

Forecasting Educator Diversity in Massachusetts: Technical Appendix

In 2023, researchers at the Wheelock Educational Policy Center (WEPC) developed an analytic model to forecast the racial composition of the Massachusetts teacher workforce under several different hypothetical policy scenarios. These projections contributed to a research report published in 2024 by MassINC, in partnership with Latinos for Education, entitled "[In Pursuit of Greatness: Bold Strategies to Grow a Strong and Diverse Educator Workforce](#)." This technical appendix provides more details about WEPC's forecasting analyses used in the report.

Primary Research Questions

1. What will the racial/ethnic composition of the K-12 teacher workforce in Massachusetts look like through 2030 if recent hiring and turnover trends continue?
2. Above this baseline trend, to what extent would teacher recruitment and retention patterns need to change for the workforce to more closely reflect the demographic profile of the Massachusetts K-12 student population in 2030?

Part 1: Foundation Setting Trends

Key Insights

- The teacher workforce has been growing increasingly diverse over the last decade. However, given the rapid pace of changing student demographics, statewide gaps between students of color and teachers of color are likely to widen even as teacher diversity continues to increase. (Figure 1-1)
- Teachers of color comprised 18% of newly hired teachers in 2022, compared to 7% in 2011. This translates to an increase in overall teacher workforce composition from 7% teachers of color in 2011 to 10% in 2022. Much of the diversity among newly hired teachers in recent years comes from those entering through non-traditional pathways and/or under waived licensure requirements. (Figure 1-2)
- Teachers of color have historically had lower retention rates than white teachers, and these levels are projected to remain steady. Generally, retention rates are 86% for teachers of color and 90% for white teachers.¹ (Figure 1-3)

¹ Among teachers of color, Black teachers tend to have the lowest retention rates; however, the differences in retention rates between Black, Hispanic/Latinx, Asian, American Indian, and multiple-/other-race teachers are smaller than the overall difference between white teachers and teachers of color.

Figure 1-1: Trends in Teachers and Students of Color

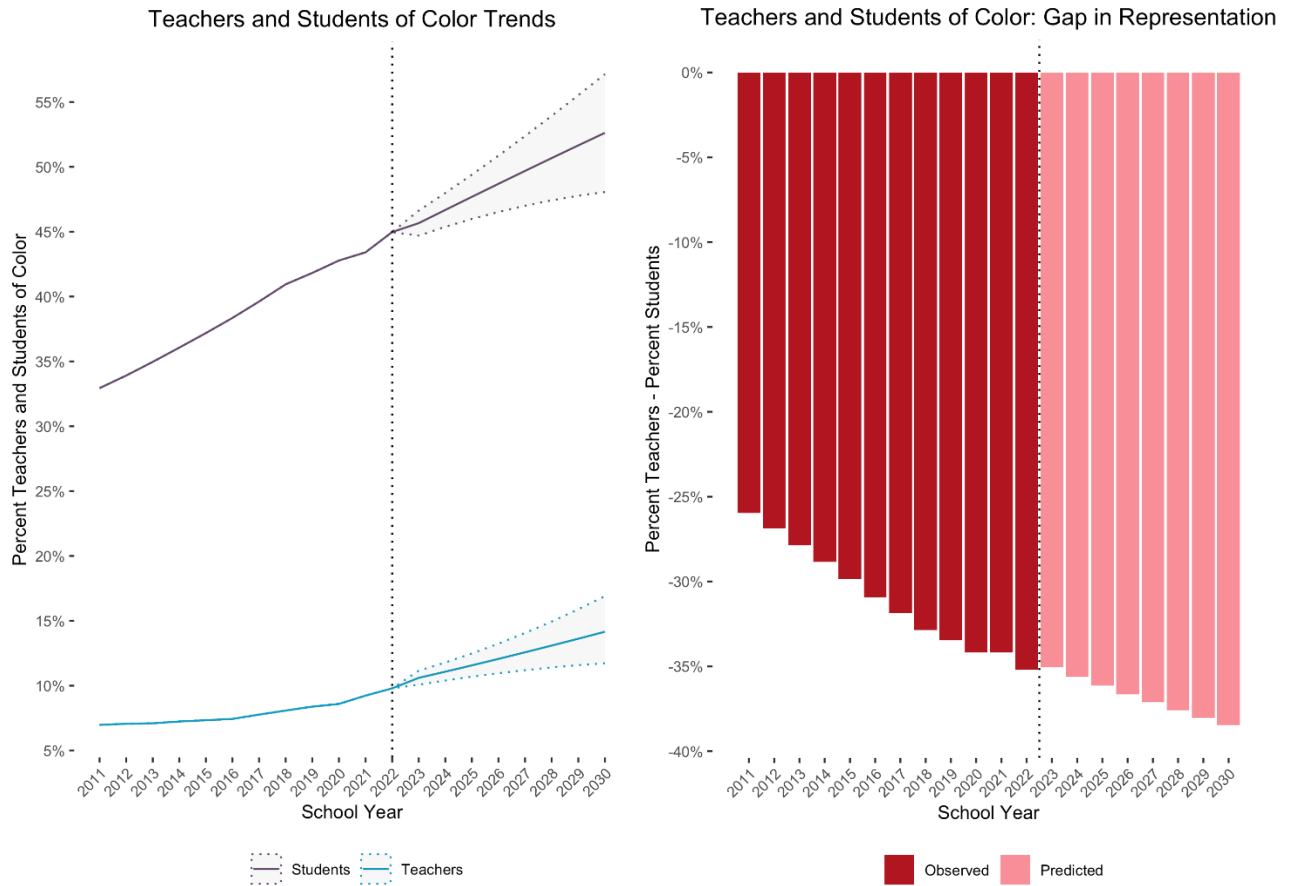


Figure 1-2: Trends in New Teachers

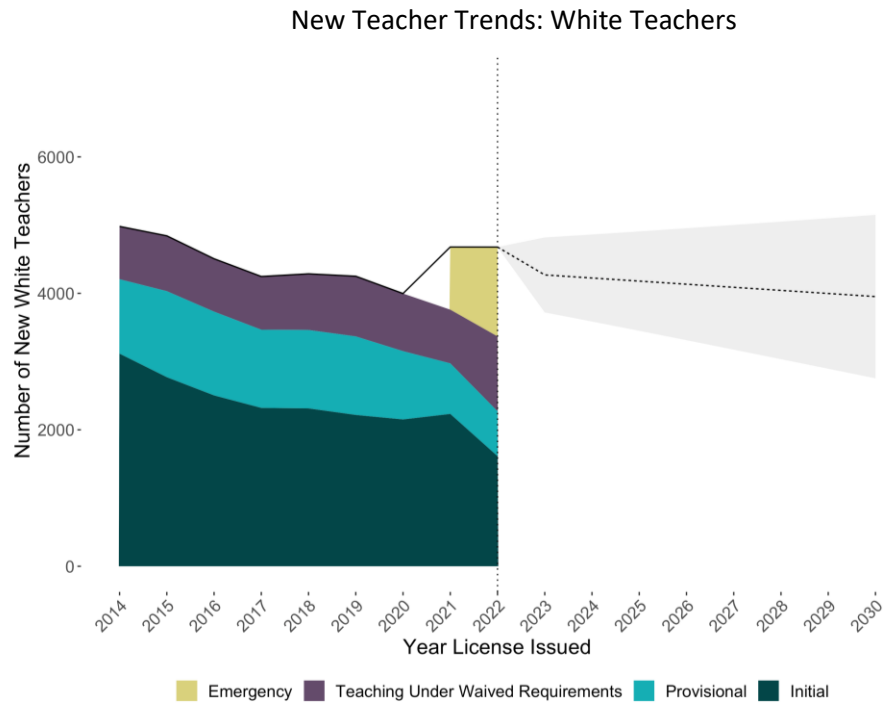
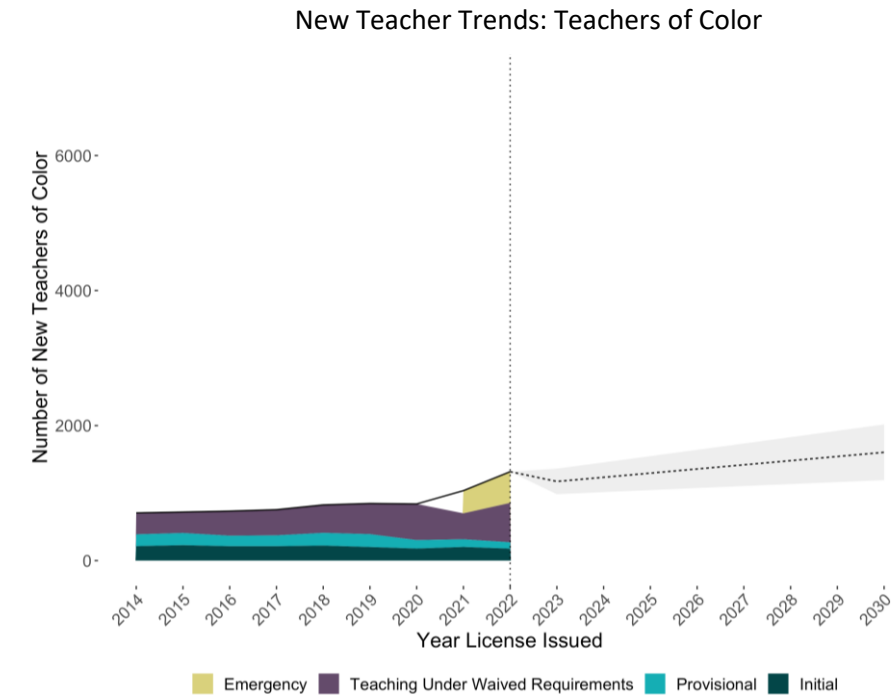
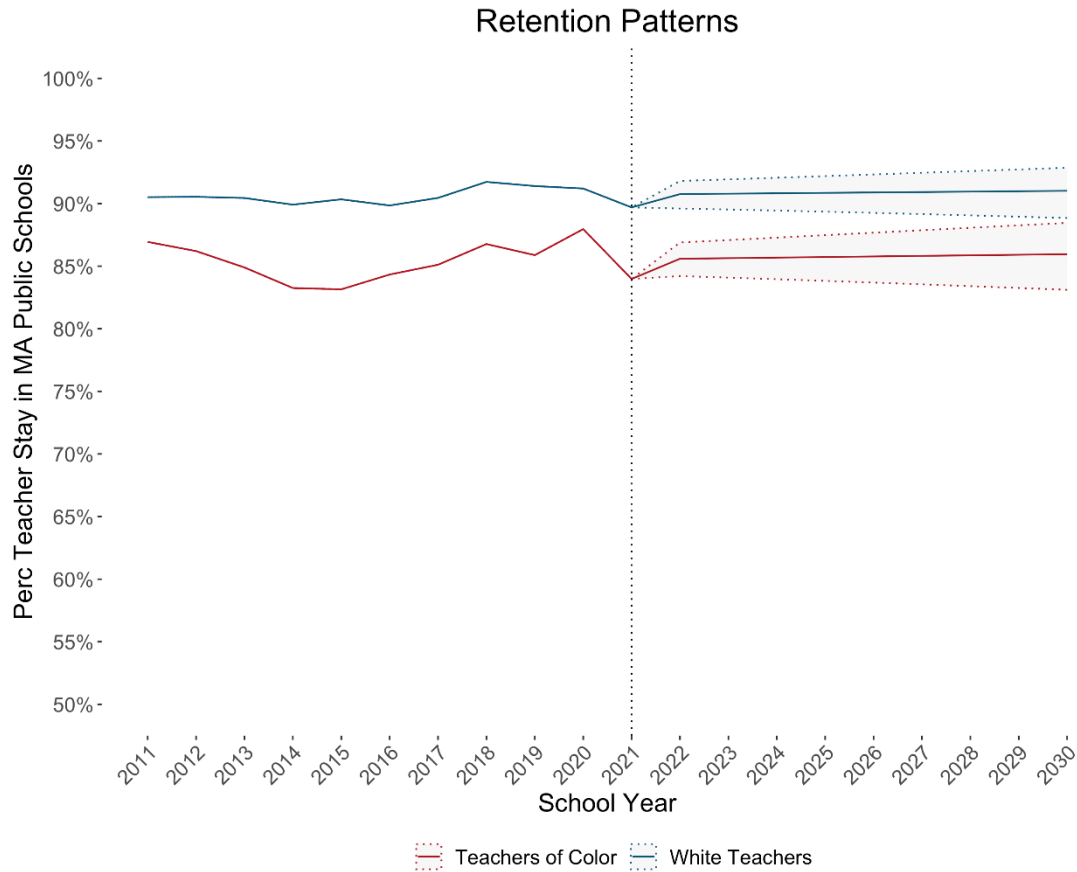


