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Mindfulness and Psychological Health Outcomes: A Latent Profile Analysis among Military Personnel and College Students

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Abstract

Previous research on trait mindfulness facets using person-centered analyses (e.g., latent profile analysis [LPA]) has identified four distinct mindfulness profiles among college students: a high mindfulness group (high on all facets of the Five-Factor Mindfulness Questionnaire [FFMQ]), a judgmentally observing group (highest on observing, but low on non-judging of inner experience and acting with awareness), a non-judgmentally aware group (high on non-judging of inner experience and acting with awareness, but very low on observing), and a low mindfulness group (low on all facets of the FFMQ). In the present study, we used LPA to identify distinct mindfulness profiles in a community based sample of U.S. military personnel (majority veterans; $n = 407$) and non-military college students ($n = 310$) and compare these profiles on symptoms of psychological health outcomes (e.g., suicidality, PTSD, anxiety, rumination) and percentage of participants exceeding clinically significant cut-offs for depressive symptoms, substance use, and alcohol use. In the subsample of college students, we replicated previous research and found four distinct mindfulness profiles; however, in the military subsample we found three distinct mindfulness profiles (a combined low mindfulness/judgmentally observing class). In both subsamples, we found that the most adaptive profile was the “high mindfulness” profile (i.e., demonstrated the lowest scores on all psychological symptoms and the lowest probability of exceeding clinical cut-offs). Based on these findings, we purport that the comprehensive examination of an individual’s

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Compliance with Ethical Standards

Ethical Approval: All procedures performed in our study were approved by the institutional review board at the participating university and in accordance with the ethical standards of the 1964 Helsinki declaration and its later amendments.

Informed Consent: Informed consent was obtained from all individual participants included in the present study.

Author Contributions:

AJB: conceptualized the research questions, conducted the analyses, drafted the introduction, method, statistical analyses, and results sections, and created the tables and figures. MRP: assisted with analysis, interpretation of the data, and drafted parts of the introduction and discussion sections. MLK: designed and executed the study, wrote parts of discussion sections of the first draft, and edited the other sections of the first draft. All authors contributed to and approved of the final manuscript.

mindfulness profile could help clinicians tailor interventions/treatments that capitalize on individual's specific strengths and work to address their specific deficits.

Keywords

Mindfulness; Psychological Well Being; Latent Profile Analysis; Military Personnel; College Students

Introduction

Within the field of psychology, there is strong support that mindfulness, defined as paying attention in the present moment with awareness and nonjudgment (Bishop et al., 2004; Kabat-Zinn, 1994), is associated with better psychological and physical outcomes (see Keng, Smoski, & Robins, 2011 for a review). However, researchers have acknowledged that trait mindfulness contains multiple components that are difficult to assess empirically (Quaglia, Brown, Lindsay, Creswell, & Goodman, 2015). With the Five Facet Mindfulness Questionnaire (FFMQ), Baer, Smith, Hopkins, Krietemeyer and Toney (2006) have attempted to measure five specific components of mindfulness in a multi-factorial questionnaire. Specifically, the FFMQ assesses acting with awareness (e.g., "I rush through activities without being really attentive to them; reverse-coded"), non-judging of inner experience, (e.g., "I tend to evaluate whether my perceptions are right or wrong; reverse-coded"), non-reactivity to inner experience (e.g., "I watch my feelings without getting lost in them"), describing (e.g., "My natural tendency is to put my experiences into words"), and observing (e.g., "I intentionally stay aware of my feelings"). Recent studies show that these facets of mindfulness are differentially associated with psychological outcomes across various populations (e.g., community samples, Cash & Whittingham, 2010; college students, Pearson, Brown, Bravo, & Witkiewitz, 2015; military personnel, Boden et al., 2012; and clinical samples, Carmody & Baer, 2008). However, current research on trait mindfulness and psychosocial health outcomes may be limited by the method of analysis.

Although variable-centered analyses (e.g., multiple regression, structural equation modeling) predominate the trait mindfulness-health literature, they are limited in that they tend to focus on the unique associations between a single facet of mindfulness and associated outcomes. Further, variable-centered approaches assume that all participants have been sampled from a single population (i.e., population homogeneity assumption; Collins & Lanza, 2010). The limitations of variable-centered analyses can be overcome through the use of person-centered analyses (e.g., hierarchical cluster analysis, latent profile/class analysis). Person-centered analyses provide the ability to identify distinct subpopulations defined by individuals' full response profiles on mindfulness facets. To date, several published studies that have used person-centered analysis to examine subgroups of individuals on mindfulness facets (cluster analysis, Lilja, Lundh, Josefsson, & Falkenstrom, 2013; latent profile analysis [LPA], Bravo, Booth, & Pearson, 2016; Gu, Baer, Strauss, Barnhofer, & Crane, 2017; Kimmes, Durtschi, & Fincham, 2017; Pearson, Lawless, Brown, & Bravo, 2015; Sahdra et al., 2017). Lilja et al. (2013) found 13 distinct clusters based on participant's mindfulness scores that were distinctly characterized by higher or lower probability of mindfulness

mediation experience; however, they did not compare psychological functioning of respondents in different clusters.

Using LPA, Pearson et al. (2015) found four classes of college students based on their FFMQ mindfulness scores: a “high mindfulness” group (i.e., moderately high on all facets of mindfulness), a “low mindfulness” group (i.e., relatively low-to-average on all facets of mindfulness), a “judgmentally observing” group (i.e., high on observing facet, low on non-judging of inner experience and acting with awareness) and a “non-judgmentally aware” group (i.e., low on observing, high on non-judging of inner experience and acting with awareness). Using an independent sample of college students, Bravo et al. (2016) replicated this four-class solution across subsamples of meditators and non-meditators. Across both studies, the profiles of each class were remarkably similar such that the “high mindfulness” and “non-judgmentally aware” groups had the most adaptive profiles (i.e., lower means on negative mental health outcomes and higher means on psychological well-being) compared to the “low mindfulness” and “judgmentally observing” groups. Furthermore, and compared to the “low mindfulness” group, the “judgmentally observing” group consistently showed a more maladaptive profile (i.e., higher means on negative mental health outcomes and lower means on psychological well-being). More recently, Kimmes et al. (2017) replicated these four classes among another independent sample college students and found that these classes differed on relationship attachments and attributions for partner aggressions, with the “high mindfulness” group showing the most adaptive profile.

