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Stability of Risk Status During Preschool

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Abstract

The current study investigated the stability of children's risk status across the preschool year. A total of 1,102 preschool children attending Title I schools (n = 631) and non-Title I schools (n = 471) participated in this study. Using averaged standard scores for two measures of language, print knowledge, and phonological awareness administered at the beginning of preschool (Time 1) and midyear (Time 2), children were classified as at-risk or not at each time point. Prevalence rates were determined for four categories of risk status: (1) always at risk, (2) only at risk at Time 1, (3) never at risk, and (4) only at risk at Time 2. Univariate and multivariate analyses indicated that the best predictor of children's risk status was their level of skill in the respective literacy domain at the beginning of preschool. These results suggest that children with stable risk can be identified early and may benefit from the early provision of extra instructional support within a response-to-instruction framework.

Keywords

risk, learning disabilities, preschool, response to intervention

In 2004, the U.S. government reauthorized the Individuals With Disabilities Education Act (IDEA) (U.S. Department of Education, 2004) to include the use of Response to Intervention (RTI) as a framework for identifying children who are at risk for learning disabilities (LD) and for providing intervention at the level of intensity necessary to support individual children's learning needs (Fuchs & Fuchs, 2006; Fuchs & Vaughn, 2012). The primary objectives of this multitiered model of service delivery are to prevent LD and to reduce the number of children requiring special education services (e.g., Fuchs & Deshler, 2007; Fuchs & Fuchs, 2006). Recent studies have shown that the RTI framework can be implemented as early as preschool to identify children showing early signs of risk for reading-related LD and that it can provide children with instructional support that could mitigate some or all of the delays in prereading skills (Al Otaiba & Fuchs, 2002; Kruse, Spencer, Olszewski, & Goldstein, 2015; Lonigan & Phillips, 2016).

The standard RTI model involves a multitiered protocol that initially includes assessing and identifying those children who are considered to be at risk for reading-related LD because, despite comprehensive evidence-based classroom instruction (i.e., Tier I), they are not making adequate progress based on a predetermined criterion, such as school, region, state, or national standards. Children who are identified may be eligible to receive more intensive Tier II instruction that typically involves small-group instruction intended to improve children's academic ability in a targeted set of skills. Children who are considered responsive to Tier II intervention, again based on pre-established criteria, return to Tier I classroom instruction only and are determined to not have LD (Compton, Fuchs, Fuchs, & Bryant, 2006). In the older grades, children who are classified as nonresponsive to Tier II intervention are identified as having persistent deficits that impede their ability to benefit from this level of instruction (Vaughn & Fuchs, 2003), and in some settings, these children are recommended to receive more intensive individualized Tier III instruction (Fuchs, Fuchs, McMaster, & Al Otaiba, 2003). In preschool, children are identified as at-risk for reading-related LD when they are making inadequate progress in foundational reading-related skills (Lonigan & Phillips, 2016; Milburn, Lonigan, Allan, & Phillips, 2017).

Some children arrive at preschool and kindergarten with substantially delayed foundational reading-related skills (i.e., language, phonological awareness, print knowledge; Lonigan, Schatschneider, & Westberg, 2008), raising the

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question of when to provide supplemental intervention. The typical RTI framework advocates for a period of monitoring children's progress to determine if the children improve in language and literacy once exposed to quality preschool instruction (Catts, Nielsen, Bridges, Liu, & Bontempo, 2015; Milburn, Lonigan, & Phillips, 2017). This period of monitoring is expected to facilitate more accurate identification of children who really need intervention, resulting in greater sensitivity (i.e., identifying the children who are at risk for LD and including them in intervention) and specificity (i.e., identifying the children who are not at risk for LD and not including them in intervention). However, some researchers have advocated for implementing intervention as early as possible to avoid a period of "waiting to fail" for early identification of risk (Al Otaiba et al., 2014; O'Connor, Bocian, Beebe-Frankenberger, & Linklater, 2010), and some have advocated that this identification begin prior to kindergarten (Lonigan & Phillips, 2012; Vellutino, Scanlon, Zhang, & Schatschneider, 2008). The current study examined the stability of children's risk status during the preschool year to inform decisions related to the use of the RTI framework in preschool.

Identification and subsequent intervention for preschool children who are considered at-risk for reading-related LD may be time-sensitive. That is, children who have poor early language and literacy skills might be expected to have difficulty keeping up with progressive curricular standards because instructional content builds on material expected to have been learned previously. Subsequently, these children may not benefit from preschool instruction and learning opportunities in the same way as their typically developing peers. During shared book reading, for example, some children may be less likely to actively participate because of limited vocabulary knowledge or insufficient exposure to print to discuss aspects of the print on the page (Milburn, Girolametto, Weitzman, & Greenberg, 2014). Furthermore, young children's poor academic achievement can lead to lowered self-esteem, reduced motivation for academic activities and learning, and frustration that may result in inattentive and disruptive behavior (Arnold & Doctoroff, 2003). Externalizing behaviors can result in children spending time outside the classroom, which in turn results in fewer interactions with educators and peers that support early learning (e.g., Hamre & Pianta, 2005). As a result, the achievement gap between these children and their same-aged peers would be expected to widen overtime (Cunningham & Stanovich, 1998; Stanovich, 1986). These interrelated aspects of some children's academic experience indicate a downward spiral that may be avoided by addressing the deficit knowledge and skills early to enhance children's ability to benefit from instruction and to support a positive self-image and motivation for learning.

