Introduction
Latin America and the Caribbean (LAC) is a region of the American continent made up of 33 countries in Central America, South America, and the Caribbean. This region stretches about 22,222,000 km², from Mexico to Cape Horn in Chile, and includes several Caribbean islands whose inhabitants speak a Romance language (e.g., Spanish, Portuguese, or French). According to the World Bank,¹ the LAC population amounted to 646,430,841 inhabitants in 2019. This chapter aims to capture the most salient demographics and cultural aspects of this region and its inhabitants. Given the inherent diversity of the LAC population and local governments, the history and development of neuropsychology in this region has been heterogeneous, resulting in varying degrees of clinical and research advancement.

About LAC

Migration
LAC has had a linear increase in its population since the 1960s¹ due to the migration flow patterns. On the one hand, international migration has been characteristically bidirectional in the last two centuries with the arrival of Japanese and other Asians in Peru and Brazil at the end of the 19th century, and Mexican and South American migration to the United States and Spain in the 20th and 21st centuries. On the other hand, there has also been an increase in intraregional migration in recent years. Chile is one of the leading destinations for Haitian and Venezuelan migrants and cross-border migration in Mexico, Paraguay, and Colombia yields 80% of immigrants from neighboring countries. Notably, Venezuela’s serious economic and social crisis for the last two decades has resulted in almost 5 million Venezuelans leaving their homeland in search of opportunities and better living conditions in countries like Colombia and Chile.²

Language
The term LAC emerged in the 19th century to identify parts of the American territory whose languages derived from Latin (Spanish, Portuguese, and to a lesser extent, French) as a result of colonization carried out by the Spanish and Portuguese.³ Understanding the LAC population and its development over time requires a closer look at various aspects that have significantly shaped its culture. One important component of this process is the interaction between language and all aspects of society. This is known as sociolinguistics and examines how groups of people have used language and linguistic differences to form identity and establish differentiation.⁴

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Spanish is the official language in most LAC countries, followed by Portuguese, spoken by more than 211 million people in Brazil. Although scarcer, English and French are still spoken in many countries (e.g., Guyana), while as many as 420 other indigenous languages (e.g., Quechua, Aymara, Guarani) are recognized as official languages.

There is the heterogeneity of Spanish in LAC, which reflects the great cultural wealth that defines this region. Original dialects were introduced to the Americas by European colonizers, along with linguistic interactions with various indigenous linguistic groups. This resulted in a great diversity of Spanish dialects and accents across the region. For instance, LAC Spanish differentiates from European Spanish in its pronunciation, intonation, and vocabulary.

It is worth noting that although Spanish speakers can generally understand each other with minimal effort, individuals from Central America may speak and use completely different nouns and verbs as those used by South American or Caribbean people. Within countries, unique linguistic differences are closely related to other important factors, including geographic location, population migration, literacy, and education. It is therefore not surprising to find areas in LAC with very specific Spanish dialects. For instance, Rioplatense Spanish is primarily spoken in Argentina and Uruguay, and predominantly in the River Basin region that divides both countries. This version of Spanish is known for its distinctive pronunciation features of the letters “y” and “ll.” There is also Caribbean Spanish, which is predominantly spoken in Caribbean countries like Cuba, Puerto Rico, and the Dominican Republic as well as some coastal regions of Central America and northern South America. To this day, this variation of Spanish maintains many lexical borrowings from African and Amerindian languages.

Ethnicity

Language and communication in LAC are greatly influenced by the diversity of ethnic backgrounds that characterize this region. People from LAC tend to express great pride in their country’s local dialects and generally self-identify in terms of their specific country of origin rather than in a general LAC identity. For instance, people from LAC may identify with European, Middle Eastern, African, or Indigenous ethnic backgrounds. The majority of the 133 million Afro-Latin Americans in LAC descend from slaves brought by European merchants from the West African coast. In addition, according to Freire et al., Mexico, Guatemala, Peru, and Bolivia are home to over 80% of the 42 million indigenous people in LAC. There are 780 indigenous groups and over 560 indigenous languages that share co-official status with Spanish in LAC (e.g., Colombia, Bolivia, and Mexico). Many indigenous languages may be used for formal education (e.g., Brazil, Chile, Honduras, Panama) and official regional purposes (e.g., Nicaragua and Ecuador), while others receive no recognition (e.g., Belize).