Despite advancing our knowledge regarding subpopulations of individuals based on their mindfulness profiles, a limitation of the studies mentioned above is that outcomes tended to be centered on symptoms of psychological health and less is known about differences in the classes on more clinically relevant outcomes. Understanding how mindfulness profiles relate to clinically relevant outcomes (e.g., percentage of individuals in each class that exceed the cut-off for probable depressive episode) is advantageous for tailoring specific mindfulness-based practices to individuals based on their mindfulness profiles to enhance the efficacy and the efficiency of mindfulness-based interventions for a specific disorder. Further, a recent study found mood disorders were the second most prevalent class of mental health disorders among college students (Auerbach et al., 2016). Given that substance use is prevalent among college students (Johnston et al., 2015; Pearson, Liese, Dvorak, & Marijuana Outcomes Study Team, 2017), it is also important to examine how these profiles differentiate on substance use outcomes.

Another limitation of this line of research is the predominant focus on college students. Additional work is needed to determine the number of classes in other populations that may be at higher risk for poor psychological functioning (e.g., military personnel). Understanding classes of mindfulness and how these classes are associated with psychological functioning among recent-era military members is critical as almost 2.8 million individuals have served in the U.S. military since 9/11 (National Center for Veterans Analysis and Statistics, 2016). Further, many of these military members experienced lengthy and combat-related deployments which are related to greater risk for poor psychological outcomes (e.g., substance use disorder, Institute of Medicine, 2012; depression, Mustillo et al., 2015; posttraumatic stress disorder, Stander, Thomsen, & Highfill-McRoy, 2014).

The purpose of the present study was to expand previous research applying person-centered analyses to the study of mindfulness. First, we wanted to see if we could replicate the four-class solution reported previously (Bravo et al., 2016; Kimmes et al., 2017; Pearson et al., 2015) in an independent sample that includes both military personnel (predominately veterans) and non-military college students. Given that military personnel and civilian populations differentiate on mental health outcomes (e.g., student military personnel vs. civilian college students; Barry, Whiteman, & MacDermid Wadsworth, 2014) we conducted our analyses separately among military personnel (predominately veterans) and non-military college students. Second, we wanted to examine how these classes differed not only on symptoms of psychological health outcomes (i.e., depressive symptoms, anxiety symptoms, rumination, suicidality, posttraumatic stress disorder symptoms, alcohol misuse, and drug abuse symptoms), but also compare the percentage of individuals in each class that exceeded the cut-off for probable depressive episode, probable drug use disorder, hazardous drinking, and probable alcohol use disorder. We expected that a “high mindfulness” group would emerge and show the most adaptive profile.

Method

Participants

Participants were a community based sample of veterans, active duty, and reservists military personnel ($n = 407$) and non-military college students ($n = 310$). Military personnel were comprised of veterans ($n = 300$, 73.7%), National Guard/Reservists ($n = 67$, 16.5%), and active duty members ($n = 31$, 7.6%); with the Army ($n = 195$, 47.9%) and the Navy ($n = 118$, 29.0%) being the most represented branches of service. The majority of military personnel ($n = 316$; 77.6%) reported serving in a region that supported Operation Enduring Freedom (OEF; average number of deployments = 2.86) and Operation Iraqi Freedom (OIF; average number of deployments = 2.94). Further, the majority identified as being either White, non-Hispanic ($n = 254$; 62.4%), or Hispanic and/or Latino ($n = 81$; 19.9%), were men ($n = 226$; 55.5%), and reported a mean age of 32.74 ($SD = 7.50$) years. Among non-military college students, the majority of participants identified as being either White, non-Hispanic ($n = 142$; 47.8%), or African American ($n = 98$; 33.0%), were men ($n = 168$; 58.7%), and reported a mean age of 24.46 ($SD = 8.66$) years.

Procedures

Participants were recruited via Facebook ($n = 130$, 18.7%), online listservs for military affiliated personnel ($n = 84$, 11.7%), the Department of Psychology research pool at the participating university ($n = 312$, 43.5%), student veterans' organization announcements ($n = 50$, 7.0%), friend or family member ($n = 50$, 7.0%), and other sources ($n = 69$, 9.6%). After reviewing the study description and consenting to participate, participants completed an online self-report survey that took approximately 30 minutes to complete. Non-student participants were emailed a \$10 Amazon gift card; students were given their choice of being entered into one of twenty \$20.00 Amazon gift card raffles or receiving research credit. The study was approved by the institutional review board at the participating institution.

Measures

Mindfulness—Mindfulness was assessed using the 39-item Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) measured on a 5-point response scale (1 = *never or very rarely true*, 5 = *very often or always true*). The five facets (items were averaged) assessed by the FFMQ include acting with awareness ($\alpha = .88$), non-judging of inner experience ($\alpha = .88$), non-reactivity to inner experience ($\alpha = .81$), describing $\alpha = .76$), and observing ($\alpha = .84$).

Depressive symptoms—Depressive symptoms was assessed using the 10-item *Short Form of the Center for Epidemiologic Studies Depression Scale* (CESD-10; Kohout, Berkman, Evans, & Comoni-Huntley, 1993) measured on a 4-point response scale (0 = *rarely or none of the time/less than 1 day*, 3 = *most or all of the time/5–7days*). Example items include, “I felt sad” and “I felt that everything I did was an effort” (items were summed; $\alpha = .84$). A score of 10 or higher was used as a cut-off for probable depressive episode (Andresen, Carter, Malmgren, & Patrick, 1994).

