ORIGINAL ARTICLE

Assessing the clinical utility of MMPI-2-RF interpersonal theory of suicide proxy indices in psychiatric hospitalization setting

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Abstract

Introduction: The Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF Ben-Porath & Tellegen, 2008/2011) has been applied to suicide risk assessment through derived proxy indices of perceived burdensomeness, thwarted belongingness, and the acquired capability for suicide (Anestis et al., 2018, Joiner, 2005). However, limited research has examined the clinical utility of these proxy indices outside the outpatient setting. This study examined the performance of these proxy indices in identifying past-month suicide ideation intensity and attempts upon admission to a psychiatric inpatient program and changes in suicidal ideation intensity at discharge. We expected these indices and their interaction would be associated with suicide ideation intensity and attempts at baseline and with a lack of significant improvement in suicide ideation intensity at discharge, including when controlling for MMPI-2-RF Suicide/Death Ideation (SUI) scale scores.

Method: Participants were 1007 patients in a private inpatient psychiatric hospital in the southwestern United States, 968 of whom completed study measures at admission and discharge. Participants were administered the C-SSRS and MMPI-2-RF upon admission, while the C-SSRS was administered again prior to discharge. A series of moderation analyses were conducted to examine the main and interaction effects of the MMPI-2-RF derived proxy indices on suicidal ideation intensity and suicide attempts at admission. Logistic regression analyses were conducted to examine whether MMPI-2-RF proxy index scores at admission were associated with changes in suicidal ideation intensity at discharge.

Results: Neither the proxy indices nor their interaction was associated with all study outcomes. The acquired capability for suicide proxy index and its interaction with other indices were not associated with suicide attempt status at admission. However, high thwarted belongingness proxy index scores were associated with greater suicidal ideation intensity at admission; high perceived burdensomeness proxy index scores were indicative of a lack of significant change in suicide ideation intensity at discharge.

Conclusion: These results indicate a need to further examine these proxy indices in high acuity samples.

KEYWORDS
interpersonal theory of suicide, MMPI-2-RF, suicide

INTRODUCTION

Before 2020 and the COVID-19 pandemic, suicide consistently remained a leading cause of death in the United States (Centers for Disease Control and Prevention, 2020), despite increased research and clinical efforts focused on identifying and decreasing suicide risk. However, suicide risk assessments are largely unable to identify individuals at greatest risk of suicide (Franklin et al., 2017). Given the limitations of current standards of suicide risk assessment, identifying the underlying mechanisms of suicidal ideation (SI) and suicide attempts (SA) may be clinically advantageous to standard suicide risk assessment procedures (Chu et al., 2015; Mitchell et al., 2017). Furthermore, assessing these mechanisms in clinical settings through time- and resource-efficient methods may have clinical merit in identifying targets for treatment in high-risk populations, including those in psychiatric inpatient settings (Harris & Barraclough, 1997).

The Minnesota Multiphasic Personality Inventory (MMPI-2-RF; Ben-Porath & Tellegen, 2008/2011) is a broadband measure of maladaptive personality characteristics and symptoms of psychopathology with demonstrated clinical utility in detecting heightened suicide risk. Particularly, the five-item Suicide/Death Ideation scale (SUI) is strongly associated with other measures of suicide risk in psychiatric outpatients (Gottfried et al., 2014; Tarescavage et al., 2013) and has predicted future suicidal behavior in forensic inpatient settings (Glassmire et al., 2016). While SUI has demonstrated clinical utility in identifying those at heightened risk of suicide, assessing for the presence of mental states that contribute to strong SI may provide clinically relevant information that may guide decision about targets of treatment.