It is worth noting that despite the presence of indigenous peoples in LAC, spoken indigenous languages are increasingly uncommon. This could be attributed, in part, to systemic issues involving poverty, social and political segregation, and acculturation at the expense of language and other salient aspects of their culture. There are important ongoing initiatives such as “The United Nations Declaration on the Rights of Indigenous Peoples” and “The Sociolinguistic Atlas of Indigenous Peoples in LAC” that attempt to protect the rights and cultural identity of indigenous people residing in LAC.

Education and Literacy

Literacy rates in LAC have been marginally improving across age groups in the last decade. As of 2019, the literacy rate of adult females (15 years and older) was 94.8% when compared to the
94.7% literacy rate of their adult male counterparts. Similarly, the gender parity index (GPI) in this region has remained steady between 1.004 and 1.008 since 2005, suggesting a parity rate that marginally favors females in the last years. According to the World Bank, children between ages 6 and 11 report school attendance rates of 83% in Brazil, 96% in Ecuador, 92% in Panama, and 93% in Peru.

Not surprisingly, a gap in school attendance persists between indigenous and non-indigenous children, particularly in countries with smaller and more scattered indigenous populations. Educational attainment of indigenous groups also varies significantly across the region, with a large portion of members of these communities having completed less than primary school (55%–76%), primary school (17%–34%), secondary school (1%–14%), and only less than 2% having obtained a college degree.

Similarly, the Afro-Latin American population in most LAC countries has significantly lower levels of educational attainment. On average, about 64% of Afro-Latin Americans complete primary education, 30% secondary education, and only 5% have achieved tertiary education or higher. Disparities in academic attainment among the Afro-Latin American and indigenous communities might be related to multiple factors including gender roles, access to education, and lower socio-economic status.

An important aspect of education access is intergenerational mobility, broadly defined as the changes in the socio-economic status of parents and children across generations. While younger generations have better access to education than their parents in most world regions, LAC children continue to fall behind in relative intergenerational mobility. In other words, children born in the least educated households are significantly more prone to become the least educated in their generations. The impact of intergenerational mobility on the LAC region extends beyond educational access and completion. The Program for International Student Assessment (PISA), an international test of education quality collected by the Organization for Economic Co-operation and Development (OECD), consistently finds that when compared to other regions, LAC students underperform across all tested subject areas, particularly in reading, suggesting that intergenerational mobility may also have an impact on the quality of education received by individuals from this region.

**Poverty**

Poverty is a major problem that continues to affect LAC. While the region does not have the largest number of poor people in the world, it has the most unequal income distribution. Recent data estimated that nearly 45 million more Latin Americans will be forced into poverty, with tens of millions facing extreme poverty as a result of the COVID-19 pandemic. Additionally, more than one-third of the population will face unemployment resulting in food insecurity, increased risk of illness, and earlier disability.

**Healthcare Systems in LAC**

Prior to the middle of the 20th century, healthcare coverage in LAC was offered only to employed individuals in the formal labor market through public health insurance plans and contributions made by employers, workers, and the government. The rest of the population received limited assistance from their local health department, church, charitable organizations, or universities. Undoubtedly, the underpinning principles of this healthcare model provided more access to wealthier individuals, with restricted or no access to the poor. The 1960s brought a wave of transition to the region from traditional healthcare into a more unified model, first led by Cuba, followed by Costa Rica in the 1970s, and Brazil in the 1980s.
The 1990s welcomed the extension of healthcare coverage to urban and poor neighborhoods, inspired by the 1978 Alma-Ata Declaration and the World Health Assembly strategy “Health for all in the Year 2000” in 1979. Two opposed models of reform have been implemented in the region: The Universal Health Coverage (UHC) model and the Single Universal Health System model. The UHC depends on the payer/provider split, free choice, and pre-priced health service plans. In this framework, insurance (public or private) is critical to assure market solvency. Conversely, the Single Universal Health System is a public health model funded by tax revenue that provides access to healthcare to every individual free of charge. Today, the UHS is considered the dominant healthcare model in LAC, with Argentina, Brazil, Cuba, Chile, Colombia, Ecuador, Mexico, Peru, Trinidad and Tobago, Uruguay, and Venezuela making adequate implementations.

However, the UHS is far from perfect. According to Laurell and Giovanella, the UHC model increases bias in access, generates administrative barriers for timely access, and does not provide financial protection for its members. Conversely, the Single Universal Health System has increased health access to millions in the region. Nonetheless, private health insurance has also increased among unionized employees and those in the upper-middle class.

Health Conditions and Social Disparities

Despite significant improvement in access to healthcare that has been observed in recent decades, and that life expectancy has improved by almost four years from 2000 to 2017, LAC still has some of the most persistent social and health inequalities worldwide.

