Is "Response or No Response" Too Simple a Notion for RTI Frameworks? Exploring Multiple Response Types with Latent Profile Analysis

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"Responsiveness" to intervention

Conceptualized as a categorical phenomenon, in line with practice required by MTSS (multi-tier system of supports) at school (e.g., Tier 1 v. Tier 2 v. Tier 3).

However,

❑*Binary*: response (program participants demonstrate greater pre-to-posttreatment reading growth than control students) and no response (participants do no better than controls from pre-to-posttreatment);

❑Immediately after intervention *without considering maintenance effects* (Wanzek, Stevens, Williams, Scammacca, Vaughn, & Sargent, 2018).

❑Ignores the possibility of *subgroups* of responders and non-responders especially in the consideration of maintenance effect (Wanzek et al., 2018).

A Typology of Response to Early Intervention

Response-response: children who show superior outcomes to controls immediately following program completion and at follow up (e.g., Ehrhardt et al., 2013).

Children in this category may be considered as at-risk readers whose reading difficulties are likely caused by insufficient reading instruction. They need timely intervention in the window of opportunity wherein reading problems are more easily altered by instruction and thus risk of later reading difficulty is likewise minimized (Lyon & Chahabra, 1996).

Under the RTI framework, these children may be sometimes considered false-positives, not children with reading disabilities (e.g., Compton, et al., 2010; McAlenney, & Coyne, 2015).

A Typology of Response to Early Intervention

Response-no response (fade-out): children who outperform controls at the end of intervention, but not at later time points (Bailey et al., 2016; Barnett, 2011; Protzko, 2015).

Children in this category may be at-risk readers who can improve reading skills after the intensive and comprehensive reading intervention, but may not fully master these reading skills to generalize to reading development under general classroom reading instruction.

Under the RTI framework, these children may be considered at-risk readers in the tier-2 intervention, who constantly need relatively intensive reading intervention and should be constantly progress monitored to see if they make sufficient progress as to return to tier-1 general classroom education.

A Typology of Response to Early Intervention

No response-response (sleeper): children whose performance shows no immediate benefit from intervention but who outperform controls at a later point (Barnett, 2011; Holmes et al., 2009).

Although such sleeper effect is demonstrated in cognitive training (e.g., Holmes et al., 2009), it may not likely exist with respect to the reading intervention where reading skills are explicitly taught and these reading skills are often strongly related to performance on reading outcomes.

A Typology of Response to Early Intervention

No response-no response: children whose performance is no better than controls immediately following intervention nor at follow up (Fuchs et al., 2004).

The intervention does not have sufficient dosage or intensity or target the right skills (e.g., Wanzek & Vaughn, 2007; Wanzek & Vaughn, 2008).

Under the RTI framework, children in this group may be those referred as students who need special education/children with reading disabilities.

Research Questions

We used a latent profile model based on word reading performance at pretreatment, posttreatment, and 1-year follow-up to pursue two related objectives, with the control group serving as a local norm at each time point.

First, to determine whether there are multiple response types in a treatment group of 265 at-risk first-grade readers who generally benefitted from an empirically-validated early reading program (Fuchs et al., 2019)

Second, to identify which pretreatment domain-general skills (working memory, non-verbal reasoning) and domain-specific skills (letter knowledge, decoding, passage comprehension, and language) differentiate among them

Methods

Participants--265 children identified by their classroom teachers as "at-risk readers" in fall of first grade. They came from 24 elementary schools in a large district in the Southeast

Teacher nomination
- Score in the lower percentile on reading tests
- IQ in the normal range
- Treatment group from a reading intervention study across three cohorts
- Treatment effects were identified (Fuchs et al., 2019)

Methods

Measures

In fall of first grade, our study sample was tested on **Letter Knowledge** (Rapid Sound Naming, Rapid Letter Naming; **Decoding** (TOWRE-Phonemic Decoding Efficiency and WMRT-R-Word Attack); **Language** (WASI-Vocabulary and WJ-Oral Comprehension); **Passage Comprehension** (WRMT-Passage Comprehension); **Non-verbal Reasoning** (WASI-Matrix Reasoning Subtest (Wechsler, 1999) and **Working Memory** (WMTB-Listening Recall).

- In fall of first, spring of first, and second grades, we assessed word reading (TOWRE-sight word).

Methods

- First, because data missing at random based on Little's MCAR test. Using maximum likelihood estimate approach for the latent profile analysis based on word reading across three time points;

- Next, we adjusted standard errors to account for the nested structure (students nested within schools);

- We used the mean and standard deviation of the control group at each time point to transform treatment students' scores into z scores as to establish a local norm.

