Longitudinal Associations between Posttraumatic Stress Disorder

and Metabolic Syndrome Severity

**Supplementary Material**

**Supplementary Methods**

Additional Recruitment and Sampling Methods

Potential participants were recruited from a roster provided by the VA Environmental Epidemiology Service. Potential participants (n = 4,331) were contacted by phone; of these, 2712 (62.6%) consented to participate. Of consented participants, 2,169 (80.0%) completed the questionnaires and 1,649 (60.8%) completed both the questionnaires and the diagnostic interview and comprised the complete Project VALOR cohort.

Comparison of Subjects with versus without T2 Data

Those missing T2 MetS data were slightly younger (*M* = 36.36 years, *SD* = 9.42) than those who had T2 MetS data (*M* = 38.46, *SD* = 10.11, *t* [1,353] = 3.51, *p* < .001) and they also had slightly lower PTSD severity scores (*M* = 9.55, *SD* = 4.87 vs *M* = 10.16, *SD* = 4.75; *t* [1,353] = 2.13, *p* = .03). There were no differences between the two groups with respect to total number of T1 traumatic life events, MetS-related variables, sex, or race.

Time between Posttraumatic Stress Disorder (PTSD) and Metabolic Syndrome (MetS) Assessments

At Time 1 (T1), the mean time between the PTSD assessment and the date the biometric parameters were obtained was -.08 months (*SD* = 2.25, range: -6.0 to 5.90), indicating that, on average, the MetS data were dated slightly prior to the PTSD assessment. At Time 2 (T2), the mean time between the PTSD and MetS assessments was -.10 months (*SD* = 2.26, range: -5.87 to 5.80). The time between PTSD assessments ranged from 18.80 to 56.50 months and averaged 29.78 months (*SD* = 6.89).

Additional measures that were the focus of secondary data analyses

**The Patient Health Questionnaire (PHQ)**. The PHQ (Spitzer et al., 1999) is a self-report version of the PRIME-MD. The PHQ is a 58-item questionnaire, which assesses eight somatic diagnoses divided into threshold and subthreshold disorders. One of these diagnoses is depression, which is assessed using the PHQ-9. The PHQ-9 is a nine item scale with response scores ranging from 0 to 3. The PHQ-9 can be used either dichotomously (to identify probable depression) or continuously (as a measure of severity). In this study, it was used as a dichotomous measure based on the *DSM-IV* major depressive disorder diagnostic criteria (i.e., endorsement of little interest or pleasure in doing things or feeling down, depressed, or hopeless, as well as endorsement of at least 5 total depressive symptoms occurring more than half the days in the past-two weeks; see Spitzer et al., 1999).

**Combat Experiences Scale of the Deployment Risk and Resilience Inventory**. We assessed the extent of combat exposure at postdeployment using a modified version of the Combat Experiences Scale of the Deployment Risk and Resilience Inventory (DRRI; King et al., 2006). The modified scale consists of the same 15 items from the original measure except that it utilizes a 5-point Likert-type scale (1 = never and 5 = daily or almost daily) to determine the extent of combat exposure severity. It also included an additional item to assess the extent to which military members participated in a support convoy. Item scores on this measure were summed (range = 16–80), with higher scores indicating greater combat exposure severity.

**The Alcohol Use Disorders Identification Test (AUDIT)**.The AUDIT (Saunders, Aasland, Babor, Fuente, & Grant, 1993) is a 10-item questionnaire of alcohol misuse, with item response options ranging from 0 to 4. Items are totaled to indicate severity of problematic alcohol use, with higher scores indicative of greater severity.

**Smoking Assessment**. We did not have data pertaining to T1 cigarette use but at T2, cigarette use was assessed via 5 self-report items from the Smoking and Tobacco Use Questionnaire that is embedded in the National Health and Nutrition Examination Survey Questionnaire (NHANES; Centers for Disease Control, 2009). This included an assessment of lifetime and current cigarette use (yes/no). These two items were included in analyses described below.