The Interpersonal Theory of Suicide (ITS; Joiner, 2005; Van Orden et al., 2010) asserts that active SI occurs when individuals jointly and consistently experience feelings of perceived burdensomeness and thwarted belongingness. Perceived burdensomeness refers to individuals' beliefs that others would derive greater benefit from the individual's death than if they continued living, while thwarted belongingness refers to feelings of isolation and a perceived lack of connectedness to others. Additionally, individuals are only able to transition from experiencing SI to SA if they possess the capability for suicide through a heightened fearlessness about death and an increased pain tolerance. Empirical support for the ITS has been observed in samples of military personnel (Anestis et al., 2015) individuals seeking outpatient treatment (Anestis & Joiner, 2011), and those in psychiatric inpatient settings (Horton et al., 2016). Although the interaction of these states is posited to engender the greatest suicide risk, identifying any of these states provides valuable clinical information about suicide risk (Mitchell et al., 2017) and may aid in identifying patterns of maladaptive thinking or distorted beliefs to address in treatment (Stellrecht et al., 2006).

Despite the clinical utility of identifying ITS during suicide risk assessment, these states are typically assessed in research settings using various versions of self-report measures (Anestis et al., 2018; Bender et al., 2011; Hill & Pettit, 2014; Ribeiro et al., 2014; Van Orden et al., 2012). In response to this lack of a uniform and efficient method approximating these ITS states in clinical settings, Anestis et al. (2018) developed and validated MMPI-2-RF proxy indices of perceived burdensomeness (RF-PB), thwarted belongingness (RF-TB), and acquired capability for suicide (RF-AC) in an outpatient clinical setting. RF-PB is comprised of Malaise (MLS), Helplessness/Hopelessness (HLP), Self-Doubt (SFD), Inefficacy (NFC), Stress/Worry (STW), and Family Problems (FML), and RF-TB is comprised of Low Positive Emotions (RC2), Juvenile Conduct Problems (JCP), Family Problems (FML), Interpersonal Passivity (IPP), Social Avoidance (SAV), Shyness (SHY), and Aggressiveness-Revised (AGGR-r). RF-AC is comprised of SUI, Behavior-Restricting Fears (BRF), Multiple Specific Fears (MSF), Aggression (AGG), Activation (ACT), JCP, Mechanical Interests (MEC), and AGGR-r. RF-PB and RF-TB independently, but not when interacting together or with RF-AC, predicted SI after controlling for SUI. Therefore, these proxy indices may provide valuable clinical information above assessing SI and SA history alone. While the three-way interaction between RF-PB, RF-TB, and RF-AC was not predictive of clinician-rated suicide risk in a manner consistent with the ITS, there is preliminary evidence for the clinical utility of the RF-PB and RF-TB proxy indices. However, the study was cross-sectional, and the sample was restricted to individuals receiving outpatient treatment.

In the first follow-up study of the ITS proxy indices in a higher acuity setting, Khazem et al. (2021) examined whether the RF-PB and RF-TB were associated with the frequency of past-week SI in a sample of veterans enrolled in a Veterans Affairs (VA) psychiatric partial hospitalization program. While both indices were significantly and positively correlated with past-week SI frequency and the MMPI-2-RF SUI scale, neither index was a significant predictor in regression analyses. Given that this cross-sectional research was restricted to only examining limited aspects of SI and did not include the RF-AC scale in analyses, further research examining the clinical utility of the MMPI-2-RF ITS proxy indices is needed, particularly in higher acuity samples.

Examining the MMPI-2-RF ITS proxy indices in a psychiatric hospitalization sample at admission and whether they are indicators of changes in SI intensity at discharge will provide further information about the clinical utility of these indices in identifying those with heightened levels of PB, TB, and AC that may necessitate targeted interventions to decrease these states. Additionally, examining the clinical utility of these indices in detecting ITS states may provide valuable insight into the ability of the MMPI-2-RF in identifying those at greatest risk of suicide at discharge from treatment. No research to date has examined these possibilities.

The overall aim of the current study was to further examine whether the MMPI-2-RF ITS proxy indices possess clinical utility in identifying those with heightened SI intensity and recent SA. Additionally, we sought to examine whether higher levels of ITS states at admission would be indicative of less change in suicide ideation at discharge. In line with Anestis et al.'s (2018) findings, we anticipated that RF-PB and RF-TB would independently and jointly predict SI intensity at admission. We expected RF-AC and its three-way interaction with RF-PB and RF-TB to be associated with recent suicide attempts at admission. We also anticipated that heightened RF-PB and RF-TB scores would be associated with a lack of significant improvement in SI intensity at discharge. Finally, we expected RF-PB, RF-TB, and their interaction to provide incremental validity in predicting SI intensity and its change at discharge above indicators of suicide risk within the MMPI-2-RF (SUI). Findings in line with our hypotheses would provide additional support for the utility of the MMPI scales and ITS proxy indices in suicide risk assessment in acute settings.

