



## Predicting violence in veterans with posttraumatic stress disorder

### Predviđanje nasilnog ponašanja veterana sa posttraumatskim stresnim poremećajem

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#### Abstract

**Background/Aim.** Frequent expression of negative affects, hostility and violent behavior in individuals suffering from posttraumatic stress disorder (PTSD) were recognized long ago, and have been retrospectively well documented in war veterans with PTSD who were shown to have an elevated risk for violent behavior when compared to both veterans without PTSD and other psychiatric patients. The aim of this study was to evaluate the accuracy of clinical prediction of violence in combat veterans suffering from PTSD. **Methods.** The subjects of this study, 104 male combat veterans with PTSD were assessed with the Historical, Clinical and Risk Management 20 (HCR-20), a 20-item clinician-rated instrument for assessing the risks for violence, and their acts of violence during one-year follow-up period were registered based on bimonthly check-up interviews. **Results.** Our findings showed that the HCR-20, as an actuarial measure, had good internal consistency reliability ( $\alpha = 0.82$ ), excellent interrater reliability (Interclass Correlation ICC = 0.85), as well as excellent predictive validity for acts of any violence, non-physical violence or physical violence in the follow-up period (AUC = 0.82–0.86). The HCR-20 also had good interrater reliability (Cohen's kappa = 0.74), and acceptable predictive accuracy for each outcome criterion (AUC = 0.73–0.79). **Conclusion.** The results of this research confirm that the HCR-20 may also be applied in prediction of violent behavior in the population of patients suffering from PTSD with reliability and validity comparable with the results of previous studies where this instrument was administered to other populations of psychiatric patients.

**Key words:**  
stress disorders, post-traumatic; risk assessment;  
veterans; predictive value of tests; aggression.

#### Apstrakt

**Uvod/Cilj.** Često ispoljavanje negativnog afekta, neprijateljskog i nasilnog ponašanja kod osoba sa posttraumatskim stresnim poremećajem (PTSP) odavno je uočeno i posebno dobro dokumentovano kod ratnih veterana kod kojih je uočen povišen rizik od nasilnog ponašanja u odnosu na veterane bez PTSP i druge psihijatrijske bolesnike. Cilj ove studije bio je da se izvrši klinička procena rizika od nasilnog ponašanja kod učesnika rata sa PTSP. **Metode.** Ispitanici ove studije, 104 veterana muškog pola sa PTSP procenjavani su instrumentom strukturisane kliničke procene rizika od nasilnog ponašanja *Historical, Clinical and Risk Management 20* (HCR-20), a ispoljavanje nasilnog ponašanja praćeno je tokom jednogodišnjeg perioda, u okviru kontrolnih pregleda na svaka dva meseca. **Rezultati.** Sa stanovišta aktuarijalne procene, HCR-20 je imao dobru internu konzistenciju ( $\alpha = 0.82$ ), odličnu saglasnost između ispitivača (ICC = 0.85), kao i odličnu prediktivnu vrednost u pogledu ispoljavanja nasilnog ponašanja (fizičko ili nefizičko nasilje) u toku jednogodišnjeg perioda praćenja (AUC = 0.82–0.86), što je u skladu sa psihometrijskim svojstvima ustanovljenim u drugim studijama. Sa stanovišta strukturisane kliničke procene rizika (nizak, srednji ili visok), saglasnost među ispitivačima u pogledu HCR-20 bila je dobra (Kohenev kapa koeficijent = 0.74), a prediktivna tačnost prihvatljiva (AUC = 0.73–0.79). **Zaključak.** Rezultati istraživanja potvrđuju da se HCR-20 može koristiti za predviđanje nasilnog ponašanja kod populacije obolelih od PTSP sa pouzdanošću i vrednošću koju je imao u ranijim studijama, kada je primenjivan na drugim populacijama psihijatrijskih bolesnika.

**Ključne reči:**  
stresni poremećaji, posttraumatski; rizik, procena;  
veterani, ratni; testovi, prognostička vrednost; agresivnost.

#### Introduction

Though clinicians have traditionally assessed violence risk on an individual basis, using unstructured or unaided clinical judgment (which has frequently been criticized for

being impressionistic and subjective), the prediction of violence has substantially improved over the last decades thanks to the development of various systematic violence risk assessment schemes such as the Dangerous Behavior Rating Scale (DBRS), the Psychopathy Checklist-Revised (PCL-R),

the Violence Risk Appraisal Guide, the Historical, Clinical and Risk Management 20 (HCR-20), and the Classification of Violence Risk (COVR)<sup>1-6</sup>. These divergent approaches have resulted in different views to the relative contribution of clinical items in risk prediction scales as well as in debate over the merits of clinical vs. actuarial approaches and their relevance to risk prediction<sup>7</sup>.

