



EARLY DEVELOPMENT INSTRUMENT
a population-based measure for communities

Children's developmental health using the EDI: Exploring new summary outcome groups



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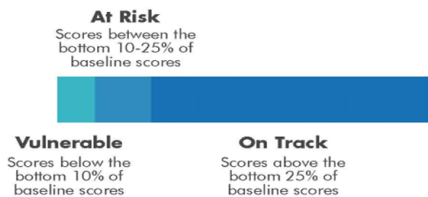
Children's developmental trajectories in the early years take many different paths. Not all children are able to demonstrate their optimal outcomes at the same time, or may take longer to meet milestones than their same age peers. However, despite some children seeming to struggle or lag developmentally at a young age, they can also demonstrate resiliency and are able to catch up in later years. The following report aims to identify broad developmental categories that children fall into using scores from the Early Development Instrument (EDI).

About the EDI

The teacher-completed checklist called the Early Development Instrument (EDI; Janus & Offord, 2007) was developed at the Offord Centre for Child Studies at McMaster University to measure children's ability to meet age-appropriate developmental expectations at school entry. The EDI focuses on the overall outcomes for children as a health-relevant, measurable concept that has long-term consequences for individuals and populations. The data derived from the collection of the EDI facilitate and encourage community, provincial, national, and international monitoring of the developmental health of our young learners (Janus & Offord, 2007).



Figure 1. Distribution of EDI scores in developmental domains



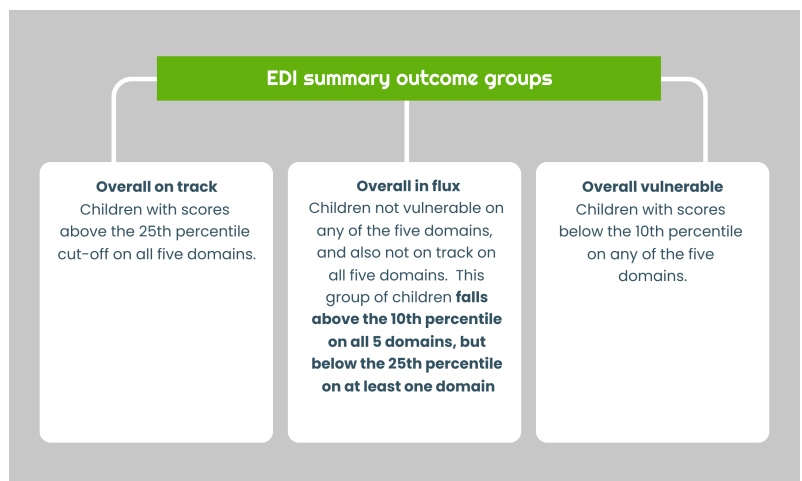
The EDI comprises five domains: Physical Health and Well-being, Social Competence, Emotional Maturity, Language and Cognitive Development, and Communication Skills and General Knowledge. Historically, EDI domain outcomes are reported in three distinct groups based on the child's score *in each of the five domains*. These groups are defined by population-based percentile cut-points with **Vulnerable** defined as having a score below the 10th percentile cut-point, **At risk** as having a score between the 10th and 25th percentiles, and finally **On track** as having a score above the 25th percentile (Figure 1).

Existing and new overall summary outcome groups

The percentage of children deemed **overall vulnerable**, that is **vulnerable on one or more domains** is reported as a summary EDI outcome and provides a snapshot of children's developmental outcomes for a given cohort (e.g., province, school board, community). Recently, community partners have expressed an interest in using an EDI-based indicator that would capture the potentially changeable nature of child development at school entry in a manner similar to how it is done per domain, as illustrated in Figure 1, and in addition to the overall vulnerable category.

In response, two new overall outcome groups were developed: the **overall in flux** and **overall on track** groups. Figure 2 offers a definition of each group.

Figure 2. Definition of the three overall summary outcome groups.