METHOD

Participants

Participants were patients in a private inpatient psychiatric hospital in the southwestern United States admitted on a voluntary basis. Consistent with previous research (Anestis et al., 2018; Arbisi et al., 2011; Sellbom et al., 2012), individuals were excluded from the analyses based on invalid responding identified by significantly elevated MMPI-2-RF validity scale scores [Cannot Say (CNS) ≥18, Variable Response Inconsistency (VRIN-r) or True Response Inconsistency (TRIN-r) ≥80T, or Infrequency - Psychopathology (Fp-r) ≥100T],[1] leaving a final sample of 1,007. The present sample ranged in age from 18 to 88 years of age ($M = 31.48$, SD = 13.41). The sample was roughly evenly split by gender with 52.4% men ($n = 528$) and 47.6% women ($n = 479$), and a large majority (90.3%) self-identified as White. The number of reported lifetime suicide attempts ranged from zero to 11 ($M = 0.62$, SD = 1.32); 675 (67.0%) reported no lifetime attempts; 138 (13.7%) reported one attempt; and 147 (14.6%) reported multiple attempts. The number of reported admissions for previous acute psychiatric hospital care ranged from zero to 50 ($M = 1.16$, SD = 2.60). The number of reported admissions for previous extended psychiatric hospital care ranged from zero to 20 ($M = 0.87$, SD = 1.72). Data were collected between 2012 and 2019.

The sample for the analyses from admission to discharge lost 39 participants to attrition, leaving 968 for analyses who ranged in age from 18 to 88 years of age ($M = 31.37$, SD = 13.47). The sample was still evenly split by gender with 52.9% men ($n = 512$) and 47.1% women ($n = 456$), and a large majority (90.4%) self-identified as White. The number of reported lifetime suicide attempts ranged from zero to 11 ($M = 0.63$, SD = 1.33), and average length of stay for the present sample was 46.92 days (SD = 17.86). In terms of direction of change in SI intensity at discharge, 54.5% of patients demonstrated a decrease in scores, 41.7% did not demonstrate a change in scores, and 3.7% endorsed increased SI intensity scores at discharge.

Participants completed outcomes assessments at admission and discharge, while MMPI-2-RF data were accessed archivally after patients had discharged. The average length of stay for the present sample was 46.21 days (SD = 18.33). At admission, the MMPI-2-RF and Columbia Suicide Severity Rating Scale (C-SSRS; Posner et al., 2011) were administered roughly 12 days apart from each other, and the C-SSRS was readministered at discharge. All patients' were administered the C-SSRS; however, which patients were administered the MMPI-2-RF was a clinical decision determined solely by the treatment team. Administration of the MMPI-2-RF was deemed inappropriate for a subset of patients who

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[1]CNS scores are a total of unanswered items. VRIN-r and TRIN-r scores are indices of inconsistent responding to similar items. F-p is a measure of feigning serious psychopathology through endorsing symptoms rarely endorsed by psychiatric inpatient samples.

were not included in this study. All data collection was approved by the IRB.

Measures

Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF; Ben-Porath & Tellegen, 2008/2011)

The MMPI-2-RF is a 338-item broadband self-report measure of personality and psychopathology, comprised of nine Validity scales, three Higher Order Scales, 23 Specific Problems Scales, two Interest Scales, and a revised version of the Personality Psychopathology Five Scales (Ben-Porath & Tellegen, 2008/2011). Patients completed the MMPI-2 as part of the intake assessment process, and these data were rescored as the MMPI-2-RF. Prior research has demonstrated the validity of this method (Tarescavage et al., 2013; Van der Heijden et al., 2010). RF-PB, RF-TB, and RF-AC were calculated using the weighted scoring algorithm described by Anestis et al. (2018). MMPI-2-RF scale raw scores were used in all analyses.

