

## Violence risk–assessment screening tools for acute care mental health settings: Literature review



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### ARTICLE INFO

#### Keywords:

Assessment  
Mental health  
Screening  
Tools  
Violence

### ABSTRACT

**Background:** Violence is a large concern for mental health professionals: 90% of physicians and nurses working in mental health areas have been subject to violence from patients. Approximately 80% of violent acts from patients are directed toward nurses.

**Objective:** The purpose of this integrative literature review was to identify violence risk–assessment screening tools that could be used in acute care mental health settings.

**Design:** The Stetler model of evidence-based practice guided the literature search, in which 8 violence risk–assessment tools were identified, 4 of which were used for further examination.

**Results:** The Brøset Violence Checklist and Violence Risk Screening-10 provided the best assessment for violence in the acute care mental health setting.

**Conclusions:** Using a violence risk assessment screening tool helps identify patients at risk for violence allowing for quick intervention to prevent violent episodes.

According to the [Occupational Safety and Health Administration \(n.d.\)](#), over 2 million American workers are victims of workplace violence each year. The National Institute for Occupational Safety and Health defines violent acts as aggression or physical assault, threatening behaviors, or behaviors that cause emotional or physical harm ([Papa & Venella, 2013](#)). Almost 75% of all workplace assaults from 2011 through 2013 happened in a health care setting ([Hackethal, 2016](#)). It is estimated that 80% of violent acts from patients are directed toward nurses ([OSHA, n.d.](#)); 21% of nurses across all work settings reported being physically assaulted, and over 50% reported being verbally assaulted within a 12-month period ([OSHA, n.d.](#)). The estimated cost for workplace violence is \$120 billion a year ([Papa & Venella, 2013](#)), and costs for workplace violence are direct and indirect, including jury awards for injuries, high employee job turnover, medical leaves, attendance issues, and stress-related illness ([Papa & Venella, 2013](#)).

Violence is a large concern for mental health professionals and other persons who work in mental health areas. According to [Newton, Elbogen, Brown, Snyder, and Barrick \(2012\)](#), 90% of physicians and nurses working in mental health hospitals have been subject to violence from patients. The acuity of patients' illnesses continues to increase, potentially contributing to patient violence. One contributing factor for the increase in acuity may be the decrease in funding for resources at the federal and state levels. From 2009 through 2012, states cut \$4.35

billion from their mental health budgets ([NAMI, 2011](#)). Estimates, according to [Newton et al. \(2012\)](#), are that 18% of patients who are civilly committed have physically assaulted other people and 30% to 35% engage in fear-inducing behavior. More than two-thirds of patients under civil commitment are likely to engage in some type of violence within the first 72 h of their hospitalization ([Newton et al., 2012](#)).

Patients under a civil commitment meet the following criteria: they pose imminent danger to themselves or others, they have received a diagnosis of a mental health disorder, they refuse mental health treatment, and they are 18 years or older ([Testa & West, 2010](#)). Additionally, each state has developed separate and specific criteria for civil commitment. When a patient has been placed under civil commitment, the legal system intervenes, and the patient may be ordered to receive certain services, including involuntary hospitalization ([Testa & West, 2010](#)).

The 2 categories for clinical assessment for violence are unstructured professional judgment (UPJ) and structured professional judgment (SPJ). UPJ is defined as personal intuition or opinion ([Falzer, 2013](#)), and SPJ is defined as structured assessment based on historical factors or observable factors (or both) that can be placed into probabilistic risk bins ([Singh, 2013](#)). [Falzer \(2013\)](#) states that UPJ cannot be supported by empirical evidence. Several studies cited by [Falzer \(2013\)](#) support the claim that UPJ is less reliable and valid compared with SPJ.

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**Table 1**  
Initial violence assessment tools.

