Brief Communication

Diagnostic utility of the Minnesota Multiphasic Personality Inventory-2 Restructured Form in the epilepsy monitoring unit: Considering sex differences

Cayla J. Duncan [a], Nicole A. Roberts [a], Kristin A. Kirlin [b], David Parkhurst [a], Mary H. Burleson [a], Joseph F. Drazkowski [c], Joseph I. Sirven [c], Katherine H. Noe [c], Amy Z. Crepeau [c], Matthew T. Hoerth [c], Dona E.C. Locke [b],*

[a] School of Social and Behavioral Sciences, Arizona State University, 4701 W. Thunderbird Rd. MC 3051, Glendale, AZ 85306, USA
[b] Division of Psychology, Mayo Clinic Arizona, 13400 E. Shea Blvd., Scottsdale, AZ 85259, USA
[c] Department of Neurology, Mayo Clinic Arizona, 5777 E. Mayo Blvd., Phoenix, AZ 85054, USA

A R T I C L E   I N F O

A B S T R A C T

Psychological assessment measures are frequently used to evaluate patients in epilepsy monitoring units. One goal of that assessment is to contribute information that may help with differential diagnosis between epilepsy and psychogenic nonepileptic seizures (PNES). The Minnesota Multiphasic Personality Inventory-2 Restructured Form (MMPI-2-RF) is one such measure. Del Bene et al. (2017) recently published an analysis that was the first to compare MMPI-2-RF scale elevations between diagnostic groups stratified by sex. The purpose of the present study was to replicate that analysis in a larger sample. Similar to previous work, we found that both men and women with PNES were more likely than men and women with epilepsy to report high levels of somatic complaints (2 to 5 times greater odds of somatic symptom reporting) and a variety of types of complaints. Mood disturbance scales were not significantly elevated in our PNES sample. Results contribute to the small body of research on sex differences in patients with PNES and suggest that somatization is a key characterization across sexes.

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1. Introduction

Psychogenic nonepileptic seizures (PNES) are seizure-like behaviors that can appear similar to epileptic seizures (ES) but that lack the expected electrocortical abnormalities. Despite a large literature attempting to identify clinical tools to differentiate PNES and ES, such differentiation remains challenging [1,2]. The Minnesota Multiphasic Personality Inventory-2 (MMPI-2) is a personality assessment tool used by neuropsychologists in epilepsy monitoring units (EMUs) to evaluate patients' psychological functioning and inform diagnostic comparisons of PNES and ES based on patient profiles [3,27]. Studies have found group differences between patients with PNES and ES in multiple somatic complaints scales using the MMPI-2 [4–6].

Previously, we evaluated the potential clinical utility of the MMPI-2 Restructured Form (MMPI-2-RF; [7,8]) with respect to differential diagnosis of ES and PNES [9] as it is a more uniform and reliable restructured version of the MMPI-2. We reported sensitivity, specificity, overall percentage of the sample classified correctly, and likelihood ratios for the MMPI-2-RF scales at different clinical cut points. We found that the restructured clinical somatic complaints scale (RC1), the somatic/cognitive subscales of head pain complaints (HPC), neurological complaints (NUC), and malaise (MLS), and the symptom validity (FBS-r) subscale showed the greatest potential for predictive utility of the MMPI-2-RF scales while controlling for the effects of sex and current psychotropic medications. Furthermore, adding the RC1 scale improved the predictive accuracy of a model that included demographic and clinical risk factors specifically sex, number of years of seizures, frequency of seizures, number of antiepileptic drugs (AEDs), current psychotropic medication, and psychiatric history.

Del Bene et al. [10] also explored whether there were greater odds of MMPI-2-RF scale elevations among patients with PNES versus patients with epilepsy. Consistent with our own research and that of others [9,11,12], Del Bene et al. [10] found that individuals with PNES, compared with individuals with ES, had overall greater odds of clinical elevations (scores of 65 or greater) and marked clinical elevations (scores of 80 or greater) on the RC1 and dysfunctional negative emotions (RC7) scales. They also examined sex differences and found that women with PNES had 3 to 6 times greater odds of scale elevations for RC1, RC7, and Suicidal/Death Ideation (SUI) than women with ES; men with PNES were 5 to 15 times more likely to score above the clinical

threshold on RC1 and HPC than men with ES. This suggests that somatic complaints are relevant diagnostic indicators for both men and women with PNES but that there may be differences in other aspects of their presentations [13]. This echoes a larger literature suggesting men can manifest psychological concerns differently from women [14]. Furthermore, given that odds of elevation on the RC1 scale are greater in men with PNES versus men with epilepsy than in women with PNES versus women with epilepsy, these indicators may be more strongly predictive of PNES among men than among women.

As most patients with PNES are women [15–18], relatively few studies have evaluated sex differences in a large sample. In one prior study of patients with seizure disorders (95% epilepsy, 5% PNES), sex contributed significantly to the variance explained in regression models where MMPI-2-RF RC1 and RC7 scales were used to predict the corresponding MMPI-2 scales (Hypochondriasis and Psychasthenia, respectively), with women showing decreased odds of scale elevations compared with men; sex was not a significant contributor for other scales [19]. These results support the notion that sex can be a meaningful consideration when using the MMPI-2-RF as a diagnostic tool in seizure patient samples, particularly for clinical scales that have demonstrated diagnostic reliability in distinguishing PNES from epilepsy [5,9,10].

