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# The Role of School Context in Explaining Racial Disproportionality in Special Education

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## Abstract

There has been an explosion of research on racial disproportionality in special education. Some recent research shifts the focus from the role of student characteristics alone to inquire whether school context moderates findings (e.g., is a Black student less likely than a White student to receive special education services as the proportion of a school's Black students increases?). We significantly extend this emerging literature using eight years of elementary student-and school-level data from NYC public schools, examining more school contextual moderators, expanding racial categories, and distinguishing between cross-sectional and over-time differences. We find many more moderators than previous research has identified and these school context factors appear to be particularly salient for the classification of Black students.


*Keywords:* over/underrepresentation, disproportionate representation, special education, descriptive and comparative, longitudinal research, secondary data analysis, elementary

**The Role of School Context in Explaining Racial Disproportionality in Special Education**

A large literature raises concerns about the share of U.S. public school students identified for special education services by race. Evidence that Black students are under-identified has been repeatedly shown in studies using different data sets and sophisticated quantitative methods, particularly when conditioning on student prior academic achievement (e.g. Morgan *et al*., 2015; Morgan *et al*., 2017). There is some disagreement with this evidence about data, models, and generalizability (e.g. Collins *et al.*, 2016 and Skiba *et al.*, 2016), but Morgan *et al.* (2016) have replied to these critiques. Beyond this debate, researchers have found consensus that representation in special education is multiply determined (Artiles & Trent, 1994)—that is, it is a product of both individual student characteristics and the features of districts and schools (Ahram *et al.*, 2021). The role of school context factors, however, has been understudied, and this gap is important. Parents, leaders, and policymakers may benefit from knowing whether or not the specific school a student attends is a neutral factor with respect to disproportionate racial identification in special education.

Early research identified a number of district characteristics as correlates of disproportionality (e.g. Coutinho *et al.,* 2002; Finn, 1982; Donovan & Cross, 2002; Skiba *et al.*, 2005). Recently, new literature has begun to analyze the role of schools. A few researchers have found that Black and Hispanic students in schools with more students of color are *less likely* to be placed in special education (Elder, *et al.*, 2021; Fish, 2019a; Shifrer & Fish, 2020). School context, however, entails much more than student race and ethnicity (hereafter race) and, to obtain a full picture of the correlates of disproportionality, it is worth examining whether other school characteristics are associated with racial disparities in special education. This is especially salient in large school districts, such as New York City, Los Angeles, Chicago, and Miami, which have hundreds of schools that may differ in their classification patterns. *The first major contribution of this paper is to study multiple school-level factors that might affect racial disparities in special education:* not only school racial composition, but also concentrations of teachers by race, of students eligible for free and reduced-price lunch (FPRL), and of English learners (EL), as well as school size and climate. Some of these contextual factors have been considered predictors of special education classification, but their role in school-level *disproportionality* has rarely been examined.

To simultaneously study how numerous school factors predict special education placement for students from different race groups, we use eight years of administrative, student-level data for elementary school students from the largest public-school system in the U.S., New York City (NYC). NYC elementary schools have a diverse student body, with over 400,000 K-5 students educated annually. Of those students, in 2019, 20% were students with disabilities, 41% were Hispanic, 24% were Black, 16% were Asian, 16% were White, and 3% were Native American, Alaskan Indian, or multi-racial. Existing research on school context moderators uses simple binaries when considering school racial composition (e.g. school-level percent non-White vs. White), so *a second major contribution of this study is the expansion of racial categories*.

Our analyses use cross section and within-school-by-race models, the latter examining changes within school, which have rarely been used in research on disproportionality. *A third major contribution of this study is to elucidate the interpretation of such estimates with the use of a model that accounts for school-by-race differences* to appropriately estimate the within-school associations between school context and disproportionality. We follow recent quantitative literature in controlling for available student-level characteristics to compare observationally similar students, although results are comparable without these controls.

We find that several school-level factors are associated with disproportionality. In line with prior research (e.g. Elder *et al.*, 2021), we generally find students who are racially similar to their peers are less likely to be classified into special education. We also contribute new findings on the association between disproportionality and teacher racial composition, school size, and teachers' perceptions of school climate; these school context factors appear to be particularly salient for the classification of Black students. Importantly, though, because some of these factors change little *within* a school over time, many of these associations are driven by differences *across* schools. We return to this point in the Discussion and discuss implications for research in terms of appropriate quantitative models, as well as policy implications.

NYC serves as a helpful context for this study for several reasons. First, its students are demographically diverse (by race, poverty, and English Learner status), similar to many other large school districts, although the proportions of students by these characteristics differs across such districts. Second, given its size and status as the largest US district, NYC is important in its own right. Third, it is important to study specific local contexts, where policies are the same for all schools. While national surveys provide some generalizability, they cannot control for local policy contexts. Fourth, while a special education reform began toward the end of the period of our data (2012), its goals did not include addressing disproportionality, and no other major education policies were changed during the time of our study.

## Literature Review: Why Might School Context Moderate the Racial Composition of Special Education Students?

Some literature has considered how school context may influence special education classification overall, but most research has not considered how school context factors might influence special education classification *differentially by race*. Exceptions are a few recent studies that have examined student body racial composition (Elder *et al.*, 2021; Fish, 2019a;

Shifrer and Fish, 2020) and, to a lesser extent, teacher racial composition (Cooc, 2017; Fish, 2019b; Hibel *et al.*, 2010). We extend the consideration to other student body characteristics: FRPL status, EL status, and academic performance, as well as school size and school climate. There is little evidence on the mechanisms through which these school-level characteristics may affect disproportionality in special education, but we draw on the literature on student and teacher racial composition by analogy, as well as the larger body of research, both quantitative and qualitative, on special education more broadly. For additional student body characteristics in particular, we hypothesize they may affect racial disproportionality similarly to student body racial composition, by (1) changing the reference group to which students are compared when classification decisions are made and (2) affecting the effectiveness of education for students of different races, and in turn affecting their likelihood of classification; both are discussed in further detail below. We view extending analyses to additional school context factors as exploratory, offering directions for future research, which we return to in the conclusion. The literature also predicts differences by disability classification, and we consider these differences (and results from heterogeneity analyses) in Online Appendix D.

**Student Body Characteristics (Race, Poverty, EL, Performance, Size)**

Recently, research has found that students were less likely to be classified into special education in schools with higher proportions of same-race peers (Elder *et al.*, 2021; Fish, 2019a; Shifrer & Fish, 2020; see Online Appendix A for more on comparisons of these findings). The authors of these studies have theorized that students' racial distinctiveness plays a role in classification, that is, schools are more likely to notice a students' disability (or incorrectly label a student as disabled) if the student is racially distinct. Fish (2019a) also suggested that student body racial composition may change the "racial political climate," with two implications. First, in schools with more students of color, there may be greater pressure to avoid classifying students of color into special education. Indeed, there is evidence that administrators and educators are aware of IDEA regulatory pressure to reduce racial disproportionality (Kramarczuk Voulgarides *et al.*, 2021). Second, Fish (2019a), based on many authors she cited, hypothesized that White families may encourage segregation of students of color into special education when these children are the minority, and/or might advocate for their own children to receive services (as a means to receive additional support) when their own children are the minority (racialized competition).

Additionally, attending school with a high portion of Black and/or Hispanic students may affect reference groups because such schools may have higher rates of underlying disability due to racial inequalities in health and socioeconomic status (Elder *et al.*, 2021; Fish, 2019a). School racial composition might also affect social-psychological and academic wellbeing of students, which in turn might affect the need for special education services; that is, Black and Hispanic students may perform better in schools with high portions of same-race peers (Fish, 2019a).

Other school-level student body characteristics have been included in prior research on disproportionality as a control (mediator), and that work has generally found attending a school with a higher portion of low-SES students (Cooc, 2017; Fish, 2019a; Hibel *et al.*, 2010; Shifrer & Fish, 2020), a higher portion of ELs (Cooc, 2017; Fish, 2019a), and lower average performance (Cooc, 2017; Fish, 2019a; Hibel *et al.*, 2010; Shifrer and Fish, 2020) were associated with lower likelihood of special education classification. In contrast, Kincaid and Sullivan (2017), Morgan *et al.* (2022), and Sullivan and Bal (2013) found evidence that these student body characteristics were not predictive of special education classification.

Some of the potential mechanisms through which student body racial composition may affect disproportionality can be extended to these other student body characteristics. Schools with higher portions of low-SES students may have higher rates of underlying disability, resulting in lower classification rates overall (because students with disabilities do not stand out), and particularly low classification rates for Black and Hispanic students. If resources are scarce and the ability to serve students with disabilities is limited in schools with high portions of low-SES students, schools with high portions of ELs, and/or schools with lower performing students, “racialized competition” for resources (Fish, 2019a) may result in conditional underrepresentation of Black and Hispanic students.

To our knowledge, school size has been included as a mediator in only one study on disproportionality (Sullivan & Bal, 2013). Researchers, however, have found that smaller schools improve student achievement (e.g. Bloom & Unterman, 2014; Author, 2013), suggesting size is an important school context variable to consider. School size may moderate disproportionality through channels similar to student body characteristics. In larger schools, it may be more difficult for students to stand out, so Black and Hispanic students may be conditionally underrepresented. In contrast, larger schools may have resources that alleviate some of the administrative burden of special education placement, resulting in less competition for services and less underrepresentation. Indeed, district size has been hypothesized to similarly moderate disproportionality (Eitle, 2002; Sullivan & Artiles, 2011).

**Teacher Race**

Prior quantitative research has also considered *teacher* racial composition as a potential moderator of disproportionality. Estimates suggest that the majority of teacher referrals lead to special education classification and teachers initiate the majority of special education referrals (Fish, 2022; Harry & Klinger, 2007), making teachers a potentially critical factor in disproportionality patterns. Teachers' race may moderate both their bias against and their effectiveness for students of particular races. There is evidence that teachers have improved perceptions of students and are more effective (student outcomes are improved) when students' and teachers' race match, perhaps due to shared cultural understanding. The evidence on student-teacher race match is particularly strong for Black elementary school students (Hwang *et al*., 2022; Redding, 2019), although recent research looking at student-teacher race match within schools found largely null effects on achievement and special education classification (Morgan & Hu, 2023). Therefore, it is an open question whether the disproportionate classification of Black students is reduced in schools with high portions of Black teachers. Fish (2019b) also theorized that when teachers share racial characteristics with the student population ("representative bureaucracy"), student outcomes may be improved through more equitable resource distribution, cultural sensitivity, and attention to racial disparities (see, Meier, 2019, for a general discussion of representative bureaucracy).

Findings from research that consider the proportion of teachers by race as a potential mediator in special education classification are mixed. Cooc (2017) found White teachers were more likely to perceive students as having a disability than teachers of color, but Fish (2019a) found the opposite. While Cooc (2017), Fish (2019b), and Hibel *et al.* (2010) did not find that teacher race moderated disproportionality overall, Fish (2019b) found evidence of significant interactions between teacher race and disproportionality for some specific disability categories. Fish (2019b) and Hibel *et al.* (2010) operationalized teacher race dichotomously (White teachers/teachers of color), which may obscure the relationship between the proportion of teachers of a specific race and classification of students of that race (given the potential student-teacher race match mechanisms).

**School Climate**

School climate is often cited as important to school outcomes, such as achievement or attendance, and could influence patterns of special education referral and placement (e.g. Johnson & Stevens, 2006; Maxwell *et al.*, 2017; Welsh & Little, 2018). While school climate *per se* has not been included in quantitative studies of disproportionality, qualitative research on disproportionality has highlighted the role of classroom management and school culture in moderating the placement of otherwise similar students into special education (Harry & Klinger, 2014; Skiba *et al.*, 2006). Research has also found discipline referrals and suspension rates are related to disproportionality (Cooc, 2018; Sullivan & Bal, 2013), and racial disparities in discipline referral, particularly for students with disabilities, are well documented (e.g. Cruz *et al.*, 2021; Losen *et al.*, 2015; Sullivan *et al.* 2014), although it is unclear if Black and Hispanic students with disabilities are more likely to be suspended than White students with disabilities, conditional on observed characteristics related to disciplinary outcomes (Morgan *et al.*, 2019). School climate and disciplinary outcomes, while distinct, are related, and negative school climates have been associated with increases in discipline referrals (Gage *et al.*, 2016). Indeed, Heilbrun *et al.* (2017) found schools with high levels of student- and teacher-reported structure had lower overall suspension rates and a lower gap between Black and White suspension rates. Analogously, schools with better climates may exhibit less disproportionality in special education classification. School climate may be particularly important for Black students' classification, given Black students consistently report worse perceptions on nearly all measures of school climate compared to White students, and these disparities persist within schools (Graham, 2022; Voigt *et al.*, 2015).

Overall, hypotheses on mechanisms for and directions of effects of school-level variables on racial disproportionality have relied on theories from the literature on racial reference groups, distinction, political climate, and composition as well as teacher perceptions and bias.

## Data and Measures

We used a rich longitudinal dataset constructed from four sources (this study received IRB approval as an exempt study using secondary data). From the NYC Department of Education (NYCDOE), we obtained longitudinal, student-level data for traditional public elementary schools (i.e. schools with a fourth but not a seventh grade, mostly K-5 and K-6), from 2007 to 2014. The elementary school data included demographic variables (gender, race), eligibility for free or reduced-price lunch (FRPL), English Learner status (EL), test scores on state math and ELA exams for Grades 3-6, and an indicator for students who had an Individualized Education Program (IEP), which entitled them to receive special education services. Each student with an IEP in the data was additionally identified with one of 13 federal disability classifications.

NYCDOE also provided teacher-level administrative data that contained teacher demographic information (e.g. race) and teacher characteristics, and data from the NYC School Survey that provided teacher responses each year to questions about various aspects of school climate. Both the administrative and survey teacher-level data were aggregated to the school level. Finally, publicly available New York State report card data provided information on enrollment, demographics, and grade span (school organization level).

Our sample included K-6 students in traditional elementary public schools that served students with IEPs and general education students (GENs). We excluded schools serving only students with IEPs (i.e., District 75 schools in NYC), which encompassed 10.1% of students with IEPs overall in NYC, because these students were often ungraded, and did not attend schools with GENs, the latter preventing estimations of within-school probability of having an IEP.

Our dependent variable (IEP) was dichotomous, indicating whether a student had an IEP in a given year (1) or not (0). In heterogeneity analyses (results in Online Appendix D), we specified that a student had a specific disability classification (e.g., learning disability) or not (i.e. GEN). Our primary independent variables were student-level indicators of race (Black, Hispanic, Asian and other, with White as the comparison) and a set of school-level variables (further described below), and their interactions.

Our school-level variables were all time-varying and included individual student-level control variables aggregated to the school level (portion of students by race, EL status, FRPL-eligibility and average test scores), and some variables measured only at the school level: school size (enrollment in hundreds of students), portion of teachers by race, and teachers' perceptions of school climate. Teachers' perceptions of school climate were based on factor analysis of a set of questions from the NYC School Survey for teachers; see Online Appendix B for further details.

Our student-level control variables included those established in prior research: gender, EL status (time varying), and FRPL status (time varying), which were dichotomous measures, attendance (proportion of days present; time varying), and an indicator for whether the student was foreign-born. If gender, attendance, or foreign-born status was missing (~1% of cases), we used mean-replacement and added flags for missingness. We also added controls for third-grade test scores (standardized over all students by grade and year to mean 0 and standard deviation 1). We controlled for third-grade test scores as these are the earliest measures of achievement in our data, although of course they are not ideal controls for K-3 students as they may be affected by classification in grades K-3. As previously mentioned, however, results without these student-level controls are similar. When stratifying the sample by disability (Online Appendix D), we followed other authors (e.g. Shogren *et al.*, 2014) and combined the 13 classifications into five groups.

Table 1 displays descriptive statistics for all of our variables averaged over all years, 2007-2014. As shown in Table 1, 11.6% of students in traditional public elementary schools had IEPs. Hispanic students comprised the majority of the sample (41%), followed by Black (25%), Asian and other (18%), and White (16%). Classification rates differed by race: 49% of Hispanic students; 24% of Black students, 9% of Asian and other students, and 19% of White students in the sample had IEPs.

## Methods

We begin with a basic linear probability model, examining the relationship between IEP receipt and school context variables by race. In Model 1, we conceptualize IEP receipt for student *i* at time *t* in school *s* and of race group *r* (notating *r* here is helpful for when we get to a later model) as a function of student race ***R*;** non-race student characteristics ***X***; the interaction of student race ***R*** with other student characteristics ***X***, with the resulting interaction vector labeled as ***I*** in the equation below; school-level contextual variables ***W***; the cross-level interaction of the school-level vector ***W*** with student race ***R***, with the resulting vector labeled ***C***; grade-by-race fixed effects $\theta_{rg}$; year-by-race fixed effects $\omega_{rt}$; and a random error $\varepsilon$. More simply, it is a model of IEP receipt fully interacted by race. Standard errors are clustered at the school level.

$$IEP_{itrs} = \alpha + R'_{itrs}\rho + X'_{itrs}\beta + I'_{itrs}\upsilon + W'_{ts}\gamma + C'_{itrs}\delta + \theta_{rg} + \omega_{rt} + \varepsilon_{itrs} \quad \textbf{(Model 1)}$$

The primary variables of interest are the cross-level interactions in ***C***, and their coefficients, $\delta$, which reflect how school context variables differentially predict *IEP* for students of different races—in other words, *how school context moderates disproportionality*.

Because our data span eight years, the school context variables can change over time within the same school. For example, the proportion of students who are Black can increase or decrease over time. While almost never used in the disproportionality literature (Elder *et al.*, 2021, are an exception), a common practice in other research with such longitudinal data is to include school fixed effects, which remove school-specific average relationships between *IEP* and other variables in the model over the time period examined. Thus, variation in any school-level variable (***W***) in the outcome is (conditionally) within-school variation, attributed to deviations from the school-specific average.

Interestingly, a school fixed effects model does *not* isolate the school-context *moderation* effects because those moderation effects are derived from cross-level (i.e., student-level–by–school-level) interactions. These cross-level interactions do *not* have a single school-specific average value across all race groups because they “turn on” for students within a school only if students are a member of the race interacted with the school-level variable. Hence, the values of $\delta$ recovered from estimating a school fixed effects model would contain a combination of within-school relationships *and* between-school relationships that differ for students of different races (so empirically, it is possible to estimate a school fixed effects model with only one year of cross-sectional data when including these cross-level interactions).

