5	6
1. M	—					
2. R	.53**	—				
3. BNSAT	.60**	.70**	—			
4. BNFRUS	-.56**	-.61**	-.82**	—		
5. ADC	.19*	.42**	.44**	-.38**	—	
6. MALC	-.42**	-.38**	-.45**	.55**	.08	—
Mean	3.6	28.1	45.9	28.9	42.7	22.6
Std. Dev.	.81	6.6	7.8	8.5	7.7	4.8
Range	1-6	6-40	16-59	12-54	17-62	12-40

M, mindfulness; R, resilience; BNSAT, basic psychological need satisfaction (autonomy, competence, relatedness); BNFRUS, basic psychological need frustration (autonomy, competence, relatedness); ADC, adaptive coping; MALC, maladaptive coping.

* $p < .05$, ** $p < .01$.

and resilience and need satisfaction were each significant correlates of adaptive coping (b). Although the initial paths (c) between mindfulness and adaptive coping were significant, mindfulness was no longer a significant correlate of adaptive coping after controlling for the two mediators, need satisfaction and resilience (c'). These results were consistent with a full mediation. Approximately 65% of the variance in adaptive coping was accounted for by both variables—resilience (29%) and need satisfaction (36%). Based on the bootstrap estimation approach with 10,000 samples, results indicated that the indirect coefficients for resilience, $B = 2.31$, $SE = .61$, 95% CI [1.33, 3.75], and need satisfaction, $B = 2.98$, $SE = .62$, 95% CI [1.91, 4.34] were both significant. Thus, every point increase in mindfulness was associated with approx. 2.3 points higher adaptive coping scores as mediated by resilience, and approx. 3.0 points higher adaptive coping scores as mediated by need satisfaction.

Mediation model of maladaptive coping

As seen in Figure 2a and b, also supporting the mediational hypothesis, mindfulness significantly correlated with need frustration and resilience (a), and resilience and need frustration were each significant correlates of maladaptive coping (b). Mindfulness was still a significant correlate of maladaptive coping after controlling for the two mediators, need frustration and resilience (c'), but to a lesser extent than the initial path (c). These results were consistent with a partial mediation. In this case, approximately 53% of the variance in maladaptive coping was accounted for by both variables—resilience (21%) and need frustration (32%). Results of the bootstrap estimation approach with 10,000 samples indicated that the indirect coefficients for resilience, $B = -.75$, $SE = .38$, 95% CI

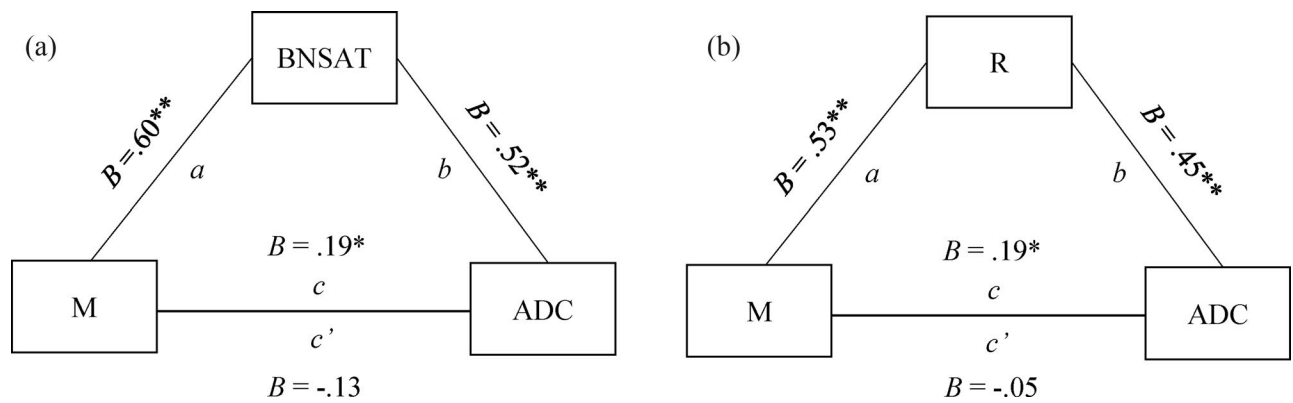


Fig. 1 a. Relationship between mindfulness and adaptive coping as mediated by need satisfaction in medical school.
b. Relationship between mindfulness and adaptive coping as mediated by resilience.

