Recognizing and Treating Psychosocial Dysfunction in the Child with CKD and Impaired Neurocognition

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Disclosures

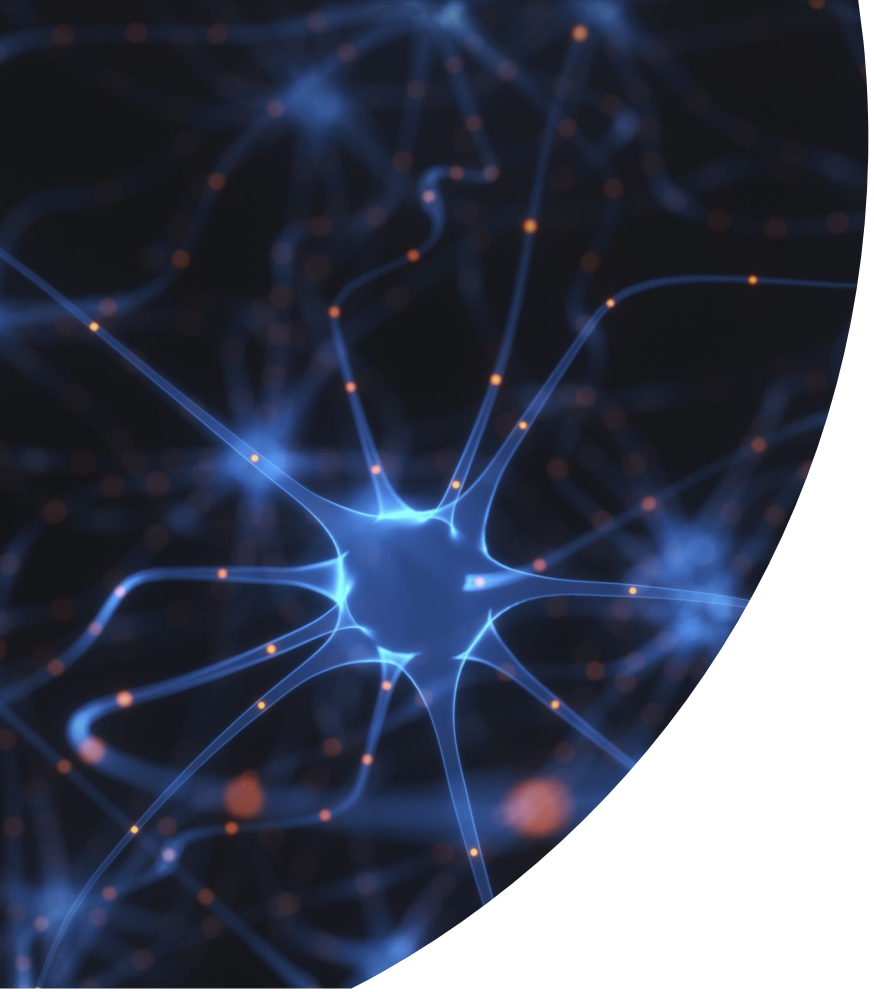
I do not have any disclosures.

Objectives

- Understand risk for neurocognitive dysfunction in pediatric CKD, which domains of cognition are most at risk, and name two ways these domains are assessed.
- Identify three ways that impaired neurocognition can impact the social-emotional health and academic achievement of youth with CKD.
- Name three intervention strategies that may be used to treat social-emotional and academic concerns that arise within the context of neurocognitive deficits.