At the social level, it should be noted that historically racial/ethnic minorities have had limited access to healthcare services, in part due to geographical locations, socio-economic status, and cultural factors (e.g., communication barriers, prejudice, stereotypes). Regarding health, there is a lack of access to physicians and physical resources that prevents an effective response to the population’s healthcare needs. As tabulated by the World Bank and OECD, there is an average of two doctors and less than three nurses available per 1000 individuals, falling below OECD standards (3.5 and almost 9, respectively). There is also an average of 2.1 available hospital beds per 1000 individuals. Similarly, the availability of medical technologies, as well as effective treatments for some diseases is also very limited. For instance, there is only 55% coverage for antiretroviral drug treatment among people living with human immunodeficiency virus (HIV).

On the other hand, according to the World Bank and OECD, there are several risk factors for poor health in LAC, including smoking, drinking alcohol, and being overweight; the latter is considered one of the most salient risk factors for poor health in children under age 5 (8%), adolescents (28%), and adults (men, over 53%; women, 61%). Sanitation is another health-related concern for people living in rural (1 out of 4, on average) and urban (1 out of 8, on average) areas, with some countries reporting less than 50% sanitation in the same areas.

In addition to the aforementioned social and health disparities, LAC faces another challenge with non-communicable diseases (NCD) (e.g., cardiovascular disease, most cancers, diabetes, chronic respiratory diseases, Alzheimer’s disease (AD), and Parkinson’s disease (PD), which were the leading cause of death between 2000 and 2015.

Psychiatric Disorders in LAC

There is a scarcity of available mental health professionals in LAC, with 1.6 psychiatrists, 2.7 psychiatric nurses, 2.8 psychologists, and 1.9 social workers per 100,000 population. Nonetheless, this region has seen significant advances in mental healthcare in the last two decades. According to Rodriguez, between 2005 and 2011, the region reported the highest percentage of countries
providing psychosocial interventions (64%) and follow-up community care (35%). Since the Caracas declaration, 39% of LAC have created or revised their mental health legislations, and after 2001, significant steps were taken to integrate international to national regulations on human rights.

Despite substantial improvements, the field of mental health continues to face many challenges. According to the PAHO and WHO, psychiatric and neurological disorders account for 22% of the total burden of disease (measured in disability-adjusted life years, DALYs). The most common neuropsychiatric disorders are unipolar depressive disorders (13.2%) and alcohol use disorders (6.9%). Despite the significant burden of mental health disorders, the treatment gap is astounding. The region reports a 4.9 prevalence for major depressive disorder, persistent depressive disorder (dysthymia) (1.7, 59%), non-affective psychosis (1, 37%), bipolar disorder (0.8, 64%), anxiety disorder (3.4, 63%), panic disorder (1.0, 53%), obsessive-compulsive disorder (1.4, 60%), and alcohol use disorders and harmful alcohol use (5.7, 71%). In practical terms, this means that only a minority of those needing mental healthcare receive it. Moreover, an estimated 65,000 individuals die from suicide every year, an age-adjusted mortality rate of 7.3 per 100,000 populations between 2005 and 2009. Consistent with global trends, suicide rates remain higher in males, accounting for 79% of all suicide deaths. The majority of deaths from suicide occurred in individuals ages 25 to 44 (37%) and 45 to 59 (26%), while only 20% occurred in individuals aged 60 and over, and 12% in those aged 70 and older.

There is a scarcity of epidemiological studies looking into psychiatric and mental health disorders of LAC children and adolescents, making understanding prevalence rates problematic. A study conducted in a pediatric hospital in Colombia established that the most prevalent conditions in this population were impaired learning, attention deficit hyperactivity disorder (ADHD), depression and suicide associated disorders, anxiety, eating disorders, substance use, psychotic disorders, conduct disorders, and pervasive developmental disorders or autism spectrum disorder (ASD). According to Oschilewsky et al., several LAC countries are home to some of the highest at-risk children population with mental health disorders (e.g., Brazil, Mexico), with abandoned children at a higher risk of engaging in criminal behavior or substance use as survival strategies. Another study conducted in northern Chile found differences by sex in depression, anxiety, and behavioral disorders, demonstrating the female population to be the most affected, with a high probability of carrying these disorders into adulthood.

