

Core competencies in clinical neuropsychology training across the world

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Abstract

Objective. This work aimed to review main competency requirements from training models in countries with well-established specialties in clinical neuropsychology and to extract core competencies that likely will apply to clinical neuropsychologists regardless of regional and cultural context.

Method. We reviewed standards for post-graduate training in clinical neuropsychology from countries in Europe, Australia and North America based on existing literature, presentations at international conferences, and from description of the training models from national psychological or neuropsychological associations.

Results. Despite differences, the reviewed models share similar core competencies considered necessary for a specialty in clinical neuropsychology: 1. In-depth knowledge of general psychology including clinical psychology (post-graduate level), ethical and legal standards. 2. Expert knowledge about clinically relevant brain-behavioral relationships. 3. Comprehensive knowledge about, and skills in, related clinical disciplines. 4. In-depth knowledge about and skills in neuropsychological assessment, including decision-making and diagnostic competency according to current classification of diseases. 5. Competencies in the area of diversity and culture in relation to clinical neuropsychology. 6. Communication competency of neuropsychological findings and test results to relevant and diverse audiences. 7. Knowledge about and skills in psychological and neuropsychological intervention, including treatment and rehabilitation.

Conclusions. All the models have undergone years of development in accordance with requirements of national health care systems in different parts of the world. Despite differences, the common core competency requirements across different regions of the world suggest generalizability of these competencies. We hope this summary can be useful as countries with less established neuropsychology training programs develop their models.

Key words: Core competencies, Clinical Neuropsychology, Training in Clinical Neuropsychology; Brain Behavior relationships

Introduction

The growth of clinical neuropsychology over the last few decades has been remarkable. This development has occurred along with an increased awareness of the cognitive and behavioral consequences of major health conditions that affect the brain. The benchmark study of the European Brain Council suggested that disorders of the brain are the largest contributor to Europe's total morbidity burden, accounting for 35% of all disease burden (Olesen & Leonardi, 2003). The economic costs of brain disorders are correspondingly large (including cost of treatment and lost productivity of patients and caregivers), estimated to be twice the cost of cancer (Andin-Sobocki et al., 2005) and constituting 24% of the total direct healthcare expenditure in Europe in 2010 (Gustavsson, Svensson, Jacobi, et al. 2011, Olesen, Gustavsson, Svensson et al. 2012). Globally, neurological disorders reviewed by WHO contribute to 10.9%, 6.7%, 8.7% and 4.5% of the total burden of disease in high, upper middle, lower middle and low income countries, respectively, in 2005; by 2030 these figures are estimated to increase by 12% globally (World Health Organization, 2006)

Although the prevalence and the consequences of major brain disorders are fairly similar throughout the world (Prince et al. 2013, Marini et al. 2011, Roozenbeek et al. 2013, WHO 2006), the development of clinical neuropsychology has mainly taken place in higher income regions with developed health care systems and higher life expectancies, like Europe, Australia, and North America. This is reflected both by the growth of clinical neuropsychology relative to the other clinical psychological disciplines and by the number of scientific publications that come from these areas of the world. One example of this is that the Society of Clinical Neuropsychology (Division of Clinical Neuropsychology) now is the largest of 55 divisions of the American Psychological Association (<http://www.apa.org/about/division/officers/services/profiles.aspx>). Additionally, over the last 5 years board certification in clinical neuropsychology in North America has grown faster than any of the other 13 specialties under the umbrella of the American Board of Professional Psychology, including general clinical psychology. As Europe, Australia and North America only represent a minority of the world's population, the global impact of services provided by clinical neuropsychology is still limited, with most of the world having no access to such services. Most countries in other regions do not currently provide systematic training in clinical neuropsychology.

The training models in clinical neuropsychology in those countries that do provide such services share important features. However, there are also substantial differences with regard to content and duration (see the special issue of *The Clinical Neuropsychologist*, October 2016, Grote, 2016). In the US a doctoral degree is required with specialization in clinical psychology, which is usually (but not always) coupled with specialization in clinical neuropsychology including a year of a clinical internship. Although not required, two years of postdoctoral experience is relatively common and is required for board certification in clinical neuropsychology in North America under the auspices of the American Board of Professional Psychology (<https://www.abpp.org/>, Grote, Butts, & Bodin, 2016). This requirement is consistent with the Houston Conference guidelines (Hannay et al. 1998), which serve as the education and training guidelines for the specialty of neuropsychology in the US. More recently, a taxonomy document intended to clarify the language used to describe training experiences across different levels of training in clinical neuropsychology in the U.S. has been published (Sperling et al., 2017). In the UK, training in clinical psychology precedes training in clinical neuropsychology, with clinical psychology training being completed at doctoral level, followed by specialist training courses and supervised practice in clinical

neuropsychology. Clinical neuropsychology training in Australia may be undertaken in parallel with that in clinical psychology at masters or doctoral levels, with clinical experience both during and after the degree. In the Nordic countries and many other European countries the training is inspired by international medical models of specialization. In these countries, the training consists of three main elements: (1) basic university education in general psychology including clinical psychology (Master's degree or equivalent, 5-6 years), (2) supervised neuropsychological work in specialist health care for 4-5 years (covering the major neurological and psychiatric conditions), and (3) comprehensive courses in clinical neuropsychology during work in specialist health care (Hessen, Hokkanen et al. 2017). Despite differences, the major models of training produce specialists with similar function and responsibility in the health care system of their respective countries.