The actuarial prediction procedure has been described as a formal or algorithmic method that uses an equation, a formula, or an actuarial table to arrive at a probability, or expected value, of some outcome<sup>8</sup>. While this approach has generally improved the reliability and validity of risk assessment, its clinical application has certain limitations because it tends to ignore individual variations in risk, overfocuses on relatively static (demographic) variables (in large, frequently heterogeneous populations), fails to consider clinically relevant variables and minimizes the importance of clinical assessment<sup>9</sup>. On the other hand, a model of decision making called the "structured professional judgment model" or "structured clinical judgment model" of risk assessment has emerged in recent years and has produced a number of assessment schemas well as comprehensive reviews<sup>10-15</sup>. This model is based on empirical knowledge and clinical expertise, and defines the levels of risk for violence such as risk judgments of low, moderate, and high risk after a systematic consideration of a standard set of operationally defined risk factors.

A significant step in bridging the gap between clinical and actuarial measures was the development of the HCR-20, which adopted a combined approach and recognized the importance of both static actuarial variables and the clinical/risk management items that clinicians normally take into account in risk assessments of individuals. The studies of reliability and validity of the HCR-20 have covered large samples of forensic psychiatric patients, involuntarily hospitalized civil psychiatric patients, correctional settings, and mixed samples of correctional offenders and forensic patients<sup>16-26</sup>. Hence, the important issue of extending practical application of the HCR-20 to the domain of other psychiatry populations, such as voluntarily hospitalized patients or outpatients where clinical picture may also present with affect dysregulation and hostility, still requires further research<sup>27</sup>.

Affect dysregulation is possibly the most far-reaching effect of psychological trauma underlying significant impairment in the regulation of anger, anxiety and sexual impulses of people with severe psychotraumas<sup>28, 29</sup>. Frequent expression of negative affects, hostility and violent behavior in individuals suffering from posttraumatic stress disorder (PTSD) were recognized long ago, and have been retrospectively well documented in war veterans, who were shown to have an elevated risk for violent behavior when compared to both veterans without PTSD and other psychiatric patients<sup>30-39</sup>. Given that a prospective research on predicting violent behavior in PTSD survivors with a systematic violence risk assessment scheme is undoubtedly relevant yet under-researched topic, the primary objective of our study was to assess the accuracy of violence prediction based on the HCR-20 in a treatment seeking sample of veterans suffering

from PTSD, a population which has not yet been specifically examined with this instrument.

## Methods

The sample consisted of 104 male veterans engaged previously in reserve forces of the former Yugoslav Army during armed conflicts in ex-Yugoslavia (after 1990). The subjects of this study were consecutively recruited at the Institute of Psychiatry and Institute of Mental Health, Belgrade in the period 1998 – 2002 among outpatients who were suffering from combat-related chronic PTSD and willing to participate in the study. The subjects were diagnosed according to the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) Axis I Disorders (SCID-I)<sup>40</sup>, and the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II)<sup>41</sup>. Written informed consent was obtained from all the subjects, and the results obtained were kept confidential.

All the subjects were assessed with the HCR-20, a 20-item clinician-rated instrument for assessing the risks for violence. The HCR-20 was developed from a detailed consideration of the previous studies concerning factors related to violence. It contains 20 items, each scored "0" (*no/absent*), "1" (*partially/possibly present*), or "2" (*yes/definitely present*) and divided into three subscales - Historical, Clinical and Risk Management. The ten Historical items (*Previous Violence, Young Age at First Violent Incident, Relationship Instability, Substance Use Problems, Major Mental Illness, Psychopathy, Early Maladjustment, Personality Disorder, Prior Supervision Failure*) correspond to risk factors for violence in the past. The five Clinical items (*Lack of Insight, Negative Attitudes, Active Symptoms of Major Mental Illness, Impulsivity, Unresponsive to Treatment*) reflect current correlates of violence. The five Risk Management items (*Plans Lack Feasibility, Exposure to Destabilizers, Lack of Personal Support, Noncompliance with Remediation Attempts, and Stress*) focus attention on situational factors that may influence risk for violence in the future. For each of the items the HCR-20 manual provides both a precise definition and detailed information on scoring procedure based on a semistructured interview. For research purposes, it is possible to use the HCR-20 as an actuarial scale and simply sum the numeric item codes to obtain total and subscale scores. For clinical purposes, the authors of the HCR-20 recommend that assessors make a "final risk judgment", i.e. final decision regarding risk for violence using a 3-point scale. Here, "low" indicates that the assessor believe that individual is at no risk, or very low risk, for violence; "moderate" indicates that the assessor believes the individual is at somewhat elevated risk for violence; and "high" indicates that the assessor believes the individual is at high or very elevated risk for violence.