Tier II intervention has been successfully administered during kindergarten (Al Otaiba & Fuchs, 2006; Catts et al., 2015; O'Connor, Harty, & Fulmer, 2005) and preschool (Lonigan & Phillips, 2016); however, little is known about the stability of a classification of risk status during the preschool year and whether it might be best to intervene at the beginning of preschool for some children. Al Otaiba et al. (2014) conducted a randomized controlled trial with matched pairs of first graders who received either the typical RTI protocol (i.e., assessment with a period of monitoring for responsiveness to Tier I instruction before beginning Tier II intervention) or dynamic RTI (i.e., assessment followed immediately with either Tier II or Tier III intervention commensurate with the students' initial screening results) using the same intervention across conditions. At the end of the year, the results indicated that students in the dynamic RTI group scored significantly higher on reading performance than students in the typical RTI condition.

The findings of the Al Otaiba et al. (2014) study along with other intervention studies (O'Connor et al., 2010; Vellutino et al., 2008) support deviating from the standard RTI framework to identify children and begin providing intervention early in the year based on screening results alone without a period of monitoring children's responsiveness to high-quality Tier I classroom instruction. Although there are concerns that this deviation may result in overidentification of children, there is also concern that, without sufficient foundational oral language and code-related knowledge, children will fall farther behind, particularly given that the quality of preschool and kindergarten is often insufficient to ameliorate such gaps for these early literacy skills (Greenwood et al., 2013). Building on the results of these intervention studies, if children's status of risk for reading-related LD remains constant over the year, there would be no reason to wait to provide Tier II intervention in accordance with the standard RTI framework. However, if children's risk status changes from at-risk to not at-risk, then Tier II intervention would be premature and unnecessary. What is needed is a means of identifying children who would be likely to be unresponsive to Tier I instruction.

Some children, such as those who have very low scores at the beginning of the preschool year in one or more key early literacy skills, may be identified at the beginning of the year as unlikely to be responsive to Tier I instruction throughout the preschool year. Al Otaiba and Fuchs (2002) conducted a review of 23 intervention studies, which included samples ranging from preschool to third grade, and they reported seven characteristics of the children who were nonresponsive to early literacy intervention, including poor performance in verbal memory, IQ, oral language, phonological awareness, orthographic awareness, rapid naming, and attention/behavior problems, as well as home environment (e.g., socioeconomic status). However, this study included a wide age range and identified characteristics associated with nonresponsiveness to Tier II intervention and not Tier I classroom instruction. Identifying

characteristics of preschool children who are likely to demonstrate stable risk status throughout the preschool year may provide empirical support for offering Tier II intervention at the beginning of preschool as an alternative to a typical RTI framework that includes monitoring responsiveness to Tier I instruction before offering Tier II intervention.

The concern that the typical RTI framework may be a wait-to-fail approach for preschool children showing early signs of risk for reading-related LD guided this study. A large sample of children were assessed at the beginning and middle of the preschool year for risk status for three early literacy skills (i.e., oral language, print knowledge, phonological awareness) and at two cut-off levels of performance (i.e., 15th and 25th percentile), and children were grouped into one of four risk categories (i.e., always at-risk status, at-risk only at the beginning of the year, never at-risk, and at-risk only at midyear). To identify characteristics of children associated with each of the categories of risk, binomial logistic regressions were conducted using generalized linear mixed modeling (GLMM) to differentiate children classified as at-risk at Time 1 as likely to always be at-risk versus only at-risk at Time 1 (i.e., true and false positives) and characteristics of children classified as not at-risk at Time 1 as never being at-risk or presenting with late emerging risk status (i.e., true and false negatives). It was expected that there would be children identified in each of the four categories of risk status and that children's ability in each skill area at initial screening would predict their risk status for that skill.

Method

Participants

A total of 1,102 children from 43 preschool programs in north Florida were recruited for participation in this study ($n = 631$ in Title I schools and $n = 471$ in non-Title I schools). Three cohorts of children were recruited in the fall of their prekindergarten year (i.e., Year 1, $n = 332$; Year 2, $n = 425$; Year 3, $n = 345$). Many of these children were considered at-risk due to familial demographics (e.g., low socioeconomic status), and some children had identified developmental disabilities or delays in language. Exclusionary criteria included frank sensory impairment (i.e., children with severely impaired visual or auditory abilities) and children with no expressive language ability. There were 607 males (53%), mean age at Time 1 = 55.15 months (SD = 3.65; range: 48–63), and racial composition included 518 white (47%), 463 black/African American (42%), 33 Hispanic (3%), 26 Asian (2%), 4 American Indian (<1%), 38 children whose parents identified more than one race (3%), and 20 children whose parents did not identify race (2%). All children attending Title I preschools were eligible based on family income or identified risk. Furthermore, all Title I preschools used an evidence-based curriculum with educators who held either a certificate or degree, and this was not always the case in non-Title I preschools.

