Development and Application of Neuropsychology in Hong Kong:

Implications of its Value and Future Advancement

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Objective: To review the development, application and value of neuropsychology, and the standard education and training pathway for neuropsychologists or clinical neuropsychologists in Hong Kong.

Method: The information provided here was gathered via a literature review of the status of neuropsychology and the validity of commonly adopted neuropsychological tests in Hong Kong. Additional details were acquired via the internet about local tertiary education curricula and the related requirements, the availability of professional associations for licensure or board certification, and relevant statistics / surveys conducted by the government. Some information about the clinical practice of neuropsychology was collected through personal communication with local clinical psychologists.

Results: The development of neuropsychology in Hong Kong over the past twenty years is rapid and productive, given the increasing application of advanced neuroimaging techniques, neuropsychological tests, and opportunities for exchanging up-to-date neuropsychological knowledge and professional training through international conferences, workshops and seminars. Given that neuropsychology services are often provided by clinical psychologists who are master degree graduates in clinical psychology, the relatively limited training in neuropsychological knowledge and skills and the lack of division for membership or mandatory registration as a neuropsychologist / clinical neuropsychologist may have an impact on the quality of clinical neuropsychological services and the development of this specialty.

Conclusions: These findings signify a need for further improvement or refinement of educational and training pathways for neuropsychologist or clinical neuropsychologist along with the recognition of its value in clinical practice through registration of different disciplines of psychology in Hong Kong.

Keywords: neuropsychology; clinical neuropsychology; education; training; Hong Kong

History and Development of Neuropsychology in Hong Kong

The development of neuropsychology in Hong Kong began in the 1990s by a number of pioneering young scholars who had been trained in the United States and returned to work in Hong Kong, including Agnes Chan at The Chinese University of Hong Kong (CUHK) and Tatia Lee at The University of Hong Kong (HKU). These scholars provided a strong foundation in assessment, scientific methods, and brain behavioral relationships (Chan, Leung, & Cheung, 2010, 2011). The formation of the Hong Kong Neuropsychological Association (HKNA) in 1998 established a first step toward the firm establishment of neuropsychology in Hong Kong. The HKNA has served as a bridge between the east (including Hong Kong SAR and Mainland China) and the west in the exchange of neuropsychology knowledge. It has also served as a platform for promoting the advancement of brain science information and facilitating clinical and theoretical research into neuropsychology in Hong Kong.

With the dedicated effort of a group of clinical psychologists, including Dr. Sonia Chang, Dr. Cheung Mei-chun, Dr. Queenie Wong, Dr. Cheryl So, Dr. Connie Leung, Dr. Alma Au, Dr. Maggie Wong and Dr. Sophia Sze, committee members of the HKNA, together with me as the founding chairperson, the HKNA has organized and co-organized an international conference, training workshops / seminars for professionals and semi-professionals, and quarterly case consultations for practicing clinicians and clinical trainees to share knowledge about neuropsychology. In 2003, the HKNA, in collaboration with the Department of Psychology at CUHK, the National Institute of Mental Health, the American Psychological Association (APA), the International Neuropsychological Society (INS) in the United States, and the Institute of Psychology and Hushan Hospital in China, co-organized the first international conference on neuropsychology in Hong Kong, entitled ‘An International Conference on

Neuropsychology: Recent Advances in the East and West'. The conference attracted over 200 professionals and scholars from all over the world, including China, the U.S.A., Taiwan, Japan and Europe to the workshops hosted by world-renowned neuroscientists, presenting and discussing their advanced brain science research from Mainland China and Hong Kong SAR. Furthermore, professional training workshops about two commonly adopted neuropsychological tests, namely the *Hong Kong List Learning Test* (HKLLT; Chan, 2006; Chan & Kwok, 1999) and the *Chinese Version of the Mattis Dementia Rating Scale* (CDRS; Chan, Poon, Choi, & Cheung, 2002), were offered repeatedly from 2005 to 2010. The HKLLT is a locally developed and validated verbal memory test with local normative data ranging from age 6 to 95, whereas the CDRS is a translated and validated version of the DRS using normative data based on the local Chinese population as a screening tool for dementia. The purpose of these workshops was to provide the basic concepts of neuropsychological assessment and hands-on clinical application training of these two tests for assessing memory and other major cognitive functions among the local Chinese population.

In 2014, the HKNA organized the 'Neuropsychological Assessment: Seminar and Workshop' sponsored by the Department of Psychology, at CUHK. Dr. Muriel D. Lezak, a renowned clinician and scientist in the field of neuropsychology, was invited as the keynote speaker for a workshop entitled 'Mild Traumatic Brain Injury Issues in Adolescents: The Condition, the Patients, the Families'. This seminar also introduced a locally validated neuropsychological test battery for primary school children, namely *Neuropsychological Test Battery for Primary School Cantonese-Speaking Children in Hong Kong* (Working Group on Child Neuropsychology, HKNA, 2014), which had been developed over eight years by the Working Group on Child Neuropsychology in HKNA under the leadership of Dr. Cheryl So. This battery is a locally normalized and

validated set of neuropsychological tests for assessing memory, attention, perception, language and executive function in young children from 6 to 12 years of age. The test battery is available for qualified clinical and educational psychologists on the HKNA website (www.hkneuropsy.org).

