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Evaluating the performance of the MMPI-3 over-reporting scales: sophisticated simulators and the effects of comorbid conditions

Nicole M. Morris, Jessica Mattera, Brittney Golden, Serena Moses and Paul B. Ingram

Department of Psychological Sciences, Texas Tech University, Lubbock, TX, USA

ABSTRACT

Objective: We examined the utility of the Minnesota Multiphasic Personality Inventory-3 (MMPI-3) to detect feigned over-reporting using a symptom-based coaching simulation design across a control group and three diagnostic conditions: posttraumatic stress disorder (PTSD), minor traumatic brain injury (mTBI), and comorbid PTSD and mTBI. **Method:** Participants were310 college students who wererandomly assigned to one of the four conditions. For participants in the feigning conditions, they were provided with a descriptionof their respective disorder condition throughout the duration of the session and asked to feign according to their condition while completing the MMPI-3. **Results:** MMPI-3 over-reporting scales perform well at classifying feigning. There is low sensitivity, high specificity, and effect magnitudes are medium to large range (1.12 – 2.47). There are no differences in scales assessing over-reporting between diagnostic conditions with dissimilar symptoms. **Conclusions:** Findings provide initial support for the use of the MMPI-3 overreporting scales for detecting feigned PTSD, mTBI, and comorbid PTSD and mTBI. Further, individuals feigning different disorders, namely PTSD, mTBI, and comorbid PTSD and mTBI, feign predominantly general psychopathological symptoms, making Fp the strongest scale in terms of detecting these feigned disorders. Future research will benefit from establishing relevant diagnostic comparison groups to contrast with this study and utilizing known-group designs withboth PVT and SVT administration.

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In many contexts, it is beneficial, and often profitable, for individuals to misrepresent symptoms to achieve a more advantageous outcome (Rogers & Bender, 2003). Thus, accurately detecting invalid responding is central to good psychological testing as interpretation relies on respondents providing accurate information about their symptoms, attitudes, and beliefs (Rogers & Bender, 2018). Undetected invalid responding limits the capacity to interpret clinical scale content (Burchett & Ben-Porath, 2010).

CONTACT Nicole M. Morris nmlemaster1@gmail.com Department of Psychological Sciences, Texas Tech University, 2810 18th Street, Lubbock, TX 79424, USA.

Misrepresentation of functioning undercuts the validity of assessment data and leads to unnecessary costs, which may include erroneously recommended treatment (i.e.,lengthy hospital stays, treatment programs), use of clinical resources (i.e.,time and clinician availability), costly and inappropriate prescription medication, disability compensation, and general strain on the healthcare system (Taylor et al., 2007).

The Minnesota Multiphasic Personality Inventory (MMPI) family of instruments are the most widely used (Wright et al., 2017) and frequently trained (Ingram et al., 2020) of personality assessment instruments. The MMPI-3 (Ben-Porath &Tellegen, 2020a) is the most recent version of the MMPI and an updated version of the MMPI-2-RF (Ben-Porath &Tellegen, 2008/2011). The MMPI-3 updates include a revised normative sample that is comparable to the current United States census and several new scales. There were also item changes made to most MMPI-2-RF scales, such as wording changes to increase content clarity. The MMPI-3 is composed of 335 items. While many come directly from the MMPI-2-RF item pool (263; 78% of items), the MMPI-3also contains 72 new items and 43 items with revised wording. Updates to the validity scales are particularly relevant for this study.

All validity scales were renormedandsome also include item content changes. The Symptom Validity Scale (FBS) and the Response Bias Scale (RBS) were unchanged in content. The MMPI-3's F scale (F-r on the MMPI-2-RF) consists of 35 items, nine of which are new to the MMPI-3 (25.7% new content). Fp (previously Fp-r) contains 21 items, including four items which replaced MMPI-2-RF scale content (19% new content), while Fs scale contains 16 items, two of which are new to the MMPI-3 and one which was reworded (12.5% new content). In addition to the MMPI-3 Technical Manual (Ben-Porath &Tellegen, 2020b), two studies have investigated the MMPI-3 over-reporting scales. First, Whitman et al. (2020) utilized a simulation design with an undergraduate sample to investigate the capacity of the revised MMPI-3 scales (F, Fp, Fs) to detect nonspecific feigned psychopathology(e.g., feign a serious mental health problem to obtain a lesser sentence on a legal charge) and found large effect sizes (Cohen's d_{Mean}= 4.03). Second, Tylicki et al. (2020) examined RBS in a non-head injury related disability claimant sample and found medium to large effectsdepending on the criterion (d = .71 – 1.01).

