Appendix:

**Brief Descriptions of the Complimentary Roles of each NCD Expert Consultant in the correct diagnosis and proper management of neurocognitive disorders.**

**Geriatricians**

Geriatricians are physicians with added training specifically in managing the problems typically seen in those aged 60 and older including mental illness. They often follow patients who reside in long-term care settings until their death and therefore have greater experience tracking the progression of NCDs into their later stages. In collaboration with neurology, geriatricians are experts in brain manifestations of metabolic diseases, the effects of chronic pain syndromes, the complex interplay of multi-system disease, the contributing effects of multiple medications and their drug interactions, and the impact of the aging process on chronic disease states. Geriatricians and particularly helpful in identifying and addressing multiple medical problems that could to be “tuned up” to improve cognition such as better control of hypertension, diabetes, thyroid homeostasis and pain management regimens. The cumulative results of these “tune-up” interventions may improve function in multiple cognitive domains in addition to improvements in ambulation, social activity participation, sleep quality, improved nutrition, a healthier BMI, and a greater willingness to pursue healthier lifestyle choices. Continued longitudinal care for long term benefits is optimal.

**Neurologists**

The expertise of neurologists can recognize subtle neurological signs of neurological disease such as Parkinson’s Disease or the contribution of parkinsonism to other clinical presentations, occult seizure phenomena, Amyotrophic Lateral Sclerosis, Huntington’s Disease, corticobasilar degeneration, paraneoplastic effects of non-brain tumors, and inflammatory disease manifestations in the brain. Known co-morbidities of established neurologic diseases such as anti-seizure medication side effects need to be scrutinized for appropriateness for the patient’s current age as well as in the context of their other illnesses. Cognitive disorders with neurologic manifestations are the neurologist’s particular area of expertise as well as which diagnostic tests can pinpoint the correct diagnoses such as a particular imaging study, EEG, vestibular testing, optokinetic testing, or the need for CSF analysis or other specialized tests.

**Neuropsychologists**

Neuropsychologists are psychologists with expertise in determining the nature and severity of cognitive impairments by utilizing standardized paper and pencil tests to specifically evaluate all areas of brain function including attention, language, visuospatial ability, executive functioning, and memory management that differentiates acquisition, consolidation, and accurate retrieval after a timed interval. Patterns in symptom presentation and cognitive performance on standardized tests can help identify specific NCD etiologies. In some cases, neuropsychologists can make inferences about regions in the brain that correlate with specific cognitive functions and therefore determine whether the observed deficits match observable pathology in brain imaging studies. They are expert in assessing the extent to which test results might be skewed by focusing ability, intellectual ability, education level, aging, and chronic mental and/or physical illness. A Neuropsychologist referral will include performing their own comprehensive history of all relevant factors that potentially contribute to a brain disease that might reveal something overlooked in the everyday practice of medicine by bringing a fresh perspective such as the extent to which lifelong diagnoses such as generalized anxiety disorder or attention deficit disorder might be exacerbated by the early stages of an NCD. Information obtained through neuropsychological testing can assist with both diagnosis, treatment recommendations, and longitudinal change.

**Psychiatrists**

Psychiatrists, particularly geriatric psychiatrists, are adept at assessing mental status changes, particularly the contribution of chronic mental illness to cognitive impairment presentations. Psychiatrists also have the most experience prescribing psychopharmacotherapy for the behavioral disturbances that often accompany a diagnosis of NCD such as delusions, hallucinations, agitation, oppositional behavior, paranoia, Capgras Syndrome (Imposter syndrome) or aggression. Beyond providing appropriate pharmacotherapy, psychiatrists and their colleagues in social work, psychology, and nursing can also use their psychotherapy skills to provide tailored, empathic, psychoeducational support for helping individuals with NCDs to make sense of their changing world. Psychiatrists, psychologists, and social workers are also adept at providing explanatory psychoeducation for caregivers that can directly reduce conflicts between patients and caregivers, optimize cooperation, encourage ample respite to prevent caregiver burnout and enhance the quality of life for both patient and caregiver. These clinicians also provide advice about making the difficult decisions such as when to access paid help or seek placement in a supervised care setting. A geriatric psychiatrist referral will focus on the past mental health history, their family members’ mental health, and the role that co-morbid psychiatric illness is playing in the current presentation of cognitive impairment. Specific psychotropic medication recommendations are made along with their rationale explained with appropriate psychoeducation.

