Published in final edited form as:

Clin Neuropsychol. 2008 July ; 22(4): 662–665. doi:10.1080/13854040701476976.

EQUIVALENCY OF SPANISH LANGUAGE VERSIONS OF THE TRAIL MAKING TEST PART B INCLUDING OR EXCLUDING “CH”

Mariana Cherner¹, Paola Suárez¹, Carolina Posada¹, Lidia Artiola i Fortuny², Thomas Marcotte¹, Igor Grant^{1,3}, Robert Heaton¹, and the HNRC group

¹Department of Psychiatry, University of California San Diego, La Jolla, California

²Private Practice, Tucson, Arizona

³VA San Diego Healthcare System, La Jolla, California, USA

Abstract

Spanish speakers commonly use two versions of the alphabet, one that includes the sound “Ch” between C and D and another that goes directly to D, as in English. Versions of the Trail Making Test Part B (TMT-B) have been created accordingly to accommodate this preference. The pattern and total number of circles to be connected are identical between versions. However, the equivalency of these alternate forms has not been reported. We compared the performance of 35 healthy Spanish speakers who completed the “Ch” form (CH group) to that of 96 individuals who received the standard form (D group), based on whether they mentioned “Ch” in their oral recitation of the alphabet. The groups had comparable demographic characteristics and overall neuropsychological performance. There were no significant differences in TMT-B scores between the CH and D groups, and relationships with demographic variables were comparable. The findings suggest that both versions are equivalent and can be administered to Spanish speakers based on their preference without sacrificing comparability.

Keywords

Alphabet; CH; Equivalent forms; Spanish; Trails B

INTRODUCTION

The Trail Making Test B (TMT-B; War Department, 1944) is commonly used to measure aspects of cognitive flexibility, divided attention, and processing speed. It requires recognition and knowledge of natural numeric and alphabetic sequences, visual scanning, flexible switching between number and letter series, and working under time pressure. Data from 475 neuropsychologists who completed a survey on the status of neuropsychological practice with Hispanic people in the United States, place the TMT-B among the 10 most widely used tests with bilingual and monolingual Hispanics (Echemendia & Harris, 2004). As Spanish speakers commonly use two versions of the alphabet, one that includes the sound “Ch” between C and D and another that goes directly to D, versions of the TMT-B have been created to accommodate this preference.

As with other romance languages, Spanish is based on the Latin alphabet. Since the fourth edition of their dictionary in 1803, the Academia Real de la Lengua Española has endorsed a 29-symbol alphabet: a, b, c, ch, d, e, f, g, h, i, j, k, l, ll, m, n, ñ, o, p, q, r, s, t, u, v, w, x, y, z. The digraphs (symbols made up of two letters) *ch* and *ll* were included in the alphabet, since each represents a single sound. During the Tenth Congress of the Association of Academies of the Spanish Language in 1994, it was agreed by petition of several international organizations to stop considering *ch* and *ll* as independent symbols. Consequently, words that begin with these two digraphs are to be alphabetized as they would be if they began with *c* and *l*, respectively. Despite this change, *ch* and *ll* were allowed to remain in the alphabet (Fernandez Lopez, 2007; X Congreso de Academias de la Lengua Española, 1998).

The determinants of whether Spanish speakers include or exclude these digraphs when asked to recite the alphabet have not been systematically reported, to our knowledge, and likely depend on regional customs. Nevertheless, the TMT-B version chosen should be tailored to this preference in order to avoid spurious problems with test performance resulting from divergence between the individual's learned alphabetic sequence and that of the test stimulus. We therefore set out to determine the equivalency of these two versions of the TMT-B.

METHOD

Participants

The sample consisted of 131 (71 women, 60 men) native Spanish speakers of Mexican descent from the US–Mexico border regions of Arizona and California. Study participants responded to flyers or direct contact with recruiters in community settings. They were selected on the basis of having reason to spend time in the United States on a regular basis (e.g., for work, school, place of residence). All participants responded to a language use questionnaire to determine that Spanish was their preferred language. Additionally, the Controlled Oral Word Association Test (Borkowski, Benton, & Spreen, 1967) was administered in both languages (PMR in Spanish, FAS in English) to confirm relative language proficiencies—mean (*M*) and standard deviation (*SD*) for PMR vs. FAS: CH = 41.2 (12.6) vs. 17.6 (13.8); D = 39.6 (11.9) vs. 18.6 (13.1); no significant differences between groups. Participants were carefully screened to ensure that they had no significant history of neurologic, metabolic, psychiatric, developmental, or substance abuse problems. Participants with low literacy who could not recite the alphabet were excluded. There were 35 participants who completed the “Ch” form (CH group), based on mentioning “Ch” in their oral recitation of the alphabet, and 96 individuals who received the standard form (D group). All participants were part of a larger neuropsychological (NP) test-norming study. Both groups ranged in age from 20 to 55 years (CH: *M* = 37.5, *SD* = 9.3; D: *M* = 36.6, *SD* = 9.6, *p* = .63) and had comparable levels of education (CH: *M* = 10.1, *SD* = 4.4, range 3–20; D: *M* = 10.5, *SD* = 4.0, range = 3–19; *p* = .61). The CH group had proportionately more women (68% vs. 49%; $\chi^2 = 4.06$, *p* < .05). The groups had similar overall NP performance, as indexed by a demographically corrected mean T-score for the complete battery of 16 NP tests (CH: *M* = 51.9, *SD* = 4.0; D: *M* = 51.1, *SD* = 4.4, *p* = .39).