The difference among the models stems from dissimilar educational traditions, different ways of organizing and financing health care and the fact that psychologists have different roles and responsibilities in health care around the world. In some countries, psychologists have a subordinate and primarily advisory role with regard to diagnosis and treatment planning, while psychologists in other countries have a fully independent role with regard to diagnosis and treatment of patients (Hessen, Hokkanen et al. 2017).

Currently, there is an ongoing international debate about training models in clinical neuropsychology (Grote, 2016), and several published papers describe the specific features of training in a variety of countries. Detailed comparison of training models is useful for mutual inspiration and development (Grote & Novitski, 2016). However, to aim for one global gold standard training model in clinical neuropsychology may not be realistic, as the differences between countries usually are rooted in national laws and regulations, as well as long-held regional traditions. Additionally, social and economic factors differ considerably throughout the world and clearly influence the possibilities for training and specialization.

In our view, an approach that focuses on the relevant core competencies for an entry-level clinical neuropsychologist has a greater potential for agreement and for greater impact on clinical practice and training. Despite variability of diseases as well as social and financial contingencies among countries, the clinical challenges of the neuropsychologist are generally similar, and require a set of core competencies regardless of whether the clinician works in Argentina, Australia, India or South Africa (Grote & Novitski, 2016). While most countries have begun with training guidelines, it is now becoming more acceptable to delineate core competencies for entry-level professional practice in clinical neuropsychology. More recently, core competencies for professional practice have been specified in the United States in medicine (Williams et al., 2010) and in psychology. For example, the Health Service Psychology Collaborative (2013) published such standards. The Houston Conference Guidelines (Hannay et al., 1998) have been the basis for defining clinical neuropsychology training guidelines in the United States for almost 20 years, but greater specificity is needed in terms of competencies for professional practice in clinical neuropsychology. In response to this need, core competencies for entry-level clinical neuropsychologists have been delineated (Rey-Casserly, Roper, & Bauer, 2012) and modified, and approved by a group of neuropsychology organizations in the U.S. (Clinical Neuropsychology Synarchy; CNS). These core competencies were submitted at the end of 2016 in partial support of the continued recognition of clinical neuropsychology as a specialty to the American Psychological Association. (Council of Specialties, 2012, https://docs.wixstatic.com/ugd/12cc9c_14c7e4ba69a2447e9b125a2d279346c8.pdf).

Worldwide development of clinical neuropsychology presupposes the exchange of clinicians across countries and regions. Today, this is problematic even between countries within Europe, not only due to language differences, but also because differences in competency and role in health care may disqualify clinical neuropsychologists from working as a clinician in other countries. A similar situation also applies to other nations and regions. Thus, at present clinical neuropsychologists primarily exchange ideas and experiences with national colleagues, unlike their scientific colleagues who largely profit from worldwide exchange. If clinical training of neuropsychologists were based on international agreement of core competencies, this might facilitate the exchange of clinicians across countries and thus further the development of clinical neuropsychology worldwide.

The aim of this paper is therefore to review the main competency requirements from training models in countries where clinical neuropsychology has become an established specialty within health care, and extract fundamental core competencies that most probably will apply to clinical neuropsychologists regardless of regional and cultural context.

A future aim might be to reach a consensus across nations and regions of the world about core competencies, defining the fundamental features of a clinical neuropsychologist, who is able to provide independent diagnosis and treatment for disorders and diseases characterized by neuropsychological symptoms. The potential for such a consensus about competencies, not training models, is to serve as a guideline both for existing training programs and for development of future programs. Our hope is that a consensus might constitute an authoritative framework and help in development of clinical neuropsychology in those parts of the world where the majority of the world-population live, and where training programs currently do not exist.

The underlying assumption and hypothesis of the present paper is that despite their differences in organization and educational model, well-established training models across the world provide similar core competencies.

Methods

We conducted a qualitative review of standards for post-masters training in clinical neuropsychology from countries in Europe, North America, and Australia. Information on the training was gathered from literature (Grote, 2016), from presentations at two international conferences in 2015 (Federation of the European Societies of Neuropsychology in Tampere, Finland and International Neuropsychological Society in Denver, USA) and from the description of the training models as described, in a variety of languages, by national psychological or neuropsychological associations (Council of Specialties, 2012, https://docs.wixstatic.com/ugd/12cc9c_14c7e4ba69a2447e9b125a2d279346c8.pdf, Hannay et al., 1998, Hokkanen 2015, Hokkanen et al. 2016, Morris 2015, Wright and Fisher 2012, British Psychological Society 2017a, 2017b, Ponsford 2016, Hessen et al. 2017, Prof. Cecilia Guariglia, University of Rome (personal communication)).