EDI in Ontario

The EDI has a long history in the province of Ontario. Between 2003/2004 and 2011/2012 the Ministry of Children and Youth Services sponsored three full provincial collections of the EDI, completed over three-year cycles. In contrast to previous cycles, the fourth and fifth provincial EDI data collections took place in a single year and were sponsored by the Ministry of Education. For more information about the EDI in Ontario please see: <https://edi.offordcentre.com/partners/canada/edi-in-ontario-2004-2018/>



Due to the availability of five provincial cycles of data, we utilized Ontario EDI results to examine and illustrate the characteristics of children in the new summary outcome groups. Additionally, Ontario EDI data from Cycle 1 (2004-2006) have been linked with standardized academic assessment data from the Education Quality and Accountability office (EQAO). This linked database will allow for a longitudinal approach to the exploration of these groups.

Comparison of Summary Outcome Groups using Ontario Cycles 1-5

In order to conduct descriptive analyses on the new overall groups, we applied several exclusion criteria to the Ontario Cycle I – IV data set (data collected between 2004 and 2018). The criteria result in the population that is known as valid for analysis (VFA).

Children were excluded if:

1. They were not in Senior Kindergarten (Year 2)
2. They were not in class for at least one month
3. They had a special needs designation
4. They had more than one EDI domain missing
5. They were not linked provincially by the Ontario Ministry of Education (Cycles 4 and 5 only)
6. They were on track in four domains but were missing a score for the remaining domain (See Appendix A for more information)

Table 1. Ontario children valid for analysis Cycles I – V by summary outcome group.

	Total VFA	Overall on track		Overall in flux		Overall vulnerable	
	Count	Count	%	Count	%	Count	%
Cycle I	113,323	55,533	49.0	25,380	22.4	31,710	28.0
Cycle II	110,916	54,172	48.8	24,590	22.2	31,584	28.5
Cycle III	119,494	60,042	50.2	25,983	21.7	32,937	27.6
Cycle IV	125,858	62,447	49.6	26,123	20.8	36,994	29.4
Cycle V	123,912	60,943	49.2	26,042	21.0	36,677	29.6

Table 1 displays the number and percentage of children that were classified into each of the three summary outcome groups by cycle.

Note: The counts for the outcome summary groups will not add up to the total Ontario VFA count due to some children not being categorized due to missing one domain (See Appendix A).

When examining the demographic information of the three summary outcome groups across the five cycles, similar patterns were consistent across all cycles. In the overall on track group there was a lower proportion of males and children with E/FSL status, and a higher mean age of students than the two other groups. The overall vulnerable group had the highest percentage of males and E/FSL children and children in this group were also, on average, younger than children in the two other groups. The descriptive statistics (sex, E/FSL status, age) of the children in the overall in flux group were somewhere in the middle between the overall on track and overall vulnerable groups.

Overall summary outcome groups as predictors of later academic achievement

In order to gain a better understanding of the newly created overall summary outcome groups (the overall in flux and overall on track group in particular), we examined to what degree the membership in one of the three groups predicted children's academic achievement three and six years later. Ontario Cycle I EDI data (2004-2006) were matched to the database of standardized academic assessments in reading, writing, and mathematics from the Education Quality and Accountability Office (EQAO) for Grades 3 and 6. Since 1996/7, EQAO has assessed the majority of Ontario's students attending publicly funded schools in reading, writing, and mathematics in Grades 3, 6, and 9 (EQAO, 2013).

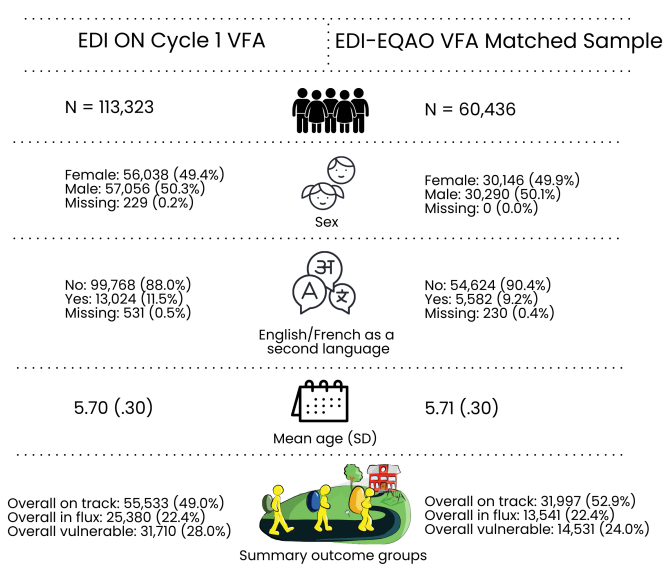
The Cycle I EDI data collection was rolled out across all Ontario school boards over a three-year cycle (2004, 2005, 2006), with each school board represented only once, and matched with corresponding Grade 3 EQAO data (years 2008, 2009, 2010).