Figure 1-3: Teacher Retention Patterns by Race



Analytic Approach

The forecasting algorithm proceeds in two steps:

1. We use the following formula to estimate time trends from 2011 through 2022:

$$PctWhite_t = \beta_0 2022_t + \beta_1 TimeSince2022_t + \beta_2 TimeSince2022_t^2 + \epsilon_t$$

The outcome of interest is the percentage of teachers who identify as white in each year (t), which is estimated as a function of the share of teachers who are white in 2022 (β_0) and a quadratic time trend based on distance (i.e., number of years) from 2022 (β_1 and β_2).

2. We generate an out-of-sample forecast in each year (t) from 2023 through 2030 based on the time trends estimated in step 1. All predictions include 95% confidence intervals.

We use the same algorithm to generate predictions for all outcomes, though in some cases the number of available prior years differs.



This forecasting model simply extends forward historical trends observed in the data over the past decade. The model accounts for everything that has been changing historically (e.g., demographics, enrollment size, differences across sub-groups and regions, etc.) and does not make any additional assumptions beyond incorporating patterns found in historical state administrative data. This approach captures more nuance than attempting to control for specific individual factors observed in the data. Unless there are massive disruptions to these trends, these projections represent the most likely scenario. We do not attempt to forecast trends beyond 2030, as the farther out we extend our time period, the less likely our underlying assumptions are to hold true.

This is how we examine or account for the following considerations:

- *Looming Retirement Cliff*: Based on the age distribution of the current teacher workforce, we do not anticipate a significant change in retirement trends before 2030. It appears there may be a potential bump in white teacher retirements in about 15 years, beyond the end of the projection time period. Figure A-1 illustrates teacher age distributions by race across years.
- *Declining K-12 Enrollment*: Historical trends show that teacher hiring has been increasing even as student enrollment decreases. The baseline projection model carries these trends forward. If, however, there is a significant and unprecedented slowdown in teacher hiring before 2030, then these projections may overstate the future share of teachers of color, because new hires are more racially diverse than the current teacher workforce.
- *Increasing K-12 Diversity*: The baseline projection model accounts for the ongoing trend of increasing student diversity.
- *Unequal Distribution of Teachers of Color*: Teachers of color are more likely to teach in high-need schools where teacher retention is lower overall – this contributes in part to statewide differences between the retention of white teachers and teachers of color. The baseline projection model accounts for these underlying differences, but they do suggest that simulations equalizing the retention rates of white teachers and teachers of color represent a highly ambitious alternative to current trends.
- *The COVID-19 Pandemic*: In consultation with this project’s advisory board, WEPC has incorporated all years of data from 2010 through 2022 in the projection models, including years impacted by the pandemic. Including pandemic years does change the projections, though the high-level policy implications remain the same. Models that exclude the pandemic years (figures A-2 and A-3) project a slower increase in the entry of new teachers of color and a faster decrease in the entry of white teachers through 2030. While it is likely that some new teachers who entered the workforce with an emergency license during the pandemic would still have entered without that option in place, there are many unknowns about the extent to which the emergency license released a backlog of potential teachers and how entry patterns during this unusual period will or will not continue outside of the pandemic context.

For more information, see WEPC’s complementary research with Massachusetts on the [composition of the teacher workforce](#) and the [emergency teacher license](#) during COVID-19.

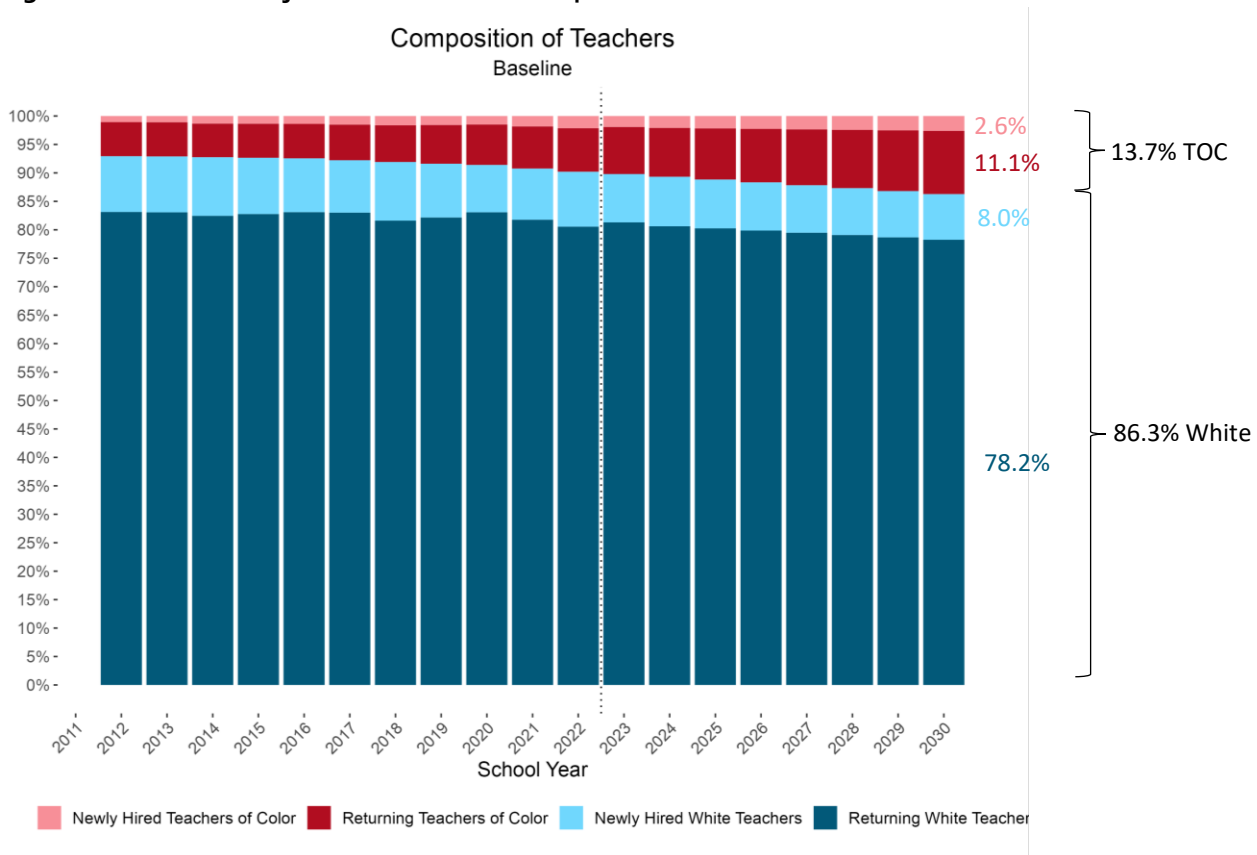


Part 2: Simulations

Key Insights

- Despite progress towards increasing teacher diversity in Massachusetts, achieving racial parity between the student population and teacher workforce by 2030 is an improbable outcome.
- If all of our current diversification efforts were to continue on the same trajectory, we project teachers of color to comprise about 14% of the overall teacher workforce by 2030. (Figure 2-1)
- Simulated scenarios suggest that ambitious systemic policy changes that close retention gaps and further increase new hire diversity would produce at best modest increases (+7 percentage points) in overall teacher diversity above the baseline level of 14% projected by 2030. (Figure 2-2)
- Even the most aggressive simulations, which are extremely unlikely to occur, project teachers of color to comprise at most 26% of the workforce by 2030. (Figure 2-3)