Violence screening instrument	Study setting	Time to complete assessment	Ease of application	Instrument structure	Weakness	Strength
Dynamic Appraisal of Situational Aggression–Inpatient Version (DASA-IV)	Forensic, inpatient (Newton et al., 2012)	24 h Peak score, longer term (Chu et al., 2012)	No formal training needed nurse can perform (Griffith et al., 2013)	7 items: 5 from HCR-20 and 2 from BVC Dynamic (Newton et al., 2012)	Nursing observation—objective (Griffith et al., 2013)	Quick, easy, better than no tool Good indicator in first 24 h (Griffith et al., 2013)
Psychopathy Checklist: Screening Version (PCL-SV)	Correctional (Jaber and Mahmoud, 2013)	Long-term violence (Jaber and Mahmoud, 2013)	Trained, experienced, highly skilled professional needed (Jaber and Mahmoud, 2013)	20-item checklist to identify psychopathy (Jaber and Mahmoud, 2013)	Meaningless stereotype Not helpful Could lead to self-harm Limited use in clinical setting, leading to patient harm (Jaber and Mahmoud, 2013)	Across cultures Identifies psychopathology and predicts violence to property (Jaber and Mahmoud, 2013)
Violence Risk Screening–10 (V-RISK-10)	Correctional, inpatient (Jaber and Mahmoud, 2013)	Short term (< 1 y) (Jaber and Mahmoud, 2013)	Psychiatric diagnosis needed (Jaber and Mahmoud, 2013)	10-item checklist Actuarial scale General violence recidivism (Jaber and Mahmoud, 2013)	5 dynamic factors No further violence (Jaber and Mahmoud, 2013)	Across cultures (Jaber and Mahmoud, 2013)
Short-Term Assessment of Risk and Treatability (START)	Forensic, inpatient (Chu et al., 2011)	< 1 mo to 6 mo (O’Shea & Dickens, 2014)	Training required (O’Shea & Dickens, 2014)	20-item dynamic clinical judgment and risk assessment with protective factors (Chu et al., 2011)	Used as intervention No effect compared with regular care (O’Shea & Dickens, 2014)	Strong predictor and validity for aggression outcomes Good for predicting self-harm (O’Shea & Dickens, 2014)
Violence Risk Appraisal Guide (VRAG)	Forensic (Chu et al., 2011)	15 mo to 10y (Harris, Rice, & Camilleri, 2004)	Psychiatric diagnosis needed (Harris et al., 2004)	12 static factors (Chu et al., 2011)	Inadequate for inpatient aggression (Chu et al., 2011)	Prediction of criminal violence over 7 y (Harris et al., 2004)
Historical Clinical Risk Management–20 (HCR-20)	Forensic, inpatient (Jaber and Mahmoud, 2013)	Short term (< 1 y) (Jaber and Mahmoud, 2013)	Clear, simple No specialist needed Time consuming (Jaber and Mahmoud, 2013)	20 items (10 history, 5 clinical, and 5 risk management) Static and dynamic (Jaber and Mahmoud, 2013)	Subjectivity in scoring, depending on report (Jaber and Mahmoud, 2013)	Used in various populations (Jaber and Mahmoud, 2013)
McNiel-Binder Violence Screening Checklist (VSC)	Inpatient (Newton et al., 2012)	72 h (Newton et al., 2012)	Time consuming if include other factors (Newton et al., 2012)	5 items: physical attack, fear-inducing behavior, age, sex, and suicidal ideation 4 behaviors (Newton et al., 2012)	4 static risk factors (Newton et al., 2012)	
Brøset Violence Checklist (BVC)	Forensic, inpatient (Marques, Bessa, Santos, Carvalho, & Neves, 2015)	24–72 h (Marques et al., 2015)	Little training required (Marques et al., 2015)	physical threats, and attacking dynamics—observed patient behavior (Marques et al., 2015)	Based on observation and nursing assessment—subjective (Marques et al., 2015)	Sensitivity, 77% Boisterousness, irritability (Marques et al., 2015)

Results in a study by Griffith, Daffern, and Godber (2013) also supported this claim. UPJ's predictive validity is slightly higher than chance compared with SPJ's higher predictive validity. Therefore, SPJ was the primary focus for the present article.

Violence risk–assessment screening tools help clinicians identify patients who may be at high risk for violence, allowing staff to take appropriate steps. Early intervention may reduce the number of injuries incurred by staff or other patients. Meta-analyses have identified over 120 different violence risk–assessment screening tools (Singh, Grann, & Fazel, 2011). The tools were developed for several settings, including prisons, communities, general hospitals, and forensic hospitals (Singh et al., 2011). Few instruments are available for acute mental health settings (Newton et al., 2012).

Tools developed for mental health settings are categorized as internal (demographics, psychopathy, and personality characteristics), external (environmental factors such as privacy and unit design), or interactional (staff-patient relations) tools (Clarke, Brown, & Griffith, 2010). Patients' internal factors can be described as static (demographics, history, diagnosis, and personality) or dynamic (untreated psychiatric symptoms, such as psychosis) (Clarke et al., 2010). An actuarial model measures static characteristics and inventories risk factors for aggression resulting in a total risk score (Dumais, Larue, Michaud, & Goulet, 2012). According to Chu, Thomas, Ogloff, and Daffern (2011), static factors, such as past violence, are less useful for planning treatment because static factors are not amendable to change through interventions. Many of the instruments developed for static factors are time consuming, rely on historical factors, and predict violence long term (Newton et al., 2012). In acute mental health settings, clinicians are pressured to make decisions quickly and may have less predictive historical or static information available on admission than clinicians in a long-term patient setting (Newton et al., 2012). Tools developed to measure dynamic factors may provide better predictability in a short-term setting and can be affected by interventions (Chu et al., 2011).

