

Executive Summary

The objective of this study was to determine which factors may be most impactful for students entering kindergarten to set them up for success, measured as graduating from high school. The resulting analysis showed that the factor most strongly associated with graduation was not academic performance or attendance, but rather a student's socioeconomic status, as measured by free/reduced lunch status. The gap in graduation rates between students on free/reduced lunch and their peers not on free/reduced lunch could be narrowed, but not eliminated, with high attendance and strong academic performance. Additional data sets are needed to more fully understand what factors underlying a student's socioeconomic status are most impactful to allow for more targeted interventions.

Introduction and description of data

The objective of this study is to determine which factors for students entering kindergarten are most strongly associated with high school graduation. In effect, what are the most important characteristics of students entering K-12?

Students were included in this study if they entered a North Dakota Kindergarten during the 2009-10 through the 2012-13 school years and graduated or dropped out of a North Dakota high school. Additionally, students must have taken the Fall NWEA assessment in both reading and mathematics during their Kindergarten year. 8,796 students met these criteria and were included in the study.

Differentiating Kindergarten factors in graduation rates

To begin to untangle the various factors potentially associated with high school graduation, the following factors were considered. Again, these are factors that are measured near the beginning of a student's K-12 experience and therefore provide an early indication of student characteristics. These factors include:

- Gender
- Ethnicity
- IEP status
- Free/reduced lunch status
- NWEA Mathematics national percentile
- NWEA Reading national percentile
- Kindergarten attendance rate

Table 1: Overall Kindergarten characteristics of students in the study

Male %	Free/Reduced Lunch %	IEP %	Math Percentile	Reading Percentile	Graduation Rate	Count
51.0%	25.0%	9.6%	59.7	59.9	94.6%	8796

A decision tree model was created to determine which of these Kindergarten factors were most strongly associated with high school graduation. The decision tree model is shown below. Note that this does not indicate that some factors had no association with high school graduation, simply that they were not as influential in splitting students into groups of graduates and non-graduates.

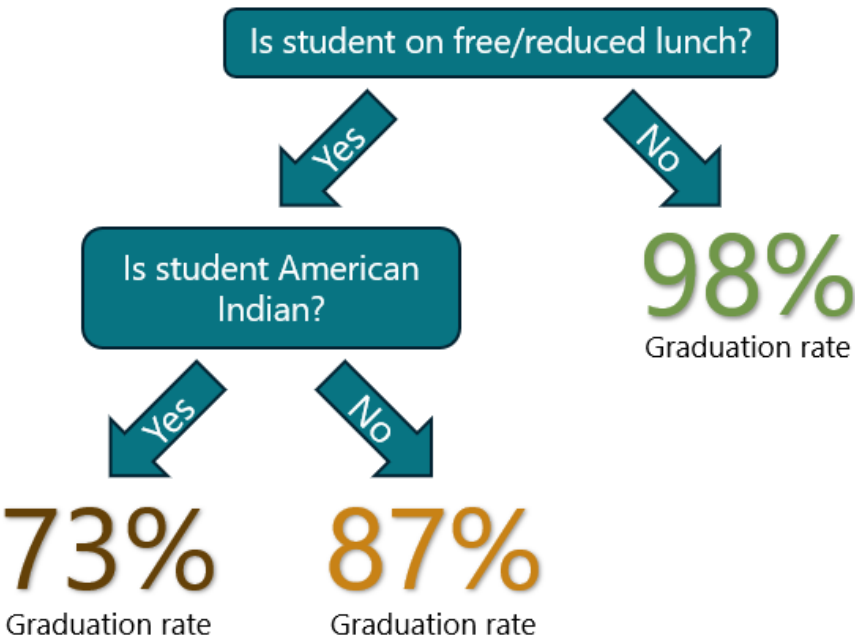


Figure 1: Decision tree model for predicting graduation based on Kindergarten factors