Measures

At Time 1 (the beginning of the preschool year), the children completed multiple measures of early literacy (i.e., oral language, phonological awareness, print knowledge), measures of overall cognitive ability, and a measure of executive function. At Time 2 (midyear of the preschool year), the six measures of early literacy were administered again.

Oral language. Five of six subtests from the Clinical Evaluation of Language Fundamentals–Preschool (CELF-P; Wiig, Secord, & Semel, 1992) were administered to the children, including three receptive measures and two of three expressive language measures. The third expressive language subtest was estimated from the scaled scores on other measures such that the standard Expressive Language score could be calculated along with the Receptive Language and the total Standard Score. All subtests include basal and ceiling rules that were followed. Internal consistency reliability for children in this sample's age span range from .81 to .96 for the composite scores, and scales have robust evidence of concurrent validity with other norm-referenced measures (Wiig et al., 1992).

The Definitional Vocabulary subtest of Preschool Comprehensive Test of Phonological and Print Processing (Pre-CTOPPP; Lonigan, Wagner, Torgesen, & Rashotte, 2002), the development version of the Test of Preschool Early Literacy (TOPEL; Lonigan, Wagner, Torgesen, & Rashotte, 2007) was administered. Pre-CTOPPP has excellent psychometric properties for children in this age group (3- to 5-year-olds; αs = .86 to .96) with concurrent validity coefficients of .59 to .77 with other measures of similar constructs. This subtest consists of 40 items that include two parts. First, the child is asked to label a single image or a group of images illustrated in the stimulus manual, and second, the child is asked a question regarding the function or relevant context for the item. These questions assess both expressive vocabulary for labeling as well as depth of vocabulary. Following practice items, all items were administered to all children without ceiling criteria. The maximum raw score for this measure was 80.

Phonological awareness. The Blending and Elision subtests of the Pre-CTOPPP were administered. Pre-CTOPPP Blending included 21 items that spanned the levels of complexity from word level (i.e., compound word) to phoneme levels (i.e., onset–rime) and included both multiple-choice items with pictures and free response items. Likewise, Pre-CTOPPP Elision included 18 items that also spanned the

levels of linguistic complexity and included both multiple choice with pictures and free response items. Internal consistency reliabilities for these two subtests are high for 3–5-year-old children (i.e., αs = .85–.87), and both subtests have moderate validity coefficients (*r*s = .33–.53) with other measures of phonological awareness.

Print knowledge. The three subtests (i.e., Alphabet, Conventions, Meaning) of the Test of Early Reading Ability–Third Edition (TERA-3; Reid, Hresko, & Hammill, 2001) were administered to make up the composite Reading Quotient standard score. The Alphabet subtest consists of 29 items used to assess children's letter knowledge (e.g., letter naming and letter–sound correspondence). The Conventions subtest consists of 21 items used to assess children's familiarity with the conventions of print (e.g., directionality of print, punctuation). The Meaning subtest consists of 30 items used to assess children's ability to comprehend the meaning of printed words, sentences, and paragraphs. Basal level is established by beginning at the item designated by the child's chronological age and achieving three consecutive correct responses either moving forward or backward. A ceiling is established with three consecutive incorrect responses. The maximum combined raw score was 80. The TERA-3 has excellent psychometric properties, including coefficient alphas above .95 for all subtests (Reid et al., 2001).

The Print Knowledge subtest of Pre-CTOPPP consists of 36 items used to assess children's concepts of print (e.g., "Which one is a letter?", "Which one can you read?"), letter-name recognition, letter-sound recognition, and letter-name and letter-sound production. Internal consistency for this measure is high for 3–5-year-old children (i.e., αs = .89–.95), and it has moderate to high validity correlations with other measures of alphabet and print knowledge (e.g., *r* = .58 with the Test of Early Reading Achievement–III; Reid et al., 2001).

Cognitive abilities. The Block Design and Matrix Reasoning subtests of the Wechsler Preschool and Primary Scales of Intelligence (3rd ed., WPPSI; Wechsler, 2002) were administered to children to obtain a measure of general cognitive abilities. For the Block Design subtest, children are required to replicate increasingly complex geometric patterns from either a picture or a model, with a limited amount of time for each pattern to be replicated. For the Matrix Reasoning subtest, children are required to identify one stimulus out of four that completes the two-by-two matrix of stimuli. Both subtests have good reliability, and they have significant correlations both with the WPPSI Performance and Full Scale IQ scores.

