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Accounting for ethnic-cultural and linguistic diversity in neuropsychological assessment of patients with drug-resistant epilepsy: A retrospective study

Valeria Peviani [a,b,*], Pina Scarpa [a,b], Alessio Toraldo [b], Gabriella Bottini [a,b]

[a] Cognitive Neuropsychology Center, ASST Grande Ospedale Metropolitano Niguarda, Piazza dell'Ospedale Maggiore 3, 20162 Milan, Italy
[b] Department of Brain and Behavioural Sciences, University of Pavia, Via Bassi, 21, 27100, Pavia, Italy

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ABSTRACT

Neuropsychological assessment is critical in both diagnosis and prognosis of patients with epilepsy. Beyond electrophysiological and anatomical alterations, other factors including different ethnic-cultural and linguistic backgrounds might affect neuropsychological performance.
Only a few studies considered migration and acculturation effects and they typically concerned nonclinical samples.
The current study aimed at investigating the influence of ethnic background and time spent in Italy on a full neuropsychological battery administered to both Italian and foreign-born patients and at providing a brief interview for obtaining relevant information on each patient's transcultural and language-related history.
Clinical reports from 43 foreign-born patients with drug-resistant epilepsy were collected from the archives of Milan Niguarda Hospital. Epileptogenic zone, age, education, profession, illness duration, seizure frequency, handedness, and gender were considered in selecting 43 Italian controls.
Ethnicity (Italian/foreign-born) and years spent in Italy were analyzed as main predictors on 21 neuropsychological scales by means of General(ized) Linear Models. An additional analysis studied two composite scores of overall verbal and nonverbal abilities.
Ethnicity significantly affected the following: the verbal overall score, Verbal Fluency, Naming, Token-test, Digit Span, Attentional Matrices, Trail-Making-Test, Line-Orientation-Test, and Raven matrices; no effects were found on the nonverbal overall score, Word Pairs Learning, Episodic Memory, reading accuracy, visual span, Bells test, Rey Figure, and face memory and recognition. No significant effects of years spent in Italy emerged.
While years spent in Italy does not predict neuropsychological performance, linguistic background had a strong impact on it. With respect to Italian-speaking patients, those who were foreign-born showed large task-related variability, with an especially low performance on language-related tests. Hence, language tests should not be considered as valid measures of neuropsychological impairment in this population, not even in foreign-born patients with good Italian fluency. Clinicians should consider such asymmetries in order to improve the accuracy of neuropsychological assessment of foreign-born patients.

1. Introduction

Over the past few decades, migratory flows of people have been increasing all over the world; 8.1% of the Italian population are foreign-born [1]. As a consequence, clinicians are routinely dealing with ethnic and linguistic diversity. Neuropsychological assessment is crucial in defining diagnostic and prognostic outcomes of patients with drug-resistant epilepsy (DRE) [2] and to investigate how electrophysiological and anatomical cerebral alterations modulate cognitive functions. Although these two components seem to be the most relevant in inducing neuropsychological impairments, there are several other variables to consider e.g., the diverse ethnic, cultural, and linguistic

Abbreviations: DRE, drug-resistant epilepsy; ROCF, Rey-Osterrieth Complex Figure; TMT-A, Trail Making Test-A; ILAE, International League Against Epilepsy; FGB, foreign-born group; ICG, Italian control group; EZ, epileptogenic zone; YI, years in Italy; VIF, variance inflation factor; JLO, Judgment of Line Orientation; TMT-B, Trail Making Test-B; CSRMT, Camden Short Recognition Memory Test; CPM, Colored Progressive Matrices; GLM, General Linear Model; GzLM, Generalized Linear Model; FW, forward; BW, backward; WPL, Word Pairs Learning; IF, Italian fluency; Corsi SS, Corsi Sovraspan; BFR, Benton Facial Recognition; L1, mother tongue; L2, L3, second languages.

* Corresponding author at: Via Cimabue 12, 26841 Casalpusterlengo, LO, Italy.
E-mail addresses: valeriacarmen.peviani01@universitadipavia.it (V. Peviani), pina.scarpa71@gmail.com (P. Scarpa), alessio.toraldo@gmail.com (A. Toraldo), g.bottini@unipv.it (G. Bottini).

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background [3,4], which might affect the patients' performance on neuropsychological testing. The effects of bilingualism on neuropsychological performance have primarily been studied; for instance, lower scores on verbal tests (Verbal Fluency and Naming) were frequently observed in early bilinguals compared with monolinguals [5–7], although the assessed individuals typically showed very high fluency levels. However, most of these studies did not take into account the possible modulation by ethnicity and cultural factors, which might have induced some of the differences observed between international samples [8–10] and among the American main ethnic subgroups [11–13]. Furthermore, only a few studies were conducted considering the migratory contexts rather than the effect of bilingualism.

When comparing the performance of Caucasian-American groups with that of ethnic minority groups on verbal tests such as Verbal Fluency, Naming, Digit Span, Stroop test, and Similarities test, the latter showed lower scores despite their good fluency in English [14–16]. Interestingly enough, ethnic minorities also performed worse in some nonverbal tasks: ROCF (Rey-Osterrieth Complex Figure), TMT-A (Trail Making Test-A), and visual integration [16,17].

Brickman [3] suggested that although ethnicity does not directly impact on cognitive performance, it might influence the level of acculturation, which is very relevant in the assimilation process of individuals into a majority or dominant culture [5].

