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The Impact of the Adequate Yearly Progress Requirement of the Federal "No Child Left Behind" Act on Schools in the Great Lakes Region

Technical Appendix

by

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This appendix describes the analytical procedures used to project the status of schools in the Great Lakes state toward meeting AYP requirements from 2005 to 2014.

Meeting AYP Targets

To "make AYP," the school as a whole and each numerically significant subgroup must meet "Annual Measurable Objectives" (annual objectives). States set their own annual objectives and these requirements increase over time toward the goal of 100% of students reaching proficiency in 2014. Reaching proficiency is measured by students meeting standards on the state assessment. In addition, each state sets the minimum student count necessary for a student subgroup to reach numerical significance. Once a subgroup reaches the minimum student count threshold, it is included in the AYP calculations.

The observed percentage of student proficiency for each subject area, overall school, and numerically significant subgroup combination represents a statistical estimate of the "true" proportion proficient within a given grouping. Statistical uncertainty, then, plays a role in the likelihood that an observed proficiency rate exceeds the corresponding annual objective. Rogosa[1] makes this point in describing his study quantifying the effects of statistical uncertainty associated with NCLB:

> Statistical properties of school and subgroup scores are important in understanding accountability systems... statistical variability in the school and subgroup scores makes growth targets far more formidable than they might appear, in large part because of the subgroup requirements (as each of the subgroups has larger uncertainty than the school index).

This study draws from Rogosa's work. True proportions proficient are projected under a variety of scenarios for the whole school and for each numerically significant subgroup. In practice, these true proficiency rates cannot be observed – they can only be estimated (subject to statistical variability mentioned above). The likelihood of observing proficiency greater than the associated annual objective is calculated based on group size and projected true proficiency. Aggregating these likelihoods over all group measurements (the school as a whole and for each subgroup) and over all subjects (mathematics and English/language arts) gives an overall likelihood of a school making AYP. Furthermore, aggregating these likelihoods over all schools in a given year provides an estimate of statewide rates of school "success" and "failure" relative to AYP.

Consider the following example[2]: School A consists of 200 students, 100 percent of whom participate in both the English/language arts (ELA) assessment and the mathematics assessment. School A is a “perfectly homogenous” school – all the students belong to the same ethnic subgroup, and no students are designated Limited English Proficiency (hereafter “LEP”), Socioeconomically disadvantaged (“SD”), or disabled (“SWD”). This school has only one numerically significant subgroup (the whole school) and must meet two annual objective targets – one for ELA and one for math.

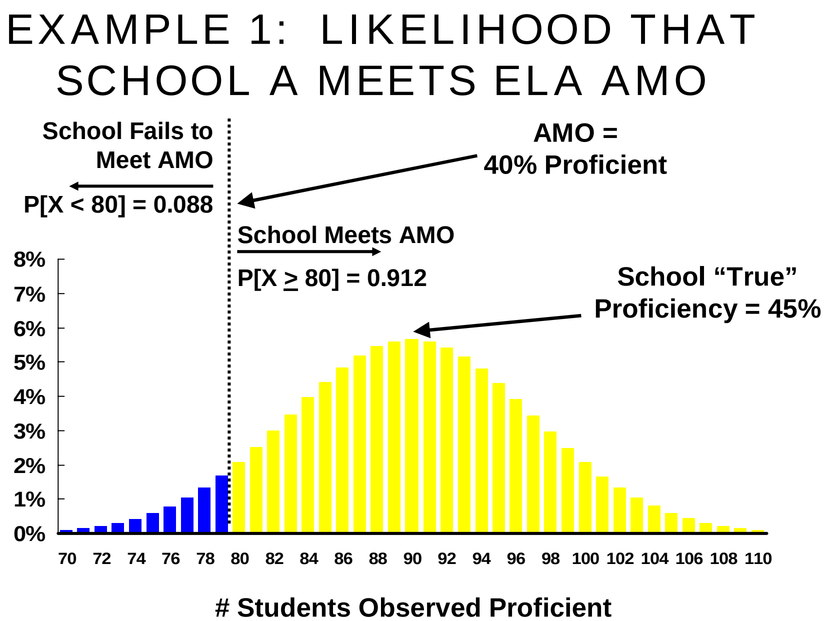
Assume the annual objectives which School A must meet to make AYP are 40 percent of students meeting the standards on the state test for both ELA and mathematics. Put another way, School A must have at least 80 students (40 percent of its 200 total students) proficient on both its ELA and mathematics assessments to make AYP.