The matching process utilized a deterministic approach and involved a variety of individual demographic variables (gender, day/month/year of birth, E/FSL variables, self-identified as Indigenous), as well as school and school board identifiers. The matching process was subject to some limitations. In particular, the lack of successful match could have been caused by:

1. Child has moved schools from kindergarten to Grade 3;
2. Date of birth information missing from Grade 3 EQAO collection in 2007/2008;
3. Student did not complete the Grade 3 EQAO tests (e.g., granted an exemption due to needing special educational assistance or being an English Language Learner);
4. Student moved between districts or out of province.

There was a total of 65,680 successful matches from the Ontario EDI Cycle I data set to the EQAO Grade 3 data set, representing a match rate of 52.6% of the EDI Cycle I population. This sample of unique matched EDI-EQAO Grade 3 records were then linked to corresponding EQAO Grade 6 test scores, resulting in a matched dataset of 64,192 children. When applying the EDI inclusion criteria previously discussed, the final EDI-EQAO Grade 3 - Grade 6 sample was 60,436. There were some differences in the demographic distribution between the Ontario Cycle 1 valid for analysis population and the valid for analysis EQAO-matched sample. The percentage of females was slightly higher (49.9%) and there was a lower percentage of children identified as E/FSL (9.2%) in the EDI-EQAO matched sample (Figure 3). There was only a slight age difference (5.71 years v. 5.70 years) between the ON Cycle I VFA population and the EQAO-matched valid for analysis sample. When looking at the summary outcome groups, the percentage of children was higher in the EQAO-matched valid for analysis sample for the overall on track (52.9%) and lower for the overall vulnerable group (24.0%). There was no difference between the percentage of children in the overall in flux groups (22.4%).

Figure 3. Demographic characteristics and breakdown of the summary outcome groups of the Ontario Cycle I VFA population and the matched EDI-EQAO VFA sample



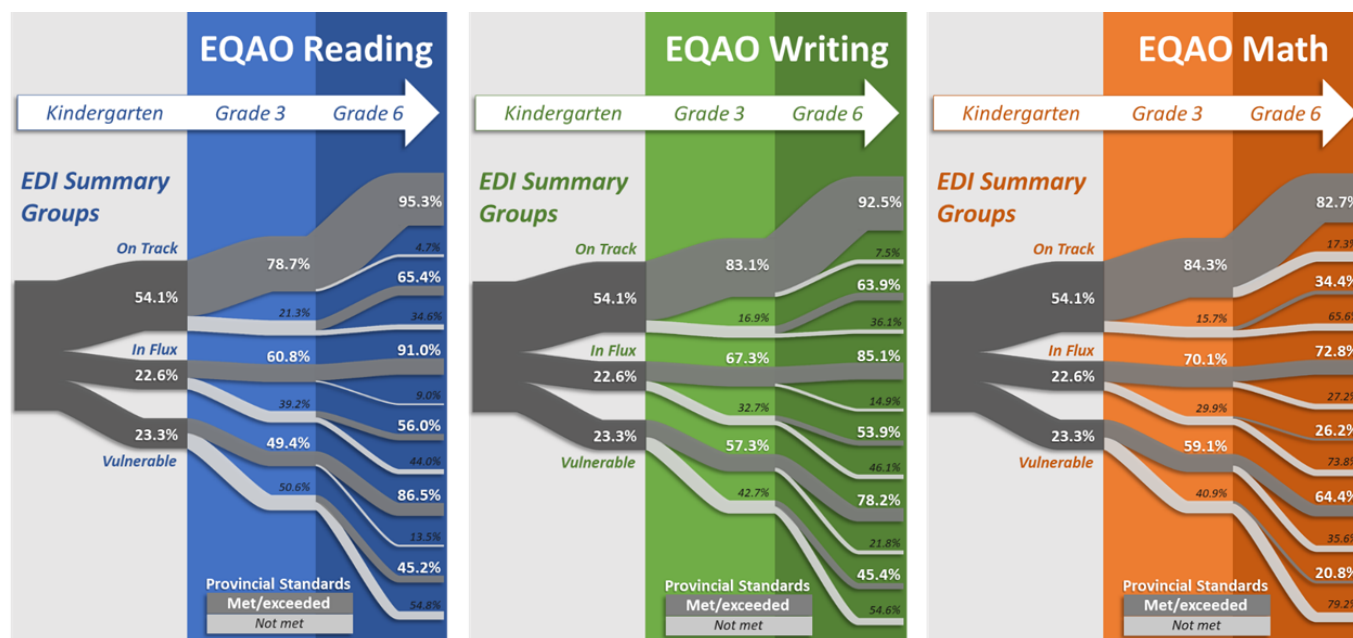
We next examined the demographic characteristics of the matched EDI-EQAO sample by overall summary outcome groups. Table 2 shows a pattern that is consistent with what was found in the Ontario Cycles I-V population.

