

Development of Inattention and Executive Dysfunction in Youth with Spina Bifida: Condition Severity Variables as Predictors

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June 12, 2025

Child Neuropsychology/
AACN Student Project
Competition

AACN Conference 2025



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Overview of Spina Bifida (SB)

- Common birth defect
- Due to failure of neural tube closure during embryonic development
- Significant CNS impacts
 - Multisystem deficits: neurologic, orthopedic, and urologic
- Increased survival rates
 - Lasting medical complications
- Heterogeneous condition



Healthy Baby



Baby with Myelomeningocele

Neuropsychological Functioning in SB

Neurologic Complications

Chiari II Malformation

Structural defect of posterior fossa, brain stem, and cerebellum

Hydrocephalus

Build-up of cerebrospinal fluid in the brain

Risk for Neuropsychological Deficits

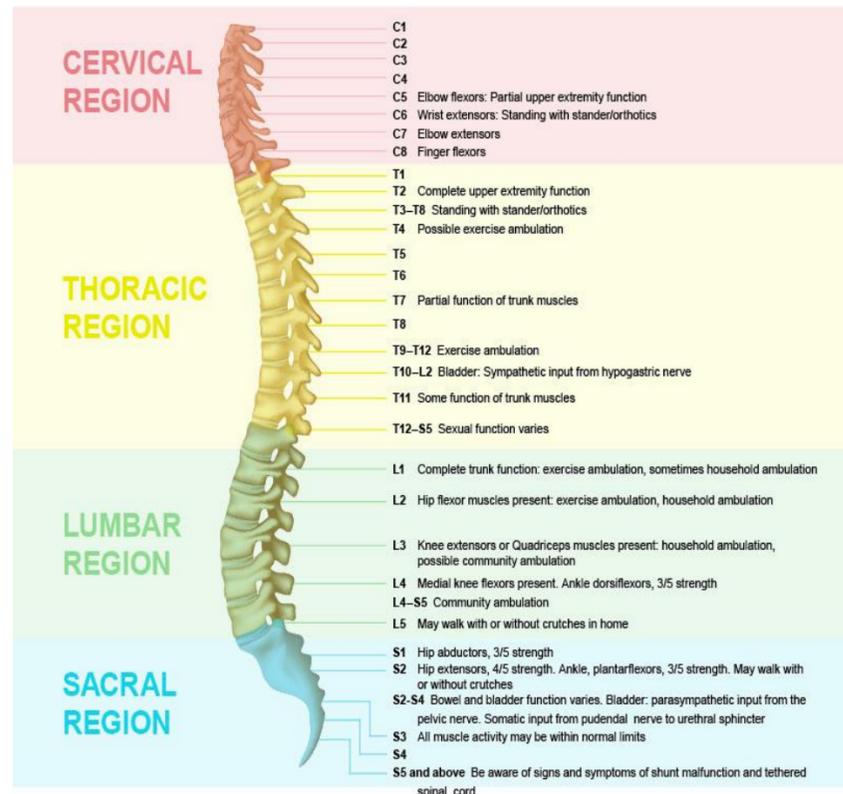
Inattention

Executive Dysfunction

SB Heterogeneity

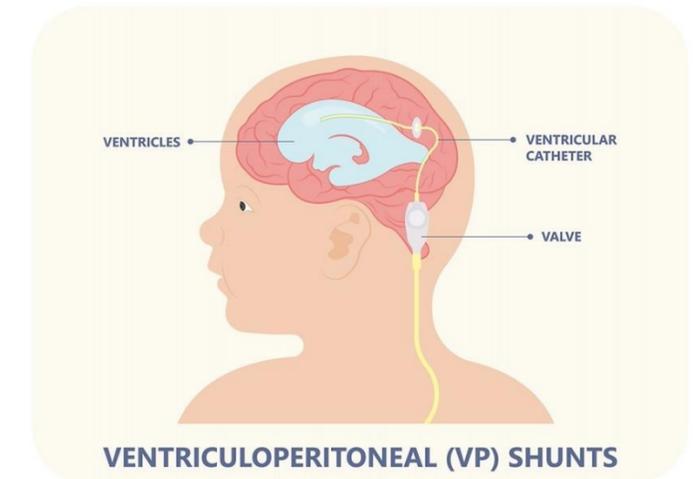
Lesion Level

- Location of SB lesion on the spine
- Higher lesion level → increased condition severity → worse outcomes



