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Introduction

- **Internalizing symptoms** refer to experiences of emotional distress that are typically internal in nature (e.g., somatic complaints, depression).
- **Executive functions** refer to a set of core skills used for the cognitive control of behavior: 1) *inhibitory control*, 2) *working memory*, and 3) *cognitive flexibility*.
- Emotional and cognitive functioning may **bidirectionally influence** each other over childhood, with the nature of the association changing with development.

This study examined **associations among internalizing symptoms** (*anxiety, social withdrawal*) and **executive functioning** (*inhibitory control*) in the preschool period and middle childhood.

Methods

Sample:

114 mother-child dyads from Project PRISM, a prospective birth cohort study of the effects of maternal and child stress on child health and development.

Demographics:

- 56% male
- 35% White, 33% Black/African American, 26% Hispanic/Latino, 6% other
- Maternal education: 15% <high school, 13% high school/GED, 19% some college, 26% college degree, 27% post-college degree
- Annual income: 20% <\$20k, 18% \$20k-\$49k, 28% \$50k-\$99k, 34% \$100k+

Measures:

Collected at 3.5 and 5 years:

- *Anxiety* and *withdrawal* symptoms: Maternal report via **Child Behavior Checklist (CBCL 1.5-5)**
- *Inhibitory control*: **Go/No-Go computer task**

Child Behavior Checklist (CBCL 1.5-5)

Example Anxiety Items	Example Withdrawal Items
Too fearful or anxious	Seems unresponsive to affection
Fears certain animals, situations, or places	Shows little interest in things around him/her

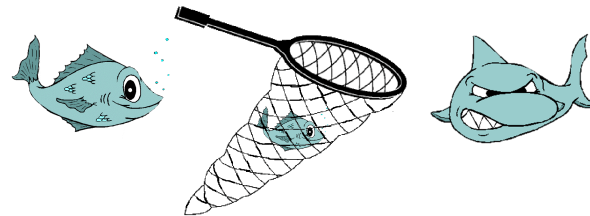
Go/No-Go Computer Task

- Child asked to press button to “catch” fish and avoid pressing button when shark appears
- 75% fish / 25% sharks, randomized
- 40 trials

Test Item	Response	
	Go	No-Go
Fish	Hit	Miss
Shark	False Alarm	Correct Inhibition

Inhibitory Control Scores:

- **Hit Rate** = number of **correct Go** trials/total Go trials
- **Inhibition** = number of **correct No-Go** trials/total No-Go trials
- **Sensitivity** = calculated from proportion of *Hit Rate* and *Inhibition*



Results

Analyses:

- Spearman's correlation coefficients determined associations of anxiety and withdrawal symptoms with inhibitory control within and across time
- Differences in correlation coefficients at 3.5y vs 5y were determined using correlation coefficient difference tests via Fisher-to-z transformation

Findings:

At 3.5 years:

- **Increased anxiety** and *withdrawal* symptoms each associated with **poorer inhibitory control (negative association)**, particularly in inhibition of incorrect responses.

At 5 years:

- *Internalizing symptoms* and *inhibitory control* no longer associated; correlation coefficients in **positive** direction.

Across ages:

- *Inhibitory control* was modestly stable: inhibition $r_s=.13$, sensitivity $r_s=.41$.
- Symptoms of *withdrawal*, $r_s=.44$, and *anxiety*, $r_s=.23$, were modestly stable.
- The **differences in the correlation coefficients** at 3.5y vs 5y were **significant** for associations of *anxiety symptoms* with *inhibitory control* and *withdrawal symptoms* with *inhibitory control*.
- **Greater inhibition** at 3y predicted **more anxiety symptoms** at 5y, $r_s=.25$.
- **More withdrawal symptoms** at 3y predicted **lower hit rate** at 5y, $r_s=-.33$.

Results continued:

Concurrent Correlations of Inhibitory Control Scores with **Anxiety Symptoms** at 3.5 Years and 5 Years

	Anxiety 3.5Y	Anxiety 5Y
Sensitivity	-.217*	.105
Inhibition	-.212*	.056

Concurrent Correlations of Inhibitory Control Scores with **Withdrawal Symptoms** at 3.5 Years and 5 Years

	Withdrawal 3.5Y	Withdrawal 5Y
Sensitivity	-.209*	.101
Inhibition	-.231*	.121

* = correlation significant at .05 level (2-tailed)

Conclusion

These findings suggest that **emotional** and **cognitive** functioning may **influence** each other over childhood, with the **nature** of the association **changing** with **development**.

➤ *Why?* Studies have shown a link between inhibitory control and anxiety/withdrawal-related psychopathology (e.g., avoidance-drive behaviors, such as missing school).

Why the developmental change?

- Executive functioning abilities develop rapidly during this period.
- Environmental changes (e.g., introduction of formalized school/organized extracurricular activities) may reinforce an already-anxious or socially-withdrawn child's inhibition-related behaviors.
- By age 5, greater anxiety may be reflected in heightened self-monitoring and fear of making errors, explaining a relation between inhibition and anxiety.

What does this mean?

- These findings have implications for how we conceptualize the development of inhibitory control in early life.
- These findings are in line with several etiological theories of anxiety/withdrawal-related psychopathologies (e.g., depression, social phobia, separation anxiety), especially learning-based theories.

More research is needed:

- Replications with different populations, especially clinical samples
- Further analyses to determine direction and predictive nature of the associations