Learning from the Yamhill Early Learning Hub: Evidence for Effectiveness of the Ready for Kindergarten Workshops

Introduction & Background

Yamhill Early Learning Hub (ELH) has supported Ready for Kindergarten (R4K) workshops in seven school districts, serving families in 17 school catchment areas, for over five years. R4K is an evidence-informed parent education program designed to provide parents[1] with information and tools to engage with their children around developmentally appropriate activities. Activities are designed to improve a broad array of school readiness skills, including early literacy, early numeracy, and social-emotional development. R4K workshops in two school districts in Yamhill County are offered for parents with children as young as one month old. More commonly, however, R4K workshops are offered to families with children ages 4-5 years (i.e., in the year prior to kindergarten entry).

R4K programming typically includes three successive workshops offered during the year prior to kindergarten (one in fall, one in winter, and one in spring). Some schools offer the three R4K workshops in a shorter timespan (e.g., during the spring before kindergarten). Workshop sessions are two hours long and are both instructional and interactive. Workshops are led by trained volunteer facilitators, some of whom are school staff (e.g., kindergarten teachers). Parents receive numerous materials for supporting early literacy and numeracy skills as well as other doing developmentally supportive activities at home with their children. During the workshops, parents have opportunities to practice these activities with one another and receive feedback from the facilitator. Some families choose to bring their child to the workshop with them, and in these cases, parents can practice activities directly with their child. Typically, however, children are engaged in separate activities with childcare staff. To encourage participation, most R4K sessions begin with a free family meal. Workshops in Yamhill County are hosted at elementary schools.

In 2017, in order to examine the effectiveness of the R4K programs, Portland State University (PSU), as a part of their statewide evaluation of the Kindergarten Readiness Partnership and Innovation funds (KRPI), collaborated with the ELH to obtain Oregon Kindergarten Assessment (OKA) data, information about R4K participation, and child and family demographic information in school districts implementing R4K in Yamhill County. This work sought to answer two primary questions:

1. Are incoming kindergartners whose parent(s) participated in R4K during the year prior to kindergarten entry more school ready, as measured by the Oregon Kindergarten Assessment (OKA)?
2. Do children whose parent(s) participated in more years of R4K and/or who attended more R4K sessions have higher school readiness as measured by the Oregon Kindergarten Assessment (OKA)?

Yamhill ELH worked with school districts implementing R4K to obtain OKA and other child-level data for all 2016-17 incoming kindergartners. R4K attendance records were linked by school and HUB staff with individual child OKA data. Data were then de-identified and sent to PSU for analysis in early summer 2017.

Data Sources & Participants

Data Sources

OKA data were received from five school districts (Amity, Dayton, McMinnville, Newberg, and Yamhill) in Yamhill County, and included the OKA indicators of early literacy (knowledge of letter names and letter

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[1] The term "parent(s)" is used throughout this document, but this also includes other family or non-traditional caregivers.

sounds), early numeracy, self-regulation skills, and interpersonal skills, as well as gender and race/ethnicity for all kindergarteners in schools where R4K was offered. Two large school districts provided information about whether each child participated in Head Start and one school district provided data on participation in another preschool program (NOT Head Start). McMinnville School District provided data on Head Start participation as well as preschool participation, and participation in these two early learning opportunities was mutually exclusive. Additionally, these same two large school districts provided information about the

number of years of R4K programming received by each family. All but one school district provided data on number of sessions attended in the year before kindergarten.

Children of parents who participated in R4K during the 2015-16 school year were flagged and linked by school district staff within their local OKA databases. Databases were then sent to PSU. Table 1 describes data obtained from each school district.

Table 1. Child-level data obtained by school district[2].

	School District				
R4K Participation Data	Amity	Dayton	McMinnville	Newberg	Yamhill
R4K participation (yes/no)	X	X	X	X	X
# R4K sessions	X	X	X		X
# R4K years attended			X	X	
Demographic Data[3]					
Attended Head Start (yes/no)			X	X	
Attended Preschool Other than Head Start (yes/no)			X		
Home Language/ELL status			X		
Race/ethnicity	X	X	X	X	X
Child gender	X	X	X	X	X
Free & Reduced Meal Eligibility (yes/no)[3]	X			X	

Results

Levels of R4K Program Participation

The percentage of incoming kindergartners whose parents participated in R4K varied by school and by school district. As seen in Table 2, greater participation was seen in smaller communities such as Amity and Dayton where about one-quarter of the incoming kindergarten class attended at least one R4K workshop

in the year prior to kindergarten. About one in every 10 kindergartners had a parent who participated in at least one R4K workshop in larger school districts. Rates of participation across the schools ranged from 2% to 26%, with an average of 13%.

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[2] These variables were collected locally by these school districts.

[3] ELL status and Free and Reduced Lunch status are available for every child who participates in the OKA; however, not all schools shared this information with PSU for analysis.

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Table 2. 2016-17 incoming kindergartners by school & school district.

District	School	Total '16-'17 Kinders	R4K Participation			
			No		Yes	
			n	%	n	%
Amity	Amity	54	40	74%	14	26%
Dayton	Dayton	72	54	75%	18	25%
McMinnville		484	428	88%	56	12%
	Columbus	79	74	94%	5	6%
	Grandhaven	84	77	92%	7	8%
	Memorial	93	84	90%	9	10%
	Newby	89	84	94%	5	6%
	Sue Buel	76	59	78%	17	22%
	Wascher	59	46	78%	13	22%
	Missing School Name	4	4	100%	0	0%
Newberg		414	373	90%	41	10%
	Antonia Crater	64	61	95%	3	5%
	Dundee	46	44	96%	2	4%
	Edwards	121	101	84%	20	17%
	Ewing Young	21	17	81%	4	19%
	Joan Austin	67	66	99%	1	2%
	Mabel Rush	95	84	88%	11	12%
Yamhill	Yamhill Carlton	70	62	89%	8	11%
Total		**1094**	**957**	**88%**	**137**	**13%**

As seen in Tables 3 and 4, among the schools that provided attendance information, about half of families (48%) attended one session, 23% attended 2 sessions, and just over one-quarter (28%) attended all three R4K sessions. In Yamhill, all eight participating families attended all 3 sessions. Although Amity, Dayton, and Yamhill school districts only offered R4K workshops for families of 4-5 year olds (i.e., those transition into kindergarten in 2016-17), over one-quarter (28%) of families attended for more than one year in school districts where R4K was offered for multiple age groups (i.e., McMinnville and Newberg).