Apart from the work of the HKNA, some enthusiastic neuropsychologists in Hong Kong have also contributed to the development of neuropsychology in the community. For instance, the Neuropsychology Laboratory at CUHK (www.cuhkneurolab.com) conducted clinical research investigating the cognition and behavior of individuals with normal brain functions as well as individuals with various brain disorders, such as autism, dementia, epilepsy, and depression, and the association with their neurophysiological state as measured by advanced technology including functional magnetic resonance imaging (fMRI), quantitative electroencephalography (qEEG), and recently, near infrared spectroscopy (NIRS). Another focus of clinical research conducted by the laboratory has been to explore potentially effective neuropsychological interventions for brain disordered patients by integrating the Western brain science with the thousand-year-old wisdom of Chinese medicine and health concepts. This laboratory has published approximately one hundred research papers over the past twenty years in internationally renowned journals, such as *Nature* (Chan, Ho, & Cheung, 1998), *Archives of Neurology* (Cheung, Chan, Law, Chan, & Tse, 2000), *Cancer* (Cheung, Chan, Law, Chan, & Tse, 2003), and *Journal of Affective Disorders* (Chan et al., 2012a). Innovative ideas have been continuously generated in this laboratory. One of these ideas is the development of a neuro-immunological model for understanding the core autistic symptoms, which investigate the association between abnormal brain electrical activity and immunological weakness with the behavioral and memory problems in autism (Han et al., 2013; Han, Cheung, Sze, & Chan, 2014; Han et

al., 2011). Additionally, a series of research paper about implementing Chinese *Chan* medicine as a possible neuropsychological intervention for individuals with autism, depression, epilepsy, age-related memory problems, and for normal children and adults have been produced since 2007 (Chan, Cheung, Sze, Leung, & Shi, 2011; Chan, Cheung, Tsui, Sze, & Shi, 2011; Chan, Han, & Cheung, 2013; Chan, Han, Sze, & Lau, in press; Chan, Han, Sze, Wong, & Cheung, 2013; Chan et al., 2011a; Chan, Sze, Cheung, Lam, & Shi, 2009; Chan, Sze, & Han, 2014; Chan, Sze, Han, & Cheung, 2012; Chan, Sze, & Shi, 2008; Chan, Sze, Siu, Lau, & Cheung, 2013; Chan, Sze, Woo, & Yu, 2014; Chan et al., 2012a, 2012b; Yu, Woo, Chan, & Sze, 2014). As a result of encouraging empirical evidence for *Chan* medicine in treating various brain disorders, the Chanwuyi Research Center for Neuropsychological Well-being was established in 2013 (www.chanwuyicenter.com) and conducts related research and provides clinical services in neuropsychological and *Chan* concepts. In addition to discovering new research findings, the Neuropsychology Laboratory also puts effort into developing indigenous assessments and adapting validated Western assessments for ethical and valid clinical applications. Developed tests with local or mainland Chinese norms include the *HKLLT*, the *Chinese Vocabulary Test*, the *Shape Trails Test*, the *Concept Thinking Test* and the *Common Knowledge Test*. Translated tests with validation include the *CDRS,* the Category Fluency Test and the *Boston Naming Test*.

The Laboratory of Neuropsychology at HKU (http://www.psychology.hku.hk/neuropsy/lab/), founded by Prof. Tatia Lee, has also made an effort to exchange neuroscience ideas in assessment and treatment between local and worldwide neuroscientists and neuropsychologists by organizing a number of public lectures, seminars and workshops since 2008. In collaboration with the Faculty of Social Sciences of the HKU and Caritas Hong Kong – Service for the Elderly, the

laboratory organized an 'International Symposium on Applied Neuroscience and Neuropsychology: Decoding the Aging Brain' in June 2015. The symposium included workshops on neuropsychological assessment of the elderly, cognitive rehabilitation and MRI studies on the elderly. Neuropsychology experts from Canada, Germany, the United Kingdom and the United States were invited as speakers. A similar symposium with a focus on 'Discovering the Social Brain' was held in 2009, and renowned local and international speakers exchanged their research ideas for understanding human social behaviors from the perspective of brain science. Moreover, the Institute of Clinical Neuropsychology at HKU also contributed to neuropsychological assessment and treatment of patients with brain disorders and conducted a translational research project for tests and treatment protocol adaptation for the local population. *Neuropsychological Measures: Normative Data for Chinese, 2nd edition* was developed by Prof. Tatia Lee and a co-worker (available at http://www.psychology.hku.hk/neuropsy/icn/?page_id=557 for clinicians and researchers in practice only) with a number of translated Western neuropsychological tests of attention, memory, visual-spatial function, and verbal/non-verbal fluency, and it provided and uses normative data for both Cantonese-speaking and Mandarin-speaking Chinese. A validation of normative data has been published in the *Journal of Clinical and Experimental Neuropsychology* (Lee, Yuen & Chan, 2002) and in the first edition of the norm book.