**Neurological Conditions in LAC**

In terms of neurological diseases, dementia is one of LAC’s major health and social challenges; however, it is continuously neglected by the government and policymakers. Accurate dementia estimates have been difficult to establish, mainly due to low disease awareness and diagnostic accuracy. From 2015 to 2050, the number of people living with dementia in LAC is predicted to increase fourfold. In 2020, an estimated 89.28 million people in LAC lived with dementia, with Argentina, Brazil, Chile, Costa Rica, Cuba, Colombia, Dominican Republic, Ecuador, Mexico, Peru, Uruguay, and Venezuela experiencing the highest dementia rates. According to the 2015 Alzheimer’s Disease International (ADI) report, LAC has the highest worldwide prevalence of dementia (8.4%) in people age 60 and older, with incidence rates as high as 13.8 (per 10,000 people) for individuals 65 years and older. AD is the most common cause of dementia in LAC (56.3%), followed by a mixed etiology (AD and vascular dementia [VD, 15.5%]) and VD (8.7%). The literature is limited on frontotemporal dementia (FTD), with prevalence and incidence rates largely unknown. Similarly, prevalence estimates of Huntington’s disease in LAC are challenging due to misdiagnosis. Reported estimates range from 0.5% (Venezuela) to 4% (Mexico City). Moreover, LAC provides access to unique populations, including the world’s largest familial AD (Colombia).
Huntington disease (Venezuela), ataxia (Cuba), and high late-onset dementia incidence in the Caribbean. Overall, dementia is considered the largest cause of disability for countries such as Cuba, Dominican Republic, Mexico, and Peru, with higher deaths (hospital settings) occurring in Cuba (41.4%), Dominican Republic (29.1%), Peru (urban, 31%, rural, 83.3%), and Mexico (31.3%) making hospitalizations the leading healthcare cost.

Stroke is the second leading cause of death and disability in LAC countries. In 2017, more than 5.5 million stroke survivors, 0.60 million new cases, and more than 0.26 million deaths were reported in this region. In particular, Paraguay has the highest incidence rate (128 cases per 100,000) and mortality (67 cases per 100,000), while the prevalence is higher in Brazil (1,133 cases per 100,000) and Uruguay (1,120 cases per 100,000). On the contrary, Colombia and Peru are the countries with the lowest incidence (85–87 cases per 100,000), prevalence (790–812 cases per 100,000), and mortality (25–29 cases per 100,000). The main types of stroke in this population are intracerebral hemorrhage and subarachnoid hemorrhage.

The incidence of traumatic brain injury (TBI) is also high in LAC. According to the 1998 WHO data, the incidence of TBI secondary to road accidents and violence was 163 per 100,000 and 67 per 100,000, respectively, the highest in the world. The prevalence has likely increased in recent years; however, the scarcity of epidemiological studies on TBI in LAC countries has limited obtaining updated data. Regarding mortality, a recent study evidenced that 37% of patients in LAC died due to TBI, and of the surviving patients, 44% were left with mild-moderate disability. The situation is even more dramatic if one considers that public rehabilitation services are scarce, if not non-existent, in some countries. The majority of the population lacks sufficient socio-economic status to afford private services. Furthermore, it has been estimated that only 1% of people living with disabilities in rural areas benefit from rehabilitation following a TBI and other brain-related injuries.

In terms of epilepsy, approximately five million individuals live with the disorder in LAC, with a prevalence of 17.8%, and without significant group differences (e.g., age, sex). Epilepsy mortality in LAC is 1.04%, a figure considered higher than the rate of the United States and Canada (0.50).

Regarding the epidemiology of multiple sclerosis (MS) in LAC, a recent systematic review reported an incidence between 0.15 and 3 cases per 100,000 from 1995 to 2016. On the other hand, the prevalence of this disease varied throughout countries, with the highest rates in Brazil and Argentina (12 to 38.2 cases per 100,000), and lowest rates in Ecuador, Colombia, and Panama (0.75 to 6.5 cases per 100,000). It is important to note that the incidence and prevalence of MS in LAC is considerably lower than in developed countries, such as Europe and North America. In fact, Caucasians are more vulnerable to suffering from this disease than mestizos, which supports the genetic and environmental influence on the development of the disease.

Finally, although epidemiological studies on PD are really scarce, a recent study on the worldwide burden of this disease reported that between the period 1990 and 2016, Chile was the Latin American country that experienced the greatest increase in the prevalence of PD (19.9%), followed by Paraguay (19.4%), El Salvador (18.6%), Honduras (18.4%), and Guatemala (18%). Regarding the number of deaths attributed to PD, Paraguay (23.4%) tops the list, followed by Haiti (21.7%), Bolivia (21.1%), Honduras (19.8%), and Chile (16.5%). This increase has been attributed to the increase in life expectancy, as well as to other environmental factors such as industrialization.