**Psychotropic Medication Use**. We extracted data regarding psychotropic medication use from the VA electronic medical record. We created dichotomous variables that reflected use of anti-depressants, sedatives, anti-psychotics, or opioids in the 6 months before or after the SCID-based PTSD assessments. These were included in potential confounder analyses described below.

**Supplementary Results**

Bivariate Correlations between PTSD and MetS Severity

As shown in Supplementary Table 1 (below), PTSD and MetS severity were concurrently associated with each other at each time point. In addition, T1 PTSD severity was associated with T2 MetS severity and T1 MetS was associated with T2 PTSD severity. The total number of different T1 traumatic experiences was weakly associated with T1 but not T2 MetS severity.

Analyses of potential covariates of T1/T2 PTSD and MetS

Bivariate correlations revealed that: (a) race (dichotomized into majority/minority with minorities as the reference group) was associated with PTSD severity at T1 (*r* = -.05, *p* = .047) and T2 (*r* = -.12, *p* < .001); (b) sex (women as reference group) was associated with MetS at T1 (*r* = .23, *p* < .001) and T2 (*r* = .19, *p* < .001); (c) age was associated with T1 PTSD (*r* = .08, *p* = .003), and with MetS at T1 (*r* = .25, *p* < .001) and T2 (*r* = .25, *p* < .001); and (d) educational attainment was associated with PTSD at T1 (*r* = -.10, *p* < .001) and T2 (*r* = -.10, *p* = .001) and with MetS at T1 (*r* = -.10, *p* < .001) and T2 (*r* = -.11, *p* = .001). Based on these results, as detailed in the main text, we included these demographic variables in the primary path models. None of the time difference variables were significantly correlated with MetS or PTSD severity.

Analyses of potential psychological confounds of our primary results

We wondered if other forms of trauma exposure (combat, as assessed on the DRRI), lifetime and current cigarette use (as assessed via self-report at T2) and other psychopathology (T1/T2 depression, as assessed with the PHQ-9, and T1/T2 alcohol misuse as assessed by the AUDIT total score) might account for our primary PTSD to MetS cross-lagged effects. To investigate this, we first computed partial correlations between each potential confounding variable and MetS at T1 and T2 controlling for age, sex, race, education, and T1 or T2 PTSD severity. There were no significant partial correlations between combat exposure or cigarette use and MetS; however, major depression at T2 was significantly associated with MetS at T2 (*r* = .08, *p* = .019), controlling for age, race, sex, education, and T2 PTSD severity. In addition, alcohol misuse at T1 was negatively correlated with MetS severity at T1 (*r* = -.08, *p* = .002) and at T2 (*r* = -.08, *p* = .014), controlling for age, sex, education, race, and T1 PTSD severity. Alcohol misuse at T2 was not significantly associated with MetS severity at T2 (*r* = -.06, *p* = .079), controlling for age, sex, race, education and T2 PTSD severity.

Given this pattern of results and our primary concern about potential confounds in our T1 PTSD to T2 Mets cross-lagged associations, we ran a series of follow-up linear regressions. In the first, we included T1 depression as a predictor of T2 MetS severity with age, sex, race, education, T1 MetS severity, and T1 PTSD severity in the model. There were no significant effects of T1 depression (β = .002, *p* = .947). In the second, we included T2 depression as a predictor of T2 MetS severity with age, sex, race, education, T1 MetS severity and T1 PTSD severity in the model and found that T2 depression was not significantly related to T2 MetS (β = .034, *p* = .20). In both instances, T1 PTSD severity continued to evidence a significant association with T2 MetS. In a third regression, we included total T1 AUDIT scores as a predictor of T2 MetS severity controlling for age, sex, race, education, T1 MetS severity, and T1 PTSD severity. Results indicated that T1 alcohol misuse was not a significant predictor of MetS (β = -.04, *p* = .10), while T1 PTSD remained significantly associated (β = .07, *p* = .004). In sum, none of these potential confounding variables altered our main pattern of results.