Table 1 shows the countries selected for the present study. In all these countries, the supervised specialist education of 4 to 6 years follows the completion of undergraduate level studies, so the total length of education exceeds 10 years in most cases. All countries require practical training/internships. The university degree required for practicing psychology/neuropsychology varies from a doctoral degree in US and UK, to Master's (or equivalent) in psychology elsewhere in Europe and Australia. However, even in countries

where the doctoral degree is not included in the specialty education or required for practicing, many students complete it during or after specialist education. Canada has well developed standards for education and practice in clinical neuropsychology, similar to the US, but was not specifically included in this analysis (Janzen & Guger, 2016).

As a framework for comparison, we have used the most recent entry-level clinical neuropsychology core competencies in the US that have recently been approved and modified by the CNS and submitted to APA in partial support for reapproval of the specialty (https://docs.wixstatic.com/ugd/12cc9c_14c7e4ba69a2447e9b125a2d279346c8.pdf). This approach is based upon the assumption that despite differences in organization and educational model, well-established training across the world would provide similar core competencies. This framework delineates foundational and functional competencies. Foundational competencies include knowledge-based elements that are necessary across all of the neuropsychologist's functional domains. They include knowledge of scientific information and methods; individual and cultural diversity; ethical, legal standards, and policy; professionalism; reflective practice (including self-assessment); relationships; and interdisciplinary systems (See Table 1). In contrast, functional competencies are knowledge based or skill based. The elements of functional competencies describe particular aspects of practice, such as assessment, intervention, and consultation (See Table 2). Additional competencies involve research, teaching and supervision, management-administration, and advocacy within neuropsychology (See Table 3).

A particular competency was marked as included within the training for each country if it was mentioned in the competency guidelines or other reviewed documents of the countries. Competencies accumulate on all levels of education and training, and no distinction was drawn in the analysis between those acquired during the undergraduate or graduate/post-graduate level, or those acquired through theoretical coursework or during practical training periods, such as internship or postdoctoral fellowship.

Results

Tables 1, 2, and 3 list the foundational and functional core competencies. Neuropsychologists fulfill these criteria through formal coursework, supervised clinical training (ideally in a formal program), and informal training, e.g., neurology rounds, brain dissection. The specialist education in different countries and even within one country clearly differs in the depth of focus on each core competency, and estimation of hours spent on learning each competency was not possible.

Foundational competencies (Table 1) are very similar across the different countries. These skills begin accumulating at the undergraduate level and gain more depth during the specialization. Minor differences can be found; for examples, individual and cultural diversity is less emphasized in Finland compared to the other countries. In addition, all the countries are committed to evidence-based practice but some variation exists in how much emphasis is put into decision-making strategies in differential diagnosis, or the application of outcome research as a guide for assessment and intervention. Differences can also be seen for teaching regarding the application of information technology (IT) in evaluation of best evidence.

Of the functional competencies (Table 2 and 3), assessment is covered very similarly in all included countries. Small variation exists in the amount of focus on the fields of neurochemistry, neuropsychopharmacology, and neuroendocrinology and also on the amount

of emphasis on addressing issues related to specific populations both within and across countries. Neuroradiological techniques are covered in all the countries, as are neurological and psychiatric disorders. Within the intervention domain, both the knowledge base and the application are with a few exceptions covered similarly. Missing in all the countries is a review of activities for promoting cognitive health, and the interventions provided by other professionals are not equally covered across countries. Within competencies related to consultation, the countries differ. The application and basic skills are covered, but the knowledge base remains limited in several of the countries.

Competencies related to scientific research/evaluation are mentioned by all the countries. The depth and breadth varies, however. Most, but not all, of the US and some of the Australian models involve comprehensive research training, leading to a research doctoral degree. The UK also requires a Doctorate in Clinical Psychology, which includes research training and a substantial empirical research study, although the majority of the time is spent in supervised clinical practice and broader clinical education. In Italy and the Netherlands, the research requirement includes both empirical research and a review of literature but completing the training does not lead to a doctoral degree. The training in Finland and Norway includes one manuscript, either empirical or a review, but training in research methodology is more aimed at enhancing critical reading skills than conducting original research. Competencies related to management/administration and advocacy are also covered very differently in the different national models.

Discussion

Despite differences in training models, the different countries reviewed were found to share similar core competencies considered necessary for a specialty in clinical neuropsychology. Fundamental competencies, common to all fields of psychology (e.g., professionalism, ethical awareness, relationships and interdisciplinary systems), scientific knowledge and methods of clinical and cognitive neurosciences, brain-behavioral relationship, functional neuroanatomy, and related clinical disciplines is covered across all countries examined. Within the functional competencies, the theoretical knowledge base and applied skills of assessment, communication of findings and intervention were at the core of training in all the countries.