Outline

- Define neurocognitive abilities
- Scope of deficits in pediatric CKD
- Assessment of neurocognition
  - Differential diagnosis
- Psychosocial impact of neurocognitive deficits
- Interventions
  - Potentially modifiable contributing factors



Neurocognitive Abilities

- Intellectual abilities (IQ)
  - Crystallized and Fluid
  - Verbal and Performance
- Executive functions – needed for intellectual functioning but can be assessed more specifically
  - Attention
  - Working memory
  - Inhibition
  - Task initiation
  - Reasoning
- Memory and learning

Crystallized Intelligence

- Accumulated verbal knowledge and skills
- More dependent on experience and less on biological influences
- Influenced by education and cultural experiences
- Develop throughout childhood, continue some development into middle adulthood

Fluid Intelligence

- Problem-solving, thinking and acting quickly, encoding new episodic memories
- Facilitates adapting to novel situations
- Sensitive to biological influences
- Less dependent on past learning
- Develop rapidly during childhood and peak in early adulthood

Executive Function (Merriam-Webster)

Complex mental processes and cognitive abilities, such as . . .

- *Working memory*
- *Impulse inhibition*
- *Reasoning*

That control skills required for goal-directed behavior, such as . . .

- *Organizing tasks*
- *Remembering details*
- *Managing time*
- *Solving problems*

Scope of Neurocognitive Deficits in CKD

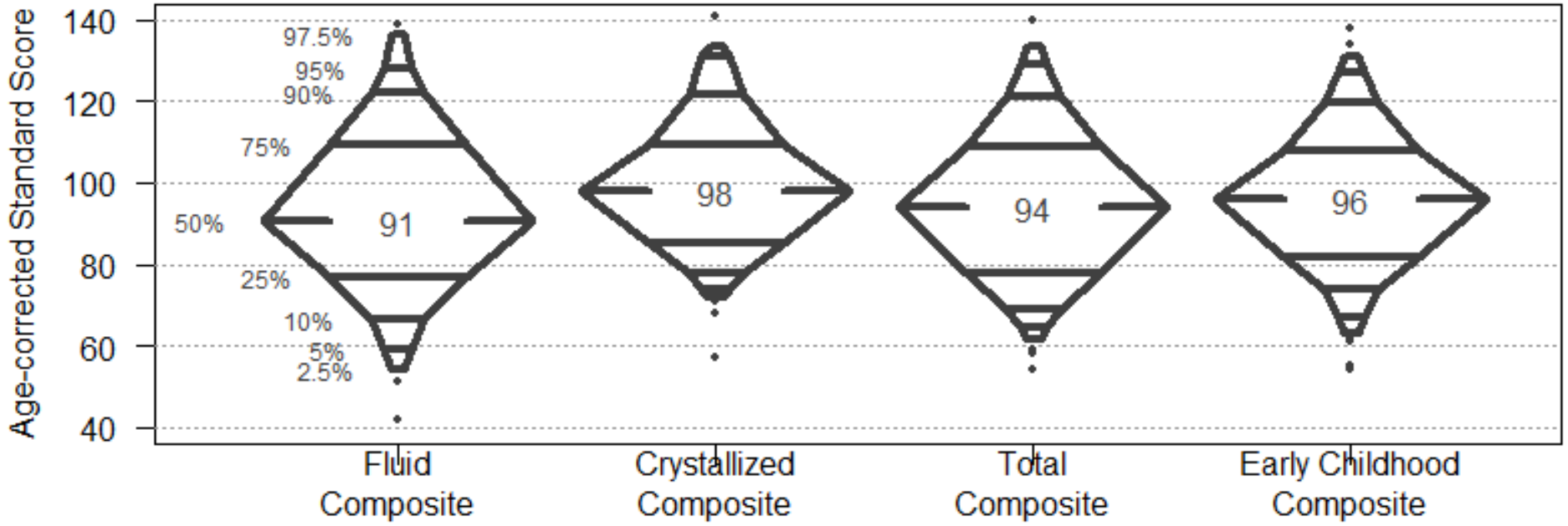
Intellectual Functioning (IQ)