Analyses of potential psychotropic medication use confounds of our primary results

At T1, the use of psychotropic medications per the medical record (within +/- 6 months of the PTSD interview) was as follows: opioid prescription = 26.5%, sedative prescription = 31.9%, antidepressant prescription = 66.8%, and antipsychotic prescription = 13.5%. At T2, among the 971 participants with T2 data, use of these medications was as follows: opioid prescription = 15.3%, sedative prescription = 20.8%, antidepressant prescription = 49.9%, and antipsychotic prescription = 9.1%.

As before, we computed partial correlations between use of each medication class at T1 and T2 and T1/T2 MetS severity controlling for age, sex, education, and PTSD severity (at T1 or T2, as appropriate). Cross-sectional partial correlations revealed that T1 opioid (*r* = .13, *p* < .001), sedative (*r* = .07, *p* = .012), anti-depressant (*r* = .11, *p* < .001) and antipsychotic (*r* = .10, *p* < .001) medication classes were significantly associated with T1 Mets severity, controlling for the aforementioned variables. At T2, cross-sectional partial correlations revealed that opioid (*r* = .08, *p* = .015), sedative (*r* = .09, *p* = .004), antidepressant (*r* = .14, *p* < .001), and antipsychotic (*r* = .08, *p* = .017) use were also associated with T2 MetS severity controlling for the aforementioned variables.

As the primary association of interest was longitudinal in nature, we also computed the partial correlations between T1 psychotropic use and T2 MetS severity controlling for T1 PTSD severity and the other demographic covariates named above. Doing so revealed partial correlations between opioid, antidepressant, and antipsychotic use and T2 MetS severity. Based on this, we then ran a regression analysis in which we included these three classes of T1 medications, T1 PTSD and MetS severity, and the demographic covariates as predictors of T2 MetS severity. Doing so revealed that none of the medication classes were significantly associated with subsequent MetS severity (smallest *p* was for antidepressant use, *p* = .054), while T1 PTSD severity remained significantly associated with T2 MetS severity (*p* = .04).

To be thorough, we also ran the same regression but included T2 psychotropic medication use in the model instead of T1. In this analysis, only T2 antidepressant use was significantly associated with T2 MetS severity (β = .06, *p* = .019), but T1 PTSD severity continued to be associated with increased MetS severity at T2 (β = .05, *p* = .04). In sum, while psychotropic medication use was associated with MetS severity, inclusion of psychotropic medication use in the model did not alter our primary findings with respect to PTSD predicting increasing MetS severity over time.

**References**

**Centers for Disease Control and Prevention (CDC)**. **National Center for Health Statistics (NCHS)** (2009). *National Health and Nutrition Examination Survey Questionnaire*. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

**King L, King D, Vogt D, Knight J, Samper R** (2006). Deployment Risk and Resilience Inventory: A collection of measures for studying deployment-related experiences of military personnel and veterans. *Military Psychology* **18**, 89-120.

**Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M** (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption—II. *Addiction* **88**, 791-804.

**Spitzer RL, Kroenke K, Williams JB** (1999). Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. *JAMA* **282**, 1737-1744.

**Supplementary Table S1**

*Bivariate Correlations (and n) Among Trauma Exposure, PTSD Severity, and MetS Severity at Each Time Point*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | 1 | 2 | 3 | 4 | 5 |
| 1. T1 PTSD Severity | 1.00 | 1,355 | 1,124 | 971 | 1,353 |
| 2. T1 MetS Severity | .15\*\*\* | 1.00 | 1,124 | 971 | 1,353 |
| 3. T2 PTSD Severity | .67\*\*\* | .11\*\*\* | 1.00 | 971 | 1,122 |
| 4. T2 MetS Severity | .17\*\*\* | .63\*\*\* | .10\*\* | 1.00 | 969 |
| 5. T1 Traumatic Experiences | .32\*\*\* | .06\* | .30\*\*\* | .03 | 1.00 |

*Note.* The numbers in the bottom half of the triangle reflect Pearson correlation coefficients. The numbers in the top half of the triangle reflect the sample size for each correlation, given missing data. The number of traumatic experiences reflects the total number of events endorsed on the Life Events Checklist. T1 = time 1; T2 = time 2; PTSD = posttraumatic stress disorder; MetS = metabolic syndrome.

\**p* < .05. \*\**p* < .01. \*\*\**p* < .001.