Anxiety symptoms—Anxiety symptoms was assessed using the 14-item *Kremen Anxiety Scale* (KAS; Kremen, 1996). Similar to research using the KAS with military women (Kelley et al., 2002), the present study modified the KAS’s original 4-point Likert response scale (1 = *does not apply at all*, 4 = *applies very strongly*), using instead a 5-point response scale (1 = *never*, 5 = *always*). Example items include, “I suffer from nervousness” and “I worry about terrible things that might happen” (items were summed; $\alpha = .90$).

Rumination—Rumination was assessed using the 20-item Ruminative Thought Style Questionnaire (RTSQ; Brinker & Dozois, 2009) measured on a 7-point response scale (1 = *not at all descriptive of me*, 7 = *describes me very well*). Example items include, “I find that my mind often goes over things again and again” and “I have never been able to distract myself from unwanted thoughts” (items were averaged; $\alpha = .95$).

Suicidality—Suicidality was assessed using the 6-item suicidality subscale of the Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007) measured on a 5-point response scale (1 = *not at all*, 5 = *extremely*). Example items include, “I had thoughts of suicide” and “I thought about my own death” (items were summed; $\alpha = .83$).

Posttraumatic stress disorder—Posttraumatic stress symptoms was assessed using the 20-item Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5; Blevins, Weathers, Davis, Witte, & Domino, 2015) measured on a 5-point response scale ranging from (0 = *not at all*, 4 = *extremely*). Example items include, “Repeated, disturbing dreams of stressful experiences” and “Avoiding memories, thoughts, or feelings related to the stressful experience?” (items were summed; $\alpha = .93$).

Alcohol misuse—Hazardous drinking was assessed using the 10-item *Alcohol Use Disorders Identification Test* (AUDIT; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993) which assesses three facets of hazardous drinking: alcohol-related problems, dependency symptoms, and alcohol use. For the present study, a total score for the AUDIT

was calculated (items were summed; $\alpha = .88$). A score of 8 or higher is used as a cut-off for hazardous drinking and a score of 16 or higher is used as a cut-off for probable alcohol use disorder (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001).

Drug abuse symptoms—Drug abuse symptoms was assessed using the 10-item *Drug Abuse Screening Test* (DAST-10; Skinner, 1982). Each item is measured dichotomously to reflect presence/absence of drug misuse (0 = no, 1 = yes). Example items include, “Do you feel bad or guilty about your drug use”, and “Have you engaged in illegal activities in order to obtain drugs” (items were summed; $\alpha = .73$). A score of 3 or higher is used as a cut-off for probable drug use disorder (Skinner, 1982; Yudko, Lozhkina, & Fouts, 2007).

Statistical Analyses

To determine the number of latent classes based on the pattern of means of the five subscales of the FFMQ across our samples (i.e., military personnel subsample and non-military college student subsample) we used the Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LRT; Lo, Mendell, & Rubin, 2001; Vuong, 1989), which compares whether a k class solution fits better than a $k-1$ class solution using *Mplus* 7.4 (Muthén & Muthén, 1998–2012). As recommended by previous research (Henson, Reise, & Kim, 2007; Marsh, Lüdtke, Trautwein, & Morin, 2009; Nylund, Asparouhov, & Muthén, 2007), we also examined goodness-of-fit indexes (i.e., Akaike Information Criterion, Akaike, 1973, 1974; Bayesian Information Criterion, Schwarz, 1978), classification diagnostics (e.g., relative entropy [.80 is considered high, Clark & Muthén, 2009] and mean posterior assignment probabilities [.70 or higher is considered optimal, Nagin, 2005]), and substantive interpretation to settle upon the number of latent classes. Furthermore, Nagin (2005) suggests that when it is difficult to clearly identify an optimal number of groups (i.e., the LRT, goodness-of-fit indexes and classification diagnostics offer different optimal class-solutions), the most parsimonious model should be selected and the smallest class of any class-solution should not contain less than 5% of the sample. Finally, to determine whether our class solutions fit better than a single latent trait model of mindfulness, we conducted a confirmatory factor analyses of a single latent factor of mindfulness with each mindfulness facet as a factor loading and compared goodness-of-fit indexes, with lower values indicating better fit (Hooper, Coughlan, & Mullen, 2008).

After deciding on our class solutions, equality of means across the latent classes on distal outcomes was tested using BCH method (Asparouhov, & Muthén, 2015; Bakk & Vermunt, 2016), which uses posterior probability-based multiple imputations (Asparouhov & Muthén, 2007). Briefly, this method accounts for the probabilistic nature of class membership and produces more unbiased standard errors than alternative methods. Outcomes included continuous scores on psychological health variables (i.e., depressive symptoms, anxiety symptoms, rumination, suicidality, PTSD symptoms, alcohol misuse, and drug misuse) as well as percentages of participants that exceeded the cut-off for probable depressive episode, probable drug use disorder, hazardous drinking, and probable alcohol use disorder. In the military sample only, we also examined treatment seeking for mental health or substance use issues either through Veterans Affairs (VA) or non-VA services (totaling 4 separate questions). Continuous variables were converted to z-scores for that specific subsample for

interpretability; thus, a mean difference of one indicates one standard deviation difference among that specific population.

Results

Bivariate correlations and descriptive statistics among study variables across subsamples (i.e., military personnel and non-military college students) are shown in Table 1. Mindfulness (i.e., total score of the FFMQ) was moderately to strongly associated with better psychological health outcomes across both subsamples. Independent *t*-tests (see Table 1) demonstrated that non-military college students had significantly higher means on the observing facet of mindfulness, the describing facet of mindfulness, and the total score of mindfulness. Among psychological health outcomes, the military personnel subsample had significantly higher means on suicidality, posttraumatic stress disorder (PTSD) symptoms, alcohol misuse, drug abuse symptoms, and depressive symptoms (the only exception was rumination). Among clinical cutoff scores, 240 (59.0%) participants in the military personnel subsample exceeded the cut-off for hazardous drinking, 169 (41.5%) exceeded the cut-off for probable alcohol use disorder, 169 (41.5%) exceeded the cut-off for probable drug use disorder, and 255 (62.7%) exceeded the cut-off for a probable depressive episode. Among non-military college students, 76 (24.5%) participants exceeded the cut-off for probable hazardous drinking, 12 (3.9%) exceeded the cut-off for probable alcohol use disorder, 34 (11.0%) exceeded the cut-off for probable drug use disorder, and 129 (41.6%) exceeded the cut-off for probable depressive episode.