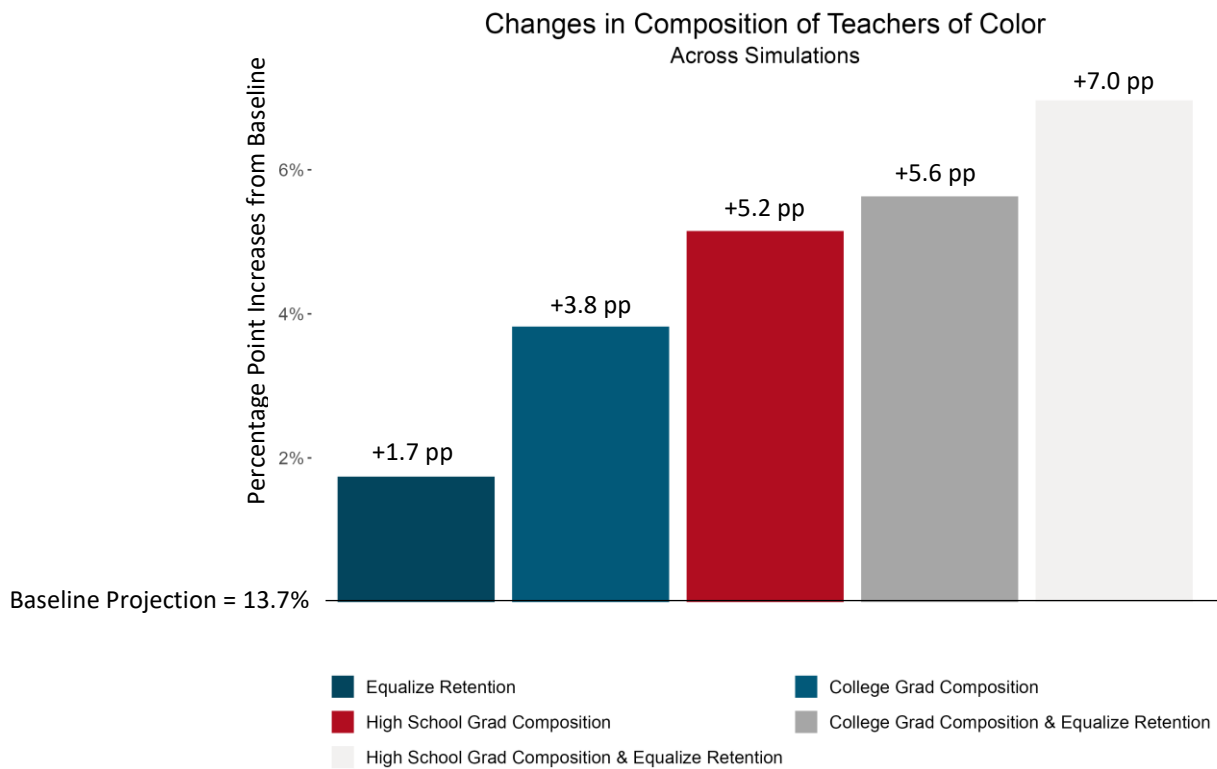
Figure 2-1: Baseline Projections of Teacher Composition Over Time



See Figure A-4 for a version of this figure that projects numbers rather than percentages of teachers.



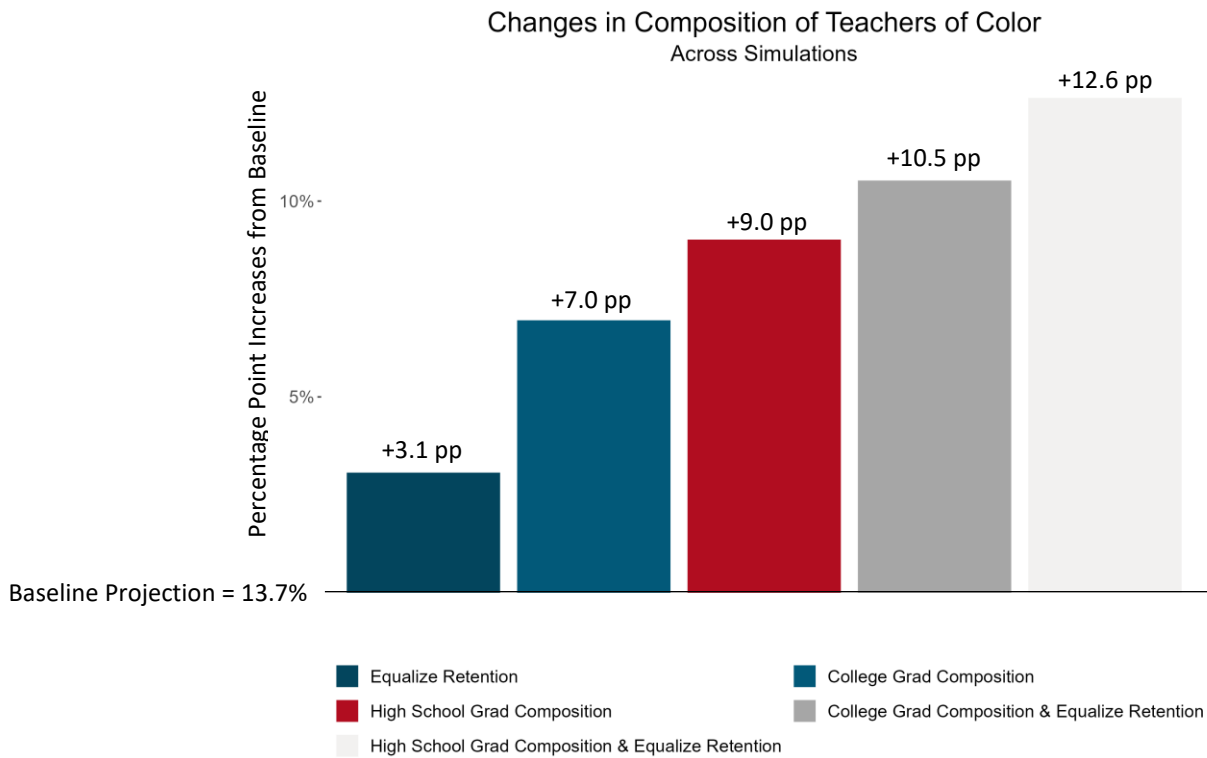
Figure 2-2: Changes in Projected Teacher Composition in 2030 Under Different Simulated Policy Scenarios (Gradual Target Approach)



See Figures A-5 through A-9 for year-by-year breakdowns of each of these projections.



Figure 2-3: Changes in Projected Teacher Composition in 2030 Under Different Simulated Policy Scenarios (Immediate Target Approach)



See Figures A-10 through A-14 for year-by-year breakdowns of each of these projections.

Analytic Approach

We begin with a baseline model that forecasts three key components of teachers supply:

1. The total number of teachers needed in the workforce in each year,
2. The one-year retention rates of existing teachers for each year (forecasted separately for teachers of color and white teachers), and
3. The share of newly hired teachers who are people of color in each year.

We forecast each of these components through 2030 based on linear projections of historical trends and ensure that the sum of the retained teachers and newly hired teachers equals the projected total workforce size in each year. We then alter these baseline projections in two different ways:



- *Simulation Approach A (Gradual Target)*: In this approach, we simulate retention and/or new hire targets to be achieved by 2030, with progress towards these targets being made at a constant rate beginning in 2023 and continuing onwards with compounding effects through 2030. Specifically:
 - **Retention Rate Simulation**: We augment the baseline projections by setting the projected retention rate of teachers of color equal to the projected retention rate of white teachers in each year. We then fill remaining vacancies according to the projected shares of newly hired teachers of color and white teachers.
 - **New Hire Simulations**: We augment the baseline projections by changing the composition of newly hired teachers. In one scenario, we set the new hire composition in each year equal to the composition of Massachusetts four-year college graduates from 2021. In a second scenario, we set the new hire composition in each year equal to the composition of Massachusetts high school graduates from 2022.
 - **Combination**: Finally, we offer simulations that modify both retention and new hire composition. We first equalize retention rates as described above. We then fill remaining vacancies according to the composition of either four-year college graduates or high school graduates.
- *Simulation Approach B (Immediate Target)*: In this approach, we simulate retention and/or new hire targets to be immediately achieved beginning in 2023 and continuing onwards with compounding effects through 2030.

We advise caution in forecasting teacher composition using Simulation Approach B due to the extreme assumptions that all teacher retention and new hire composition targets were achieved by 2023. We view these scenarios as illustrative of the upper bound of what could be possible in the most extreme simulations, which are likely unrealistic. Simulation Approach A sets the same end targets for 2030 but allows for gradual progress toward reaching these targets between 2023 and 2030, which we consider more attainable though still incredibly ambitious, requiring intensive, systemic intervention to achieve.



