

May 20, 2018

Overview

This update reports on the Enrollment Projections Working Group's review of the methodology currently used by the Public Schools of Brookline in its annual enrollment projections.

The Public Schools of Brookline (PSB) made annual enrollment projections each school year since 2016-17 using the same methodology. Each year these projections are intended to be used only for planning purposes as they are estimates of future populations. Prior to the School Department producing enrollment projection reports beginning in FY 2017, Town efforts on enrollment projections included the study done by MGT in 2009 and updated in 2011, by the Brookline School Population and Exploration Committee (B-SPACE) in 2013, and by the 2014 Override Study Committee.

As has been stated in each of its annual Enrollment Projection Reports, PSB will continue to analyze and update its methodology as needed in order to be as accurate and precise as possible in their projections. This update provides specific recommendations on possible next steps for updating the methodology.

As a result of the November 27, 2018 presentation of the SY 2018-19 enrollment projections data to the Ad Hoc Subcommittee of the Advisory Committee, PSB decided to convene an Enrollment Projections Working Group (EPWG) to consider concerns raised about the reliability of using Birth to K progression rates as the primary driver of our enrollment projections and to consider improving the enrollment projection methodology and process for PSB enrollment projections moving forward. Some important questions the group decided to tackle were:

- How accurate and precise is PSB's current enrollment projection methodology for predicting each K enrollment and grades 1-12 enrollment?
- What approaches have communities used to project school enrollment?
- Are there more effective ways school enrollment projections can be done?
- How can we get more complete data about incoming students between the ages of birth and 5?

To answer these questions, the EPWG spent three meetings analyzing data, learning from an experienced enrollment projection analyst, reviewing enrollment projections from other communities, and reviewing internal Brookline and PSB documentation.

The members of the Enrollment Projections Working Group are:

- Cliff Brown - Advisory Committee Member, Town Meeting Member, Member of the Brookline Fiscal Advisory Committee
- Ruth Quinn Burdell - Expert Consultant on School District Enrollment Projections
- Erin Cooley - Director of Data Analysis & Information Management, Public Schools of Brookline
- Ben Lummis, -Special Assistant to the Superintendent for Strategy & Performance, Public Schools of Brookline
- Nathan Shpritz - Town Meeting Member, Member of the Brookline Fiscal Advisory Committee
- Mike Toffel, Town Meeting Member, Member of the Brookline Fiscal Advisory Committee

Data and Information Review

To determine whether to recommend a methodology modification for PSB's enrollment projections, the EPWG analyzed current and historic data on PSB enrollment and residents.

- I. Brookline Historical Birth Data
- II. METCO and Materials Fee kindergarten Enrollments Over Time
- III. PSB Mobility Rate Over Time
- IV. Actual School Enrollment Over Time

Backcasting

To assess the accuracy and precision of enrollment projections based on PSB's current methodology, the EPWG used "backcasting" by applying the current methodology¹ to prior years' data. This process generated enrollment projections for prior years, and enabled the group to compare those projections to actual enrollment numbers. The group ran a similar backcasting exercise using three- and four-year rolling averages of actual kindergarten enrollment and noted that this approach was not any more accurate than the currently used methodology.

Through the backcasting process, the EPWG drew three conclusions:

- 1) Kindergarten enrollment is the primary driver of the year to year variation in our elementary school population and carries forward to and through high school. Because the grade 1 – 12 progression rates are so close to 1 and vary so little, once a kindergarten class size is established, a cohort of approximately the same size will graduate almost thirteen years later.
- 2) Because of the above observation, the EPWG spent most of its time studying the size and projections of each kindergarten class. The EPWG determined that the number of Brookline births does not predict kindergarten class size five years later. Prior kindergarten class enrollment also fails to account for year to year variation in the size of the total kindergarten class.
- 3) Through the backcasting process it became clear that both methodologies (birth to K progression rates or averages of recent actual K enrollments) are inaccurate predictors of Brookline's K enrollment between September 2005 and September 2018. Birth based kindergarten class size forecasts were uniformly low through the early part of the study period and uniformly high in the latter part of the period. In other words, the EPWG's review found that both approaches underestimated kindergarten enrollment for the years 2010 to 2014 and overestimated kindergarten enrollment between 2015 and 2019. The largest *underestimate* was when the methodology was applied to data available in SY 2011-12, which predicted SY 2012-13 K enrollment to be 557 whereas actual K enrollment was 666, an underestimate of 109 students.