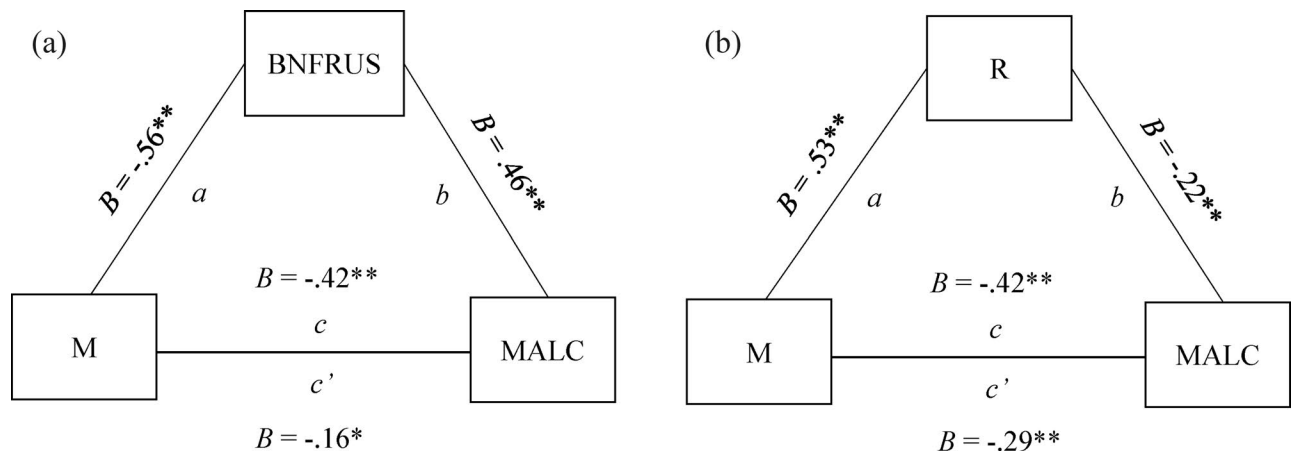


Fig. 2 a. Relationship between mindfulness and maladaptive coping as mediated by need frustration in medical school.
b. Relationship between mindfulness and maladaptive coping as mediated by resilience.

[-1.54, -.02], and need frustration, $B = -1.57$, $SE = .35$, 95% $CI [-2.32, -.95]$ were both significant. Thus, each point increase in mindfulness was associated with approx. 0.8 points lower maladaptive coping scores as mediated by resilience, and each point decrease in mindfulness was associated with approx. 1.6 points higher maladaptive coping scores as mediated by need frustration.

Discussion

To our knowledge, the present study is the first to assess the impact of basic psychological need fulfillment and resilience as mediators of the association between medical students' mindfulness and coping behaviors. As was hypothesized, we found that higher mindfulness was associated with more adaptive and less maladaptive coping, and that students' need fulfillment and resilience significantly mediated that relationship. These findings align with SDT and complement studies outside of medical education,

highlighting the important link between mindfulness, resilience, and basic psychological needs, in coping with stress.^{18,27}

Interestingly, our results show that need satisfaction and resilience fully account for the relationship between mindfulness and adaptive coping, and conversely, that need frustration and resilience partially account for that between mindfulness and maladaptive coping. While no other studies have assessed these relationships (i.e., with coping as an outcome), the pattern of our findings supports SDT's proposed mechanism of mindfulness, in relation to positive versus negative mental health outcomes.^{36,37} Additionally, in both coping models, need fulfillment is a stronger mediator of students' coping than resilience, which has also been found in non-medical studies.⁴⁰ Though the extent of this finding is surprising, given the obvious importance of resilience in medical school,^{3,55} it illustrates how potentially detrimental thwarting medical students' basic needs may be for their mindfulness to function optimally.

Olafsen⁵⁶ explained that this may occur because psychological need deprivation tends to provoke lower *state* mindfulness (present moment awareness), whereby even mindful individuals will perceive their activities as less autonomous (and thus less need-fulfilling). In support of this theory, our findings suggest that medical learners' ability to be mindful may reflect or vary as a function of their need fulfillment in medical school.