Child and Family Demographics

Table 5 describes child and family demographic characteristics of the 2016-17 incoming kindergarten cohort in Yamhill County. Most 2016-17 incoming kindergartners were identified as White (65%); Latino students were the largest minority group, comprising 28% of all incoming kindergartners. In Dayton and McMinnville, Latino students made up about one-third of the incoming kindergartners. While less than half of the students in the Amity school district qualified for free or reduced meals (FARMS), about two-thirds of kindergartners in McMinnville qualified for FARMS. In school districts where data were made available, between 8% and 20% of kindergartners attended Head Start or some other preschool/child care program in the year before kindergarten.

Differences in Demographic Characteristics for R4K Participants and Non-Participants

Because we were interested in comparing school readiness scores for children whose families participated in R4K compared to those who did not, it is important to understand how participating R4K families

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may differ from those who elected not to participate. There were relatively few variables provided that can be used to fully understand differences across these two groups. Table 6 shows differences between participating children and families who did not participate on the variables provided.

As seen in Table 6, families that participated in R4K were significantly less likely to be White and more likely to be Latino. Further, few families in R4K were from other, non-White backgrounds. In school districts providing this information, results also found that very few R4K participants had been enrolled in Head Start (although the numbers were very small and should be considered carefully). Additionally, children who attended some other preschool (not Head Start), were more likely to participate in R4K. Because of differences between R4K participants and non-participants in race/ethnicity, we statistically controlled for these differences in analyses[4].

Family & Child Factors Associated with OKA Scores

Differences by Racial/Ethnic Background & Gender

Differences in OKA scores were examined by child gender and race/ethnic background (see Table 7). These were the only demographic/background characteristics available for the full study sample. Note that, due to the small number of children from non-White, non-Latino backgrounds, these children were grouped together as being from an "other" racial/ethnic background. We conducted statistical analyses comparing OKA scores for White, Latino and this combined group of children from other backgrounds. OKA scores for children from specific non-White, non-Latino backgrounds are reported by racial/ethnic category for descriptive purposes in Table 7.

Results found that, overall, there were significant differences in early literacy and numeracy indicators for children from different racial/ethnic backgrounds, such that Latino children consistently scored significantly lower than White kindergartners and kindergartners from other ethnic/racial backgrounds. There were no significant differences between these children, however, in teacher's rating of children's self-regulation or interpersonal skills.

There were no significant differences between girls and boys on indicators of early literacy or early numeracy, but girls were rated significantly higher by teachers on indicators of approaches to learning (i.e., self-regulation and interpersonal skills). These findings are consistent with statewide patterns of differences in OKA scores.

Children's home language was provided by the McMinnville School District only. Results mirror findings for differences between Latino and White children, specifically that Spanish-speaking children identified significantly fewer letter names, knew fewer letter sounds, and scored lower on the early numeracy assessment compared to children who speak English or other languages.

Other Factors Related to Children's OKA Scores

Other variables that may be importantly related to OKA scores include family economic status and children's prior early learning experiences. These variables were only provided by a small subset of schools and/or districts and therefore these analyses are more exploratory in nature and less representative of Yamhill County as a whole.

As shown in Table 7, economically disadvantaged children (i.e., eligible for free or reduced meals or FARMs, provided by two school districts) scored lower on OKA indicators of early literacy and numeracy indicators compared to their higher income peers.

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[4] Because Spanish speaking children were almost entirely Latino, we elected to include only their race/ethnic background in statistical model to avoid confounding. While we ran models controlling for Head Start and preschool

participation for McMinnville and Newberg School Districts for comparison purposes, the same sizes were very small. Findings presented here only include child race/ethnicity and gender as control variables.

Interestingly, however, they were rated as being significantly *more* socially and emotionally ready by their teachers.

In two districts that provided information about Head Start enrollment, results found that children who attended Head Start (and therefore are likely to be more economically disadvantaged) scored significantly lower on all OKA measures of school readiness compared to children who did not attend Head Start. Head Start children were also significantly more likely than those not enrolled to be Latino (53% of Head Start children were Latino and only 30% of children not enrolled in Head Start were Latino). Thus, this finding should be interpreted with caution as it is highly likely that attending Head Start is strongly confounded with socioeconomic status. Children in Head Start, are by definition, from families at or below the Federal Poverty Level. Because we did not have FARMS data for all students, we could not explore this issue directly. Additionally, children who had other early learning experiences in non-Head Start preschools scored higher on school readiness indicators. These differences complement results found in analyses comparing Head Start and non-Head Start children in that children who have other early learning experiences such as preschool often come from families that can afford to pay for preschool tuition and thus may come from families with higher socioeconomic status than others.

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Table 3. Average R4K Program Participation.

	Total			Amity			Dayton			McMinnville			Newberg			Yamhill		
	n	mean	range	n	mean	range	n	mean	range	n	mean	range	n	mean	range	n	mean	range
mean # sessions attended (1-3)	95	1.8	1-3	13	1.8	1-3	18	1.4	1-3	56	1.8	1-3				8	3.0	3
mean # years attended R4K	127	1.5	1-5							57	1.6	1-5	51	1.3	1-2			

Table 4. Percent of R4K Program Participation.