The review of the selected models suggests at least seven core competencies necessary for specialization in clinical neuropsychology (Table 4). The traditional tasks of the clinical neuropsychologist are to detect cognitive, behavioral and emotional correlates of brain function for a variety of diagnostic purposes (Lezak, Howieson, Bigler, & Tranel, 2012). The first five core competencies relate closely to these tasks. They involve, (1) In-depth knowledge of general psychology including clinical psychology, based on a master's degree in psychology or equivalent, including development of normal and abnormal behavior and cognition throughout the lifespan. This is a fundamental competency for the clinical neuropsychologist when evaluating normality or abnormality in behavior and cognitive function. (2) Expert knowledge about clinically relevant brain-behavior relationships and functional neuroanatomy. Detailed knowledge about the relation between brain pathology and behavioral manifestations in a range of trauma-related, developmental disorders and neurological diseases is probably the most important and defining competency of a clinical neuropsychologist. While both clinical psychologists and clinical neuropsychologists can assess normal and abnormal behavior without relation to brain function, the key feature of the clinical neuropsychologist is to make inferences between behavior and brain function. This aspect of training is critical in order for the clinical neuropsychologist to relate medical and

psychiatric history and symptoms to the neuropsychological test results. (3) Comprehensive knowledge about and skills in related clinical disciplines such as, clinical psychology, psychiatry, neurology, speech pathology and occupational therapy. It is recognized that the extent to which advanced clinical psychology competencies are considered to be required for practice in clinical neuropsychology varies around the world. As noted earlier, in some countries (e.g. UK) it is a requirement that clinical neuropsychologists are qualified clinical psychologists (or educational psychologists in the case of pediatric clinical neuropsychologists), but this is not the case in all countries. (4) In-depth knowledge about and skills in neuropsychological assessment. The key instrument for the clinical neuropsychologist is the neuropsychological examination. Thus, expert knowledge about the use and appropriateness of different test batteries, inventories and other methods for different patient populations and understanding of their psychometric properties is a core component of the clinical neuropsychologist's toolbox. (5) In a world with increasing migration and multicultural populations, competencies in the area of diversity and culture are critical for general psychology training as well as specialization in clinical psychology and neuropsychology. The knowledge base in cross cultural psychology and neuropsychology is complex and often uncertain, but knowledge about this and appreciation of its complexity is vital for clinical neuropsychologists and should be considered one of the core competencies.

The last two competencies relate to communication and intervention: (6) Targeted and adapted communication of neuropsychological findings and test results to diverse audiences, including patients, families, collaborating health professionals and insurance companies, is incorporated in all the reviewed models, and may be considered to be the sixth core competency. Apart from performing the neuropsychological assessment according to state of the art, the communication of neuropsychological conclusions to those involved, is the neuropsychologists main tool for influence, and thus a vital core competency. (7) The seventh competency, knowledge about and skills in psychological and neuropsychological intervention, including treatment and rehabilitation, extends beyond the traditional diagnostic role of the clinical neuropsychologist. As the field has developed into a clinical specialty with its own knowledge base, particularly regarding brain-behavior relationships in neurological, developmental and psychiatric conditions, a natural consequence has been to develop interventions and treatments for the impairments and disabilities that are detected through neuropsychological assessments. A recent survey conducted for the European Federation of Psychological Associations (Symposium presented at the European Congress of Neuropsychology, Maastricht 2017) showed that among European neuropsychologists thirty-six percent of the neuropsychologists conduct a similar amount of treatment and rehabilitation as assessment work, while sixty-four percent primarily do assessment and diagnostic work. This clearly suggests that the seventh suggested core competency, knowledge about and skills in psychological and neuropsychological intervention, is a valid and important competency.

In conclusion, our goal here was to review the essential or core competency requirements for the clinical neuropsychologist in different parts of the world based upon well-established guidelines for neuropsychology practice. We did not intend to review specific training programs in clinical neuropsychology. The rationale for this was that all the reviewed models have undergone years of development in accordance with requirements of national health care systems in different parts of the world. Although not without weaknesses, they have proven themselves successful in the sense that they have become established specialties among the other medical and psychological specialties that constitute the panorama of health care fields. Despite differences, the common core competency requirements across different regions of the world suggest generalizability of these competencies. Of note, all the guidelines were

approved by the respective national licensing agencies or by the national psychological associations at approximately the same time, between 1980 and 2000, suggesting an independent but parallel development in a variety of countries spanning large parts of the world. For instance, the Norwegian Psychological Association approved the specialty guidelines in clinical neuropsychology in Norway in 1987, and board certification in clinical neuropsychology began in 1981 in the US with approval of the first specialty guidelines in clinical neuropsychology by the American Psychological Association in 1996.