Overall, the development of neuropsychology in Hong Kong has been fruitful and rapid in the past two decades in both research and clinical practice. Advanced modern technologies, such as fMRI, Positron Emission Tomography (PET), qEEG, and NIRS, are commonly used or are beginning to be applied to study the various cognitive functions in normal and clinical samples in research studies in Hong Kong. Findings of

research studies applying these techniques have been published in internationally renowned journals such as *Archives of Clinical Neuropsychology* (Cheung, Chan, Chan, Lam, & Cheung, 2004), *Human Brain Mapping* (Li et al., 2006), *Journal of Neurology, Neurosurgery and Psychiatry* (Cheung, Chan, Lam, & Chan, 2009), *Neuropsychology* (Cheung, Chan, Chan, & Lam, 2006; Chan, Sze, & Cheung, 2007; Yeung, Han, Sze, & Chan, 2015), Journal of Child Neurology (Wong, Sun, & Yeung, 2006) and *Research in Autism Spectrum Disorders* (Chan et al., 2011b, 2011c; Yeung, Han, Sze, & Chan, 2014). Collaborative research has also been undertaken between neuropsychologists in Hong Kong and clinicians/researchers in Western countries and mainland China. In terms of clinical practice, some of these technologies have also been applied in general hospitals and even some private clinics to evaluate the brain functions of patients with various brain disorders. Furthermore, much effort has been made by certain clinical psychologists and neuropsychologists to translate and adapt Western neuropsychological instruments for use in Hong Kong and to develop indigenous assessment tools that are valid for the local population. Moreover, it has also been common practice for medical doctors to refer cases of suspected brain disorders for neuropsychological assessments and cognitive rehabilitation to clinical psychologists at general hospitals in Hong Kong.

Licensure and Board Certification of Neuropsychologists / Clinical Neuropsychologists in Hong Kong

Although neuropsychology is a board-certified specialization in the United States, there is no mandatory registration requirement for the clinical practice of neuropsychology or requirement of specialized training, such as coursework or supervised internships in neuropsychology, in Hong Kong. Even for the practice of clinical psychology or other disciplines of psychology, official statutory registration is not yet enforced. It is not

mandatory for any person to be licensed or registered with a government agency or professional board to practice as a clinical psychologist or clinical neuropsychologist in Hong Kong. Neuropsychologists in Hong Kong are generally clinical psychologists practicing in hospital settings or mental health centers, government organizations or non-government organizations (NGO), and at the departments of psychology in at the HKU and CUHK. Most of these practitioners receive training at either the HKU or CUHK, where a module in clinical neuropsychology is part of the curriculum of the master's degree program in clinical psychology. Given the lack of standardized criteria or examinations qualifying a neuropsychologist in Hong Kong, a person can work in the field of neuropsychology if he/she has a graduate degree in psychology with course(s) taken in this specialty and has related work experience. To ensure and maintain the professional standards of clinical psychologists or neuropsychologists in Hong Kong, a few non-mandatory registration systems have been established.

With greater relevance to the specialty of neuropsychology, the HKNA was established in 1998. With recognition by the APA and INS, the HKNA provides membership for individuals with a postgraduate degree in psychology and relevant experience in neuropsychology (as a full member) or any person who is interested in neuropsychology (as an affiliate member). Qualification for registration as a member is approved by the general guidelines set by the executive committee of the association. There are a total of 37 registered full members, suggesting that psychologists with relevant experience in neuropsychology are still relatively few in Hong Kong or that many clinical psychologists have not registered as HKNA members even though they are practicing clinical neuropsychology. Interestingly, there are 45 total professionals (including clinical psychologists, educational psychologists, professors, clinical neuropsychologists, and occupational therapists) registered as members of HKNA, there

are 108 registrants for the use of the *Neuropsychological Test Battery for Primary School Cantonese-Speaking Children in Hong Kong*, which suggests a much greater practical need for the use of neuropsychological assessments in local clinical settings than expected. The annual membership fee of HKNA for full and affiliate members is HK$200 and HK$100, respectively.

For those specializing in clinical psychology, there is one association offering registration for practicing clinical psychologists, namely the Hong Kong Psychological Society (HKPS; http://www.hkps.org.hk/index.php). The HKPS is both an educational society and a professional association that was founded in 1968, and it is the only organization of psychologists in Hong Kong that represents all specialties of psychology. The Registration Board of HKPS, which was established in 1994, has assumed responsibility for registration of qualified psychologists with different specialties. The HKPS maintains a Code of Professional Conduct for its members and to compel the observance of strict rules of professional conduct as a condition of membership. They also formed a Working Group in 2004 to revise the Society's Code with reference to other major psychological societies such as the APA, the Australian Psychological Society, the British Psychological Society (BPS) and the Canadian Psychological Association and to update the Society's Code by incorporating comments from the BPS and the Ethical Committee of the APA. The HKPS maintains a register of psychologists who have applied for and been granted admission to the register. There are four divisions specializing in different fields of psychology: 1) Division of Clinical Psychology (DCP); 2) Division of Educational Psychology (DEP); 3) Division of Industrial-Organizational Psychology (DIOP); and 4) Division of Counseling Psychology (DCoP). However, neuropsychology / clinical neuropsychology is still not a distinct division in the HKPS. The DCP, as one of the divisions of the HKPS, has the

mission of promoting and guiding the standard of practice and teaching of clinical psychology in Hong Kong. Members of the HKPS who have completed either a master's or doctorate training program in clinical psychology are qualified to be a registered member of the DCP. The application fee for the HKPS is HK$450, and its annual subscription fee ranges from HK$310 to HK$700 depending on the type of membership. The membership fee for the DCP is HK$200 for full members and HK$150 for affiliate members. According to HKPS database, there are 535 psychologists registered to their society, among which 273 specialize in clinical psychology. However, statistics about the proportion of clinical neuropsychologists are not available.