Columbia Suicide Severity Rating Scale (C-SSRS; Posner et al., 2011)

The C-SSRS is a structured clinical interview designed to assess and monitor changes in SI and behavior. Responses are coded and scored to calculate a total score for each domain. The Suicide Ideation Intensity subscale was utilized to assess the respondent's severity of past-month SI at admission (ranging from death wishes to suicidal intent with a plan) and during the past two weeks at discharge. In the current study, the C-SSRS was administered within roughly 4 days of admission, and again at discharge. Higher scores are indicative of greater SI severity. Another C-SSRS item was administered to assess whether respondents attempted suicide within the past month at admission. The number of participants endorsing this item was not sufficient to examine recent suicide attempts at discharge as an outcome.

Data analyses

A series of bivariate and partial correlations were conducted to examine associations between variables of interest, followed by a series of moderation analyses conducted utilizing version 3.4 of the SPSS PROCESS macro (Hayes, 2018). The first set of analyses examined whether the interaction between RF-PB and RF-TB

were significant predictors of SI intensity at admission. Additionally, all analyses examining the RF-PB and RF-TB interactions were repeated, controlling for SUI, to examine whether the proxy indices provide incremental variance above SUI. The interaction between RF-PB, RF-TB, and RF-AC was examined as a predictor of SI intensity at baseline. As SUI is included in the RF-AC proxy index, it was not included as a covariate in analyses including this index. Next, a series of binary logistic moderation analyses was conducted to examine whether the proxy indices and their interactions were predictive of decreased SI intensity at baseline. Given the low percentage of patients who endorsed increased SI intensity scores at discharge (3.7%), the change in SI intensity at discharge was dichotomized to reflect either a decrease or no decrease in SI intensity. All predictor variables were mean centered, and effect sizes for correlations (r) were calculated and interpreted based on recommendations by Cohen (1992; small: $r = 0.10$, medium: $r = 0.30$; large: $r = 0.50$). Missing data (RF-PB = 2.5%. RF-TB = 3.5%, and RF-AC = 2.5%) were handled by pairwise deletion in each analysis.

RESULTS

Suicide ideation intensity and recent suicide attempts at admission

Results of Pearson correlations revealed significant and large-sized, positive associations between SI intensity at admission and SUI ($r = 0.61$, $p < 0.001$) and medium-sized effects for RF-PB ($r = 0.32$, $p < 0.001$) and RF-TB ($r = 0.37$, $p < 0.001$), but not RF-AC ($r = -0.04$ $p = 0.21$). Additionally, there were moderately sized, positive associations between SA at admission and SUI (0.33, $p < 0.001$). There were also small-sized, positive associations between SA at admission and RF-PB and RF-TB (both $r = 0.07$, $p < 0.001$) but not RF-AC ($r = 0.05$, $p = 0.13$). See Table 1 for all correlations between MMPI-2-RF ITS proxy indices, the MMPI-2-RF scales comprising these indices, and study outcomes.

Results of moderation analyses [$R^2 = 0.14$, $F(3,952) = 51.54$, $p < 0.001$] indicated that only RF-TB ($b = 0.96$, 95% CI = 0.67–1.25, $p < 0.001$), and not RF-PB or the interaction between the two proxy indices, was a significant predictor of SI intensity at admission. When included in the model [$R^2 = 0.14$, $F(7,929) = 21.24$, $p < 0.001$], RF-AC and its interaction with RF-PB and RF-TB were not significant predictors of SI intensity at admission; RF-TB remained the only significant predictor ($b = 0.96$, 95% CI = 0.67–1.26, $p < 0.001$). However, in the model examining the interaction between RF-PB

TABLE 1 Correlations between MMP-2-RF ITS states and suicide-related variables at admission and discharge