Additional Figures

Figure A-1: Distribution of Teacher Age by Race

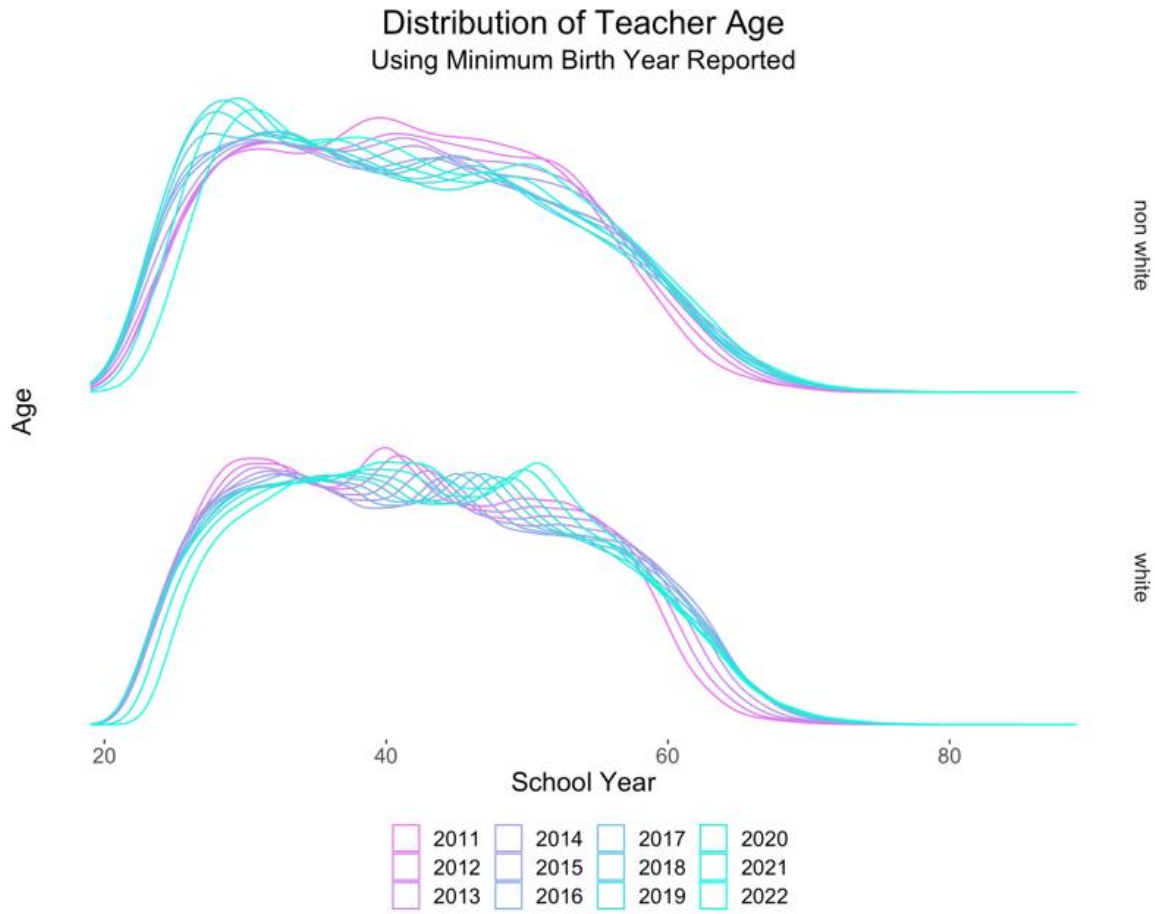


Figure A-2: Trends in Teachers and Students of Color Excluding Pandemic Years

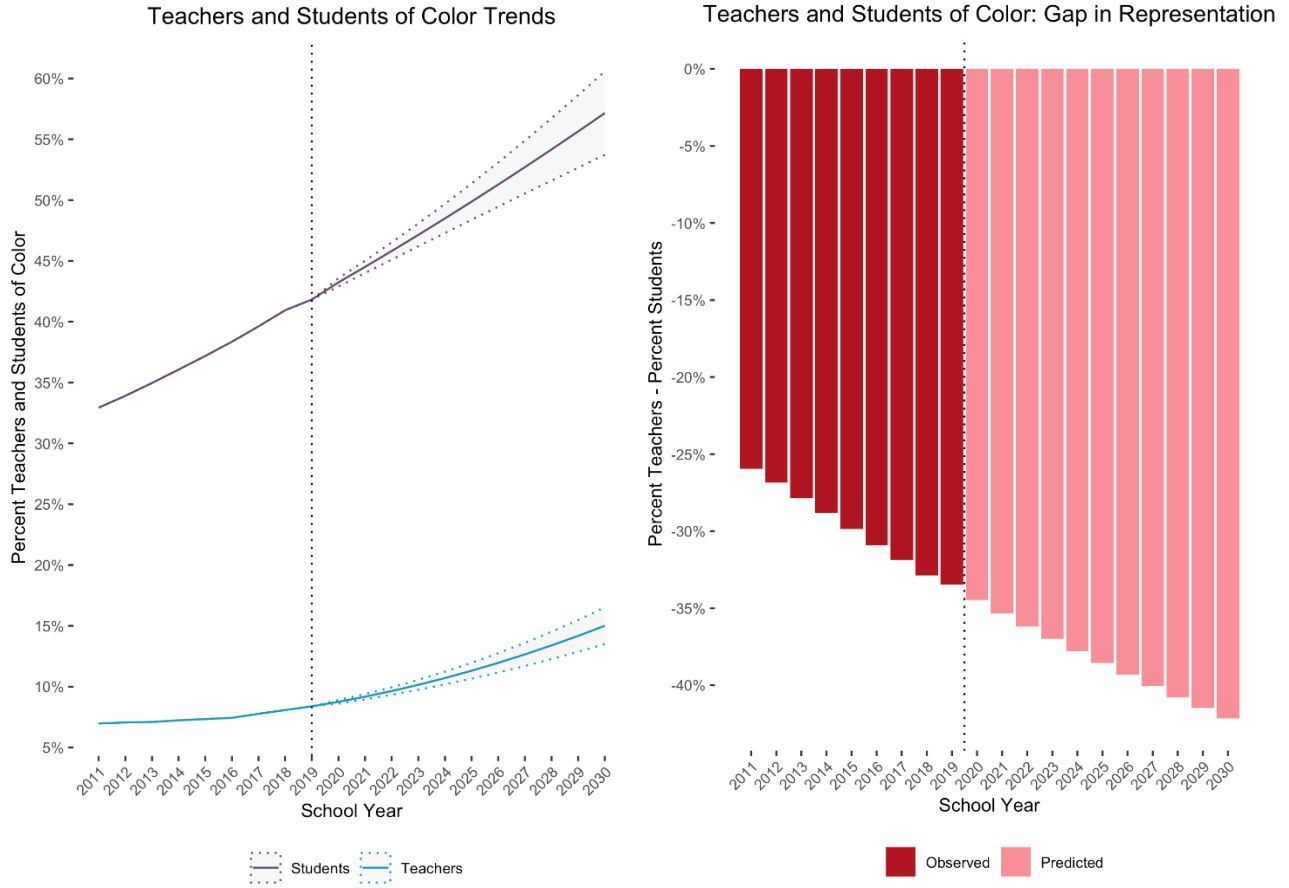


Figure A-3: Trends in New Teachers Excluding Pandemic Years

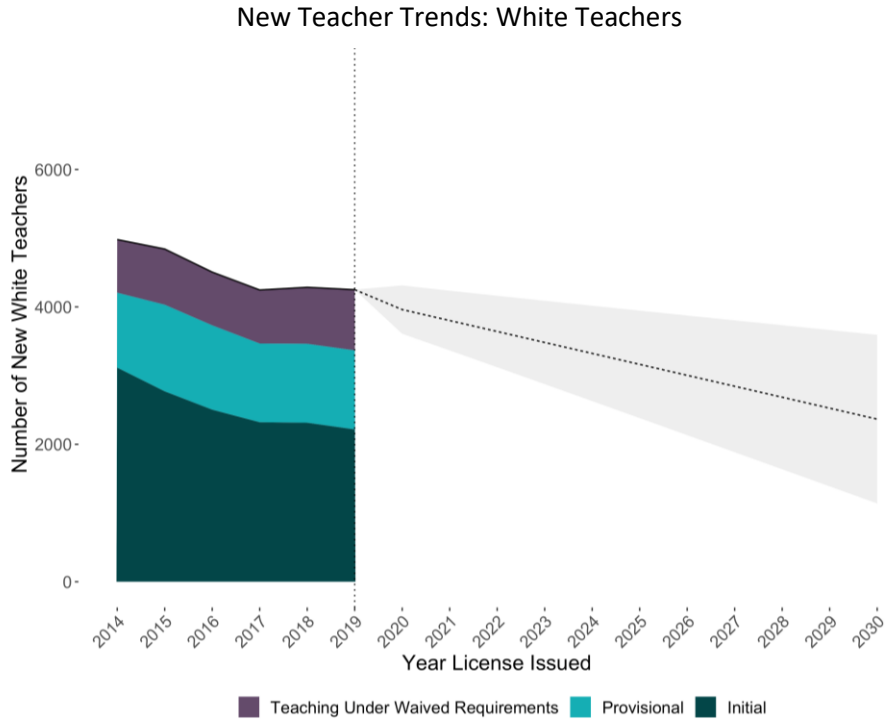
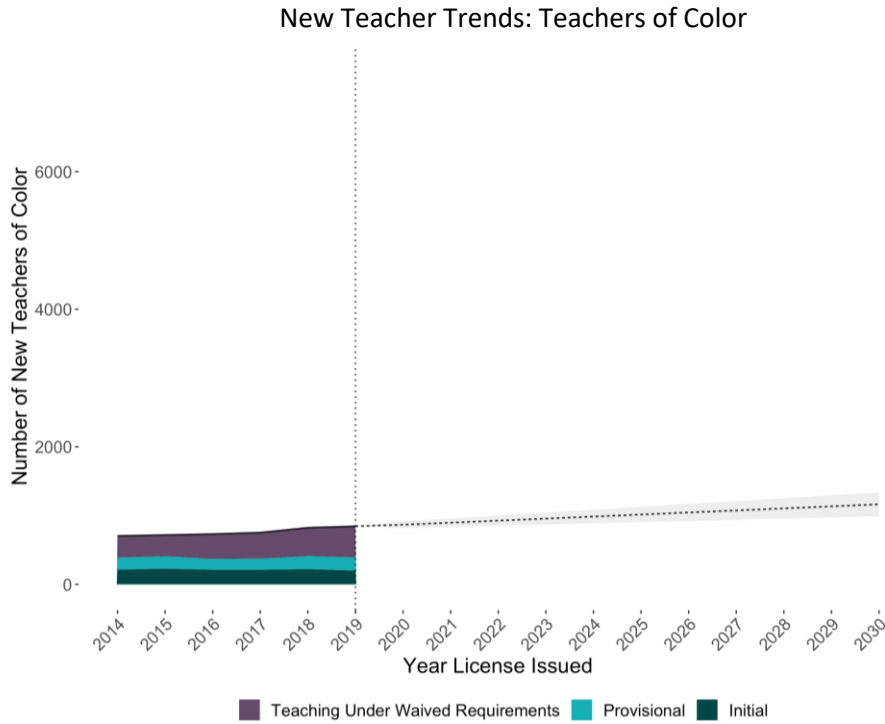


Figure A-4: Baseline Projections of Teacher Composition Over Time (Number of Individuals)

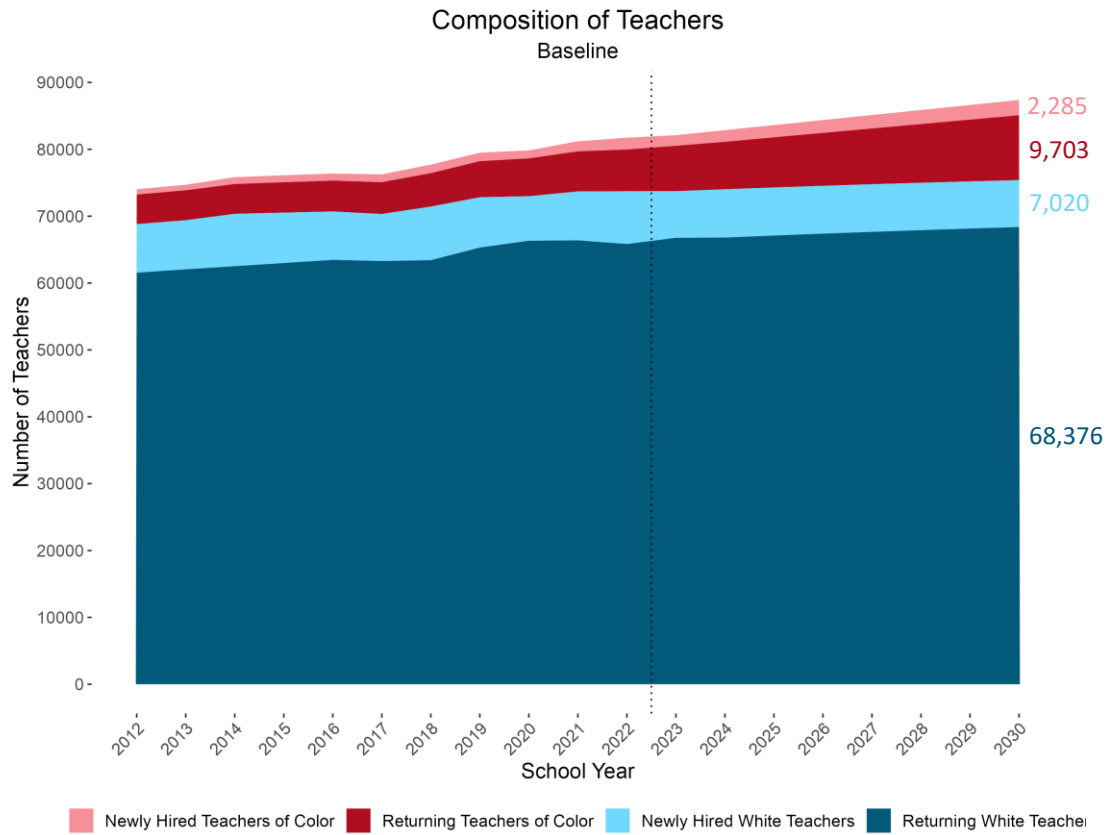


Figure A-5: Equalizing Retention Rates (Gradual Target Approach)