Measure

The Trail Making Test-B requires the respondent to connect encircled numbers and letters in an alternating pattern (1-A-2-B-3-C, etc.) as quickly as possible. The pattern and total number of circles to be connected are identical between the original and “Ch” versions. We used Reitan's method of scoring (Reitan & Wolfson, 1995), which involves pointing out errors as they are made, requiring participants to correct any errors in their responses without stopping the clock. The raw score is the total time to completion, up to 300 seconds.

RESULTS

There was no difference in mean raw TMT-B time to completion between the CH ($M = 91.8''$, $SD = 52.8''$) and D ($M = 90.8''$, $SD = 55.6''$) groups ($p = .54$). The relatively high mean scores are consistent with representation of low levels of education in both groups. Associations between education and TMT-B raw score were comparable between the groups (CH: $r = .65$, D: $r = .55$; Z difference = 0.73, $p = .46$). There was no relationship between raw score and either age or gender.

DISCUSSION

In this study we set out to determine the equivalence of two versions of the TMT-B, with the premise that performance may be hampered if individuals are given a test version that is discordant with their use of Ch in the alphabet. However, we did not have the data necessary to examine this potential difference in performance. It would therefore be useful to test this hypothesis in a demographically diverse sample of Spanish speakers. In the US, the more likely scenario in a clinical setting is that a Ch user will receive the original ("D") version. In this situation, we believe that some time would be lost during the visual search for the non-existent Ch. In the opposite scenario, those who do not use Ch would search directly for D and would lose time retracing their steps on the Ch version. We speculate that this latter situation would be more costly, since the presence of Ch on the test form may be more surprising to someone who is unfamiliar with its use than its absence would be in the converse situation. Additionally, the "recovery" in performance after the unexpected letter/digraph is encountered may be influenced by familiarity with these variants of the Spanish alphabet, which may in turn be related to level of education or, among immigrant groups, level of acculturation. These thoughts remain speculative until further study.

The findings based on our available data suggest that versions of the TMT-B with and without "Ch" are equivalent and can be administered to Spanish speakers based on their preference without sacrificing comparability. Since raw scores for each version had nearly identical relationships with demographic variables, demographically corrected norms can be generated based on the raw scores without regard to test version. Given the relatively small sample size in this study, it would be helpful to verify the findings with larger groups. Additionally, to ensure generalizability, the equivalency of the two TMT-B versions should be tested in Spanish speakers of different national origin.

Acknowledgments

The authors wish to acknowledge support from the U.S. National Institutes of Health (P30-MH62512, R01-MH064907) and the contributions of study participants and staff at the HIV Neurobehavioral Research Center, San Diego, CA, USA.

REFERENCES

- Borkowski JG, Benton AL, Spreen O. Word fluency and brain damage. *Neuropsychologia*. 1967; 5:135–140.
- Echemendia RJ, Harris JG. Neuropsychological test use with Hispanic/Latino populations in the United States: Part II of a national survey. *Applied Neuropsychology*. 2004; 11(1):4–12. [PubMed: 15471742]
- Lopez, J. Fernandez El alfabeto y la pronunciación. Hispanoteca. [Retrieved 2007]. 2007 from <http://culturitalia.uibk.ac.at/hispanoteca/>
- Reitan RM, Wolfson D. The Category Test and the Trail Making Test as measures of frontal lobe functions. *Clinical Neuropsychology*. 1995; 9:50–56.

- War Department. Army Individual Test Battery: Manual of directions and scoring. War Department, Adjunct General's Office; Washington, DC: 1944.
- X Congreso de Academias de la Lengua Española. Memoria, Madrid: Espasa-Calpe, S.A. 1998.
Retrieved from <http://www.asale.org/ASALE/ConAALEBD?IDDOC=6010>