In a study by van de Sande et al. (2013), events of violence occur within 1 to 3 days after a patient is admitted to a mental health setting. According to van de Sande et al. (2013), patients admitted to acute care mental health settings often exhibit fluctuating symptoms and behavior patterns within hours after admission. Assessments for violence in acute care mental health settings need to occur early in the patient's stay and focus on dynamic factors that can be affected with early interventions (van de Sande et al., 2013).

## Purpose

The purpose of this integrative review of the literature was to identify violence risk–assessment screening tools that could be used in acute care mental health settings. To further identify the purpose of this study and guide the literature search, the following clinical question was developed: In an acute care mental health setting, what violence risk–assessment screening tool for patient violence would best identify potential violence within the first 72 h of admission? This question was constructed in the population, intervention, comparison, and outcome (PICO) format (Melnyk & Fineout-Overholt, 2015).

## Methods

Violence risk–assessment screening tools were located by narrowing the search to publications from the past 5 years and to tools that were appropriate for acute care mental health settings. The following 8 violence risk–assessment tools were reviewed: Dynamic Appraisal of Situational Aggression–Inpatient Version (DASA-IV); Psychopathy Checklist: Screening Version (PCL-SV); Violence Risk Screening–10 (V-RISK-10); Short-term Assessment of Risk and Treatability (START); Violence Risk Appraisal Guide (VRAG); Historical Clinical Risk Management–20 (HCR-20); McNeil-Binder Violence Screening Checklist (VSC); and Brøset Violence Checklist (BVC). The following

criteria were considered in evaluating the assessment tools: time to complete the assessment, ease of application (education needed for staff), study setting (forensic, community, or inpatient psychiatry), and assessment structure (static, dynamic, combination), and strengths and weaknesses of the tool (Table 1). Incorporation of the above criteria resulted in elimination of 4 of the 8 tools. The tools selected for further examination were DASA-IV, BVC, START, and V-RISK-10.

Chu et al. (2011) rated the BVC and DASA-IV as good predictors for violence within 72 h of admission, and neither assessment required staff education. Dynamic factors were noted in the BVC, START, V-RISK-10, and DASA-IV (Chu et al., 2011; Newton et al., 2012). Although the START violence risk–assessment screening tool focused on static factors, the preliminary evaluation of the strengths of this tool showed promise for further exploration (O'Shea & Dickens, 2014), so it was included for further evaluation.

The HCR-20 and the VSC were considered as potential violence risk–assessment screening tools; however, supporting literature was not found for acute care mental health settings, thereby excluding these tools. PCL-SV was also excluded because it focused on a forensic mental health setting (Table 1), had limited clinical use, and potentially could lead to patient harm (Jaber & Mahmoud, 2015). VRAG was excluded because Chu et al. (2011) stated that this tool was inadequate for assessing inpatient aggression.

## Method of inquiry

The method of inquiry was the Stetler model of evidence-based practice. The Stetler model includes 5 phases: phase 1—preparation; phase 2—validation; phase 3—comparative evaluation/decision making; phase 4—translation/application; and phase 5—evaluation (Melnyk & Fineout-Overholt, 2015). Phases 1 through 3 are discussed below. For the purpose of this article, phases 4 and 5 were not completed, because implementation was not within the scope of the present inquiry, which produced a recommendation.

### Phase 1: preparation

Preparation consists of identifying the purpose, context, and sources of evidence (Grove, Burns, & Gray, 2013). A detailed search was conducted to determine the strength of the evidence, leading to the recommendation within this article (Tables 2 and 3) (Grove et al., 2013).

### Phase 2: validation

Validation outlines the need for a comprehensive literature search to determine the scientific soundness of current literature (Grove et al., 2013). The following section describes the primary literature review, which identified various violence risk–assessment screening tools used in acute care mental health settings.

**Primary review.** The aim of the primary literature review was to identify violence risk–assessment screening tools used in acute care mental health settings. A search of the EBSCOhost and CINAHL databases identified 60 articles. An additional search of PubMed, focusing on meta-analysis and systemic reviews, produced another 57 articles. Inclusion criteria for the literature search: written in English, peer-reviewed journals, and contained one or a combination of selected keywords (assessment; mental health; screening; tools; violence). Of the 117 articles identified, further review of the abstracts excluded studies within forensic mental health populations and publication dates before 2010. One exception was an article published in 2004, which was allowed because it provided historical information related to violence risk–assessment screening tools. Twenty articles were selected for further examination.