A second interesting finding is that the regression coefficients between mindfulness and both mediators (need fulfillment and resilience) are very similar in each coping model. This could reflect the strength of the relationships between these constructs. For instance, Charbonneau⁴⁰ reports a moderate correlation ($r = .43$) between trait mindfulness and need satisfaction, and between mindfulness and resilience ($r = .37$), which are lower but comparable in scale to those in the present study. Our findings also closely resemble Pitzer and Skinner's,⁵⁷ who report similar correlations between resilience and the three basic needs (ranging from $r = .56$ to $.80$), although their study was conducted among elementary and middle school students. Further studies are needed to elucidate these relationships in medical education, as aggregated need fulfillment, mindfulness, and resilience have each been conceptualized differently in the literature.

Finally, the finding that the two mindfulness models account for a considerable amount of variance in medical students' adaptive ($R^2 = 65\%$) and maladaptive ($R^2 = 53\%$) coping highlights the potential benefit of mindfulness to help them cope more effectively with stress.^{24,26,58} This multi-directional pattern is in keeping with SDT's conceptualization of mindfulness, as being in opposition to avoiding one's stressful experiences.¹⁹ Interestingly, it also lends support to Shapiro et al's³⁸ theory of *reperceiving*, which views mindfulness as a process (i.e., mindful practice) and an outcome (i.e., mindful attention), involving cognitive, emotional, and behavioral flexibility. While it was beyond the scope of the present study to assess actual mindfulness interventions, our findings suggest that implementing mindfulness-based programs in medical schools may well-support learners' need fulfillment and healthy coping. More importantly, however, our results and others' further suggest that, if students' autonomy, competence, and relatedness needs are hindered in medical school, it will likely promote stress incursion and constrain their ability to be mindful, in the first place.⁴⁷ Without drawing conclusions, this may help to explain why mixed evidence remains for the usefulness of wellness and

mindfulness-based interventions in medical education.^{59,60}

Implications in medical education

Results from this study support the SDT model of mindfulness, which views it as a stress-buffering and mental health enhancing quality.^{18,19} For instance, the finding that medical students who scored high in mindfulness tended to respond to stressors more adaptively versus maladaptively is consistent with SDT's perspective that more mindful individuals are more likely to adapt to stressors in their environment, better regulate their emotions, and meet their basic psychological needs.^{19,61} Drawing on Palmer and Rodger's²³ suggestions, this information suggests that helping medical students to cultivate their own mindfulness and self-regulatory skills (e.g., through wellness curriculums, optional workshops, or guidance counselling) may assist them in meeting the unique demands associated with their medical training. Relatedly, it may be helpful for medical educators and counselors to assist medical learners in identifying their intrinsic values and goals, to help direct their mindful attention and need-fulfilling behaviors.

With respect to promoting mindfulness, adaptive coping, and ultimately, well-being, findings from this study also demonstrate the practical significance of creating learning environments that promote (and do not undermine) medical students' sense of autonomy, competence, and relatedness. A potentially valuable avenue toward doing this is supporting medical teachers, in their awareness of and ability to foster these needs among their learners. To that end, it may be worthwhile to teach medical faculty how to cultivate their own mindfulness. Studies suggest this could directly promote the abilities and need fulfillment of educators, which would indirectly support the motivation and well-being of learners.^{19,62,63} Secondly, by reinforcing that engagement is best shaped by stimulating intrinsic motivation (i.e., based on interests, values, and goals), medical educators can avoid using controlling methods of pedagogy that are counterproductive for medical learners' development, performance, and well-being.^{35,45,64}

An additional consideration is that the majority of medical students are likely unaware of their basic psychological needs for optimal functioning and well-being. As such, promoting medical students' awareness of these needs may help to improve their understanding of self, and why they might respond to stressful events in their learning environment, in

the ways that they do.⁶³ Others have proposed that teaching socio-emotional competencies could also help prevent learner stress and facilitate need fulfillment,⁶⁵ which could be incorporated into wellness curricula or mindfulness-based programs in medical education. It has also been suggested that even increasing the perception of more autonomy, competence, and relatedness may make meaningful differences in experiences of need fulfillment and well-being, such as in decisions that might normally be considered negligible.^{40,66} In medical education, this might translate into simple things like using more autonomy-supportive phrasing in emails to learners, assignments, evaluation forms, and in course and clinical rotation syllabi. While far from arbitrary, it would also support learners' basic needs to ensure proper alignment between learning objectives, teaching, assessments, and curriculum scheduling (i.e., cohesion between staff, teachers, and learners).