**Toward a Better Health System**

Overall, healthcare inequalities have precluded millions of Latin Americans from receiving adequate access to healthcare, leading to unnecessary suffering, disabilities, deaths, and thus impacting the region’s economy. Subsequently, recent initiatives have been created with the sole purpose of improving healthcare in LAC. In 2016, the Director of the Pan American Sanitary Bureau...
(PASB, or the Bureau) established the Commission on Equity and Health Inequalities in the Americas, delegating it with promoting actions to reduce inequities and inequalities in the region. This is the first large-scale initiative developed to gather evidence on health disparities in LAC. The commission comprises 12 regional experts from different countries geared to focus on specific areas, including gender, equity, human rights, and ethnicity. Overall, this initiative is promising, given the opportunity of reducing inequality and improving health-related outcomes across LAC.

History of Neuropsychology in LAC

The beginnings of neuropsychology in LAC date back to the period between 1950 and 1970. Pioneers at that time included Alberto Leónidas Merani and Juan Enrique Azcoaga in Argentina and Carlos Mendilaharsu in Uruguay. Their efforts focused primarily on the study of language and linguistic alterations. At the same time, their research interests and clinical practice were unequivocally influenced by French-speaking authors, including Henri Hécaen and Julián de Ajuriaquerra, and Soviet authors Iván Pavlov, Lev Vygotsky, and Alexander Luria. The influence of Luria is particularly evident in the evolution of LAC neuropsychology as many of his works were translated to Spanish, and many pioneers from this era spent time in the Soviet Union. At the same time, several groups dedicated to studying the brain were forming in Mexico. In contrast, very few efforts were observed in the field in Central and South America during this time, except for René Calderón de Soria in Bolivia, who is regarded as a pioneer of neuropsychology, and who is responsible for the underpinnings of neuropsychiatry in this country.

Between 1970 and 1999, neuropsychology in Colombia and Mexico advanced considerably, due in great part to the work of Dr. Alfredo Ardila, though it remained at the beginning stages in other countries. Additionally, LAC neuropsychology began to expand its horizons and feed on North American authors and researchers. During this period, numerous organizations were formed, including the Neuropsychological Society of Argentina, the Chilean Neuropsychological Society, the Mexican Society of Neuropsychology, the Colombian Association of Neuropsychology, and the Brazilian Society of Neuropsychology, among others. In addition to country-specific organizations, two other organizations brought LAC neuropsychology professionals together: The LAC Association of Neuropsychology (ALAN) and the LAC Society of Neuropsychology (SLAN). It is also during this era when the first congresses and symposiums of the region emerged, such as the SLAN and ALAN congresses, as well as the selection of LAC countries to host relevant international congresses (e.g., The International Neuropsychological Society congress in Mexico City in 1983).

Other countries started to become involved in the field of neuropsychology during this period. Ernesto Vela and José Luis Henríquez introduced neuropsychology into El Salvador, Lucio Balarezo into Ecuador, Ricardo de Obaldía into Panamá, José Luis Henríquez and Tedd Judd into Nicaragua, Eduardo Cairo into Cuba, Otto Lima Gómez into Venezuela, and Artidoro Cáceres Velásquez into Peru. However, other countries of the region faced a delay in the field as a result of dictatorships. Such was the case of Chile (1973–1990), Argentina (1976–1983), and Uruguay (1973–1985) under civil-military dictatorship, and Brazil under military dictatorship (1964–1985).

The field of neuropsychology began to solidify in the 2000s with the creation of graduate programs in the field (e.g., Master in Neuropsychology in Bolivia and Mexico) and the introduction of requirements for obtaining specialty in neuropsychology (e.g., Brazil). LAC specific journals began to be published (e.g., Iberoamerican Journal of Neuropsychology, Argentinian Journal of Neuropsychology, and the Chilean Journal of Neuropsychology) along with more neuropsychology books (“Fundamentos de Neuropsicología Clínica” by Jorge Lorenzo Otero and Luis Fontán Scheitler, “Tratado de Neuropsicología Clínica” by Edith Labos, “Rehabilitación Neuropsicológica” by Juan Carlos Arango-Lasprilla, among others). Neuropsychological
measures also began to be developed (e.g., Batería Neuropsicológica Neuropsi, batería ECOFON, Evaluación de la Conciencia Fonológica, batería ENI, Evaluación Neuropsicológica Infantil) and new neuropsychology organizations grew (Venezuelan Society of Neuropsychology, Colombian Society of Neuropsychology).