Table 2. Demographic characteristics of the matched EDI-EQAO sample by summary outcome groups

		Overall on track		Overall in flux		Overall vulnerable	
Demographics		Count	%	Count	%	Count	%
All		31,997	-	13,541	-	14,531	-
Sex	Female	18,871	59.0	5,820	43.0	5,260	36.2
	Male	13,126	41.0	7,721	57.0	9,271	63.8
	Missing	0	0.0	0	0.0	0	0.0
E/FSL	No	30,095	94.1	12,231	90.3	11,966	82.3
	Yes	1,783	5.6	1,265	9.3	2,501	17.2
	Missing	119	0.4	45	0.3	64	0.4
Mean age (SD)		5.74	(0.29)	5.69	(0.30)	5.65	(0.30)

Of the three groups, we found that the largest percentage of children from the overall on track group met or exceeded provincial expectations in Grade 3 and 6 in reading, writing, and math; followed by the overall in flux group, and the smallest percentages in the overall vulnerable group (Figure 4).

Figure 4. Descriptive statistics of meeting or exceeding EQAO provincial standards in reading, writing, and math split by summary outcome group and EQAO grade-level



In order to establish relevance of the newly-defined groups, we ran statistical analyses (binary logistic regressions) to find out whether belonging to overall in flux or overall on track groups is predictive of academic success in Grade 3 and 6, controlling for sex, age, and E/FSL. For further information on the analytic sample for the regression analysis please see Appendix B.

Table 3 shows the results of the unadjusted and adjusted binary logistic regression examining the association between summary outcome group membership and children's performance on the three Grade 3 EQAO assessments. After controlling for age, sex, and E/FSL status, children in the overall in flux group had 1.5 to 1.6 times higher odds of meeting or exceeding Grade 3 provincial standards compared to children in the overall vulnerable group ($p < .001$). Children in the overall on track group had 3.3 to 3.8 times higher odds of meeting or exceeding provincial expectations in Grade 3 compared to children in the overall vulnerable group ($p < .001$).

Table 3 also shows the results of the unadjusted and adjusted binary logistic regression examining the association between summary outcome group membership and children's performance on the three Grade 6 EQAO assessments. Similar to the Grade 3 results, after controlling for age, sex, and E/FSL status, the overall in flux and overall on track groups had 1.7 to 1.8 times and 3.5 to 3.9 higher odds, respectively, of meeting or exceeding provincial expectations in Grade 6 reading, writing, and math compared to children in the overall vulnerable' group ($p < .001$).

Table 3. Binary logistic regression analyses examining the association between the summary outcome groups and meeting or exceeding Grade 3 and Grade 6 EQAO provincial expectations in reading, writing, and math.