¹ This backcasting applied the methodology used in the 2016-17 report and the corrected projections from the 2017-18 report. In this methodology students in the METCO and Materials Fee programs were included only when creating the birth to kindergarten progression rate.

The largest overestimate was when the methodology was applied to data available in SY 2015-16, which predicted SY 2016-17 K enrollment to be 671 whereas actual K enrollment was 582, an overestimate of 89 students. While the birth to kindergarten methodology may be effective for many communities it is not effective for Brookline.

Methods from Other Communities

There does not seem to be a consensus among other communities in Massachusetts on a specific methodology as a variety of methods are used between and even within districts. In speaking with an experienced enrollment projection analyst, the EPWG learned that projections typically work best when the school department and Town collaborate to have a better understanding of their population. Instead of solely using birth counts to predict kindergarten enrollment, some towns including Lexington rely more heavily on census records and keep close track of children from birth to five years old to help gain an understanding of how many five year-olds are likely to enroll in kindergarten in a specific year. Knowing the residency patterns of these families, and working with the Town Clerk's office to obtain this information make projections more reliable in those communities. Towns that do not have strong census and/or database for children ages birth to 5, often use other methods including a rolling average of historic kindergarten enrollment to project enrollment. In different years, [Cambridge](#) has used either birth to kindergarten progression rates or a combination of kindergarten progression rates and historical data in making its annual enrollment projections. Cambridge limits their annual enrollment projections to five years.

Communities that use different methodologies than Brookline also struggle with the accuracy and precision of their estimates which can lead them to seek outside expert guidance to develop projections. As recently as this school year, Newton released its [annual enrollment projection](#) report in November 2018. In the past Newton has used incorporated city census data on four-year old children in its methodology. In recent reports including its 2018 report, Newton used the four-year average of recent kindergarten enrollment to project its kindergarten enrollment and limited its projection to five years. Like Brookline, Newton is facing a series of potentially large scale housing developments. City officials and residents wanted further detail on the possible enrollment impact of the planned housing developments and did not feel that the Newton School Department had the internal capacity to incorporate the numerous economic, real estate, and demographic considerations required for such an analysis. As a result, Newton hired two firms to collaborate on a more complex [Demographic Study Report](#) that considered a wider range of variables including fertility rates, mortality rates, in- and out-migration, changes in median age, rate and price of existing home sales as well as specific economic assumptions. Further the more detailed demographic forecast used these data disaggregated across school zones to develop specific enrollment projections for each school zone.

Limitations

The methodology currently used by PSB is largely reliant on strong projections for incoming kindergarten classes. Because the grade 1-12 progression rates are more easily calculated based on historical data and are fairly stable, PSB can make more reliable future projections in these grades based on the prior grade's actual enrollment. However, the kindergarten projections are based on births from

five years before and do not take into account the comings and goings of families in the five years between birth and enrollment in kindergarten. If the District and Town can develop a better understanding of population trends of families with children between birth and 5, it would likely lead more reliable projections.

