



## The “Prediction of Alcohol Withdrawal Severity Scale” (PAWSS): Systematic literature review and pilot study of a new scale for the prediction of complicated alcohol withdrawal syndrome

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### ABSTRACT

**Background:** To date, no screening tools for alcohol withdrawal syndromes (AWS) have been validated in the medically ill. Although several tools quantify the severity of AWS (e.g., Clinical Institute Withdrawal Assessment for Alcohol [CIWA]), none identify subjects at risk of AWS, thus missing the opportunity for timely prophylaxis. Moreover, there are no validated tools for the prediction of complicated (i.e., moderate to severe) AWS in the medically ill.

**Objectives:** Our goals were (1) to conduct a systematic review of the published literature on AWS to identify clinical factors associated with the development of AWS, (2) to use the identified factors to develop a tool for the prediction of alcohol withdrawal among patients at risk, and (3) to conduct a pilot study to assess the validity of the tool.

**Methods:** For the creation of the Prediction of Alcohol Withdrawal Severity Scale (PAWSS), we conducted a systematic literature search using PRISMA (preferred reporting items for systematic reviews and meta-analyses) guidelines for clinical factors associated with the development of AWS, using PubMed, PsychInfo, MEDLINE, and Cochrane Databases. Eligibility criteria included: (i) manuscripts dealing with human subjects, age 18 years or older, (ii) manuscripts directly addressing descriptions of AWS or its predisposing factors, including case reports, naturalistic case descriptions, and all types of clinical trials (e.g., randomized, single-blind, or open label studies), (iii) manuscripts describing characteristics of alcohol use disorder (AUD), and (iv) manuscripts dealing with animal data (which were considered only if they directly dealt with variables described in humans). Obtained data were used to develop the Prediction of Alcohol Withdrawal Severity Scale, in order to assist in the identification of patients at risk for complicated AWS.

A pilot study was conducted to assess the new tool's psychometric qualities on patients admitted to a general inpatient medicine unit over a 2-week period, who agreed to participate in the study. Blind to PAWSS results, a separate group of researchers retrospectively examined the medical records for evidence of AWS.

**Results:** The search produced 2802 articles describing factors potentially associated with increased risk for AWS, increased severity of withdrawal symptoms, and potential characteristics differentiating subjects with various forms of AWS. Of these, 446 articles met inclusion criteria and underwent further scrutiny, yielding a total of 233 unique articles describing factors predictive of AWS. A total of 10 items were identified as correlated with complicated AWS (i.e., withdrawal hallucinosis, withdrawal-related seizures, and delirium tremens) and used to construct the PAWSS. During the pilot study, a total of 68

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subjects underwent evaluation with PAWSS. In this pilot sample the sensitivity, specificity, and positive and negative predictive values of PAWSS were 100%, using the threshold score of 4.

*Discussion:* The results of the literature search identified 10 items which may be correlated with risk for complicated AWS. These items were assembled into a tool to assist in the identification of patients at risk: PAWSS. The results of this pilot study suggest that PAWSS may be useful in identifying risk of complicated AWS in medically ill, hospitalized individuals. PAWSS is the first validated tool for the prediction of severe AWS in the medically ill and its use may aid in the early identification of patients at risk for complicated AWS, allowing for prophylaxis against AWS before severe alcohol withdrawal syndromes develop.

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## Background

Alcohol use disorder (AUD) is the most serious substance abuse problem in the United States; the lifetime prevalence in the general population of alcohol abuse is 17.8%, and of dependence is 12.5% (Grant et al., 2004; Lieber, 1995; Williams et al., 1996). In 2011, 52% of Americans reported current alcohol use, 22.6% participated in binge drinking, and 6.2% reported heavy drinking (SAMHSA, 2012). The problem of AUD is often missed by house officers and may worsen among the growing population of elderly patients. When compared to standardized screening (e.g., CAGE questionnaire, Short Michigan Alcohol Screening Test), about 60% of screen-positive young patients with AUD were identified by their house officers, but only 37% of elderly patients were so identified ( $p < 0.05$ ) (Curtis, Geller, Stokes, Levine, & Moore, 1989).

Although AUD has been reported in 20%–42% of hospitalized medical patients, only about 7% of them are identified by a physician (Dawson, Dadheech, Speroff, Smith, & Schubert, 1992; Dolman & Hawkes, 2005; Gerke, Hapke, Rumpf, & John, 1997; Jarman & Kellett, 1979; Mayo-Smith, 1997; McCusker, Cherubin, & Zimberg, 1971; Moore, 1971; Moore et al., 1989; Nielsen, Storgaard, Moesgaard, & Gluud, 1994; Smothers, Yahr, & Ruhl, 2004; Taylor, Kilbane, Passmore, & Davies, 1986). The prevalence of AUD is higher in specialized populations, affecting about 40% of patients presenting to the emergency department (Holt et al., 1980), 43–81% of head and neck surgical patients (Martin et al., 2002; Moore et al., 1989; Nielsen et al., 1994), 42% of hospitalized veterans (Tracy, Trafton, & Humphreys, 2004), 59–67% of trauma patients (Angles et al., 2008; Gentilello, Donovan, Dunn, & Rivara, 1995; Hervè, Gaillard, Roujas, & Huguenard, 1986; Pandharipande et al., 2008; Soderstrom et al., 1992; Spies, Neuner, et al., 1996), up to 44% of elderly inpatients admitted to acute geriatric units (Henni, Bideau, Routon, Berrut, & Cholet, 2013), and up to 60% of ICU patients (Awissi, Lebrun, Coursin, Riker, & Skrobik, 2013).