Executive function. The Head Toes Knees Shoulders task (HTKS; McClelland et al., 2007; Ponitz, McClelland, Matthews, & Morrison, 2009) was administered. For this task, children are asked to do the opposite of a command spoken by the examiner (e.g., if told "touch your head," the child is expected to touch her toes). Following practice items, a set of 10 trials are completed with two commands (i.e., "touch your head," "touch your toes") alternating in a fixed order. In a second set of 10 trials, two new commands are added (i.e., "touch your knees," "touch your shoulders"). Each trial is scored (i.e., correct = 2, self-corrected response =1 [i.e., child initially reaches for the command location but completes the correct response], incorrect = 0). Scores on the HTKS correlate with other direct measures of self-regulation (e.g., Allan & Lonigan, 2011).

Procedure

Once parental informed consent was obtained, trained research assistants administered the battery of assessments with each child individually in quiet areas of the preschool centers at both time points. All research assistants were trained in the administration of the measures and demonstrated mastery of the testing protocols in one-on-one sessions with the project's coordinator. At each time point, assessments were completed over three to four 20- to 30-minute sessions within a 2-week period. During testing, children were given breaks if requested or if the examiner noticed fatigue or distraction. Order of test administration varied across children.

Classification of Risk

At both Time 1 and Time 2, children were classified as either at-risk or not at-risk for each early literacy domain using the averaged standard score equivalent of two measures for language, print knowledge, and phonological awareness. Children were classified as at-risk if their scores were below the threshold criterion at two levels of severity, the 15th percentile and 25th percentile. The stability of children's risk status was categorized as one of four possible outcomes: (a) always at-risk (i.e., both Time 1 and Time 2), (b) only at-risk at Time 1, (c) only at-risk at Time 2, and (d) never at-risk.

Results

Descriptive statistics of the children's construct scores for each of the early literacy domains (i.e., the averaged standard score equivalent of two measures) as well as the six individual measures of early literacy, cognitive abilities, and executive function scores are shown in Table 1. Overall, the scores for the full sample of children ranged widely, with scores ranging from greater than 2 *SD*s below and above the mean. Descriptive statistics for children by type of school indicate significantly lower scores for children attending Title I schools compared to children attending

Table 1. Descriptive Statistics for Children's Abilities at Two Time Points for the Full Sample and the Type of School Separately.

Domain	Full Sample		Title I Schools		Non-Title I Schools	
Variable	Time 1 *M* (*SD*)	Time 2 *M* (*SD*)	Time 1 *M* (*SD*)	Time 2 *M* (*SD*)	Time 1 *M* (*SD*)	Time 2 *M* (*SD*)
Language construct	91.3 (14.0)	93.6 (13.5)	86.0 (13.4)	88.3 (12.9)	98.2 (11.5)	100.4 (10.8)
TOPEL DV	92.9 (13.9)	94.9 (12.9)	88.6 (14.0)	90.5 (13.1)	98.4 (11.8)	100.5 (10.2)
CELF-P TLS	89.7 (15.9)	92.1 (16.1)	83.4 (14.9)	85.8 (15.0)	97.9 (13.2)	100.3 (13.5)
Print knowledge construct	93.6 (13.1)	96.5 (13.2)	90.3 (12.2)	92.8 (12.7)	97.9 (12.9)	101.2 (12.3)
TOPEL PK	97.4 (14.8)	101.1 (14.6)	94.3 (13.8)	97.6 (14.5)	101.4 (15.0)	105.6 (13.4)
TERA RQ	89.7 (13.4)	91.8 (14.2)	86.1 (12.6)	87.9 (13.2)	94.4 (13.0)	96.9 (13.8)
Phonological awareness construct	95.9 (11.6)	98.95 (12.0)	92.8 (11.2)	95.4 (12.1)	100.0 (11.0)	103.5 (10.4)
PCTOPPP Elision	97.2 (13.2)	100.0 (13.9)	94.1 (12.3)	96.2 (13.7)	101.2 (13.2)	104.8 (12.6)
PCTOPPP Blending	94.7 (14.0)	97.9 (13.6)	91.5 (14.1)	94.5 (14.1)	98.8 (12.9)	102.3 (11.6)
Cognitive abilities						
WPPSI Block Design[1]	8.06 (3.3)	—	7.5 (3.2)	—	8.8 (3.2)	—
WPPSI Matrix Reasoning[1]	8.48 (3.4)	—	8.0 (3.4)	—	9.2 (3.3)	—
Executive function						
HTKS[2]	11.1 (11.4)	—	9.3 (10.5)	—	13.4 (12.0)	—

Note. Construct = average of standard scores for two measures; [1]scaled score, [2]raw score; CELF-P TLS = Clinical Evaluation of Language Fundamentals–Preschool–Total Language Score; HTKS = head shoulders knees toes; PCTOPPP = Preschool Comprehensive Test of Phonological and Print Processing; TERA RQ = Test of Early Reading Ability–Reading Quotient; TOPEL DV = Test of Preschool Early Literacy Definitional Vocabulary; TOPEL PK = TOPEL Print Knowledge; WPPSI = Wechsler Preschool and Primary Scales of Intelligence.

non-Title I schools at the beginning of the year for all construct scores, *t*s(961.16–1,051) = 9.71–15.58, *p*s < .001, and individual measures, *t*s(950.82–1,051) = 7.94–16.53, *p*s < .001, as well as at midyear for construct scores, *t*s(1,033.02–1,044) = 10.73–16.48, *p*s < .001, and individual measures, *t*s(1,013.42–1,044) = 9.15–16.11, *p*s < .001.