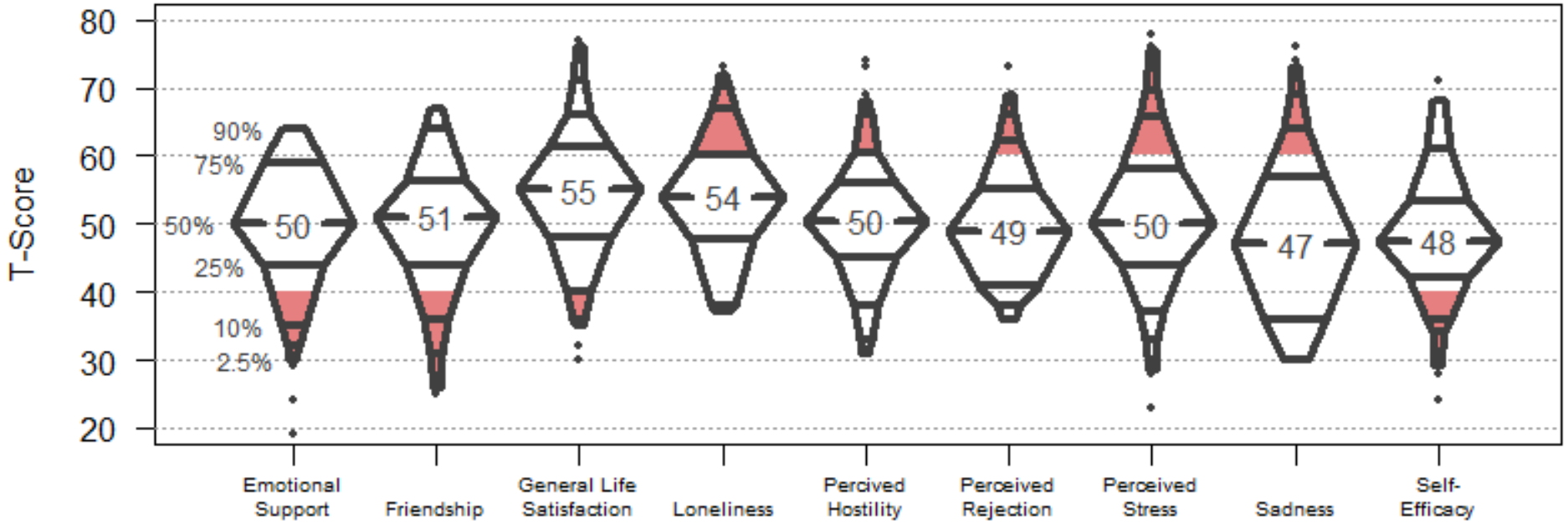
- Chen et al. (2018) performed a meta-analysis of studies that examined intellectual functioning
- For children with **mild to moderate CKD**, compared to general population:
  - Full scale IQ -9.30 points
  - Verbal IQ -8.07 points
  - Performance IQ -8.73 points
- Significant impairment was observed for children on **dialysis**:
  - Full Scale IQ -16.2 points
  - Verbal IQ -14.1
  - Performance IQ -15.5
- **Transplant** recipients had somewhat better outcomes:
  - Full Scale IQ -11.2
  - Verbal IQ -4.1
  - Performance IQ -10.5

MEASURE	MEAN (Standard or T Score)	SD	%>1SD FROM MEAN
WASI			
Verbal IQ	98	17	21
Performance IQ	95.4	16.3	27
Full Scale IQ	96.4	16.5	25
WIAT-II-A			
Reading	96.5	17.1	26
Spelling	96.2	16.8	26
Numerical Operations	93.7	20.2	33
Total Achievement	95.2	17.8	31
CPT-II			
Omissions*	51.7	13.5	15
Commissions*	51.7	11	23
Variability*	50.1	11	22
BRIEF			
Behavioral Regulation Index*	53.5	11.1	28
Metacognition Index*	55.9	11.5	35
GEC* (overall composite)	55.2	11.6	33
*Indicates higher = worse Hooper et al. (2011)			