- Predictors of response-profile membership were added to the latent analyses as auxiliary variables

Results
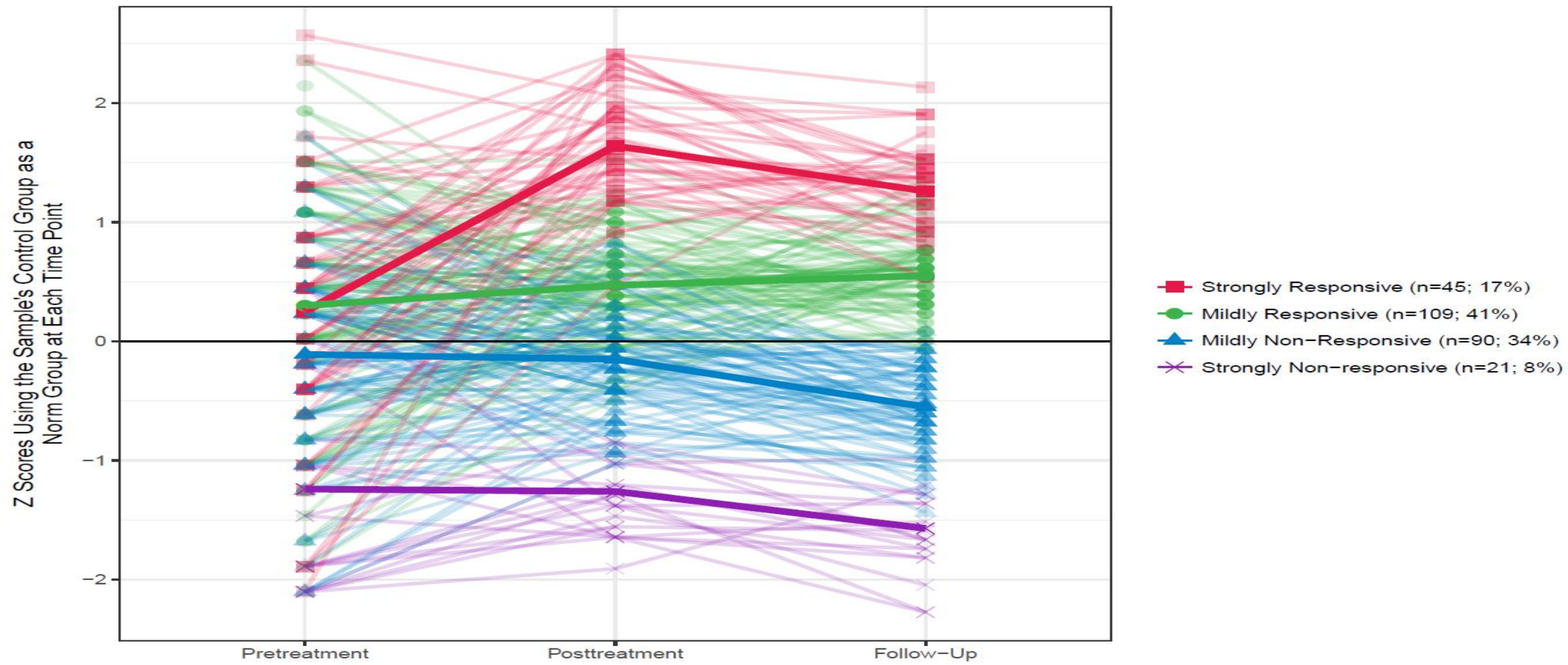
Results

Descriptive Statistics of Different Profile Groups on Word Reading Performance across Three Time Points

Variables	Strongly Responsive (n = 45)			Mildly Responsive (n = 109)			Mildly Non-Responsive (n = 90)			Strongly Non-Responsive (n = 21)		
	Estimated Mean (%tile)	SE	z	Estimated Mean (%tile)	SE	z	Estimated Mean (%tile)	SE	z	Estimated Mean (%tile)	SE	z
TOWRE sight word pretest	11.09 (48)	.63	0.25	11.32 (48)	.53	0.30	9.40 (42)	.59	-0.11	4.07 (32)	.61	-1.24
TOWRE sight word posttest	47.25 (84)	.67	1.64	33.95 (70)	.68	0.47	26.95 (55)	.77	-0.15	14.31 (29)	.84	-1.26
TOWRE sight word follow-up	58.52 (79)	.78	1.26	49.22 (55)	.81	0.55	34.73 (27)	.79	-0.55	21.26 (8)	1.63	-1.57

Note. * $p < .05$; ** $p < .001$.
TOWRE sight word pretest, posttest, and follow-up: The Sight Word Efficiency subtest of the TOWRE (Torgesen et al., 1999) at the beginning of 1st grade, the end of 1st grade, and the end of 2nd grade, respectively. %tile = Percentile rank based on the national norm of The Sight Word Efficiency subtest of the TOWRE; z = z scores using the controls as a local norm at each time point.

Results

Letter knowledge and *passage comprehension* differentiated the groups.

❑ The mildly responsive group showed stronger pretreatment letter knowledge than the mildly non-responsive group and greater pretreatment letter knowledge and passage comprehension than the strongly non-responsive group.

❑ The strongly responsive group showed more impressive pretreatment passage comprehension than the strongly non-responsive group.

❑ The mildly non-responsive group showed better pretreatment passage comprehension than the strongly non-responsive group.

Working memory and non-verbal reasoning did NOT predict the four response types.

Implications

❑Young at-risk children's response to early reading intervention was more complicated than "response or no response,"

❑Pretreatment reading comprehension was an important predictor of response even when pretreatment word reading skills were controlled.

❑Cognitive factors are NOT important in predicting responsiveness (using word reading as outcomes)

❑Future study with a focus on methodology to study the responsiveness to early reading intervention can directly compare the categorical approach with the continuous approach with a bigger sample and a more comprehensive set of child/classroom/school level variables as predictors of responsiveness.