Educational and Training Pathways Leading to the Independent Practice of Neuropsychology in Hong Kong

The minimum level of education required for the independent practice of neuropsychology in the clinical field in Hong Kong is a master's degree in Clinical Psychology. The Master Degree programs (M.S.Sc) in Clinical Psychology offered by HKU and CUHK are relatively well-recognized. Both programs are recognized by the Division of Clinical Psychology of the HKPS. The M.S.Sc in Clinical Psychology at HKU is also recognized by the Hong Kong Council for Accreditation of Academic and Vocational Qualifications. Thus, graduates of the programs are eligible to become registered clinical psychologists of the HKPS. The M.S.Sc in Clinical Psychology is a two-year full-time government-funded taught program, in which the candidates receive no stipends and have to pay tuition of HK$42,100 per year. The M.S.Sc at HKU admits approximately 19 candidates every other year, and CUHK admits the same number of candidates every year.

The M.S.Sc programs at the two universities require coursework and five clinical practicums in different fields of clinical settings over the two years. At HKU, a total of 14 formal courses (3 credits each), a dissertation (6 credits) and practicums (12 credits) are required, where Clinical Neuropsychology is one of the compulsory 3-credit courses in the curriculum. At CUHK, the program requires a total of 19 compulsory courses (1-3 credits each) and 5 clinical placements (2 credits each), where two 3-credit compulsory courses in Neuropsychology Assessment and Clinical Seminar provide teaching and training in clinical neuropsychology. Other requirements include passing a comprehensive examination and an oral examination, submission of a research thesis, and no more than one course scoring 'D' or below. Apart from the topic of neuropsychology, other required courses in the two universities cover topics of ethics and professional issues, research methods, cognitive assessment, psychopathology, personality, health and community psychology, and clinical seminars. The coursework is assessed depending on the requirements of course assignments, presentations, and /or examinations set by the lecturers in accordance with the guidelines of the graduate school.

For clinical placement, students who are clinical psychology trainees should complete at least 220 days of supervised practicum, averaging 2-4 days per week, over two years and covering 5 blocks of placement, which include 3 core placements and 2 electives. The core placements comprise the service areas of Adult Psychiatry/Psychology, Child and Adolescent Psychiatry/Psychology, and service for people with chronic mental illnesses or impairments such as intellectual disability. Elective Placements may involve one of the above-mentioned core placements, or services related to Forensic Psychology, Health/Community Psychology, Elderly Psychology, Social/Family Services and Neuropsychology. Depending on the types of

services, the clinical settings can be at hospitals / clinics under Hospital Authority, Child Assessment Centres under the Department of Health, service centers under the Social Welfare Department, the Correctional Services Department, the Hong Kong Police Force or other non-governmental organizations. An elective overseas placement on the specialty of neuropsychology at the University of California, San Diego can also be offered for clinical psychology trainees at CUHK. Throughout the practicum in various settings, students will gain practical experience working with a variety of clientele with different problems at various life stages, and they are expected to master basic skills in assessment, case formulation, and treatment planning / procedures in adherence to code of professional ethics. The placement performance has been evaluated by each placement supervisor based on a set of standardized evaluation criteria on ethics abided by the trainee and on clinical skills he/she possesses.

For master's graduates who have an interest in pursuing further study in clinical psychology / clinical neuropsychology, a Doctor of Psychology in Clinical Psychology (PsyD) or Doctor of Philosophy (PhD) program in Clinical Psychology at the two universities is an option. At HKU, the PhD program requires a minimum of 4 years of full-time study, whereas the PsyD program takes at least 2 years of full-time or 3 years of part-time study. At CUHK, the PhD and PsyD program takes 3 years of full-time and 3 years of part-time study, respectively. The annual tuition of the PhD Program is HK$42,100, which is much lower than that of the self-funded PsyD Program (approximately HK$72,000 per year). Students in the PhD program can receive monthly stipends of approximately $14,000 in return for assisting in the teaching and research of the graduate division, which is not applicable to students in the PsyD program. Nevertheless, because a master's degree in Clinical Psychology provides eligibility to work as a clinical psychologist in Hong Kong, the desire for further academic pursuits is

relatively low in this field. Despite a much higher tuition fee for the PsyD program, the proportion of master's graduates studying in the PhD program is much smaller (usually less than 10% of master graduates each year) than those studying in the PsyD program, e.g., only 2 part-time PhD but 14 PsyD students are currently studying in clinical psychology this year at CUHK.