All the models included stem from well-developed industrial countries, representing a minority of the world population. The resources involved in the training of any of the described specialties are extensive. An important question is whether they are too extensive to be realistic for the developing part of the world with less financial and educational resources, than what is available in the industrialized countries. If training is expensive for the country's economy, fewer experts can be trained. Currently the number of neuropsychologists, expressed as the ratio of neuropsychologists to the national population, ranges from 1 per 26,666,666 (in India) to 1 per 19,231 (in Finland) in the 14 countries reviewed by Grote & Novitski (2016). In more than half of those countries the ratio was better than 1/100,000 (1 per 40,885 for Australia and 1 per 80,250 for the US). If the density of well-trained neuropsychologists is lower, more emphasis must be placed on efficient and well targeted consultation strategies. However, if the training requirements are perceived as too resource demanding for the developing world, it may create governmental pressure to offer only the minimum competencies that can be obtained with a shorter and less expensive training. This may jeopardize the level of the expertise of even the few that are trained.

An applicable comparison is the established medical specialties. In general, the requirements for obtaining a medical specialty are extensive and quite similar throughout the world, regardless of the social and financial situation of the country. This is rational, as the key challenges do not vary with geography. Rather, similar knowledge of medical diseases and their treatments is mandatory anywhere. An obvious consequence is that the availability of medical services to the population vary greatly among countries, due to differences in economic level (WHO: World health statistics 2016). Clinical neuropsychology will likely face a similar situation with the emergence of the specialty and development of the specialty in less industrialized countries. As with the medical specialties, the acquisition of a specialty requires many years of training and any short-cut training to accommodate the situation in countries with fewer resources will violate the necessary competency conditions, and not produce sufficiently competent clinical neuropsychologists.

One difference in the competencies that exists between the described models is the level of scientific education required for obtaining a specialty in clinical neuropsychology. In the US, the condition for obtaining a specialty in clinical neuropsychology is either to have a research doctoral degree (Doctor of Philosophy, PhD) or a more clinical doctoral degree (Doctor of Psychology, Psy.D). In most European countries clinical doctoral degrees are not offered as an alternative to research doctorates. In the UK, the process involves a Bachelor's level education in psychology (3-4 years), then a Doctorate in Clinical Psychology (3 years) that combines clinical practice, education, and research. Once qualified in clinical psychology further specialist education and supervised clinical practice over two years leads to registration on a Specialist Register of Clinical Neuropsychologists. In the rest of Europe and Australia, a doctoral degree is not a requirement for a specialty in clinical neuropsychology, although some programs in Australia include a research doctoral degree. In these countries, the training model is more similar to the medical training model, primarily consisting of three

elements: Basic university education in psychology (5-6 years), followed by supervised neuropsychological practice in specialist health care for 2-5 years (covering the major neurological and psychiatric conditions), along with comprehensive courses in clinical neuropsychology. In total, candidates spend a minimum of seven to eleven years in different psychology and neuropsychology education and training before they obtain their specialty and are allowed to work independently within neuropsychology. Similar to the medical specialties, this kind of model produces high quality specialists, able to take responsibility in diagnostics, treatment and rehabilitation. A relevant question is if a clinical specialty without a research doctoral degree is sufficient, or if it is second rate to models requiring a research doctoral degree as part of the clinical training. A research doctoral degree does imply a higher scientific qualification than a master's degree, and the ability to critically review and understand the scientific literature and conduct research to underpin evidence-based practice. Thus conducting research for a doctoral degree certainly has relevance for acquisition of clinical skills but cannot be regarded as a prerequisite. However, an alternative view comes from the US's scientist-practitioner model that research training is critical or, at minimum, enhances the quality of clinical practice (Baker, Benjamin, Ludy, 2000). The most common model across the world is that extensive supervised clinical experience over years as well as core academic didactic courses are the core conditions for obtaining true specialty competency. Therefore, a requirement of adding several years for producing original scientific research for a doctoral degree, is not regarded as necessary for obtaining a specialty in clinical neuropsychology except for most programs in the US and some in Australia. A research doctoral degree or equivalent is not regarded as necessary for specialist training in the medical fields in any of the countries in question. The same logic also applies to clinical neuropsychology. Thus, while including research training is ideal, the guidelines across the majority of countries included in this review support the conclusion that extended research experience at PhD-level should not be considered to be among the seven core competencies required for a clinical neuropsychologist.

The guidelines differed also in their emphasis on consultation as a separate domain of expertise, and the additional domains of management/administration and advocacy. Consultation and communication with e.g. educational personnel, social service agencies, nursing homes, rehabilitation staff, industry, legal systems, and public policy makers is common in many work settings. The applied skills are often learned in practice but relevant literature and appropriate and contextually sensitive methods of consultation are not always included in training. Within management/administration, many neuropsychologists might benefit from knowledge of administrative structures of different practice settings (independent practice, academic health centers, group practice, forensic, military, education, research, etc.), and specific administrative and business strategies needed to address prevalent assessment and consultation issues (e.g., referral patterns, coding, billing, documentation). Within advocacy, knowledge of the regulatory and policy initiatives that can affect provision of neuropsychology services and access to care might be useful in educating public policy makers regarding the importance and impact of neuropsychological science and practice. Nonetheless, we are not including formal academic training in this area as a core competency for clinical neuropsychology.