Thus, the objective of the present paper was to extend our previous findings by examining the MMPI-2-RF's predictive utility separately for men and women. This also provided an opportunity to replicate and compare our results with those of Del Bene et al. [10] using a much larger sample. We note that our sample overlaps with that reported in Locke et al. [9] and Locke and Thomas [5], with 12.3% of the present sample comprising new patients.

2. Methods

2.1. Participants

Our sample was drawn from 485 EMU patients with video-electroencephalography (video-EEG) confirmed diagnoses of either ES or PNES and who had completed the MMPI-2-RF or completed the MMPI-2, and it was rescored into the RF version (see below). Data from 429 of these participants were collected from 2001 to 2009 and were reported in Locke et al. [9] and Locke and Thomas [5], and data from an additional 56 patients were collected since 2010. The original 429 completed the MMPI-2, and the additional 56 patients completed the MMPI-2-RF. Diagnoses were made by a board-certified neurologist (for further detail, see [9]).

All MMPI-2-RF profiles were reviewed for invalid profiles due to missing data (cannot say >15) or random responding (variable response inconsistency [VRIN ≥ 80] scale and true response inconsistency [TRIN ≥ 80]). Thirty-two MMPI-2-RF protocols (20 from patients with ES and 12 from patients with PNES; 30 from our initial sample and 2 from patients added since 2010) were excluded from the analyses (6 cannot say >15; 9 VRIN ≥80; 15 TRIN ≥80; 2 VRIN and TRIN ≥80). In addition, one patient from the newly added sample did not report sex and, therefore, was not included in further analyses. Thus, our final sample consisted of 452 patients with complete and valid MMPI-2-RF profiles and included 323 women (136 = ES, 187 = PNES) and 129 men (85 = ES, 44 = PNES).

2.2. Procedure

The MMPI-2 was administered during a neuropsychological assessment that was part of routine clinical practice. Minnesota Multiphasic Personality Inventory-2 profiles were electronically rescored into the MMPI-2-RF using the QLocal rescoring procedure. QLocal is the scoring software for the MMPI-2/MMPI-2-RF sold by Pearson Assessments, the test publishing company that publishes the MMPI-2 and MMPI-2-RF products. Within the QLocal computerized scoring system, there is a

process for automated rescoring of the 338 items that comprise the MMPI-2-RF from a prior administration of the 567 item MMPI-2.

Minnesota Multiphasic Personality Inventory-2 Restructured Form data, along with demographic information and clinical history, were entered into a database; any identifying information was subsequently removed. Because the database included only existing, de-identified information, the study was considered exempt by the Mayo Clinic Institutional Review Board.

2.3. Statistical analyses

As we did not previously examine sex differences [9], we examined in the current study diagnostic (PNES vs. ES) group differences in MMPI-2-RF scores, separately for men and women, using a multivariate analysis of covariance (MANCOVA) for each group of MMPI-2-RF scales of interest (validity, higher-order, restructured clinical, somatic/cognitive). We included current use of psychotropic medication as a covariate and used an alpha of 0.01 (see Table 2). Second, for scales with significant diagnostic group differences based on the MANCOVAs (see [9]), we calculated separately for women and men the sensitivities, specificities, likelihood ratios, and overall correct classification rate (calculated as correct classifications divided by all classifications: true positives + true negatives / true positives + true negatives + false positives + false negatives) of a PNES or epilepsy diagnosis based on a binarization of T-scores at both clinically elevated (T ≥ 65) and markedly elevated (T ≥ 80) thresholds (see [10]). For the scales showing significantly increased likelihood of elevation for men or women with PNES, we also calculated the odds ratios, positive and negative predictive values (PPV and NPV), false omission rates (FOR), and false discovery rates (FDR).

3. Results

3.1. Descriptive analyses: demographics and clinical history

Demographic and clinical history comparisons of PNES and ES without sex stratification are consistent with those reported in our prior paper and are not duplicated here. Table 1 presents a summary of demographic and clinical information for patients with ES and PNES separated by sex. For both women and men, those with epilepsy reported having seizures for a greater number of years and reported taking a greater number of AEDs upon admission than those with PNES; conversely, those with PNES were more likely to have a psychiatric treatment history and to be taking psychotropic medication than those with epilepsy. In addition, women with PNES reported more frequent seizures than women with epilepsy, whereas the difference in reported seizure frequency did not reach statistical significance for men.

3.2. Diagnostic accuracy of MMPI-2-RF scales by sex

Among women, we found diagnostic group differences for the FBS-r, adjustment validity (K-r), RC1, cynicism (RC3), HPC, NUC, and MLS scales. Women with PNES showed higher scores than women with epilepsy on all of these scales with the exception of RC3 on which they showed lower scores (see Table 2). Somatic complaints and NUC showed the largest effect sizes. In terms of correctly classifying women with PNES or epilepsy, the RC1 scale showed the best overall correct classification rate (67%) at the clinical symptom threshold (with classification rates of 65% for the NUC scale and 64% for the FBS-r scale) while the NUC scale showed the best overall correct classification rate (63%) at the markedly elevated symptom threshold (see Table 3).

Among men, we found diagnostic group differences for the RC1, NUC, and MLS scales; men with PNES had higher scores on these three scales than men with epilepsy. Somatic complaints and MLS showed the largest effect sizes (see Table 2) and correctly classified