	# R4K Session			# R4K Years				
	1 session	2 sessions	3 sessions	1 year	2 Years	3 Years	4 Years	5 Years
Total (n=95-108)	48%	23%	28%	71%	19%	3%	7%	1%
Amity (n=13)	62%	0%	39%	NA	NA	NA	NA	NA
Dayton (n=18)	67%	28%	6%	NA	NA	NA	NA	NA
McMinnville (n=56-57)	46%	30%	23%	72%	9%	5%	12%	2%
Newberg (n=51)	NA	NA	NA	71%	29%	0%	0%	0%
Yamhill (n=8)	0%	0%	100%	NA	NA	NA	NA	NA

Table 5. 2016-17 Incoming Kindergartner Demographics.

Demographics	Total		Amity		Dayton		McMinnville		Newberg		Yamhill	
Race/ethnicity (n=1094, all school districts)	n	%	n	%	n	%	n	%	n	%	n	%
American Indian/Alaska Native	7	0.6%	2	3.7%	1	1.4%	3	0.6%	0	0.0%	1	1.4%
Asian	5	0.5%	0	0.0%	0	0.0%	5	1.0%	0	0.0%	0	0.0%
African American/Black	11	1.0%	0	0.0%	0	0.0%	7	1.4%	4	1.0%	0	0.0%
Hawaiian/Pacific Islander	3	0.3%	0	0.0%	0	0.0%	3	0.6%	0	0.0%	0	0.0%
Latino	308	28.2%	6	11.1%	26	36.1%	158	32.6%	118	28.5%	0	0.0%
White	715	65.4%	45	83.3%	44	61.1%	292	60.3%	271	65.5%	63	90.0%
Multi-racial	45	4.1%	1	1.9%	1	1.4%	16	3.3%	21	5.1%	6	8.6%
Child Gender (n=1091, all school districts)												
Male	572	52.4%	27	50.0%	39	54.2%	252	52.1%	210	50.7%	44	65.7%
Female	519	47.6%	27	50.0%	33	45.8%	232	47.9%	204	49.3%	23	34.3%
Home Language (n=898, McMinnville & Newburg Only)												
English	344	71.1%					344	71.1%				

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Demographics	Total		Amity		Dayton		McMinnville		Newberg		Yamhill
Spanish	136	28.1%					136	28.1%			
Other	4	0.8%					4	0.8%			
Eligible for Free & Reduced Meals (n=463 in Amity & Newberg only)	274	59.2%	21	38.9%					253	61.9%	
Attended Head Start (n=898 in McMinnville & Newberg)	127	14.1%					95	19.6%	32	7.7%	
Attended Preschool (other than Head Start) (n=484 in McMinnville & Newberg)	68	14.0%					68	14.0%			

Table 6. Demographic Differences by R4K Participation.

	No R4K		R4K	
Race/Ethnicity	n	%	n	%
White	648	68%	67	49%
Latino**	244	26%	64	47%
Other	65	7%	6	4%
American Indian/ Alaska Native	5	<1%	2	2%
Asian	5	<1%	0	0%
African American/ Black	11	1%	0	0%
Hawaiian/ Pacific Islander	3	<1%	0	0%
Multi-racial	41	4%	4	3%
Child Gender				
Male	504	53%	68	50%
Female	450	47%	69	50%
Home Language (McMinnville & Newberg only)				
English	312	73%	32	57%
Spanish*	113	26%	23	41%
Other	3	<1%	1	2%
Eligible for Free & Reduced Meals (Amity & Newberg only)				
No	168	41%	21	38%
Yes	240	59%	34	62%

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	No R4K		R4K	
Attended Head Start (McMinnville & Newberg only)	n	%	n	%
No	680	85%	91	94%
Yes*	121	15%	6	6%
Attended Preschool Other than Head Start (McMinnville only)				
No	401	94%	15	27%
Yes**	27	6%	41	73%

* $p<.05$

** $p<.001$

Table 7. OKA Scores by Demographic Sub-Groups.

	Uppercase Letter Names		Lower Case Letter Names		Letter Sounds		Numbers & Operations		Self-Regulation		Interpersonal Skills	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Race/Ethnicity												
White (n=700-705)	16.25	9.56	13.66	8.99	10.27	9.29	8.72	3.07	3.55	0.87	3.79	0.93
Latino (n=305)	9.18**	9.55	7.82**	8.53	5.54**	7.97	7.37*	3.14	3.55	0.81	3.88	0.88
Other (n=67-70)	17.89	8.88	14.99	8.68	11.44	9.62	8.57	2.89	3.63	0.95	3.97	0.91
American Indian/ Alaska Native	14.29	9.98	12.43	8.87	7.00	8.17	8.29	0.95	3.70	0.89	3.90	0.81
Asian	25.80	0.45	24.20	2.49	21.40	3.29	11.00	3.94	4.53	0.62	5.00	0.80
African American/ Black	17.40	9.22	14.50	9.85	12.30	8.95	6.91	2.34	3.46	0.99	4.06	0.99
Hawaiian/ Pacific Islander	21.33	5.51	16.67	7.02	11.67	11.24	8.00	5.66	3.50	2.12	3.50	2.12
Multi-racial	17.44	9.00	14.36	8.57	10.82	9.90	8.78	2.86	3.58	0.93	3.93	0.87
Child Gender												
Male (n=563-565)	14.58	10.12	12.17	9.32	9.10	9.45	8.41	3.15	3.39	0.87	3.66	0.96
Female (n=512-513)	14.1	9.99	12.01	9.16	8.91	8.96	8.24	3.11	3.73**	0.82	4.01**	0.83
Home Language												
English (n=334-335)	14.03	9.81	11.69	8.94	8.59*	8.80	8.34	3.10	3.47	0.87	3.78	0.93
Spanish (n=134)	15.34	10.17	13.21*	9.39	10.57	9.61	8.27	3.25	3.59	0.84	3.83	0.88
Other (n=4)	14.38	12.39	11.38	10.86	11.25	10.54	7.50	5.32	3.50	0.92	3.55	0.80
Eligible for Free & Reduced Meals												
No (n=187-189)	18.21**	9.03	15.62**	8.74	12.91**	9.71	9.23**	3.08	3.63	0.74	3.77	0.84
Yes (n=273)	13.92	10.42	12.12	9.47	9.59	9.11	7.93	3.28	3.78*	0.78	3.98*	0.83