Fifteen violence risk–assessment screening tools were identified in the literature. Eight of the 15 tools were identified for evaluation (Table 1). An additional search in PubMed was conducted for 6 of the 8 (BVC, HCR-20, VSC, V-RISK-10, VRAG, and DASA-IV). Use of English

**Table 2**  
Strength of evidence.

Related violence risk assessment	Supportive evidence	Study design	Level of evidence <sup>a</sup>
BVC	Rechenmacher, Muller, Abderhalden, & Schulc, 2014 Yao et al., 2014	Prospective cohort study Prospective study	II II
DASA-IV	Marques et al., 2015 Griffith et al., 2013 Lantta, Kontio, Daffern, Adams, & Valimaki, 2016 Dumais et al., 2012 Ogloff and Daffern, 2006 Hartvig, Roaldset, Moger, Ostberg, & Bjorkly, 2011	Descriptive study Comparison study Feasibility study design Randomized controlled trial Comparison study Prospective design	V V VI II V II
V-RISK-10	Roaldset, Hartvig, Morten Linaker, & Bjorkly, 2012	Naturalistic prospective study	III
START	O'Shea & Dickens, 2014	Meta-analysis	I

Abbreviations: BVC, Brøset Violence Checklist; DASA-IV, Dynamic Appraisal of Situational Aggression–Inpatient Version; V-RISK-10, Violence Risk Screening–10.

<sup>a</sup> See Table 3 for descriptions of levels of evidence.

language and peer-reviewed articles as inclusion criteria for the tools resulted in 134 hits. Studies were excluded if they did not review validity and reliability of the tool and were published before 2010. Four of the 6 tools (START, BVC, DASA-IV and V-RISK-10) warranted further exploration.

**Secondary review.** The aim of the secondary review was to further explore the literature identified as violence risk–assessment screening tools. Secondary review was conducted with searches in the CINAHL, PubMed, and PsycINFO databases, resulting in an additional 77 studies. Search inclusion criteria included English as the published language, publication date after 2010, and the following keywords: Brøset Violence Checklist, Dynamic Appraisal of Situational Aggression, V-RISK-10, and START. Of the 77 abstracts reviewed, 42 were selected for review and 32 were selected for further evaluation. Information from the primary and secondary searches is provided in the Fig. 1.

### Phase 3: comprehensive evaluation and decision making

Phase 3 addresses evaluation of the literature and provides a recommendation for practice (Grove et al., 2013). Each article was evaluated with a literature table, including the level of evidence (Tables 2 and 3). The recommendation for violence risk–assessment screening tools was based on predictive validity, calibration, discrimination, and reliability reported in the literature.

**Comprehensive evaluation.** Over past decades, several violence risk–assessment screening tools have been studied to establish predictive validity (based on calibration and discrimination) for assessing the likelihood of violence (Singh, 2013). *Calibration* of an assessment is defined as the ability of the tool to predict risk with actual observed risk. *Discrimination* of an assessment is defined as the ability of the tool to assess tendency toward violence (Singh, 2013). According to Singh (2013), measuring only 1 of the components would not provide predictive validity.

Calibration and discrimination reflect sensitivity, specificity,

positive predictive value (PPV), negative predictive value (NPV), and area under the curve (AUC) (Singh, 2013). Sensitivity is the proportion of persons at high risk for violent behavior; specificity is the proportion of persons at low risk for violent behavior (Singh, 2013). Sensitivity, specificity, PPV, and NPV are determined with a 2 × 2 contingency table (Table 4). True positives (TPs) indicate persons at high risk for committing a violent act who have committed a violent act. True negatives (TNs) indicate persons at low risk for committing a violent act who do not have a history of committing violent acts. False positives (FPs) indicate persons at high risk for a violent act who do not commit any violent acts. False negatives (FNs) indicate persons at low risk who did commit a violent act (Singh et al., 2011) (Table 4). If a violence risk–assessment screening tool accurately identifies violent and non-violent populations, larger base rates increase the sensitivity and decrease the specificity (Singh, 2013).

The relationships between sensitivity and specificity were analyzed with the receiver operating characteristic (ROC) curve for all possible cutoff values; the relationship was summarized with the AUC (Singh et al., 2011). AUC represents the probability that a randomly selected person who exhibits violent behavior received a higher risk classification, in contrast to a randomly selected person who does not exhibit violent behavior (Singh, 2013). AUC is an index of the overall predictive accuracy, ranging from 0 (perfect negative prediction) to 0.50 (chance prediction) to 1.0 (perfect positive prediction) (Ogloff & Daffern, 2006). AUCs of 0.75 to 0.80 are considered moderate or large effect sizes and values of 0.50 are equivalent to chance (i.e., the FP rate equals the TP rate) (Falzer, 2013). AUC measures discrimination but not calibration; therefore, it does not predict risk with actual observed risk (Singh, 2013).

The 2 performance indicators, PPV and NPV, have been argued to be of greater relevance to clinical decision making than the sensitivity and specificity of a violence risk–assessment tool (Singh, 2013). PPV predicts the proportion of persons at high risk of committing a violent act (Singh, 2013). NPV predicts the proportion of persons at low risk who do not commit a violent act (Singh, 2013). These calibration indexes

**Table 3**  
Descriptions of levels of evidence.

Level of evidence	Description
I	Evidence from a systematic review or meta-analysis of all relevant RCTs or evidence-based clinical practice guidelines based on systematic reviews of RCTs or 3 or more RCTs of good quality that have similar results
II	Evidence from at least 1 well-designed RCT (e.g., large multisite RCT)
III	Evidence from well-designed controlled trials without randomization (i.e., quasi-experimental)
IV	Evidence from well-designed case-control or cohort studies
V	Evidence from systematic reviews of descriptive and qualitative studies (meta-synthesis)
VI	Evidence from a single descriptive or qualitative study
VII	Evidence from the opinion of authorities or reports of expert committees (or both)

Abbreviation: RCT, randomized controlled trial.