The Screening Version of the Hare Psychopathy Checklist-Revised (PCL:SV), a 12-item symptom-construct rating scale based on a semistructured interview, was also completed for all the subjects in order to code the seventh item on the Historical subscale of the HCR-20 which refers

to psychopathy<sup>42</sup>. The PCL: SV is divided into two parts (each comprising of six items and each scored using a 3-point ordinal scale). One section of the PCL: SV deals with affective/interpersonal symptoms of psychopathy and the other with social deviance symptoms.

For the purpose of this study, two raters, specialists in neuropsychiatry completed research protocols for 104 subjects containing anamnestic data, psychiatric diagnoses, and the assessment with the HCR-20 and the PCL: SV. Each rater completed 78 protocols randomly assigned with an overlap of 50% to permit interrater reliability analyses for the HCR-20 and PCL: SV. Acts of violence during one-year follow-up period were recorded based on bimonthly check-up interviews lasting 30-45 minutes (supplemented by clinical records from treating psychiatrists and when available by information from close persons, social workers and judicial files) made by assessors who were not informed about the results for the HCR-20 risk assessments. Violent acts in this study were defined as deliberate and nonconsensual acts of actual, attempted or threatened harm to other persons, and regardless of severity divided into categories of any violence, physical violence and non-physical violence, which is consistent with the approaches used in other risk assessment studies.

Reliability analyses of the HCR-20 and PCL:SV comprised the evaluation of internal consistency reliability and interrater reliability. In order to investigate the relationship between HCR-20 scores and violence, three different analyses are reported: (a) Receiver Operating Characteristic (ROC) analyses for all subscales and the total scale, (b) cross tabs for the HCR-20 "final risk judgment" (low/moderate/high) and (c) results of a logistic regression analysis with all the items of the HCR-20 as predictor variables. With respect to the HCR-20 and PCL: SV as actuarial measures, a reliability analysis comprised the evaluation of internal con-

sistency reliability in terms of Cronbach Alpha and interrater reliability in terms of Intraclass Correlation (ICC)<sup>43,44</sup>. A one-way random-effects model of the ICC was used for both the reliability of single-rater ratings (ICC1) and averaged ratings (ICC2).

## Results

The mean age of the subjects was 35 years (SD = 10.2). They were mostly married, having children, completed secondary education, employed and possessed fire-arms which is shown in Table 1.

Anamnestic data on the subjects and psychiatric comorbidity where substance use disorder was the most frequent (30%) comorbid diagnosis are shown in Table 2.

Seventy (67%) subjects committed at least one violent act in the one-year follow-up period while 63 (61%) committed non-physical violence in a sense of threatening or fear-inducing behaviour, 58 (56%) perpetrated physical violence, and nine (8%) were charged with violent criminal offences. Among the subjects who possessed firearms, 25 (24%) manifested dangerous firearm-related behaviour (threatening with a gun) in the follow-up period.

The Table 3 presents the central tendencies, dispersions, internal consistency reliability and interrater reliability of the HCR-20 (and its respective subscales) and the PCL: SV.

Receiver Operating Characteristic Analysis was conducted to evaluate the accuracy of sum of raw scores on the HCR-20 and its subscales as well as the PCL: SV in predicting the three violence categories, i.e. any violence, non-physical violence, and physical violence (Table 4). Receiver Operating Characteristic analysis is independent of the criterion base rate and is graphically presented with an "area under curve" (AUC) produced by plotting sensitivity and specificity pairs for each possible cut-off score on a measure.