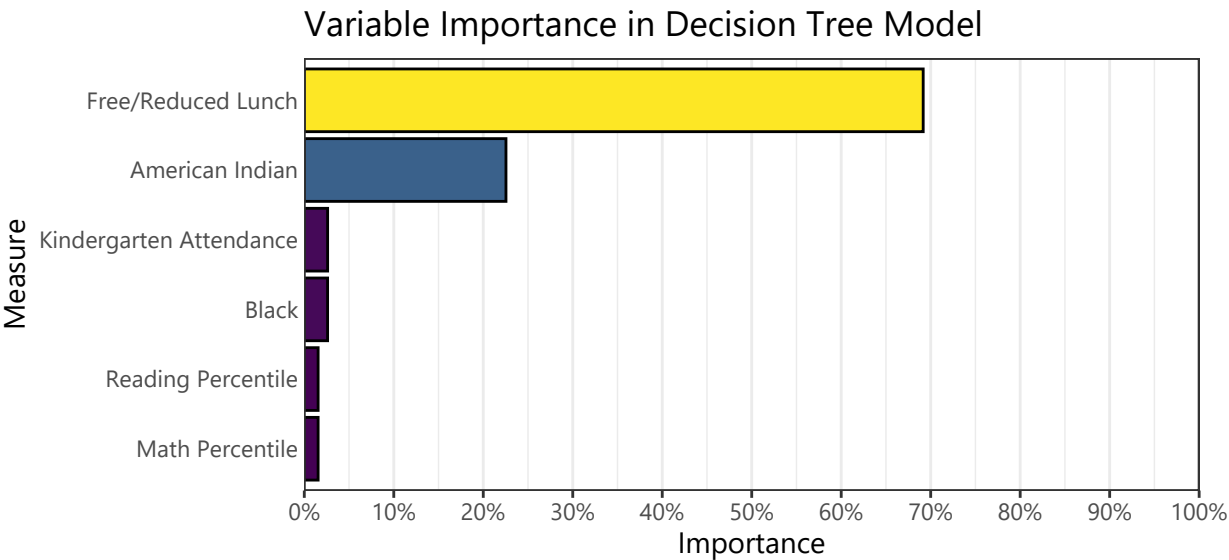


Figure 2: Variable Importance in Decision Tree Model

As Figures 1 and 2 illustrate, the most influential factor in predicting whether or not a Kindergarten student graduates from high school is the student’s socioeconomic status, as measured by free/reduced lunch status. Students entering Kindergarten not on free/reduced lunch eventually went on to graduate high school 98% of the time. However, among students on free/reduced lunch, the graduation rate varied depending on whether the student was American Indian: 87% for students who were not American Indian and 73% for American Indian students. These figures are all irrespective of the student’s academic performance, as measured by their Fall Kindergarten NWEA Reading and Mathematics scores, which played a relatively small role in predicting a student’s likelihood of graduating, primarily because they were strongly correlated with the other factors.

Further analysis of free/reduced lunch status

While free/reduced lunch status is an important factor, it certainly is not the only one. Next, graduation rates were analyzed by both free/reduced lunch status and fall Mathematics and Reading percentiles. This was done to investigate whether increasing academic performance closes or negates any gap in graduation rates between students on free/reduced lunch and those not on free/reduced lunch.

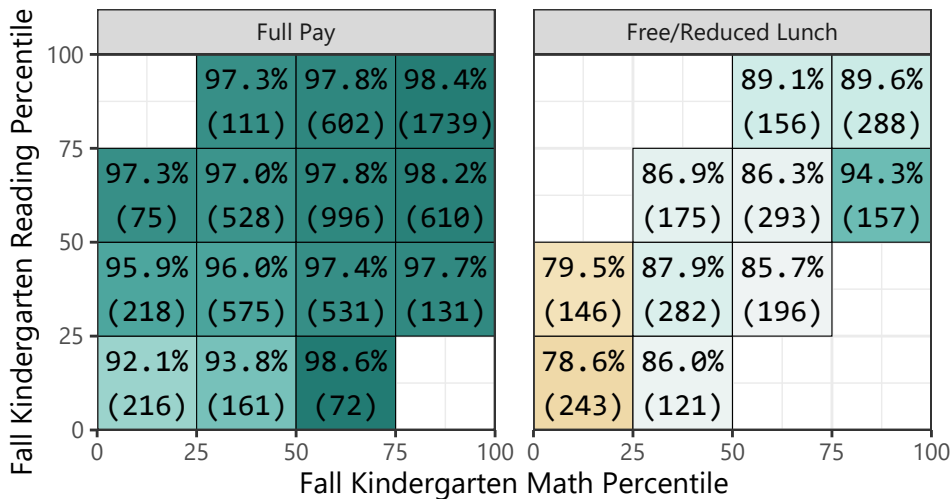


Figure 3: Graduation rates by kindergarten assessment and free/reduced lunch status

The figure above shows that even if students on free/reduced lunch performed above average in Mathematics and Reading, they still graduated at a lower rate than students **below** average in Mathematics and Reading who were not on free/reduced lunch. This indicates that free/reduced lunch status is a strong factor associated with whether or not a student graduates from high school, and that academic performance alone does not eliminate this difference. If a student on free/reduced lunch performed well academically, they graduated more often than if they performed poorly, but still at a lower rate than their similar peers not on free/reduced lunch.