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	Uppercase Letter Names		Lower Case Letter Names		Letter Sounds		Numbers & Operations		Self-Regulation		Interpersonal Skills	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Attended Head Start												
No (n=757-761)	15.69**	9.90	13.43**	9.14	10.56**	9.39	8.46**	3.27	3.58**	0.84	3.84*	0.88
Yes (n=124-126)	9.25	8.34	7.13	7.58	4.61	6.57	7.34	2.60	3.28	0.87	3.62	1.00
Attended Preschool												
No (n=68)	12.73	9.86	10.36	8.83	7.20	8.49	8.05	3.01	3.33	0.90	3.71	0.97
Yes (n=404-405)	19.40**	8.15	17.07**	8.2	13.47**	9.62	9.12*	3.25	3.69*	0.84	3.84	0.93

* *p*<.05
**p<.001

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OKA Scores & R4K Participation

This project sought to answer two primary questions about the preparedness of incoming kindergartners whose families did and did not participate in the R4K program during the year prior to kindergarten entry in Yamhill County. Results for each question are presented below.

Research Question 1: Are incoming kindergartners whose parent(s) participated in R4K more school ready, as measured by the Oregon Kindergarten Assessment?

Descriptively, R4K participants scored higher on all 5 OKA indicators of school readiness. Figure 5 highlights mean differences in early literacy and early numeracy indicators of the OKA by participation in R4K during the year before kindergarten. Figure 6 presents the two scales of the Child Behavior Rating Scale (CBRS) related to self-regulation and interpersonal skills for these two groups.

Next, multilevel modeling was used to compare differences in these OKA scores for children who did versus did not participate in R4K. Multi-level modeling is an analytic approach that accounts for the fact that school-level factors may influence students' scores (e.g., that students are nested or clustered within schools). Additionally, these models controlled for demographic differences[5,6] between participating and non-participating children.

Results of these analyses found that, after accounting for demographic characteristics, **children whose parent(s) participated in R4K the year before kindergarten identified significantly more letter names (both upper and lowercase), letter sounds, and had**
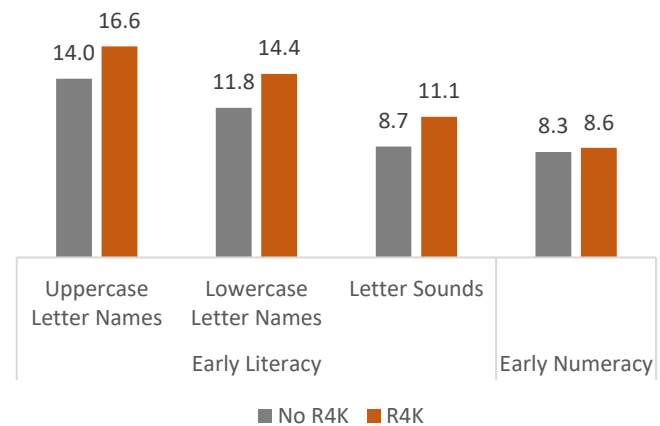
significantly higher early numeracy skills compared to children whose parent(s) did not participate in R4K in the year before kindergarten.

Multilevel models, controlling for the same demographic characteristics, were also conducted to examine differences in teacher-rated skills related to approaches to learning. **While differences were small, children whose families participated in R4K had significantly higher self-regulation scores than those who did not**, controlling for demographic characteristics and differences between schools. There was no significant relationship between participating in R4K and teacher's ratings of children's interpersonal skills.
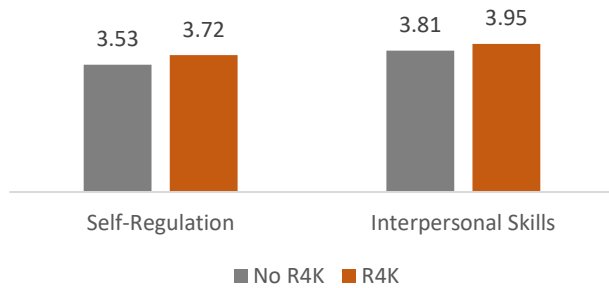
Refer to Appendix B for detailed information on the multilevel models conducted and Appendix C for mean OKA scores by R4K participation by school.

Figure 5. Mean Early Literacy & Early Numeracy Scores by Participation in R4K

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[5] Not all demographic information was available for children in each school. Only demographic indicators for the majority of schools and that correlated with OKA scores (see Appendix B) were included in the multilevel models, specifically child gender and child race/ethnicity (comparing White, Latino, and children from other racial/ethnic groups).

[6] Multi-level models were also run including Head Start and preschool covariates, which were only available for students in the McMinnville and Newberg school districts. There were no major differences in results between these models and those presented in this report.

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Figure 6. Mean Approaches to Learning Scores by Participation in R4K

Research Question 2: Does dosage, as measured by number of years of participation in R4K or number of sessions attended, predict school readiness as measured by the Oregon Kindergarten Assessment?