To address the between-school average differences in covariates that function differently for students of different races within the schools, we estimate Model 2 by differencing the school by race mean for each covariate. We do this by estimating school-by-race group-centered models with random effects and reintroduced group means (Raudenbush & Bryk, 2002; Snijders & Bosker, 2011). The switch from a traditional fixed effects model to a model that produces identical estimates by use of a combination of recentering, school-by-race averages, and school-by-race random effects is central to our approach because we aim to estimate average racial disproportionality in order to help contextualize the moderation. If we tried to estimate race covariates with school-by-race fixed effects, then the average racial disparities for each race group comparison would be subsumed by the school-by-race fixed effects. (Nevertheless and for completeness, we ensured that the resulting estimates and standard errors of the moderators are identical across this model and a school-by-race fixed effects model.) For the remainder of this paper, we refer to these models simply as "within-school-by-race" models.

In Model 2 below, we use notation such as $\tilde{I}_{itrs}$ to indicate the value of a variable after the school-by-race mean ($\bar{\bar{I}}_{..rs}$, or for shorthand, $\bar{\bar{I}}_{rs}$) has been subtracted, such that $\tilde{I}_{itrs} = I_{itrs} - \bar{\bar{I}}_{..rs}$. To achieve the equivalence of a school-by-race fixed effect model, the school-by-race averages (e.g., $\bar{\bar{I}}_{rs}$) are added as covariates and a school-by-race random effect $\tau_{rs}$ is added (Raudenbush & Bryk, 2002; Snijders & Bosker, 2011).

$$IEP_{ist} = \alpha + \tilde{R}'_{itrs}\rho + \tilde{X}'_{itrs}\beta + \tilde{I}'_{itrs}\upsilon + \widetilde{W}'_{ts}\gamma + \tilde{C}'_{itrs}\delta + \tilde{\theta}_{rg} + \widetilde{\omega}_{rt}$$

$$+ \overline{R}'_{rs}\zeta + \overline{X}'_{rs}\eta + \overline{I}'_{rs}\vartheta + \overline{W'}_{rs}\lambda + \overline{C}'_{rs}\xi + \bar{\theta}_{rs} + \overline{\omega}_{rs}$$

$$+ \tau_{rs} + \varepsilon_{ist} \quad \textbf{(Model 2)}$$

In this model, *unobserved school-level factors may differ for students of different race groups*, and their average effects are subsumed by the school-by-race model modifications just described. For example, over the years of our panel, a school's leadership (which may be the same or may change over the time of the study) may *on average* identify students of different races for special education differently (e.g. through bias or over-attention to raw disproportionality). Ignoring the school-by-race differential treatment would thus conflate such school-race-average differences with the differences in the covariates included in the model. The added flexibility in Model 2 means that the cross-level interactions, $\delta$, of individual student race by school covariates will be solely determined by the remaining variation for students of a given race group over time within a school.

Model 2 yields the moderation estimates *within schools*. However, for presentation purposes, we aim to translate those estimates into the predicted probabilities of a student having an IEP depending on their race and being at different levels of the school characteristic. To do that, we estimate the race gap averages in these models—which we can only do here because we are using the model as described above rather than as a traditional fixed effects model—to serve as anchors in the predictions. For example, Asian and Black students are identified for IEPs at different rates, and we would not want the average differences in the levels to be lost in the predictions due to the fixed effects; hence the approach we just described preserves these average-level differences in the prediction (again, for further description of these very helpful models, see Raudenbush & Bryk, 2002, or Snijders & Bosker, 2011).

Models 1 and 2 are useful for addressing different kinds of policy questions. Model 1 provides information on what might happen if changes were made across schools, for example, if teachers or students were to change schools in significant numbers. Model 2 more directly addresses policy questions related solely to within-school changes (e.g., a policy aimed at improving a school's climate) while also flexibly allowing those effects to be different for students of different races. In doing so, this model most directly approximates the effects on disproportionality that could be expected from policies aimed at modifying specific schools' contexts over time. Still, we note that even this model is descriptive, not causal, and should be interpreted with appropriate caution—a point we return to in the Discussion and Limitations.
For Model 1, it was also possible to estimate a logit model, which yielded similar results. Due to the complexity of Model 2, a logit model did not converge. For its relative ease of interpretability and given its successful estimation, we proceed with the linear probability model.

## Results

We begin with Model 1 (no fixed effects) to explain how to interpret findings, and then we discuss in more detail results from Model 2 (within-school-by-race models), including comparisons to Model 1.

### Model 1 (Figure 1)

Table 2 shows coefficients on the school-level variables and all the interactions between school-level variables and student race, for Models 1 and 2. (The coefficients for all variables in the equation are available from authors).

Figure 1 displays predicted probabilities for an IEP (versus no IEP, i.e. GEN) and racial disproportionality gaps based on the regression estimates for all moderators for elementary schools using coefficients from Model 1 (no school effects). We first describe how Table 2, Column 1, and Figure 1 relate. As an example, the main effect coefficient for the proportion of Black students in a school was 0.062 ($p$<.05), suggesting that there was on average a 0.62 percentage point (pp) higher probability of an IEP for observationally similar White students (the omitted group) in a school where the portion of Black students is 10 pp higher (and the proportion of white students is 10 pp lower). The coefficient on the interaction of the proportion of Black students with the indicator for being a Black student was -0.208 ($p$<.001), suggesting that the relationship between the concentration of Black students in the school and the probability of an IEP was quite different for Black students than for White students. Combining the main effect and interaction term, the total relationship for a Black student was -0.146, meaning there was a 1.5 pp lower probability of an IEP for a Black student in a school where the portion of Black students is 10 pp higher (and the portion of White students is 10 pp lower).

Continuing a focus on results from Model 1, Figure 1a combined the regression coefficients to create predicted probabilities for students of each race group, first in an elementary school where the proportion of Black students was 0.5 SD above average (i.e., a school with 38.5% Black students), then in one where the proportion was 0.5 SD below average (i.e., 10.9% Black students), holding all other factors constant at their means. This was a similar calculation to the one in the last paragraph, but instead of comparing schools that differ in the portion of Black students by 10 pp, in the Figures we used ranges of plus and minus 0.5 SD from the mean (see Table 1) for the overall standard deviations used for all moderators. In Figure 1a, we see that 14.8% of White students were predicted to have an IEP in a school with more Black students, but 13.1% of White students were predicted to have an IEP in a school with fewer Black students, all else equal—a difference of 1.7 pp ($p<.05$), shown in the column labeled "above-below difference." Black students had the opposite relationship: in an elementary school with more Black students, 10.8% of Black students were predicted to have an IEP but that percentage rose to 14.9% in a school with a lower concentration of Black students, all else equal. The difference in predicted probabilities in those two types of schools for Black students was -4.1 pp ($p<.001$). Collectively, this implies that for schools that differed only in the concentration of Black students (and therefore, had an offsetting concentration of White students, the omitted group), the Black-White IEP differential was -5.8 pp ($p<.001$), shown in the column labeled "Difference with respect to White" in Figure 1a. Put differently, as the portion of Black students increased, Black students were increasingly conditionally underrepresented relative to White students. The results in the three "difference with respect to White" columns therefore present the size/direction and statistical significance of the relationship between the school context variables and disproportionality.

**Model 2 (Figure 2)**

To facilitate comparisons between results of Models 1 and 2, we used the same overall standard deviations from the entire sample of elementary students that we used in the calculations for Figure 1; however, note that the variation is generally larger between schools than within schools (see Online Appendix C), and we return to this point in the Discussion section. The association of IEP receipt with the proportion of Black students in a school (Figure 2a) was now in the same direction, but stronger, as what we discussed above for Figure 1a. That is, Black and Hispanic students were less likely to have an IEP as the proportion of Black students increased (and White students decreased), while there remained no statistically significant association between the proportion of Black students and the probability of an IEP for Asian students.

The proportion of Hispanic students at a school (Figure 2b) had directionally similar associations with the probability of receiving an IEP compared to Figure 1b, but no statistically significant associations with disproportionality. Similarly, the proportion of Asian students at a school (Figure 2c) had fewer statistically significant associations compared to Figure 1c, although there remained a statistically significant relationship between the portion of Asian students and Black students' underrepresentation.

Both across and within schools, higher proportions of FRPL eligible students (Figures 1d and 2d) were consistently associated, for students of all races, with lower probabilities of having an IEP but overrepresentation relative to White students (because White students see the largest decline in likelihood of classification). However, the proportion of EL students (Figures 1e and 2e), as well as average ELA performance at a school (Figures 1f and 2f), had almost no statistically significant associations with the probability of an IEP.

Figures 1g and 2g show that larger compared to smaller schools were consistently associated with a lower probability of an IEP for all races. However, while Model 1 (Figure 1g) suggested this resulted in underrepresentation of Black and Hispanic students (with no statistically significant relationship to disproportionality for Asian students), Model 2 (Figure 2g) suggested this resulted in overrepresentation of Black and Asian students (with no statistically significant relationship to disproportionality for Hispanic students), and the statistically significant associations with disproportionality were small.

Factors beyond student body composition had independent relationships to IEP identification and racial disproportionality: Figures 1h, 1i, 1j and 2h, 2i, and 2j illustrate the associations with *teacher* racial concentration in a school from Models 1 and 2 respectively. Figure 1h suggests that the proportion of Black teachers was statistically significantly associated with a decreased likelihood of classification but also overrepresentation of students of all races relative to White (because the decreased likelihood of classification was largest for White students). Figures 1i and 1j show the proportion of Hispanic and Asian teachers had a statistically significant relationship with disproportionality for same-race students; the direction of the relationship differed for Hispanic students, who were underrepresented as the portion of Hispanic teachers increased. While there were smaller relationships and fewer that were statistically significant in Model 2, Figure 2h shows that the relationship between the proportion of Black teachers and disproportionality for Black students was still statistically significant. That is, higher proportions of Black teachers were consistently associated with proportionately more Black students identified with an IEP.

Although Model 1 showed no statistically significant results between school climate and disproportionality, results from Model 2 suggested higher teacher perceptions of order and discipline (Figure 2k) were associated with a *reduction* in the probability of an IEP for Black students as well as a *reduction* in Black with respect to White student probability of an IEP. In contrast, higher perceptions of crime and violence (Figure 2l) were associated with an *increase* in the probability of an IEP for Black students as well as an *increase* in Black with respect to White student probability of an IEP. Teachers' perceptions of conflict resolution (Figure 2m) had no statistically significant association with the probability of an IEP for students of any race.

**Discussion**

In this paper, we augmented a small literature on the role of school moderators in racial disproportionality by considering additional school moderators, estimating marginal associations of moderators and the probability of receiving an IEP by four racial groups, and expanding the methodological literature by examining differences in estimations from models with no fixed effects and within school-by-race models. These results add to the emerging research on school moderators of disproportionality and help answer the question of whether the school a student attends is associated with disproportionate placement into special education by race.

Findings based on estimations with no fixed effects *confirmed and refined prior research on the role of student racial composition*. In general, other researchers have found that when race was dichotomized as White/non-White, non-White students were less likely to be classified as the portion of non-White students in a school increased. We refined this result by showing that it held specifically for Black, Hispanic, and Asian students, when their *specific* same race school peers increased. Additionally, we found *new cross-race interactions*—Black students were less likely to be classified as the portion of Hispanic or Asian students increased, and Hispanic students were less likely to be classified as the portion of Black or Asian students increased. These results suggest nuances in the racial distinctiveness hypothesis that align with Fish's (2019a) theory regarding racial political climate: under-representation of Black and Asian students increased when the portion of any group other than White students increased. Finally, when school-level disproportionality was estimated with a within-school-by-race model, the racial composition of students had a statistically significant relationship with the disproportionate classification of Black students. That this relationship persisted even after accounting for variation across schools suggested the classification of Black students is particularly sensitive to the composition of their reference group. While we can only speculate on mechanisms, the IEP determinations for Black students based on their school context is a cause for concern and is consistent with racial bias.

Overall, of student body characteristics, *the racial composition of a students' reference group appears to be the most relevant influence on classification.* Black students are 5.8 pp less likely to be classified as SWD than observationally similar White students in schools with higher concentrations of Black students (comparing schools one SD above and below the mean percentage of Black students). The gap for Hispanic students in schools with higher concentrations of Hispanic students is 2.5 pp, and the gap for Asian students in schools with higher concentrations of Asian students is 1.9 pp—smaller but still statistically significant and meaningful given baseline classification rates. In addition, there are cross-race interactions (e.g. Hispanic students are also under-classified in schools with higher percentages of Black students). For Black students, the magnitude of the gap was even larger when looking within schools (Model 2), and still statistically significant. The proportion of FRPL eligible students, proportion of ELs, average school performance, and school size all had either small, inconsistent, or nil associations with racial disproportionality.

Importantly, for both models we estimated, we found that *a higher proportion of Black teachers was associated with a lower probability of receiving an IEP for Black students—but a higher probability relative to White students.* This result is consistent with both the theory that representative bureaucracy may improve outcomes for students and some research on the benefits to student performance of teacher-student racial matches, particularly for Black students (e.g., Gershenson *et al.*, 2021). That is, the pairing of Black students with Black teachers might reduce special education classification by increasing student performance. However, as previously mentioned, other recent research finds null effects of student-teacher race match on performance and classification (Morgan & Hu, 2023), leaving mechanisms unclear. In addition, our findings differ from Fish (2019b) who found that higher portions of teachers of color lead to higher likelihood of classification for White students—we found White students are less likely to be classified as the portion of Black or Hispanic teachers increases.

Within-school-by-race models suggested *teachers' perceptions of school climate were associated with disproportionality for Black students*. Higher perceptions of order and discipline were associated with lower probabilities of an IEP for Black students and under-representation, while higher teacher perceptions of crime and violence were associated with higher probabilities of an IEP for Black students and over-representation. Again, this aligns with theory suggesting that positive school climate can ameliorate excessive use of exclusionary interventions (discipline and special education referrals). Since this moderator varied over time by school and race, there may be a role for schools to develop and adopt programs that improve these perceptions (with the caveat that our results do not confirm a causal link between school climate and racial disproportionality in special education). Although there is limited causal evidence on how to improve school climate, research suggests a variety of interventions may be effective, such as social-emotional curricula, small group sessions for students with behavior problems, and one-on-one student-staff contact (Voight & Nation, 2016). A growing literature is developing on the importance of restorative justice programs to help with disproportionate disciplinary action (e.g. Anyon *et al,* 2016; Gregory *et al.*, 2015; Kervick *et al.*, 2019), and it is possible these programs might also reduce inappropriate referrals to special education.

We also found model choice was important for the estimation of disproportionality, with more statistically significant results for a model with no school effects. This was unsurprising in NYC, a highly segregated district, where the variation in moderators is greater across schools than within schools by race over time. Results from cross-section (no school fixed effects) models can provide some guidance on redistribution effects for policies that change cross-school compositions. When looking at disproportionality within schools, it is important to include school-by-race effects, because variation in moderators over time differs by race. Results from school-by-race effect models are better for devising possible policies that schools themselves can implement. We note, however, that there is stickiness of moderators in schools-by-race over time; that is, the within-school variations of the moderators are smaller than their variations between schools (see Online Appendix Table C-1). Thus, it would take larger changes in moderators to potentially effect changes in disproportionality within schools. For example, much of the variance in teacher racial composition is between schools, implying that leveraging this to alter disproportionality would entail changing teacher racial composition across schools. That is, while a SD of the percentage of Black teachers in a school is about 20 pp in the full dataset, only about 12% of the variation is within schools over time, meaning that a within-school SD is a little more than 2 pp. School climate is the exception; much of the change in teachers' perceptions of school climate is within schools over time (about 90% or more across the measures), suggesting if school leaders foster improved school climates this could also reduce racial inequalities in special education.

## Limitations and Future Directions

This study has some limitations, which suggest future potential areas for exploration. First, the relationships we examined are descriptive. Future research should explore these patterns with an eye toward whether causal designs can be devised. Second, although the findings are based on data from the largest US school district, important in its own right, the results pertain to students in a single district, and they may be only indicative of where other large districts, with different proportions of students by race or EL status, for example, might start to look for patterns. Future researchers might consider how findings generalize by analyzing these other districts or whole states and, when doing so, they might search for places that exhibit larger within school changes over time than we find in NYC.

Third, the "optimal" identification rate is inherently unobservable and complicated due to both the subjective nature of some special education classification, particularly in high incidence classification categories (Donovan & Cross, 2002), and the understudied efficacy of special education services (although see Ballis & Heath, 2021; Hurwitz *et al.*, 2019; and Author, 2021, for growing evidence on the positive impacts of special education classification). A limitation of this study, common to much special education research, is that we identify over- and under-representation relative to White students (rather than to underlying disability rates, which are unobserved).

Fourth, this work is unable to definitively speak to mechanisms. Quantitative work might be able to match specific students to their teachers to better examine the role of race match in IEP identification, as well as explore differences by service setting, which we are unable to examine. Qualitative research might help to understand if parent reactions to teacher referrals, or school administrator reactions to federal regulations of disproportionality, could explain teacher reactions. NYCDOE and other localities that want to better understand these patterns might consider adding survey items to their annual surveys that the qualitative literature suggests might be important. Questions for parents on their views about special education, and questions for teachers on pressures surrounding identification, would be enlightening.

Finally—and further underscoring why we do not view these results as causal—changes in school composition are overwhelmingly not random, and in NYC, they often reflect broader changes in the neighborhood, such as gentrification. The relationships revealed in this paper may reflect a larger social process playing out in the neighborhoods. We cannot untangle these processes in this work, and we urge researchers to consider the effects of broader social forces that the composition of schools may reflect. Such forces can act as a powerful omitted variable biasing any observational study like our own.

## Conclusion

In this paper, we added to the disproportionality literature by including many school moderators to models that control for student-level characteristics and showed that some of these moderators work to reduce—and others to increase—the probability that Black, Hispanic, or Asian students received IEPs relative to similarly situated White students. The schools students attend matter in terms of racial representation in special education. Specifically, our results are consistent with the theory that racial distinctiveness increases the likelihood of special education classification, and that same-race teachers and school climate affect disproportionality, particularly for Black students. While our research design did not support causal interpretations, by identifying a range of school-level features that relate to disproportionality, both across and within schools, we broadened the toolkit that researchers, educators, and policymakers can consider for monitoring, understanding, and possibly changing these disproportionalities.