	SI admission	SI discharge	SI change	SA admission	SUI	RF-PB	RF-TB	RF-AC
SI admission	–							
SI discharge	**0.35**	–						
SI change	**0.80**	−0.29	–					
SA	**0.40**	0.19	0.28	–				
SUI	**0.61**	**0.45**	**0.34**	**0.33**	–			
RF-PB	**0.32**	0.28	0.14	0.07	**0.43**	–		
RF-TB	**0.37**	**0.30**	0.18	0.07	**0.75**	**0.78**	–	
RF-AC	−0.04	−0.03	−0.03	0.05	0.08	−0.09	−0.17	–
ITS proxy index component scales								
MLS	0.27	0.22	0.13	0.001	**0.32**	**0.73**	**0.66**	−0.25
HLP	**33**	**0.30**	0.13	0.13	**0.49**	**0.66**	**0.67**	−0.10
SFD	**0.37**	0.21	0.23	0.09	**0.37**	**0.78**	**0.66**	−0.15
NFC	0.24	0.17	0.13	0.04	**0.30**	**0.42**	**0.61**	−0.16
STW	0.21	0.18	0.10	0.03	0.29	**0.54**	**0.54**	−0.12
FML	0.06	0.14	−0.04	0.01	0.18	**0.64**	**0.48**	0.14
RC2	**0.40**	0.29	0.22	0.08	**0.44**	**0.62**	**0.91**	**−0.34**
JCP	−0.09	−0.06	−0.06	−0.03	−0.02	0.10	0.02	**0.46**
IPP	0.20	0.13	0.11	0.04	0.16	0.17	**0.33**	**−0.59**
SAV	0.23	0.20	0.10	0.03	0.26	**0.32**	**0.60**	−0.18
SHY	0.23	0.18	0.12	0.04	0.26	**0.38**	**0.67**	−0.19
AGGR	−0.18	−0.11	−0.11	−0.02	−0.13	−0.10	−0.23	**0.70**
BRF	0.15	0.14	0.07	0.05	0.24	**0.37**	**0.35**	−0.28
MSF	−0.001	0.02	−0.003	−0.03	0.002	0.14	0.13	**−0.58**
AGG	0.08	0.05	0.04	0.07	0.12	0.26	0.21	**0.51**
ACT	−0.01	0.05	−0.05	0.01	0.06	0.13	0.001	**0.32**
MEC	−0.15	−0.10	−0.10	−0.04	−0.08	−0.18	−0.21	**0.73**

Note: All $r \leq 0.07$ are significant at $p \leq 0.05$. Bolded values represent $r \geq 0.30$.

Abbreviations: RF-AC, MMPI-2-RF acquired capability; RF-PB, MMPI-2-RF perceived burdensomeness proxy index score; RF-TB, MMPI-2-RF thwarted belongingness proxy index score; SI admission, suicidal ideation upon admission; SI change, change in suicidal ideation from admission to discharged (dichotomized to reflect either a decrease or no decrease in SI intensity); SI discharge, suicidal Ideation upon discharge; SUI, MMPI-2-RF Suicide/Death Ideation scale scores.

and RF-TB [$R^2 = 0.38$, $F(4,950) = 148.37$, $p < 0.001$] when including SUI as a covariate, RF-TB ($b = 0.44$, $95\% = 0.19–0.69$, $p < 0.001$) and its interaction with RF-PB was significant [$\Delta R^2 = 0.01$, $F(1,950) = 11.83$, $b = −0.26$, 95% CI $= −0.42$ to $−0.11$, $p < 0.001$], but only at high levels of RF-TB ($b = −1.06$, 95% CI $= −1.82$ to $−0.29$, $p = 0.01$), and low ($b = 0.71$, 95% CI $= 0.41–1.01$, $p < 0.001$) and mean ($b = 0.44$, 95% CI $= 0.19–0.69$, $p < 0.001$) but not high levels of RF-PB, and in the unanticipated direction. See Figure 1 for a graphical depiction of this relationship.

In terms of SA status at admission, the model examining the association between RF-PB and TF-TB, their interaction, and recent suicide attempt status was not significant [$\chi^2(3) = 764.47$, Nagelkerke $R^2 = 0.02$, $p = 0.08$].