Other limitations of school enrollment projections include their ability to accurately predict enrollment at times when birth rates or enrollment rates are changing their rate of growth or decline, when birth or enrollment trends are changing rapidly, and beyond five years out when prospective children are between one and five years from even being born. In Brookline birth data is changing rapidly, making projections particularly difficult to anticipate with reliability in the out years where children are not born yet. Evidence of the recent variation in births to Brookline mothers includes:

- 2012-13 had the highest number of births (706) in Brookline since before 1999. (These students entered kindergarten in September 2018)
- Just five years later, Brookline had its lowest number of births since before 1999 (548)
- The five years from 2010-11 to 2014-15 had the five highest 3-year trailing birth averages of any 3-year period since 1999
- Immediately following those five years of high 3-year average births, the years 2015-16 to 2017-18 had three of the four lowest 3-year average birth numbers since 1999

The current methodology also does not account for larger demographic trends, particularly those described in the [Massachusetts Area Planning Council's 2014 report](#), including the ongoing and long term resurgence of urban communities like Brookline, the aging of the baby boomer generation and a likely "senior sell-off" of housing that will continue to open up single and multi-family housing for younger families, and the predicted growth of school-age children in "Inner Core" communities such as [Brookline](#).

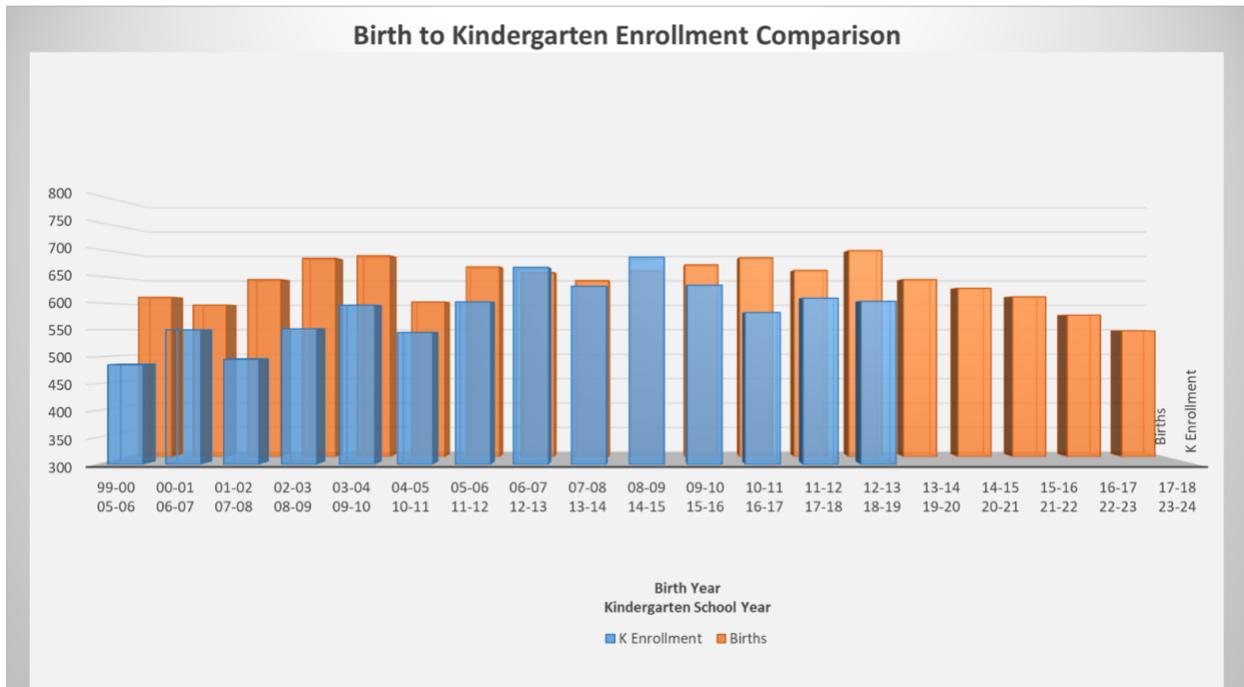
Conclusion

For the reasons listed above, the Enrollment Projection Workgroup believes the currently used birth to kindergarten progression rate methodology should not be used further in Brookline. Further, the EPWG recommends that the current long term projections should not be relied upon.