The field is evolving and so will the understanding of which core competencies are considered necessary for obtaining specialty competency in clinical neuropsychology. The present seven core competencies considered necessary today will likely need revision in the future. Based on previous development there will be changes regarding assessment methods,

treatment methods, employed technologies as well as roles and responsibilities in health care. In addition, increasing worldwide migration will necessitate better transcultural knowledge.

Thus, the concept of core competencies in clinical neuropsychology should not be static, but rather characterize a specialty field in constant development that need continuous update and redefinition.

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References

Andlin-Sobocki P, Jönsson B, Wittchen H.U, Olesen J. (2005). Cost of disorders of the brain in Europe. *Eur J Neurol.*12, Suppl. 1:1-27.

American Psychological Association. Division profiles by division, from:
<http://www.apa.org/about/division/officers/services/profiles.aspx>

Baker, D.B., Benjamin, L.T. (2000). The affirmation of the scientist-practitioner: A look back at Boulder. *American Psychologist*, 55, 241-247.

British Psychological Society (2017a) *Standards for the accreditation of programmes in adult clinical neuropsychology*. Leicester: British Psychological Society.

British Psychological Society (2017b) *Standards for the accreditation of programmes in paediatric clinical neuropsychology*. Leicester: British Psychological Society.

Council of specialties in professional psychology. (2012). *Clinical neuropsychology*. Retrieved from <http://cospp.org/specialties/clinicalneuropsychology>

Gustavsson A, Svensson M, Jacobi F, Allgulander C, Alonso J, Beghi E, Dodel R, Ekman M, Faravelli C, Fratiglioni L, Gannon B, Jones DH, Jennum P, Jordanova A, Jönsson L, Karampampa K, Knapp M, Kobelt G, Kurth T, Lieb R, Linde M, Ljungcrantz C, Maercker A, Melin B, Moscarelli M, Musayev A, Norwood F, Preisig M, Pugliatti M, Rehm J, Salvador-Carulla L, Schlehofer B, Simon R, Steinhausen HC, Stovner LJ, Vallat JM, Van den Bergh P, van Os J, Vos P, Xu W, Wittchen HU, Jönsson B, Olesen J; CDBE2010Study Group. (2011). Cost of disorders of the brain in Europe 2010. *Eur Neuropsychopharmacol.*, 21, 718–779.

Grote CL. (2016). Prologue to special issue of ‘International perspectives on education, training and practice in clinical neuropsychology’, *The Clinical Neuropsychologist*, 30, 1151-1153

Grote CL, Butts AM, Bodin D. (2016). Education, training and practice of clinical neuropsychologists in the United States of America. *The Clinical Neuropsychologist*, 30, 1356-1370

Grote CL and Novitski JI. (2016). International perspectives on education, training, and practice in clinical neuropsychology: comparison across 14 countries around the world. *The Clinical Neuropsychologist*, 30, 1380-1388.

- Hannay HJ. (1998). Proceedings of the Houston conference on specialty education and training in clinical neuropsychology, September 3–7, 1997, University of Houston Hilton and conference center. *Arch Clin Neuropsychol.*, 13,157-158.
- Health service psychology education collaborative. (2013). Professional psychology in health care services: A blueprint for education and training. *American Psychologist*, 68, 411–426.
- Hessen E, Hokkanen L, Nyman H, Bartfai A, Gade A. The history of clinical neuropsychology in the Nordic countries. In *The History of Clinical Neuropsychology*. Eds. Bieliauskas L & Barr W. Oxford University Press, New York, 2017.
- Hokkanen L, Nybo T, Poutiainen E. (2016). Neuropsychology in Finland - over 30 years of systematically trained clinical practice. *The Clinical Neuropsychologist*, 30, 1214-1235.
- Hokkanen L. (2015). Neuropsychology specialization training models in Europe. Presentation at the 5th scientific meeting of the ESN and 12th Nordic meeting in neuropsychology in Tampere, Finland, 2015. University of Helsinki, Finland.
- Janzen LA, Guger S. (2016). Clinical neuropsychology practice and training in Canada. *The Clinical Neuropsychologist*, 30, 1193-1206.
- Lezak MD, Howieson DB, Bigler ED, Tranel D. *Neuropsychological Assessment*. Oxford University Press, New York, 2012.
- Marini, C., Russo, T., & Felzani, G. (2011). Incidence of stroke in young adults: A review. *Stroke Research and Treatment*, 2011, 535672. <http://doi.org/10.4061/2011/535672>
- Morris R. (2015). The dual competency model of training in clinical neuropsychology in the United Kingdom. Presentation at the 5th scientific meeting of the ESN and 12th Nordic meeting in neuropsychology 2015 in Tampere, Finland, 2015. Kings College Hospital, London, England.
- Olesen J, Leonardi M. (2003). The burden of brain diseases in Europe. *Eur J Neurol.*, 10,471-477.
- Olesen J, Gustavsson A, Svensson M, Wittchen HU, Jönsson B; CDBE2010 study group; European Brain Council. (2012). The economic cost of brain disorders in Europe. *Eur J Neurol.*, 19, 155-62.
- Ponsford J. (2016). The practice of clinical neuropsychology in Australia. *The Clinical Neuropsychologist*, 30, 1179-1192
- Prince M, Bryce R, Albanese E, Wimo A, Ribeiro W, Ferri CP. (2013). The global prevalence of dementia: A systematic review and metaanalysis. *Alzheimer's & Dementia*, 9, 63 – 75.
- Rey-Casserly C, Roper BL, Bauer RM. (2012). Application of a competency model to clinical neuropsychology. *Professional Psychology: Research and Practice*, 43, 422–431