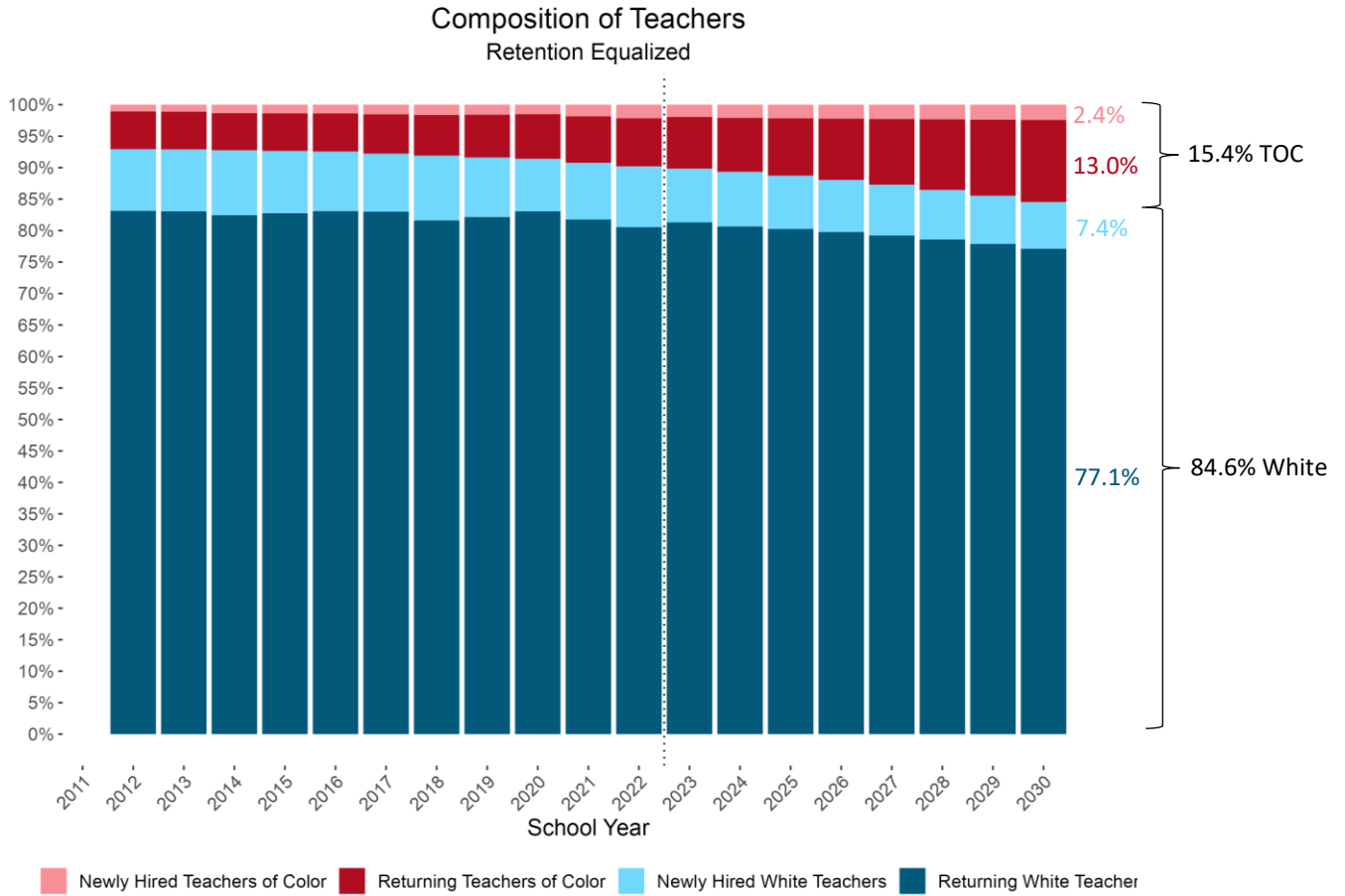
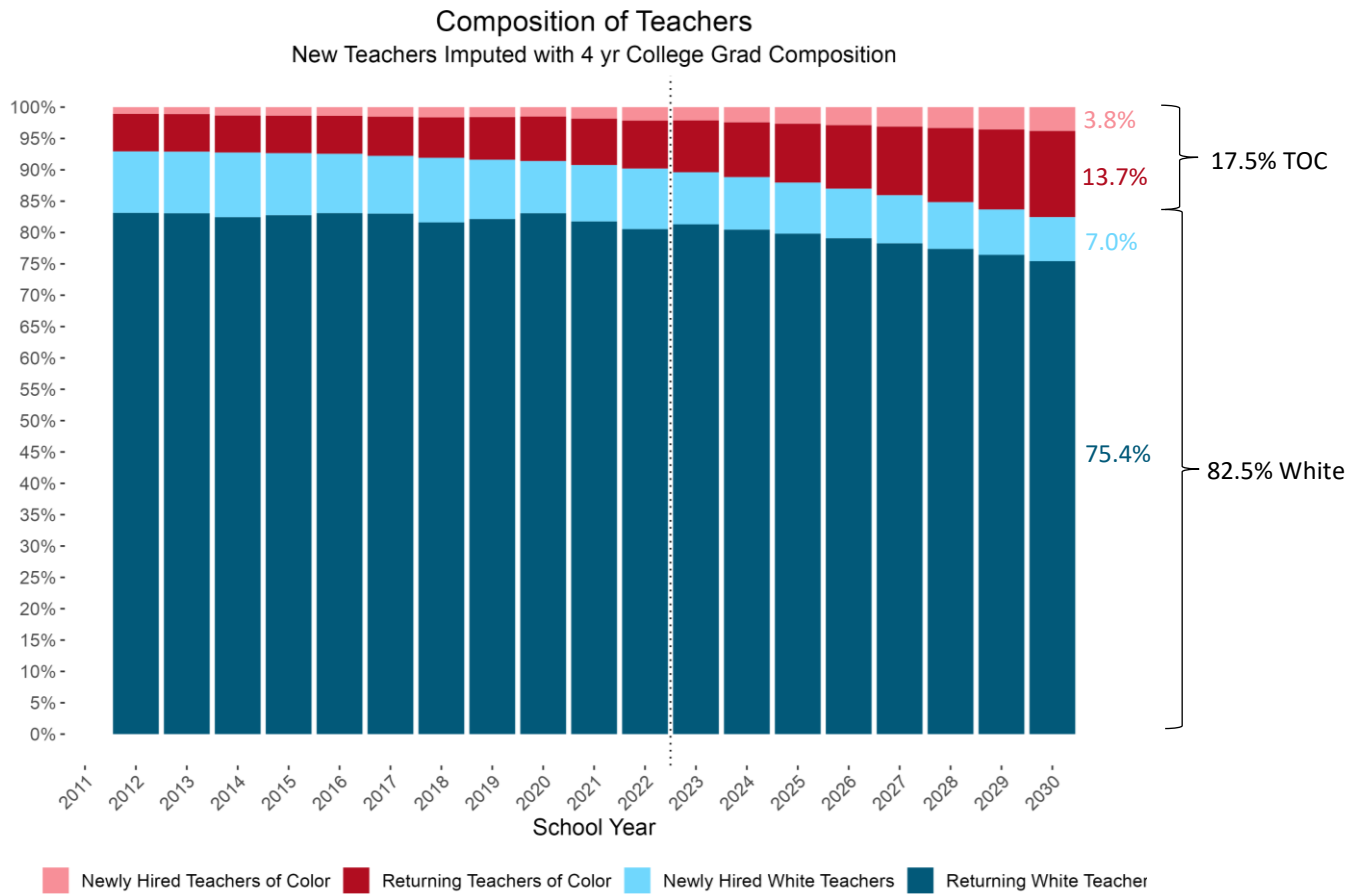