Adapted from Harris RP, Helfand M, Woolf SH, Lohr KN, Mulrow CD, Teutsch SM, et al.; Methods Work Group, Third US Preventive Services Task Force. Current methods of the US Preventive Services Task Force: a review of the process. *Am J Prev Med.* 2001 Apr; 20 (3 Suppl):21–35. Used with permission.

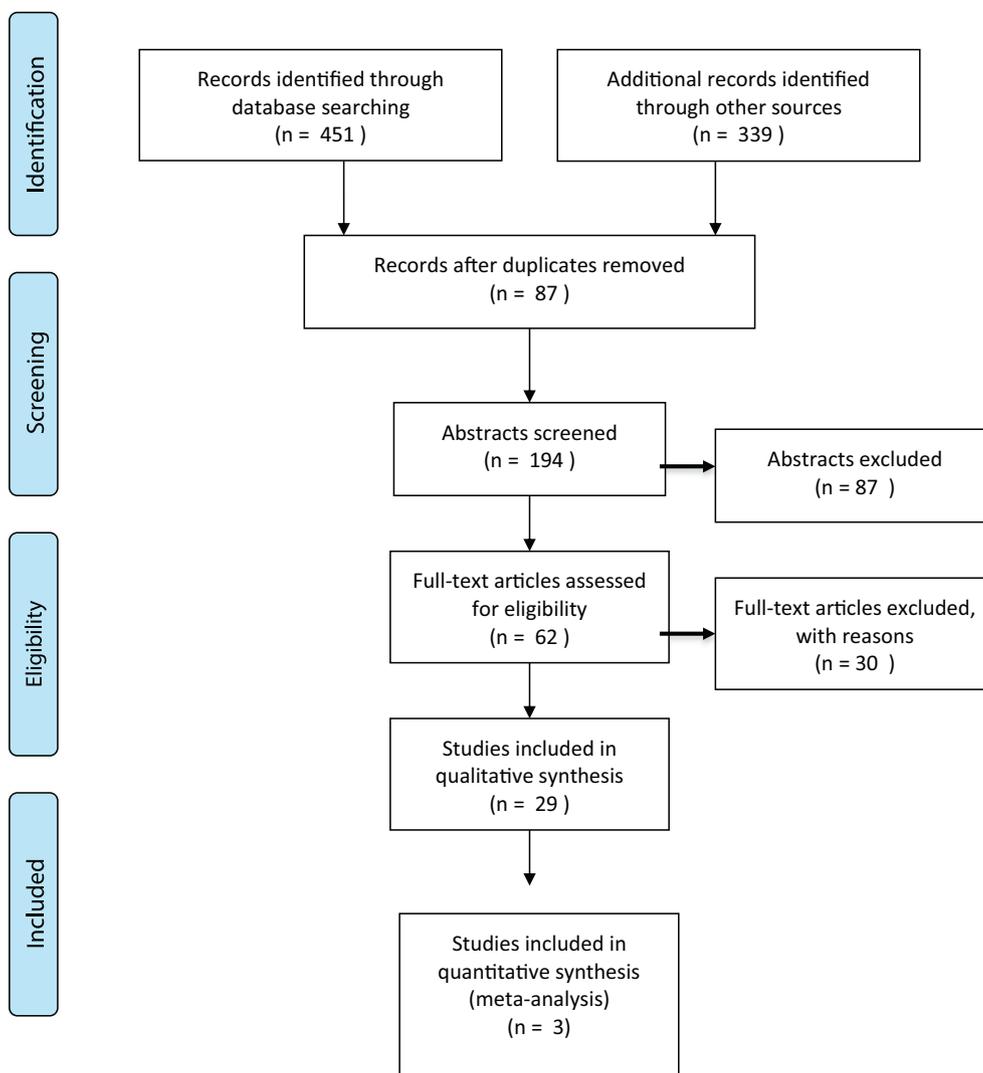


Fig. 1. Flowchart for studies selected.  
Note: Modified version of PRISMA 2009 Flow Diagram, (Grove et al., 2013).