Also assume that School A has a “true” proportion proficient of 45 percent in both ELA and mathematics. If we were able to observe this true proficiency without error, we would clearly designate School A as having made AYP because it exceeds the 40 percent requirement in ELA and math. This true proficiency cannot be observed, however; it is subject to statistical uncertainty in the form of sampling variability.[3]

What, then, is the likelihood that the observed proficiency exceeds the 40 percent requirement or 80 out of 200 students meeting the standards? Probability calculations based on the binomial distribution provide an estimate of the likelihood that this 80-student requirement will be met given a true proficiency level of 45 percent. As Rogosa[4] notes, not only can calculations based on the binomial distribution provide an estimate of likelihood of school success relative to AYP, but citing CCSSO[5] he also states, “even more crude large-sample normal theory approximations to binomial variability are at the core of the state NCLB plans that use the (unfortunate) confidence interval adjustments to the AMO.”

Figure 1 details the binomial calculation described above. School A is most likely to have 90 students observed proficient – no surprise since its true proficiency is 45 percent. Given this true proficiency, School A has a 91 percent chance of meeting its target of 80 proficient students – a high percentage, but by no means a certainty.

Figure 1



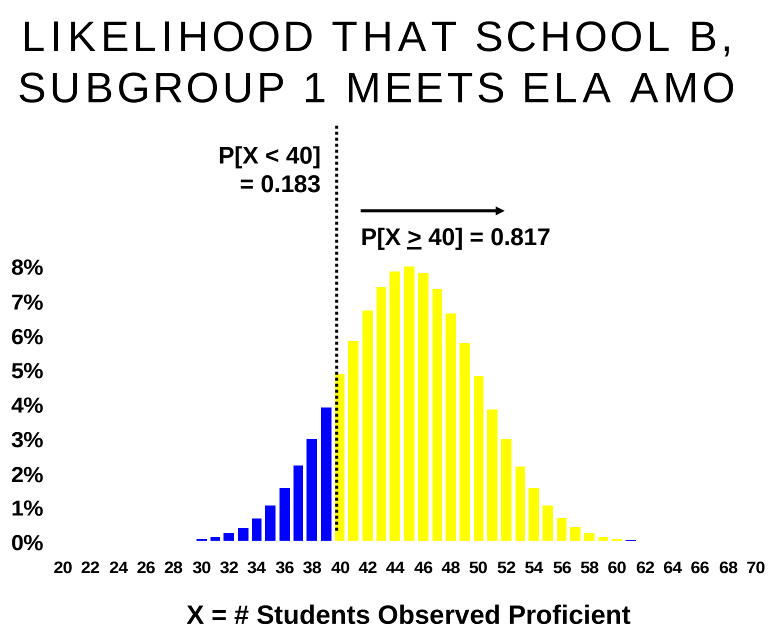
School A likelihood of meeting AMO = 91.2%

To see the effect of having multiple subgroups, consider a second example. School B consists of 200 students, 100 percent of whom participate in both the English/language arts (ELA) assessment and the mathematics assessment. In contrast to School A, students in School B are perfectly split between two numerically significant student subgroups, each with 100 students. Similar to School A, no students are designated as LEP, SD, or SWD. School B must meet four annual objective targets – one for each of the two subgroups for both ELA and math.

Similar to School A, assume that each subgroup of School B has a "true" proportion proficient of 45 percent in both ELA and mathematics. Again, if we were able to observe this true proficiency without error, School B makes AYP because the percentage of proficient students for each subgroup exceeds the 40 percent target in both ELA and math. This true proficiency cannot be observed, however, so the task at hand is to estimate the likelihood that the observed proficiency exceeds the 40 percent target.

Consider first the likelihood that Subgroup 1 meets the 40 percent ELA target. At least 40 students (of the 100 in the subgroup) must be observed proficient in order to meet this target. As detailed in Figure 2, given a true proficiency level of 45 percent, School B's Subgroup 1 has about an 82 percent chance of meeting its target of 40 proficient students.