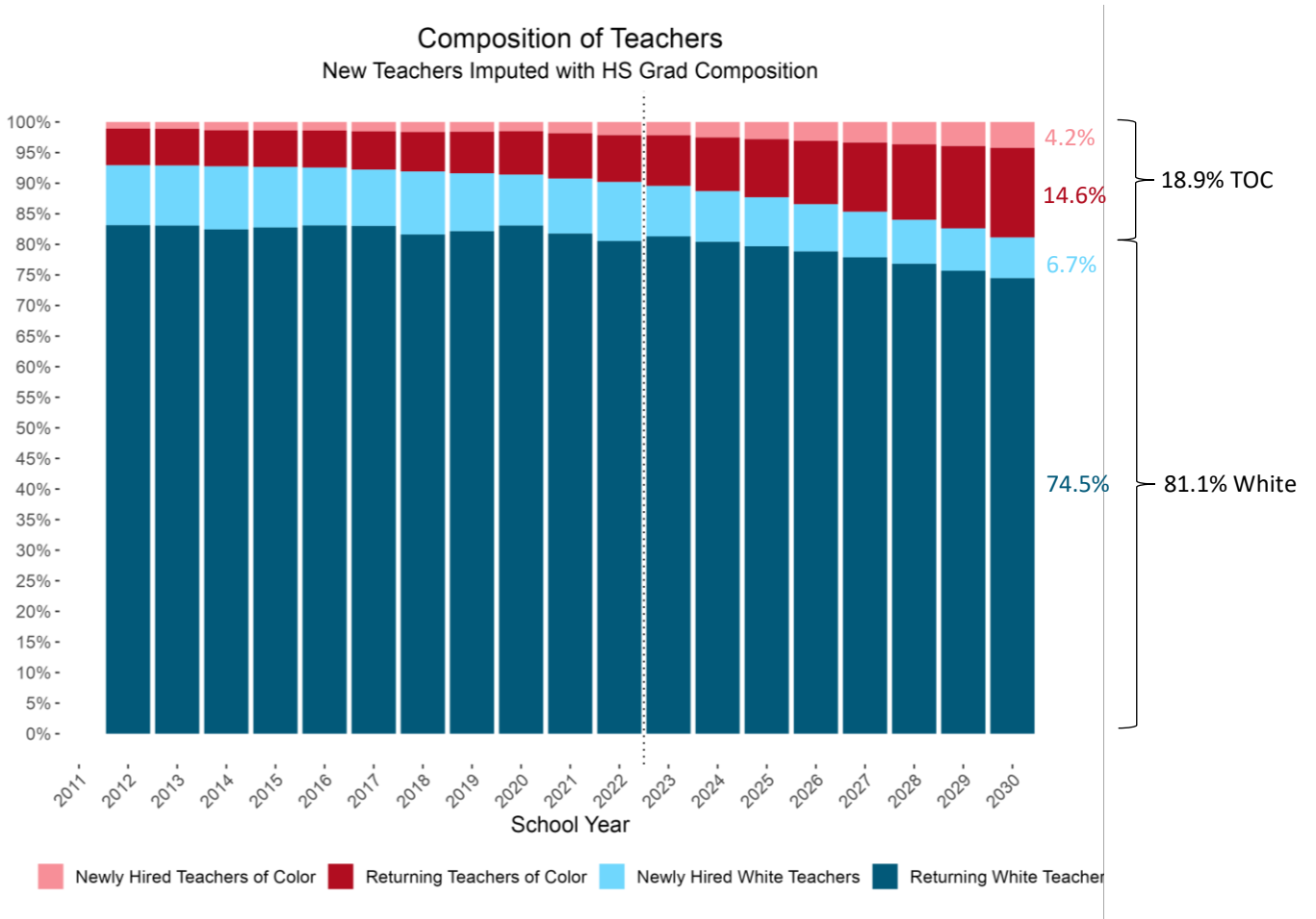
Figure A-6: Matching New Hire Composition to Four-Year College Graduates (Gradual Target Approach)



Notes: Racial composition of four-year college graduates in 2021 calculated from IPEDS data: approximately 65% white and 35% people of color. Sample includes students with four-year degrees from Massachusetts higher education institutions and excludes individuals with missing race information (such as non-resident students who do not have race information recorded in the data).



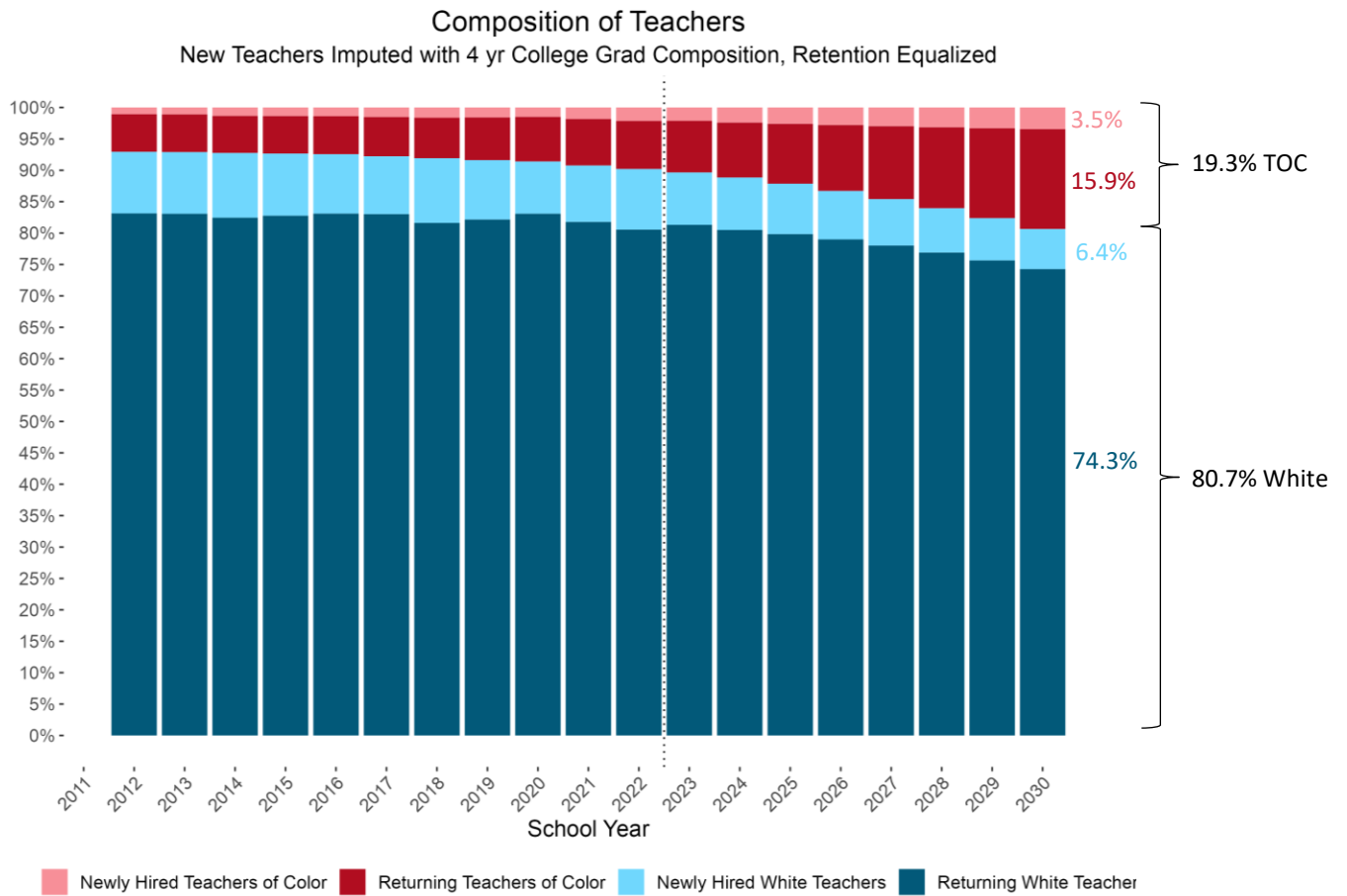
Figure A-7: Matching New Hire Composition to High School Graduates (Gradual Target Approach)



Notes: Racial composition of 2022 high school graduates calculated from publicly available [district profile data](#): approximately 61% white and 39% people of color.



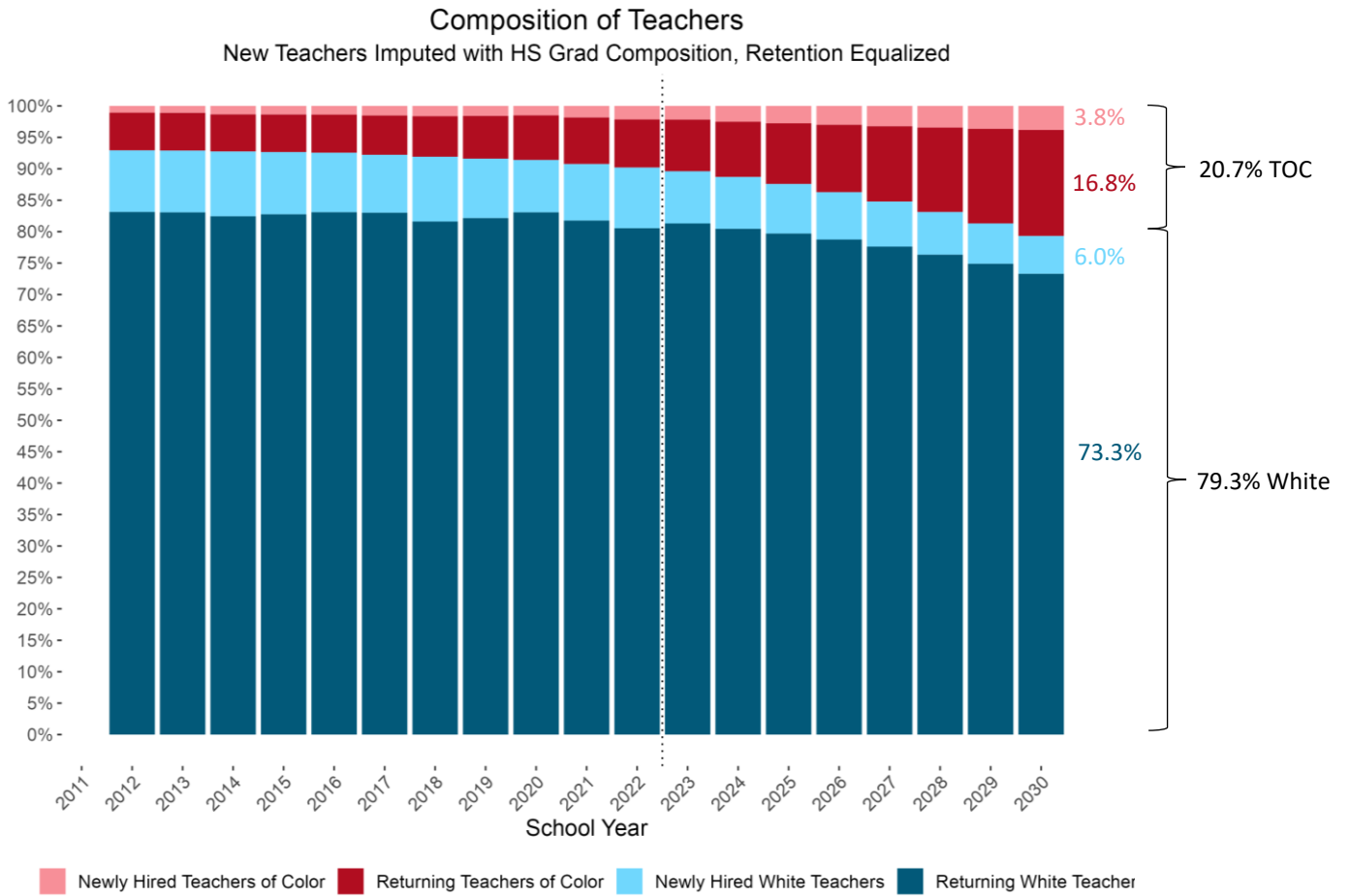
Figure A-8: Equalizing Retention Rates and Matching New Hire Composition to Four-Year College Graduates (Gradual Target Approach)



Notes: Racial composition of four-year college graduates in 2021 calculated from IPEDS data: approximately 65% white and 35% people of color. Sample includes students with four-year degrees from Massachusetts higher education institutions and excludes individuals with missing race information (such as non-resident students who do not have race information recorded in the data).