First, correlations between the two indicators of dosage and OKA scores were examined. Correlations between OKA scores and number of sessions attended were all small to moderate and positive, ranging from 0.03 (early numeracy) to 0.29 (lowercase letter names). Correlations between OKA scores and number of years of attendance were all small and negative, ranging from -0.06 (lowercase letter names) to -0.15 (early numeracy). Although attendance at more R4K sessions was associated with higher OKA scores, particularly for early literacy indicators, the number of years that families attended the program was not associated with higher OKA scores. It should be noted that none of these correlations were significant at the $p<0.05$ level.

In order to further examine this question, multilevel models were also conducted; one set of models was run for each indicator of dosage (i.e., number of sessions attended, number of years attended). Results related to number of R4K sessions attended (1-3 sessions) generally suggested a positive relationship between R4K

sessions attended and OKA scores. Similar to the correlational results, the more R4K sessions a family attended, the higher their child scored on the OKA. However, these findings were not statistically significant when accounting for demographic characteristics of the children[7]. It should be noted that statistical power to detect differences in OKA scores based on number of sessions attended was limited because there are only 3 sessions of R4K, restricting the variability in attendance.

In analyses examining the relationship between OKA scores and the number of years of R4K programming that families attended, only kindergartners from McMinnville and Newberg School Districts were included because they were the only districts to offer R4K for multiple age groups (i.e., for 0-1 year olds, 1-2 year olds, 2-3 year olds, etc.). There was no discernible pattern of results related to number of years of R4K attendance for early literacy indicators or approaches to learning. However, the number of years families attended R4K significantly predicted early numeracy skills, when controlling for school and demographic differences. Reflecting results found in bivariate correlations, the more years that families attended R4K, the lower their child scored on the early numeracy portion of the OKA. Because these analyses only included children in the two school districts that offered the program for multiple age groups, the sample sizes were relatively small and may not have been able to detect significant effects of program dosage on OKA scores. Additionally, families that attended the program for more years were significantly more likely to be Latino than White (e.g., 84% of families attending 2 years of programming were Latino, 67% of families attending 3 years of programming were Latino). These results should be considered in light of significant differences in OKA scores between White and Latino children.

Refer to Appendix B for detailed information on the multilevel models conducted.

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[7] In order to increase power, or the ability to detect significant differences in OKA scores based on these two indicators of dosage, only child gender and child race/ethnicity were used as demographic control variables.

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Conclusions & Limitations

These analyses contribute to the evidence base supporting the effectiveness of the R4K program in supporting children's school readiness, at least in terms of aspects of academic readiness measured by the OKA (early literacy and early numeracy). Specifically, controlling for differences in race/ethnicity, compared to children whose families did not participate, children whose parent(s) participated in R4K during the year before kindergarten:

- Identified significantly more letter names;
- Knew significantly more letter sounds, and
- Had significantly better early numeracy skills such as counting and identifying numbers.
- Were rated by teachers as having significantly better self-regulation skills.

It should be noted that, while statistically significant, the differences in rated self-regulation skills was small, and there were no significant differences in ratings of children's interpersonal skills. That said, the primary focus of the R4K program is on early academic skills and other skills parents can directly support at home; the opportunity for facilitated work to build interpersonal skills (e.g., through social interactions with other children) is fairly minimal. While aspects of the curriculum provide parents with skills and knowledge to improve their child's social skills, these skills are not the primary emphasis of workshop or take-home activities.

Further, the tools used by the OKA to measure self-regulation and interpersonal skills tend to be positively skewed, with most teachers rating children quite positively. Further, very little training in administration of these measures is provided to kindergarten teachers, which may decrease the validity of the assessment of children's actual social and self-regulation skills and increase the likelihood that unmeasured factors, including inherent and unconscious biases, may influence teachers' ratings. These limitations should all be considered when interpreting and using findings from these analyses.

Additionally, although the sample size was limited, findings suggested a trend where attending more R4K

sessions may be associated with better outcomes, although this trend was not significant.

Counter to expectations, results also found an inverse relationship between the number of years attending R4K programming and early numeracy scores, where the more years parents attended, the lower their child's early numeracy score. However, these results should be considered in light of the fact that families that attended R4K multiple years in a row were more likely to be Latino, and incoming Latino kindergartners scored significantly lower on all academic aspects of the OKA (i.e., early literacy and early numeracy).

While the results of these analyses suggested positive benefits for children of parents who participated in R4K, results should be interpreted with several caveats. Most importantly, this was not a randomized control trial nor were comparison children identified through a systematic matching process. Instead, comparisons of OKA scores were made between families who voluntarily decided to participate and those who did not. OKA scores for children whose parent(s) participated in the program were compared to those scores for all other children in the school district. Comparing demographic characteristics of these two groups of families, it is apparent that R4K does not serve a representative or random sample of Yamhill County families. R4K participants were much more likely to be of Latino descent, for example. Additionally, children in R4K families were more likely to have attended a non-Head Start preschool, which may indicate these families had more financial means to provide private preschool experiences for their children. Similarly, very few families whose child attended Head Start participated in the program. Although some demographic characteristics were accounted for in these analyses, these controls are by nature imperfect.

Further, there may be other family characteristics that were not measured that contribute to these outcomes. For example, it is possible that, among other things, families that attended the R4K sessions are generally more proactive about getting the resources that they and their children need to be ready for and succeed in school. These families may be more likely to be

providing other kinds of support for children's learning at home, compared to those who did not attend. Conversely, families who are experiencing poverty and family instability are more likely to face considerably more barriers to participating in formal group-based experiences such as these.

Other limitations to this work include inconsistent demographic and program dosage data across schools and school districts as well as limitations in what can be understood about school readiness through the Oregon Kindergarten Assessment. School readiness embodies a number of different skills and knowledge, and the OKA assesses aspects of only four of these skills using very brief instruments (i.e., aspects of early literacy, aspects of numeracy, self-regulation, and interpersonal skills). In particular, the measures of self-regulation and interpersonal relationships may not be sensitive enough to show effects of the R4K program.