EQAO assessments ^a		Grade 3				Grade 6					
		Unadjusted Odds Ratio (95% CI)		Adjusted Odds Ratio (95% CI) ^b		Unadjusted Odds Ratio (95% CI)		Adjusted Odds Ratio (95% CI) ^b		Adjusted Odds Ratio (95% CI) ^c	
Reading	Overall on track	3.78	(3.62-3.95)	3.44	(3.29-3.60)	4.20	(3.99-4.41)	3.94	(3.74-4.16)	2.54	(2.40-2.69)
	Overall in flux	1.59	(1.52-1.67)	1.53	(1.46-1.61)	1.79	(1.69-1.89)	1.76	(1.66-1.86)	1.56	(1.46-1.65)
Writing	Overall on track	3.66	(3.49-3.83)	3.26	(3.11-3.42)	3.96	(3.77-4.16)	3.54	(3.36-3.72)	2.59	(2.45-2.74)
	Overall in flux	1.54	(1.46-1.62)	1.50	(1.42-1.58)	1.66	(1.57-1.75)	1.65	(1.56-1.74)	1.49	(1.41-1.58)
Math	Overall on track	3.71	(3.55-3.89)	3.82	(3.64-4.01)	3.47	(3.32-3.62)	3.80	(3.63-3.97)	2.69	(2.56-2.83)
	Overall in flux	1.63	(1.55-1.71)	1.64	(1.56-1.73)	1.65	(1.57-1.73)	1.73	(1.65-1.82)	1.52	(1.44-1.61)

^a Reference group = Overall vulnerable group

^b Controlled for children's sex, age, and E/FSL status.

^c Controlled for subject-specific Grade 3 EQAO, children's sex, age, and E/FSL status.

Summary and Discussion

The objective of this report was to describe the development of two new overall outcome groups based on EDI results, provide descriptive characteristics of children in these groups, and offer a preliminary examination into the new groups' predictive validity in relation to academic outcome in Grades 3 and 6. EDI data from Cycles I to V in Ontario were used for the descriptive analyses and data from Ontario Cycle I, matched to EQAO data, were used for statistical analyses. We were guided by the need to establish more nuanced indicators of children's functioning in addition to the overall vulnerability. Of specific interest was the new overall in flux group, including children who had a score between the 10th and 25th percentile in at least one domain, but not below the 10th percentile (vulnerable) on any domain. Due to the necessary restriction of classifying the overall in flux group as those that were not vulnerable on any domains, we felt that it would be inappropriate to name this group "overall at risk", as there were children who had scores in the at risk category in as many as four domains that were not captured in this group due to this definition. We felt that the overall in flux name better reflected the potentially changeable nature of these children's developmental status.

We found that almost half of the children (49.4%) were classified as overall on track, and one in five (21.6%) as overall in flux. Considering a vast amount of evidence indicating that children who are overall vulnerable are more likely to be males, be English/French learners and be younger than children who are not overall vulnerable (Brinkman et al., 2012; Canadian Institute for Health Information, 2014; Collie et al., 2019; Curtin et al., 2013; Dennaoui et al., 2015; Gagné et al., 2020; Guhn, Milbrath, & Hertzman, 2016; Webb et al., 2020), we expected that the overall on track group would include more females, fewer children with E/FSL status and older children. It was somewhat surprising that the new overall in flux group included children in proportions almost exactly in the middle between the overall on track and overall vulnerable groups. Since these children were not vulnerable in any domains, it could have been expected that their demographic profile would be more similar to the overall on track group.

In Ontario, children in the overall in flux group were more likely to meet academic expectations in Grade 3 and 6 than overall vulnerable children, but less likely than children in the overall on track group, once again placing in between the other two groups.

Evidence from many jurisdictions supports the association between kindergarten children scoring below the 10th percentile on one or more developmental domains (i.e. vulnerability) and later poor health and academic outcomes (Brinkman et al., 2013; Davies et al., 2016; Davies et al., 2021; Duncan et al., 2020; Forget-Dubois, 2007; Guhn et al., 2016; Thomson et al., 2021). It is also important to explore the academic and social trajectories of children who are, at the time of school entry, overall on track or overall in flux in other provinces and territories in Canada beyond Ontario.