NIH Toolbox Cognitive Measures

Instrument	Construct Measured	Ages
Picture Vocabulary	Language	3+
Oral Reading Recognition Test	Language	7+
List Sorting Working Memory Test	Working Memory	7+
Dimensional Change Card Sort Test	Executive Function	3+
Pattern Comparison Processing Speed Test	Processing Speed	7+
Picture Sequence Memory Test	Episodic Memory	3+
Flanker Inhibitory Control and Attention Test	Executive Function, Attention	3+





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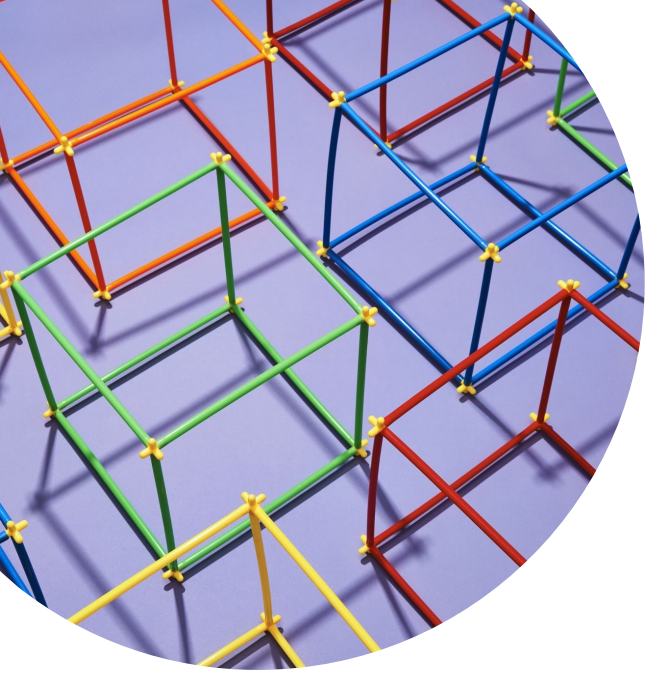

Executive Functions

- In **mild to moderate CKD**, average median scores but scores skew low with more participants “at risk” than expected
- In studies of advanced CKD, including **dialysis and transplant**, performance declines and scores are significantly lower than healthy control groups
- Parents endorse more dysfunction for children with CKD, particularly for metacognition
- Proteinuria, abnormal blood pressure, and anemia have all been associated with poorer performance
- Kidney function (eGFR) appears to be protective

Hooper et al., 2011; Singh et al., 2022; Lande et al., 2016; Ruebner et al., 2016; Johnson & Warady, 2013; Gipson et al., 2006

Memory and Learning

- Children with **mild to moderate CKD** score lower on measures of verbal and visual memory than the general population
- **Transplant** patients scored significantly worse than general population (11-13 points)

Chen et al., 2018; Johnson & Warady, 2013

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Summary

- Children with CKD exhibit neurocognitive deficits
- Youth on dialysis tend to have the lowest scores and exhibit significant deficits
- Disease-related comorbidities are associated with neurocognitive deficits
- Fluid intelligence, particularly executive functions, appear to be impacted more than verbal or “crystallized” abilities

Assessment of Neurocognitive Deficits in CKD

Assessment of Neurocognitive Deficits in CKD

- What are the typical presenting concerns?
  - **Struggling in school/school failure**
  - **Inattentive/difficulty concentrating**
  - **“Memory problems”**
  - “Unmotivated” “Teachers say he can do the work but doesn’t want to work”
  - Child hates school

Assessment of Neurocognitive Deficits in CKD

- Rating scales
  - Multi-informant assessment
  - BASC-3, BRIEF-3, NICHQ Vanderbilt Assessment Scale (free)
- Diagnostic interview
  - Thorough history
  - Presenting concerns
  - Current functioning

If indicated . . .