In order to improve confidence in our ability to make claims about the benefits of the R4K program, it is recommended that more data be consistently collected from R4K families related to dosage and that comparison children be identified in a more systematic way. Additional information that could contribute to understanding baseline differences between participants and non-participants would also be helpful in creating more rigorous comparisons. This additional data could include information about families' initial level of support for children's learning at home, access to and use of other early childhood services, and other factors that might influence OKA scores independent of the R4K program.

Finally, this study provides an overall assessment of outcomes across a relatively large number of implementing schools. It may be that some schools or facilitators are doing a better job implementing the content of R4K in a way that engages families and supports child outcomes. Yamhill County might want to consider collecting implementation and process data that could be used for monitoring and improving the quality of implementation across school districts. Using volunteer facilitators is a highly sustainable approach yet is likely to lead to inevitable variability in quality of

facilitation and sessions. Improvements in quality and consistency could contribute to larger effects of the program on desired outcomes.

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Appendix A. OKA mean scores by R4K participation and demographic characteristics.

| | Uppercase Letter Names | | | | Lower Case Letter Names | | | | Letter Sounds | | | |
| | No R4K | | R4K | | No R4K | | R4K | | No R4K | | R4K | |
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Race/ Ethnicity												
White	15.90	9.67	19.89	7.49	13.35	9.02	16.95	7.87	10.00	9.29	13.17	8.89
Latino	8.23	9.22	12.73	10.01	6.86	8.01	11.42	9.52	4.73	7.43	8.63	9.15
Other	17.52	8.95	20.83	10.25	14.66	8.79	18.50	8.92	11.13	9.72	13.67	10.61
Child Gender												
Male	14.45[†]	10.12	15.25	10.22	12.00[†]	9.29	13.21	9.66	8.97[†]	9.44	9.85	9.56
Female	13.56	10.07	17.88	8.68	11.50	9.15	15.63	8.44	8.43	8.88	12.25	8.94

[†]interaction between R4K participation and demographic characteristic is marginal, p<.10

[1] n<4 per group; means and standard deviations are not displayed

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	Numbers & Operations				Self-Regulation				Interpersonal Skills			
	No R4K		R4K		No R4K		R4K		No R4K		R4K	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Race/Ethnicity												
White	8.65	3.06	9.33	3.11	3.54	0.85	3.77	0.93	3.79	0.91	3.98	0.92
Latino	7.24	3.20	7.86	2.88	3.51	0.84	3.69	0.68	3.86	0.92	3.94	0.72
Other	8.69	3.03	8.33	1.51	3.57	0.97	4.20	0.62	3.94	0.92	4.33	0.72
Child Gender												
Male	8.42	3.16	8.31	3.11	3.38	0.87	3.51	0.81	3.65	0.97	3.79	0.81
Female	8.14	3.14	8.88	2.93	3.71	0.80	3.99	0.74	4.00	0.81	4.16	0.80

*interaction between R4K participation and demographic characteristic is significant, p<.05

[1] n<4 per group; means and standard deviations are not displayed

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Appendix B. Detailed information about the multilevel models conducted.

Multilevel modeling is a statistical approach used when data include information at different levels of analysis or when the structure of the data is "nested." In this case, data related to individual children (i.e., OKA scores, demographic information) is nested within or can be grouped by school. Multilevel models are conducted when the nested data structure is present and there is reason to believe that there are significant differences in the outcome of interest (i.e., OKA scores) by school. Significant differences in OKA scores between schools was found; as seen in Table 1 below, intraclass correlation coefficients (ICC) indicated that between 7% and 17% of the differences in OKA scores were explained by differences between schools.

Table 1. ICCs for OKA scores.

	ICC
LN Upper	0.07
LN Lower	0.08
LS	0.10
Numbers	0.02
Self-Regulation	0.15
Interpersonal	0.17

Table 2 includes the estimates of the coefficients for models examining OKA scores on R4K participation. Models examining differences in OKA scores between children whose parents did and did not participate in R4K during the school year prior to kindergarten include 4 demographic controls, including participation in Head Start, participation in a non-Head Start preschool, child gender, and child race/ethnicity (White is the reference category). Table 3 includes estimated coefficients for multilevel models conducted to examine the relationship between program dosage variables (i.e., number of sessions attended, number of years attended) and OKA scores. These models include fewer demographic controls due to inconsistent demographic information for a smaller number of schools available for these analyses.

Table 2. Multilevel models of OKA scores on R4K participation.

			Fixed Effects		Residual	
			b (s.e.)	p-value	b (s.e.)	p-value
Early Literacy	Uppercase Letter Names					
		Intercept (Mean Uppercase LN)	15.78 (0.77)	<0.001	83.83 (3.65)	<0.001
		R4K Participation	5.03 (0.97)	<0.001		
		Female	-0.22 (0.56)	0.70		
		Latino[1]	-7.21 (0.68)	<0.001		
		Other Race/Ethnicity[2]	1.28 (1.15)	0.27		
	Lowercase Letter Names					
		Intercept (Mean Lowercase LN)	13.13 (0.74)	<0.001	71.79 (3.12)	<0.001
		R4K Participation	4.80 (0.80)	<0.001		
		Female	0.01 (0.52)	0.98		
		Latino[1]	-6.07 (0.63)	<0.001		