Conclusion

The descriptive and predictive characteristics of the two additional overall outcome groups have shown expected patterns in comparison to the overall vulnerable group. We expect that the addition of these two categories in describing the EDI results will provide a complementary level of nuance for understanding the developmental patterns in children at school entry. We recommend that the associations of these groups with children's concurrent and subsequent health, and academic outcomes continue to be explored at the national, jurisdictional, and regional levels to further understand children's varying developmental trajectories.

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Glossary

Special Needs: Children identified as needing special assistance in the classroom due to chronic medical, physical, or mental disabling conditions.

E/FSL: Children identified as having English or French as a second language.

Domains: The EDI measures children's developmental health across five domains:

- Physical Health & Well-Being - 13 questions
 - Children are healthy, independent, and rested each day.
- Social Competence - 26 questions
 - Children play and get along with others, share, and show self-confidence.
- Emotional Maturity - 30 questions
 - Children can concentrate on tasks, help others, show patience, and are not often aggressive or angry.
- Language & Cognitive Development - 26 questions
 - Children are interested in reading and writing, can count, and recognize numbers and shapes.
- Communication Skills & General Knowledge - 8 questions
 - Children can tell a story and communicate with adults and other children.

Domain Outcomes:

- **On track:** Children with scores above the 25th percentile of the distribution.
- **At risk:** Children with scores between the 10th and 25th percentiles of the distribution.
- **Vulnerable:** Children with scores below the 10th percentile cut-off of the distribution.

Summary outcomes groups:

- **Overall on track:** Children with scores above the 25th percentile cut-off on all five domains.
- **Overall in flux:** Children who fall above the 10th percentile on all 5 domains, but below the 25th percentile on at least one domain.
- **Overall vulnerable:** Children with scores below the 10th percentile cut-off on any of the five domains.

Ontario EDI data from Cycle 1: The first provincial EDI collection in Ontario from 2004-2006. Used as a reference for all subsequent EDI collections in Ontario. Vulnerability is based on cut-offs from this population.

Linked provincially: EDI questionnaires that have been matched by the Ontario government to a student information database. Only applicable to Cycles 4 and 5 of the EDI provincial data collections.

EQAO: The Education Quality and Accountability Office (EQAO). The EQAO administers assessments in reading, writing, and math completed by children attending publicly-funded schools in Ontario. The assessments used in this report were those administered in Grades 3 and 6. V

Valid for analysis (VFA): Questionnaires meet the criteria for being included in analyses, which include child is in Senior Kindergarten or Year 2 in Ontario, child has been in class for at least one month, child does not have a special needs diagnosis, and the questionnaire is at least 75% complete. For Cycles IV and V in Ontario, additional inclusion criteria were introduced that required the child be validated by the Ministry of Education.

Appendix A

Description of children not categorized in one of the three outcome summary groups

In the process of defining the EDI summary outcome groups, a small percentage of children (< 1% of the valid for analysis sample) were discovered to be missing one domain but had domain scores that fell into the on track category for the remaining 4 domains. The decision was made not to put these children in any group as we could not assume what score they may have received on the missing domain. Demographic characteristics of children who were 'Not Grouped' can be found in Table A2.

Table A2. Demographic descriptive statistics for Ontario Cycles 1-5 VFA Sample Split by Summary group.

Ontario Cycles 1-5 Valid for Analysis		All Children valid for analysis		Overall on track		Overall in flux		Overall vulnerable		Not Grouped	
Demographics		Count	%	Count	%	Count	%	Count	%	Count	%
All		593,503	-	293,137	49.4	128,118	21.6	169,902	28.6	2,346	0.4
Sex	Female	293,742	49.5	172,105	58.7	56,660	44.2	63,679	37.5	1,298	55.3
	Male	299,486	50.5	120,910	41.2	71,398	55.7	106,130	62.5	1,048	44.7
	Missing	275	0.0	122	0.0	60	0.0	93	0.1	0	0
E/FSL	No	516,865	87.1	267,220	91.2	110,750	86.4	136,857	80.6	2,038	86.9
	Yes	74,593	12.6	24,945	8.5	16,903	13.2	32,454	19.1	291	12.4
	Missing	2,045	0.3	972	0.3	465	0.4	591	0.3	17	0.7
Mean age (SD)		5.68	(0.3)	5.72	(0.29)	5.67	(0.29)	5.63	(0.30)	5.71	0.30