- Formal assessment
  - Wechsler scales, Stanford Binet, DAS
  - Academic achievement
  - Measures of specific abilities
  - Adaptive skills

Differential Diagnosis

- Neurodevelopmental disorder
  - Intellectual Disability (Intellectual Developmental Disorder)
  - Autism spectrum disorder
- Learning disorder
- Anxiety
- Depression
- Other psychopathology
- Vision/hearing

Diagnosis

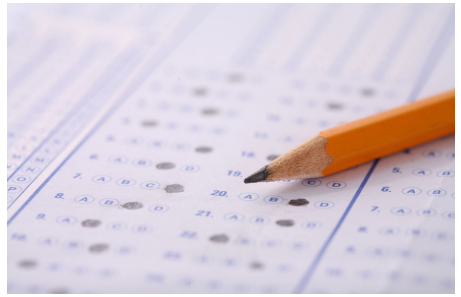
- Attention-Deficit/Hyperactivity Disorder (ADHD)
  - Combined presentation
  - Predominantly inattentive presentation
  - Predominantly hyperactive/impulsive presentation
- Other Specified Attention-Deficit/Hyperactivity Disorder
  - Symptoms characteristic of ADHD cause significant impairment
  - But do not meet full diagnostic criteria

Prevalence of Diagnosis

- Prevalence of ADHD in general population ranges from 5%-7% depending on how it is assessed/rigor of studies included (Polanczyk et al., 2014; Thomas et al., 2015)
- DSM-5 lists prevalence of 5% in children
- Examination of CKiD data compared to National Survey of Children's Health found little difference in parent-reported ADHD (10.6% vs. 9.2%; Stahl et al., 2022)

Psychosocial Impact

Academic Achievement



- Few studies of real-world academic progress
- Studies tend to use standardized, brief measures of achievement:
- In mild to moderate CKD, scores tend to skew lower with more at risk than expected
- Academic achievement among transplant patients was 9-12 points lower than general population
- Math tends to be the most affected
- Lower achievement associated with days of missed school

Hooper et al., 2011; Harshman et al.; 2018; Chen et al., 2018

What is impacted?

- Poor academic achievement has cascading effects . . .
  - School stress/anxiety
  - Learned helplessness/depression
  - Disengagement from school
  - Low participation in extracurricular activities
  - Poorer social relationships
- Organization/memory in day-to-day life
  - Adherence
  - Homework
  - Goal-oriented behaviors
- Overall mental/behavioral health
  - Adherence
  - Social Relationships

Interventions

Potentially Modifiable Contributing Factors

- Improved disease management
- Missed school
- School avoidance
- Academic problems
- Poor sleep/fatigue
  - Screens
  - Poor sleep habits
  - Sleep disorder

Sleep problems and fatigue at baseline

Symptoms List		
Fatigue	271	26%
Sleep Disturbance	302	30%

PedsQL		
Low Energy	386	52%
Trouble Sleeping	294	39%

Sleep

- Sleep problems were prevalent, 26% reported fatigue, 30% sleep disturbance, 52% low energy, 39% trouble sleeping
- Longer duration of CKD, anemia, nephrotic-range proteinuria, and HTN increased odds of reporting sleep problems
- Waking early, trouble sleeping, and falling asleep during the day were associated with greater parent-reported problems with executive function
- **Low energy** was associated with parent-reported problems with executive functions and poorer performance on tests of working memory, inhibition, and problem-solving fluency

Significant associations between low energy and neurocognitive and emotional-behavioral outcomes

Low Energy	Predicts:	Effect est. (95% CI)	p value
	BRIEF-2 Global Executive Function *(as well as BRI, MI)*	1.85 (0.79, 2.9)	0.0006
	Behavioral Symptoms	1.82 (0.93, 2.7)	0.0001
	Externalizing Problems	1.10 (0.23, 1.97)	0.01
	Internalizing Problems	3.20 (2.18, 4.22)	<0.0001
	Digit Span Forward	-0.37 (-0.72, -0.01)	0.046
	Digit Span Backward	-0.48 (-0.87, -0.09)	0.02
	Design Fluency	-0.67 (-1.25, -0.09)	0.02
	Color-Word Switching	-0.92 (-1.57, -0.28)	0.006

