



Towards reporting standards for neuropsychological study results: A proposal to minimize communication errors with standardized qualitative descriptors for normalized test scores

Mike R. Schoenberg*, Ruba S. Rum

Department of Neurosurgery and Brain Repair, University of South Florida Morsani College of Medicine, Tampa, FL, USA

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ABSTRACT

Objective: Rapid, clear and efficient communication of neuropsychological results is essential to benefit patient care. Errors in communication are a lead cause of medical errors; nevertheless, there remains a lack of consistency in how neuropsychological scores are communicated. A major limitation in the communication of neuropsychological results is the inconsistent use of qualitative descriptors for standardized test scores and the use of vague terminology.

Patients and methods: PubMed search from 1 Jan 2007 to 1 Aug 2016 to identify guidelines or consensus statements for the description and reporting of qualitative terms to communicate neuropsychological test scores was conducted. The review found the use of confusing and overlapping terms to describe various ranges of percentile standardized test scores.

Results: In response, we propose a simplified set of qualitative descriptors for normalized test scores (Q-Simple) as a means to reduce errors in communicating test results. The Q-Simple qualitative terms are: 'very superior', 'superior', 'high average', 'average', 'low average', 'borderline' and 'abnormal/impaired'. A case example illustrates the proposed Q-Simple qualitative classification system to communicate neuropsychological results for neurosurgical planning.

Conclusions: The Q-Simple qualitative descriptor system is aimed as a means to improve and standardize communication of standardized neuropsychological test scores. Research are needed to further evaluate neuropsychological communication errors. Conveying the clinical implications of neuropsychological results in a manner that minimizes risk for communication errors is a quintessential component of evidence-based practice.

1. Introduction

Neuropsychological evaluations provide unique information to the referring clinician and patient (and caregivers as appropriate), offering answers to diagnostic and treatment-related questions in terms of brain-behavior correlates, capacity, rehabilitation, and prognosis [1–5]. It is essential the assessment results be communicated accurately, clearly and efficiently to promote patient health, reduce costs, and minimize risks for communication errors [6–9]. Ultimately, practice patterns that diminish the efficient, understandable, and timely communication of results adversely affect patient safety, reduce the quality of patient care and increase costs [8,10].

1.1. Types of neuropsychological data to convey

A central component of a neuropsychological evaluation consists of

standardized, reliable, and norm-based assessments to measure brain function that can include attention/executive, language, memory/learning, and/or visuospatial/constructional functions as well as processing speed, academic skill development and fine motor speed/dexterity [2,11,12]. The tests are standardized, using normative data and regimented administration procedures to allow for generalization of measured behavior to established brain-behavior relationships for the purposes of health care provision, rehabilitation, prognosis or capacity decisions. In an ideal case, appropriate norms are used to increase the specificity of test findings while simultaneously reducing the test variance associated with other demographic variables such as age, gender, and education level. A consequence of norm-referenced tests is that cutoff values and the normative set used can dramatically influence: (1) test sensitivity, (2) test specificity, and (3) diagnostic validity [13]. The clinical interpretation is made particularly complex given that a single neuropsychological assessment can include multiple (10 or more)

* Corresponding author.

E-mail address: mschoenb@health.usf.edu (M.R. Schoenberg).

neuropsychological tests, each having an independent normative data set from which standardized test scores are derived that can also differ in extent demographic factors (age, education, gender, ethnicity, etc.) are incorporated. Further, the same neuropsychological test may have more than one (sometimes multiple) independent normative data sets a clinician may use (see for example Trail Making Test normative data sets [14,12,15]). In addition to normative test data, the neuropsychological study also includes history of symptoms or problems, medical/psychiatric history, social/occupational/development history, mental status, behavioral observations, and observations about study validity/reliability. To provide holistic, personalized, and reliable medical care, a neuropsychologist must be able to interpret and convey both qualitative aspects of the patient's behavior and quantitative test data into meaningful clinical judgment to answer referral question(s).

1.2. Conveying neuropsychological results

There is no agreed upon standard for a neuropsychological report format, and neuropsychologists and users of the report may have differing perspectives of the ideal format and style [2,16–19,3–5,9]. The existing recommendations for communicating neuropsychological results provide general guidance in what sections a written report should have and calls for writers to clearly convey results/diagnosis and recommendations [2,9]. Furthermore, testing standards [6] and professional ethics [7] highlight the need to produce reports that: (1) support the role of the neuropsychologist as a consultant by encouraging communication of results, (2) is tailored to satisfy the need for timeliness for communicating results, and (3) minimizes the risk for communication errors [6,7,2,8,3–5,9]. The proposed suggestion for a neuropsychology reporting guideline mirrors the recommendations established by radiology [20–22] for reporting results such that the format for communicating study results is less important than is it that the report is: (a) timely and (b) efficiently conveys results that minimize potential for communication errors. Unfortunately, there has been no guidance or consistency in how standardized test scores are communicated.