Additionally, the model was not significant when RF-AC and its interaction with RF-PB and RF-TB were included [$\chi^2(7) = 746.72$, Nagelkerke $R^2 = 0.02$, $p = 0.12$]. When SUI was included as a covariate in the model examining the interaction between RF-PB and RF-TB [$\chi^2(4) = 668.42$, Nagelkerke $R^2 = 0.18$, $p < 0.001$], RF-PB was the only significant predictor (OR $= 2.02$, 95% CI $= 1.74–2.35$; $p < 0.001$).

Change in suicide ideation intensity at discharge

Results of Pearson correlations revealed a significant and large-sized positive correlation between ideation intensity

FIGURE 1 Depiction of interaction between RF-PB and RF-TB predicting SI intensity at admission when controlling for SUI. RF-PB, MMPI-2-RF perceived burdensomeness proxy index; RF-TB, MMPI-2-RF thwarted belongingness proxy index; suicide ideation intensity, C-SSRS suicide intensity subscale
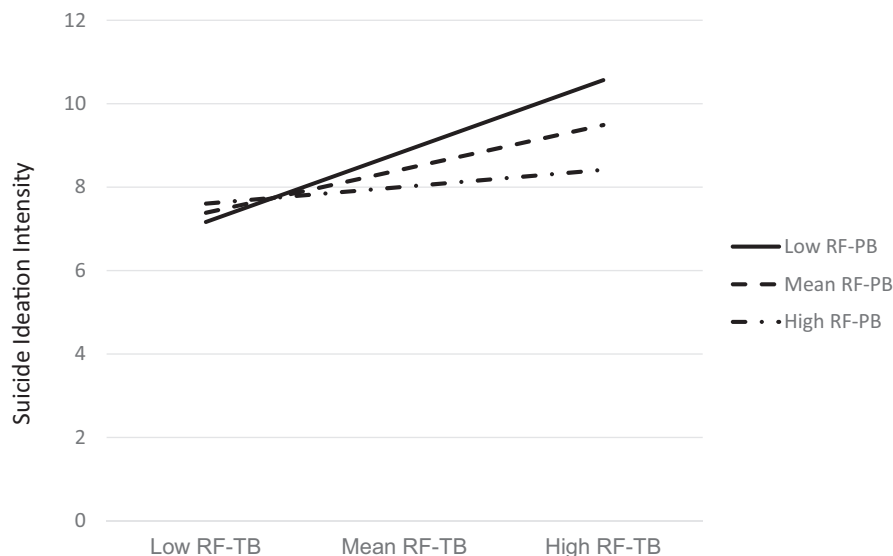
at admission and change in ideation from admission to discharge ($r = 0.80$, $p < 0.001$), suggesting participants with higher scores at admission reported greater change over the course of treatment, which may be partially due to patients' ideation intensity decreasing to mean levels. Given this, a series of partial correlations were conducted, controlling for SI intensity at admission, with results indicating that RF-PB ($r = -0.08$, $p = 0.02$) and RF-TB ($r = -0.08$, $p = 0.01$), but not RF-AC ($r = -0.02$, $p = 0.47$), were associated with changes in SI intensity at discharge, all with small-sized effects.

When examining the impact of admission ITS proxy scores on change in SI intensity at discharge, controlling for SI intensity scores at admission [$\chi^2(4) = 905.93$, Nagelkerke $R^2 = 0.83$, $p < 0.001$], SI intensity at admission (OR = 1.64, 95% CI = 1.54–1.74, $p < 0.001$) was associated with increased odds of reduced SI intensity at discharge and RF-PB scores at admission were significantly associated with decreased odds of reduced SI intensity at discharge (OR = 0.62, 95% CI = 0.39–0.97, $p = 0.04$). When RF-AC and its interactions with the other indices were included in the model [$\chi^2(8) = 886.60$, Nagelkerke $R^2 = 0.83$, $p < 0.001$], similar results were observed; only SI intensity at admission (OR = 1.64, 95% CI = 1.54–1.74, $p < 0.001$) and none of the ITS indices or their interactions were associated with increased odds of reduced SI intensity at discharge. RF-PB was associated with decreased odds of reduced SI intensity at discharge (OR = 0.58, 95% CI = 0.37–0.93, $p = 0.02$), consistent with the results of the previous model. Lastly, when controlling for SUI in the model examining the interaction between RF-B and RF-TB, [$\chi^2(5) = 919.57$, Nagelkerke $R^2 = 0.85$, $p < 0.001$], neither index nor their interaction predicted change in SI intensity at discharge.