This study examines MMPI-3 over-reporting scale effectiveness in detecting symptom-based coaching of over-reporting across three feigning conditions (posttraumatic stress disorder [PTSD], mild traumatic brain injury [mTBI], and PTSD + mTBI) relative to each other, and to a control condition of honest responders. PTSD and mTBIfrequently co-occur and areconceptually related to different types of feigning (e.g., psychopathology and somatic/cognitive, respectively). As such, these conditions should be differentiated across validity scales depending on what the scale measures. Indeed, MMPI-2-RF research has found that mTBI produces elevations on somatic/cognitively based scales more so than on those assessing psychopathology (see Jurick et al., 2019). Research on mTBI feigning is limited on the MMPI-2-RF within the context of co-occurring conditions, such as PTSD presentation (e.g., Arbisi et al., 2011) despite condition moderating scale effectiveness (e.g., Ingram & Ternes, 2016; Olsen & Veltri, 2018). Such research is non-existent on the MMPI-3 given its recent release.We expected that the over-reporting scales would demonstrate medium to large effect size differences (d = 1.0 – 1.5) between honest respondents and all three feigning

groups, consistent with MMPI-2-RF simulation studies (Ingram & Ternes, 2016). Smaller effects were expected between diagnostic groups and the comorbid condition was hypothesized to have higher scale means and more frequent scale invalidations, relative to other diagnostic conditions.

Methods

Participants

After excluding 76 individuals from the analyses if they produced invalid protocols based on non-content responding scales on the MMPI-3: (Cannot Say [CNS] ≥ 18 or Combined Response Inconsistency [CRIN], True Response Inconsistency [TRIN], or Variable Response Inconsistency [VRIN] ≥ 80T), participants were 310 students at a large southwestern universityin the United Stateswho were administered the MMPI-2-RF-Expanded (MMPI-2-RF-EX) from which the MMPI-3 can be scored (Hall et al., 2021). The final sample identified mostly as female first year college students who are White, with a majority of non-Hispanic origin (Table 1).

Measures

MMPI-3. The MMPI-3 is composed of 335 true/false items which assess personality and psychopathology (Ben-Porath &Tellegen, 2020a). It includes ten validity scales (three non-content-based responding, five over-reporting, and two under-reporting), with the new scale (CRIN) measuring a pattern of mixed non-content-based responding. The MMPI-3 also has 42 substantive scales: three Higher-Order Scales, eight Restructured Clinical (RC) Scales, and 26 Specific Problems Scales. Scales are organized hierarchically and supplemented by the Personality Psychopathology Five (PSY-5) scales. For additional reliability and validity data, the reader is referred to the *MMPI-3 Technical Manual* (Ben-Porath &Tellegen, 2020b).

Procedure

After receiving IRB approval, participants were recruited from a student research pool and data was collected during an in-person study session. After participants consented to the study and basic demographic information was collected, participants were randomly assigned to feign one of the psychiatric conditions in the study, or to respond honestly. Participants were instructed to attempt to feign in an accurate and believable manner. A description of the condition specific symptoms were read aloud by a research assistant and participants were provided with printed information about diagnostic criteria/symptoms for their condition, which they were able to reference during the study (Appendix A). To ensure comprehension, participants were also asked to explain the directions they received to the research assistant. All participants successfully provided a verbal explanation of the administration directions.Theyreceived course credit for participation.

All groups were compared using rounded/truncated T-scores of the MMPI-3 over-reporting scales andUnivariate Analysis of Variance (ANOVAs) with post-hoc

Table 1. Demographic characteristics.