At HKU, a total of 16 compulsory courses and 1 elective course are required for the PhD program, and 6 compulsory courses and at least 1 elective course are required for the PsyD program. A course in Clinical Neuropsychology is either compulsory or elective for the PhD and PsyD programs offered by HKU. For the CUHK, PhD students are required to take a total of 18 units of courses throughout the study period and a course on dissertation every term after passing a candidacy assessment, whereas PsyD students are required to take a total of 25 units of courses and two thesis research courses after passing the candidacy assessment. Students in the PhD or PsyD program can choose to receive 150-200 days of supervised practical training in a specific specialty, such as clinical neuropsychology, over the course of the Advanced Practicum and/or Advanced Clinical Seminar. The criteria for evaluation in the practicum are similar to those set by the master's program in Clinical Psychology.

Individuals who have an interest in pursuing postgraduate study in neuropsychology in the research field can consider taking the 2-year full-time master of philosophy program (MPhil) in Psychology at CUHK. There are also MPhil and PhD Programs provided by the Department of Psychology at HKU, yet specialization in neuropsychology is not available. The curriculum at CUHK requires students to take 14 units of required courses and 3 units of elective courses covering different aspects of psychology, such as organizational psychology, psychopathology, health and community psychology, cognitive psychology, social psychology, developmental

psychology, where they can choose course in Neuroimaging Methods in Psychology and specialization in neuropsychology under close supervision by a faculty member. Students with an overall GPA of 3.5 or above in their first year of study, a satisfactory thesis proposal and a pass in the oral thesis proposal defense qualify for transfer from the MPhil to PhD Pre-Candidacy. The PhD program in psychology takes 3 years full-time. The coursework in the PhD Pre-Candidacy program requires completion of a minimum of 14 units, plus a thesis research course each term. Students who have passed the candidacy examination, twice per year, have submitted a thesis proposal and passed a thesis proposal oral defense administered by a thesis committee will proceed to post-candidacy status, where a 3 unit course and thesis research course every term are required until graduation. In 2013-2014, there were 6 PhD and 8 MPhil students who graduated from the program. The annual tuition of the MPhil and PhD program is HK$42,100, and student assisting teaching and research work is eligible for monthly stipends of approximately HK$14,000.

The Role and Value of Neuropsychologists / Clinical Neuropsychologists in Hong Kong

Given that neuropsychologists in Hong Kong are generally clinical psychologists working in various clinical settings, and there has not been a survey targeted at neuropsychologists in Hong Kong, the statistics on practicing clinical psychologists may provide hints about the workplace of neuropsychologists. The latest broad-scale survey data that have been retrieved are from the Health Manpower Survey conducted by the Department of Health in 2009. This survey covered a total of 12,854 institutions in which healthcare personnel were likely to be employed. These institutions include hospitals, clinics or centers, schools, and laboratories under Government, Hospital Authority, Academic / Subvented / Private Institutes. The Department of Health,

Correctional Service and Hong Kong Police Force should have been included in the Government sector. It was found that there were altogether 403 clinical psychologists (307 full-time and 96 part-time) with a master's degree or doctoral degree in Clinical Psychology employed by the covered institutions. Approximately 35% of them were employed by the private sector, followed by 26% employed by the government, 23% employed by the Hospital Authority, 10% employed by the subvented sector, and 7% employed by the academic sector. The above data suggest that neuropsychologists in Hong Kong probably work in similar institutions, yet exact statistics about the distribution of neuropsychologists in different sectors are not available. An educated estimation based on personal communication with practicing clinical psychologists seems to indicate that clinical psychologists conducting neuropsychology related work are more likely to be employed under the Hospital Authority, private sector or universities.

In Hong Kong, the average salaries of clinical neuropsychologist are the same as that of clinical psychologist, at approximately HK$48,000 per month at the entry level and approximately HK$80,000 – HK$100,000 at mid-career. Clinical psychology / neuropsychology services provided by units under the Hospital Authority charge every new client HK$100 and every follow up HK$60 in outpatient clinics and no additional fee is charged for the said services for inpatients. Psychological services provided by the centers under the Social Welfare Department or in NGOs or subvented institutions are free of charge or sometimes charge at a rate using a sliding scale according to the financial status of the client as they have been subsidized by the government or other funding sources. For clinical services provided at clinics or at centers in the private sector, non-profit organizations or at universities, the service fees will be fully paid by the client, and these fees vary across settings and types of service, from approxiately

HK$800 to HK$5,000 for 50-60 minute sessions. The typical rate of reimbursement for a clinical assessment plus formal written report for a forensic case (around HK$10,000 - $30,000) is generally much higher than that of a general clinical / neuropsychological case (around HK$3,000 - $9,000).