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**Table 1**

*Sample of NYC Students in Traditional Public Elementary Schools, 2007-2014*

| | Mean | SD (cont.) |
|---|---|---|
| **Student-level variables** | | |
| **Students receiving IEPs** | 0.116 | |
| **Prop. of IEPs by Disability** | | |
| **Specific Learning Disability (LD)** | 0.467 | |
| **Speech/Language Impairment (SI)** | 0.377 | |
| **Other Health Impairment (OH)** | 0.086 | |
| **Emotional Disturbance (ED)** | 0.036 | |
| **Low incidence Disabilities (LI)** | 0.035 | |
| **Asian and other** | 0.178 | |
| **Black** | 0.247 | |
| **Hispanic** | 0.414 | |
| **White** | 0.161 | |
| **Prop. of Students with IEPs, by Race** | | |
| **Asian and other** | 0.086 | |
| **Black** | 0.241 | |
| **Hispanic** | 0.487 | |
| **White** | 0.185 | |
| **English Learner (EL)** | 0.176 | |
| **Foreign-born/Immigrant** | 0.109 | |
| **Male** | 0.502 | |
| **Free/reduced lunch eligible (FRPL)** | 0.691 | |
| **Attendance Rate (% days)** | 93.55 | 6.71 |
| **Grade 3 ELA Score (SD)** | 0.048 | 0.398 |
| **School-level variables** | | |
| **Prop. Asian/Other students** | 0.176 | 0.213 |
| **Prop. Black students** | 0.246 | 0.276 |
| **Prop. Hispanic students** | 0.417 | 0.273 |
| **Prop. White students** | 0.161 | 0.227 |
| **Prop. EL students** | 0.175 | 0.133 |
| **Prop. Free/reduced lunch students** | 0.691 | 0.276 |
| **Average ELA Score (SD)** | 0.048 | 0.398 |
| **Prop. Asian/Other teachers** | 0.056 | 0.075 |
| **Prop. Black teachers** | 0.163 | 0.195 |
| **Prop. Hispanic teachers** | 0.163 | 0.152 |
| **Prop. White teachers** | 0.618 | 0.241 |
| **School Size** | 783 | 333 |
| **Tch Per 1: Discipline and Safety** | -0.002 | 0.538 |
| **Tch Per 2: Crime and Violence** | 0.093 | 0.437 |
| **Tch Per 3: Conflict Resolution** | -0.003 | 0.553 |
| **Student-year observations** | 2,825,366 | |
| **Unique Students** | 928,231 | |
| **Unique Schools** | 691 | |

**Table 2**

*Linear Probability Model Results: School characteristics, New York City Public Elementary Schools, 2007-14*

| | | Model 1 | | Model 2 | |
|---|---|---|---|---|---|
| | | **Estimate** | **Std. Err.** | **Estimate** | **Std. Err.** |
| **Prop. Asian Students** | Main effect | 0.059** | 0.020 | 0.043 | 0.024 |
| | Int w/ Asian/Other | -0.091*** | 0.020 | -0.092*** | 0.022 |
| | Int w/ Black | -0.145*** | 0.027 | -0.084** | 0.031 |
| | Int w/ Hispanic | -0.134*** | 0.023 | -0.046 | 0.025 |
| **Prop. Black Students** | Main effect | 0.062* | 0.025 | 0.095** | 0.030 |
| | Int w/ Asian/Other | -0.060* | 0.025 | -0.118*** | 0.033 |
| | Int w/ Black | -0.208*** | 0.031 | -0.197*** | 0.035 |
| | Int w/ Hispanic | -0.125*** | 0.027 | -0.108*** | 0.030 |
| **Prop. Hispanic Students** | Main effect | 0.006 | 0.021 | 0.027 | 0.025 |
| | Int w/ Asian/Other | -0.025 | 0.021 | -0.036 | 0.026 |
| | Int w/ Black | -0.097*** | 0.027 | -0.038 | 0.031 |
| | Int w/ Hispanic | -0.091*** | 0.023 | -0.049 | 0.026 |
| **Prop. Asian Teachers** | Main effect | 0.037 | 0.044 | 0.020 | 0.050 |
| | Int w/ Asian/Other | 0.027 | 0.044 | 0.064 | 0.047 |
| | Int w/ Black | 0.003 | 0.053 | 0.091 | 0.052 |
| | Int w/ Hispanic | 0.034 | 0.049 | -0.012 | 0.052 |
| **Prop. Black Teachers** | Main effect | -0.107*** | 0.032 | -0.102** | 0.032 |
| | Int w/ Asian/Other | 0.049 | 0.031 | 0.030 | 0.070 |
| | Int w/ Black | 0.075* | 0.031 | 0.072* | 0.031 |
| | Int w/ Hispanic | 0.027 | 0.032 | 0.032 | 0.032 |
| **Prop. Hispanic Teachers** | Main effect | -0.030 | 0.034 | -0.070* | 0.035 |
| | Int w/ Asian/Other | 0.023 | 0.033 | 0.040 | 0.037 |
| | Int w/ Black | -0.018 | 0.035 | 0.005 | 0.035 |
| | Int w/ Hispanic | -0.019 | 0.033 | 0.031 | 0.033 |
| **School Size (00s)** | Main effect | -0.004*** | 0.001 | -0.006*** | 0.001 |
| | Int w/ Asian/Other | 0.002* | 0.001 | 0.003** | 0.001 |
| | Int w/ Black | -0.001 | 0.001 | 0.001 | 0.001 |

*Linear Probability Model Results: School characteristics, New York City Public Elementary Schools, 2007-14*

| | | Model 1 | | Model 2 | |
|---|---|---|---|---|---|
| | | **Estimate** | **Std. Err.** | **Estimate** | **Std. Err.** |
| | Int w/ Hispanic | -0.001 | 0.001 | 0.001 | 0.001 |
| **Factor 1: Discipline & Safety** | Main effect | 0.000 | 0.002 | -0.003 | 0.014 |
| | Int w/ Asian/Other | -0.002 | 0.003 | -0.014 | 0.014 |
| | Int w/ Black | -0.002 | 0.003 | 0.000 | 0.015 |
| | Int w/ Hispanic | -0.001 | 0.003 | 0.004 | 0.013 |
| **Factor 2: Crime & Violence** | Main effect | -0.002 | 0.003 | -0.034 | 0.002 |
| | Int w/ Asian/Other | 0.002 | 0.003 | 0.020 | 0.018 |
| | Int w/ Black | 0.004 | 0.003 | 0.033 | 0.020 |
| | Int w/ Hispanic | 0.003 | 0.003 | 0.017 | 0.019 |
| **Factor 3: Conflict Resolution** | Main effect | -0.005 | 0.005 | -0.012 | 0.037 |
| | Int w/ Asian/Other | 0.004 | 0.005 | 0.022 | 0.035 |
| | Int w/ Black | 0.000 | 0.005 | -0.026 | 0.038 |
| | Int w/ Hispanic | 0.003 | 0.005 | 0.002 | 0.038 |
| **Prop. EL Students** | Main effect | -0.190*** | 0.036 | 0.024 | 0.048 |
| | Int w/ Asian/Other | 0.130*** | 0.036 | -0.065 | 0.052 |
| | Int w/ Black | 0.165*** | 0.040 | -0.066 | 0.054 |
| | Int w/ Hispanic | 0.153*** | 0.037 | 0.031 | 0.060 |
| **Prop. FRPL Students** | Main effect | -0.046*** | 0.008 | 0.051 | 0.061 |
| | Int w/ Asian/Other | 0.030*** | 0.007 | -0.030 | 0.063 |
| | Int w/ Black | 0.013 | 0.009 | -0.189** | 0.072 |
| | Int w/ Hispanic | 0.020* | 0.009 | -0.214** | 0.080 |
| **Average School Performance** | Main effect | -0.017 | 0.010 | 0.016 | 0.021 |
| | Int w/ Asian/Other | 0.026* | 0.010 | 0.015 | 0.022 |
| | Int w/ Black | 0.015 | 0.011 | -0.012 | 0.024 |
| | Int w/ Hispanic | 0.022 | 0.012 | 0.014 | 0.023 |

*Note*. Grade and year fixed effects, student level characteristics, and all their respective interactions by race are also included but not shown. Standard errors are clustered at the school level. *p < .05. **p < .01. ***p < .001

**Figure 1**

*Model 1: Predicted Probability of an IEP with School Characteristics +/- 0.5 SDs from Mean, by Student Race*

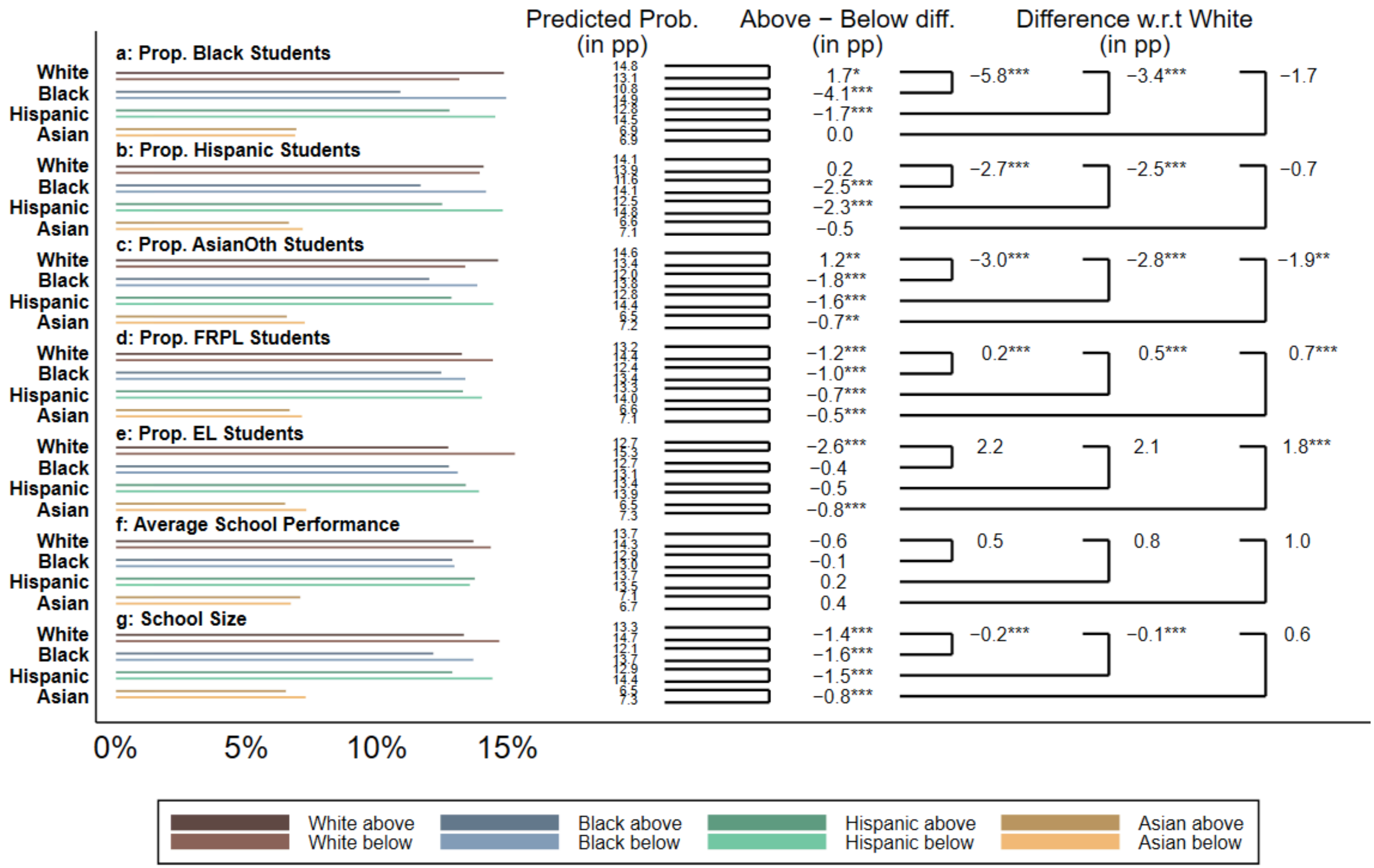


**Figure 1 (cont.)**

*Model 1: Predicted Probability of an IEP with School Characteristics +/- 0.5 SDs from Mean, by Student Race*

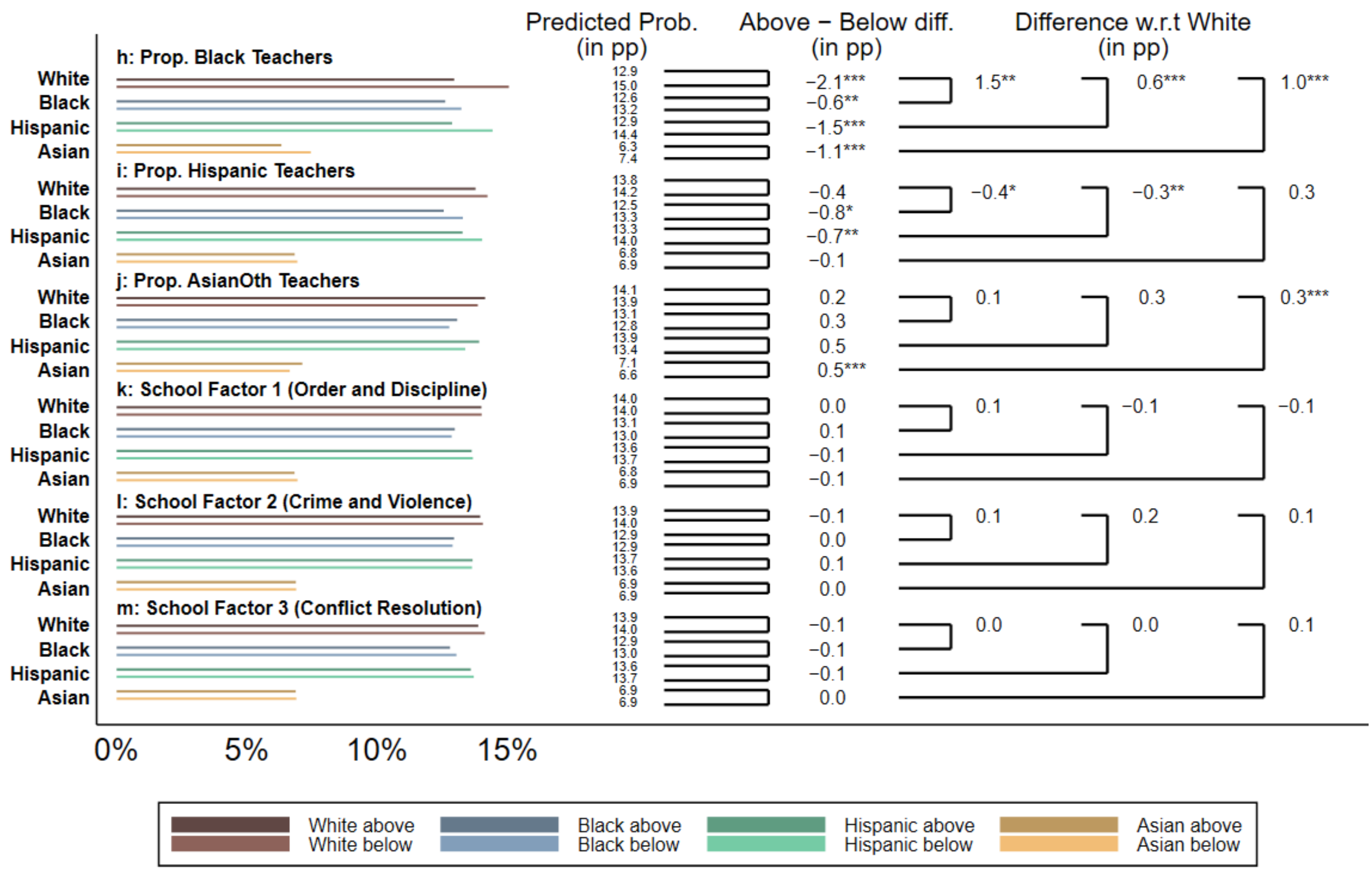


**Figure 2**

*Model 2: Predicted Probability of an IEP with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race*