Sleep Interventions

- Recommend good sleep habits/routine
  - https://pedpsych.org/fact_sheets/bedtime_problems/
  - https://infoaboutkids.org/body/sleep/
- Refer to behavioral health professional or PCP
- Refer to sleep medicine/behavioral sleep expert

School Interventions

- Appropriate evaluation
- IEP or 504 Plan
  - Appropriate accommodations
- Strategies to increase school attendance
- Organizational/behavioral strategies
- Increase social engagement at school
  - Marker of social-emotional health = sees friends outside of school
- Staff or peer mentor
- Tutoring

Medication Intervention

- Many different options for medication
- Medication trials/adjustments may be needed
- Monitoring is important
  - Side effects
    - Decreased appetite
  - Benefits
- Different medication schedules
- Little or no research on use of stimulant medication in pediatric CKD for treatment of inattention
- Many parents are reluctant to add stimulant medication

Case Study

- 14yoF with kidney transplant
- Presenting concerns:
  - Inattentive, “spacy”
  - Hard to wake up for school/late
  - Not following instructions
  - Missing assignments
  - Range of A’s to F’s
  - Feels overwhelmed when behind on schoolwork
  - Always struggled with school but focus was on medical needs/transplant
- Rating scales:
  - Parents endorsed inattention and anxiety
  - Teachers endorsed inattention
  - Teachers also endorsed problems with social skills, leadership
  - Patient endorsed attention problems, hyperactivity, worry, and low self-esteem

Case Study

- Assessment
  - Average intellectual abilities
  - Direct measures of executive function were average
  - Memory and learning were average
- Diagnosis
  - ADHD combined presentation
  - Unspecified anxiety disorder
- Intervention
  - Behavioral/organizational strategies
  - Cognitive-behavioral anxiety management
  - Contingencies for homework completion
  - Medication
    - Improved sleep
    - Homework easier because attention in class improved
    - Performance on tests improved
    - Feeling less stressed so less irritability

Another Case Study

- 19yoM on hemodialysis
  - Presenting concern = “memory problems”
  - New onset
  - History of doing well in school/work
  - Extremely variable work schedule
- Assessment:
  - Diagnostic interview
- Interventions:
  - Education regarding sleep and cognitive functioning
  - Recommended various sleep/lifestyle modifications
  - Patient got a new job, began sleeping at night, memory problems resolved

Summary

- Children with CKD are at risk for neurocognitive deficits
- Executive functions are particularly impacted
- Psychosocial treatment of the child with neurocognitive deficits may require a comprehensive approach:
  - Disease management
  - School/academic interventions
  - Optimizing school attendance
  - Behavioral health assessment and treatment

Thank you!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Pediatric Symptom Checklist (PSC-17)

Please mark under the heading that best describes your child:

		(0) NEVER	(1) SOMETIMES	(2) OFTEN
1.	Feels sad, unhappy	☐	☐	☐
2.	Feels hopeless	☐	☐	☐
3.	Is down on self	☐	☐	☐
4.	Worries a lot	☐	☐	☐
5.	Seems to be having less fun	☐	☐	☐
6.	Fidgety, unable to sit still	☐	☐	☐
7.	Daydreams too much	☐	☐	☐
8.	Distracted easily	☐	☐	☐
9.	Has trouble concentrating	☐	☐	☐
10.	Acts as if driven by a motor	☐	☐	☐
11.	Fights with other children	☐	☐	☐
12.	Does not listen to rules	☐	☐	☐
13.	Does not understand other people's feelings	☐	☐	☐
14.	Teases others	☐	☐	☐
15.	Blames others for his/her troubles	☐	☐	☐
16.	Refuses to share	☐	☐	☐
17.	Takes things that do not belong to him/her	☐	☐	☐

Does your child have any emotional or behavioral problems for which she/he needs help? __No __Yes

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