Figure 2



Subgroup 1 likelihood of meeting AMO = 81.7%

Because the two ethnic subgroups do not overlap, the likelihood that the school meets both ELA requirements (one for each subgroup) is the joint likelihood that both subgroups meet their individual ELA annual objectives. The likelihood that subgroup 1 meets its targets is 81.7 percent, detailed above. Subgroup 2 has the same true proficiency as subgroup 1 (45 percent) and is of identical size; thus the likelihood that subgroup 2 meets the 40 percent target is also 81.7 percent. Because the groups are independent (non-overlapping), the joint likelihood that they meet their targets is the product of the independent likelihoods (0.817 * 0.817 = 66.7 percent).

Through this example, the effect of multiple subgroups becomes evident. Given the same annual objectives and true proficiency assumptions, School A composed of a homogenous, 200-student population, has about a 91 percent chance of making AYP in ELA. School B has less than 67 percent chance to make AYP.

The examples provide likelihoods of making AYP targets in ELA only. Schools must also meet similar requirements in mathematics in order to make AYP. Rogosa[6] provided an approximation for the joint likelihood of meeting both ELA and mathematics targets, noting that this likelihood should fall somewhere between the "single test probability" and the probabilities under independent trials. This study uses a similar approximation, using the geometric mean of (a) the product of the likelihoods of meeting the two targets (i.e., independent trials), and (b) the geometric mean of the two likelihoods (to approximate the "single test probability").

Applying this approximation to the example schools yields an 87.1 percent likelihood of School A meeting both math and ELA targets, and a 54.5 percent likelihood that School B meets both targets. Schools with higher numbers of smaller-sized subgroups face greater challenges making AYP based on this characteristic alone.

Many states have employed a variety of methodological strategies to increase the likelihood that schools and subgroups meet their AYP targets such as, "confidence intervals" (IL, IN, MN, and WI), rolling averages (OH), and awarding partial credit for nearly-proficient students (MN). As part of projecting the outcomes for schools in each state, our analyses take into account all the strategies employed in the AYP parameters for each state accountability system.[7]

Meeting Safe Harbor

Schools may also demonstrate that they have made adequate yearly growth through another option known as "Safe Harbor." The Safe Harbor criteria include, (1) the school or subgroup must reduce the percentage of students not meeting standards by at least ten percent and (2) the school or subgroup must also demonstrate adequate yearly progress on an alternative criterion, such as attendance rate or graduation rate.

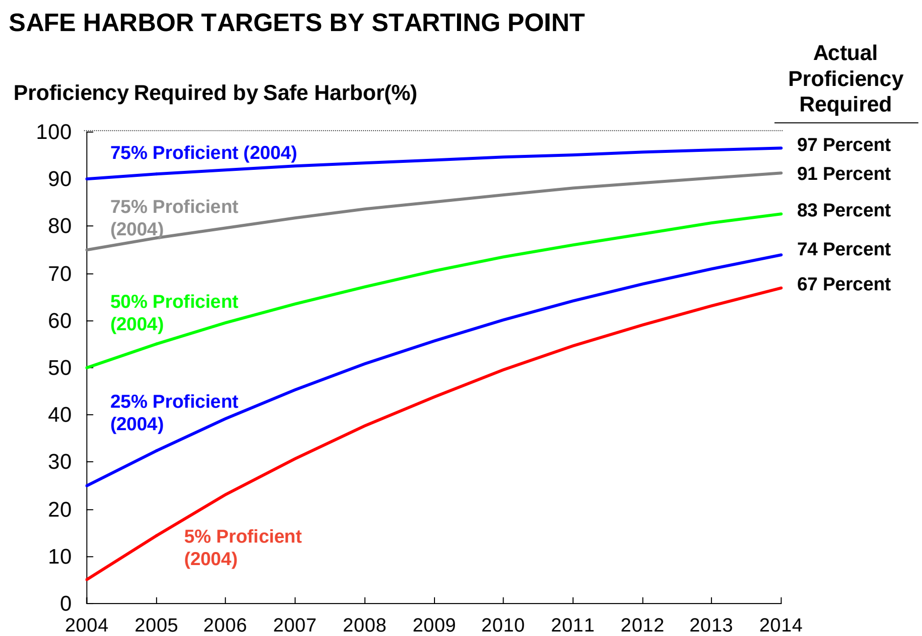
This study includes projections of schools *eligible* for Safe Harbor under the first criterion; no attempt is made to project growth against the second criterion. It must also be noted that the schools eligible for Safe Harbor have not necessarily made AYP. Therefore, the projections in this study provide an upper bound, or a conservative estimate, of the schools that will actually achieve Safe Harbor; in reality, some proportion of schools eligible will fail to demonstrate progress on the alternative measure and will subsequently be designated as failing to meet AYP.