RECOMMENDATIONS FOR FUTURE REPORTING

Update Birth to Kindergarten Progression Methodology

Although the birth to kindergarten progression method is the best we have available given the data the School Department has access to, and one other districts subscribe to, the below chart highlights how using births to project kindergarten enrollment can be challenging in Brookline. In this chart, the blue bar represents actual Kindergarten enrollment and the orange bar represents number of births for that Kindergarten enrollment year (children that will be 5 years old by August 31). As EPWG determined, and the chart below shows, Brookline’s birth to kindergarten progression rate is volatile and the year to year changes are unpredictable.



There are many factors that alter a family’s trajectory before a child enters kindergarten at age five. Housing costs, real estate availability, job market, schools, and other matters all play a role in where a family makes their home and where their children attend school. Many of these factors can change multiple times between the time children are born and the point where they are ready to enter school. The following recommendations will help deepen the School Department and Town’s understanding of families and children between the ages of birth and five, thereby strengthening our projections of incoming kindergarten classes which in turn will help make total enrollment projections more accurate.

1. Town Clerk and School Department Work Together to Improve the Birth to Five Census

Under Massachusetts General Law (M.G.L) Chapter 51, Section 4, a yearly town census is mandated. The Town Clerk conducts the annual census of all Brookline’s households and publishes the results in a printed residents’ list (commonly known as the "Street List"). The publication contains an alphabetical-numerical list of all residents seventeen and older, as of January 1st of each year. The Town Census collects “the name, date of birth, occupation, veteran status, nationality, if not a

citizen of the United States, and residence on January 1 of the preceding year and the current year, of each person three years of age or older residing in their respective cities and towns.”

In addition, as part of the census, “A list of all persons 3 to 21 years of age, inclusive, shall be transmitted by the board of registrars to the respective school committee not later than April 1 of each year. The list shall contain the name, residence and age or date of birth of each such person; but the names of persons 3 to 16 years of age, inclusive, shall not be disclosed to any person other than the respective school committee or board of trustees of a county agricultural school or a police department.” The School Department would benefit from getting this information from the Town Clerk annually.

As stated previously, the EPWG learned that projections work best when a school department and town work in collaboration to have a better understanding of the population between birth and 5 years old. The more reliable and accurate the Town of Brookline census data for children between the ages of birth through age 5, the more accurate kindergarten enrollment projections will become, at least in the short term. This information could also help the Town identify patterns of churn (when families come in and out of the Town) in order to better predict life cycles moving forward.

Recommendations to strengthen the birth to five census include:

- The School Department and Town Clerk’s office should collaborate to strengthen the records on children age birth to 5 who live in the town by creating a database that is a joint record of school enrollment and census data. Creating this type of record would require a number of steps including:
 - The Town identifying how census and residency records are currently stored, maintained, and shared with other Town departments in order to determine what practices or applications need updating.
 - The Town creating rules and guidelines for data maintenance and data access especially when sharing records between Town departments.
 - The Town Clerk’s office making clear on annual census forms that residents must include all of their children on the form and the form must be returned by a specific deadline.
 - The Town Clerk’s office revising Town census forms so that all known household members (including children) are listed on the census form before it is mailed to help educate families that children should be reported as well.
 - The Town Clerk’s office adding the birth record to the family profile when births are given to the Town from local hospitals, so that the new child is included on family’s annual census form.
 - At the time of enrollment, the PSB Office of Student Affairs (OSA) should ask families if they have any other children (school age or not). If the family does indicate they have other children, OSA can update the family record by notifying the Town Clerk’s office to ensure the child gets added to the family record for census purposes.
 - The School Department should attempt to match, historically, incoming kindergarten students with older siblings and confirm whether any older sibling was a student the

prior year. In this way, the School Department could potentially estimate the number of younger siblings who may become kindergarten students and correlate those numbers with the additional census information indicated above. By following this approach, the School Department would understand an incoming kindergarten class as two cohorts: those with older siblings in PSB and those who are the first in their families to enroll. The Working Group believes that having better data on older and younger siblings could result in less variability in the projections.