In order to have a better understanding of the Not Grouped children, we used the matched EDI-EQAO sample containing Grade 3 and Grade 6 EQAO results and compared children in each summary outcome group to the Not Grouped children. Results are presented in Table A3. Results suggest that the Not Grouped children's scores are most similar to those of the overall on track group. This is especially clear for the Grade 6 results where differences between the percentages of children meeting or exceeding provincial expectations in the overall on track and Not grouped children ranged from as low as 0.1% for Reading to 3.9% for Math. In Grade 3 these differences were larger (4.6% to 6.4%). Overall, a higher percentage of Not Grouped children met or exceeded provincial standards for all EQAO subjects at each grade level than either of the overall in flux or overall vulnerable groups.

Table A3. Descriptive statistics of meeting/exceeding EQAO provincial standards in Reading, Writing, and Math split by summary outcome group and EQAO grade

Ontario Cycles 1-5 Valid for Analysis		Overall on track		Overall in flux		Overall vulnerable		Not Grouped	
Demographics		Count	%	Count	%	Count	%	Count	%
All		31,997	52.9	13,541	22.4	14,531	24.0	367	0.6
Grade 3	Reading	24,402	76.3	7,890	58.3	6,634	45.7	263	71.7
	Writing	25,763	80.5	8,742	64.6	7,745	53.3	272	74.1
	Math	26,784	83.7	9,350	69.0	8,194	56.4	289	78.7
Grade 6	Reading	28,297	88.4	10,353	76.5	9,121	62.8	324	88.3
	Writing	27,916	87.2	10,030	74.1	8,939	61.5	316	86.1
	Math	23,919	74.8	7,889	58.3	6,442	44.3	289	78.7

Based on the above, we concluded that the distribution of scores for the Not Grouped children were similar to the Overall on track group, making it appropriate to combine these children into the overall on track group for future research purposes. However, for clarity in reporting, we chose to leave these children as missing when reporting on the three summary outcome groups.

Appendix B

Analytic sample for the regression analyses

When examining the association between the summary outcome groups and later academic achievement, 3,666 cases were missing data for at least one variable included in the regression analyses, which led to their exclusion from the analyses. Removal of these cases resulted in a small increase in average age (5.68 to 5.71), an increase in the percentage of children in the overall on track' group (52.9% to 54.1%), and an increased percentage of children meeting or exceeding provincial expectations on the three EQAO assessments in both Grades 3 and 6 (see table A3 for details). Figures A1-A3 represent the percentage breakdown of subject-specific EQAO performance in Grade 3 and subsequently in Grade 6 based on EDI summary outcome group membership.

Table A3. Demographic characteristics, frequencies of summary outcome group, and frequencies of children meeting provincial expectations on the EQAO assessments for the EDI-EQAO matched sample and the sample used in the regression analyses.

		EDI-EQAO matched sample		Sample used in the regression analyses	
Demographics		Count	%	Count	%
All		60,436	-	56,770	-
Sex	Female	30,146	49.9	28,399	50.0
	Male	30,290	50.1	28,371	50.0
	Missing	0	0	0	0
E/FSL	No	54,624	90.4	51,486	90.7
	Yes	5,582	9.2	5,284	9.3
	Missing	230	0.4	0	0
Mean age (SD)		5.68	(.30)	5.71	(.29)
Summary outcome group		Count	%	Count	%
	Overall on track	31,997	52.9	30,723	54.1
	Overall in flux	13,541	22.4	12,839	22.6
	Overall vulnerable	14,531	24.0	13,208	23.3
	Not grouped	367	0.6	0	0
Met/Exceeded provincial expectations on EQAO assessments		Count	%	Count	%
Grade 3	Reading	39,189	64.8	38,511	67.8
	Writing	42,522	70.4	41,725	73.5
	Math	44,617	73.8	42,694	75.2
Grade 6	Reading	48,095	79.6	45,901	80.9
	Writing	47,201	78.1	45,019	79.3
	Math	38,359	63.8	36,791	64.8