Table 2 shows the percentage of children in each category of risk status for each of the three early literacy domains and at two levels of severity, first for the full sample and then separating the children by type of school. Whereas approximately one half of the children in the full sample were never at-risk at the 25th percentile, the percentages of children who were always at-risk at this level of severity varied, with rates of language and print knowledge being similar and rates for phonological awareness being much lower. As expected, the percentages of children who were always at-risk were lower using the 15th percentile cut-off for risk status.

From the full sample of children using the least stringent criterion (25th percentile) to classify children as at-risk at the beginning of preschool (i.e., always at-risk + only at-risk at Time 1), 40% of the children were at-risk for language, 44% of the children were at-risk for print knowledge, and 26% of the children were at-risk for phonological awareness. Of these, approximately two thirds of the children classified as at-risk in language and print knowledge continued to be at-risk at midyear, and approximately one half of the children classified as at-risk in phonological awareness were still classified as at-risk at Time 2. At the more stringent level of severity, fewer children were classified as at-risk at Time 1, with 28%, 26%, and 14% of the sample classified as at-risk for language, print knowledge, and phonological awareness, respectively. By midyear, between one half and two thirds of the children classified as at-risk using the more stringent criteria in language and print knowledge continued to be at-risk, and approximately one third of the children continued to be at-risk.

There were differences in the prevalence of children classified in risk categories between the two types of schools (i.e., Title I vs non-Title I), with some notable patterns across school type. The percentage of children who presented as always at-risk compared to those who were only at-risk at Time 1 was significantly higher for children in Title I schools than in non-Title I schools for all three literacy domains at the 25th percentile: language: $\chi^2(1, N = 410) = 11.46$, $p = .001$; print knowledge: $\chi^2(1, N = 456) = 15.09$, $p < .001$; phonological awareness: $\chi^2(1, N = 279) = 8.36$, $p = .003$, and at the 15th percentile: language, $\chi^2(1, N = 288) = 5.28$, $p = .018$, and print knowledge, $\chi^2(1, N = 278) = 8.05$, $p = .004$. However, there was no significant difference across school type for the percentage of children who presented with persistent risk at the 15th percentile for phonological awareness, $\chi^2(1, N = 143) = 2.53$, $p = .082$.

Percentages of children classified as at-risk at the beginning of the preschool year for children attending Title 1 schools were high for language (i.e., 57%) and print knowledge (i.e., 54%) and lower for phonological awareness (i.e., 36%) at the least stringent level of severity, and

Table 2. Percentage of Children Classified in Four Categories of Risk Status at Two Levels of Severity for Three Early Literacy Skills for the Full Sample and the Type of School Separately.

Level of Severity	Full Sample (*N* = 1,102)				Title I Schools (*n* = 631)				Non-Title I Schools (*n* = 471)			
Domain	Always	Time 1 Only	Time 2 only	Never	Always	Time 1 only	Time 2 only	Never	Always	Time 1 only	Time 2 only	Never
25th percentile												
Language[1]	28	12	6	55	42	15	8	36	10	8	3	80
Print knowledge[2]	29	15	4	52	39	15	5	41	16	14	4	66
Phonological awareness[3]	11	15	9	64	17	19	14	50	4	10	4	82
15th percentile												
Language[1]	18	10	4	68	28	13	6	53	5	5	2	88
Print knowledge[2]	15	11	5	68	22	13	9	57	7	9	2	83
Phonological awareness[3]	5	9	7	80	7	12	10	71	2	5	2	91

[1]Risk based on averaged score of Test of Preschool Early Literacy (TOPEL)–Definitional Vocabulary subtest and Clinical Evaluation of Language Fundamentals–Preschool Total Language Score.
[2]Risk based on averaged standard score of TOPEL Print Knowledge subtest and Test of Early Reading Ability–Reading Quotient.
[3]Risk based on averaged standard score of the Pre-CTOPPP Elision and Pre-CTOPPP Blending.

approximately one half to three quarters of these children were still at-risk at midyear at this level of severity for language and print knowledge, with fewer still at-risk for phonological awareness (i.e., 17%). When the more stringent level of severity was used, classification rates in language and print knowledge were still high (i.e., 41% and 35%, respectively) and somewhat lower for phonological awareness (i.e., 19%), and between one third and two thirds of these children continued to be at-risk at midyear. Finally, there were children classified as not at-risk at Time 1 but identified as at-risk at Time 2 or having late-emerging risk status in both school types across all three early literacy skills and at both levels of severity (see Table 3).