	Feigning (n = 225)		Control (n = 85)	
	n	%	*n*	%
Gender*				
Female	177	79.0%	73	85.7%
Male	48	21.0%	12	14.3%
Ethnicity				
White	139	60.7%	49	58.3%
LatinX	29	12.7%	16	19.0%
Black/African American	19	8.3%	9	10.7%
Other	25	10.9%	10	11.9%
Student Status				
Freshman	135	59.0%	39	46.4%
Sophomore	35	15.3%	20	23.8%
Junior	27	11.8%	14	16.7%
Senior	14	6.1%	10	11.9%
Other	1	0.4%	1	1.2%

Note. Feigning groups are combined across conditions. *All participants identified as cisgender. Chi Square tests indicated that feigning groups (i.e., PTSD, mTBI, and mTBI + PTSD) did not differ in their distribution of individuals as a function of gender or ethnicity.

testing. Cohen's *d* effect sizes were calculated to assess magnitudes of observed differences. Consistent with recommendations of Rogers et al. (2003), Cohen *d* effect magnitudes were interpreted as: ≥ .75 as moderate,≥ 1.25 as large, and ≥ 1.75 as very large. Clinically meaningful group differences were identified *a priori* as having a statistically significant univariate f-statistic and post-hoc testing, as well as exceeding a medium effect size (Rosnow et al., 2000). Sensitivity, specificity, positive predictive value, and negative predictive value were calculated across cut scores for each over-reporting scale, with .90 specificity indicating good classification (Sherman et al., 2020).

Results

ANOVA results (Table 2) indicated significant differences between all five MMPI-3 over-reporting validity scales (F, Fp, Fs, FBS, and RBS). Post-hoc results indicate that those within the feigning groups scored higher than those within the control group across each scale (Table 2, Average M_{diff}= −28.3). Differences between the control and feigning groups are very large in effect (d = 1.00 to 2.47). There were no differences between the feigning groups. Effect magnitudes between mostfeigning groups fell below the threshold of a small effect and none exceeded a medium effect. Sensitivity and specificity, as well as positive and negative predictive value, were calculated (Table 3). In general, scales have modest positive identification of those feigning (sensitivity) and a high capacity to identify honest respondents (specificity). At recommended cut-values, specificity was always above a .90 threshold (M= .96).

Discussion

The current study utilized a simulation design to investigate the effectiveness of the MMPI-3 overreporting validity scales in detecting overreported feigning of PTSD, mTBI,

Table 2. ANOVA results.

		1. Control		2. PTSD		3. mTBI		4. PTSD + mTBI	
		n = 85		*n* = 81		*n* = 70		*n* = 74	
	F	M (SD)	% ≥ CS	M (SD)	% ≥ CS	M (SD)	% ≥ CS	M (SD)	% ≥ CS
F	33.54*	53.5 (15.3)[a]	1.20%	89.2 (32.3)	49.40%	79.8 (27.1)	37.10%	91.2 (31.1)	50.0%
Fp	28.55*	56.4 (15.4)[a]	1.20%	89.5 (31.8)	48.10%	79.1 (28.8)	37.10%	91.8 (30.9)	51.4%
Fs	36.99*	54.3 (13.2)[a]	1.20%	87.1 (28.8)	44.40%	84.1 (27.9)	30.00%	88.4 (27.9)	43.2%
FBS	33.85*	52.9 (10.6)[a]	0.00%	69.5 (15.1)	0.00%	71.7 (13.7)	0.00%	70.6 (15.4)	0.0%
RBS	36.31*	53.1 (11.7)[a]	1.20%	82.0 (25.6)	32.10%	77.6 (20.1)	17.10%	82.8 (24.6)	31.1%
Cohen's d Effect Size									
	1 v 2	1 v 3	1 v 4	2 v 3	2 v 4	3 v 4			
F	**1.42**	**1.22**	**2.47**	−0.32	0.06	−0.39			
Fp	**1.33**	**1.00**	**1.47**	−0.34	0.07	−0.42			
Fs	**1.47**	**1.57**	**1.59**	−0.11	0.05	−0.17			
FBS	**1.28**	**1.55**	**1.35**	0.15	0.07	−0.07			
RBS	**1.46**	**1.52**	**1.57**	−0.19	0.03	0.23			

Note. % ≥ CS = percent of cases that elevated beyond recommended cut-scores.
*p <.01.
[a]= Control group produced significantly lower mean scores than each of the feigning conditions; F = Infrequent Responses; Fp = Infrequent Psychopathology Responses; Fs = Infrequent Somatic Responses Scale; FBS = Symptom Validity Scale; RBS = Response Bias Scale.

Table 3. Classification accuracy of MMPI-3 scales for control versus any feigning condition.