**Table 1**  
**Sociodemographic data of the subjects**

| Characteristics        | Subjects |     |
|------------------------|----------|-----|
|                        | n        | (%) |
| Married                | 74       | 71  |
| Number with children   | 53       | 51  |
| Secondary educated     | 69       | 66  |
| Employed               | 80       | 77  |
| Possession of firearms | 64       | 61  |

**Table 2**  
**Anamnestic data and psychiatric comorbidity of the subjects**

| Characteristics                          | Subjects |     |
|------------------------------------------|----------|-----|
|                                          | n        | (%) |
| Mental disorders in the family           | 26       | 25  |
| Juvenile criminal record                 | 2        | 2   |
| Past violent charge                      | 7        | 7   |
| Past violent conviction                  | 5        | 5   |
| Adult psychiatric treatment before PTSD* | 15       | 14  |
| Previous inpatient treatment             | 43       | 41  |
| Substance use disorder                   | 31       | 30  |
| Mood disorder                            | 9        | 9   |
| Organic disorder                         | 8        | 7   |
| Personality disorder                     | 17       | 16  |

\*Posttraumatic stress disorder

Table 3

**Descriptive characteristics, internal consistency reliability and interrater reliability of the History, Clinical, and Risk Management 20 (HCR-20) and the Screening Version of the Hare Psychopathy Check list (PCL: SV)**

| Measure (range)                 | Mean  | Standard error | Standard deviation | Alpha | ICC <sub>1</sub> <sup>†</sup> (CI) <sup>‡</sup> | ICC <sub>2</sub> <sup>§</sup> (CI) |
|---------------------------------|-------|----------------|--------------------|-------|-------------------------------------------------|------------------------------------|
| HCR-20 total score (0-40)       | 11.33 | 0.56           | 5.72               | 0.82  | 0.95 (0.92–0.97)                                | 0.97 (0.96–0.98)                   |
| Historical subscale (0-20)      | 3.71  | 0.33           | 3.38               | 0.82  | 0.96 (0.93–0.98)                                | 0.98 (0.96–0.99)                   |
| Clinical subscale (0-10)        | 4.89  | 0.16           | 1.60               | 0.53  | 0.75 (0.60–0.85)                                | 0.85 (0.75–0.92)                   |
| Risk Management subscale (0-10) | 2.72  | 0.20           | 2.05               | 0.50  | 0.88 (0.80–0.93)                                | 0.93 (0.89–0.96)                   |
| PCL:SV total score (0-24)       | 6.60  | 0.55           | 5.65               | 0.88  | 0.88 (0.81–0.93)                                | 0.94 (0.89–0.96)                   |

\* Cronbach Alpha coefficient of internal consistency reliability (for 104 subjects); <sup>†</sup>single-measure intraclass correlation coefficient (for 52 overlapping subjects); <sup>‡</sup>95% confidence interval; <sup>§</sup>average-measure intraclass correlation coefficient (for 52 overlapping subjects)

Table 4

**Area under the receiver operating characteristic curves (AUC) for the History, Clinical and Risk Management 20 (HCR-20) and The Screening Version of the Hare Psychopathy Checklist (PCL:SV) in 104 veterans with posttraumatic stress disorder**

| Measure                         | Any violence* |                 |                  | Non-physical violence <sup>†</sup> |      |           | Physical violence <sup>‡</sup> |      |           |
|---------------------------------|---------------|-----------------|------------------|------------------------------------|------|-----------|--------------------------------|------|-----------|
|                                 | Mean          | SE <sup>§</sup> | CI <sup>  </sup> | Mean                               | SE   | CI        | Mean                           | SE   | CI        |
| HCR-20 total score (0–40)       | 0.85          | 0.04            | 0.78–0.92        | 0.82                               | 0.04 | 0.74–0.90 | 0.86                           | 0.04 | 0.79–0.93 |
| Historical subscale (0–20)      | 0.83          | 0.04            | 0.75–0.90        | 0.81                               | 0.04 | 0.72–0.89 | 0.86                           | 0.04 | 0.79–0.93 |
| Clinical subscale (0–10)        | 0.70          | 0.05            | 0.60–0.80        | 0.70                               | 0.05 | 0.60–0.80 | 0.73                           | 0.05 | 0.63–0.82 |
| Risk Management subscale (0–10) | 0.71          | 0.05            | 0.61–0.81        | 0.69                               | 0.05 | 0.58–0.78 | 0.69                           | 0.05 | 0.59–0.79 |
| PCL: SV                         | 0.82          | 0.04            | 0.74–0.90        | 0.80                               | 0.04 | 0.71–0.88 | 0.87                           | 0.03 | 0.81–0.94 |

\*The HCR-20 optimal cut-off score of  $\geq 10$  corresponds to 0.73 specificity, 0.82 sensitivity and 0.75 hit rate;

<sup>†</sup> The HCR-20 optimal cut-off score of  $\geq 10$  corresponds to 0.75 specificity, 0.76 sensitivity and 0.75 hit rate;

<sup>‡</sup> The HCR-20 optimal cut-off score of  $\geq 10$  corresponds to 0.83 specificity, 0.80 sensitivity and 0.82 hit rate;

<sup>§</sup> Standard error;

<sup>||</sup> 95% Confidence interval.