**Neuroradiologists**

Neuroradiologists arguably have played the largest role in advancing our ability to discern brain changes that potentially account for cognitive impairment through a literal, non-invasive, window into the brain. With a Computed Tomography (CT) scan level of detail, larger strokes, tumors, and enlarged ventricles are readily diagnosable. Magnetic Resonance Imaging (MRI) levels of resolution can further assess microvascular changes and can localize atrophy patterns and microvascular changes in much sharper detail than CT scans and are thus preferred to obtain the most accurate diagnoses.

Referral to a neuroradiologist, who is most capable of determining subtle brain findings, is not specified, however, when brain imaging is ordered in the electronic medical record, particularly in smaller hospital settings. The images will most likely be read by a general radiologist, as they are more available. Unfortunately, “screening brain image” reports from non-academic hospitals too often merely report whether any strokes, tumors, or midline shifts are present. Some reports comment on presence or the extent of deep white matter ischemic changes and whether they are commensurate with the age of the patient or not. While providing some security that obvious neurological processes are ruled out, not all brain imaging provide the most granular or nuanced diagnostic clarity. The quality of the actual brain images can also vary considerably. The number of cuts or image slices from which conclusions are drawn is often minimal to suffice as a screen for obvious pathology such as ischemic strokes, tumors or intracranial bleeding and reports do not always show all three brain views (axial, sagittal, and coronal). Coronal views are best for observing hippocampal volume loss, for example. The interpretation of these limited radiologic findings does not offer much help in differentiating the underlying type of dementia and can lead to underdiagnosing brain changes that account for cognitive impairment. Also, patients now commonly read their own reports on Mychart or similar portals to their electronic medical record and can conclude erroneously that no significant brain problems were detected.

In contrast, protocolized advances in the interpretation of structural brain imaging read by experienced neuroradiologists can be affirming and sometimes exclusionary when presenting clinical symptoms are vague or confusing. Atrophy patterns derived from high-resolution MRI scans with an adequate number of slices, in all three viewing angles, performed with a more powerful magnet (3T or higher) for finer resolution can now quantify atrophy patterns with standardized rating scales for severity (0-4) known to correlate with memory and cognition loss in brain areas such as the hippocampus, entorhinal cortex, medial temporal lobe, and in the frontal, temporal and parietal cortices. AD typically shows predominant biparietal and temporal lobe atrophy patterns. FTD shows predominantly frontal and temporal atrophy. DLB can sometimes, but not always, show occipital atrophy. Vascular damage severity can similarly be quantified with the Fazekas scale (0-3) with more granular localization. Expert interpretive judgment, however, is still required to weigh the relative importance of a lifetime of accumulated effects on the aging brain from various contributing disease processes, thus neuroradiologists that specialize in NCD interpretation offer the most useful interpretations.

Interpreting amyloid PET (positron emission tomography) scans requires new training techniques with a move toward standardization protocols that achieves consistency throughout various institutions for making defined cut-offs as precise as possible for determining who is diagnosable with AD which is requirement for eligibility for anti-amyloid monoclonal antibody therapy.

**The consensus of a team of dementia experts**

The expert consensus of a team of dementia specialists mentioned above can offer a level of real-time debate over the interpretation of all diagnostic tests being considered as part of the dementia work-up that can bring 100 years of combined experience compared to each individual test result being left up to the PCP to interpret themselves. The opportunity to ask questions of each other, clarify ambiguity and hear about the latest new developments can offer robust cross-checking of various pieces of diagnostic evidence to help assure a correct diagnosis to ultimately help the referring primary care physician provide appropriate psychoeducation, decision-making, and long-term treatment planning.