1. When Should I Be Concerned?

- **What are the early signs of ASD?**
- **Are there typical characteristics that are part of an ASD diagnosis?**
- **How do variations in symptoms and severity create challenges in early diagnosis of ASD?**

What do we know?

A child's caregivers are often first to identify the signs of ASD. In the classic case, there may be delays or plateaus in a child's attainment of developmental milestones, such as the use of gestures, responding to name, or the onset of speech and pretend play. In other cases, the first signs of ASD occur in young children who appear to regress after they seem to have been developing normally. Current diagnostic criteria and classifications of ASD represent progress in identifying a core set of developmental symptoms that, in the past, might have been attributed to other disorders because of more narrowly defined ASD evaluation criteria.

The diagnosis of ASD can be reliably made by age three, because the core symptoms emerge by that time. However, most children eventually diagnosed with ASD exhibit signs of abnormal development well before the age of two. Recent studies of children at high risk because of the presence of a sibling with ASD suggest that many cases of autism can be detected by 12 months of age using simple behavioral tests, such as response to calling the child's name or ease of engaging the child in jointly looking at an object (Landa, Holman, & Garrett-Mayer, 2007). Nevertheless, the average age of diagnosis is 5 years (Wiggins, Baio, & Rice, 2006). A number of screening tools have been developed for detecting autism for children of varied ages and different levels of clinical variability. There are tools available for parents and caregivers, including a video glossary of early "red flags" of ASD in young children developed to help families and professionals learn how to identify subtle differences in development that may indicate areas of concern (Wetherby et al., 2007). In terms of diagnosis, there is emerging evidence that tools can be developed with sufficiently high sensitivity and specificity to support epidemiologic and risk factor studies.

Nationwide, there has been an effort to improve early identification of children with ASD to improve their functioning and outcomes. A recently published randomized, controlled trial demonstrated how a comprehensive developmental behavioral intervention for toddlers with ASD led to improvements in cognitive and adaptive behavior, thereby emphasizing the importance of early identification of and intervention for young children with ASD (Dawson et. al., 2010). Various public campaigns, including the CDC's "Learn the Signs. Act Early," have been initiated in recent years to raise awareness about the importance of early identification of developmental delays, including those associated with ASD. The American Academy of Pediatrics recommends screening children for ASD at 18 and 24 months with a standardized screening tool.

What do we need?

Most cases of autism and related disorders are not diagnosed until after a child's third birthday and sometimes not until adulthood, yet early intervention can have a critical influence on the future course of ASD. Moreover, many children from culturally, linguistically, and other diverse groups may have limited access to assessment services leading to delays in diagnosis (Mandell et al., 2009). Several issues have limited the use of early interventions. It remains difficult to diagnose ASD in very young children because there is considerable healthy variation in the age at which infants and toddlers reach typical developmental milestones (e.g., speech) and delays do not always indicate the presence of a disorder. The diagnosis of an ASD in a person of any age is currently based on behavioral and cognitive signs, reflecting abnormal brain development, but not on detection of brain or other biological differences that may be present before the emergence of the behavioral or cognitive signs. The discovery of reliable biomarkers could potentially identify people with ASD, or infants who will subsequently develop or are already developing subtle signs of ASD.

Children with ASD develop along different trajectories, some show abnormal behavior soon after birth, others develop normally for the first year or longer and then regress while others appear to later improve significantly. Greater clarity is needed in identifying these different trajectories and greater consistency is needed in applying their definitions. Healthcare and other early care and education providers may not have received training in recognizing the early warning signs of ASD. Pediatricians may not have received training on using existing screening tools at well check-ups as recommended by the American Academy of Pediatrics and some caregivers may be unaware of the early warning signs of ASD or where to access services, leading to delays in diagnosis.

Although families are eager for guidance, more research is needed to better answer the question of when developmental variation should become cause for concern. We need studies that test both new and current diagnostic and screening methods and that integrate both developmental and biologic approaches in community-based settings. In particular, studies need to be designed to validate methods in underrepresented minorities and disadvantaged populations. Such studies could increase our understanding of barriers to diagnosis and access to services. Taken together, earlier identification coupled with increased access to interventions and services could reduce disparities in health care and service provision, and ultimately improve outcomes for people with ASD.