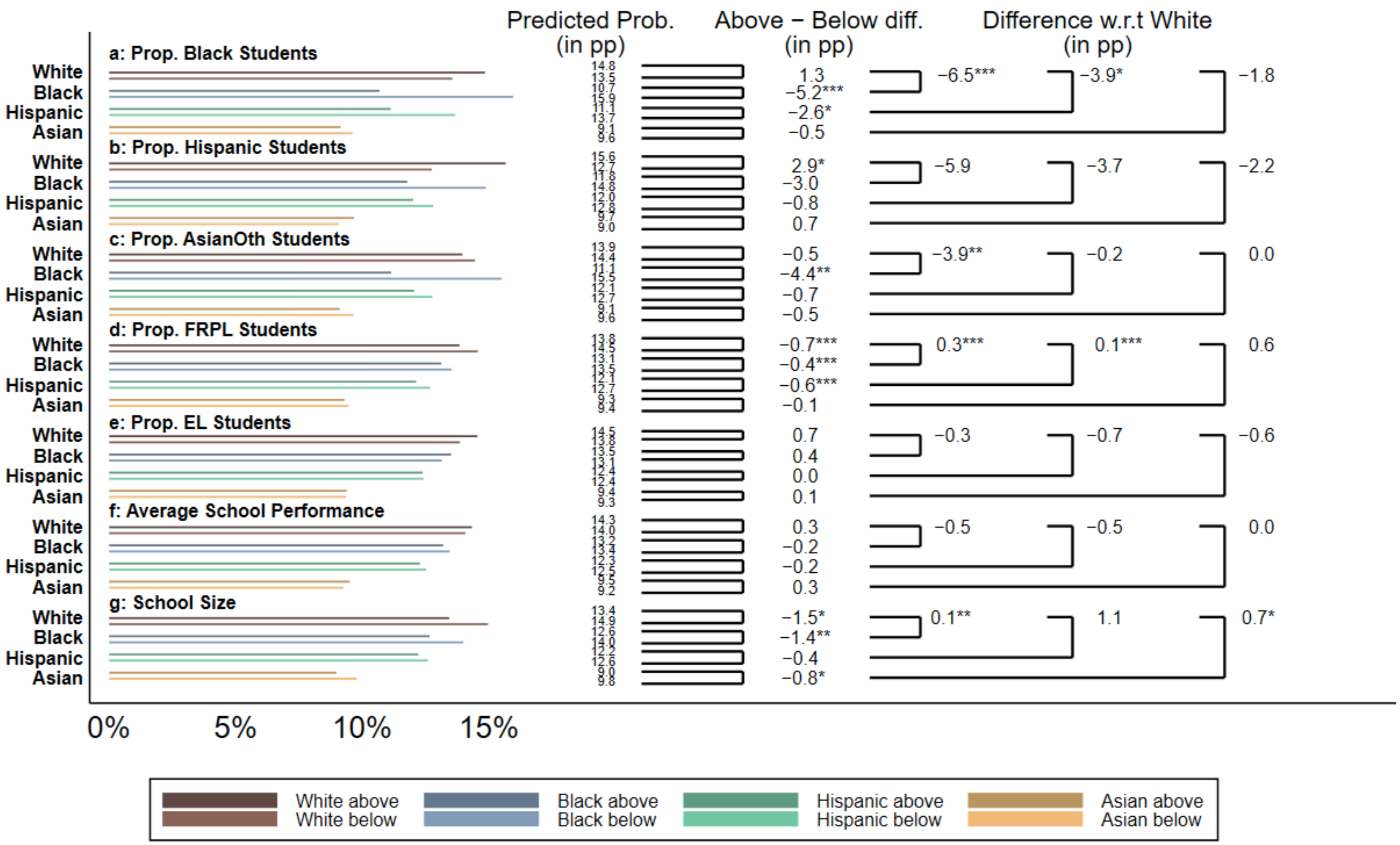
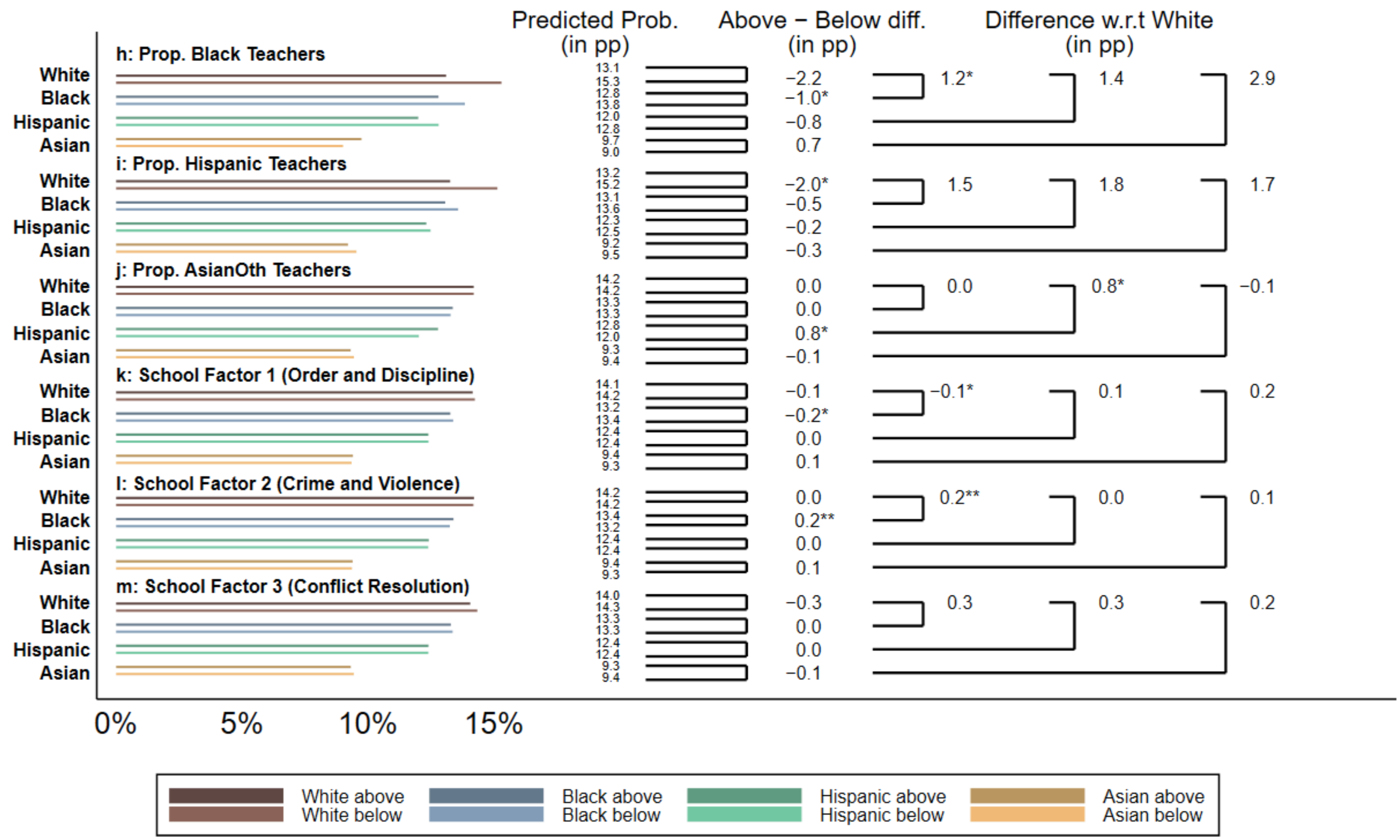


**Figure 2 (cont.)**

*Model 2: Predicted Probability of an IEP with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race*



**NOTE:**

**The following materials are supplemental and intended to aid the reviewers and then be available as Online Supporting Materials to accompany the publication.**

**Online Appendix A: Prior Research Quantifying Associations between School Contextual Moderators and Racial Disproportionality**

To the extent possible, we summarize the information on magnitudes from all three studies looking at student body racial composition. Overall, comparing magnitudes of prior estimates is challenging because:

- The way school-level student racial composition is measured differs across studies (as well as the actual racial composition of students, given the differing contexts).
    - Elder *et al.* (2021): percent Minority (Black + Hispanic)
    - Fish (2019a): percent White
    - Shifrer & Fish (2020): percent Black in the model interacting with Black students' race; percent Hispanic in the model interacting with Hispanic students' race
- The way predicted probabilities are presented differs across studies.
    - Elder *et al.* (2021) presented predicted probabilities with the full range of % Minority on the x-axis (0-100), in 10 percent point bins.
    - Fish (2019a) presented predicted probabilities with the full range of % White values on the x-axis (0-100), in 10 percentage point increments.
    - Shifrer & Fish (2020) presented predicted probabilities from 1 standard deviation (SD) below the % Black (or % Hispanic) to 0.5 SDs above the average % Black (or % Hispanic), in 0.5 SD increments.
- The predicted probabilities are presented in Figures, making it impossible to *precisely* calculate changes in predicted probabilities for given changes in student racial composition.

**Elder *et al.* (2021)**

Figure 3 on p. S172 presents the results of interest, which are discussed on p. S173:

> In schools with fewer than 10% minority students, a black student is 3.8 percentage points more likely to be identified as disabled than an observationally equivalent white student. This value steadily decreases as the minority share of a school grows, so that a black student in a school with more than 90% minority students is 5.3 percentage points less likely to be identified than an observationally equivalent white student. The gradient is roughly linear, implying that for every 10-point increase in the minority share, underrepresentation among black students increases by approximately 0.9 percentage points.

They describe the relationship for Hispanic students, which is similar in direction but smaller in magnitude, and White students, which appears to have little relationship to % minority.

In addition, the results are for fourth grade only (they show Kindergarten in an Appendix) and the percent minority is the percent of the student's *Kindergarten* cohort.

Finally, their method of calculation is somewhat different than others as they are presenting the gap between raw classification rates and predicted classification rates (Blinder-Oaxaca decomposition).

**Fish (2019a)**

Fish presents results from a logit estimation in Table 3 (p. 2587-8) and shows predicted probabilities in Figure 1 (p. 2588). The coefficient on proportion White in the Table is -1.089 and the odds ratio is 0.337. Since White is the left-out category for student-level race, this is the effect of proportion White for White students (see discussion in text on p.2585 and 2588). From Footnote 1:

> White students experience a decrease in log odds of special education receipt of -1.089 (exponentiated to an odds ratio of 0.337) when they experience a change from a school with no White students to a school with all White students. (p. 2601-2).

Because the predicted probabilities are only shown in the Figure, it is hard to calculate the magnitude of the change, although it looks like it is about a -12.5 percentage point (pp) change in classification likelihood for a White student going from a school that is 0% White to a school that is 100% White.

**Shifrer & Fish (2020)**

Figure 2, top panel ("Black Children") on p. 190 reflects the estimates of interest. It looks like as a Black student goes from a school half a standard deviation below the average portion of Black students to a school half a standard deviation above the average portion of Black students, they are 0.33 pp (1/3 of a pp) less likely to be classified as SWD (the change appears to be the same for both "over-designated" and "under-designated" disabilities even though the levels for the two are different). They do not discuss the magnitude in the text (see paragraph before conclusions on p. 188).

The estimates from the logit estimation are presented in their supplemental material online, p. 7, Table 5 Part 1. The hazard ratio for the proportion of students in a school who are Black is 0.87, and the hazard ratio for proportion of students in a school who are Black interacted with whether the student is Black is 0.95. (These from Model 3, which looks at "over-designated" disabilities (LD, OH, ID, ED), but the results are basically the same in Model 4, which looks at "under-designated" disabilities (SI, AU); this is also evident in the Figure in the paper).

## Online Appendix B: Factor Analysis

We performed Factor Analysis using consistent item questions, described in Table B-1, from the NYC School Survey from 2007-2014. We used Stata's **factor** command, which by default produces estimates using the principal-factor method (communalities set to the squared multiple-correlation coefficients). After fitting a factor model, the factor-loading matrix was rotated using the varimax (orthogonal). The varimax rotation helped to make the pattern of loadings more pronounced by maximizing the variance of loadings for each factor, producing a simpler structure and factors that may be easier to interpret while preserving the pairwise orthogonality and total variance of the original components. Our choice of an orthogonal rotation allowed us to construct measures of distinct dimensions of the school context that are uncorrelated at the teacher level. We limited the analysis to retain only factors with an Eigenvalue greater than or equal to one; this is a common bar used in factor analysis in order to isolate traits that have significant power to explain covariance among survey items. Based on this analysis, the survey item questions loaded onto three factors, as seen in the table below: Order and Discipline (factor 1), Crime and Violence (factor 2), and Conflict Resolution (factor 3).

**Table B-1**

*Survey Questions and Factor Loading*

| | Item # | Factor 1 | Factor 2 | Factor 3 |
|---|---|---|---|---|
| **a. Order and discipline are maintained at my school.** | A1 | 0.849 | | |
| **b. I can get the help I need at my school to address student behavior and discipline problems.** | A2 | 0.842 | | |
| **c. I am safe at my school.** | A3 | 0.710 | | |
| **d. Crime and violence are a problem in my school.** | A4 | | 0.683 | |
| **e. Students in my school are often threatened or bullied.** | A5 | -0.389 | 0.626 | |
| **f. Adults at my school are often disrespectful to students.** | A6 | 0.499 | | |
| **g. Most students at my school treat teachers with respect.** | A7 | 0.662 | | |
| **j. Students' use of alcohol and illegal drugs in school is a problem at my school.** | A9 | | 0.721 | |
| **k. There are conflicts at my school based: on race, culture, religion, sexual orientation, gender, or disability.** | A10 | | 0.695 | |
| **l. There is a person or a program in my school to help students resolve conflicts.** | A11 | | | 0.796 |
| **m. Gang activity is a problem at my school.** | A12 | | | -0.788 |

## Online Appendix C: Variation and Correlation of School Context Moderators

As shown in Appendix Table C-1, for most school context moderators, the within-school variations of the moderators are smaller than their variations between schools. Thus, it would take larger changes in moderators to potentially effect changes in disproportionality within schools. For example, much of the variance in teacher racial composition is between schools, implying that leveraging this to alter disproportionality would entail changing teacher racial composition across schools. School climate is the exception; much of the change in teachers' perceptions of school climate is within schools over time, suggesting if school leaders foster improved school climates this could also reduce racial inequalities in special education.

In addition, we included many school-level variables in the models, raising a possible concern that they were highly collinear, preventing many from exhibiting statistical significance. This concern, however, was unwarranted, as shown in the correlation matrices presented in Appendix Tables C-2 (raw correlations) and C-3 (school-by-race demeaned correlations): There were few raw correlations in the high 0.5 range, and the demeaned correlations that were relevant for Model 2 were low, only two times surpassing 0.37.

**Table C-1**

*Overall Standard Deviations (SD) and Within School-by-Race as a Proportion of Overall SD, School-Level Variables (Moderators)*

| School-level Variables | Overall SD | Prop. Within |
|---|---|---|
| Prop. White students | 0.227 | .093 |
| Prop. Black students | 0.276 | .080 |
| Prop. Hispanic students | 0.273 | .092 |
| Prop. Asian/Other students | 0.213 | .099 |
| Prop. Free/reduced lunch students | 0.277 | .621 |
| Prop. EL students | 0.133 | .218 |
| Average School Performance (SD) | 0.394 | .287 |
| School Size | 3.332 | .200 |
| Prop. White teachers | 0.241 | .004 |
| Prop. Black teachers | 0.195 | .118 |
| Prop. Hispanic teachers | 0.153 | .144 |
| Prop. Asian/Other teachers | 0.075 | .253 |
| Factor 1: Discipline and Safety | 0.538 | .898 |
| Factor 2: Crime and Violence | 0.437 | .920 |
| Factor 3: Conflict Resolution | 0.553 | .986 |

**Table C-2**

*Raw Correlations*

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **a. Prop. of Black Students** | 1.00 | | | | | | | | | | | | |
| **b. Prop. of Hispanic Students** | -0.33 | 1.00 | | | | | | | | | | | |
| **c. Prop. of Asian/Other Students** | -0.44 | -0.37 | 1.00 | | | | | | | | | | |
| **d. Prop. of FRPL Students** | 0.26 | 0.39 | -0.24 | 1.00 | | | | | | | | | |
| **e. Prop. of EL Students** | -0.43 | 0.59 | 0.19 | 0.25 | 1.00 | | | | | | | | |
| **f. Average School Performance** | -0.37 | -0.53 | 0.45 | -0.58 | -0.36 | 1.00 | | | | | | | |
| **g. School Size** | -0.32 | 0.16 | 0.25 | -0.03 | 0.39 | 0.04 | 1.00 | | | | | | |
| **h. Prop. of Black Teachers** | 0.83 | -0.17 | -0.41 | 0.32 | -0.28 | -0.41 | -0.31 | 1.00 | | | | | |
| **i. Prop. of Hispanic Teachers** | -0.17 | 0.79 | -0.35 | 0.38 | 0.54 | -0.53 | 0.04 | -0.04 | 1.00 | | | | |
| **j. Prop. of Asian Teachers** | -0.18 | -0.16 | 0.54 | -0.09 | 0.26 | 0.15 | 0.13 | -0.14 | -0.10 | 1.00 | | | |
| **k. Factor 1: Order and Discipline** | 0.09 | 0.02 | -0.07 | 0.09 | 0.02 | -0.14 | -0.02 | 0.08 | 0.05 | -0.01 | 1.00 | | |
| **l. Factor 2: Crime and Violence** | -0.10 | -0.05 | 0.07 | -0.07 | -0.03 | 0.17 | 0.01 | -0.09 | -0.06 | 0.04 | -0.10 | 1.00 | |
| **m. Factor 3: Conflict Resolution** | 0.02 | 0.01 | -0.03 | -0.07 | -0.01 | -0.01 | -0.04 | 0.02 | 0.02 | -0.06 | 0.01 | -0.01 | 1.00 |

**Table C-3**

*Demeaned School-by-Race Correlations*

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **a. Prop. of Black Students** | 1.00 | | | | | | | | | | | | |
| **b. Prop. of Hispanic Students** | -0.37 | 1.00 | | | | | | | | | | | |
| **c. Prop. of Asian/Other Students** | -0.28 | -0.42 | 1.00 | | | | | | | | | | |
| **d. Prop. of FRPL Students** | -0.04 | 0.03 | 0.07 | 1.00 | | | | | | | | | |
| **e. Prop. of EL Students** | -0.15 | 0.04 | 0.19 | -0.12 | 1.00 | | | | | | | | |
| **f. Average School Performance** | -0.15 | -0.04 | 0.09 | 0.00 | -0.07 | 1.00 | | | | | | | |
| **g. School Size** | -0.05 | -0.09 | 0.15 | 0.04 | 0.07 | 0.06 | 1.00 | | | | | | |
| **h. Prop. of Black Teachers** | 0.00 | 0.02 | 0.00 | 0.02 | 0.03 | 0.00 | -0.13 | 1.00 | | | | | |
| **i. Prop. of Hispanic Teachers** | -0.06 | 0.06 | 0.02 | 0.01 | 0.04 | 0.01 | -0.11 | -0.16 | 1.00 | | | | |
| **j. Prop. of Asian Teachers** | -0.15 | -0.03 | 0.18 | 0.07 | 0.15 | 0.11 | 0.27 | -0.07 | -0.08 | 1.00 | | | |
| **k. Factor 1: Order and Discipline** | 0.02 | 0.02 | -0.02 | 0.01 | 0.04 | -0.05 | -0.08 | -0.01 | 0.04 | 0.01 | 1.00 | | |
| **l. Factor 2: Crime and Violence** | -0.11 | 0.05 | 0.05 | 0.04 | 0.04 | 0.11 | 0.07 | 0.00 | 0.04 | 0.09 | -0.08 | 1.00 | |
| **m. Factor 3: Conflict Resolution** | 0.06 | -0.02 | -0.04 | -0.12 | -0.01 | 0.04 | -0.17 | 0.02 | 0.03 | -0.18 | -0.01 | -0.01 | 1.00 |

**Online Appendix D: Results by Disability Classification**

The association between school context and disproportionality in special education broadly likely differs by specific disability classification due to some degree of subjectivity in diagnosis, stigma, degree of exclusion from general education settings, and the racialized construction of specific disability classifications. Indeed, there are varying levels of disproportionality by race depending on the specific disability (USDOE, 2022), and prior literature suggested school context was unlikely to moderate disproportionality uniformly across different disability classifications. Fish (2019a) found the proportion of White students is significantly associated with the increased classification of Black students only for students with emotional disturbances (ED), intellectual disabilities (ID), or specific learning disabilities (LD). She hypothesized that, rather than there being uniform racialized competition for special education classification broadly, students of color were segregated into “low-status” classifications when they were the minority, while White children were placed in “high-status” disabilities when they were the minority. As another example, the classification of ELs, most of whom are Hispanic or Asian, may be complicated by educators who have difficulty in accurately distinguishing between language acquisitions difficulties and specific learning disabilities or language disabilities (Sullivan, 2011). Finally, perceptions of school climate may particularly moderate disproportionality in classification into ED, as students may be more likely to receive this classification in response to classroom management challenges (Bal *et al.*, 2019; Harry & Klinger, 2014). In contrast, we might expect little moderation of school context variables for low-incidence disabilities that are typically considered more objective (e.g. hearing impairment; visual impairment) and often diagnosed by physicians rather than school-based staff (though disproportionality in such classifications may persist due to racial disparities in children’s health care). These are just a few examples.