Figure A-9: Equalizing Retention Rates and Matching New Hire Composition to High School Graduates (Gradual Target Approach)



Notes: Racial composition of 2022 high school graduates calculated from publicly available [district profile data](#): approximately 61% white and 39% people of color.

Figure A-10: Equalizing Retention Rates (Immediate Target Approach)

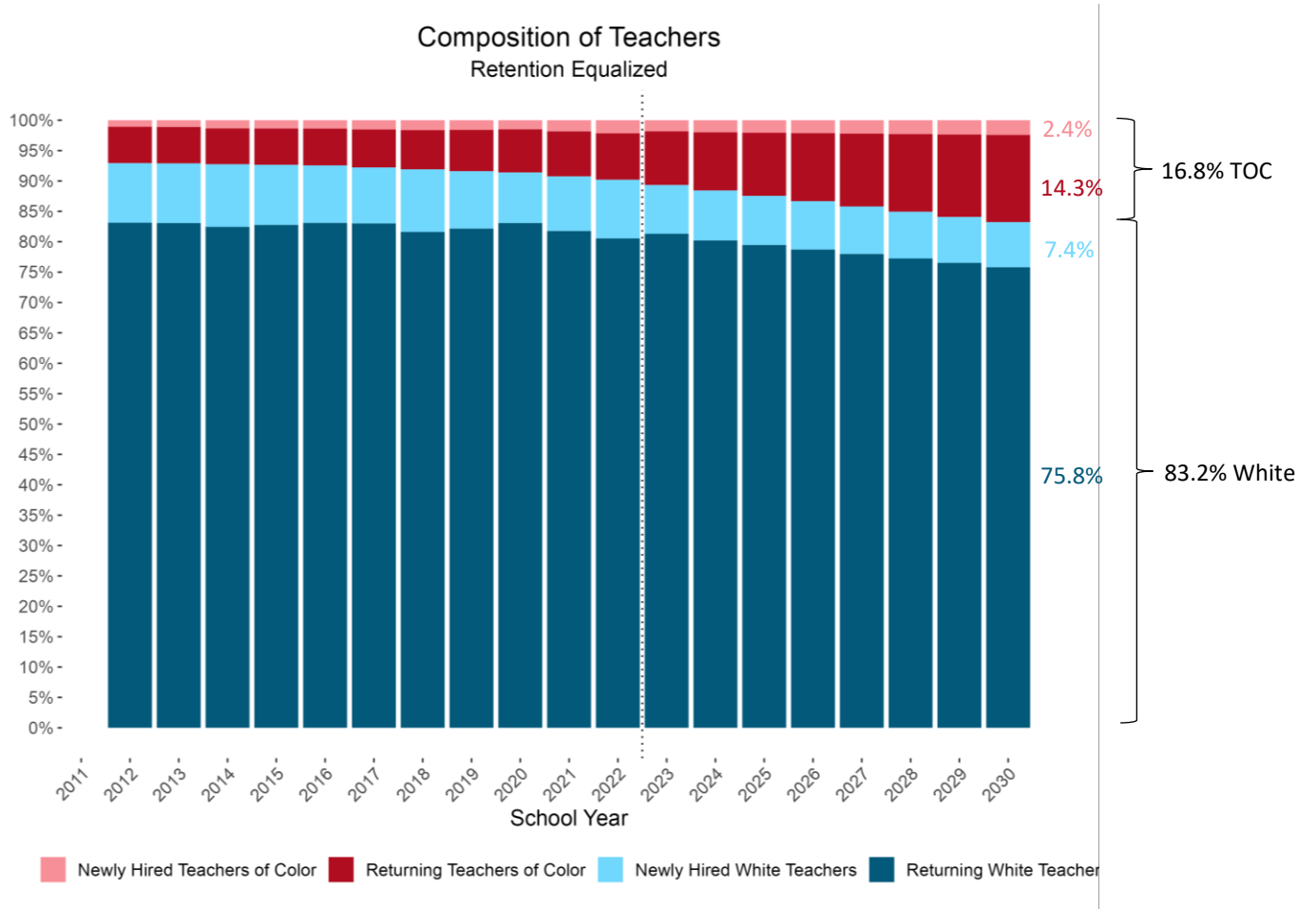
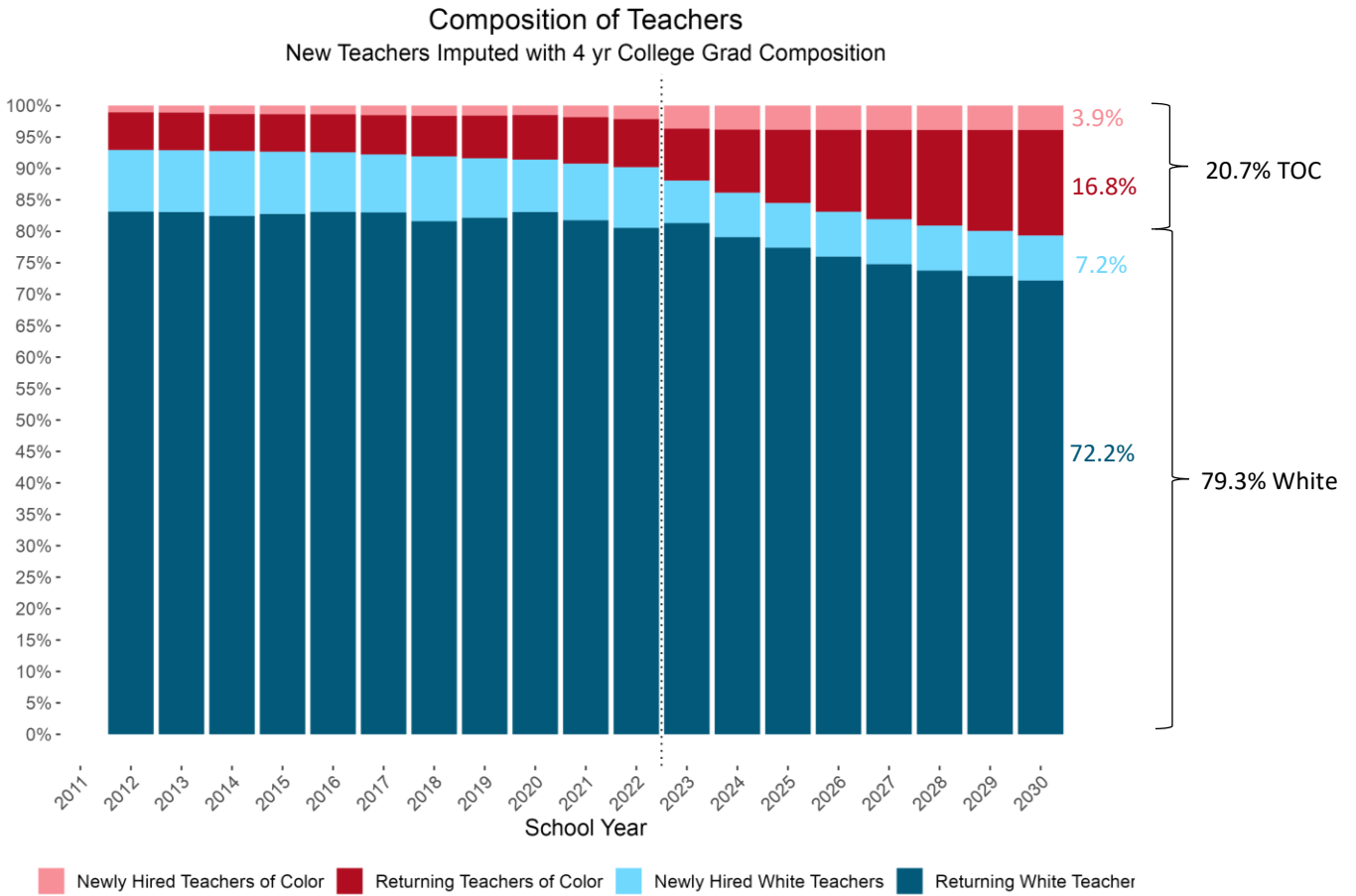


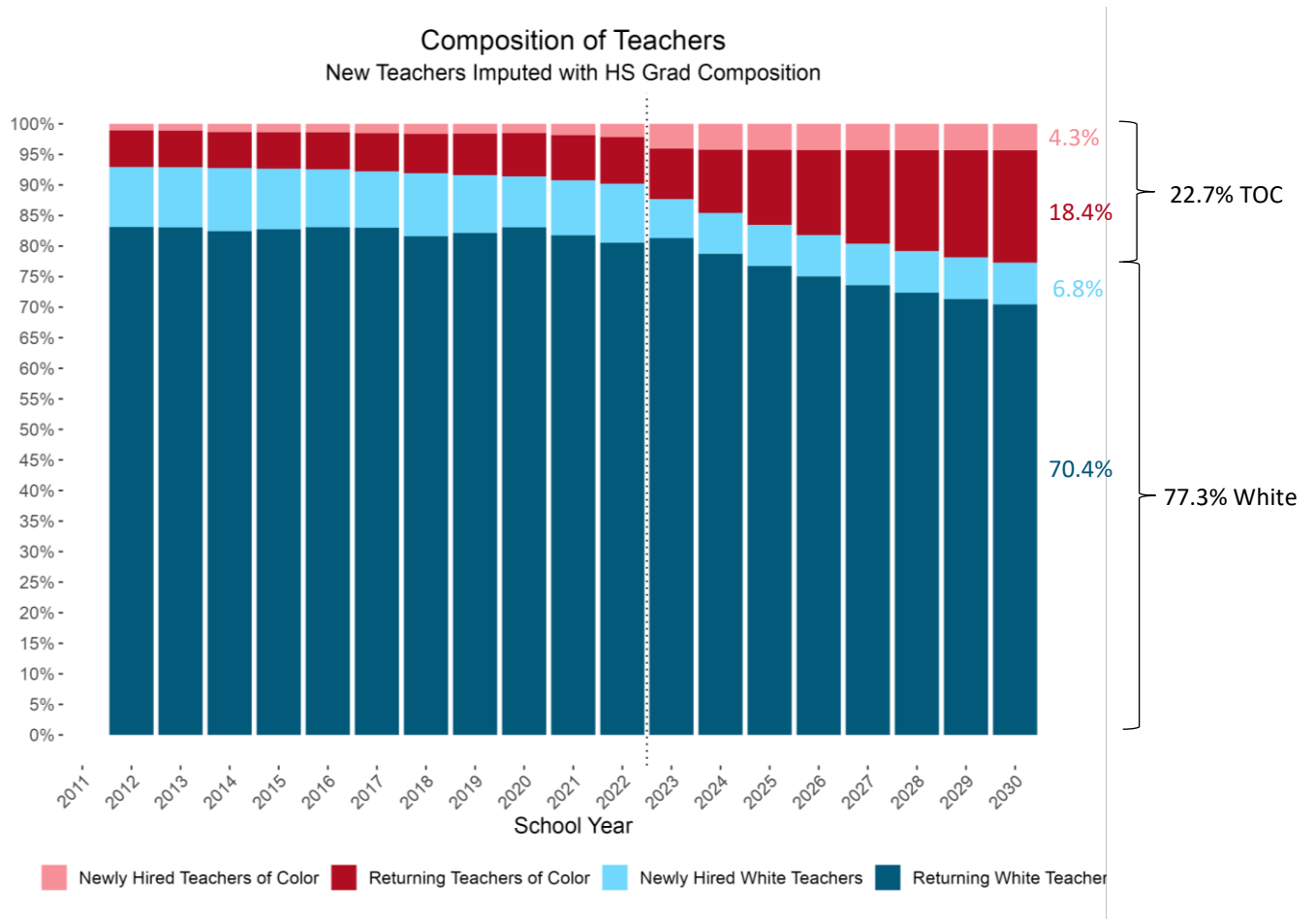
Figure A-11: Matching New Hire Composition to Four-Year College Graduates (Immediate Target Approach)