Scientific studies of ASD require the reliable diagnosis of participants but this can be a time consuming and labor intensive process. Therefore, streamlined diagnostic approaches that facilitate the enrollment of research participants are needed. Researchers also need ASD measures that are easy to administer and are sensitive to changes in clinical status. With regard to heterogeneity, identifying characteristics that are specific to certain ASD subpopulations could potentially identify neurobiological and genetic markers and improve our understanding of more global causal and intervention mechanisms.

***ASPIRATIONAL GOAL*: CHILDREN AT RISK FOR ASD WILL BE IDENTIFIED THROUGH RELIABLE METHODS BEFORE ASD BEHAVIORAL CHARACTERISTICS FULLY MANIFEST.**

Research Opportunities

- Valid and reliable ASD screening instruments and approaches, including general developmental screening instruments for use in community settings to identify a wide range of people, including younger children, adolescents, adults, people with co-occurring medical conditions, and people with subtle characteristics, who require diagnostic evaluation.

- Sensitive and efficient clinical diagnostic tools for diagnosing ASD in widely diverse populations, including underrepresented racial and ethnic groups, females, younger, older age groups, people with co-occurring medical conditions.

- ASD measures that are easy to administer and sensitive to incremental changes in both core and associated ASD characteristics. Such measures can be used to help track the clinical course of people with ASD, monitor responses to interventions, and provide information about the broader autism phenotype.

- Detailed criteria for specific ASD sub-types in order to better describe the variations in characteristics and severity and study how these variations relate to underlying pathology, intervention strategies, and outcomes.

- ASD subpopulations and associated biobehavioral markers that provide early indication of ASD risk and opportunities for appropriate early intervention.

- Protocols for genetic testing in routine clinical practice in order to identify people at risk for ASD. Identification of people with genetic variations associated with ASD will facilitate intensive studies of ASD subpopulations with shared genetic risk factors to characterize common phenotypic and biological features.

- Inclusion of ethical considerations into the diagnosis and screening processes, including consideration of the implications of genetic testing.

- Addressing barriers to the use of screening and diagnostic tools in minority populations and in community settings, including training programs for professionals.

Short-Term Objectives

A. Develop, with existing tools, at least one efficient diagnostic instrument (e.g., briefer, less time intensive) that is valid in diverse populations for use in large-scale studies by 2011. *IACC Recommended Budget: $5,300,000 over 2 years.*

B. Validate and improve the sensitivity and specificity of new or existing screening and diagnostic tools, including comparison of general developmental screening versus autism-specific screening tools, in both high risk and population-based samples through studies of the following community populations that are diverse in terms of age, socio-economic status, race, ethnicity, characteristics of ASD, and general level of functioning by 2012. *IACC Recommended Budget: $5,400,000 over 3 years.*

New Objective

C. Conduct at least three studies to identify reasons for the health disparities in accessing early screening and diagnosis services by 2012. *IACC Recommended Budget: $2,000,000 over 2 years.*

New Objective

D. Conduct at least two studies to understand the impact of early diagnosis on choice of intervention and outcomes by 2015. *IACC Recommended Budget: $6,000,000 over 5 years*.

Long-Term Objectives

A. Identify behavioral and biological markers that separately, or in combination, accurately identify, before age 2, one or more subtypes of children at risk for developing ASD by 2014. *IACC Recommended Budget: $33,300,000 over 5 years.*

B. Develop at least five measures of behavioral and/or biological heterogeneity in children or adults with ASD, beyond variation in intellectual disability, that clearly relate to etiology and risk, treatment response and/or outcome by 2015. *IACC Recommended Budget: $71,100,000 over 5 years.*

C. Identify and develop measures to assess at least three "continuous dimensions" (i.e., social reciprocity, communication disorders, and repetitive/restrictive behaviors) of ASD symptoms and severity that can be used by practitioners and/or families to assess response to intervention for people with ASD across the lifespan by 2016. *IACC Recommended Budget: $18,500,000 over 5 years.*

What Progress is Being Made in Fulfilling the Objectives?

(Please provide 1-2 paragraphs to summarize progress.)

***Note:** Objectives labeled "New Objective" are either entirely new additions to the 2010 Strategic Plan or significantly modified objectives from the 2009 Strategic Plan. Objectives from the 2009 Strategic Plan that did not change or that have been slightly modified for clarification purposes are unmarked.*