2. Move from Point Projections to Ranges

The current report identifies each year of future projected enrollment as a single point on a graph and specific numbers in tables without any indication of the range of possible outcomes or any margin of error. This representation can give community members and Town officials the false confidence that the report represents known and expected outcomes rather than a projection of a possible future based on historical data. Given that there are challenges with the accuracy and precision of all known methodologies including the currently used one, using point estimates is unrealistic and creates confusion when communicating about the results.

Recommendations include:

- Adding error bars and/or ranges to the presentation of projection data to make it clear to community members that future enrollment falls within a range of possible outcomes, that the major trends should be used for planning purposes, and that the projections are not to be predictive of a specific outcome.

3. Use an External Consultant to Identify and Use a More Complex Methodology

While using birth to kindergarten progression and cohort survival rates are commonly used methodologies for enrollment projections, no single method is foolproof. The District could produce projections using a variety of methods (cohort survival using birth to K for kindergarten, cohort survival using a rolling average of kindergarten enrollment, linear regression, average percentage increase, etc.) and make a determination about which is the best fit for the Brookline population. Additional variables can also be used in making enrollment projections or forecasts including fertility and mortality rates, in and out migration, population age, home sales, housing conversions and construction, and long term demographic shifts. These data can be analyzed across the entire town and by each school assignment zone to identify how they may impact enrollment in different parts of the town. The School Department and Town departments do not have the level of expertise on staff to produce reports of this complexity.

Recommendations include:

- Engage an external consultant and/or firm to help the District strengthen the projection methodology and to develop a more detailed enrollment and demographic study that includes additional variables that might influence enrollment and demographic projections, and account for how we should consider those variables over time and across different regions of the town.

- Use an external firm to determine how the School Department can continue to make annual projections without relying on external support every year

4. Determine when METCO and Materials Fee Students are Included

If PSB continues with a modified methodology that includes birth to kindergarten progression rates in some way, there are two likely options for including non-resident students in the birth to kindergarten projections. Currently, the District includes students in the METCO and Materials Fee programs when calculating the progression rate as their enrollment in the District has been consistent over the past ten years. The EPWG discussed whether or not including non-resident students in the calculation of the progression rate or adding them after the progression rate is used to create projected enrollment would make a difference in the projections. The difference between the two methods proved to be inconsequential resulting in a less than 1% difference in K-8, 9-12, and K-12 projected enrollment each year. From input from the EPWG and during public discussions of enrollment projections the following recommendation is made.

Recommendation:

- Reconsider how non-resident students are incorporated in the enrollment projections in any birth to kindergarten based methodology by:
 - First calculating the birth to kindergarten progression without the METCO and Materials Fee population.
 - Then adding the historical average for kindergarten enrollment in these programs after the resident projection for kindergarten is calculated.

5. Surveying Licensed Pre-School and Day Care Centers Annually

In addition to improving birth to five census data, the EPWG discussed surveying licensed pre-schools and daycare providers in and around Brookline to identify children who live in Brookline but may not be on our census roles. With dozens and perhaps hundreds of such providers within the area, the time and cost of this effort would have to be carefully weighed against the potential benefit. It may be possible to begin a pilot to see whether or not a smaller, focused effort yields useful information.

TIMELINE FOR FUTURE REPORTING

The Enrollment Projections Working Group recommends that PSB and the Town begin working immediately on implementing the recommendations provided in this update. The Enrollment Projection Working Group recommends remaining with the same timeline for producing the annual Enrollment Projections Report and publishing a report in November each year. This timeline would allow PSB to continue using October 1 official enrollment data and annual September 1 to August 31 birth data, the time necessary to implement the recommendations of the working group prior to the 2019-20 report, and fits with the annual budget development process. If the School Committee decides to work with an external partner, this timeline would allow sufficient time for a public procurement process and the work necessary to revise the methodology and include a more complex set of input variables.