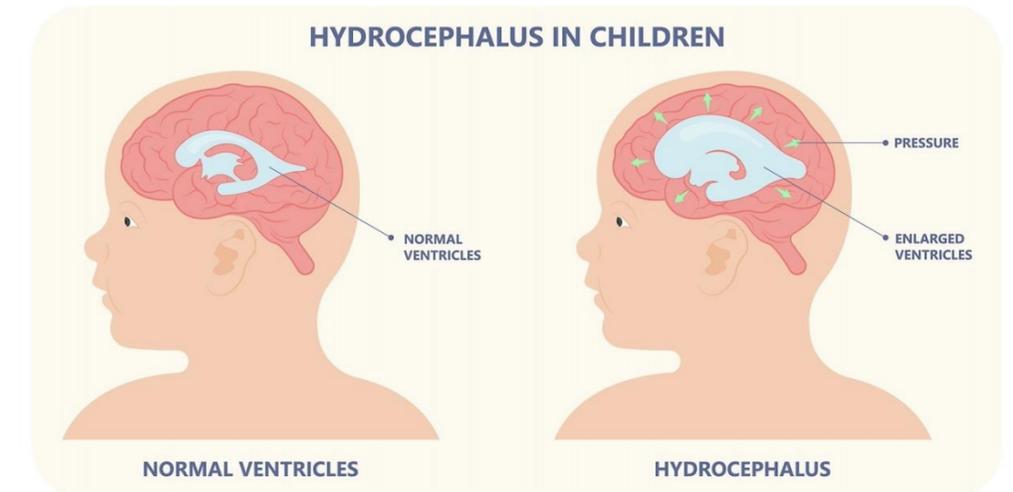
Shunt Status

- Surgical ventricular shunting to treat hydrocephalus
- Common in SB (80-90%)



Shunt Revisions

- Shunt complications (e.g., revisions, infections) are common
- Additional surgical intervention



Study Aims

Determine the development of parent- and teacher-reported inattention and executive dysfunction over time in youth with SB

Identify the relationship between measures of condition severity and inattention and executive dysfunction in youth with SB

Examine measures of condition severity as predictors of growth in inattention and executive dysfunction over time in youth with SB

Participants & Procedures

- Youth with SB enrolled in a larger, longitudinal study (CHATS study)
 - N=140; Ages 8-15 at T1
- Longitudinal study - time points 1-5 (T1-T5)
 - 2-year intervals
 - Parents and teachers completed questionnaires until the participant turned 18
 - Medical history questionnaire, SNAP-IV, BRIEF
- Medical chart reviews conducted after study visits
- Rules created to resolve shunt revision report discrepancies



Chicago Healthy Adolescent
Transition Study



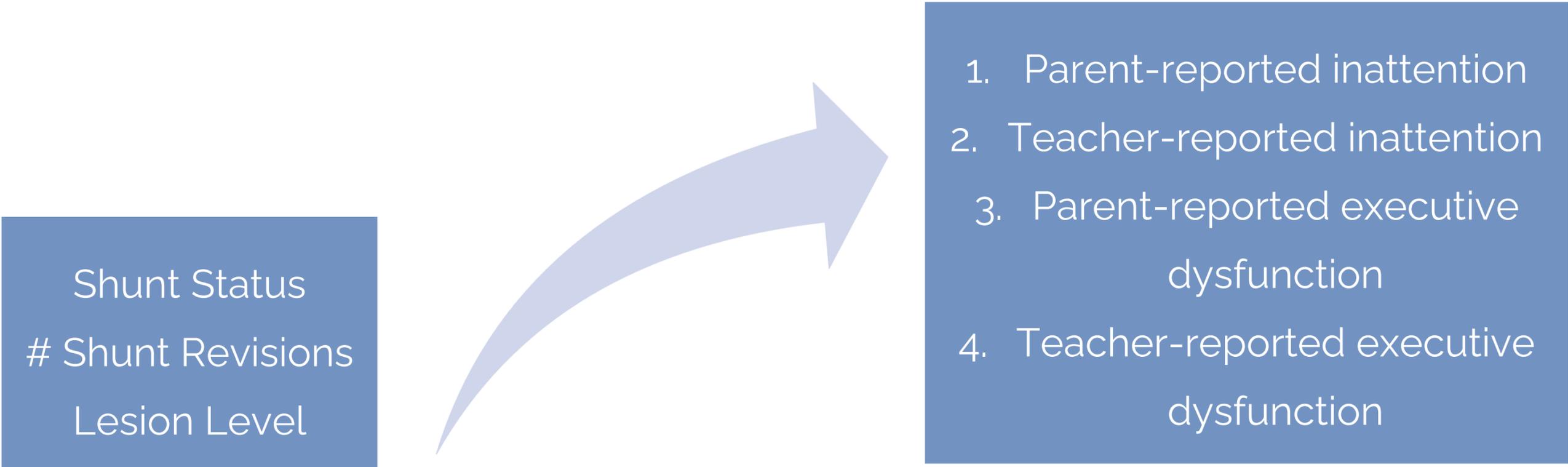
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Youth Demographic and Condition-Related Information Reported at T₁