Roozenbeek B, Maas AI, Menon DK. (2013). Changing patterns in the epidemiology of traumatic brain injury. *Nat Rev Neurol.*, 9, 231-6.

Sperling, SA, Cimino, C.R., Stricker, N.H., Heffelfinger, A.K., Gess, J.L., Osborn, K.E., Roper, B.L. (2017). Taxonomy for education and training in clinical neuropsychology: past, present, and future. *The Clinical Neuropsychologist*, 31, 817-828.

Williams BC, Warshaw G, Fabiny AR, Lundebjerg N, Medina-Walpole A, Sauvigne K, Schwartzberg JG, Leipzig RM. (2010) Medicine in the 21st century: Recommended essential geriatrics competencies for internal medicine and family medicine residents. *Journal of Graduate Medical Education: September 2010*, 2, 373-383. <https://doi.org/10.4300/JGME-D-10-00065.1>

World health organization. Neurological disorders: Public health challenges. 2006 WHO press, Geneva, Switzerland.
http://www.who.int/mental_health/publications/neurological_disorders_ph_challenges/en/

World health statistics 2016. WHO press, World health organization, Geneva, Switzerland.

Wright, I. and Fisher, Z. (2012). *Competency framework for the UK clinical neuropsychology profession*. Leicester: British Psychological Society. <http://www.bps.org.uk/networks-and-communities/member-microsite/division-neuropsychology/competency-framework>

Table 1. Foundational competencies relevant to clinical neuropsychology but common across functional domains. Coverage in different countries.

Clusters	Competencies	AU	FI	IT	NL	NO	UK	US
Scientific knowledge and methods	Clinical and cognitive neurosciences and other relevant fields	x	x	x	x	x	x	x
Individual and cultural diversity	Diversity integrated in the process of assessment and interpretation of results	x		x	x	x	x	x
Ethical, legal standards and policy		x	x	x	x	x	x	x
Professionalism	Professional identity and awareness of the roles of clinical neuropsychologists	x	x	x	x	x	x	x
Reflective practice	Limits of competence, goal of improving skill level	x	x	x	x	x	x	x
Relationships	Relationships and communication with patients, families, caregivers etc.	x	x	x	x	x	x	x
Interdisciplinary systems	Knowledge of and communication within interprofessional teamwork	x	x	x	x	x	x	x
Evidence-Based Practice (EBP)	Knowledge of key symptoms and expressions of relevant disease processes	x	x	x	x	x	x	x
	Knowledge of age-related changes across lifespan	x	x	x	x	x	x	x
	Knowledge of basis for assessment strategy, test selection	x	x	x	x	x	x	x
	Knowledge of incidence, prevalence, natural course of relevant conditions	x	x	x	x	x	x	x
	Knowledge of decision-making strategies in differential diagnosis	x	x	x	x	x	x	x
	Knowledge of scientific basis for diagnostic conclusions in neuropsychological disorders	x	x	x	x	x	x	x
	Application of outcome research as a guide for assessment & intervention	x	x	x	x	x	x	x
	Application of EBP components in assessment and intervention	x	x	x	x	x	x	x
	Application of information technology (IT) in evaluation of best evidence		x	x		x	x	x

Note: Framework delineated here is based upon U.S. framework submitted to the Council of Specialties in Professional Psychology (<http://cospp.org/specialties/clinicalneuropsychology>, 2012); AU=Australia, FI=Finland, IT=Italy, NL=Netherlands, NO=Norway, UK= United Kingdom, US=United States of America

Table 2. Functional knowledge-based and applied competencies unique to clinical neuropsychology. Coverage in different countries.