DISCUSSION

The aim of the current study was to assess the clinical utility of the MMPI-2-RF ITS proxy indices of perceived burdensomeness (RF-PB), thwarted belongingness (RF-TB), and the acquired capability for suicide (RF-AC) in predicting past-month SI intensity and SA at admission and changes in SI intensity at discharge from a psychiatric hospitalization program. Additionally, we examined whether the interaction between RB-PB and RF-TB would provide incremental validity above indicators of suicide risk contained on the MMPI-2-RF (SUI). The findings of the study were largely inconsistent with expectations, with a few exceptions.

First, the findings that RF-TB, but not RF-PB, consistently predict SI intensity at admission are inconsistent with the ITS (Van Orden et al., 2010) and previous research (Ma et al., 2016; Mitchell et al., 2017; Mitchell et al., 2019). Furthermore, the interaction between RF-PB and RF-TB was associated with SI intensity only when SUI was included as a covariate, and the relationship was strongest at high levels of thwarted belongingness but *low* levels of perceived burdensomeness. This finding is also inconsistent with the propositions of the ITS and prior research of the MMPI-2-RF ITS proxy indices (Anestis et al., 2018). The ITS posits that while the presence of either perceived burdensomeness or thwarted belongingness is sufficient to prompt the development of SI, the strongest (i.e., greatest intensity) SI occurs when these states are jointly elevated. These findings point toward different possibilities. It may be that thwarted belongingness is a more robust predictor of SI intensity than perceived burdensomeness among similar samples. Another possibility is that the MMPI-2-RF proxy index of perceived burdensomeness may not be a valid predictor of past-month SI intensity but

may perform differently when assessing more recent (e.g., past-week) suicidal ideation. Lastly, we should note that Anestis et al. (2018) developed the weighted scale-based algorithms for calculating the MMPI-2-RF ITS proxy indices in outpatient clinical samples. It may be that these algorithms are not appropriate for higher acuity samples. Recent research supports this possibility, as similar findings to the current study were observed in a sample of military veterans enrolled in a partial hospitalization program (Khazem et al., 2021). Given these possibilities and current findings, future research employing the MMPI-3 (Ben-Porath & Tellegen, 2020) should repeat the validation process conducted by Anestis et al. (2018) in lower and higher acuity samples to determine whether population-specific scoring algorithms are needed in the newest iteration of the MMPI

We also acknowledge that previous research indicates divergent findings regarding the interaction of PB and TB as a predictor of SI. In line with the current study, some prior research has not observed an interaction between PB and TB in psychiatric inpatient settings (Cero et al., 2015). Other work in this population, however, supports the interaction between the two states in predicting current SI, in addition to PB as an independent predictor (Monteith et al., 2013). Along with further examination of the MMPI-2-RF ITS proxy indices in detecting SI and suicide risk, research is needed to clarify the relationship between PB, TB, and SI across the course of treatment and in various settings. Moreover, further clarification regarding the development, stability, and association of these states with SI in psychiatrically hospitalized samples is needed.