MMPI-3 Scale	CS	Sens	Spec	PPV	NPV
F	100	.48	.93	.95	.39
	95	.49	.92	.95	.39
	90	.50	.90	.94	.39
	85	.56	.90	.94	.42
	80	.59	.90	.95	.43
	75	.63	.84	.92	.44
	70	.64	.84	.92	.45
	65	.67	.78	.90	.45
Fp	100	.49	.96	.97	.40
	95	.49	.96	.97	.40
	90	.52	.92	.95	.40
	85	.52	.92	.95	.40
	80	.59	.87	.93	.42
	75	.63	.78	.89	.43
	70	.63	.78	.89	.43
	65	.67	.69	.86	.42
Fs	100	.43	.95	.96	.39
	95	.47	.95	.96	.38
	90	.54	.94	.96	.42
	85	.65	.87	.93	.46
	80	.64	.89	.94	.46
	75	.67	.86	.93	.47
	70	.67	.86	.93	.47
	65	.71	.80	.91	.49
FBS	100	.00	1.00	–	.26
	95	.01	1.00	1.00	.26
	90	.02	1.00	1.00	.26
	85	.16	1.00	1.00	.27
	80	.35	.99	.99	.35
	75	.49	.96	.97	.40
	70	.61	.89	.94	.44
	65	.66	.87	.94	.47
RBS	100	.34	.97	.96	.41
	95	.50	.97	.98	.40
	80	.55	.95	.97	.42
	85	.58	.92	.96	.43
	80	.63	.87	.93	.45
	75	.61	.90	.95	.44
	70	.63	.87	.93	.45
	65	.66	.87	.94	.47

Note. CS = Cutscore, Sens = Sensitivity, Spec = Specificity, PPV = Positive Predictive Value, NPV = Negative Predictive Value.

and comorbid PTSD andmTBI in a symptom-based coaching study. Results suggest that between those prompted to feign and those in the control condition there were meaningful differences across the validity scales of the MMPI-3. However, between the feigning conditions, differences were not observed between those feigning PTSD, mTBI, and comorbid PTSD and mTBI.

Across the overreporting scales, medium to large effects (d_{Mean}= 1.48, d_{Range}= 1.00 to 2.47) characterized differences observed between the control condition and each feigning condition. These effects are consistent with past meta-analytic research on the MMPI over-reporting scales (Ingram & Ternes, 2016). The existing, but limited, simulation feigning research on the MMPI-3 has noted substantially larger effect sizes estimates, particularly for detecting nonspecificover-reported psychopathology (Cohen's d_{Mean}=4.03, d_{Range}=2.35 to 5.56; Whitman et al., 2020). Whitman et al. (2020) found that Fp was the best over-reporting scale for detecting nonspecific feigned psychopathology (d = 5.56), with medium to large differences between it and the other over-reporting scales (Fp-F $d_{difference}$= 1.03 to Fp-FBS $d_{difference}$= 3.21). Thelarge effect sizes noted by Whitman et al. (2020)areatypical of feigning researchand may be due to their instruction to feign serious psychopathology within college students, who are known to producer higher scale elevations. Instead, we found smaller effects and no over-reporting scale was comparable to results reported by Whitman et al. (2020). Thus, the effect estimates we observed maymore closely approximate non-simulated clinicalpresentations and decision-making confidence as it relates to over-reporting scales. Our use of a coached simulation design, which is suggested for participants to respond in a manner more closely approximating clinical populations (Sellbom & Bagby, 2010), may have partially helped us achieve this result.

In terms of classification ability, the MMPI-3 over-reporting scales performed substantially better at specificity (true positive) than they do at sensitivity (true negative) when using a variety of cut-scores (Ben-Porath &Tellegen, 2020a), consistent with Whitman et al. (2020). As a result, secondary measures assessing response validity are necessary during psychological assessments (e.g., Sherman et al., 2020) as those feigning symptoms may go under-detected using standard MMPI-3 cut-scoresalone. Our results also support clinicians having confidence in the use of standard MMPI-3 cut scores as indicating an invalidated profile.