Notes: Racial composition of four-year college graduates in 2021 calculated from IPEDS data: approximately 65% white and 35% people of color. Sample includes students with four-year degrees from Massachusetts higher education institutions and excludes individuals with missing race information (such as non-resident students who do not have race information recorded in the data).



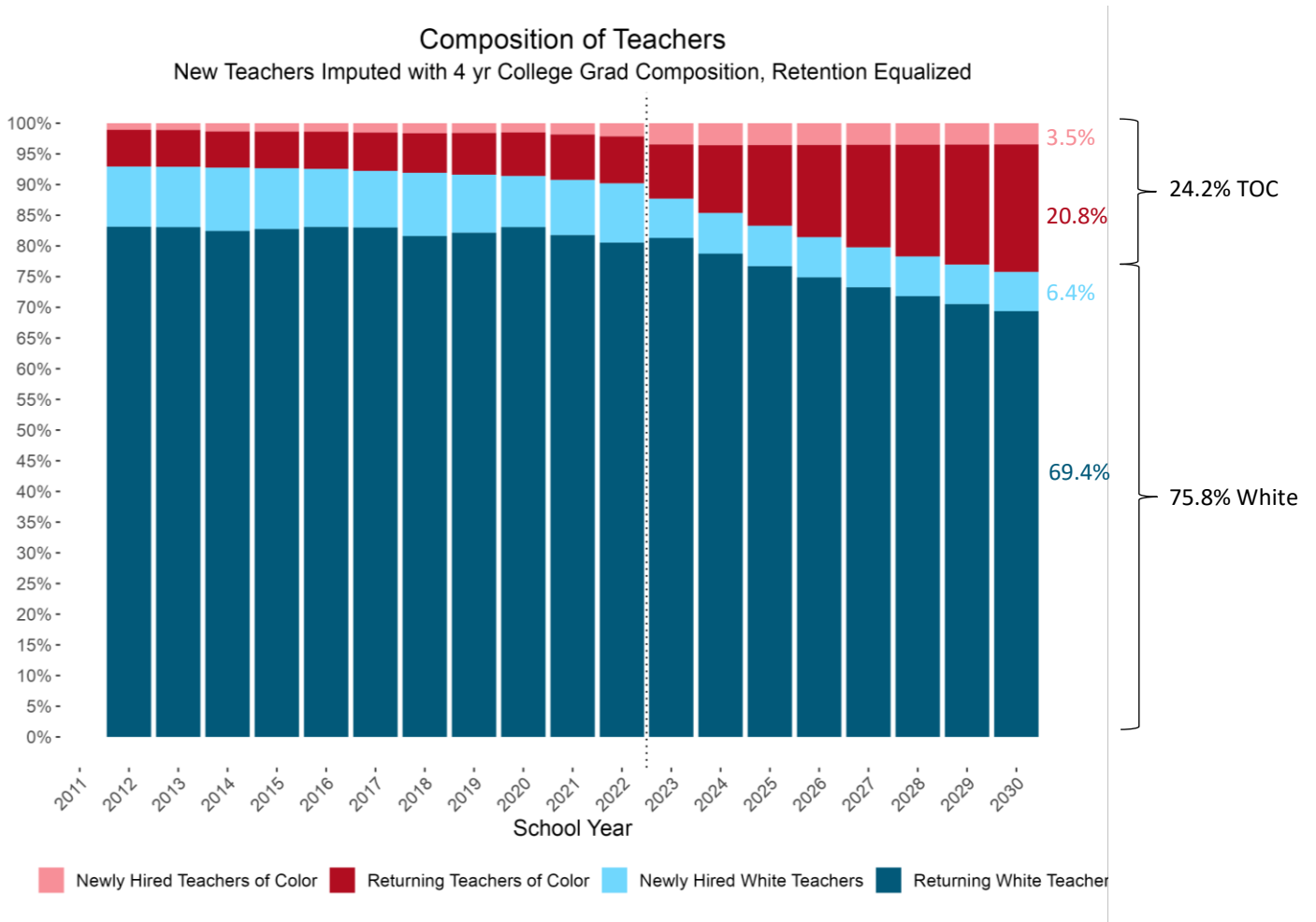
Figure A-12: Matching New Hire Composition to High School Graduates (Immediate Target Approach)



Notes: Racial composition of 2022 high school graduates calculated from publicly available [district profile data](#): approximately 61% white and 39% people of color.



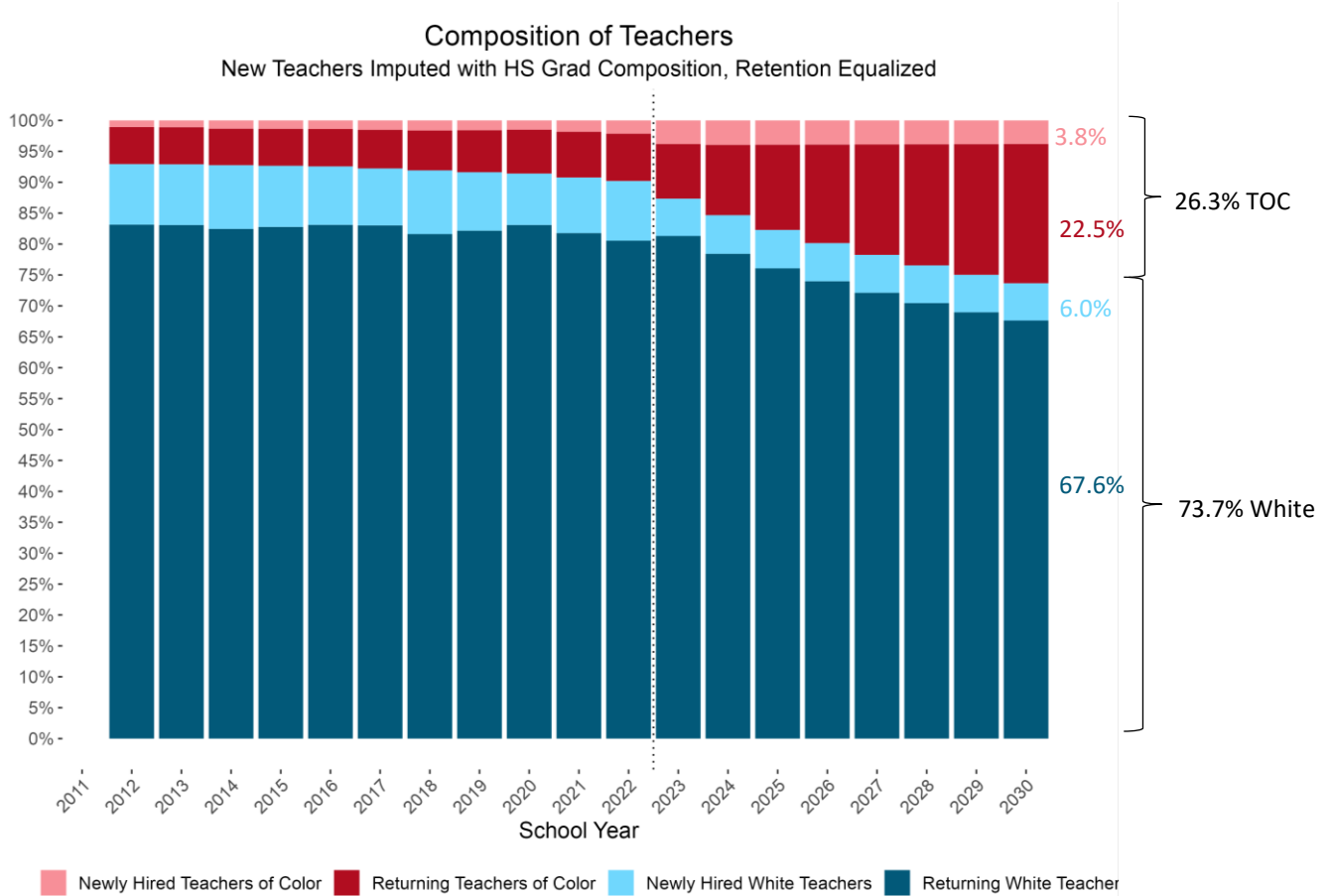
Figure A-13: Equalizing Retention Rates and Matching New Hire Composition to Four-Year College Graduates (Immediate Target Approach)



Notes: Racial composition of four-year college graduates in 2021 calculated from IPEDS data: approximately 65% white and 35% people of color. Sample includes students with four-year degrees from Massachusetts higher education institutions and excludes individuals with missing race information (such as non-resident students who do not have race information recorded in the data).



Figure A-14: Equalizing Retention Rates and Matching New Hire Composition to High School Graduates (Immediate Target Approach)



Notes: Racial composition of 2022 high school graduates calculated from publicly available [district profile data](#): approximately 61% white and 39% people of color.