Subsequently, if the AUC is significantly different from 0.50, it represents an improvement over chance in the prediction of a given outcome. Theoretical value of the AUC could range from zero to one, and for the propensity scores for any reasonable predictive model or diagnostic test, the AUC does not assume values below 0.5. In general: 1)  $0.5 < \text{AUC} < 0.7$  suggests poor discrimination; 2)  $0.7 < \text{AUC} < 0.8$  suggests an acceptable discrimination; 3)  $0.8 < \text{AUC} < 0.9$  suggests an excellent discrimination, and 4)  $\text{AUC} > 0.9$  suggests outstanding discrimination. According to our research findings, AUC values were statistically significant for each outcome criterion (any violence, non-physical violence or physical violence) and ranged from 0.69 to 0.86, as shown in Table 4. The diagnostic efficiency of the HCR-20 total score in terms of specificity (probability of correctly predicting a case as violent), sensibility (probability of correctly identifying a case as not violent) and hit rate (probability of accurate prediction) across the three categories of violence are presented in Table 4.

Another approach to violence risk assessment in this study was based on a structured clinical judgment model. In

that sense, the raters reviewed all relevant clinical data to determine the presence of specific risk factors as operationalized in the HCR-20 risk assessment manual. Overall judgments of risks were low, moderate, or high, according to raters' estimates of the likelihood of violent behavior. Agreement between raters for the violence risk judgments on the HCR-20 is summarized in Table 5. The two raters agreed in 46 (88%) of the 52 overlapping patients, and there were no low/high-risk errors. Cohen's kappa was 0.78 (Asymp. Std. Error = 0.10,  $p = 0.00$ ) and Chance-corrected agreement (Intraclass Correlation, ICC1, or weighted kappa) was 0.88, ( $p = 0.00$ , 95% confidence interval = 0.78–0.93).

The frequencies and proportions of each type of violence across the HCR-20 Final Risk Judgment levels (low, moderate, and high risk) are shown in Table 6. According to ROC analysis, the AUC values for the HCR-20 Final Risk Judgment were statistically significant for each outcome criterion (any violence, non-physical violence or physical violence) and varied between 0.73 and 0.79, as can be seen in Table 6.

Table 5

**Agreement between two rates for structured final violence risk judgements on the History, Clinical and Risk Management in 52 subjects**

| Rater A            | Rater B  |               |           | Total <sub>A</sub> |
|--------------------|----------|---------------|-----------|--------------------|
|                    | Low Risk | Moderate Risk | High Risk |                    |
| Low Risk           | 18       | 3             | 0         | 21                 |
| Moderate Risk      | 1        | 14            | 1         | 16                 |
| High Risk          | 0        | 4             | 11        | 15                 |
| Total <sub>B</sub> | 19       | 21            | 12        | 52                 |

**Table 6**  
**Committed violence across levels of structured clinical risk judgments for 104 subjects based on the History Clinical and Risk Management 20 (HCR-20)**

| HCR-20 Final Risk Judgment |       | Any violence* |     |       | Non-physical violence† |     |       | Physical violence‡ |     |       |
|----------------------------|-------|---------------|-----|-------|------------------------|-----|-------|--------------------|-----|-------|
|                            |       | No            | Yes | Total | No                     | Yes | Total | No                 | Yes | Total |
| Low Risk                   | Count | 26            | 18  | 44    | 27                     | 17  | 44    | 31                 | 13  | 44    |
|                            | %     | 59            | 41  | 100   | 61                     | 39  | 100   | 59                 | 41  | 100   |
| Moderate Risk              | Count | 7             | 26  | 33    | 11                     | 22  | 33    | 11                 | 22  | 33    |
|                            | %     | 21            | 79  | 100   | 33                     | 67  | 100   | 21                 | 79  | 100   |
| High Risk                  | Count | 1             | 26  | 27    | 3                      | 24  | 27    | 4                  | 23  | 27    |
|                            | %     | 4             | 96  | 100   | 11                     | 89  | 100   | 15                 | 85  | 100   |

\*Receiver Operating Characteristic analysis for the HCR-20 Final Risk Judgment: area under curve = 0.79; 95% confidence interval = 0.70 – 0.88