Previously, the type of disorder being feigned in simulation studies has moderated how participants approach responding to clinical content components on the MMPI (Olsen & Veltri, 2018; Veltri & Williams, 2013). This study examined if this differentiation by type of feigned pathology also existed on validity scales for the MMPI-3. Counter to our hypotheses, scale scores between the feigning groups did not differ in a clinically meaningful way. Despite providing coaching for disorders which differ in their underlying feigned symptom sets (Rogers, 2018) and despite instructions leading to distinctive patterns of responding relative to honest participants, our findings suggest that simulation participants do not differentially invalidate overreporting scales assessing different clusters of pathology (F/Fp for psychological, Fs/FBS somatic, and FBS/RBS cognitive symptoms; Ben-Porath &Tellegen, 2020a).

One implication of our findings is that participants in simulation designs use a mixed symptom presentation when feigning, consistent with what is also common

in clinical settings (Sherman et al., 2020). This finding is distinct from prior research using clinical samples which found that certain scales are particularly useful for detecting specific types of complaints (e.g., RBS for cognitive complaints; Gervais et al., 2010; Fs for somatic complaints; Sellbom et al., 2012). Studies on the moderating influence of disorder on feigning presentation (see Olsen &Veltri, 2019) focus only on psychopathology feigning. Thus, research on the moderating influence of disorders is limited and has not fully tested the degree to which feigned response differs across domains of feigned pathology (see Rogers, 2018). Research on feigning with the MMPI may wish to temporarily avoid classifying the effects from simulation studies under a single presentation domain (e.g., feigned mental pathology, cognitive, or somatic complaints) pending further investigation of feigning classification criteria (Sherman et al., 2020). Given the paucity of research on disorder moderation effects in simulation designs, particularly among distinct domains of pathology, these findings warrant caution and replication. These findings may be limited to simulation studies.

There are several limitations which must be considered. This study used a coached simulation design without clinical comparison samples, limiting direct generalizability (Roger & Bender, 2018). Our sample is also demographically restricted. However, results conform to the same patterns observed on the MMPI-2-RF (Ingram & Ternes, 2016) and MMPI-3 (Whitman et al., 2020) over-reporting scales, including in clinical samples. Thus, a simulation design does not invalidate our findings and offers the opportunity to further research validity scale performance across simulated diagnostic groups. Moreover, the inclusion of a comorbid group is novel to feigning research on the MMPI. The magnitude of effects observed are, however, likely larger than those which would be seen in similar clinical samples since simulation designs overestimate effect sizes. Future research will benefit from establishing diagnostic comparison groups to contrast with this study and utilizing known-groups designs based on both PVT and SVT administration. Replication across clinical settings is needed, and research would benefit from estimating scale sensitivity and specificity in those groups.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Nicole M. Morris http://orcid.org/0000-0001-6565-9816
Paul B. Ingram http://orcid.org/0000-0002-5409-4896

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Appendix a

Instruction 1: Comorbid PTSD and mTBI

"We are interested in how well people can pretend to be psychologically or emotionally disturbed on some tests. Please complete the testing as if you were trying to create the impression that you have psychological problems resulting from Posttraumatic Stress Disorder and mild Traumatic Brain Injury. That is, I want you to pretend you have problems associated with both of these conditions. Imagine that you want the Psychology Department to think that your symptoms are so bad that you cannot work and that you will need receive financial support to assist you because of your difficulties.

I want you to think and respond as close as someone with those disorders would be like on these tests. Your goal is for the testing to convince me that you really have these problems.

Instruction 2: PTSD

"We are interested in how well people can pretend to be psychologically or emotionally disturbed on some tests. Please complete the testing as if you were trying to create the impression that you have psychological problems resulting from Posttraumatic Stress Disorder. Imagine that you want the Psychology Department to think that your symptoms are so bad that you cannot work and that you will need receive financial support to assist you because of your difficulties.

I want you to think and respond as close as someone with PTSD would be like on these tests. Your goal is for the testing to convince me that you really have this problems.

Instruction 3: mTBI

"We are interested in how well people can pretend to be psychologically or emotionally disturbed on some tests. Please complete the testing as if you were trying to create the impression that you have psychological problems resulting from mild Traumatic Brain Injury. Imagine that you want the Psychology Department to think that your symptoms are so bad that you cannot work and that you will need receive financial support to assist you because of your difficulties.

I want you to think and respond as close as someone with mild TBI would be like on these tests. Your goal is for the testing to convince me that you really have this problems.

Instruction 4: Control – direct them to respond open and honestly so that the questions are accurate