	Total M(SD) or N (%)
Participants	140 (100%)
Age	11.43 (2.46)
Sex (Female)	75 (53.6%)
Race	
White	74 (52.9%)
African American/Black	19 (13.6%)
Hispanic/Latina/é/o	39 (27.9%)
Asian	2 (1.4%)
Biracial	6 (4.2%)
SB Type	
Myelomeningocele	122 (87.1%)
Lipomeningocele	15 (10.7%)
Myelocystocele	2 (1.4%)
Unknown/Not Reported	1 (0.7%)
Lesion Level	
Thoracic	23 (16.4%)
Lumbar	69 (49.3%)
Sacral	41 (29.3%)
Unknown/Not Reported	7 (5.0%)
Shunt Present	109 (77.9%)
Shunt Revisions	3.86 (range = 0-40)
IQ	85.75 (19.54)

Analytic Plan

- Linear mixed effects growth curves using SAS Proc Mixed
 - Time = participant age (centered at 11.5 years)
- Shunt status, number of shunt revisions, and lesion level were entered as separate predictors



Shunt Status
Shunt Revisions
Lesion Level

1. Parent-reported inattention
2. Teacher-reported inattention
3. Parent-reported executive dysfunction
4. Teacher-reported executive dysfunction

Results

Aim #1

Characterizing development of parent- and teacher-reported inattention and executive dysfunction across age, without predictors

Outcome	Slope Estimate
Parent-Report	
Inattention	-0.016
Inhibit	-0.037***
Shift	-0.016**
Working Memory	-0.015**
Plan/Organize	0.007
Teacher-Report	
Inattention	-0.053***
Inhibit	-0.022**
Shift	-0.003
Working Memory	-0.030**
Plan/Organize	-0.020

* $p < .05$, ** $p < .01$, *** $p < .001$

Aim #2

Examining condition severity variables as predictors of inattention and executive dysfunction at **11.5 years**

Outcome	Condition Severity Predictor		
	Shunt Status	Number of Shunt Revisions	Lesion Level
Parent-Reported			
Inattention	0.308*	0.023	0.008
Inhibit	-0.066	0.013	-0.121**
Shift	0.125	0.022	-0.031
Working Memory	0.242**	0.074*	-0.024
Plan/Organize	0.171*	0.040	-0.016
Teacher-Reported			
Inattention	0.394*	0.063	-0.006
Inhibit	0.028	-0.031	-0.037
Shift	0.155	-0.007	-0.009
Working Memory	0.302**	0.087	0.050
Plan/Organize	0.181	0.036	-0.010

* $p < .05$, ** $p < .01$

Aim #3

Examining condition severity variables as predictors of inattention and executive dysfunction over time

Outcome	Condition Severity Predictor		
	Shunt Status	Number of Shunt Revisions	Lesion Level
Parent-Reported			
Inattention	0.017	0.020*	-0.006
Inhibit	0.003	0.009	0.015*
Shift	-0.006	0.007	0.008
Working Memory	0.002	0.004	0.007
Plan/Organize	0.014	0.004	-0.002
Teacher-Reported			
Inattention	-0.032	0.003	0.017
Inhibit	0.005	0.006	-0.003
Shift	-0.001	0.014	-0.013
Working Memory	0.016	-0.005	0.004
Plan/Organize	0.012	-0.004	-0.001

* $p < .05$

Discussion

Discussion

- Across reporters, linear decreases in inhibition and working memory problems
 - Planning/organizing difficulties remained stable
 - Reports of inattention and shifting problems over time varied by reporter/setting
- Shunt status, shunt revisions, and lesion level were significant predictors of inattention and executive dysfunction at age 11.5
 - Higher condition severity → worse inattention and executive dysfunction
 - Lesion level findings not in expected direction
- Shunt revisions and lesion level, but not shunt status, were significant predictors of inattention and inhibition problems over time, respectively

Strengths

- Longitudinal nature (8-year period)
- Current methods expanded previous literature (i.e., cross-sectional or 2-time point studies)
- Nuance between individual executive functions
- Mother, father, and teacher reports
- Development of rules to resolve shunt revision discrepancies

Limitations

- Lack of self-report data
- Small sample size
- Geographically limited sample
- No longitudinal performance-based neuropsychological data

Clinical Implications

- Early identification of challenges is essential
 - Consider incorporating reporter-based screenings into SB clinic visits
- Youth with SB would benefit from early interventions targeting attention and executive skills
 - Particularly youth with increased condition severity
 - Interventions should be tailored to be developmentally appropriate

Thank you!

- **Grayson N. Holmbeck, PhD** (*Co-Author and Principal Investigator*)
- **Zoe R. Smith, PhD** (*Co-Author*)
- CHATS Lab Graduate Students & Research Assistants
- CHATS Study Participants, Families, & Teachers
- SB clinic staffs at Ann & Robert H. Lurie Children's Hospital of Chicago, Shriners' Children's Chicago, and Loyola University Medical Center



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The work was supported by the National Institute of Nursing Research and the Office of Behavioral and Social Sciences Research under Grant [R01-NR016235]; the Eunice Kennedy Shriver National Institute of Child Health and Human Development under Grant [R01-HD048629]; and the March of Dimes Birth Defects Foundation under Grant [12-FY13-271].