The debate is still open as to which factor weights the most on acculturation. The number of school-years carried out in the host country seems to be a significant predictor of cognitive test scores in ethnically diverse individuals [5,16,18,19], while the role of the time spent in the host country and language preference remains unclear [14–16,18].

To our knowledge, only one research studied and confirmed the impact of the extent of acculturation on nonverbal cognitive tasks in adult Latin-American patients with epilepsy who migrated to the U.S. [20].

In the current study, cognitive test scores of 86 patients, 43 Italians, and 43 immigrants, diagnosed with DRE and assessed during the presurgical stage were collected from the archives of Niguarda Hospital in Milan. The immigrant group was characterized by different ethnic backgrounds, allowing a broader generalization to the heterogeneous set which is typical in clinical practice.

A multiple regression analysis allowed us to study the influence of different ethnic backgrounds and of time spent in Italy on a full neuropsychological battery, compliant with ILAE (International League Against Epilepsy) guidelines [21] as it includes internationally adopted cognitive tasks. We aimed at identifying which tests are less affected by ethnic, cultural, and linguistic diversity, hence, suggesting ways of improving the current approach to the neuropsychological evaluation of foreign-born patients.

As a final step, we developed a brief interview for collecting information about the patient's transcultural and linguistic history.

2. Material and methods

2.1. Participants

We accessed an initial set of 64 clinical reports from foreign-born patients with DRE from the archives of the Cognitive Neuropsychology Centre of Niguarda Hospital in Milan. All the data were retrospective and referred to the presurgical neuropsychological assessment.

The data collection was approved by the Ethics Committee of Milan Area C.

From the initial N = 64 sample, 21 patients were excluded because of young age (<15 years; N = 16), antipsychotic treatment (N = 1), low education (less than 3 years; N = 2), Intellectual Disability (N = 1), and uncertain epileptic diagnosis (N = 1). After this selection, we had presurgical clinical reports and neuropsychological test scores from 43 foreign-born patients with epilepsy. This will be referred to as the foreign-born group (FBG).

We aimed at collecting a control sample of 43 Italian monolingual patients (Italian control group, ICG), taken from the same database and years, that was as close to the FBG as possible in terms of the distributions of the following: hemisphere and lobe of epileptogenic zone (EZ), seizure frequency, illness duration, gender, age, education, profession, and handedness. To achieve such a matching, we took each foreign-born patient and searched in the database for the Italian patient who was closest to him/her in terms of the maximum number of the above variables; the group-level matching result was very close and satisfactory (see Table 2). This allowed us to obtain highly reliable covariation for those variables in the statistical design.

2.2. Neuropsychological test battery

The neuropsychological battery assessed a broad set of cognitive skills, consistent with the ILAE guidelines [21]: lexical access, reading, verbal comprehension, verbal and visuospatial memory, perceptual and visuoconstructive skills, visual exploration, attention, executive functions, and abstract reasoning.

Test descriptions and number of completed tasks are reported in Table 1. Test standardizations are available in the online version of this article (Supplementary material).

2.3. Statistical analyses

Our aim was to study the influence of ethnic-cultural variables on neuropsychological outcome (dependent variables). As a consequence, ethnicity (Italian/foreign-born) was used as a main predictor, with Years in Italy (YI), age, education, gender, illness duration (time since epilepsy onset), and EZ hemisphere as covariates. In this way we could tell pure effects of ethnicity from possible differences in those nuance variables.

We preliminarily ascertained that correlations between predictors did not produce important multicollinearity problems: indeed the VIF parameter (Variance Inflation Factor) never exceeded 1.24, thus providing evidence for a low level of collinearity.

As a second step, we analyzed the shape of the distributions of the 21 outcome variables. Many of these (13) showed gross violations of the

Table 1
Neuropsychological battery.

	Tests		N		Main cognitive skills involved
			FBG	ICG	
Verbal	Verbal Fluency	Phonemic	40	43	Lexical organization and access, executive functions
		Semantic	40	43	
	Naming		34	35	Lexical access through visual presentation
	Token test		36	35	Verbal comprehension
	Reading accuracy		24	17	Grapheme–phoneme conversion accuracy
	Forward Digit Span		42	43	Short–term verbal memory
	Backward Digit Span		39	32	Verbal working memory
	Word Pairs Learning		37	42	Associative learning and anterograde verbal memory
	Episodic Memory		37	43	Episodic verbal memory
Non-verbal	TMT	TMT–B	35	42	Sustained and divided attention, processing speed, planning and flexibility
		TMT–A	40	42	Sustained attention and processing speed
	Bells test		31	14	Visual exploration, selective attention
	Attentional Matrices		40	43	Sustained and selective attention, exploration speed
	Corsi Span		41	43	Short–term visuospatial memory
	Corsi Supra–span		30	37	Long–term visuospatial memory and learning
	ROCF	Copy	41	43	Visuo–constructive skills, visuo–motor planning
		Recall	39	43	Long–term visuospatial memory
	CSRMT		32	22	Memory for faces
	BFR		26	29	Face recognition
	Judgement of Line Orientation		30	37	Perceptualand visuospatial skills, orientation matching
	Raven CPM		41	43	Deductive and inductive abstract reasoning

Number of completed tasks and verbal / non-verbal cognitive skills involved are reported for each test of the full neuropsychological battery. Test standardizations are available in the online version of this article (Supplementary material). FBG: foreign-born group; ICG: Italian control group; TMT: Trail Making Test; ROCF: Rey-Osterrieth Complex Figure test; CSMRT: Camden Short Recognition Memory Test for Faces. BFR: Benton Facial Recognition test; Raven CPM: Raven Coloured Progressive Matrices.