Finally, when medical educators are considering implementing any kind of wellness-based intervention in medical school, we would stress the importance of first considering how it will impact their learners' autonomy, competence, and relatedness needs. In particular, it would be essential to avoid, as much as possible, the use of controlling elements that may undermine these human needs, for the sake of regulating behavior and/or pressing for accountability. Examples of these approaches include mandating wellness activities that do not have a clear purpose (i.e., meaning), scheduling wellness sessions outside of learners' regular schedules, and bringing any form of assessment into the equation. Ultimately, taking learners' basic needs into account is likely to determine not only their engagement and satisfaction with these initiatives, but how much they will benefit—issues that have proven to be quite challenging in medical education thus far.^{59,60,67,68}

Limitations & future work

The results of this study are not conclusive and have several noteworthy limitations. First, this is a correlational study that relied on self-report data from students at a single institution. Additionally, the voluntary-response inclusion rate was only 49.3%, and there were fewer third and fourth year students who completed the survey than first and second years. These limitations preclude causal conclusions and limit generalizability. That said, a previous study comparing the resilience and coping of Canadian medical students, to age-matched peers in the general population, had very similar sample characteristics to those in the

present study, including proportion of year 1-4 respondents and mean resilience scores (also measured with the CD-RISC 10).³ While we could not compare respondents to non-respondents in this study (since they were anonymous), and non-response bias is still possible, it therefore seems less likely to be a significant limitation.⁶⁹ Additionally, we used previously validated instruments with preservation of strong reliability, bootstrapping procedures that are considered robust methods for hypothesis testing for relatively smaller sample sizes, and our analyses indicated adequate statistical power. While these points strengthen our findings, results should nonetheless be interpreted with caution.

Future research may wish to replicate this study, as well as consider other forms of statistical modeling in which resilience and need fulfillment are mediators of different mental health outcomes, to explore the convergent validity of our coping findings. Further, longitudinal studies (perhaps with a concurrent measure of distress) would also be useful, to assess students' need fulfillment and coping throughout the span of their medical training. This may be especially warranted, given that many stressors medical learners face may be viewed as chronic and uncontrollable (e.g., working hard toward a career speciality without guarantees of matching to a corresponding residency program). Whether “maladaptive” coping strategies may be considered relatively “adaptive” for medical learners, in this type of situation, is yet to be determined.

Another potential limitation of this study is its derived factor structure for *adaptive* and *maladaptive* coping, which warrants further validation. Although this approach was similar to previous non-medical studies^{50–52} and statistical criteria were met to proceed this way, several subscales demonstrated relatively low factor loadings (e.g., religion, denial, and self-distraction), as well as modest cross-loading (e.g., instrumental support, emotional support, and venting). Future studies may therefore wish to examine specific subscales from the Brief COPE, or to categorize them differently (e.g., emotion-focused, problem-focused, and dysfunctional coping).⁷⁰ Research is also needed to extend prior work on latent coping profiles among medical students (e.g., infrequent copers, active copers, and low or high avoidant copers) in relation to well-being outcomes.¹² Relatedly, results from this study were based on a single measure of mindfulness (the MAAS). While the MAAS has been shown to have strong psychometric properties,⁷¹ it has also been criticized for focusing more on attentional components of mindfulness, which might not capture its full essence (e.g., with acceptance and non-judgmental states).^{38,72} Future work may therefore consider other

facets or measures of mindfulness, which may differentially relate to medical students' resilience, need fulfillment, and coping styles.

Conclusion

Findings from this study suggest that mindfulness is an important psychological quality in determining how adaptively or maladaptively students cope with stress in medical school, and that their coping improves if their resilience and basic psychological needs are more supported. While implementing mindfulness programs in medical education may help foster learner resilience and coping skills, our results demonstrate the additional (if not greater) importance of addressing need-thwarting aspects of the learning environment. It is our perspective that a combined approach—with initiatives to promote mindfulness and learning environment interventions that reduce barriers to meeting basic psychological needs—would likely be most fruitful for supporting medical students' coping, healthy development, and wellness.

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Declaration of interest

The authors have no conflicts of interest to declare.

Data availability

The data from the present study can be made available upon reasonable request.

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