This is not to suggest that factors such as attendance and academics do not matter. As the figure below illustrates, as attendance rates and academic performance increase, graduation rates increase for students, both those that are on free/reduced lunch and those who are not. However, it also continues to illustrate that across all factors, students on free/reduced lunch graduate at a lower rate than their peers not on free/reduced lunch. With stronger academics and attendance rates, that gap *does* narrow.

Predicted Graduation Rate by Kindergarten Attendance Rate and Free/Reduced Lunch Status

For students with indicated percentile ranks in Reading and Mathematics

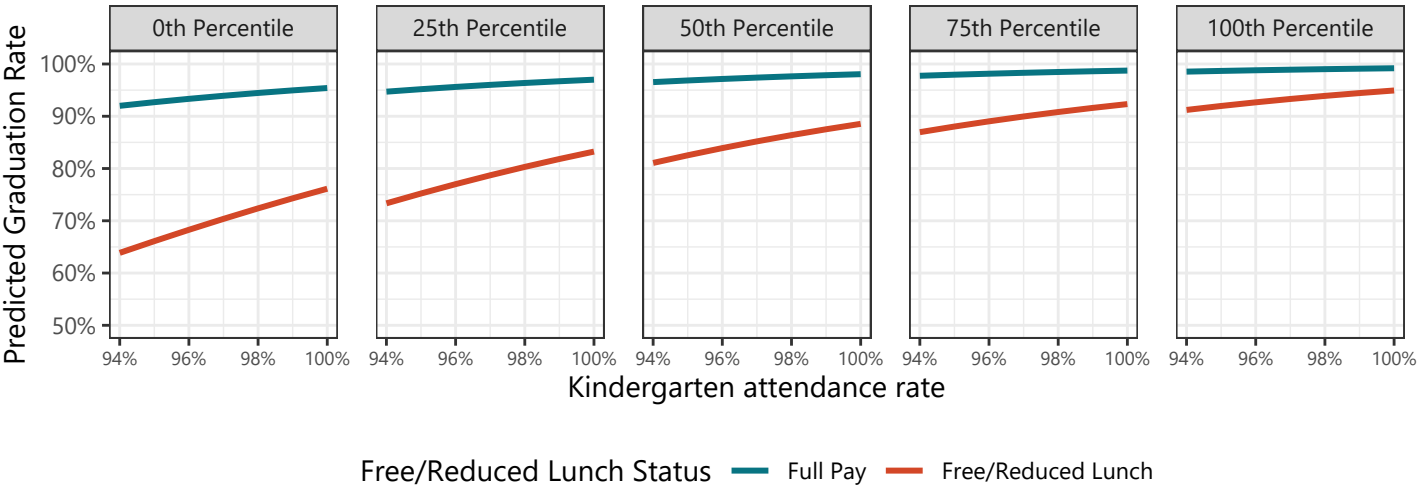


Figure 4: Predicted Graduation Rate by Kindergarten Attendance Rate, Free/Reduced Lunch Status, and Math/Reading percentile

Cluster analysis of students in the study

To further examine the characteristics of students in the study, a clustering analysis was performed. This is a statistical technique that helps determine if naturally occurring groups of students exist based on their characteristics. Rather than focusing on individual factors, this analysis groups students with similar combinations of characteristics.

This cluster analysis expanded beyond Kindergarten to include student performance in first and second grades as well. Note that this section of the analysis required continuous assessment results in grades K-2; as such, the total number of students for this analysis was 6,449. Additionally, the number of school district moves the student experienced in those first three years of school was included. Once these six clusters were discovered, the graduation rate and 9th grade GPA of each cluster were summarized. The following tables shows the characteristics of each cluster.