**Table 4**  
Contingency table for violence risk assessment.

		Patient actually became violent		
		Violence positive	Violence negative	
Patient screening outcome for violence	Screening outcome positive	True positive (TP) Screened high risk and became violent	False positive (FP) Screened high risk but did not become violent	Positive predictive value <sup>a</sup> = TP/(TP + FP)
	Screening outcome negative	False negative (FN) Screened low risk, but became violent Sensitivity <sup>c</sup> = TP/(TP + FN)	True negative (TN) Screened low risk and did not become violent Specificity <sup>d</sup> = TN/(FP + TN)	Negative predictive value <sup>b</sup> = TN/(FN + TN)

<sup>a</sup> Positive predictive value—proportion judged to be high risk and were violent.  
<sup>b</sup> Negative predictive value—proportion judged to be not violent and were not violent.  
<sup>c</sup> Sensitivity—proportion who were violent and were judged to be high risk.  
<sup>d</sup> Specificity—proportion who did not engage in violent act but were judged to be high risk.

capture the usefulness of a risk assessment in an acute mental health facility and emphasize the prospective prediction of violent outcomes (Singh, 2013). However, PPV and NPV depend on the base rate and vary with the population, time at risk, and outcome of interest (Singh, 2013).

Synthesis of the literature and final recommendations for risk assessment were based on AUC, sensitivity, specificity, PPV, and NPV. Calibration and discrimination of violence risk-assessment screening tools were also considered.

**Table 5**  
Violence risk–assessment data summary.

Study	Patients, No.	AUC	Sensitivity, %	Specificity, %	PPV, %	NPV, %	ICC
<b>BVC</b>							
Rechenmacher et al., 2014 <sup>a</sup>	220	0.93	58.8	96.8	18.5	99.5	...
Yao et al., 2014	281	0.85	62.8	96.2	45.1	98.0	...
Marques et al., 2015	64	...	77	100	...	...	0.85
<b>DASA-IV</b>							
Griffith et al., 2013	20–24	0.71	68.1	70.0	...	...	...
Lantta et al., 2016	72	0.86	...	...	...	...	...
Dumais et al., 2012	77	0.71	...	...	...	...	...
Ogloff & Daffern, 2006	...	0.84	...	...	...	...	...
<b>V-RISK-10</b>							
Bjørkly, Hartvig, Heggen, Brauer, & Moger, 2009	25 <sup>b</sup>	...	...	...	...	...	0.87
Hartvig et al., 2011	1017	0.82	81	73.2	24	97.3	0.85
Roaldset et al., 2012	489	0.84	79	71	42	92	...
<b>START</b>							
Desmarais, Nicholls, Wilson, & Brink, 2012; Desmarais, Van Dorn, Telford, Petrila, & Coffey, 2012	120	0.76	...	...	...	...	0.93
Chu et al., 2011	50	0.71	...	...	...	...	...
Chu, Thomas, Daffern, & Ogloff, 2013; Chu, Thomas, Ogloff, & Daffern, 2013	66	0.76	...	...	...	...	...
Abidin et al., 2013	98	0.71	...	...	...	...	...
Gray et al., 2011	44	0.63	...	...	...	...	...
Braithwaite, Charette, Crocker, & Reyes, 2010	34	0.65	...	...	...	...	...
Morrison et al., 2012	54	0.61	...	...	...	...	...
Nonstad et al., 2010	47	0.77	...	...	...	...	...
Wilson, Desmarais, Nicholls, & Brink, 2010	30	0.84	...	...	...	...	...

Abbreviations: AUC, area under the curve; BVC, Brøset Violence Checklist; DASA-IV, Dynamic Appraisal of Situational Aggression–Inpatient Version; ICC, intraclass correlation coefficient; NPV, negative predictive value; PPV, positive predictive value; START, Short-term Assessment of Risk and Treatability; V-RISK-10, Violence Risk Screening–10.

<sup>a</sup> This study used the extended BVC.

<sup>b</sup> Nurses.

## Results

### Validity

When the BVC, DASA-IV, V-RISK-10, and START were compared, only the BVC and V-RISK-10 provided AUC, sensitivity, specificity, PPV, and NPV (Table 5). DASA-IV and the meta-analysis used for START provided limited information.

### DASA-IV

In studies related to DASA-IV, AUC ranged from 0.71 to 0.86 (Dumais et al., 2012; Ogloff et al., 2006; Griffith et al., 2013; Lantta et al., 2016). In a study by Griffith et al. (2013), sensitivity was 68.1% and specificity was 70.0%. Those results are considered acceptable; however, the values are lower than those for other violence risk–assessment screening tools. Singh (2013) discussed how a sample size smaller than 200 results in large inaccuracies in ROC curve analysis. Three studies reported sample size: 20 to 24 (Griffith et al., 2013); 72 (Lantta et al., 2016); and 77 (Dumais et al., 2012). Given the limited available statistics and small sample sizes reported, the DASA-IV was not included in the recommendation.