Eligibility for Safe Harbor is estimated using the same strategy that is used for AYP, but it is based on the Safe Harbor targets. Given a "true" proportion proficiency within a given subgroup or school, what is the likelihood of observing a decrease of at least 10 percent in the proportion non-proficient students relative to the previous year? Safe Harbor requires growth relative to a school or subgroup's own proficiency rather than absolute annual objectives. Thus, Safe Harbor eligibility behaves differently than making AYP based on the annual objectives. In fact, the annual objectives may actually be easier to meet than their Safe Harbor in some cases. For illustrative purposes, we will consider a school that has 50 percent of students proficient in mathematics in 2006. In 2007, the Mathematics annual objective is 53 percent. Meeting the 2007 annual objective requires this school to increase Mathematics proficiency by three percent or greater from 2006 to 2007. Safe Harbor, on the other hand, requires a decrease of 10% or greater in the number of non-proficient students. Safe Harbor requires that this decrease by at least 10 percent – to no greater than 45 percent non-proficient, corresponding to proficiency of 55 percent proficient or greater. In order to trigger the Safe Harbor option, the percentage of students meeting proficiency must reach 55 percent or greater. In this case, the 2007 Safe Harbor target of 55 percent exceeds the 2007 annual objective of 53 percent. The example school is more likely to achieve the annual objective than to meet the Safe Harbor criteria.

The reader of the main report may be initially surprised to see that, in some cases, eligibility for Safe Harbor is actually greater under less aggressive growth scenarios. For example, 25.4 percent of Wisconsin schools are Safe Harbor eligible in 2014 under the Medium Growth scenario compared to 40.7 percent of Wisconsin schools eligible under the Low Growth scenario. The reason is because Safe Harbor is based on relative targets. AYP, by contrast, is based on an absolute standard and the relationship between the school projections, and AYP status is more direct. As the projected growth increases, success relative to AYP increases monotonically as well.

Precisely because Safe Harbor is based relative targets, one could argue that it violates the goals of NCLB. For demonstration purposes, Figure 1 provides an analysis of how Safe Harbor allows those groups that are currently least proficient to remain less proficient by a significant margin in 2014. As Figure 3 shows, today's least proficient subgroups could actually meet AYP every single year yet still have roughly 33 percent of students fail to meet standards.

Figure 1



True Proficiency and Projecting Growth

Previous studies that project school outcomes relative to AYP requirements have used a variety of methods to project the change for each school and each subgroup over time. While some studies have used a single growth projection for all schools and subgroups (e.g., average statewide change in proficiency over the previous year), others have simply continued each school's observed growth over a previous period.

This study employs a different method for projecting growth. Based on an empirical study of annual growth rates observed over three years (2002, 2003, and 2004) in Illinois (the only state for which sufficiently detailed data were available), this analysis has used quartiles of growth within starting bands of 10 percent proficiency to best match the current proficiency status of each subgroup with likely rates of change in proficiency over subsequent years.

Our method is advantageous because it recognizes that different schools and subgroups start at different levels of proficiency. Because of these different starting points, subgroups must achieve different rates of growth to reach the 100 percent proficiency goal by 2014 and schools should reasonably be expected to progress at different rates. For example, growth expectations for schools starting out with 90 percent of students meeting the standards in 2004 cannot be expected to achieve the same level of annual growth as schools starting out with 10 percent of students at proficiency. Changes in observed proficiency should be expected to differ by school type in addition to starting proficiency. Elementary schools will likely not only progress at a different rate than middle or high schools, but standard setting assumptions underlying proficiency designations differ across elementary, middle, and high schools as well.

Studies that employ a common growth rate across all schools fail to recognize the important relationship between starting point, differential growth rates, and school type. On the other hand, studies that project each school's rates of change based on unique observed rates over previous years run the risk of projecting extreme tails of the distribution of school proficiency changes (i.e., particularly high or low observed changes over short time periods) across longer time periods than they should be expected to sustain. Such methods disregard regression effects likely to mediate the variability in annual changes when considered over longer time periods.

Projected rates of change in this study are conditional upon both starting point and school type. For each school type (elementary, middle and high school), the growth rates are projected uniquely by 10 percent bands according to the school's starting point in 2004 (0 to 10 percent students meeting standards, 11 to 20 percent of students meeting standards, etc.).