AWS includes a broad spectrum of symptoms and severity (Alpert, 1985; Babb & Jenkins, 1990; Batel, 1999; Bayard, McIntyre, Hill, & Woodside, 2004; Berard, 1994; Boeckh, 1980; Bovim, Fauske, & Strandjord, 1987; Brown, 1982; Carlson et al., 2012; Cocayne, 1978; Couzigou & Ledinghen, 2002; Croissant & Mann, 2000; Eastes, 2010; Farfán Sedano et al., 1997; Ferrey & Sicot, 1982; Feuerlein, 1972, 1974; Gillman & Lichtigfeld, 1997; Gippini Pérez, Rodríguez López, Torre Carballada, Tomé y Martínez de Rituerto, & Barrio Gómez, 1990; Goldstein, 1986; Gross, Rosenblatt, Malenowski, Broman, & Lewis, 1972; Hall & Zador, 1997; Heil, Martens, & Eyrich, 1990; Iwasaki, 1988; Johnson, 1961; Kalant, 1977; Landers, 1983; Lerner & Fallon, 1985; Maldonado, 2010; Maldonado, DiMartini, & Owen, 2010; Margolis, Ypinazar, Clough, & Hunter, 2008; Matz, 1997; McElroy, 1981; McKeon, Frye, & Delanty, 2008; McKinley, 2005; McMicken, 1990; Nichols, 1967; Pearson, 1813; Picatoste Merino, 1997; Powell & Minick, 1988; Puz & Stokes, 2005; Rico Irlas, 1990; Robertson & Sellers, 1978; Sarff & Gold, 2010; Strasen, 1982; Sutton, 1813; Trucco, 1974; Turner, Lichstein, Peden, Busher, & Waivers, 1989; Victor, 1970; Wooddell,

1979; Yost, 1996; Zilker, 1999). Complicated AWS can present in various forms, including alcohol withdrawal seizures, alcoholic hallucinosis, and delirium tremens (DT). DT constitutes the most severe form of AWS, occurring in 5–10% of patients with AWS (Holt et al., 1980; Victor & Adams, 1953). When left untreated, DT may be fatal in up to 15% of cases (Lee et al., 2005; Thompson, 1978; Thompson, Johnson, & Maddrey, 1975). Even when treated, DT results in death in 1% of cases and in up to 20% of cases in the medically ill, with certain comorbidities (Ferguson, Suelzer, Eckert, Zhou, & Dittus, 1996; Maldonado, 2010; Thompson, 1978; Victor, 1970).

Nevertheless, studies have shown that in medically ill, hospitalized subjects (i.e., not a specialized detoxification or substance abuse unit), most cases of AWS are relatively mild and require only symptomatic management (e.g., mild anxiety, agitation, tremors, nervousness, irritability, insomnia, GI symptoms) (Whitfield et al., 1978). In fact, most patients with AUD experience only uncomplicated or mild withdrawal symptoms (Victor & Adams, 1953). In most cases, the symptoms of mild alcohol withdrawal do not require medical intervention and usually disappear within 2–7 days of the last drink (Hall & Zador, 1997; Schuckit, 2009). Furthermore, studies suggest that the incidence of AWS, among alcohol-dependent subjects admitted to a general medical hospital severe enough to require pharmacological treatment, is between 5 and 20% (Benzer, 1990; Feldman, Pattison, Sobell, Graham, & Sobell, 1975; Foy, McKay, Bertram, & Sadler, 2006; Manasco, Chang, Larriviere, Hamm, & Glass, 2012; Menecier et al., 2008; Neundörfer, Claus, & Burkowski, 1984; Palmstierna, 2001; Saitz & O'Malley, 1997; Schuckit, Tipp, Reich, Hesselbrock, & Bucholz, 1995; Victor & Adams, 1953). The unnecessary prophylaxis or treatment of patients feared to be at risk of AWS or experiencing AWS may lead to a number of unintended consequences including excessive sedation, falls, respiratory depression, propylene glycol toxicity, disinhibition, and delirium (Busch & Frings, 1988; DeCarolis, Rice, Ho, Willenbring, & Cassaro, 2007; Höjer, Baehrendtz, & Gustafsson, 1989; Kraemer, Conigliaro, & Saitz, 1999; Lejoyeux, Solomon, & Adès, 1998; Malcolm, 2003; de Wit, Jones, Sessler, Zilberberg, & Weaver, 2010). Some have found that delirium may be a significant potential complication of treatment of presumptive AWS (Pandharipande et al., 2006; Repper-DeLisi et al., 2008).

Yet, when complicated (i.e., moderate to severe) AWS do occur, it increases in-hospital morbidity and mortality, prolongs hospital stays, inflates costs, increases the burden on nursing and medical staff, and further worsens cognitive functioning among subjects experiencing withdrawal. For example, among adult patients undergoing head and neck cancer surgery, the development of AWS was associated with an increased incidence of acute medical and surgical complications, length of hospitalization, and hospital-related costs (Genther & Gourin, 2012). Similarly, among those admitted to a level I trauma center, patients experiencing AWS had more ventilator days, intensive care unit days, and total hospital days, suffered more medical complications, and incurred higher care costs (Bard et al., 2006; O'Brien et al., 2007; Spies, Nordman, et al.,

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