			Fixed Effects		Residual	
			b (s.e.)	p-value	b (s.e.)	p-value
		Other Race/Ethnicity[2]	1.03 (1.07)	0.96		
	Letter Sounds					
		Intercept (Mean LS)	9.92 (0.87)	<0.001	72.02 (3.14)	<0.001
		R4K Participation	4.49 (0.81)	<0.001		
		Female	-0.13 (0.52)	0.81		
		Latino[1]	-5.21 (0.63)	<0.001		
		Other Race/Ethnicity[2]	0.89 (1.07)	0.40		
Early Numeracy	Numbers & Operations					
		Intercept (Mean Numeracy)	8.72 (0.17)	<0.001	9.35 (0.41)	<0.001
		R4K Participation	0.65 (0.29)	0.03		
		Female	-0.12 (0.19)	0.52		
		Latino[1]	-1.39 (0.22)	<0.001		
		Other Race/Ethnicity[2]	-0.15 (0.39)	0.70		
Approaches to Learning	Self-Regulation					
		Intercept (Mean Self-Regulation)	3.35 (0.10)	<0.001	0.61 (0.03)	<0.001
		R4K Participation	0.17 (0.07)	0.02		
		Female	0.33 (0.05)	<0.001		
		Latino[1]	-0.08 (0.06)	0.15		
		Other Race/Ethnicity[2]	0.08 (0.10)	0.46		
	Interpersonal Skills					
		Intercept (Mean Interpersonal)	3.60 (0.11)	<0.001	0.74 (0.05)	<0.001
		R4K Participation	0.10 (0.08)	0.17		
		Female	0.32 (0.05)	<0.001		
		Latino[1]	0.02 (0.06)	0.80		
		Other Race/Ethnicity[2]	0.14 (0.11)	0.174		

[1] Latino children compared to White children

[2] Children from other racial/ethnic groups compared to White children

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Table 3. Multilevel models of OKA scores on program dosage.

	Number of Sessions Attended				Number of Years Attended[3]			
	Fixed Effects		Residual		Fixed Effects		Residual	
	b (s.e.)	p-value	b (s.e.)	p-value	b (s.e.)	p-value	b (s.e.)	p-value
Early Literacy								
Uppercase Letter Names								
Intercept (Mean Uppercase LN)	19.83 (1.98)	<0.001	68.38 (10.64)	<0.001	21.48 (1.80)	<0.001	58.40 (8.53)	<0.001
Dosage (# sessions or # years attended)	0.71 (1.21)	0.56			-2.56 (1.06)	0.60		
Female	-0.16 (1.80)	0.93			0.34 (1.57)	0.83		
Latino[1]	-5.28 (1.98)	0.01			-6.89 (1.79)	<0.001		
Other Race/Ethnicity[2]	-0.54 (4.42)	0.90			-5.22 (4.82)	0.28		
Lowercase Letter Names								
Intercept (Mean Lowercase LN)	16.93 (1.96)	<0.001	66.70 (10.38)	<0.001	19.01 (1.71)	<0.001	56.43 (8.23)	<0.001
Dosage (# sessions or # years attended)	1.83 (1.20)	0.13			-1.78 (4.72)	0.71		
Female	-0.47 (1.78)	0.79			0.43 (1.53)	0.780		
Latino[1]	-4.11 (1.95)	0.04			-5.96 (1.74)	0.001		
Other Race/Ethnicity[2]	0.49 (4.37)	0.91			-6.51 (4.73)	0.17		
Letter Sounds								
Intercept (Mean LS)	13.21 (2.00)	<0.001	79.55 (12.40)	<0.001	16.21 (1.81)	<0.001	73.78 (10.2)	<0.001
Dosage (# sessions or # years attended)	0.47 (1.31)	0.72			-9.94 (5.40)	0.07		
Female	0.01 (1.93)	0.99			-0.58 (1.74)	0.74		
Latino[1]	-4.38 (2.10)	0.04			-5.43 (1.93)	0.01		
Other Race/Ethnicity[2]	2.40 (4.76)	0.62			.18 (5.39)	0.97		
Early Numeracy								
Numbers & Operations								
Intercept (Mean Numeracy)	9.11 (0.56)	<0.001	9.02 (1.41)	<0.001	9.66 (0.59)	<0.001	8.08 (1.17)	<0.001
Dosage (# sessions or # years attended)	-0.23 (0.44)	0.60			-3.77 (1.78)	0.04		
Female	0.42 (0.64)	0.51			-0.07 (0.58)	0.91		
Latino[1]	-0.57 (0.67)	0.39			-1.41 (0.63)	0.03		

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	Est (SE)	p	Est (SE)	p	Est (SE)	p	Est (SE)	p
Other Race/Ethnicity[2]	-0.35 (1.59)	0.83			-0.41 (1.78)	0.82		
Self-Regulation								
Intercept (Mean Self-Regulation)	3.41 (0.16)	<0.001	0.83 (0.12)	<0.001	3.42 (0.15)	<0.001	0.43 (0.06)	<0.001
Dosage (# sessions or # years attended)	0.06 (0.13)	0.63			-0.64 (0.41)	0.12		
Female	0.53 (0.19)	0.01			0.44 (0.13)	0.002		
Latino[1]	0.08 (0.20)	0.70			-0.04 (0.15)	0.80		
Other Race/Ethnicity[2]	0.59 (0.48)	0.23			0.08 (0.41)	0.85		
Interpersonal Skills								
Intercept (Mean Interpersonal)	3.73 (0.20)	<0.001	0.93 (0.15)	<0.001	3.62 (0.17)	<0.001	0.52 (0.08)	<0.001
Dosage (# sessions or # years attended)	0.17 (0.14)	0.23			-0.33 (0.46)	0.47		
Female	0.28 (0.21)	0.18			0.38 (0.15)	0.01		
Latino[1]	0.10 (0.22)	0.66			0.02 (0.17)	0.89		
Other Race/Ethnicity[2]	0.21 (0.51)	0.68			0.15 (0.46)	0.97		

(Row group label: Approaches to Learning)

[1] Latino children compared to White children

[2] Children from other racial/ethnic groups compared to White children

[3] # years of R4K attendance was transformed ($\log_{10}$) to account for skewness

NOTE: dosage variables are group mean centered

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Appendix C. Mean OKA scores by R4K participation by school.