### START

For START, AUC scores were reported in 9 studies (Table 5). The overall aggression AUC scores ranged from 0.61 to 0.84 (O'Shea & Dickens, 2014), and the sample size ranged from 30 to 120 (O'Shea & Dickens, 2014). After combining results for the 9 studies, O'Shea and Dickens (2014) noted the following overall statistics: AUC = 0.714 and  $n = 477$  for the strength scale, and AUC = 0.738 and  $n = 493$  for the vulnerability scale. Combined results for the 9 studies were broken out into separate sections; however, an overall combined score was not provided. The AUC and sample size values reported in Table 5 were based on individual study results. With sample sizes < 200 and the meta-analysis providing only AUC scores, START was not included in

the recommendation.

### BVC

Two studies (Rechenmacher et al. (2014) and Yao et al. (2014)) reported AUC, sensitivity, specificity, PPV, and NPV for the BVC. In addition, Rechenmacher et al. (2014) reported the following: sample size, 220; AUC, 0.93; sensitivity, 58.8% (extended BVC with cutoff of 7 or more [BVC-CH  $\geq 7$ ]); specificity, 96.8% (BVC-CH  $\geq 7$ ); PPV, 18.5% (BVC-CH  $\geq 7$ ); and NPV, 99.5% (BVC-CH  $\geq 7$ ) (Table 5). Rechenmacher et al. (2014) explained that the low sensitivity was due to interventions to prevent a person who was considered to be high risk for violence from becoming violent. The study also provided TP (10), TN, (1310), FN (7), and FP (44), which are helpful when determining the validity of the outcomes. That study was a prospective cohort study with a level of evidence of II (Table 2), and it used the BVC-CH with a visual acuity scale and 2 threshold cutoff points (6 and 7). The sensitivity (64.7%) and specificity (95.1%) for a cutoff threshold of 6 were slightly better than for a cutoff threshold of 7, thereby supporting the concept that cutoff points can provide predictive validity.

Yao et al. (2014) reported a sample size of 281; AUC, 0.85; sensitivity, 62.8%; specificity, 96.2%; PPV, 45.1%; and NPV, 98.0% (Table 5). That study compared cutoff thresholds as well; a cutoff threshold of 1 provided a sensitivity (78.5%), specificity (88.3%), PPV (14.6%), and NPV (99.2%) that were slightly better compared to a cutoff threshold of 2 (Yao et al., 2014). During the study, intense preventive interventions were undertaken (e.g., injection of psychotropic medication and physical restraint) (Yao et al., 2014). Results from the study suggested that combining outcomes (implementation of intensive preventive measures or aggressive episode) increased the AUC to 0.87 (Yao et al., 2014). That prospective study was conducted in China and the level of evidence was II (Table 2), but it did not provide FP, FN, TP, or TN, which would have been useful for comparison with intense preventive measures.

The third BVC study (Marques et al. (2015) (Table 5)) reported

sample size, 64; sensitivity, 77%; specificity, 100%; TP, 10; FN, 3; TN, 51; and FP, 0. AUC was not reported. That descriptive study took place in Portugal, and the level of evidence was V (Table 2).

The BVC is included in the recommendation because of the level of evidence of the studies; the positive results for AUC, PPV, NPV, sensitivity, and specificity; and the large sample sizes. The results indicate that the BVC violence risk–assessment screening tool may be valuable in an acute mental health setting.

#### V-RISK-10

Two V-RISK-10 studies (Hartvig et al. (2011) and Roaldset et al. (2012)) reported AUC, sensitivity, specificity, PPV, and NPV (Table 5). In the study by Hartvig et al. (2011), sample size was 1017; AUC, 0.82; sensitivity, 81%; specificity, 73.2%; PPV, 24%; and NPV, 97.3%. According to those authors, the PPV was low because of the high number of FPs; however, those numbers were not reported in this prospective study conducted in Norway (level of evidence, II) (Table 2). Sensitivity, specificity, PPV, and NPV of the V-RISK-10 were positive compared with other violence risk–assessment tools; the calibration for this violence risk assessment was favorable.

Roaldset et al. (2012) reported a sample size of 489; AUC, 0.84; sensitivity, 79%; specificity, 71%; PPV, 42%; and NPV, 92% (Table 5) in a naturalistic prospective study (level of evidence, II) (Table 2).

#### Reliability

Three V-RISK-10 studies provided interrater reliability and mean intraclass correlation coefficients (ICCs) (Table 5): ICC, 0.87 (Bjørkly et al., 2009) ICC, 0.85 (Hartvig et al., 2011); and ICC, 0.85 (Marques et al., 2015). For START, as reported by Desmarais, Nicholls, et al. (2012), Desmarais, Van Dorn, et al. (2012), ICC was 0.93. Outcomes in studies that provided the ICC were within the good to excellent range.