The current study expanded upon previous research (Anestis et al., 2018; Khazem et al., 2021) by assessing whether the MMPI-2-RF ITS proxy indices could predict treatment response in the form of decreased SI intensity at discharge. Also inconsistent with the ITS and our expectations, none of the proxy indices or the interaction between RF-PB and RF-TB scores at admission were associated with decreased SI intensity at discharge— except for higher RF-PB scores. Higher RF-PB scores at admission were associated with lower odds of improvement in SI intensity at discharge, consistent with expectations. Although RF-PB did not demonstrate incremental validity above SUI, this relationship is noteworthy and indicates that heightened perceived burdensomeness at admission may not be associated with past-month SI severity but may be indicative of a lack of clinical improvement in SI during inpatient treatment, regardless of the intensity of SI at admission. In clinical settings, assessing for heightened perceived burdensomeness at admission may provide information pertinent to setting expectations regarding reductions in SI during treatment. Unlike thwarted belongingness, heightened perceived burdensomeness has repeatedly demonstrated independent associations with SI (see Hill & Pettit, 2014, for a review). The current findings not only provide additional support for the role of perceived burdensomeness in the maintenance of SI, but also indicates that the RF-PB proxy index may possess clinical utility in identifying those who may not experience significant reductions in SI during treatment and who may benefit from additional follow-up after discharge. Caring Contacts, for example, is an efficacious follow-up method that has produced reductions in suicide risk (Comtois et al., 2019; Motto & Bostrom, 2001) and may be indicated for those who endorse heightened PB at admission and do not experience significant reductions in suicide risk during treatment. Future research should examine the impact of such follow-up methods in reducing PB and suicide risk for those who do not demonstrate significant improvement during treatment.

The findings regarding the addition of RF-AC to the models—particularly in assessing past-month SA at admission—provide further insight about this proxy index and are consistent with those of previous research. Neither RF-AC or its interaction with RF-PB and RF-TB were associated with SI intensity at admission or change in SI intensity at discharge. Anestis et al. (2018) also did not observe an association between RF-AC and SI even though RF-AC includes SUI. Further, while they observed a significant interaction between RF-PB, RF-TB, and RF-AC in predicting suicide risk, the magnitude of the relationship decreased as RF-AC increased. As SI intensity and past-month SA, but not overall suicide risk, were examined as outcomes in the current study, it could not be ascertained whether RF-AC is predictive of current suicide risk in this sample or setting. Acquired capability for suicide is posited to facilitate the transition from suicidal ideation to suicide attempts, but capability is not considered to be indicative of SI itself (Joiner, 2005; Van Orden et al., 2010). As such, the lack of association between RF-AC and SI is not necessarily divergent from the ITS. The lack of association between the three-way interaction of the proxy indices and SA, however, is inconsistent with the ITS.

Research focused on the acquired capability for suicide and its interactions with perceived burdensomeness and thwarted belongingness has yielded mixed findings in various samples (Ferm et al., 2020; Monteith et al., 2013; Spangenberg et al., 2019), and a meta analysis of 122 studies indicated a small effect size for this three-way interaction (Chu et al., 2017). These findings, taken together with findings from the initial study of the ITS proxy indices (Anestis et al., 2018) and the current study, raise the possibility that this proxy index may possess less clinical utility in detecting SA than anticipated in both outpatient and inpatient settings. Therefore, a lack of significant association between RF-AC and SA status may indicate that

acquired capability for suicide may not be as robust of an indicator of SA or suicide risk as previously believed. This limitation may extend to proxy measures of this construct.

Although this research represents an incremental step in identifying novel methods of suicide risk assessment with clinical utility, other limitations should be noted. First, individuals participating in the study were assessed during hospitalization, but instruments utilized in this study were administered roughly 12 days apart. Future research would be well-served in concurrently administering validated measures of suicide risk (including current SI) when assessing the clinical utility of the MMPI-2-RF ITS proxy indices in psychiatric hospitalization settings. Lastly, we were unable to assess whether elevated MMPI-2-iRF ITS proxy indices and their interactions were associated with SA at discharge, which would be most in line with the propositions of the ITS. Despite these limitations, this research provides partial support for the clinical utility of RF-PB and RF-TB in identifying drivers and maintaining factors of SI psychiatric hospitalization setting with a heightened prevalence of suicidality.

AUTHOR CONTRIBUTIONS

Lauren Khazem: Conceptualization (lead); Writing – original draft (lead); Writing – review & editing (lead). **Joye Anestis:** Conceptualization (supporting); Methodology (supporting); Writing – original draft (supporting); Writing – review & editing (supporting). **Katrina Rufino:** Data curation (lead); Formal analysis (lead); Methodology (supporting); Project administration (equal); Resources (lead); Software (lead); Visualization (lead); Writing – original draft (supporting); Writing – review & editing (supporting).

DATA AVAILABILITY STATEMENT

Research data are not shared.

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