Class Solutions

Non-military college student sample—Table 1 reports commonly used fit statistics for 1 through 6 class solutions for analytic samples. Within our non-military college student analytic sample ($n = 310$), the Likelihood Ratio Test indicated that either a 2-class (fit better than a 1-class solution) or 4-class solution (fit better than a 3-class solution) fit best to the data. The AIC, BIC, and adjusted BIC decreased from a 1 class solution through a 6 class solution indicating an improved fit as the number of class solutions increased, suggesting that a 4-class solution may be optimal (see Table 1). Further, the relative entropy of the 4-class solution (.806) is considered high (Clark & Muthén, 2009); whereas the relative entropy of the 2-class solution (.607) does not approach a level of entropy that is considered high (Clark & Muthén, 2009). Additionally, the mPAP for the 4-class solution was considered optimal (4-class: .905, .883, .857, .892). Moreover, researchers recommend selecting the number of classes based on theory, previous research, and interpretation of the results (Marsh et al., 2009; Nylund et al., 2007). Thus, based on previous research (Bravo et al., 2016; Kimmes et al., 2017; Pearson et al., 2015), improved fit based on goodness-of-fit indexes, a higher relative entropy, and the interpretation of the results, we settled on the 4-class solution. Further, when comparing the 4-class solution to a latent trait model (i.e., one latent factor of mindfulness), the AIC, BIC, and adjusted BIC are lower for the 4-class solution than the latent trait model suggesting that a 4-class model fits significantly better than a single latent trait model (see Table 1).

Figure 1 depicts the pattern of means (standardized) across the 4-latent classes. Class 1, was the largest group and comprised 63.87% of the sample ($N = 198$; $mPAP = .905$), and we label this class the “low mindfulness” group as they were low-to-average on every facet of mindfulness ($-.33 < z_s < -.18$). Class 2 comprised 7.07% of the sample ($N = 24$; $mPAP = .883$), and we label this class the “non-judgmentally aware group” as they were high on non-judging of inner experience ($z = 1.25$) and acting with awareness ($z = 1.34$), but very low on the observing facet of mindfulness ($z = -1.85$). Class 3, comprised 12.26% of the sample ($N = 38$; $mPAP = .857$), and we labeled this class the “judgmentally observing group” as they were the highest on observing ($z = 1.37$), but very low on non-judging of inner experience ($z = -1.53$) and acting with awareness ($z = 1.52$). Finally, Class 4 comprised 16.13% of the sample ($N = 50$; $mPAP = .892$), and we label this class the “high mindfulness group” as they were moderately high on all facets of mindfulness ($.64 < z_s < 1.33$).

Military personnel sample—Within our military personnel analytic sample ($n = 407$), the Likelihood Ratio Test indicated that either a 3-class (fit better than a 2-class solution) or 5-class solution (fit better than a 4-class solution) fit best to the data. The AIC, BIC, and adjusted BIC decreased from a 1 class solution through a 6 class solution indicating an improved fit as the number of class solutions increased, suggesting that a 5-class solution may be optimal (see Table 1). However, Nagin (2005) suggest that the smallest class of any class-solution should not contain less than 5% of the sample and compared to the 3-class solution ($N = 51$; 12.53%) the 5-class solution ($N = 14$; 3.35%) contained a much lower percentage and the percentage of participants fell under the recommended 5%. Furthermore, the relative entropy of the 3-class (.905) and the 5-class solution (.924) were similar in strength (both considered high) and the $mPAP$ across the 3-class and 5-class solutions were both considered optimal (3-class: .961, .957, .942; 5-class: .984, .919, .958, .968, .956). Nagin (2005) suggests that when it is difficult to clearly identify an optimal number of groups, the most parsimonious model should be selected. Thus, based on the more parsimonious model, more individuals in the “smallest” group (3-class solution: 12.53%; 5-class solution: 3.35%), and the interpretation of the results based on previous research (Bravo et al., 2016; Kimmes et al., 2017; Pearson et al., 2015), we settled on the 3-class solution. Finally, the AIC, BIC, and adjusted BIC are lower for the 3-class solution than the latent trait model suggesting that a 3-class model fits significantly better than a single latent trait model (see Table 1).

Figure 2 depicts the pattern of means (standardized) across the latent classes. Class 1 was the largest group, comprising 56.76% of the sample ($N = 231$), and were high on observing ($z = 0.54$), but very low on non-judging of inner experience ($z = -0.71$) and acting with awareness ($z = -0.71$). Compared to the latent class structure in the non-military college student sample and findings from previous research (Bravo et al., 2016; Pearson et al., 2015), this class appeared to be a combination of the “low mindfulness group” and the “judgmentally observing group” based on the mean values across the trait mindfulness indicators (e.g., describing [$z = -0.14$] and non-reactivity [$z = 0.44$] are all within a .5 standard deviation from the sample mean) and thus we labeled this group the “low mindfulness/judgmentally observing” group. Class 2 comprised 30.71% of the sample ($N = 125$), and were high on non-judging of inner experience ($z = 0.88$) and acting with

awareness ($z = 0.87$), but very low on the observing facet of mindfulness ($z = -1.20$) and thus labeled the “non-judgmentally aware group”. Finally, Class 3 comprised 12.53% of the sample ($N = 51$), and were moderately high on all facets of mindfulness ($.46 < z_s < 1.59$) and thus labeled the “high mindfulness group”.