Numerous scientific events have taken place in the last decade. In 2011, the XII SLAN Congress was celebrated in Santiago, Chile, and in 2012 and 2013, Colombia was selected to host the VII and VIII Cerebro y Mente SLAN congresses. In 2016, the 1st Iberoamerican Neuropsychology Congress was organized in Bilbao, Spain, by its president, Juan Carlos Arango-Lasprilla, to advance the field of neuropsychology in Spanish and Portuguese countries. Subsequently, this congress was celebrated in 2018 in Almería, Spain, and in 2019 in Cali, Colombia. Finally, and given the current situation as a result of the pandemic due to the SARS-CoV-2, the IV Iberoamerican Congress of Neuropsychology was held as a virtual conference in May, 2021 with 1806 participants from 43 countries.44

Nevertheless, interested readers should note that it is difficult to fully understand the state of the literature and history of neuropsychology in several LAC countries such as Belize, Haiti, and the Dominican Republic, given the lack of literature on the subject. For more detailed information on the history of neuropsychology in LAC, readers are invited to review Arango-Lasprilla et al.44

**Neuropsychology in LAC: State of the Art**

The development of neuropsychology in LAC and its current state of the art is known to the world, in part, thanks to Juan Carlos Arango-Lasprilla and his research team’s goals. More specifically, two important research studies in neuropsychology were conducted in LAC, and the details are further discussed below.

The first study48 which was the first record about the state of the literature of LAC neuropsychology, involved a survey of 808 neuropsychologists from 16 LAC countries (Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Ecuador, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, Puerto Rico, Uruguay, and Venezuela). The majority of the professionals who participated in the survey completed training in neuropsychology during graduate school and worked part-time (44%) in private practice (25%). Interestingly, participants identified lack of academic training programs (47%), clinical training (45%), and collaboration among professionals (36%) as the main obstacles to the growth of the field of neuropsychology in LAC. In terms of neuropsychological evaluations, an alarming 52% of participants reported using normative data from other countries. Similarly, the lack of normative data for their country (62%) and cultural adaptation (54%) were two of the main challenges identified by participants regarding neuropsychological tests. The most common reason for referrals included ADHD (35%), learning disorders (33%), intellectual disability (26%), and dementia (24%), which were typically referred by neurology (67%), psychology (63%), and the school system (54%) to obtain a diagnosis (77%).

Furthermore, the percentage of professionals who provided neuropsychological rehabilitation was lower (61%) when compared to those who completed neuropsychological evaluations (81%). For the most part, individuals engaged in individual neuropsychological rehabilitation (78%) focused mainly on attention and concentration (87%), memory (80%), and executive function (79%). A lower percentage (46%) of individuals noted being involved in teaching at private institutions (53.8%) and primarily at the undergraduate level (70.8%). About 62% of the participants indicated being involved in research in the last year, though only 90% of them reported obtaining Institutional Review Board (IRB) approval prior to conducting research. In addition, 60% of the participants reported not having sufficient resources to conduct research projects, while 61% of participants had never obtained financial support.
The second study focused on the state of the literature of pediatric neuropsychology in LAC and Spain. A total of 409 neuropsychologists from 12 LAC countries participated, including Argentina, Bolivia, Colombia, Costa Rica, Cuba, Ecuador, Guatemala, Honduras, Mexico, Paraguay, Peru as well as Puerto Rico and Spain. Interestingly, 61% of participants indicated having completed graduate studies in pediatric neuropsychology. Surprisingly, while 53% indicated not completing graduate-level studies in pediatric neuropsychology, they self-identified as pediatric neuropsychologists. The majority of participants worked full time (53%). Lack of academic training programs (42%), clinical training (41%), and financial resources (36%) were identified as the three main obstacles to the development of pediatric neuropsychology in LAC.

Participants in this study worked primarily with children with ADHD (87%), learning disorders (85%), and intellectual disability (72%) between ages 6 and 11 (89%) who were referred by teachers (76%), parents (61%), and neurologists (60%), mainly to obtain a diagnosis (86%). Further, professionals surveyed in the latter study indicated working with a multidisciplinary team, specifically with child psychologists (61%), speech and language pathologists (61%), and neurologists (61%). Approximately 74% of participants reported working in a forensic setting to determine the premorbid cognitive, social, and emotional functioning as well as the neuropsychological sequelae and level of disability of children in this setting. The elevated cost was reportedly the principal problem with neuropsychological tests (61%). In addition, challenges with the lack of normative data for each country (56%) and cultural adaptation of tests (45%) were also reported. Similarly, the principal barriers to complete neuropsychological evaluations included limited neuropsychological positions in hospitals (48.4%), followed by the high cost of neuropsychological evaluations (43%) and small selection of neuropsychological measures with normative data in their country (42%).