Table 2: Cluster characteristics

Cluster	Count	Male %	Am.Ind. %	FRL %	IEP %	K Att.	1st Att.	2nd Att.	Grad. %	Gr.9 GPA
1	1986	0.0%	1.4%	3.3%	1.3%	97.1%	97.2%	97.3%	98.8%	3.637
2	1867	100.0%	1.5%	3.3%	2.4%	97.1%	97.2%	97.3%	98.4%	3.382
3	861	54.1%	2.4%	11.8%	1.4%	97.0%	97.2%	97.2%	95.4%	2.887
4	539	67.7%	6.9%	48.1%	90.4%	96.0%	96.2%	96.5%	91.5%	2.819
5	859	47.4%	6.2%	92.4%	4.1%	96.2%	96.7%	97.0%	89.6%	2.897
6	337	49.3%	60.5%	84.6%	9.5%	91.3%	92.1%	92.6%	69.4%	2.177

Table 3: Cluster characteristics (cont.)

Cluster	Count	# Moves	Math K	Math 1	Math 2	Read K	Read 1	Read 2	Grad. %	Gr.9 GPA
1	1986	1.05	81.7	81.0	75.6	82.8	82.9	77.3	98.8%	3.637
2	1867	1.06	83.6	85.0	81.1	81.7	81.1	75.6	98.4%	3.382
3	861	1.07	48.2	46.0	40.3	49.8	44.4	37.5	95.4%	2.887
4	539	1.13	54.5	51.3	48.0	55.0	49.3	44.5	91.5%	2.819
5	859	1.15	71.8	71.1	65.8	72.0	71.6	66.8	89.6%	2.897
6	337	1.37	50.6	45.7	45.2	50.9	47.2	46.8	69.4%	2.177

Six naturally occurring pockets (or clusters) of students were identified in the study. The clusters are differentiated by their characteristics, including gender, ethnicity, free/reduced lunch status, IEP status, attendance rates, academic performance, and graduation rates. The clusters are summarized in the table above.

Clusters 1 and 2: High performing, low risk students

Clusters 1 and 2 consisted primarily of non-Native American students overwhelmingly not on free/reduced lunch or IEP. These students had very high Mathematics and Reading national percentile results and a low number of school district moves. These students had the highest graduation rates and 9th grade GPAs among all six clusters.

Cluster 3: Average to low academic performance, low risk students

Cluster 3 consisted primarily of non-Native American students not on free/reduced lunch or IEP. These students had low Mathematics and Reading national percentile results compared with the other clusters, but these low academic results did not appear to have a dramatic effect on their graduation rates, which remained relatively high at 95.4%. This further illustrates that early academic performance alone does not explain differences in high school graduation rates, while socioeconomic factors are more strongly associated with those outcomes.

Cluster 4: Average academic performance, high proportion of students with IEPs, moderate proportion of students on free/reduced lunch

Cluster 4 overwhelmingly contained the students on IEPs. Here, we see the first major dip in graduation rates, to 91.5%. Their attendance rates and assessment scores are fairly average - at this point, the cluster's lower graduation rate and GPA may be related to its high percentages of students on IEPs and free/reduced lunch.

Cluster 5: High proportion of students on free/reduced lunch

Cluster 5 is one of the most interesting. These students have reasonably high attendance along with strong academic performance. Yet, their graduation rate is the second lowest of any cluster at 89.6%. On paper, these students appear to be high performing, low risk students. The most notable characteristic distinguishing this cluster from the other high-performing clusters is its high proportion of students on free/reduced lunch. This is another indication that socioeconomic status is strongly associated with whether or not a student graduates high school.

Cluster 6: High proportion of American Indian students

Cluster 6 had a substantially higher proportion of American Indian students when compared with other clusters, a majority of which were also on free/reduced lunch. These students show notably lower than average attendance coupled with average academic performance. However, their graduation rate is by far the lowest at 69.4% with a 9th grade GPA of 2.177.

Graduation rates by academic performance in later elementary

To further examine the relationship between socioeconomic status and academic performance, but in later elementary, student assessments were examined in grades 3 and 5, similar to the way the fall Kindergarten assessments were at the beginning of this study.