Equality of Means

Non-military college student sample—Across most psychological health outcomes (see Table 3), we found that the “high mindfulness” and “non-judgmentally aware” groups had the most adaptive psychological health outcomes (i.e., lower depressive symptoms, anxiety symptoms, rumination, suicidality, and PTSD symptoms) and did not significantly differ from each other on all of these outcomes. In contrast, the “low mindfulness” and “judgmentally observing” groups had the most maladaptive psychological health outcomes (i.e., higher depressive symptoms, anxiety symptoms, rumination, suicidality, and PTSD symptoms), and did not significantly differ from each other on most of these outcomes (the exception was rumination and anxiety symptoms in which there were higher means among the “judgmentally observing” group). For alcohol misuse, the only significant differences were found between the “high mindfulness” and the “low mindfulness” groups (lower alcohol misuse in the “high mindfulness” group). The groups did not significantly differ on drug abuse symptoms. On clinical outcomes, we found that the “non-judgmentally aware” group and “high mindfulness” groups had lower percentages (27% and 10%, respectively) than the “low mindfulness” and “judgmentally observing” groups (51% and 52%, respectively) for probable depressive episode. Further, we found that the “high mindfulness” group had a significantly lower percentage (0%) than the “low mindfulness group” (4%) on probable alcohol use disorder. No significant group differences were found for probable drug use disorder or hazardous drinking.

Military personnel sample—We found significant differences across each class on almost every outcome (see Table 4), such that the “high mindfulness” group had the most adaptive profile, followed by the “non-judgmentally aware” group (i.e., negative z -scores on almost every psychological health outcome), and the “low mindfulness/judgmentally observing” group had the most maladaptive profile (i.e., positive z -scores on every outcome). The only exception was that the “low mindfulness/judgmentally observing” and “non-judgmentally aware” groups did not differ on rumination. On clinical outcomes, results were similar such that the “high mindfulness” group had the most adaptive profile with a significantly lower percentage of participants exceeding each clinical cutoff compared to all other groups (14% of in the individuals in this class had probable depressive episode; 3% had probable drug use disorder, 19% were hazardous drinkers, and 1% had probable alcohol use disorder). The “low mindfulness/judgmentally observing” and “non-judgmentally aware” groups only differed on probable alcohol use disorder (37% for “non-judgmentally aware” group compared to 53% in “low mindfulness/judgmentally observing” group) and probable depressive episode (61% for “non-judgmentally aware” group compared to 74% in “low mindfulness/judgmentally observing” group). With regards to treatment seeking, results supported findings from the clinical cutoffs such that the “high mindfulness” group were least likely to have sought treatment compared to all other groups (27% of the participants in this class sought VA services for mental health; 27% sought non-VA services

for mental health; 2% sought VA services for alcohol or drug use; and 2% sought non-VA services for alcohol or drug use). The “low mindfulness/judgmentally observing” and “non-judgmentally aware” groups did not differ on treatment seeking percentages.

Discussion

The present study sought to extend the growing body of work using person-centered analyses to examine how unique mindfulness profiles relate to psychological health outcomes. In the subsample of non-military college students, we replicated a four-class solution found in previous research (Bravo et al., 2016; Kimmes et al., 2017; Pearson et al., 2015) that includes a group high on all facets of mindfulness (“high mindfulness” group), a group with high scores on non-judging of inner experience and acting with awareness but low scores on observing (“non-judgmentally aware” group), a group with low-to-average scores on all mindfulness facets (“low mindfulness” group), and a group with high scores on observing but low scores on non-judging of inner experience and acting with awareness (“judgmentally aware” group). However, among military personnel we found that two latent classes “low mindfulness” and “judgmentally observing” group were no longer distinct. This single group (i.e., “low mindfulness/judgmentally observing”) had low-to-average scores on all facets of mindfulness, especially non-judging of inner experience and acting with awareness.

Despite differences in the classes across our analytic samples, in general, the identified classes were associated with psychological health in expected ways. In each subsample, we found that the most adaptive profile includes participants who report high scores on all five facets of mindfulness and the least adaptive profile was judgmentally observing (college student sample) or low mindfulness/judgmentally observing (military sample) group. This pattern was found when using continuous measures of psychological health and dichotomous measures of probable clinical diagnoses. In fact, the clinical outcome measures revealed rather stark contrasts between the most adaptive and least adaptive profiles. For example, in the military personnel sample, 45% and 53% of participants in the “low mindfulness/judgmentally observing” group exceeded a cutoff for probable drug use disorder and alcohol use disorder, respectively. In contrast, among those in the “high mindfulness” group only 3% and 1% met alcohol and drug use disorder cutoffs, respectively. The utility of the identified classes is further supported in that in the military subgroup, such that the high mindfulness class were least likely to have sought treatment for mental health and substance use disorder. In contrast, military members who were classified as low mindfulness/judgmentally observing, were nearly three times more likely to have sought mental health treatment and over twenty times more likely to have sought treatment for substance abuse.

Although the classes of mindfulness in each subsample were associated with psychological and substance use disorder as expected, some important differences should be noted between the two groups. For instance, a higher proportion of military personnel were classified as “non-judgmentally aware”. Participants classified as non-judgmentally aware are high on acting with awareness and high on non-judging of inner experiences; however, they are low on evaluating the connection between thoughts and emotions and behavior. In part, the

greater percentage of military personnel that fall into the “non-judgmentally aware” group may reflect some degree of self-selection into the military as well as training that reinforces the necessity for military members to maintain high levels of focus and in some cases, the ability to counter or disregard negative emotions that may interfere with team member and mission success (e.g., Driskell, Burke, Driskell, Salas, & Neuberger, 2014).

Despite differences in mental health outcomes across our subsamples, mindfulness based interventions have been increasingly utilized to treat a myriad of health and psychological problems among both college student and military populations (see Marchand, 2012 for an overview). With respect to veterans, mindfulness meditation has been particularly utilized and shown to be efficacious for those with PTSD (e.g., Kearney et al., 2013; Polusny et al., 2015). For instance, in a recent multisite clinical trial, relative to treatment-as-usual, meditation programs had medium effects sizes both for PTSD severity as determined by clinical interview and self-report as well as overall mindfulness (Heffner, Crean, & Kemp, 2016). Although much of the clinical research examining mindfulness based treatments for veteran populations have focused on their utility for PTSD, the strong association between mindfulness and other aspects of mental health (e.g., depression, substance misuse) in the present study suggest the importance of incorporating mindfulness-based approaches into treatments that target mental health problems that are not necessarily combat-related. In addition, incorporating mindfulness techniques into prevention programs and resilience programs may also have the potential to reduce mental health problems. More globally, given the percentage of participants in the military subsample who endorsed high levels of mental health and substance use problems, it is recommended that mental health providers who work with military members objectively assess mindfulness in clinical evaluation.