School District	School	R4K Participation	Early Literacy						Early Numeracy		Approaches to Learning			
			Uppercase Letter Names		Lowercase Letter Names		Letter Sounds				Self-Regulation		Interpersonal Skills	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Amity	Amity	No R4K (n=40)	12.20	10.28	10.03	9.69	5.30	8.75	8.70	2.28	3.65	0.77	3.75	0.89
		R4K (n=14)	16.43	10.17	13.79	10.06	8.36	9.82	9.29	2.40	4.17	0.85	4.34	0.86
Dayton	Dayton	No R4K (n=54)	8.37	9.25	6.59	7.98	3.43	6.26	7.72	3.14	3.86	0.54	4.29	0.73
		R4K (n=17)	11.47	10.59	9.06	9.44	6.65	8.10	7.71	3.06	3.72	1.21	4.27	1.25
Newberg	Total Newberg	No R4K (n=369)	16.25	9.96	14.04	9.16	11.70	9.36	8.51	3.39	3.71	0.77	3.89	0.85
		R4K (n=41)	13.93	10.20	12.80	9.47	10.37	9.15	7.59	2.92	3.71	0.69	3.98	0.59
	Antonia Crater	No R4K (n=60)	19.70	8.06	16.92	7.74	13.88	9.15	9.39	2.97	3.23	0.67	3.47	0.73
		R4K (n=3)	25.00	1.73	24.33	2.08	16.00	7.00	9.33	4.16	3.83	0.46	3.73	0.50
	Dundee	No R4K (n=43)	14.77	10.42	12.35	9.56	10.09	10.25	7.58	4.07	3.33	0.95	3.24	0.98
		R4K (n=2)	24.50	0.71	22.00	2.83	12.00	15.56	6.50	0.71	3.90	0.00	3.70	0.42
	Edwards	No R4K (n=101)	12.52	10.65	11.17	9.74	9.01	9.02	8.09	3.35	3.94	0.65	4.18	0.65
		R4K (n=20)	8.75	9.45	7.95	8.78	5.90	7.06	6.35	2.46	3.86	0.28	4.06	0.41
	Ewing Young	No R4K (n=17)	20.06	8.43	17.71	8.48	15.71	8.91	10.47	3.24	3.12	0.76	3.81	0.56
		R4K (n=4)	10.25	9.36	9.50	8.39	8.25	10.11	9.25	2.87	2.20	1.13	2.90	0.87
	Joan Austin	No R4K (n=66)	18.42	9.00	15.59	8.45	13.36	8.86	8.32	3.36	4.05	0.79	4.33	0.74
		R4K (n=1)	26.00	NA	24.00	NA	25.00	NA	14.00	NA	3.80	NA	4.20	NA
	Mabel Rush	No R4K (n=82)	16.51	9.69	14.33	8.89	12.10	9.18	8.61	3.20	3.79	0.58	3.85	0.87
		R4K (n=11)	18.64	7.90	17.00	7.00	16.09	8.14	8.36	2.58	3.90	0.54	4.32	0.38
McMinnville	Total McMinnville	No R4K (n=413)	12.88	9.89	10.52	8.90	7.35	8.60	8.06	3.03	3.35	0.91	3.72	0.97
		R4K (n=56)	19.77	7.74	17.29	7.91	13.68	9.38	9.32	3.08	3.62	0.79	3.75	0.90
	Columbus	No R4K (n=71)	13.96	10.08	11.67	9.53	8.97	9.56	8.93	2.72	3.46	0.72	3.81	0.77
		R4K (n=5)	13.00	12.29	11.80	11.71	11.00	10.95	8.60	2.70	3.64	0.35	3.84	0.46
	Grandhaven	No R4K (n=73)	12.70	9.83	9.76	8.19	7.55	8.14	8.08	2.96	2.96	0.92	3.11	0.89
		R4K (n=7)	22.14	8.95	20.29	8.62	16.57	11.53	11.00	3.56	3.40	0.73	3.40	0.77

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| School District | School | R4K Participation | Early Literacy | | | | | | | | Approaches to Learning | | | |
| | | | Uppercase Letter Names | | Lowercase Letter Names | | Letter Sounds | | Early Numeracy | | Self-Regulation | | Interpersonal Skills | |
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	Memorial	No R4K (n=83)	17.12	9.39	14.35	9.04	9.80	8.88	7.95	3.18	3.81	0.88	4.27	0.83
		R4K (n=9)	18.33	9.15	17.11	8.10	13.89	8.59	9.67	3.28	3.86	0.95	4.36	0.87
	Newby	No RK (n=83)	11.74	9.89	9.52	8.82	6.36	8.21	7.88	3.11	3.19	0.77	3.97	0.83
		R4K (n=5)	15.60	7.13	12.60	8.96	10.60	9.66	10.60	5.27	3.56	0.62	3.72	0.59
	Sue Buel	No R4K (n=58)	10.14	9.29	8.33	7.99	5.48	8.09	7.55	3.27	3.58	0.92	3.74	0.92
		R4K (n=17)	22.65	5.53	20.29	5.63	16.12	8.96	8.77	2.64	3.81	0.88	3.81	0.90
	Wascher	No R4K (n=45)	9.33	8.72	7.63	7.76	4.22	7.04	7.80	2.75	2.98	0.95	3.15	1.11
		R4K (n=13)	19.92	5.24	15.77	7.00	11.00	9.02	8.69	2.36	3.34	0.78	3.40	1.08
Yamhill	**Yamhill Carlton**	No R4K (n=58)	14.68	9.76	12.03	8.91	6.81	8.83	8.75	2.72	3.21	0.93	3.55	0.96
		R4K (n=8)	18.75	6.98	15.13	7.51	10.25	7.09	9.38	2.62	3.75	1.28	3.75	0.89

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