Results for each of the five disability classifications are shown in Appendix Figures D-1A, 2A, 3A, 4A, and 5A (Model 1) and D-1B, 2B, 3B, 4B, and 5B (Model 2). As expected from the descriptive statistics that showed the proportions of students classified by each disability, the predicted probabilities are much higher for students with LDs and SIs compared to students with OHs, EDs, or LIs. Similar to our main results, we find that the racial composition of the student body typically has significant relationships with disproportionality in each specific disability classification, and this relationship is the largest in magnitude of any school context characteristic we consider, even after adjusting for school-by-race differences. However, the direction of this relationship depends on the specific disability classification. Similar to the main results, Black, Hispanic, and Asian students are increasingly under-represented in SI and OH classifications as the portion of their same race peers increases (see Figures D-2 and D-3, although fewer of the relationships in the within-school-by-race models are statistically significant). However, after adjusting for school-by-race differences, Hispanic and Asian students are increasingly *overrepresented* in LD classifications as the portion of their same race peers increases (see Figure D-1B; while the relationship is the opposite for Black students, it is not statistically significant). This aligns with Fish's (2019a) discussion of OH and SI as high-status disabilities and LD as a "stratified-status" disability classification that can either be used either to provide additional support for advantaged students or to segregate students of color. Other variables have statistically significant relationships with disproportionality for various disability classifications, though most are smaller in magnitude, similar to the main results, and/or not statistically significant. In particular, the portion of students who are FRPL-eligible has a statistically significant relationship with disproportionality in LD classification for students of all races, even after controlling for school-by-raced differences (see Figure D-1B), although qualitatively the results are similar to the main results.

It is possible that small sample sizes of ED or LI limit the power to identify significant relationships for these classifications in particular. However, it is striking to still see large, and in most cases statistically significant, increases in the under-representation of Black students as the portion of Black students increases, given the low overall classification rates in these disability categories (see Figures D-4 and D-5). In addition, given the historic use of the ED classification to segregate Black students in particular, it is noteworthy that so many school context variables have statistically significant relationships to disproportionality in ED for Black students, even after adjusting for school-by-race differences (see Figure D-4B).

**Figure D-1A**

*Predicted Probability of an IEP for Specific Learning Disability with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 1)*

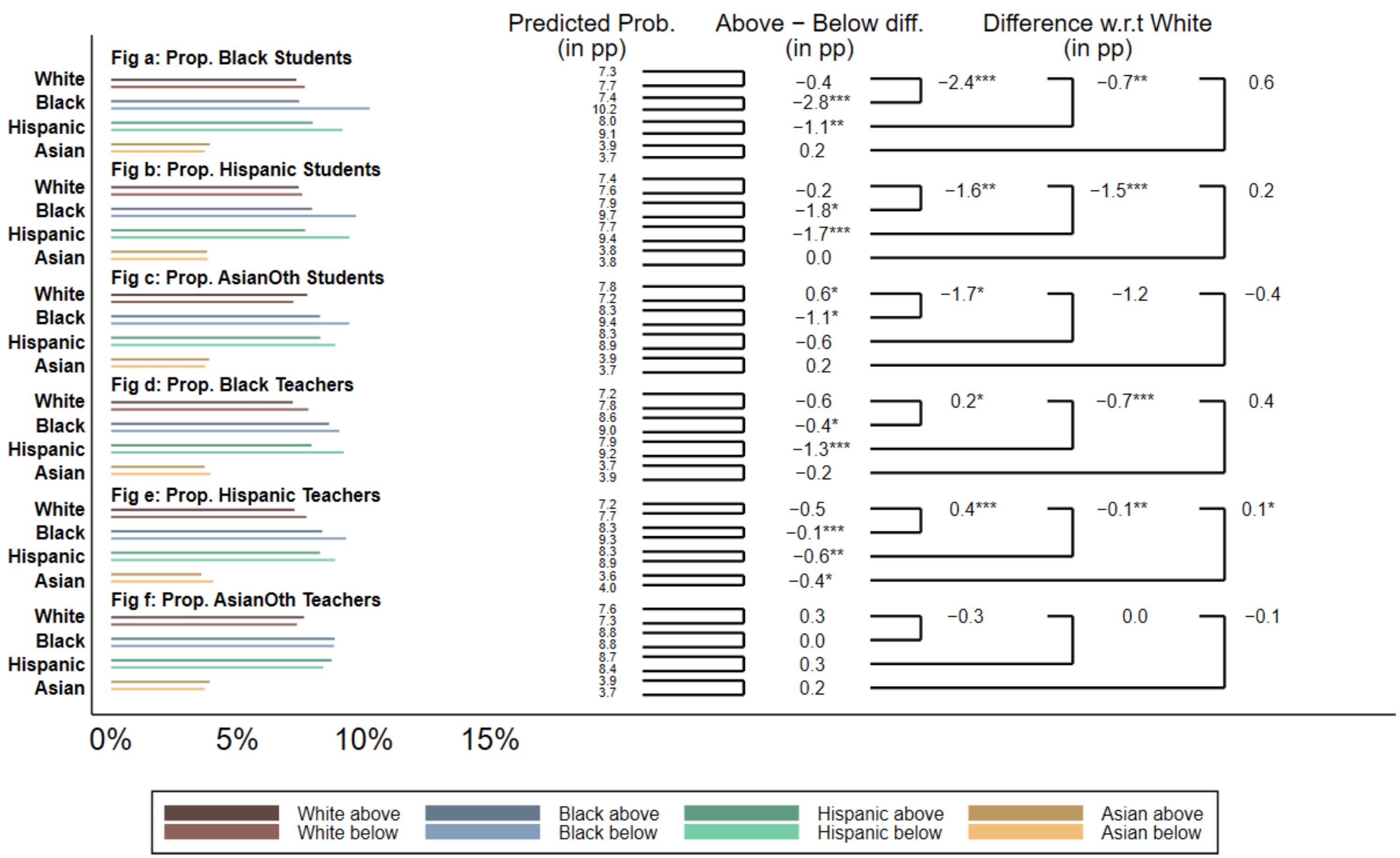


**Figure D-1A (cont.)**

*Predicted Probability of an IEP for Specific Learning Disability with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 1)*

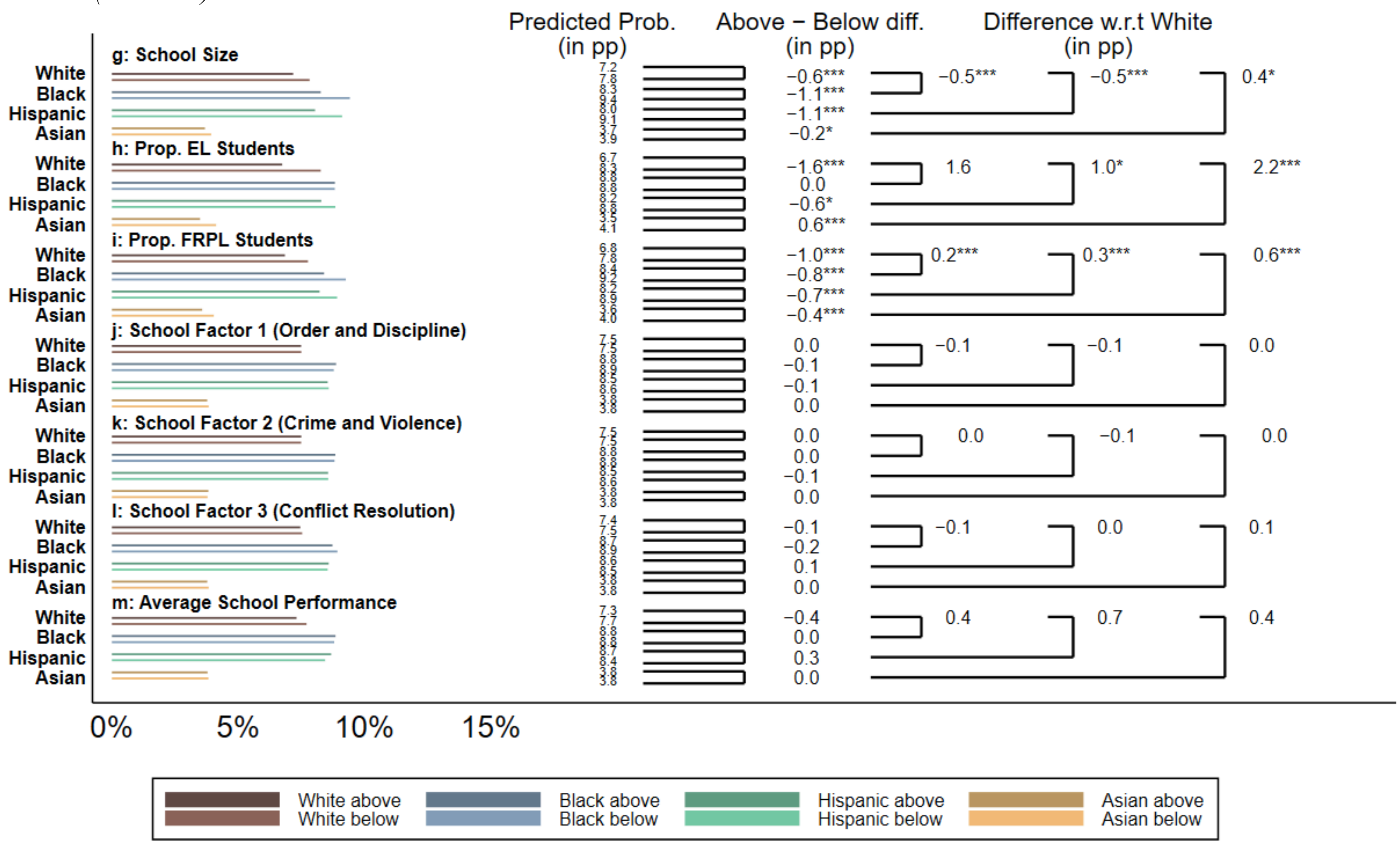


**Figure D-1B**

*Predicted Probability of an IEP for Specific Learning Disability with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 2)*

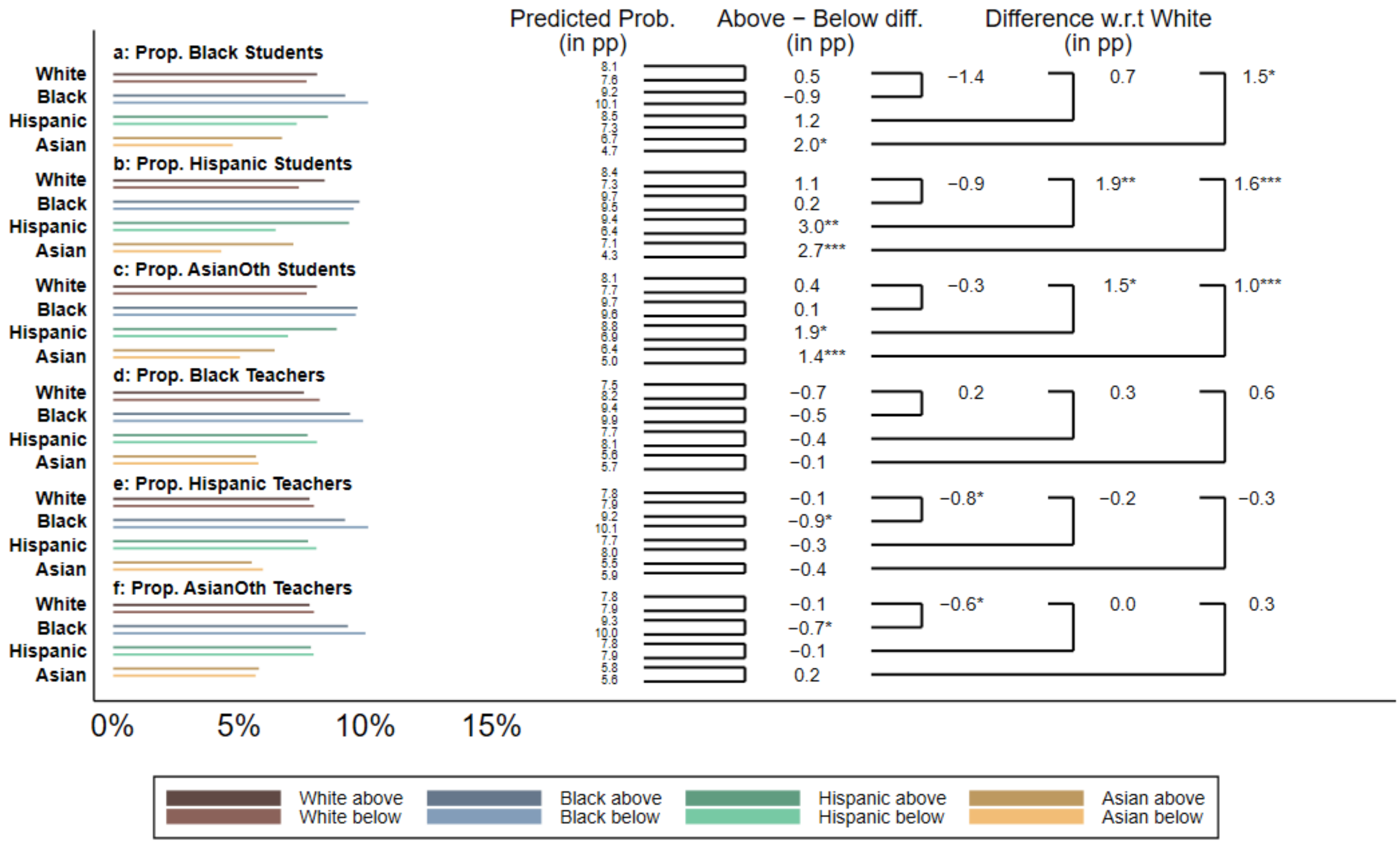


**Figure D-1B (cont.)**

*Predicted Probability of an IEP for Specific Learning Disability with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 2)*

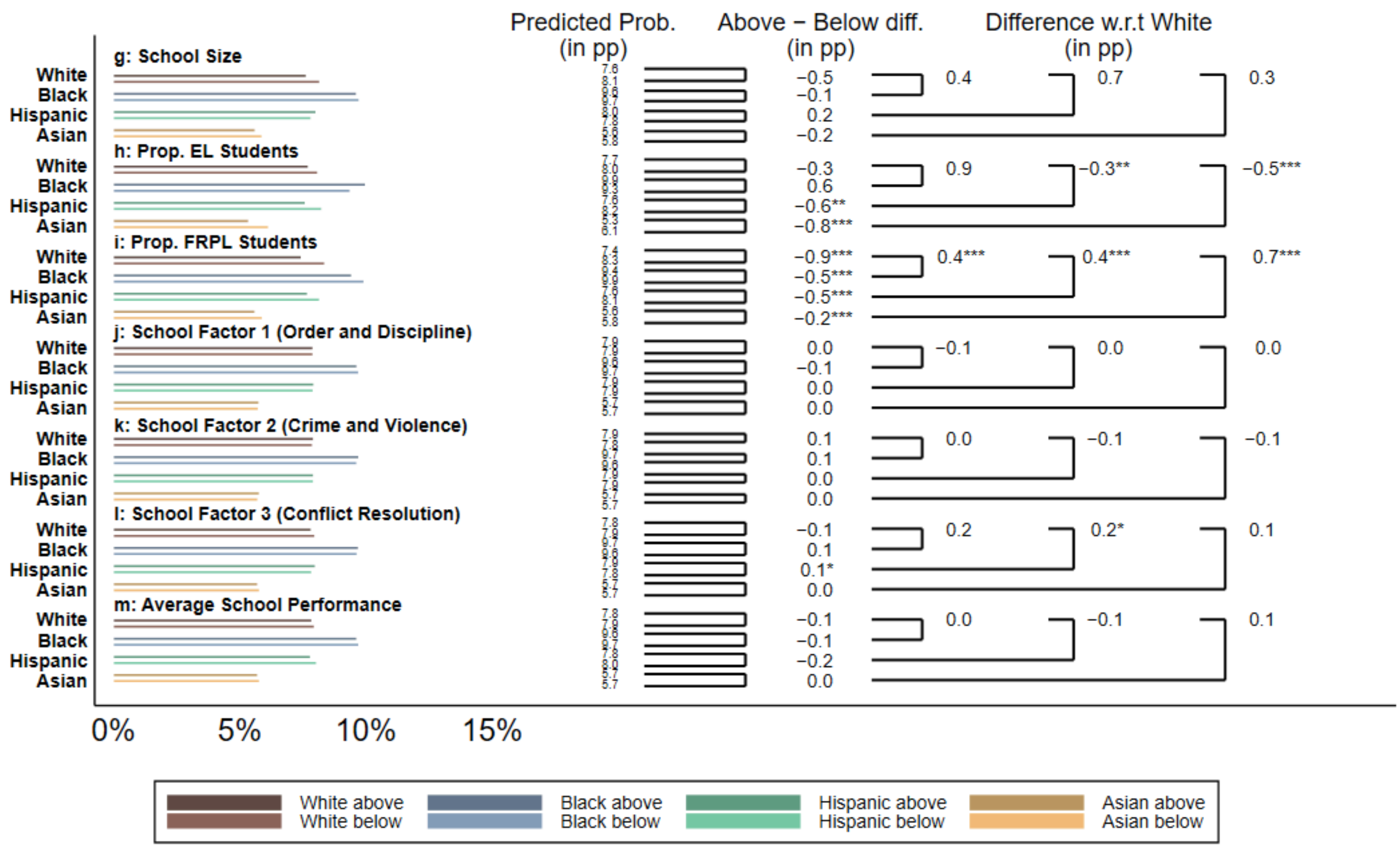


**Figure D-2A**

*Predicted Probability of an IEP for Speech Impairment with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 1)*