With respect to college students, in a stratified randomized controlled repeated measures study with three groups, college students who took part in the mindfulness or yoga intervention group reported decreased depressive, anxiety, and stress relative to those who took part in a non-interventional control group (Falsafi, 2016). Further, mindfulness based interventions and training have been shown to be efficacious at reducing attentional bias for alcohol-related cues (Ostafin, Bauer, & Myxter, 2012) and alcohol-related consequences (Mermelstein & Garske, 2015) among college students. Given that we found that 63.87% of the college-student sample were classified in the “low mindfulness” group, teaching mindfulness techniques to students is warranted and may have the potential to reduce negative emotional symptoms.

Limitations

Although our findings were largely consistent with the existing literature and mindfulness classes were largely associated with outcomes as expected, several limitations (both conceptual and empirical) should be considered. First, because the samples were convenience samples, our results may not generalize to the larger populations of college students and recent-era military personnel. Second, we did not assess *nonattachment* (i.e., letting go of positive states) which has recently been proposed as a sixth dimension of trait mindfulness (see Sahdra, Ciarrochi, & Parker, 2016 for an overview); and future research should examine whether distinct mindfulness profiles among these populations emerge with

nonattachment added as an indicator. Third, psychological and substance use were assessed via self-report. Additional research in which participants are evaluated for diagnosis of mental health and substance use disorder is warranted. Fourth, we want to be careful not to reify class membership or be overly attached to class labels. Regarding reification, class membership is probabilistic and although we found high classification precision for the four and three-class solutions, this fact does not preclude that specific individuals are poorly classified (i.e., moderate probability of being in multiple classes). Regarding the labeling of the classes, we chose the label “judgmentally observing” for individuals in the class with the highest scores on observing and low scores on acting with awareness and non-judging of inner experience. Our label should not be interpreted to suggest that non-judging is more essential to this class than acting with awareness. Researchers should be aware when attempting to replicate findings from person-centered analyses that labels cannot be relied on. Lastly, as a cross-sectional study, associations were described and causation cannot be determined. Although we discuss our results from the perspective that specific mindfulness profiles influence various psychological outcomes, it is important to recognize that mental health and substance use may influence mindfulness profiles.

Implications for Future Research

Our findings highlight the importance of examining the number of distinct profiles in different populations. Just as the factor structure of a multi-item inventory may differ across distinct populations, the number and substantive interpretation of distinct subpopulations identified using latent class/profile analyses may differ across different populations. For example, in a recent study among adults with a history of recurrent depression, Gu et al. (2017) found a different four-profile solution (i.e., high mindfulness, non-judgmentally aware, moderate mindfulness, and very low mindfulness) compared to those found in previous research using college students (Bravo et al., 2016; Kimmes et al., 2017; Pearson et al., 2015). Specific to the present study, the three-class solution for military personnel reflects a new and unexpected finding. Whether the three-class solution reflects a military sample *per se*, or more global differences between college students and non-college students cannot be ascertained in the present study. Clearly, additional research is necessary to confirm this finding. Nevertheless, findings from the present study demonstrate clear mindfulness classes among military personnel that have important associations with psychological health and substance use risk.

Our findings also add to a growing body of work demonstrating the utility of using person-centered approaches to examine a complete mindfulness profile rather than examining specific facets of mindfulness in isolation. However, an important caveat must be mentioned. Previous LPA studies (Bravo et al., 2016; Gu et al., 2017; Kimmes et al., 2017; Pearson et al., 2015), including the present study, have not taken into account the overall level of high/low responding on subscales by participants. Morin and Marsh (2015) argue that it is important to “test whether shape effects (e.g., whether each person has a distinguishable profile of scores characterized by specific areas of strengths and weaknesses) are present in multidimensional constructs—justifying the use of person centered analyses—and whether level effects (e.g., whether the ratings across all scales are consistently high or low for a particular person) are strong enough to justify considering methods allowing to the

separation of shape and level effects in the analyses” (pg. 41). In a recent study among a national sample of U.S. adults, Sahdra et al. (2017) attempted to disambiguate the quantitative (level) and qualitative (shape) components of mindfulness profiles using Bi-factor Exploratory SEM. Although they did replicate the same four factor class solution found by most other studies (Bravo et al., 2016; Kimmes et al., 2017; Pearson et al., 2015) using LPA, Sahdra et al. found a distinct 4-factor solution (i.e., non-judgmentally aware, average mindfulness, moderately non-judgmental, and judgmentally observing) when using Bi-factor Exploratory SEM. Based on their results, future research is needed to test whether our 4-class (college students) or 3-class (military personnel) solutions persist once accounting for the shared variance of the items or accounting for an overall FFMQ total score.

In utilizing LPA, we purport that the comprehensive examination of an individual’s mindfulness profile could help clinicians tailor interventions/treatments that capitalize on individual’s specific strengths and work to address their specific deficits. For example, a clinician working with an individual with scores consistent with a “judgmentally observing” profile could focus on the use of mindfulness practices that take advantage of their high level of observing to help cultivate non-judging of inner experience and acting with awareness. However, for this technique to be beneficial, future research needs to replicate our mindfulness profiles in a nationally representative sample to determine specific mean structures of the FFMQ facets in these distinct profiles. Providing robust mean structures for the profiles would make it easier for clinical practitioners to identify the likelihood of a new client belonging to one of the mindfulness classes before tailoring their clinical practice to that particular individual. Specifically, a clinician could compare their client’s means on the FFMQ facets to the robust means of the profiles in the national sample and tailor their therapy for that specific client’s suggested mindfulness profile. Furthermore, longitudinal research, including studies with more sophisticated data collection methods (e.g., daily diary and ecological momentary assessment), is needed to better clarify the associations among mindfulness profiles, mental health, and substance use over time.