In clinical practice, the major roles of neuropsychologists in Hong Kong are similar to those of clinical psychologists. In addition to the routine provision of psychological assessments and treatments and written psychological reports, clinical neuropsychologists are also required to offer neuropsychological assessments and cognitive rehabilitative training for brain-disordered patients. Depending on the specific job requirements in different clinical settings, some clinical psychologists / neuropsychologists are required to provide professional consultations to management and frontline staff, coordinate crisis intervention and disaster psychological services, develop educational materials / programs on the relevant services for patients, and provide relevant trainings to health care professionals or allied health staff. In the research field, neuropsychologists who are also researchers / professors at academic institutes are responsible for conducting research to study the brain-behavior relationships to understand the behaviors and cognitions of normal individuals and brain-disordered patients and to explore potentially effective and evidence-based interventions for cognitive enhancement. In some clinical settings, the job requirements also requires the clinical psychologist / neuropsychologist to conduct research in areas relevant to their clinical work and to sometimes launch clinical research projects in collaboration with professionals in other clinical settings and/or professors at universities.

Although specialization in neuropsychology is available in the PhD program, the differentiation between clinical neuropsychologist and clinical psychologist is blurred;

the overlapping job duties between the two disciplines and the lack of a division to represent the two specialties makes neuropsychologist a less distinct professional identity in Hong Kong. Neuropsychological services provided by clinical psychologists have received increasing recognition by other professionals such as psychiatrists, nurses, speech therapists and occupational therapists in some multi-disciplinary clinical sectors over the past twenty years. Nevertheless, in some settings, the value and function of clinical neuropsychologists have still been overlooked or underestimated by other disciplines. Additionally, because psychiatrists, occupational or physiological therapists can also be registered users of some neuropsychological tests, this may sometimes elicit a sense of competition in the field of clinical psychology. Therefore, in reality, working as a clinical psychologist in Hong Kong can be quite challenging and demanding, especially in settings, such as general hospitals, where clinical knowledge and skills in the three distinct specialties (clinical psychology, neuropsychology, forensic psychology) are required. Even more challenging for clinical psychologists working in general hospitals is the demand-over-supply clinical services. Statistics from the year 2011-2012 to 2013-2014 indicate that the overall median waiting time for first appointment at a psychiatric specialist outpatient clinic under the Hospital Authority has increased from six weeks to eight weeks. The longest waiting time reported by a practicing clinical psychologist in one of the general hospitals is one-and-a-half years!

Development and Common Practice of Neuropsychological Assessments in Hong Kong

During the early development of neuropsychological tests in Hong Kong, the assessment instruments were mainly translated and adapted from Western tests (Chan, Shum, & Cheung, 2003). Test items, or simply test instructions, will be translated for tests that were developed in the United States or elsewhere. Although some tests have

undergone crosschecking translation (e.g., back translation) and are followed by a standardized validation process and/or cross-cultural comparison, some have not. Translations of words and concepts maybe difficult in some circumstances given the discrepancy between Western and Eastern cultures (Tamayo, 1987). Even when some of the tests have been translated into Chinese in Mainland China or Taiwan, the tests may not be readily usable in Hong Kong due to the substantial cultural and language differences among the three Chinese societies. Cross-cultural validation is especially important for adapting verbal tests due to item translation, whereas adaption of nonverbal tests is generally considered easier and mainly involves translation of the test instructions. Nevertheless, aside from issues of language, educational and ethnic backgrounds are very different among Hong Kong and Western societies and even among other Chinese societies outside of Hong Kong. With the substantial increase in the number of immigrants from mainland China to Hong Kong, the local Chinese population has become diverse, with a mixture of fluent Cantonese-speakers who were born in Hong Kong and non-fluent Cantonese-speakers / Mandarin-speakers from mainland China. Sometimes, the test items validated for Cantonese-speakers may not be comprehensible for Mandarin-speakers. In these cases, an appropriate test will have to be selected with caution. Variation in ability can occur in conjunction with important demographic factors (e.g., parental education) and with content differences associated with different cultural exposure or culturally specific responses to individual items. Even for a test that is supposed to be culture-free, its performance may still vary with the mother language of the examinee, e.g., performance on the *Color Trails Test* and *Trail Making Test* was found to be highly correlated for English speakers but not for Chinese speakers in Hong Kong (Lee, Cheung, Chan, & Chan, 2000). Therefore, locally developed tests or at least adapted tests with cross-checking translation and adequate

validation and cross-cultural comparison are essential to providing a valid estimation of the cognitive functions for the local Chinese population.

Table 1 lists the commonly used neuropsychological tests in Hong Kong used for testing different cognitive domains. Among the 76 commonly used tests, a majority of them (93%) are adapted. The remaining 5 tests are indigenously developed for the Chinese population, including the *HKLLT* (Chan, 2006), the *Shape Trails Test* (Zhao et al., 2013), the *Chinese Vocabulary Test* (Chan, Cheung, Sze, Leung, & Cheung, 2008), the *Common Knowledge Test*, and the *Concept Thinking Test* (Cheung, Chan, Law et al., 2000; unpublished data). There are 14% of locally developed or adapted tests providing normative data on both adults and children, and 33% with normative data mainly for adults and 24% mainly for children. All adapted tests have been translated in terms of test items and/or test instructions with or without cross-checking the translation. Some adapted tests have gone through careful translation and validation processes, such as the *Cantonese version of Mini-Mental State Examination* (Chiu, Lee, Chung, & Kwong, 1994), the *CDRS* (Chan, Choi, Chiu, & Lam, 2003; Chan, Choi, & Salmon, 2001) and the *Category Fluency Test* (Chan & Poon, 1999), the *Boston Naming Test* (Cheung, Cheung, & Chan, 2004), the *Test of Everyday Attention* (Chan, Hoosain, & Lee, 2002; Wu et al., 2011), the *Dysexecutive Questionnaire* (Chan & Manly, 2002), the *Hong Kong Montreal Cognitive Assessment* (Wong et al., 2009), the set of tests included in the *Neuropsychological Test Battery for Primary School Cantonese-Speaking Children in Hong Kong* (Working Group in Child Neuropsychology, HKNA, 2014) and the set of neuropsychological measures on fluency (the *Word Fluency Test* and the *Design Fluency Test*), attention (the *Digit Span Test*, the *Symbol Digit Modalities Test*, the *Stroop Color-Word Test* and the *Trail Making Test*) and memory (the *Chinese Rey Auditory Verbal Learning Test*, and the *Aggie Figure Learning Test*) selected in the