#### Discussion

Of the 10 studies examined, 4 used violence risk–assessment screening tools and reported AUC, sensitivity, specificity, PPV, and NPV (Table 5). Two of the 4 studies used the BVC (Rechenmacher et al., 2014; Yao et al., 2014) and 2 used V-RISK-10 (Hartvig et al., 2011; Roaldset et al., 2012). The other studies provided the AUC as a statistic used for the deciding outcome (Dumais et al., 2012; Griffith et al., 2013; Lantta et al., 2016; Ogloff & Daffern, 2006; O'Shea & Dickens, 2014). The following studies had a sample size smaller than 200 and therefore were eliminated from further evaluation; Dumais et al., 2012; Griffith et al., 2013; Marques et al., 2015; and Lantta et al., 2016. BVC and V-RISK-10 studies reported statistical information and could be evaluated for calibration and discrimination. The BVC studies (Rechenmacher et al., 2014; Yao et al., 2014) reported a higher AUC (i.e., discrimination) (0.93 and 0.85) than the V-RISK-10 studies (0.82 and 0.84) (Hartvig et al., 2011; Roaldset et al., 2012), and the V-RISK-10 values were favorable for violence risk prediction in sensitivity, specificity, PPV, and NPV (i.e., calibration) (Table 5).

#### Implications

In a second-order systemic review, Singh, Desmarais, and Dorn (2013) stated that several factors needed to be considered when interpreting AUC scores; of the studies in their review, 16 reported AUC and 14 of those were reported accurately. Specifically accurate were the results for correctly predicting use of a violence risk–assessment screening tool. Five studies in that review provided incorrect definitions of the probability that a risk prediction would be accurate (Singh et al., 2013). Lack of standardization and reporting consistency in the description and interpretation of performance indicators implies a need for clear guidelines for risk–assessment predictive validity studies. Singh et al. (2013) suggested that studies provide performance indicators to

highlight the predictive abilities of the assessment and that decisions on implementation of a violence risk–assessment tool should not be based on the author's interpretation of the AUC, since 90% of the reported AUC values were misinterpreted.

Two studies provided specific values for TP, TN, FN, and FP (Marques et al., 2015; Rechenmacher et al., 2014). Providing specific values allows the reader to better interpret the results. Many of the studies reported having a high FP rate without providing supporting statistics (Hartvig et al., 2011; Rechenmacher et al., 2014; Roaldset et al., 2012; Yao et al., 2014). Study designs may contribute to problems with risk assessment, such as ethical issues and duty to protect third parties; thereby, TP results can become FP results (Roaldset et al., 2011). FP assessments entail risk of unwarranted interventions (e.g., restraint, seclusion, injectable medications, and staff avoidance), and FN assessments tend to decrease the need for de-escalating interventions when interventions may be needed (Rechenmacher et al., 2014).

Implementation of interventions when patients are displaying violent behavior does occur and may contribute to high FP results. Correlating early de-escalation techniques (e.g., medications for agitation or aggression) and restrictive emergent interventions (e.g., injectable medications, with or without restraint and seclusion) may provide specific information on outcomes rather than an arbitrary conclusion. Another aspect is the correlation of restraint use and seclusion rates, thereby noting an increase or decrease after implementation of a violence risk assessment.

Owing to the limitations and the ability to examine the results from the studies reviewed, the following recommendation relates to the information within the studies and the values as reported. No further statistical information could be evaluated to offer additional clarity.

#### Recommendation

The purpose of this integrative review of the literature was to identify violence risk–assessment screening tools that could be used in acute care mental health settings. After review of the literature, the BVC, DASA-IV, START, and V-RISK-10 were analyzed further.

The BVC, within the results provided, had stronger discrimination for the AUC. However, the V-RISK-10 provided better calibration results for sensitivity, specificity, PPV, and NPV (Table 5). The BVC and V-RISK-10 provided strong support for their use within a mental health practice. Given that clinical expertise and provider preference are valued in clinical practice (Melnik & Fineout-Overholt, 2015), we recommend performing a pilot study to examine the use of BVC and V-RISK-10 in an acute care mental health setting. Use of 1 or both of these tools may differ by settings. For example, the V-RISK-10, unlike the BVC, uses historical information that may or may not be available upon admission, depending on the setting (Hartvig et al., 2011). Piloting both violence risk–assessment tools would allow for a clinician's perspective on the feasibility and value within the particular practice.

#### Conclusion

Violence is a large concern for mental health professionals and other persons who work with patients who express assaultive behavior. A violence risk–assessment screening tool that can help identify patients who might be at risk for violence allows for quick interventions, preventing episodes of violence. After examining 8 violence risk–assessment screening tools, 4 were chosen for further detail: the BVC, V-RISK-10, DASA-IV, and START. Within the results provided from the literature, the BVC and V-RISK-10, provided enough statistical information to be considered for use in acute care mental health settings.

#### Author contributions

K.K.A.—primary author and writing of the first draft; C.E.J.—critical revision of the manuscript.

## Conflict of interest

Neither author has any conflicts of interest. No grants or acknowledgements.

## Funding

The authors have disclosed that this study had no funding sources.

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<sup>1</sup> References marked with \* indicate studies included in the narrative review.