The estimated impact of AYP is projected based on three possible scenarios (High, Medium, and Low Growth). The scenarios correspond to the observed annual growth rates at the 75th, 50th, and 25th percentiles of schools within each starting band in the empirical study. For example, under the High Growth assumption, elementary schools that start out with between 10 percent and 20 percent proficient are projected to grow at an annual rate equivalent to the 75th percentile of annual growth observed for schools starting out between 10 percent and 20 percent proficiency in the three-year Illinois study.

The “true” proficiency of a school or subgroup cannot be observed, but the observed proficiency provides the best estimate for this true proficiency. As such, true proficiency “starting points” were estimated for each school and for each subgroup based on the observed proficiency in 2003-2004.[8] Projections under each scenario were made on the basis of changes in true proficiency relative to these starting estimates.

The rates of change in proficiency by school type, subject area, and starting proficiency observed in Illinois from 2002-2004 are listed in Table 1. As is likely in any state, some schools evidenced declines in proficiency over these three years. For this study, however, no negative changes in proficiency were included; for cases in which observed proficiency did in fact decline, changes in proficiency were projected to be flat rather than negative. Table 2 includes the actual projections included as part of this study.[9]

Table 1: Changes in Proficiency observed in Illinois, 2002-2004

Elementary		**Initial Performance Decile (% Proficient)**									
	Growth	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90+
ELA	Low	2.8	1.5	0.2	(0.2)	(0.4)	(0.8)	(1.6)	(2.7)	(3.3)	(4.2)
	Med	5.0	3.4	2.6	2.3	2.2	1.5	0.6	(0.7)	(1.0)	(2.3)
	High	8.3	6.0	5.9	5.5	5.0	4.2	2.5	1.2	0.5	(0.8)
Math	Low	7.2	3.3	2.7	2.4	1.9	1.4	1.0	(0.2	(0.8)	(1.8)
	Med	12.2	5.8	6.1	6.3	5.7	5.0	3.4	1.9	0.8	(0.3)
	High	15.5	9.6	9.4	9.8	9.0	7.6	5.5	3.7	2.1	0.7
Middle School		**Initial Performance Decile (% Proficient)**									
	Growth	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90+
ELA	Low	9.7	3.4	3.2	1.0	-	0.1	(1.3)	(2.5)	(3.0)	(3.4)
	Med	9.7	5.4	4.9	2.6	2.1	1.7	0.7	(0.9)	(1.0)	(1.4)
	High	9.7	9.2	6.9	5.1	4.3	4.3	2.3	0.8	0.2	0.0
Math	Low	1.4	(0.1)	0.3	(0.2)	(0.6)	(0.7)	(1.4)	(3.3)	(2.8)	(6.7)
	Med	3.1	2.6	2.7	2.7	2.0	1.2	0.4	(0.8)	(0.8)	(1.4)
	High	5.8	5.2	5.3	5.9	4.4	3.1	2.8	1.1	0.8	0.0
High School		**Initial Performance Decile (% Proficient)**									
	Growth	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90+
ELA	Low	1.0	(0.6)	(0.5)	(0.4)	0.3	(1.7)	(2.6)	(3.1)	(2.2)	(8.5)
	Med	2.5	0.2	1.3	1.3	1.8	(0.0)	(1.1)	(1.2)	(0.6)	(0.0)
	High	4.1	1.3	4.3	3.7	4.1	1.7	0.4	(0.2)	(0.1)	0.1
Math	Low	(0.2)	(0.7)	(0.6)	(0.4)	(1.4)	(2.6)	(3.2)	(2.8)	(0.5)	0.4
	Med	0.3	(0.0)	0.3	1.7	0.2	(0.9)	(1.5)	(1.4)	(0.3)	1.0
	High	1.6	0.6	2.5	3.7	2.6	1.0	0.1	(0.3)	0.4	1.6