† Receiver Operating Characteristic analysis for the HCR-20 Final Risk Judgment: area under curve = 0.73; 95% confidence interval = 0.64 – 0.83

‡ Receiver Operating Characteristic analysis for the HCR-20 Final Risk Judgment: area under curve = 0.76; 95% confidence interval = 0.66 – 0.85

For each of the three categories of violence (dependent variable) a logistic regression analysis (Table 7) was performed for identifying the HCR-20 items (independent variables), which proved significant predictors of violence. In logistic regression we estimated probability (Prob) of an event occurring which can be written as  $\text{Prob} = 1/(1+e^{-Z})$ , where  $Z$  equals  $B_0 + B_1X_1 + B_2X_2 + \dots B_nX_n$ .  $B_{0-n}$  are logistic coefficients estimated from the data.  $X_{1-n}$  are independent variables, and  $e$  is the base of the natural logarithms (approximately 2.72). If the estimated probability of the event was greater than 0.5, we predicted that the event will occur, and if the probability is less than 0.5 that the event will not occur. One way to assess how our model fits is to compare our predictions to the observed outcomes. In that respect, for any violence the model correctly predicted 80% of cases. For non-physical violence it was 81% and for physical violence 80%. As can be seen from Table 7 (values of logistic coefficient  $B$  and  $\text{Exp}(B)$ ), the first item (Previous Violence) on the HCR-20 was the one which was the most strongly associated with each of the three categories of violence.

## Discussion

Our findings regarding the internal consistency reliability, interrater reliability and predictive validity of the HCR-20, as an actuarial measure for predicting violence among veterans suffering from PTSD, indicate solid psychometric properties of this instrument which are comparable to the results of previous studies where this instrument was administered to populations of psychiatric patients such as forensic psychiatric patients discharged from security units, involuntarily hospitalized civil psychiatric patients, correctional offenders and mixed samples of correctional offenders and forensic patients mainly suffering from psychotic disorders, substance use disorders and personality disorders. The Cronbach Alpha, ICC and AUC for the HCR-20 subscales have shown that the H subscale proved far better than Clinical and Risk Management subscales, which is in accordance with other findings showing that previous history of violence is the best single predictor of future violence. Though the ICC<sub>2</sub> was used to show the potential reliability of averaged ratings,

**Table 7**  
**Parameter estimates in logistic regression analyses (at the final step) for identifying the History, Clinical and Risk Management (HCR-20) items those proved significant predictors of violence in 104 male veterans**

| <i>Variables in the equation for any violence</i>                                       | $B^*$  | $SE^\dagger$ | $Wald^\ddagger$ | $df^\S$ | $p^\parallel$ | $\text{Exp}(B)^\P$ |
|-----------------------------------------------------------------------------------------|--------|--------------|-----------------|---------|---------------|--------------------|
| Lack of personal support the third item on the Risk Management subscale R of the HCR-20 | 0.871  | 0.361        | 5.816           | 1       | 0.016         | 2.389              |
| Previous violence the first item on the Historical/subscale of the HCR-20 (H1)          | 3.654  | 1.097        | 11.103          | 1       | 0.001         | 38.642             |
| Stress (fifth item on the R)                                                            | 0.954  | 0.400        | 5.686           | 1       | 0.017         | 2.597              |
| Constant                                                                                | -1.331 | 0.482        | 7.608           | 1       | 0.006         | 0.264              |
| <i>Variables in the equation for nonphysical violence</i>                               | $B^*$  | $SE^\dagger$ | $Wald^\ddagger$ | $df^\S$ | $p^\parallel$ | $\text{Exp}(B)^\P$ |
| Lack of personal support (third item on the R)                                          | 0.984  | 0.349        | 7.943           | 1       | 0.005         | 2.676              |
| Previous violence (H1)                                                                  | 2.557  | 0.644        | 15.769          | 1       | 0.000         | 12.898             |
| Unresponsive to treatment (fifth item on the Clinical subscale of the HCR-20)           | 0.780  | 0.381        | 4.198           | 1       | 0.040         | 2.182              |
| Constant                                                                                | -1.249 | 0.386        | 10.447          | 1       | 0.001         | 0.287              |
| <i>Variables in the equation for physical violence</i>                                  | $B^*$  | $SE^\dagger$ | $Wald^\ddagger$ | $df^\S$ | $p^\parallel$ | $\text{Exp}(B)^\P$ |
| Lack of insight (the first item on the Clinical subscale of the HCR-20)                 | 1.348  | 0.467        | 8.348           | 1       | 0.004         | 3.851              |
| Previous violence (H1)                                                                  | 2.342  | 0.628        | 13.923          | 1       | 0.000         | 10.398             |
| Stress (fifth item on the R)                                                            | 0.865  | 0.395        | 4.788           | 1       | 0.029         | 2.374              |
| Constant                                                                                | -2.102 | 0.557        | 14.223          | 1       | 0.000         | 0.122              |