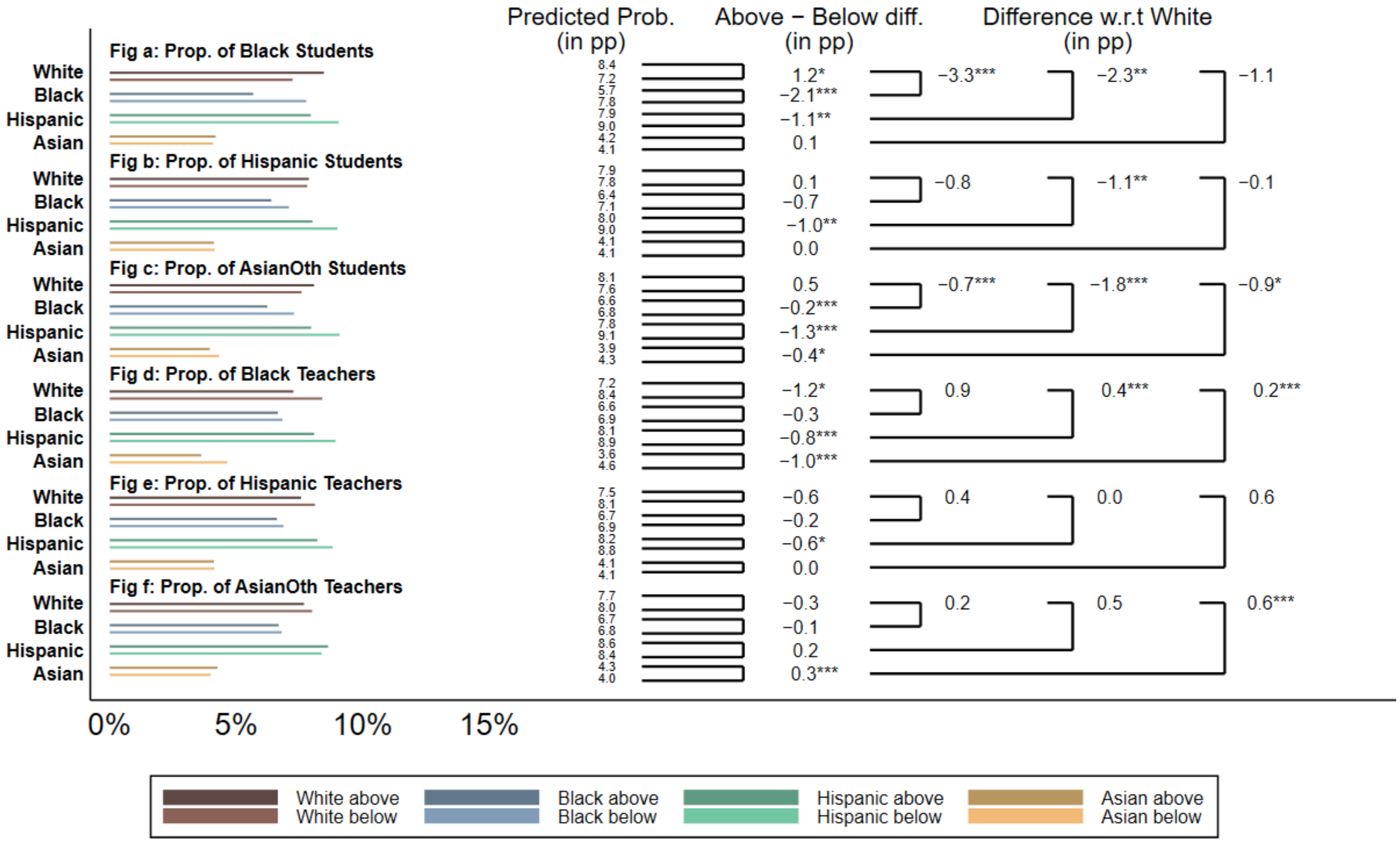


**Figure D-2A (cont.)**

*Predicted Probability of an IEP for Speech Impairment with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 1)*

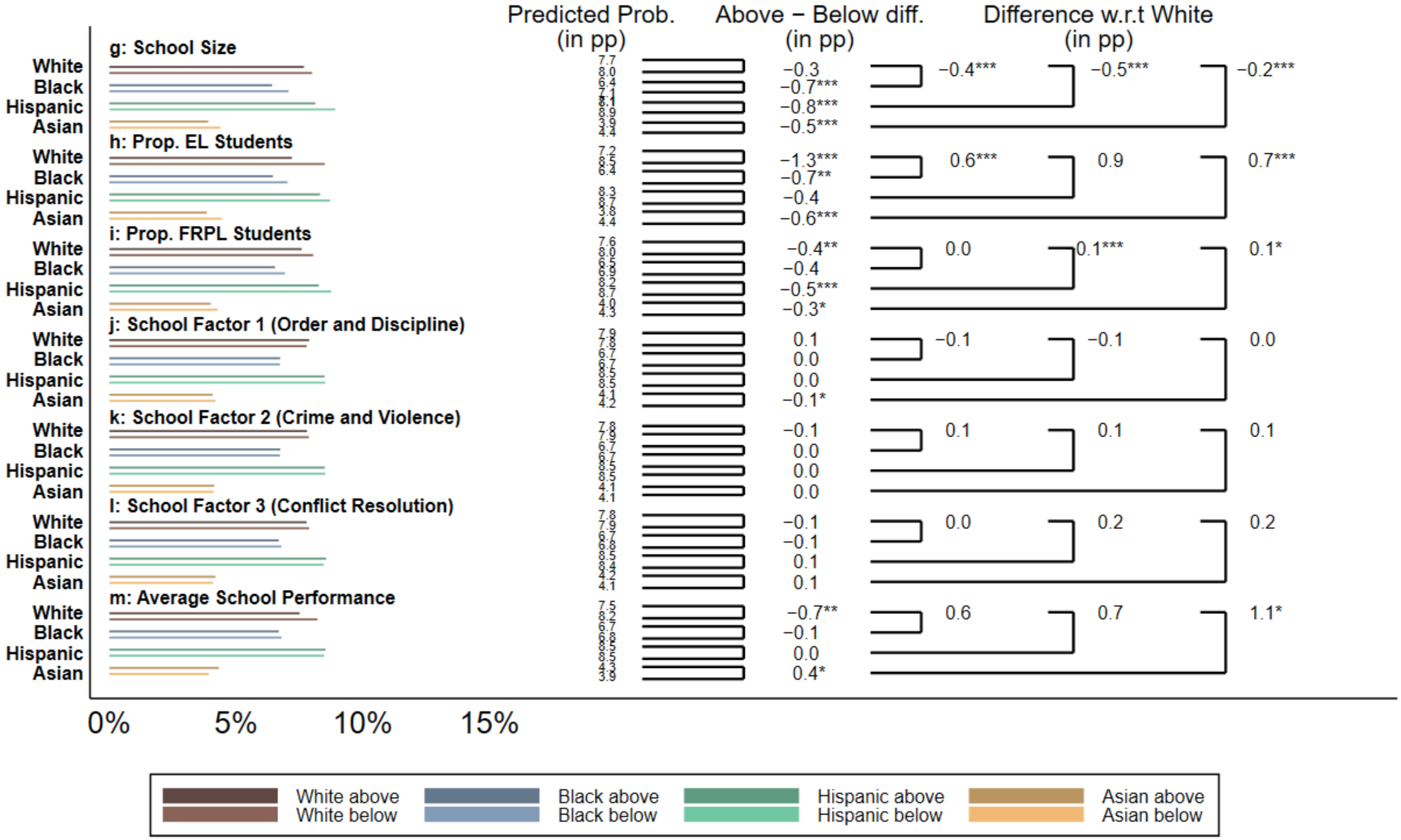


**Figure D-2B**

*Predicted Probability of an IEP for Speech Impairment with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 2)*

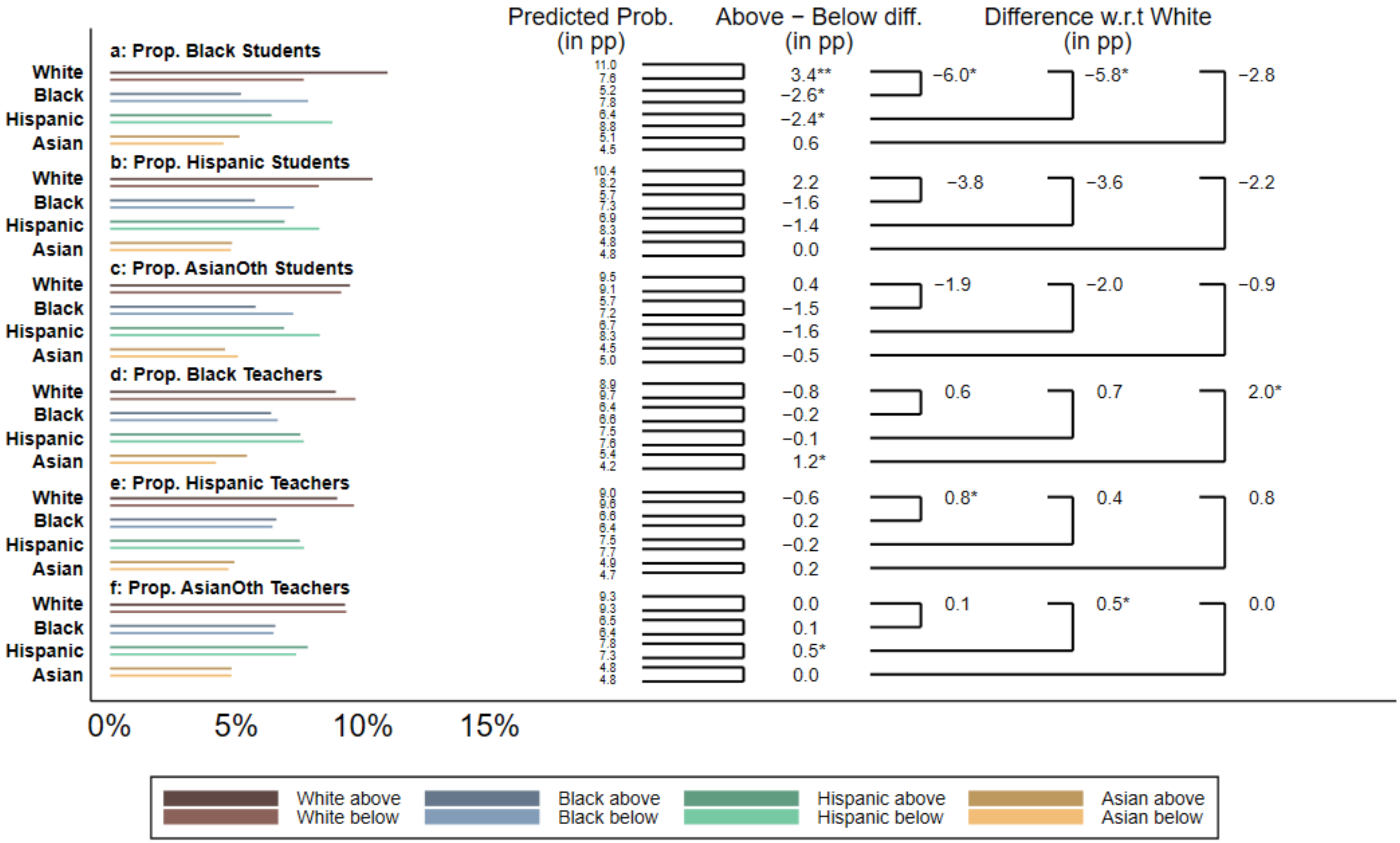


**Figure D-2B (cont.)**

*Predicted Probability of an IEP for Speech Impairment with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 2)*

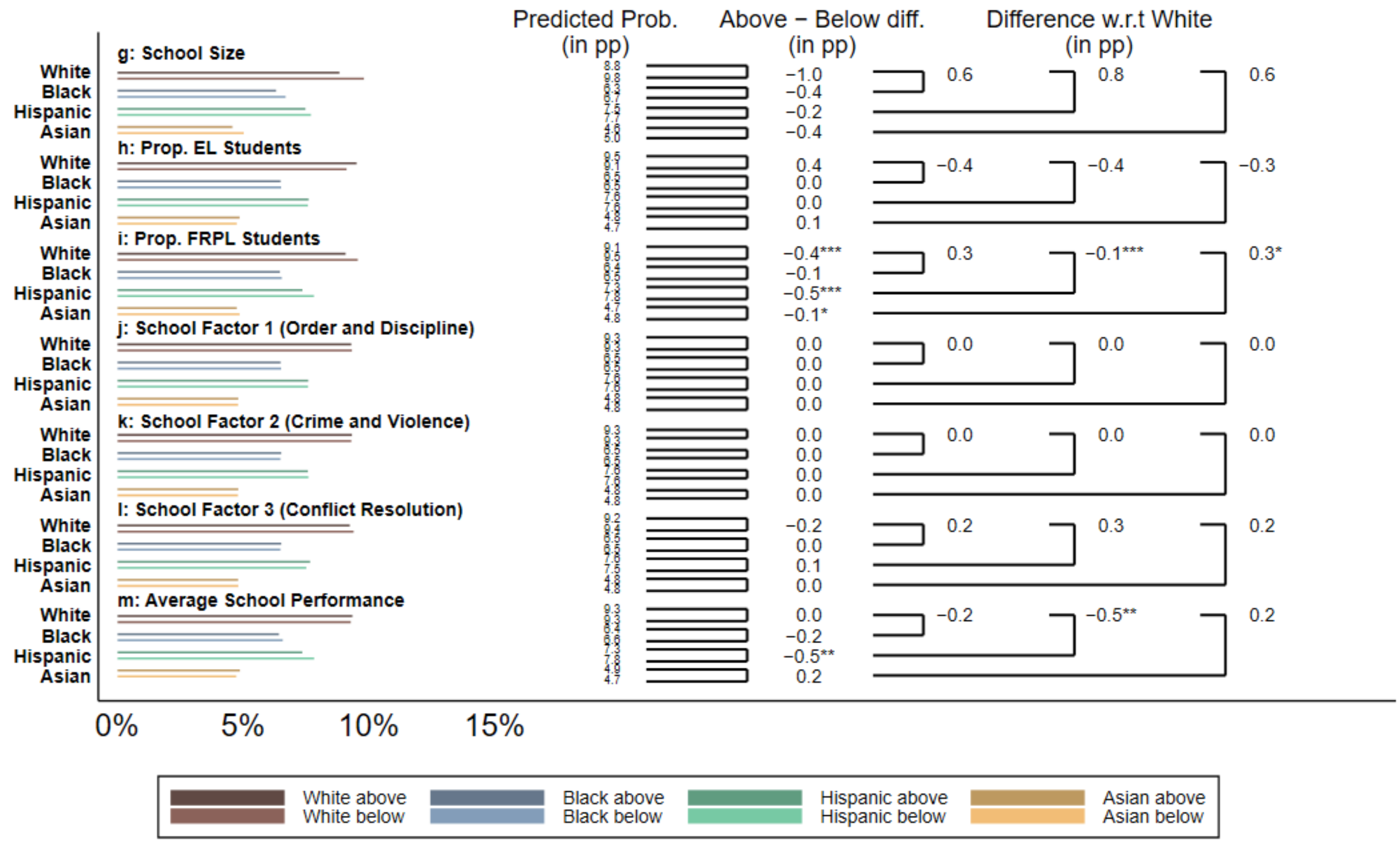


**Figure D-3A**

*Predicted Probability of an IEP for Other Health Impairment with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 1)*

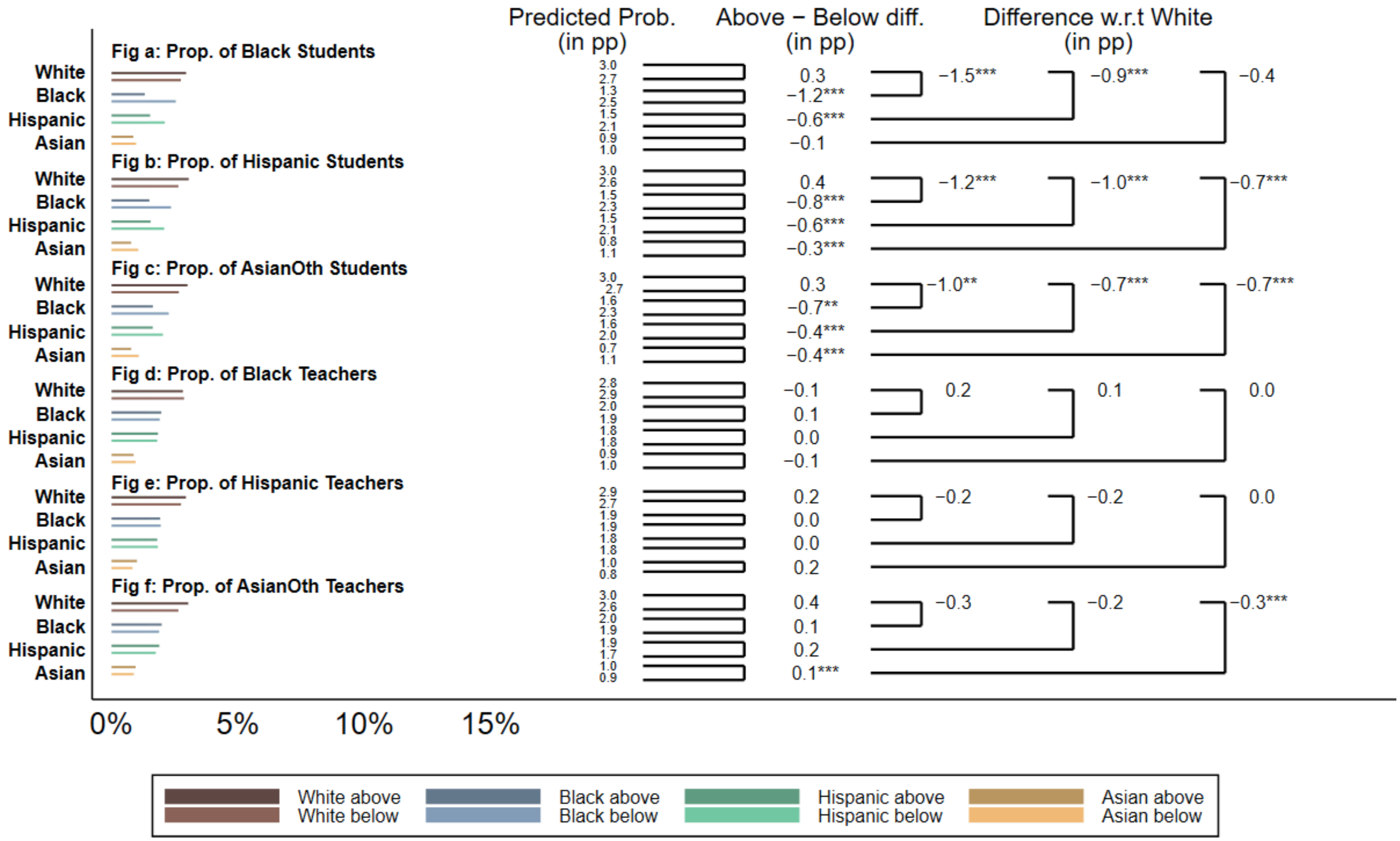


**Figure D-3A (cont.)**

*Predicted Probability of an IEP for Other Health Impairment with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 1)*