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Figure 1.
Depiction of the four latent classes defined by pattern of standardized means on five facets of mindfulness among non-military college students ($n = 310$).

Figure 2.

Depiction of the three latent classes defined by pattern of standardized means on five facets of mindfulness among military personnel ($n = 407$).

Table 1

Bivariate correlations of all observed variables among military personnel and non-military college students

	1	2	3	4	5	6	7	8	9	10	11	12	13	Military Personnel		Non-Military College Students		<i>t</i>	<i>p</i>
														<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
1. Observing	—	.18	-.22	-.28	.48	.38	-.01	.12	.22	.04	.12	-.03	.10	3.10	0.78	3.31	0.72	-3.66	<.001
2. Describing	.33	—	.30	.13	.29	.69	-.25	-.29	-.14	-.16	-.09	-.14	-.03	3.16	0.60	3.40	0.70	-4.77	<.001
3. Acting with Awareness	-.49	.20	—	.55	-.08	.62	-.36	-.38	-.45	-.21	-.31	-.14	-.14	3.21	0.84	3.20	0.76	0.10	.92
4. Non-Judging	-.53	.17	.77	—	-.16	.53	-.40	-.47	-.45	-.29	-.38	-.15	-.11	3.11	0.84	3.14	0.80	-0.44	.66
5. Non-Reactivity	.68	.46	-.37	-.34	—	.49	-.14	-.18	-.00	.02	-.17	-.08	-.03	2.97	0.74	3.00	0.67	-0.61	.54
6. FFMQ Total Score	.30	.78	.53	.51	.46	—	-.44	-.46	-.34	-.24	-.32	-.20	-.09	3.11	0.39	3.21	0.40	-3.41	.001
7. Depressive Symptoms	.07	-.42	-.52	-.45	-.01	-.54	—	.55	.43	.45	.48	.17	.07	11.41	5.95	9.40	6.03	4.45	<.001
8. Anxiety Symptoms	.24	.31	-.64	-.63	.13	-.53	.66	—	.58	.34	.56	.22	.15	39.03	11.66	38.99	11.71	0.37	.97
9. Rumination	.59	-.14	-.75	-.77	.40	-.35	.41	.68	—	.15	.46	.11	.16	4.02	1.30	4.41	1.28	-3.99	<.001
10. Suicidality	.03	-.30	-.45	-.39	.05	-.44	.64	.48	.24	—	.30	.14	.15	12.56	6.19	8.61	4.39	9.55	<.001
11. PTSD Symptoms	.24	-.32	-.68	-.64	.17	-.53	.75	.79	.57	.67	—	.20	.20	31.14	19.14	19.75	18.26	8.00	<.001
12. Alcohol Use	.02	-.22	-.34	-.26	.13	-.29	.50	.43	.19	.64	.55	—	.31	11.82	8.85	4.94	4.69	12.43	<.001
13. Drug Abuse Symptoms	-.28	-.28	-.07	.03	-.16	-.28	.37	.08	-.19	.57	.29	.50	—	2.56	2.29	1.21	1.39	9.20	<.001

Note. Significant correlations ($p < .05$) and mean differences between subsamples ($p < .05$) are bolded for emphasis. Cronbach's alphas are underlined and shown. FFMQ = Five Facet Mindfulness Questionnaire. PTSD = Posttraumatic Stress Disorder. Correlations for the military personnel subsample ($n = 407$) are below the diagonal. Correlations for the non-military college student subsample ($n = 310$) are above the diagonal.

Table 2

Fit statistics for 1 through 6 class solutions for Latent Profile Analysis (LPA) across samples

Number of Classes-Non-Military College Students							
Fit Statistics	1	2	3	4	5	6	CFA Latent Trait Model
AIC	3438.53	3338.52	3265.11	3184.23	3165.79	3148.54	3311.31
BIC	3475.89	3398.30	3347.31	3288.86	3292.84	3298.54	3367.36
Adjusted BIC	3444.18	3347.56	3277.54	3200.05	3185.00	3171.14	3319.78
Entropy		.607	.747	.806	.822	.840	
Smallest <i>n</i>	310	128	43	24	16	7	310
LRT	----	<i>p</i> = .003	<i>p</i> = .218	<i>p</i> = .005	<i>p</i> = .333	<i>p</i> = .370	----

Number of Classes-Military Personnel							
Fit Statistics	1	2	3	4	5	6	CFA Latent Trait Model
AIC	4655.58	4121.04	3842.93	3693.83	3535.26	3497.53	4105.11
BIC	4695.67	4185.18	3931.12	3806.08	3671.56	3657.88	4165.24
Adjusted BIC	4663.94	4134.41	3861.31	3717.23	3563.68	3530.95	4117.65
Entropy	----	.877	.905	.929	.924	.931	----
Smallest <i>n</i>	407	139	51	12	14	8	407
LRT	----	<i>p</i> = .012	<i>p</i> < .001	<i>p</i> = .118	<i>p</i> = .006	<i>p</i> = .393	----

Note. AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion. The CFA Latent Trait Model among non-military college students provided a poor fit to the data based on recommendations by Hu and Bentler (1999): $\chi^2(5) = 153.60$, $p < .001$, CFI = .471, SRMR = .143, and RMSEA = .310 (90% CI [.269, .353]). The CFA Latent Trait Model among military personnel provided a poor fit to the data based on recommendations by Hu and Bentler (1999): $\chi^2(5) = 423.86$, $p < .001$, CFI = .454 (90% CI [.418, .491]).