\*logistic coefficient; †standard error of  $B$ ; ‡Wald statistics; §degree of freedom; ‖significance of  $B$ ; ¶the change in odds of a violence occurring associated with one-unit change in the independent variable.

the ICC<sub>1</sub> was considered the primary index of reliability for two reasons. Firstly, all findings on the HCR-20 (apart from those regarding interrater reliability) reported here are exclusively based on ratings made by a single rater. Secondly, the application of the HCR-20 in clinical settings will most likely only use single raters and not the average score from several independent raters. Therefore, only the single-rater ICC appears relevant for this measure at all and the naturally higher averaged ratings ICC might be misleading.

The most important type of information needed to evaluate the predictive efficiency of the HCR-20 as an actuarial measure was about its sensitivity, specificity and overall hit rate. However, a consideration of these results led us to a less optimistic evaluation of the measure. Here, only for physical violence it was possible to specify a cutoff score (Table 3) that would maintain every aspect of predictive efficiency above 0.8.

The AUC values in the scope of this study simply show probability that a violent person will receive a higher score on the predictor variable (HCR-20, PCL: SV) than a non-violent person. Here, it may be useful to include information about discrimination levels for the AUC<sup>45,46</sup>.

With regard to the structured clinical judgment model, both the agreement of raters for final risk judgments and the predictive validity of the HCR-20 for each of the three types of violence proved to be acceptable. Though the results for the final risk judgment reported in Table 5 indicate that the measure has acceptable predictive accuracy (AUC ranged from 0.73 to 0.79) and a high specificity (i.e. a large majority of individuals categorized as "high risk" showed violent events in the future), the sensitivity appears to be poor (i.e. 41% of the subjects classified as "low risk" committed any violence in the follow-up interval). This unfavorable feature of the instrument obviously needs to be improved, which may be accomplished with a structured interview that could lead to a more reliable formulation of final risk judgment levels.

Although psychopathy is a vital component of any violence risk assessment, it is considered to occur less frequently out of correctional or forensic psychiatric settings. Actually, we did not focus attention on psychopathy as a violence predictor, and PCL: SV was not considered a risk assessment measure but rather a screening test for the diagnosis of psychopathy as one of the violence risk factors assessed with the HCR-20. Still, psychopathy, as measured by the PCL: SV total score was found to have the predictive validity that could be compared with that of the HCR-20 total score. This might suggest a possible direction for future research with a more comprehensive assessment instrument such as PCL-R.

The final goal of accurate and reliable assessment of risk factors is to establish the best interventions likely to ameliorate the risk of violent behaviour and its negative consequences<sup>47</sup>. As Monahan et al.<sup>6</sup> emphasised, "for a successful management of violence multiple targets for intervention would exist, and they will differ from person to person". In this respect, our findings concerning relative contribution of specific factors in assessing violence risk in veterans with

PTSD have several clinical implications. As expected, "Previous Violence" (the first of Historical factors) was the most strongly associated with each of the three categories of violence detected in the veterans with PTSD in the follow-up period. Rather than causal, this factor is referred to as a violence risk marker with a strong predictive power due to a high correlation with other causal risk factors<sup>48</sup>. The first item on Historical subscale can change in time only for the worse, i.e. when someone previously non-violent commits an act of violence or escalates it. Consequently, management decisions based on the presence of this factor need to be made only after careful consideration of the nature of previous violence and seriousness of any recidivism. Our finding of a high frequency of firearms possession (61%) and consequent firearm-related impulsive behavior (24%) in the follow-up period is in accordance with earlier studies pointing to high levels of aggression, impulsive weapon use, and weapon availability as significant factors in gun-related violence in veterans with PTSD. The possession of firearms in our subjects was six times higher than in adult population in Serbia where, according to official information of the Ministry of Internal Affairs, firearms are in legal possessions of 11% of adult citizens. On the other hand, according to the recent findings of Fontana and Rosenheck<sup>49</sup>, veterans of the Iraq and Afghanistan wars when compared with veterans who served in the Persian Gulf war and in the Vietnam war manifested significantly more violent behavior which implies a substantial need for violence risk assessment in developing treatment interventions that focus on the preservation of social assets in veterans of contemporary wars.