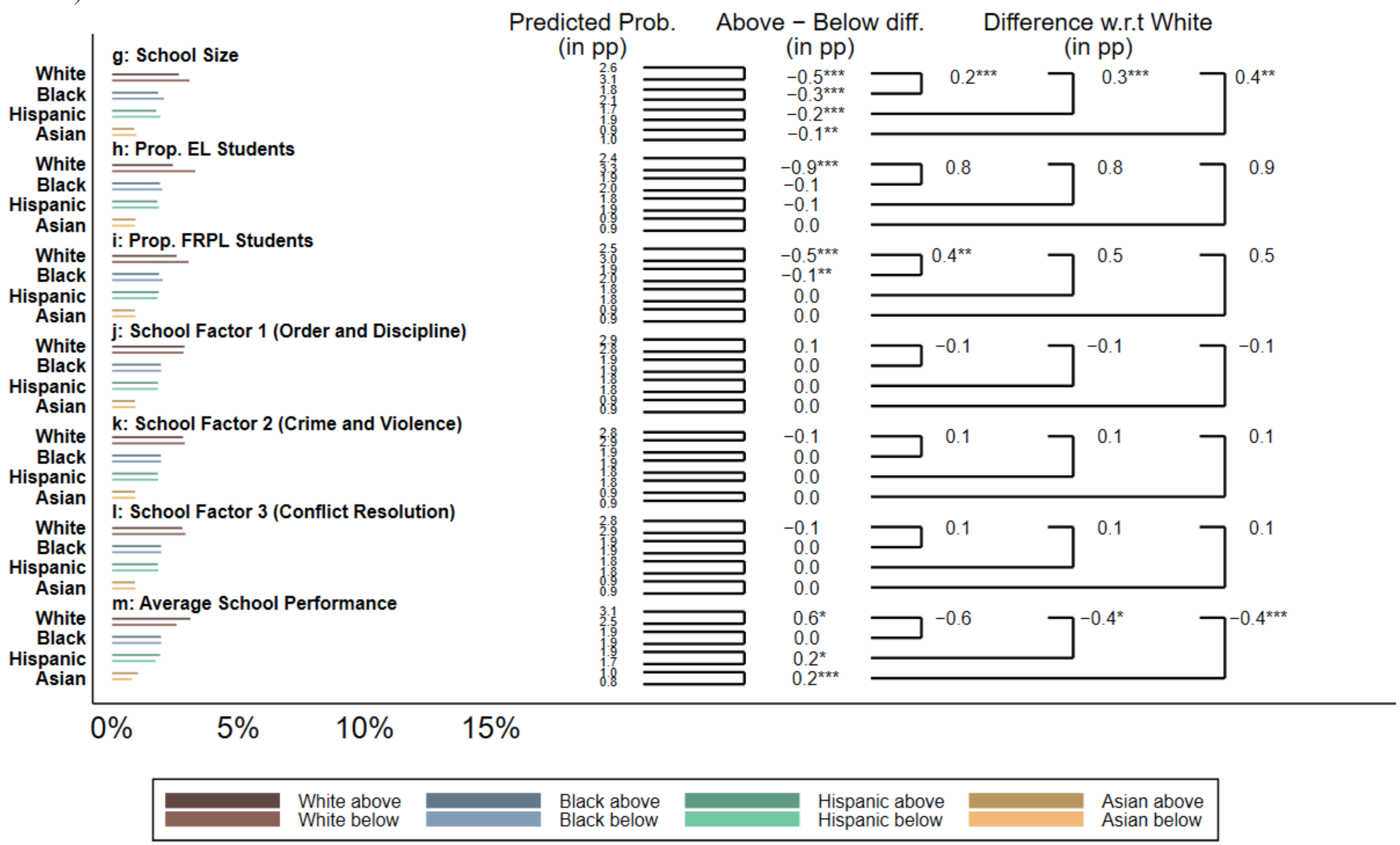


**Figure D-3B**

*Predicted Probability of an IEP for Other Health Impairment with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 2)*

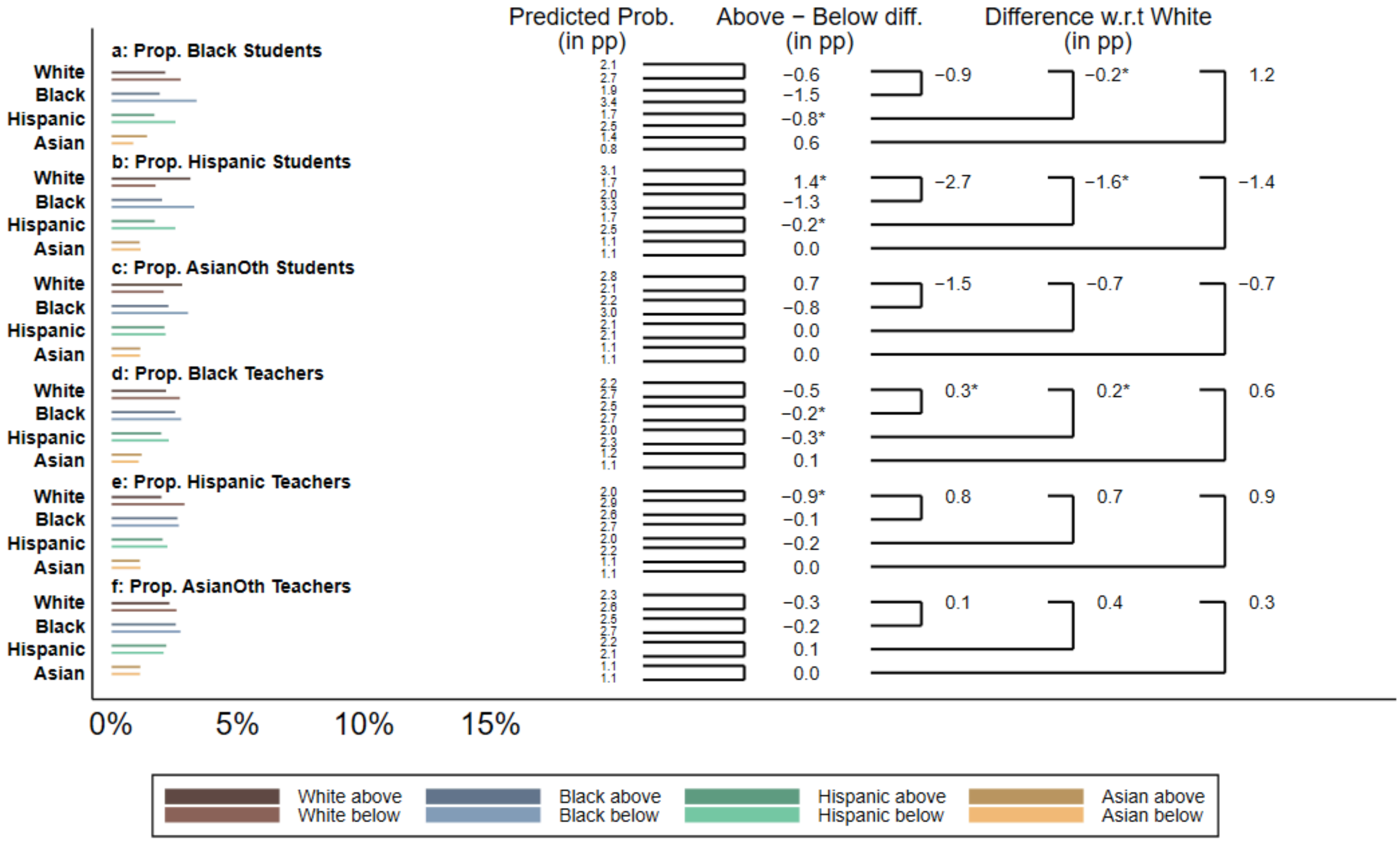


**Figure D-3B (cont.)**

*Predicted Probability of an IEP for Other Health Impairment with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 2)*

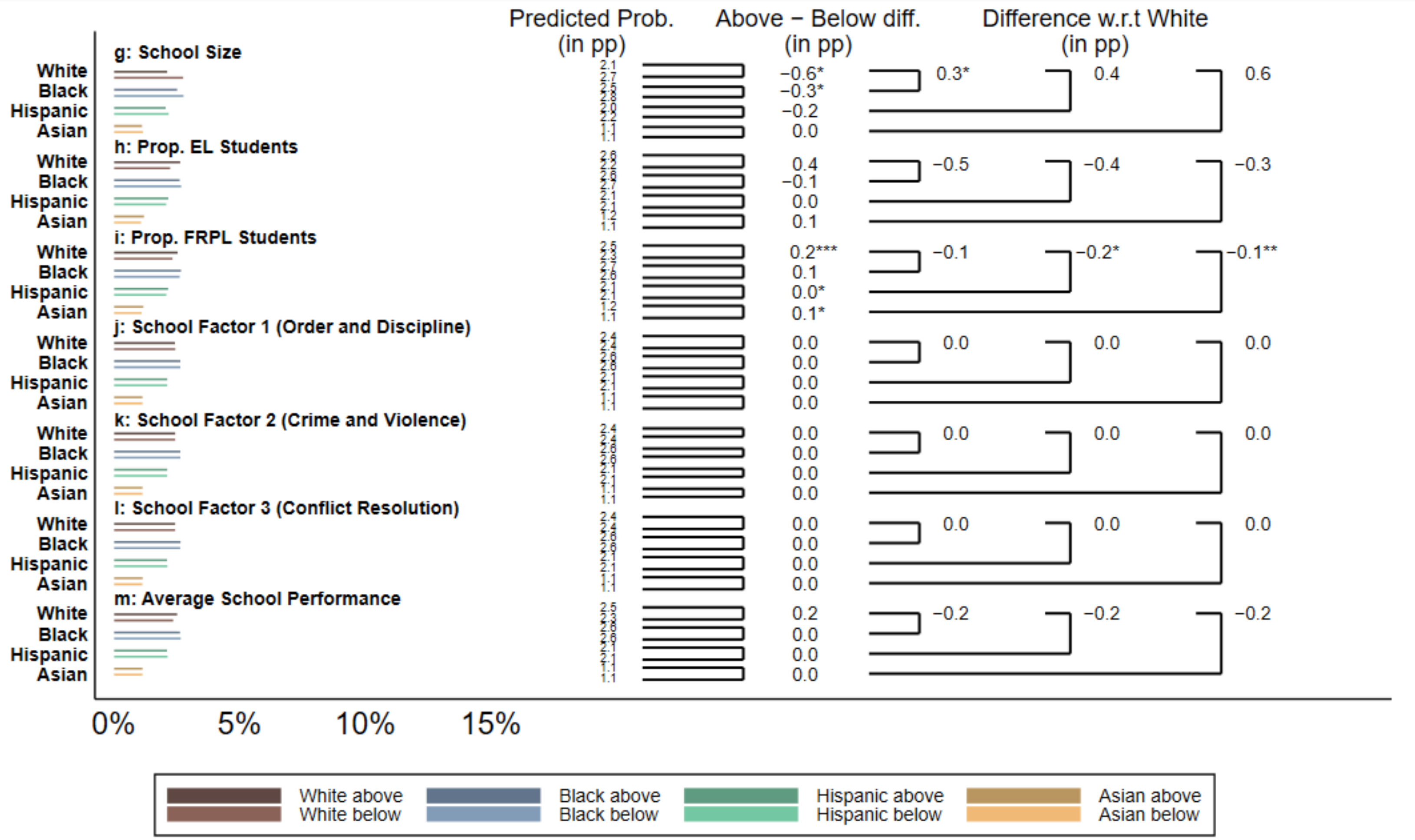


**Figure D-4A**

*Predicted Probability of an IEP for Emotional Disturbance with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 1)*

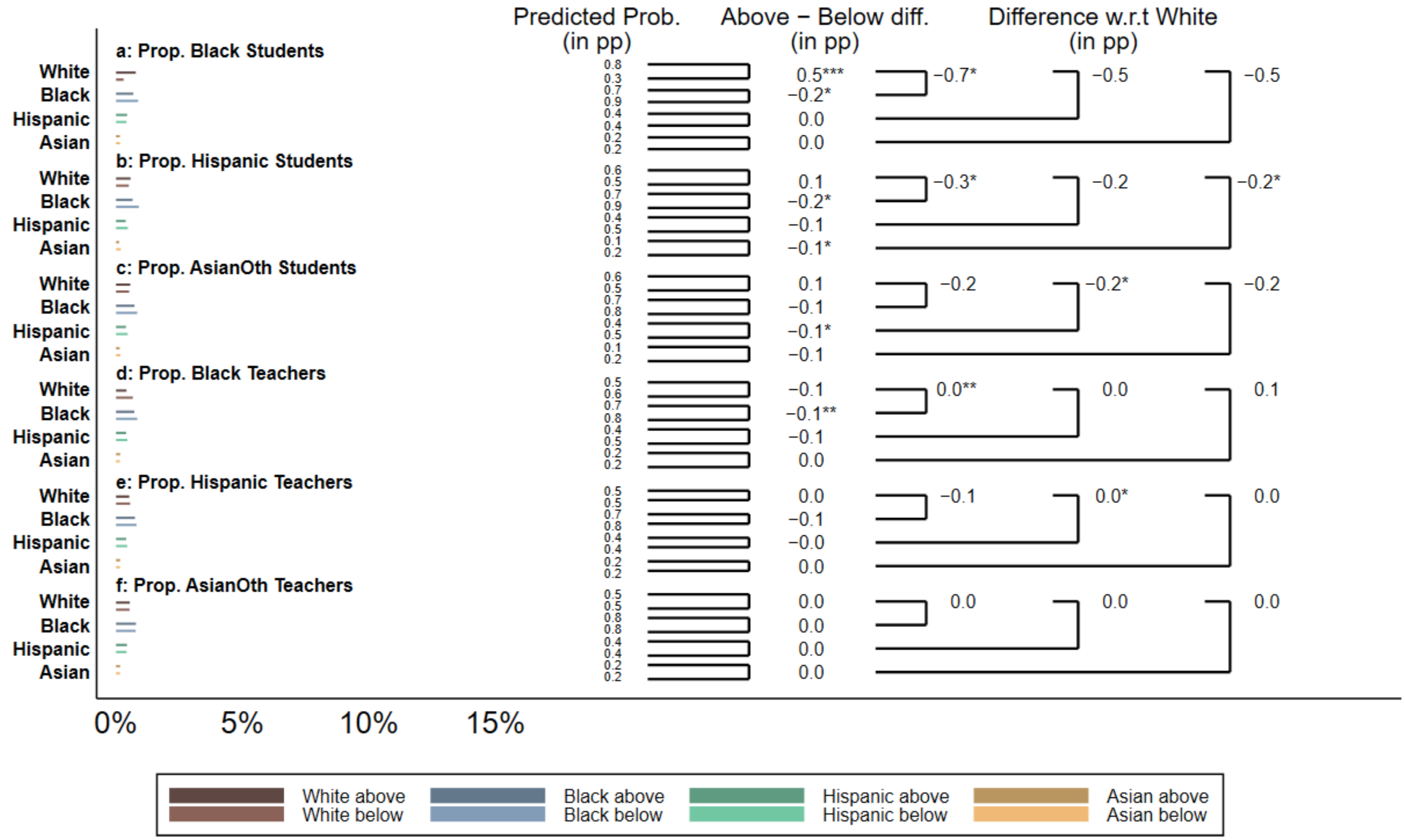


**Figure D-4A (cont.)**

*Predicted Probability of an IEP for Emotional Disturbance with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 1)*

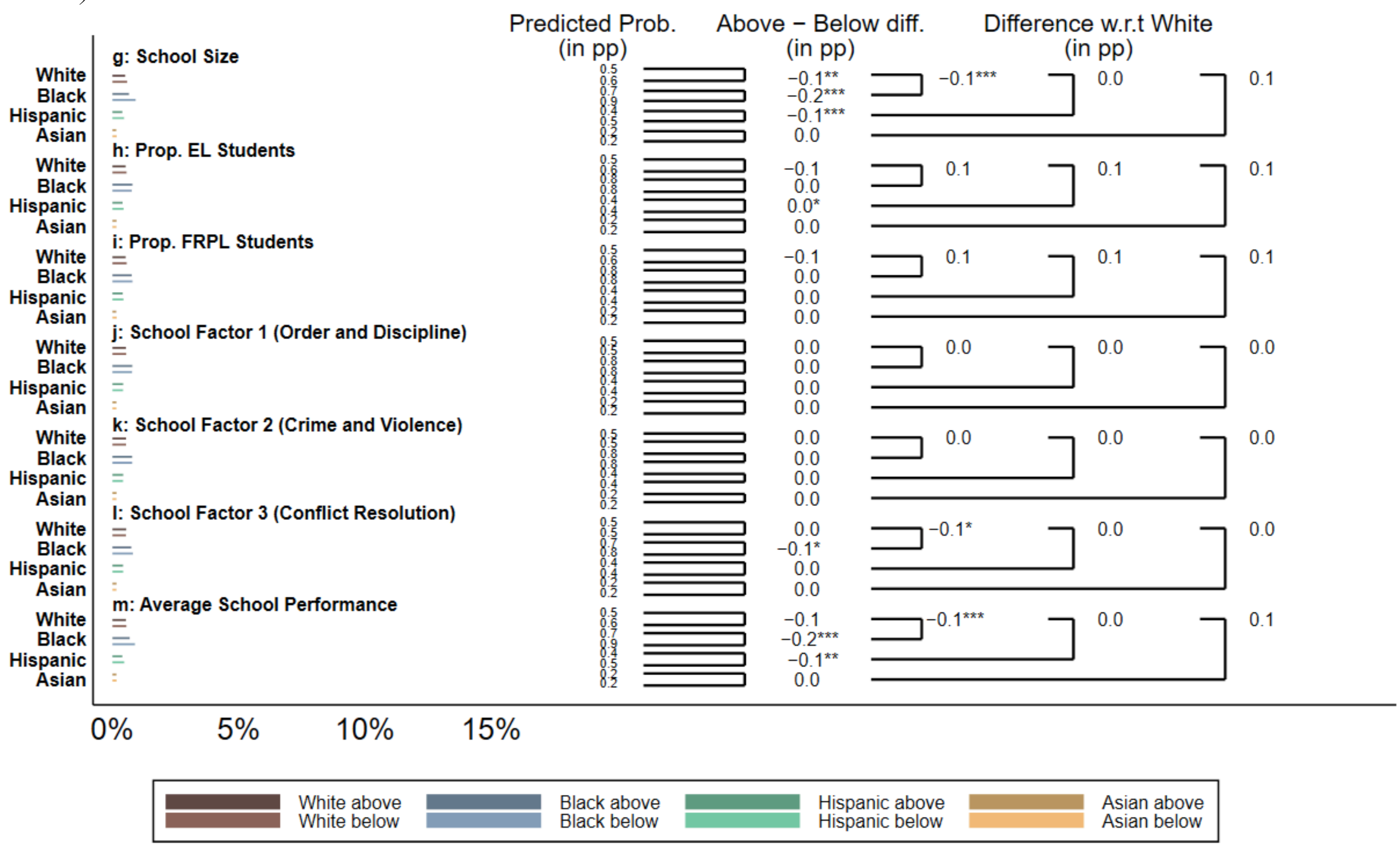


**Figure D-4B**

*Predicted Probability of an IEP for Emotional Disturbance with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 2)*