Table 3

Mean comparisons between latent classes on mindfulness facets and psychological well-being outcomes among non-military college students

Mindfulness Facets	Standardized Scores (z-scores)			
	Class 1: Low Mindfulness	Class 2: Non-Judgmentally Aware	Class 3: Judgmentally Observing	Class 4: High Mindfulness
	<i>M (SE)</i>	<i>M (SE)</i>	<i>M (SE)</i>	<i>M (SE)</i>
Observing	-0.19 _a (.061)	-1.85 _b (.150)	1.37 _c (.138)	0.64 _d (.148)
Describing	-0.33 _a (.071)	-0.46 _a (.208)	0.14 _b (.152)	1.33 _c (.129)
Acting with Awareness	-0.24 _a (.057)	1.34 _b (.126)	-1.52 _c (.131)	1.29 _a (.100)
Non-Judging	-0.18 _a (.061)	1.25 _b (.166)	-1.53 _c (.125)	1.11 _b (.112)
Non-Reactivity	-0.24 _a (.064)	-1.52 _b (.151)	0.98 _c (.171)	0.94 _c (.150)
FFMQ Total Score	-0.43 _a (.059)	-0.26 _a (.083)	-0.38 _a (.119)	1.97 _b (.102)
<i>Psychological Health Outcomes</i>				
	<i>M (SE)</i>	<i>M (SE)</i>	<i>M (SE)</i>	<i>M (SE)</i>
Depressive Symptoms	0.23 _a (.082)	-0.53 _b (.170)	0.26 _a (.173)	-0.75 _b (.111)
Anxiety Symptoms	0.20 _a (.074)	-0.59 _b (.210)	0.63 _c (.175)	-0.88 _b (.142)
Rumination	0.17 _a (.072)	-0.96 _b (.266)	0.86 _c (.144)	-0.73 _b (.138)
Suicidality	0.07 _a (.082)	-0.41 _b (.135)	0.44 _a (.228)	-0.34 _b (.124)
PTSD Symptoms	0.09 _a (.080)	-0.45 _b (.155)	0.55 _a (.223)	-0.49 _b (.128)
Alcohol Misuse	0.06 _a (.083)	0.02 _{ab} (.258)	0.11 _{ab} (.206)	-0.32 _b (.096)
Drug Abuse Symptoms	-0.01 _a (.081)	-0.20 _a (.124)	0.33 _a (.254)	-0.08 _a (.131)
<i>Clinical Cutoff Percentages</i>				
	<i>M (SE)</i>	<i>M (SE)</i>	<i>M (SE)</i>	<i>M (SE)</i>
Probable Depressive Episode	51% _a (.040)	27% _{bc} (.106)	52% _{ab} (.097)	10% _c (.056)
Probable Drug Use Disorder	11% _a (.025)	3% _a (.047)	20% _a (.076)	8% _a (.043)
Hazardous Drinking	26% _a (.101)	25% _a (.035)	30% _a (.086)	15% _a (.059)
Probable Alcohol Use Disorder	4% _a (.016)	9% _{ab} (.064)	6% _{ab} (.043)	0% _b (.003)

Note. Means sharing a subscript in a row indicate means that are not significantly different from each other.

Table 4

Mean comparisons between latent classes on mindfulness facets and psychological well-being outcomes among military personnel

Standardized Scores (z-scores)			
	Class 1: Low Mindfulness/ Judgmentally Observing	Class 2: Non-Judgmentally Aware	Class 3: High Mindfulness
<i>Mindfulness Facets</i>	<i>M (SE)</i>	<i>M (SE)</i>	<i>M (SE)</i>
Observing	0.54 _a (.044)	-1.20 _b (.055)	0.56 _a (.134)
Describing	-0.14 _a (.050)	-0.52 _b (.067)	1.90 _c (.1-6)
Acting with Awareness	-0.70 _a (.046)	0.87 _b (.066)	0.98 _b (.105)
Non-Judging	-0.71 _a (.044)	0.88 _b (.064)	1.01 _b (.116)
Non-Reactivity	0.44 _a (.049)	-1.15 _b (.059)	0.90 _c (.099)
FFMQ Total Score	-0.30 _a (.050)	-0.28 _a (.059)	2.04 _b (.102)
<i>Psychological Health Outcomes</i>	<i>M (SE)</i>	<i>M (SE)</i>	<i>M (SE)</i>
Depressive Symptoms	0.34 _a (.061)	-0.17 _b (.083)	-1.09 _c (.145)
Anxiety Symptoms	0.51 _a (.060)	-0.50 _b (.072)	-1.07 _c (.111)
Rumination	0.65 _a (.038)	-0.93 _a (.086)	-0.60 _c (.137)
Suicidality	0.34 _a (.075)	-0.22 _b (.064)	-0.97 _c (.048)
PTSD Symptoms	0.54 _a (.061)	-0.50 _b (.067)	-1.15 _c (.107)
Alcohol Misuse	0.24 _a (.074)	-0.08 _b (.072)	-0.90 _c (.081)
Drug Abuse Symptoms	0.02 _a (.073)	0.31 _b (.114)	-0.84 _c (.068)
<i>Clinical Cutoff Percentages</i>	<i>M (SE)</i>	<i>M (SE)</i>	<i>M (SE)</i>
Probable Depressive Episode	74% _a (.030)	61% _b (.046)	14% _c (.057)
Probable Drug Use Disorder	45% _a (.034)	53% _a (.047)	3% _b (.035)
Hazardous Drinking	66% _a (.033)	63% _a (.045)	19% _b (.061)
Probable Alcohol Use Disorder	53% _a (.034)	37% _b (.045)	1% _c (.029)
<i>Military Treatment Seeking Percentages</i>	<i>M (SE)</i>	<i>M (SE)</i>	<i>M (SE)</i>
VA Services for Mental Health	73% _a (.035)	69% _a (.047)	27% _b (.076)
Non-VA Services for Mental Health	72% _a (.036)	61% _a (.049)	27% _a (.076)
VA Services for Alcohol or Drug Use	57% _a (.039)	58% _a (.050)	2% _b (.036)
Non-VA Services for Alcohol or Drug Use	47% _a (.039)	54% _a (.050)	2% _b (.036)

Note. Means sharing a subscript in a row indicate means that are not significantly different from each other.