Clusters	Competencies	AU	FI	IT	NL	N O	UK	U S
Assessment (knowledge-based)	Neuropsychology of behavior	x	x	x	x	x	x	x
	Patterns of impairments in neurological diseases	x	x	x	x	x	x	x
	Neurochemistry, neuropsychopharmacology, neuroendocrinology	x		x	x	x	x	x
	Neurodiagnostic techniques	x	x	x	x	x	x	x
	Effects of systemic medical illnesses on brain functioning and behavior	x	x	x	x	x	x	x
	Patterns of impairments in psychiatric disorders	x	x	x	x	x	x	x
	Influences of motivational factors and assessment context	x	x	x	x	x	x	x
	Medications and their effects on brain functioning and behavior	x	x	x	x	x	x	x
	Theories and methods of measurement and psychometrics	x	x	x	x	x	x	x
	Functional implications of impairment	x	x	x	x	x	x	x
Assessment (applied)	Analysis of the referral question	x	x	x	x	x	x	x
	Gathering of information	x	x	x	x	x	x	x
	Selection of tests and measures	x	x	x	x	x	x	x
	Administration and scoring the tests and measures	x	x	x	x	x	x	x
	Interpretation of results, formation of an integrated conceptualization	x	x	x	x	x	x	x
	Recommendations for management	x	x	x	x	x	x	x
	Written communication skills in production of assessment report	x	x	x	x	x	x	x
	Providing of feedback, adapted to specific audiences	x	x	x	x	x	x	x
Intervention (knowledge based)	Addressing issues related to specific populations	x			x	x	x	x
	Evidence-based intervention practices	x	x	x	x	x	x	x
	Theoretical and procedural bases of intervention methods	x	x	x	x	x	x	x
	Effects of neurobehavioral disorders and sociocultural factors on interventions	x		x		x	x	x
	Activities for promoting cognitive health							

	Interventions provided by other professionals	x		x	x	x	x	x
Intervention (applied)	Identification of intervention targets and needs	x	x	x	x	x	x	x
	Assessment and feedback for therapeutic benefit	x	x	x	x	x	x	x
	Identification of barriers to intervention	x	x	x	x	x	x	x
	Development and implementation of a treatment plan	x	x	x	x	x	x	x
	Implementation of interventions	x	x	x	x	x	x	x
	Evaluation the effectiveness of the intervention	x	x	x	x	x	x	x
	Awareness of ethical and legal ramifications of intervention	x	x	x	x	x	x	x
Consultation (knowledge based)								
	Professional roles and expectations	x	x	x	x	x	x	x
	Relevant literature			x	x	x		x
	Methods of consultation			x	x	x	x	x
Consultation (applied)	Determination and clarification of referral issues	x	x		x	x	x	x
	Education of referral sources regarding neuropsychological services	x	x	x	x	x	x	x
	Communication of findings from consultation	x	x	x	x	x	x	x
	Providing assessment feedback and recommendations	x	x	x	x	x	x	x
	Providing consultation services in clinical practice	x	x	x	x	x	x	x
	Communication of scientific findings	x	x	x	x	x	x	x
	Providing consultation in clinical research	x		x	x		x	x

Note: Framework delineated here is based upon U.S. framework submitted to the Council of Specialties in Professional Psychology (<http://cospp.org/specialties/clinicalneuropsychology>, 2012); AU=Australia, FI=Finland, IT=Italy, NL=Netherlands, NO=Norway, UK= United Kingdom, US=United States of America

Table 3. Additional functional competency areas relevant to clinical neuropsychology. Description of coverage in different countries.

	AU	FI	IT	NL	NO	UK	US
Scientific research / evaluation	Research training and dissertation	Research training and one scientific paper	Research training and dissertation	Research training and two scientific papers	Research training and one scientific paper	Research training and one empirical research study	Doctoral degree (PhD or Psy.D) & dissertation
Teaching / supervision	x	x	x	x	x	x	x
Management / administration			x	x		x	x
Advocacy			x			x	x

Note: Framework delineated here is based upon U.S. framework submitted to the Council of Specialties in Professional Psychology; for more details see: <http://cospp.org/specialties/clinicalneuropsychology>, 2012); AU=Australia, FI=Finland, IT=Italy, NL=Netherlands, NO=Norway, UK= United Kingdom, US=United States of America

Table 4. Summary of suggested core competencies for specialty in clinical neuropsychology based on a review of guidelines in seven countries with well-established specialties in clinical neuropsychology

Foundational competencies	
1	In-depth knowledge of general psychology including clinical psychology (master’s degree in psychology or equivalent), including knowledge about ethical and legal standards.
2	Expert knowledge about clinically relevant brain-behavioral relationships and functional neuroanatomy.
3	Comprehensive knowledge about and skills in related clinical disciplines, in particular clinical psychology, psychiatry and neurology.
Functional competencies (including knowledge-base and applied-base)	
4	In-depth knowledge about and skills in neuropsychological assessment, including decision-making and diagnostic competency according to current classification of diseases.
5	Competencies in the area of diversity and culture in relation to general psychology and clinical neuropsychology.
6	Communication competency of neuropsychological findings and test results to relevant and diverse audiences.
7	Knowledge about and skills in psychological and neuropsychological intervention, including treatment and rehabilitation.

The US include scientific comprehensive research/evaluation as a core competency for clinical neuropsychologists based in the US on the clinical practitioner model (Baker & Benjamin, 2000)