Univariate and Multivariate Predictors of Risk Status

To identify Time 1 predictors that differentiated children likely to belong to a specific classification of risk status for early literacy skills and at two levels of severity, GLMM, which can accommodate dependencies arising from nested data (in this instance, the students were nested within classrooms) as well as nonnormally distributed categorical outcomes, was used. All analyses were conducted in SPSS, Version 23. Univariate analyses were conducted first to determine variables associated with risk status, including, sex, race, and Time 1 age, nonverbal IQ, HTKS scores, as well as Time 1 construct scores for language, print knowledge, and phonological awareness. Continuous predictor variables were grand-mean-centered based on the whole sample to make the intercept a meaningful and interpretable value. Multivariate analyses were conducted that included the variables significantly associated with risk status. Given moderate to strong correlations between the children's scores on the early literacy constructs at Time 1 and therefore shared variance between them, only the Time 1 scores of the same literacy skill were added to the multivariate GLMMs for each respective early literacy skill (e.g., language construct score for risk in language).

True positive versus false positive risk status. The first series of analyses identified predictors that differentiated children who were classified as at-risk at the beginning of the preschool year as either true positives (i.e., children who continued to be at-risk at midyear despite high-quality preschool instruction) or as false positives (i.e., children who responded to Tier I instruction and were no longer at-risk at Time 2). Despite a number of significant univariate predictors that differentiated children in these two categories of risk status across the three early literacy skills and at the two levels of severity (see online supplemental materials for univariate analyses tables), multivariate analyses often resulted in children's construct scores at Time 1 for that literacy skill as the sole or strongest predictor. See Table 3 for multivariate results for the full sample and for Title I and non-Title I schools separately. In the full sample, risk status for language at both the 25th and 15th percentile was predicted by race, nonverbal IQ, and Time 1 language ability in univariate GLMMs, but multivariate GLMMs for both levels of severity resulted in only the Time 1 language construct scores as the predictor of risk status for true and false positive. Nonverbal IQ was a consistent univariate predictor of all three early literacy skills at both levels of severity for the children in the whole sample and Title I schools but not for children in non-Title I schools where this variable was only predictive of print knowledge at the 25th

Table 3. Predictors Differentiating Children Likely to Be Always At-Risk and Only At-Risk at Time 1 at Two Levels of Severity in the Full Sample and the Type of School Separately.

Level of Severity Domain Predictor Variable	Full Sample		Title I Schools		Non-Title I Schools	
	Odds Ratio	[95% CI]	Odds Ratio	[95% CI]	Odds Ratio	[95% CI]
25th percentile						
Language						
Language	1.25***	[1.19, 1.32]	1.22***	[1.15, 1.30]	1.27***	[1.11, 1.45]
Print knowledge						
Print knowledge	1.19***	[1.13, 1.26]	1.16***	[1.09, 1.23]	1.27***	[1.15, 1.41]
IQ	1.10*	[1.01, 1.20]	1.12**	[1.01, 1.24]	—	—
Phonological awareness						
Phonological awareness	1.08***	[1.04, 1.14]	1.09***	[1.04, 1.15]	1.08**	[1.03, 1.13]
IQ	1.16**	[1.04, 1.29]	—	—	—	—
15th percentile						
Language						
Language	1.26***	[1.18, 1.34]	1.23***	[1.15, 1.31]	1.62**	[1.16, 2.26]
Print knowledge						
Print knowledge	1.26***	[1.17, 1.37]	1.22***	[1.11, 1.34]	1.30***	[1.09, 1.56]
IQ	—	—	1.14*	[1.00, 1.30]	—	—
HTKS	—	—	1.04*	[1.00, 1.08]	—	—
Phonological awareness						
Phonological awareness	1.18***	[1.08, 1.29]	1.20***	[1.08, 1.32]	—	—
IQ	1.32**	[1.11, 1.58]	1.38**	[1.11, 1.70]	—	—

Note. Predictors were sex, race (white and nonwhite), grand mean-centered: age, IQ, Head Toes Knees Shoulders measure (HTKS), and Time 1 Language, Print Knowledge, and Phonological Awareness Construct scores. CI = confidence interval.
*$p < .05$. **$p < .01$. ***$p < .001$.

percentile at $p > .01$. Multivariate analyses indicated that nonverbal IQ, along with the Time 1 construct scores, was predictive of print knowledge at the 25th percentile and phonological awareness at both levels of severity for the full sample and for children in Title I schools at both levels of severity for print knowledge and only the more stringent level of severity for phonological awareness. For children not attending a Title I school, the multivariate GLMMs resulted in only the Time 1 construct scores as predictors for language and print knowledge, and no predictors were identified to distinguish risk status for phonological awareness—only the Time 1 language constructs score was a significant discriminator of risk status for phonological awareness for children in non-Title I schools.