According to our findings, "Lack of Insight" (the first item on the Clinical subscale) and "Unresponsive to Treatment" fifth item on the Clinical subscale of the Clinical scale, as well as "Lack of Personal Support" (the third) and "Stress" (fifth item of the Risk Management subscale on the HCR-20), also proved to be closely related to future violent behavior in the subjects. Contrary to the Historical items, the Clinical and Risk Management items on the HCR-20 are usually referred to as dynamic violence risk factors because they not only relate to violence, but also may significantly fluctuate with time and circumstances and hence be targeted for violence reducing strategies<sup>50</sup>.

A lack of insight generally refers to a lack of person's self-perception of being dangerous and incapacity to understand the importance of doing something about it<sup>51</sup>. Our subjects had difficulties to overcome discrepancies between military and civilian reality, which resulted in overlooking the inadequacy and dangerousness of their military skills in civilian context<sup>52, 53</sup>. On several occasions, we could hear them say that aggression was "what they were taught in order to survive", that civilians were "just a collateral damage", and that "ordinary people without war experience can't understand them", or even, that others may be classified into "people and civilians". Therefore, developing insight in psychotherapy with veterans seems to be an important hence delicate clinical issue, which refers to both the therapeutic relationship and patient's motivation to develop awareness and readiness to change<sup>54, 55</sup>. On the other

hand, the "Unresponsive to Treatment" deals with the extent to which an individual responds to interventions and programs and there are varieties of factors that have an effect on this multidimensional concept<sup>56, 57</sup>. Most of our subjects were treated with a combination of medication (mostly combination of selective serotonin reuptake inhibitors antidepressants and benzodiazepines) and psychotherapy (mostly individual cognitive-behavior therapy and less frequently family therapy). We would like to stress that frequent comorbid disorders in veterans such as major depression, organic impairment, severe intoxication with substances or alcohol, or profound personality pathology interfered with psychotherapeutic and behavioral interventions. In general, once the violence risk is established, the efficiency of interventions that might ameliorate outcome should always be most seriously taken into consideration and carefully monitored.

The lack of personal support related to violence in our subjects generally reflected the absence of a reliable support system of peers and relatives. It is of particular practical importance since it has been shown that both family adaptive resources and social support network serve as strong buffers which alleviate life difficulties and, consequently, facilitate social adjustment and adaptation in persons suffering from chronic PTSD<sup>58-62</sup>. In that respect, there was a striking discrepancy between what was necessary and what was actually provided to our subjects and their deeply troubled families. Numerous studies, have also shown that stress increases the likelihood of aggressive behavior and our findings obviously support this relationship<sup>28-39, 63, 64</sup>. Much more difficult than helping veterans with PTSD to learn how to identify situations that would be stressful, was to help them arrange living and working environment which would include as few of these situations as possible. Namely, after they had been dismissed from the army, they found the situation to be particularly stressful at home due to numerous problems produced by an extremely turbulent transition period in a former socialist country (poverty, social conflicts, decline of social institu-

tions and health care system) as well as a criticism of war by common people. In general, the results of our study provide a strong evidence base that the HCR-20 as an actuarial measure is a reliable and valid predictor of violent behavior in veterans suffering from PTSD. However, a consideration of our results regarding predictive validity of the HCR-20, in terms of structured clinical judgment approach, led us to a less optimistic evaluation of the diagnostic utility of the instrument. Among specific risk factors involved in the HCR-20 assessment scheme, previous violence, the lack of insight, unresponsiveness to treatment, the lack of personal support and stressful environment proved to be strongly associated with violent behavior detected in the follow-up period. A strong association established between violence and the lack of insight, unresponsiveness to treatment, the lack of personal support and stressful environment was of particular practical significance for our clinical practice because it pointed at critical issues of violence management strategies to help individuals undergoing treatment for PTSD.

At least two substantial limitations of our study should be noted. Firstly, the findings presented in this paper may not be generalizable to a general or forensic population, given that the sample consisted of a male treatment-seeking veterans. Secondly, it would be also useful to establish a relationship between current symptoms of PTSD, treatment efficiency and violence at each of the assessments in the follow-up interval. These important issues were beyond the scope and design of this study and deserve to be addressed by further research.

## Conclusion

The results of this research confirm that the HCR-20 may also be applied in prediction violent behavior in the population of patients suffering from PTSD with reliability and validity comparable with the results of previous studies where this instrument was administered to other populations of psychiatric patients.

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