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Classification accuracy of the Portland digit recognition test in persons claiming exposure to environmental and industrial toxins

Kevin W. Greve [a,b,*], Kevin J. Bianchini [a,b], Matthew T. Heinly [a,b,1], Jeffrey M. Love [a,b,2], Douglas A. Swift [c], Megan Ciota [b]

[a] *Department of Psychology, University of New Orleans, New Orleans, LA, United States*
[b] *Jefferson Neurobehavioral Group, Metairie, LA, United States*
[c] *Occupational Medicine Clinic, Metairie, LA, United States*

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Abstract

The classification accuracy of the Portland digit recognition test (PDRT) in detecting cognitive malingering was studied in patients claiming cognitive deficits due to exposure to environmental or industrial toxins. Twenty-nine patients alleging toxic exposure and who met Slick et al. [Slick, D. J., Sherman, E. M. S., & Iverson, G. L. (1999). Diagnostic criteria for malingering neurocognitive dysfunction: Proposed standards for clinical practice and research. *The Clinical Neuropsychologist, 13*, 545–561] criteria for malingered neurocognitive dysfunction were compared to 14 toxic exposure patients negative for evidence of malingering. The published cutoffs were associated with a false positive error rate of 0% and sensitivity of more than 50%. When criterion for a PDRT failure was a positive PDRT finding on more than one section, the FP rate remained 0% while sensitivity improved to about 70%. The results indicate that a failed PDRT is an indication of malingering and not the neurological effect of a toxic substance or some other clinical phenomenon. The PDRT can be used with confidence as an indicator of negative response bias in cases of alleged exposure to neurotoxic substances.

Keywords: Neurotoxic exposure; Cognition; Malingering; Neuropsychological assessment; Known-groups design; Symptom validity test

The problem of malingering has been relatively neglected in cases of alleged exposure to environmental and industrial toxins (Bianchini et al., 2003). Nonetheless, it is an issue of some importance given that exposure often occurs in a compensable context. Bianchini et al. (2003) demonstrated that malingering does occur in toxic exposure and illustrated the conservative application of empirically based detection techniques and their use within Slick, Sherman, and Iverson's (1999) system for the diagnosis of malingered neurocognitive dysfunction (MND). The survey data of Mittenberg, Patton, Canyock, and Condit (2002) suggest that the prevalence of malingering in alleged cases of neurotoxic chemical-related disease is about 30%. The work of van Hout and colleagues (van Hout, Schmand,

* Corresponding author at: Department of Psychology, University of New Orleans-Lakefront, New Orleans, LA 70148, United States. Tel.: +1 504 280 6185; fax: +1 504 280 6049.
E-mail address: kgreve@uno.edu (K.W. Greve).
[1] Now at Kutztown University, United States.
[2] Now at Pennsylvania State University, United States.

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Wekking, & Deelman, 2006; Van Hout, Schmand, Wekking, Hageman, & Deelman, 2003) and Greve et al. (2006a) suggest a similar range.

Appropriate assessment of patients claiming cognitive impairment due to toxic exposure requires the assessment of potential malingering and the development of scientifically based techniques with which to identify malingering patients. Recent research (Greve et al., 2006b, 2007) with the Test of Memory Malingering (Tombaugh, 1996), a stand-alone, forced-choice symptom validity test (SVT), and Reliable Digit Span (RDS; Greiffenstein, Baker, & Gola, 1994), an "embedded" clinical indicator of malingering, indicates that malingering in persons claiming cognitive deficits attributable to toxic exposure can be accurately identified. Moreover, these studies suggest that data from malingering detection studies in traumatic brain injury (TBI) can be reasonably applied to toxic exposure cases.

The Portland Digit Recognition Test (PDRT; Binder & Willis, 1991; Binder, 1993a, 1993b), is one of the first formally developed forced-choice symptom validity tests (SVT; Bianchini, Mathias, & Greve, 2001) and is still in common use (Slick, Tan, Strauss, & Hultsch, 2004). The PDRT is a 72-item SVT employing visual recognition of orally presented five-digit number strings (Binder, 1990, 1993a). The 72 items are divided into two sets of 36 items: the first 36 trials are referred to as the "Easy" items and the second 36 are the "Hard" items based on their apparent difficulty.

The published cutoffs (Binder & Willis, 1991; Binder, 1993a) for the easy, hard and total items sets are associated with a 0% false positive error (FP) rate (100% specificity) in non-compensation-seeking patients with objective evidence of brain damage (Binder & Kelly, 1996). Ju and Varney (2000) reported a false positive error rate of 8–10% for the full test in a similar sample. Bianchini, Mathias, Greve, Houston, and Crouch (2001) reported specificity of 100% for the published cutoffs in a group of non-compensation-seeking TBI patients who had mostly suffered moderate–severe injuries. These findings were replicated by Greve and Bianchini (2006) who also reported classification accuracy data at a range of cut scores. Sensitivity at cutoffs associated with conservative FP rates (e.g., 0–5%) ranged from about 25% up to about 70% in TBI.

1. Purpose

The purpose of this study is to use a known-groups design to determine the classification accuracy of the PDRT in persons alleging toxic exposure. The Slick et al. (1999) criteria and well-validated malingering indicators were used to classify patients as malingering or not malingering. Only psychometric indicators of malingering which have been validated in traumatic brain injury patient groups which included persons with objectively documented brain damage (e.g., positive neuroradiological findings) were used. By only using data from studies that included persons with documented brain damage in the non-malingering groups, we reduce the risk of false positive errors in persons exposed to substances with well-documented neurotoxic properties (e.g., carbon monoxide).

2. Method

2.1. Participants

2.1.1. Toxic exposure

PDRT data were collected from the files of 133 persons referred for neuropsychological evaluation related to alleged exposure to environmental and industrial substances. The 71 persons who were not administered the PDRT and the two who completed an abbreviated PDRT were excluded. All data were archival and were collected over the past 10 years from a single clinical psychology practice in a Southeastern metropolitan area. Table 1 lists the substances to which these patients were exposed. Some of these substances have no neurotoxic properties (e.g., helium, clonazepam, mold). Others may indirectly result in neurological damage, usually via hypoxia secondary to pulmonary damage (e.g., hydrochloric acid, chlorine gas, mustard gas). Still others (e.g., carbon monoxide, lead, organic solvents) can have direct neurotoxic properties. In most cases, the degree of exposure was determined insufficient to produce significant brain dysfunction and/or there was no objective evidence of brain pathology. However, because some patients did have clinically meaningful neurotoxic exposures, psychometric criteria contributing to the diagnosis of malingering are based on the performance of samples which include patients with objectively defined brain pathology (see above). All included patients had external incentive in the form of a workers compensation and/or personal injury claim.