True negative versus false negative risk status. A series of analyses identified children's traits and Time 1 abilities that differentiated children classified as not at-risk for reading-related LD at the beginning of the preschool year as either true negatives, those who continued to not be at-risk at mid-year, or as false negatives, those children whose scores at Time 2 indicated late-emerging risk status. Univariate analyses identified a number of variables that were significantly associated with differentiating risk status for true and false negatives (see online Supplemental Materials for univariate analyses tables), and particularly for the full sample, multivariate GLMMs resulted in more complex models predicting risk status for this dichotomous pair than for the true and false positive risk status classification (see Table 4).

For the full sample, the GLMM models that best differentiated risk status for both language and phonological awareness at the 25th percentile included not only the Time 1 construct score but also nonverbal IQ, race, and HTKS scores; however, at the 15th percentile, only the construct scores predicted risk status. The multivariate model for print knowledge at the 25th percentile included only Time 1 print knowledge construct scores and nonverbal IQ, but, at the 15th percentile, the model also included race. The multivariate model for phonological awareness at the 25th percentile included phonological awareness, nonverbal IQ, race, and HTKS, but again, at the 15th percentile, the model only included phonological awareness and nonverbal IQ. When considering the type of schools separately, univariate analyses identified a number of variables that significantly predicted risk status as true and false negatives, but again, multivariate analyses identified the Time 1 construct scores as the primary predictor variable, with the only additional variable included in the models being nonverbal IQ for phonological awareness for both types of schools and print knowledge at the same

Table 4. Predictors Differentiating Children Likely to Never Be At-Risk and Children Likely to Be At-Risk at Time 2 at Two Levels of Severity in the Full Sample and the Type of School Separately.

Level of Severity	Full Sample		Title I Schools		Non-Title I Schools	
Domain						
Predictor Variable	Odds Ratio	[95% CI]	Odds Ratio	[95% CI]	Odds Ratio	[95% CI]
25th percentile						
Language						
Language	0.84***	[0.78, 0.90]	0.84***	[0.78, 0.91]	0.93*	[0.86, 0.99]
IQ	0.83**	[0.73, 0.94]	—	—	—	—
Race	2.08*	[1.13, 3.84]	—	—	—	—
HTKS	0.97*	[0.94, 1.00]	—	—	—	—
Print knowledge						
Print knowledge	0.79***	[0.73, 0.86]	0.78***	[0.69, 0.88]	0.83***	[0.74, 0.92]
IQ	0.87*	[0.76, 0.99]	0.83*	[0.68, 1.00]	—	—
Phonological awareness						
Phonological awareness	0.91***	[0.87, 0.95]	0.92***	[0.88, 0.96]	0.90*	[0.83, 0.98]
IQ	0.82***	[0.74, 0.90]	0.84***	[0.75, 0.93]	0.73**	[0.58, 0.92]
Race	2.95***	[1.81, 4.81]	—	—	—	—
HTKS	0.97*	[0.95, 1.00]	—	—	—	—
15th percentile						
Language						
Language	0.82***	[0.77, 0.87]	0.85***	[0.78, 0.91]	0.79***	[0.69, 0.90]
Print knowledge						
Print knowledge	0.80***	[0.75, 0.86]	0.80***	[0.74, 0.87]	0.76**	[0.62, 0.94]
IQ	0.87*	[0.77, 0.98]	—	—	—	—
Race	2.18*	[1.16, 4.08]	—	—	—	—
Phonological awareness						
Phonological awareness	0.86***	[0.83, 0.90]	0.88***	[0.84, 0.93]	0.85***	[0.76, 0.94]

Note. Predictors were sex, race (white and nonwhite), grand mean-centered: age, IQ, Head Toes Knees Shoulders (HTKS) measure, and Time 1 Language, Print Knowledge, and Phonological Awareness Construct scores. CI = confidence interval.
*$p < .05$. **$p < .01$. ***$p < .001$.

level of severity for children attending Title 1 schools, all at the 25th percentile.

Discussion

The results of this study indicated that the majority of preschool children who are at significant risk for reading-related academic difficulties can be identified early in the preschool year. That is, depending on the type of preschool and level of severity of risk classification, between one half and two thirds of children identified as at risk for reading-related difficulties in language and print knowledge domains had stable risk from the beginning of preschool to the middle of the preschool year. Risk was most stable for children in Title I preschools, despite these children's exposure to a skills-focused, evidence-based, early-literacy curriculum that was delivered by degreed and certified teachers.