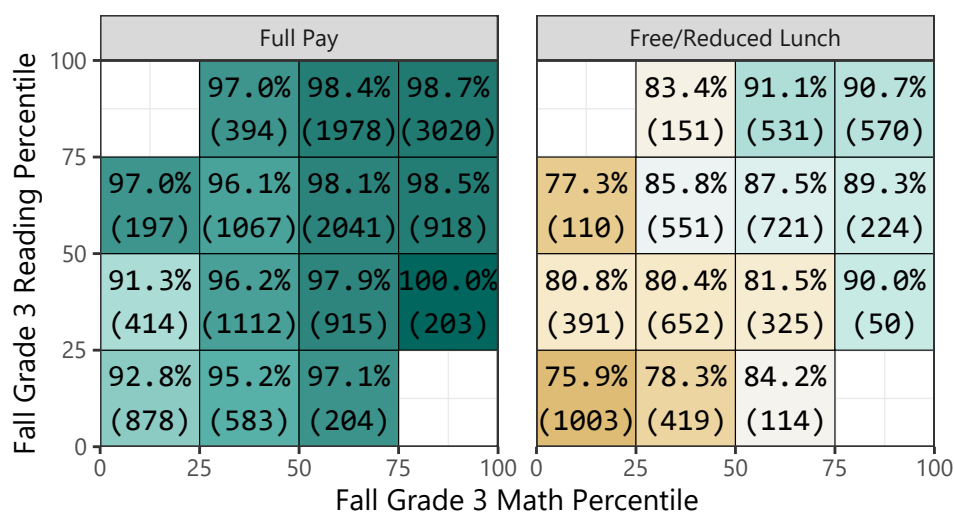


Figure 5: Graduation rates by 3rd grade assessment and free/reduced lunch status

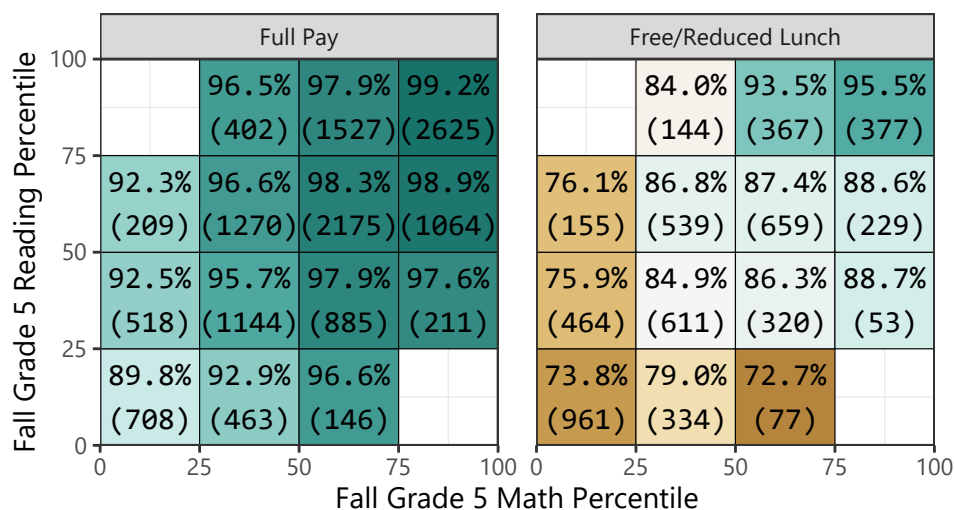


Figure 6: Graduation rates by 5th grade assessment and free/reduced lunch status

Figures 5 and 6 on the preceding page continue to illustrate the differences in graduation rates between students on free/reduced lunch and those who are not. By grade 5, students on free/reduced lunch are graduating at rates in the 90%+ range only if they are performing well academically, while students not on free/reduced lunch are graduating at rates *below* the 90% range only if they are performing poorly academically. This continues to demonstrate that socioeconomic status is strongly associated with graduation rates. While higher academic performance appears to narrow this gap, it takes a high level of academic performance to do so.

Conclusion

This analysis begs the question: “What now?” The analysis shows that free/reduced lunch status is strongly associated with whether or not an entering kindergarten student graduates from high school. While academic performance and attendance are also associated with graduation, the relationship is not as strong as the relationship between free/reduced lunch status and graduation. However, free/reduced lunch is merely a proxy variable for a student’s socioeconomic status. It does little to explain the underlying reasons for a student’s decreased likelihood to graduate from high school, and as such, provides a very wide target for intervention.

Ideally, further research would be conducted using additional data sets. Any data set that sheds additional light on a student’s socioeconomic status would be invaluable in determining a more specific target for intervention. This could potentially include information such as:

- Family income
- Family structure (single parent, two parent, etc.)
- Parent education level
- Parent employment status
- Parent incarceration status
- Parent substance abuse status
- Parent mental health status
- Parent physical health status

In the absence of additional data, the current data shows that higher graduation rates for students on free/reduced lunch are associated with high attendance and strong academic performance, although these factors do not eliminate the gap between students on free/reduced lunch and their peers who are not on free/reduced lunch. As such, interventions that focus on improving attendance and academic performance for early elementary students on free/reduced lunch may be the most effective in improving graduation rates in North Dakota.