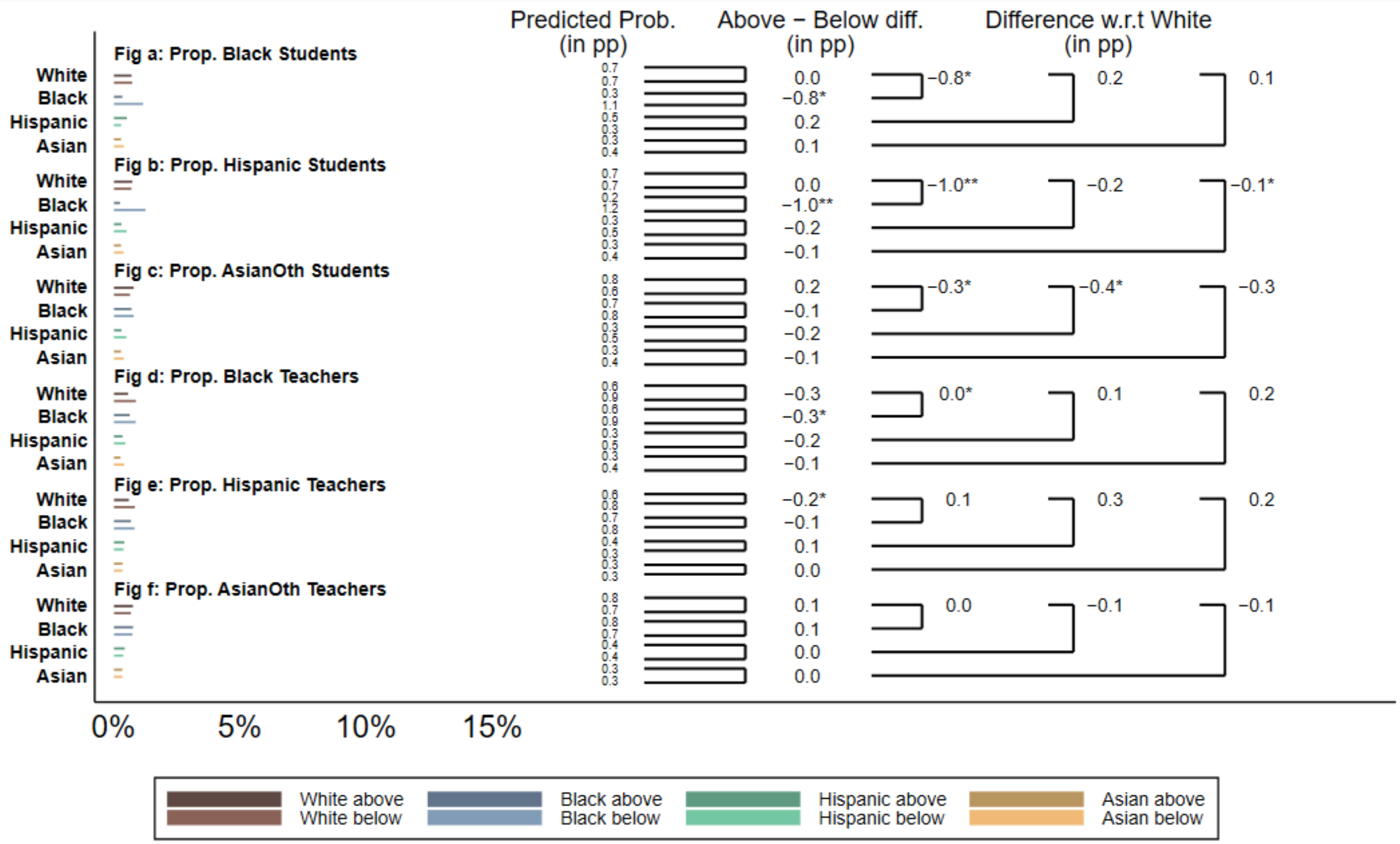


**Figure D-4B (cont.)**

*Predicted Probability of an IEP for Emotional Disturbance with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 2)*

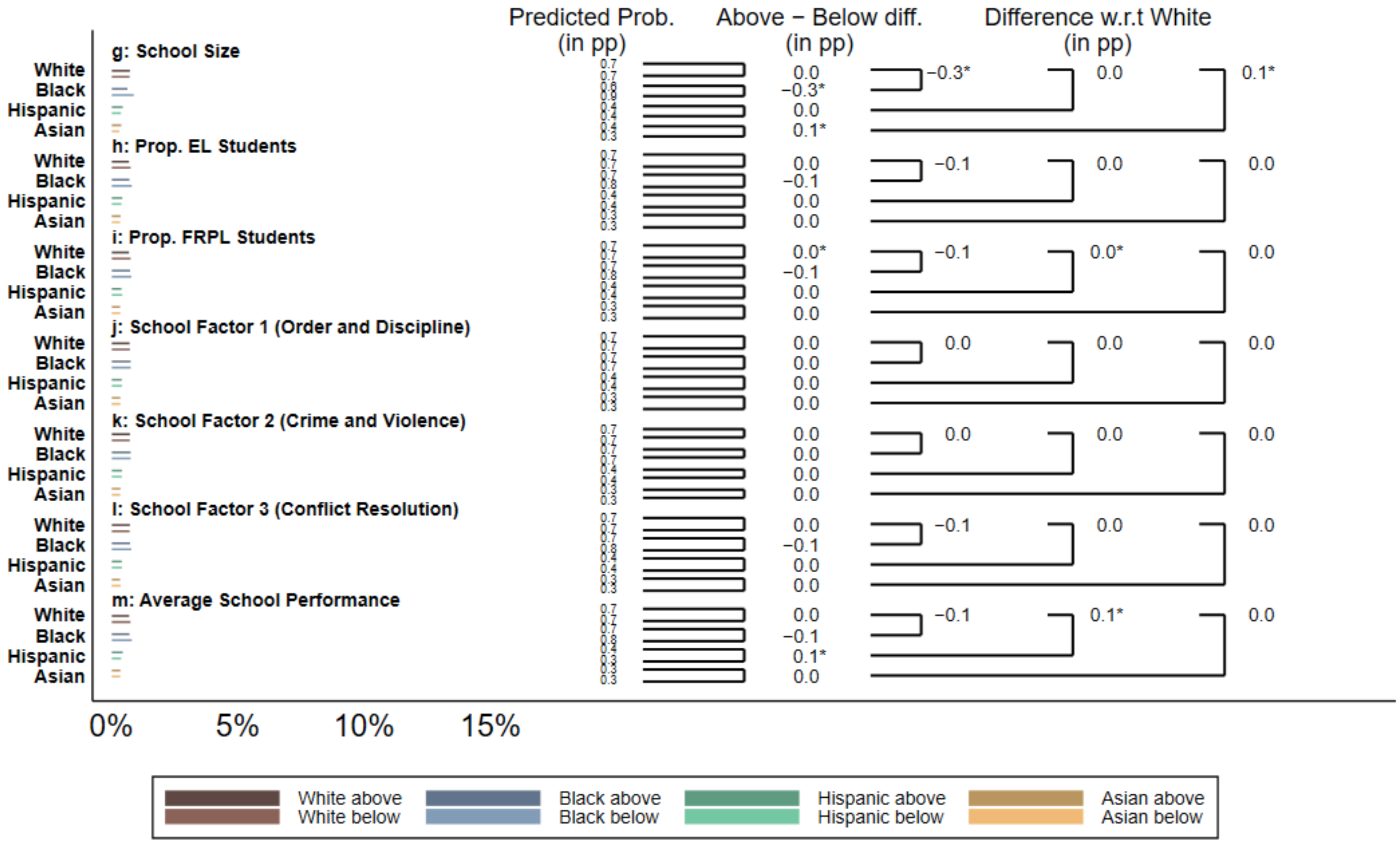


**Figure D-5A**

*Predicted Probability of an IEP for Low Incidence Disability with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 1)*

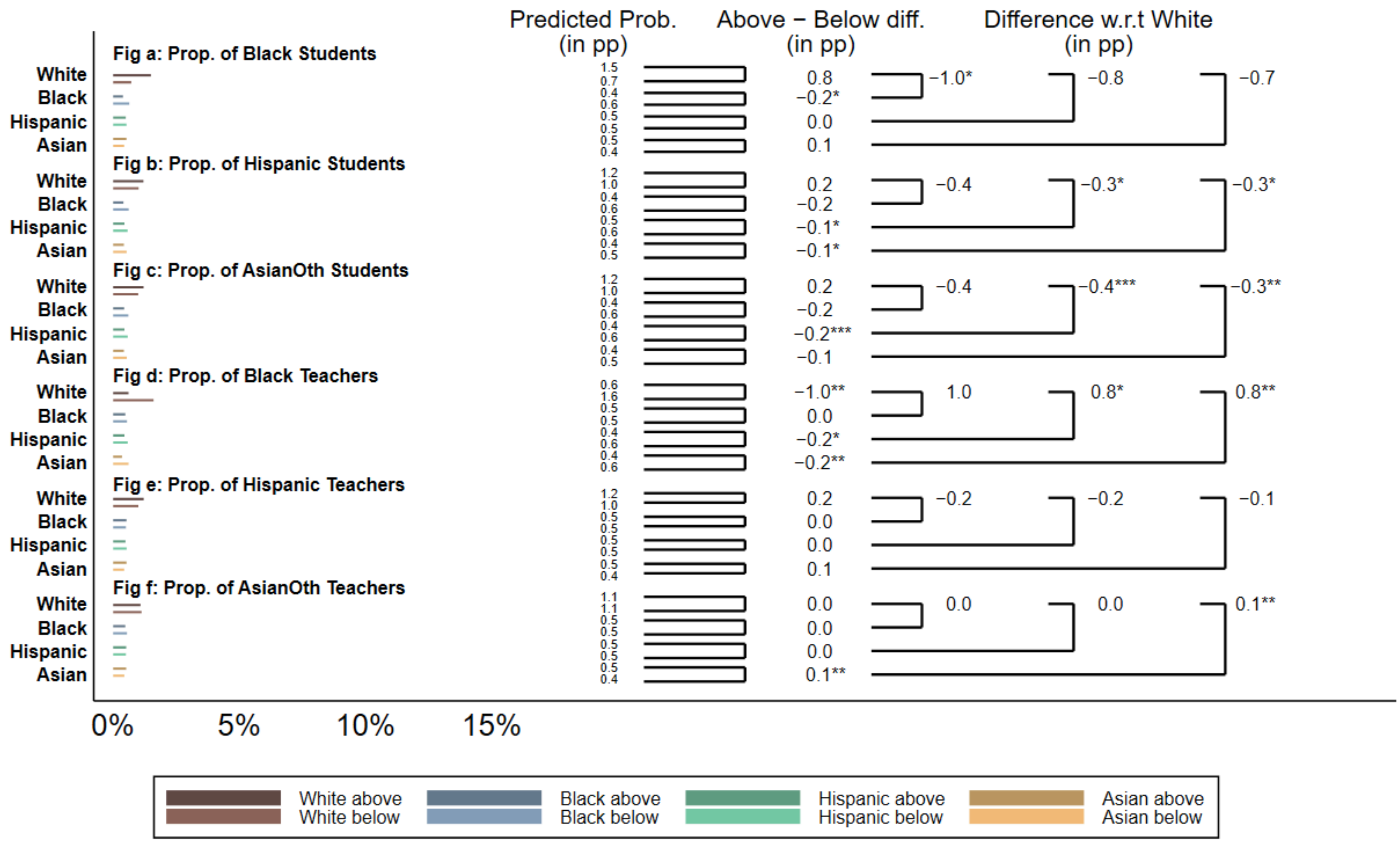


**Figure D-5A (cont.)**

*Predicted Probability of an IEP for Low Incidence Disability with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 1)*

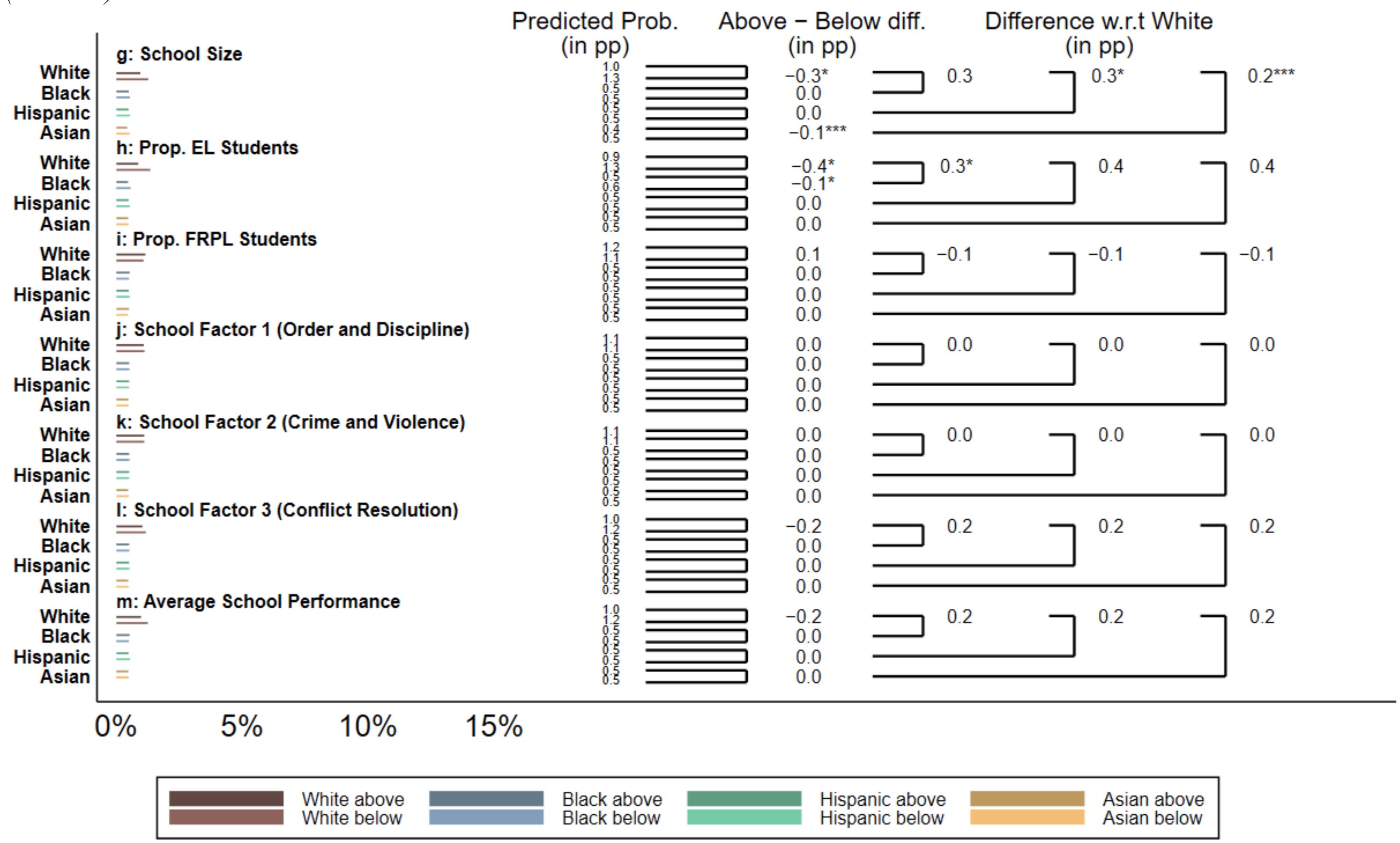


**Figure D-5B**

*Predicted Probability of an IEP for Low Incidence Disability with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 2)*

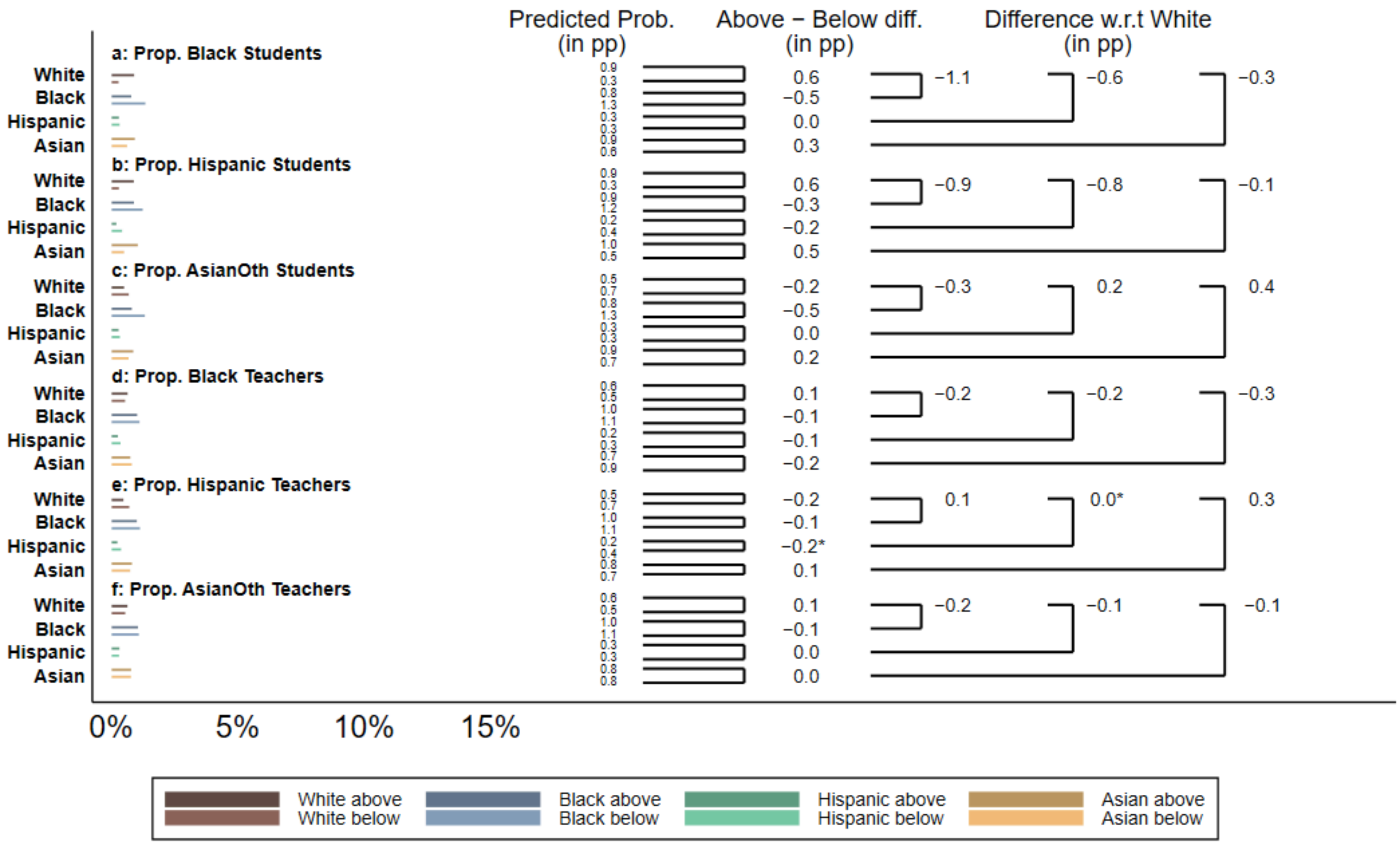


**Figure D-5B (cont.)**

*Predicted Probability of an IEP for Low Incidence Disability with School Characteristics +/- 0.5 SDs Overall from Mean, by Student Race (Model 2)*