Whereas the traditional RTI protocol includes the use of early screening or assessment to identify children who are at-risk followed by a period of monitoring their responsiveness to Tier I instruction as a way of improving sensitivity and specificity of risk-status classification (e.g., Fuchs & Fuchs, 2006), the results of this study indicate that this approach delays the provision of supplemental instruction that the majority of children initially identified as at-risk need. Indeed, some researchers have expressed concerns that this monitoring period is one aspect of the RTI protocol that undermines its *responsiveness* by creating a period of "waiting to fail" for children who could be identified early in the school year (Al Otaiba et al., 2014; O'Connor et al., 2010). Consequently, it seems likely that an approach that provides supplemental instruction to students identified as at-risk initially would represent a better approach and result in better outcomes for children who are at-risk (e.g., Al Otaiba et al., 2014; Milburn, Lonigan, & Phillips, 2017).

Additionally, although the majority of children initially classified as not at-risk maintained this classification, there were a small but not insignificant number of children in this sample who presented with late-emerging risk status for each of the three early literacy skills, particularly in the phonological awareness domain. Children with late-emerging risk are likely to be overlooked in the traditional RTI framework if the progress of these children is not being monitored because they were not identified as at-risk initially.

Such children, who may not be responding adequately to the Tier I instruction they are receiving, are also unlikely to receive supplemental instruction that they may need to reduce their risk for later reading-related difficulties. Consequently, it seems likely that an RTI approach that provides multiple opportunities for screening children's risk status would represent a better approach and result in better outcomes for children who are at-risk.

Both for children likely to benefit from immediate supplemental instruction and for children likely to benefit from continued monitoring of risk status, the results of this study indicate that children's initial scores within a domain provide useful information for the allocation of resources in an RTI approach. Across all three early literacy domains, children whose scores were farther away from the criterion score for the at-risk classification were those children who were most likely to maintain their risk status across the first half of the preschool year, even when exposed to high-quality instruction as part of the classroom environment. Depending on the threshold used for risk classification and whether a classification represented a false positive or false negative, knowing a child's nonverbal IQ added information. That is, lower nonverbal IQ in addition to scores in the risk domain predicted either stability of the initial at-risk classification or the likelihood that a child initially classified as not at risk would meet the risk-status classification later in the preschool year. Consequently, using initial scores as an index of probabilistic risk instead of solely using a categorical-risk classification for providing supplemental instruction or continued monitoring would represent a better approach that would likely result in better outcomes for children who are at-risk.

In moving forward, the use of a more dynamic RTI model of implementing intervention as early as possible for preschool children classified as at-risk for reading-related LD (Al Otaiba et al., 2014; O'Connor et al., 2010) will require screening or diagnostic measures that offer sufficient sensitivity and specificity to ensure that the children who really need immediate supplemental support are correctly classified. The battery of standardized tests used in this study has excellent psychometric properties, but many preschools are unlikely to have the resources (e.g., funding, trained personnel) to use these measures to screen children for risk status. This raises two issues: First, given the importance of early identification of children considered at-risk, screening measures are needed that have sufficient predictive validity to differentiate those children who are at high risk from children for whom monitoring may be prudent. Second, and perhaps more importantly, we should ensure that Title 1 schools have the resources necessary to identify the children who are at high risk and to provide effective supplemental instruction to reduce the number of children who will be later identified as having LD and require special education services.

Limitations

Despite a number of strengths of this study, such as the large sample of preschool children that included children attending Title 1 schools and non-Title 1 schools, the use of multiple commonly used and standardized measures of language, phonological awareness, and print knowledge at two time points with risk established at two levels of severity, there were limitations of this study that should be considered in relation to the results. First, the children were assessed at only two time points across the preschool year to determine the stability of risk for children identified at the beginning of the preschool year. Assessment at a third time point at the end of preschool would have provided additional information regarding the utility of construct scores at the beginning of preschool to predict children likely to have persistent risk status throughout the year. Furthermore, additional studies are needed to determine how preschool children classified as at-risk and not at-risk fare over a longer period in terms of early literacy abilities at kindergarten or first grade. Second, some children in the sample may have been receiving supplemental remediation or treatment for developmental language disorder, and this may have reduced the number of children with persistent risk status. Finally, although there were more and higher quality instructional activities occurring in Title I schools, the extent to which this instruction represented a high degree of fidelity to the curriculum is unknown. Consequently, it is possible that under different instructional circumstances, more children would have changed status from the beginning to the middle of the year. In other words, the results of this study are contextually bound to the specifics of the schools and instructional climate that the children attended.

Conclusion

In this study, a large number of preschool children—particularly those who qualified to attend Title I preschools—entered preschool with language, print knowledge, and phonological awareness skills that represented substantial risk for reading-related difficulties. If RTI is expected to reduce the numbers of children who might later be identified as having a reading-related LD and require special education services, prevention efforts need to ensure identification of children who are at-risk early enough during the preschool year to provide supplemental instruction for children. To do this, it will be necessary to develop methods to predict those children likely to make inadequate progress relative to their peers who are not classified as at-risk. The results of this study indicate that using initial screening scores as a probabilistic metric for risk and children with the highest probability of maintaining their risk status should be provided with supplemental instruction upon identification.

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Supplemental Material

Supplemental material for this article is available with the manuscript on the *JLD* website.

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