study of Lee, Yuen and Chan (2002). The *Neuropsychological Test Battery for Primary School Cantonese-Speaking Children in Hong Kong* comprises 10 standardized tests, including the *Category Fluency Test*, the *Children's Color Trails Test*, the *Finger Tapping Test*, the *Fist-Edge-Palm Test*, the *Five Point Test*, the *Hong Kong Digit Cancellation Test*, the *HKLLT (Short Version)*, the *Number Span Test*, the *Rapid Finger Sequencing Test*, and the *Rey-Osterrieth Complex Figure Test*. All developed tests have been standardized and verified as valid and reliable cognitive measures. All but the *Shape Trails Test* have normative data on local Chinese adults and/or children. Fifty-two of 71 (73%) adapted tests have normative data on Chinese people residing in mainland China, Taiwan and Hong Kong, from which 42 tests have normative data on Cantonese-speaking local Hong Kong people. Given the above statistics, the trend suggests over-reliance on adapted neuropsychological tests in Hong Kong, yet the validation and standardization process may not be thorough enough for some commonly used tests. Furthermore, the need for more locally developed and ecologically valid tests is still implied.

Limitations and Further Development of Neuropsychology in Hong Kong

Despite the rapid and productive development of neuropsychology in Hong Kong, there is still room for improvement and advancement. First, given that clinical neuropsychology services have largely been provided by clinical psychologists who may have very limited training in neuropsychology, to guarantee the quality of clinical neuropsychology services and the standard of practicing clinical psychologists in providing neuropsychology services, a mandatory registration system with board certification is critically needed. There should be a clear set of guidelines and examination procedures to qualify psychologists practicing neuropsychology in Hong Kong. It is also important to add a division for membership of neuropsychologists /

clinical neuropsychologists who are verified by the HKPS committee in adherence to the standard guidelines and evaluation criteria, such that the specialty of neuropsychology can be distinguished from the specialty of clinical psychology. Such clear differentiation can facilitate the development of a unique identity for neuropsychologists, easing the identification of certified clinical neuropsychologist who can provide standard services and a better understanding of the value of neuropsychology in clinical practice by other professional disciplines. Second, from an educational / training perspective, a formal tertiary program that provides comprehensive teaching and internship training on clinical neuropsychology is rather limited in Hong Kong. Such advancement in the educational pathway is needed for fostering a better foundation of knowledge and skills among future clinicians for practicing neuropsychology after graduation. Third, in terms of clinical practice, especially in multidisciplinary clinical settings, more education and communication between clinical psychologists and other disciplines of professionals about the value of neuropsychology in case conceptualization and management is encouraged. This can help provide a more in-depth understanding of the value of neuropsychology in clinical practice and can develop a more harmonic and productive multi-disciplinary team in helping patients with cognitive disorders. Last but not the least, continuous effort should be made to further develop indigenous tests and to standardize and validate the adapted tests with an adequate crosschecking translation and cross-cultural validation process. This can be contributed by practicing clinical psychologists / clinical neuropsychologists in clinical settings and researchers / professors in academic institutes and by launching more collaborative research between the two fields of professionals.

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Table 1. List of Commonly Used Neuropsychological Tests in Hong Kong.

Cognitive Domains	Commonly Used Tests	Type of Tests	Norm Available For Chinese	
			Adults	Children
General Cognitive Functions	Chinese Mini-Mental State Examination (CMMSE)	A	✓	
	Chinese version of Mattis Dementia Rating Scale (CDRS)	A	✓*	
	Hong Kong Montreal Cognitive Assessment (HK-MoCA)	A	✓*	
	Cognitive Failures Questionnaire (CFQ)	A	✓*	
Attention	Attention subscale of CDRS	A	✓*	
	Attention Scales of Leiter International Performance Scale, 3rd edition (Leiter-3)	A		
	Attention Domain of the Developmental Neuropsychological Assessment, 2nd edition (NEPSY-II)	A		
	Test of Everyday Attention (TEA)	A	✓*	
	Test of Everyday Attention for Children (TEA-Ch)	A		✓*
	Digit Span subtest of Chinese Version of Wechsler Adult Intelligence Scale, 3rd edition (CWAIS-III)	A	✓	