2. Methods and materials

2.1. The need for consensus in communicating neuropsychological test results

It is well understood across medicine that communication errors adversely affect patient care, contribute to medical errors, and increase costs [8,10]. “PubMed search from 1 Jan 2007 to 1 Aug 2016 for terms related to ‘neuropsycholog*’, ‘reporting standards’, or ‘consensus statements’ did not result in any practice guidelines to standardize the communication of qualitative descriptors for neuropsychological normative test scores (see [2]). At a minimum, the neuropsychological report should clearly communicate if the study is: (1) abnormal and related to known or suspected neurological (neurophysiological) dysfunction, (2) equivocal and the study could reflect normal variant or mild abnormality, but are indeterminate from the neuropsychologist's opinion, or (3) normal (no brain dysfunction). Unfortunately, the qualitative descriptors used to describe standardized test scores (i.e., the term(s) used to describe a standardized test score deviating from ‘normal’ or ‘abnormal’) are highly variable, which can obfuscate the results and increase the potential for communication errors (e.g. [23]).

2.2. Test score qualitative descriptors

The term ‘test score qualitative descriptor’ refers to the terms authors use to communicate how a patient performed on a norm-referenced neuropsychological test and not to descriptors of mental status. There are at least two inter-related problems in neuropsychological practice related to the use of test score qualitative descriptors. First,

there is marked variability in the test score qualitative descriptors used to describe neuropsychological standardized scores [23]. Second, there is a lack of consensus in the range of standard scores/percentiles that correspond to a particular test score qualitative descriptor (i.e., what scores are “average”) [24,25,19,26,23,27,14,28,29]. Despite repeated calls for more uniform use of the test score qualitative descriptors that delineate the relative uniqueness or statistical probability of test scores (e.g., ‘below average’, ‘mildly impaired’, ‘borderline’, ‘extremely low’, etc.), there remains excessive variability and no consensus among neuropsychologists [e.g. [2,17,23]]. Further adding to the confusion, test score qualitative descriptors that sound similar (e.g., ‘low average’, ‘low normal’, ‘borderline’, ‘below average’) do not overlap in terms of how rare or unusual a score is in its interpretation. Indeed, a survey of 110 neuropsychologists [23] found the index score of 70 (2nd percentile) was described using 22 different test score qualitative terms, with 6 different terms using the word ‘impaired’ (e.g., ‘impaired’, ‘borderline impaired’, ‘mildly impaired’, ‘moderately impaired’, ‘severely impaired’, and ‘significantly impaired’).

Currently, there are at least three different test score qualitative classification schemas (with multiple permutations) that are generally recognized [14,28,29]:

1. Clinical Classification system advocated by Heaton et al. [14]
2. Clinical classification advocated by Schretlen et al. [28]
3. The David Wechsler/Intelligence classification system [29]

The three commonly used qualitative classification systems above, along with a fourth based on the Wechsler classification system that uses different test score qualitative terms [26], are displayed in the first four columns of Fig. 1. Surprisingly, there is lack of agreement for most terms, including the most commonly used test score qualitative descriptor, ‘average’. The Wechsler system [29] suggests scores falling in the 25–74th (or 75th) percentiles are ‘average’ while the Heaton et al. [14] classification system identifies scores falling between the 30–67th percentiles as ‘average’. The Schretlen et al. [28] classification system generally mirrors the Wechsler system and describes scores between 24–74th percentiles as ‘average’. There is even less consensus for percentile scores that fall outside of the ‘average’ range. A score falling at the 9th percentile may be ‘below average’ using the Wechsler classification system [29], ‘mildly impaired’ using the Heaton et al. [14] classification system, or ‘low average’ using the Schretlen et al. [28] rating system. Even more troubling is the use of similar test score qualitative descriptors for different ranges of percentile scores between the classification schemes (i.e., ‘low average’ versus ‘below average’). For example, ‘low average’ describes scores falling between the 9–24th percentiles using the Wechsler classification scheme [29], while “below average” is used to describe scores ranging from 16–27th percentiles using the Heaton et al. [14] system. The term ‘borderline’ equates to scores ranging from the 2–8th percentiles using the Wechsler [29] and Schretlen et al. [28] systems, but Heaton et al. [14] describes scores from the 6th–15th percentiles as ‘mildly impaired’. Thus, Heaton et al.'s [14] ‘mildly impaired’ scores reflect scores that are delineated as ‘borderline’ or ‘low average’ by Wechsler [29] and Schretlen et al. [28]. The confusion of terms and disagreement in score ranges lacks precision and will contribute to errors in communicating results to health providers and patients [23]. Indeed, the lack of precision has contributed to recommendations by neuropsychologists to include test scores in the neuropsychological report itself [16,19].

To address the lack of consistency in test score qualitative descriptors when communicating the results of neuropsychological assessment, a simplified qualitative reporting system is recommended, and is delineated in Table 1. This classification categorization is also presented in reference to the four commonly used qualitative classification systems in Fig. 1.

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