Similar to the previous study, the percentage of participants who provided neuropsychological rehabilitation (78%) was smaller when compared to individuals conducting neuropsychological evaluations (96%), and the treatment model included family intervention (75%) followed by adaptive functioning (69%), and behavioral-emotional intervention (69%). For participants, the greatest limitation of providing rehabilitation was the limited number of rehabilitation programs available for children (45%). Fifty-one percent of the faculty focused on undergraduate teaching (39%), while 43% were involved in research. Once again, only 84% indicated obtaining IRB approval. Interestingly, while 97% of participants noted obtaining only informed consent from parents, only 68.1% requested consent or assent from the minor.

**Country-Specific Normative Data and Culturally Appropriate Instruments**

In the aforementioned studies, the state of the literature in LAC neuropsychology evidenced the lack of normative data for different countries in the region. The studies conducted until then (2013) are characterized by (1) focusing on the Colombian, Argentine, and Mexican population, (2) being outdated (as majority were published prior to 2009), and (3) generating normative data that utilizes traditional methodologies based on mean scores and standard deviations, and the limitations associated with this method (see Appendix for a list of available tests).

These limitations motivated Juan Carlos Arango-Lasprilla and his research team to conduct two research projects to generate normative data for neuropsychological measures in Spanish-speaking countries. The first study started in 2013 by developing normative data for the most frequently used neuropsychological measures with the LAC adult population (based on the study about the state of the literature of LAC neuropsychology including Rey-Osterrieth Complex Figure test (ROCF), Stroop Color-Word Interference Test, Modified Wisconsin Card Sorting Test (M-WCST), Trail Making Test (TMT), Brief Test of Attention (BTA), Phonological and Semantic...
Verbal Fluency Test (VFT), Boston Naming Test (BNT), Symbol Digit Modalities Test (SDMT), Hopkins Verbal Learning Test–Revised (HVLT-R), and the Test of Memory Malingering (TOMM). The study included 5,402 healthy adults from Argentina, Bolivia, Chile, Colombia, Cuba, El Salvador, Guatemala, Honduras, Mexico, Paraguay, Peru, and Puerto Rico. Normative data for the Colombian population (n = 1425) were published in the book “Neuropsicología en Colombia: Datos normativos, estado actual y retos a futuro.”51 Normative data for the remaining countries were published in the monograph “Commonly used Neuropsychological Tests for Spanish Speakers: Normative Data from LAC.”52–62

The second normative study, which began in 2016, focused on the pediatric population of 10 LAC countries, including Chile, Colombia, Cuba, Ecuador, Guatemala, Honduras, Mexico, Paraguay, Peru, Puerto Rico, and Spain. A total of 6,030 children ages 6 to 17 were evaluated using a fixed battery that included the following tests: ROCF, Stroop Color-Word Interference Test, M-WCST, TMT, SDMT, a shortened version of Token Test, Concentration Endurance Test (d2), VFT, Peabody Picture Vocabulary Test-III (PPVT-III) and the Learning and Verbal Memory Test (TAMV-I). Normative data of the study were published in the monograph “Normative Data for Spanish-Language Neuropsychological Tests: A Step Forward in the Assessment of Pediatric Populations.”50,62–71 As with normative data for Colombian adults, results from this study were published in the textbook “Neuropsicología infantil.”72

Given that LAC is one of the world regions with higher rates of illiteracy, Juan Carlos Arango-Lasprilla and his research team decided to generate normative data for this population in nine LAC countries, including Bolivia, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Peru, and Puerto Rico. The total sample included 402 adult participants ages 18–93. Normative data for the ROCF, M-WCST, BTA, VFT, BNT, SDMT, and HVLT-R tests were published in the textbook “Neuropsicología y analfabetismo.”73

Other important initiatives have been carried out to adapt existing neuropsychological measures, and even more importantly, to develop new measures for Spanish-speakers. For example, Olabarrieta-Landa et al.56,67 published an administration and scoring guide of verbal phonemic, semantic, and action fluency, taking into consideration the general characteristics of the Spanish language. In addition, Rivera et al.74 developed the TAMV-I; a new measure to assess the learning and memory of LAC children ages 6–17. The stimuli selection was carefully performed while other important factors, such as categories previously normed, the degree of adaptation to the target population, interference with existing measures (e.g., semantic fluency), and its cultural adaptation to LAC countries, including Spain, were considered.