	Digit Span subtest of Wechsler Intelligence Scale for Children - Fourth Edition (Hong Kong) (WISC-IV(HK))	A		✓*
	Digit Span Test of Wechsler Memory Scale – Revised (WMS-R)	A	✓*	✓*
	Number Span Test (NST)	A		✓*
	Coding subtest of WISC-IV(HK)	A		✓*
	Digit Symbol-Coding subtest of CWAIS-III	A	✓	
	Trail Making Test (TMT)	A	✓*	✓*
	Shape Trails Test (STT)	D	✓	
	Color Trails Test (CTT)	A	✓*	
	Children's Color Trails Test (CCTT)	A		✓*
	Hong Kong Digit Cancellation Test (HKDCT)	A		✓*
	Symbol Digit Modalities Test (SDMT)	A	✓*	✓*
	Conners Continuous Performance Test, 3rd edition (CPT-3)	A		
	Digit Vigilance Test (DVT)	A	✓*	
Memory	Hong Kong List Learning Test (HKLLT)	D	✓*	✓*
	Chinese Rey Auditory Verbal Learning Test (CAVLT)	A	✓*	✓*

	Visual Reproduction subtest of the Wechsler Memory Scale, 3rd edition (WMS-III)	A		
	Rey-Osterrieth Complex Figure (Rey-O)	A		✓*
	Aggie Figures Learning Test (AFLT)	A	✓*	✓*
	Benton Visual Retention Test, 5th edition (BVRT-5)	A		
	Memory Scales of Leiter-3	A		
	Memory and Learning Domain of the NEPSY-II	A		
	Memory subscale of CDRS	A	✓*	
	Rey Fifteen-Item Test (RFIT)	A		
	Test of Memory Malingering (ToMM)	A		
Language	Chinese version of Category Fluency Test (CCFT)	A	✓*	✓*
	Word Fluency Test (WFT)	A	✓*	✓*
	Vocabulary subtest of CWAIS-III	A	✓	
	Vocabulary subtest of WISC-IV(HK)	A		✓*
	Chinese Vocabulary Test (CVT)	D	✓*	✓*
	Boston Naming Test (BNT)	A	✓*	

	Comprehension subtest of WISC-IV(HK)	A		✓*
	Comprehension subtest of CWAIS-III	A	✓	
	Token Test (ToT)	A		
	Token Test for Children, 2nd edition (TTFC-2)	A		
	Reynell Developmental Language Scales (RDLS)	A		✓*
Visual Perception	Copy trial of Visual Reproduction subtest of WMS-III	A		
	Copy trial of Rey-O	A		✓*
	Construction subscale of CDRS	A	✓*	
	Clock Drawing Test (CDT)	A		
	Hooper Visual Organization Test (HVOT)	A	✓*	
	Judgment of Line Orientation Test (JLOT)	A	✓*	
	Matching subtest of Leiter-3	A		
	Visual Discrimination subtest of WMS-III	A	✓	
Motor	Finger Tapping Test (FTT)	A		✓*
	Grooved Pegboard Test (GPT)	A		
	Purdue Pegboard Test (PPT)	A		

	Grip Strength Test (GST)	A		
	Sensorimotor Domain of NEPSY-II	A		
	Rapid Finger Sequencing (RFS)	A		✓*
	TMT	A	✓*	✓*
	CTT	A	✓*	
	CCTT	A		✓*
Executive Functions	Chinese version of Dysexecutive Questionnaire (CDQ)	A	✓*	
	Behavior Rating Inventory of Executive Function (BRIEF)	A		
	HKLLT	D	✓*	✓*
	Rey-O	A		✓*
	Tower of London (TOL)	A		✓*
	Similarities subtest of WAIS-III	A	✓	
	Similarities subtest of WISC-IV(HK)	A		✓*
	Comprehension subtest of WAIS-III	A	✓	
	Comprehension subtest of WISC-IV(HK)	A		✓*
	Matrix Reasoning subtest of WAIS-III	A	✓	

	Matrix Reasoning subtest of WISC-IV(HK)	A		✓*
	Common Knowledge Test (CKT)	D	✓*	
	Concept Thinking Test (CoTT)	D	✓*	
	Executive Functioning Domain of NEPSY-II	A		
	Conceptualization subscale of CDRS	A	✓*	
	CCFT	A	✓*	✓*
	Design Fluency Test (DFT)	A	✓*	✓*
	Fist-Edge-Palm (FEP)	A		✓*
	TMT	A	✓*	✓*
	STT	D	✓	
	CTT	A	✓*	
	CCTT	A		✓*
	Contingency Naming Test (CNT)	A		✓*
	Five Point Test (FPT)	A		✓*
	Initiation/Perseveration subscale of CDRS	A	✓*	
	Modified Wisconsin Card Sorting Test (MWCST)	A	✓	

	Stroop Color-Word Test (SCWT)	A	✓*	✓*
	Modified Six Elements Test (MSET)	A	✓*	

Note. A = Adapted test; D = Developed test; ✓* indicates adapted or developed test that has norm data on Chinese in Hong Kong; ✓ indicates adapted or developed test that has norm data on Chinese from mainland China or Taiwan.