Juan Carlos Arango-Lasprilla and his team made further efforts to advance appropriate neuropsychological evaluations of LAC people by exploring the frequency of low scores in the general population when administered a battery of cognitive tests.75 They found that low scores are common when multiple neuropsychological outcomes (tests and/or scores) are evaluated in healthy individuals, the higher the number of tests, the greater the probability of obtaining one or more low scores that are not necessarily indicative of cognitive impairment.76

It was with this in mind that several studies with adults, children, and adolescents were published, showing that approximately 30% of the clinical sample obtained at least one or more low scores below the 16th percentile on different cognitive batteries including language, learning and memory,77 and executive function.74–76 Furthermore, it has been demonstrated that the number of low scores obtained by LAC individuals when using norms for non-Hispanic White individuals is higher when compared to when normative data for the LAC population are used.75 Therefore, it is essential to use norms that have been adequately adapted to the population being tested as well as consider the percentage of clinically healthy individuals who commonly obtain low scores at this percentile to avoid false positives and misdiagnosis.
Training/Educational Challenges

It has become apparent that neuropsychology has advanced significantly in LAC during the last decade. Depending on how this field develops over time, professionals could face challenges that would vary considerably across countries. Nonetheless, LAC countries face similar challenges in their efforts to advance and consolidate the discipline in this region as well as to make the health system and general population acknowledge the need and contribution of the discipline to the field. Below we focus on neuropsychology training challenges in LAC.44,78

1. At the undergraduate level, students receive basic training (e.g., neuropsychology-focused coursework and practicum externships). Those students who are interested in furthering their neuropsychology knowledge have limited training programs at the master’s level, while options for academic training at the doctorate and postdoctoral level are even scarcer. As a result, only those who can afford it receive training outside LAC. Additionally, students who leave to pursue training abroad generally stay overseas and never return to practice in their home country, resulting in a high number of young, qualified LAC professionals not getting involved with initiatives to advance neuropsychology in this region.

2. Graduate education is generally private and expensive in LAC, making it harder for many individuals to enroll in these programs. Some institutions take advantage of this situation by offering shortened and expensive graduate programs (often brief and intense courses) at the expense of quality.

3. The scientific and academic literature in Spanish is minimal. Considering that most research in this field is conducted and published in English and that most LAC individuals lack English proficiency, the capacity of faculty and students to become familiar with the latest research in the field is limited.

4. There are limited academic and training programs in pediatric neuropsychology, neuropsychological rehabilitation, experimental neuropsychology, and forensic neuropsychology. Currently, the majority of programs offered in this region focus on adult clinical neuropsychology.

5. Most training programs focus on clinical practice, limiting opportunities for teaching as related to research methodology, data analysis, and scientific writing. Hence, while many professionals generate exciting data, they lack the know-how of publishing in academic journals and often publish in local journals in Spanish, which results in research from this region not getting disseminated to the rest of the world.

6. The possibility of training clinically is limited due to the lack of qualified professionals in the region who can provide adequate training for students in their places of employment.

7. A common limitation of LAC countries, except Brazil, is the lack of guidelines regulating the profession. Without shared criteria of minimum standards of practice, any individual who completes graduate studies (or without graduate studies, as demonstrated by the study on the state of the literature of pediatric neuropsychology) can identify as a neuropsychologist. Moreover, the lack of uniform guidelines governing the profession furthers the gap of qualified professionals working in institutions who can, in turn, train the future neuropsychologists of the region.

Conclusions

LAC extends over 33 countries and is home to millions of individuals from diverse ethnic and cultural backgrounds. LAC neuropsychology remains an emerging discipline that has advanced greatly in the last several decades. The progress of neuropsychology in this region has been
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gradual. During its initial stages, psychologists of the time were highly influenced by European theorists and researchers who pioneered in the field. A new era emerged with creating academic programs that helped further the field by providing opportunities for specialized training and skill set development. More recently, efforts to expand the field have resulted in the development of major norming studies designed to capture the cultural differences of the LAC population to generate normative data that is appropriate, valid, and reliable to meet the clinical needs of the people from this region. Like other areas of the world, cultural, social, and governmental aspects have played a salient role in advancing the field in this region, including a limited number of neuropsychology academic and training programs and competent clinicians who can provide pre-and postdoctoral instruction across the region.

Equally, there are significant differences across LAC countries, including language, psychosocial factors, and national healthcare structure that further complicate the establishment of neuropsychology as a uniform discipline. These differences further highlight the need for culturally appropriate test measures and norms that incorporate and reflect the intricacies and diversity of the population from this region. While recent norming efforts have aimed to close the gap, research on the different cultural and ethnic backgrounds is warranted to further expand, solidify, make neuropsychological services available to underserved populations in this region.

References