Table 2: Growth Projections Used in AYP Study

Elementary		Initial Performance Decile (% Proficient)									
	Growth	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90+
ELA	Low	2.8	1.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Med	5.0	3.4	2.6	2.3	2.2	1.5	0.6	0.0	0.0	0.0
	High	8.3	6.0	5.9	5.5	5.0	4.2	2.5	1.2	0.5	0.0
Math	Low	7.2	3.3	2.7	2.4	1.9	1.4	1.0	0.0	0.0	0.0
	Med	12.2	5.8	6.1	6.3	5.7	5.0	3.4	1.9	0.8	0.0
	High	15.5	9.6	9.4	9.8	9.0	7.6	5.5	3.7	2.1	0.7
Middle School		**Initial Performance Decile (% Proficient)**									
	Growth	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90+
ELA	Low	9.7	3.4	3.2	1.0	0.0	0.1	0.0	0.0	0.0	0.0
	Med	9.7	5.4	4.9	2.6	2.1	1.7	0.7	0.0	0.0	0.0
	High	9.7	9.2	6.9	5.1	4.3	4.3	2.3	0.8	0.2	0.0
Math	Low	1.4	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Med	3.1	2.6	2.7	2.7	2.0	1.2	0.4	0.0	0.0	0.0
	High	5.8	5.2	5.3	5.9	4.4	3.1	2.8	1.1	0.8	0.0
High School		**Initial Performance Decile (% Proficient)**									
	Growth	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90+
ELA	Low	1.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
	Med	2.5	0.2	1.3	1.3	1.8	0.0	0.0	0.0	0.0	0.0
	High	4.1	1.3	4.3	3.7	4.1	1.7	0.4	0.0	0.0	0.1
Math	Low	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
	Med	0.3	0.0	0.3	1.7	0.2	0.0	0.0	0.0	0.0	1.0
	High	1.6	0.6	2.5	3.7	2.6	1.0	0.1	0.0	0.4	1.6

One last aspect of NCLB may change the requirements schools must meet to make AYP. An expansion of state testing programs built into NCLB requires that all states administer its assessments to students in grades three through eight and high school beginning in 2005-2006. Because some states are currently testing in only a subset of these grades (e.g., grades four, eight, and ten), this change will bring to these states an increase of students participating in their testing programs. As such, the number of students within each subgroup will likely increase, possibly bringing some smaller subgroups into “numerical significance” for the first time. Estimates in this analysis take into account the expansion of state testing programs, and how more students being tested will affect the size and numerical significance of subgroups. Though we do account for increases in the number of grades tested, we do not account for any possible shifts in the relative demographics of school enrollments.

AYP Failure Projections: Conservative Estimates

Projections in this study were made for school-wide proficiency as well as proficiency of individual ethnic minority subgroups. NCLB actually requires measurement of all numerically significant subgroups – including not only ethnic minority students, but also students with limited English proficiency (LEP), students with disabilities, and socioeconomically disadvantaged students. In this study, only ethnic minority subgroups are assessed, as they are the only ones that are mutually exclusive or non-overlapping. In effect, schools are given a “free pass” for the requirements that other non-ethnic minority subgroups must meet under AYP.

Projections are made for only mathematics and ELA. No projections are made for science, which will be phased in beginning in 2007, as starting proficiencies cannot yet be reliably determined in areas for which no standardized assessments are yet in place. The inclusion of Science as a required assessment area will make even more formidable the already challenging omnibus requirement for AYP success, in some cases increasing the number of participation and proficiency targets that a given school must meet by 50 percent. The current analysis does not include the addition of science, even though schools may eventually fail because of missed science targets.

In other ways as well, the estimates detailed herein represent *conservative* projections of AYP success and failure. In addition to the aforementioned ways schools can fail AYP under NCLB, these projections exclude testing participation requirements. Under NCLB, schools and subgroups must not only meet proficiency targets but must also meet an assessment “participation” target (95 percent of students taking the state assessment). In this analysis, all schools and subgroups are assumed to have met the participation target, meaning that no schools are estimated to have failed AYP on that basis.

This analysis has included only those requirements which can be reliably projected. As we have noted above, the accompanying estimates provide an upper bound for the true AYP success rates; in reality, schools could meet the requirements included in this analysis and still fail to make AYP by missing one of the targets (such as participation) excluded here. Even these upper bound estimates, however, project that school success relative to the AYP requirements as they currently stand will be quite low.

Notes & References

[1] Rogosa, D. R. (2003, October). *California's AMOs are more formidable than they appear*. Sacramento, CA: California Department of Education, Policy and Evaluation Division, p. 1. Retrieved May 26, 2005, from http://www.cde.ca.gov/ta/ac/ap/researchreports.asp

[2] Several very helpful examples for this context can be found in:

Rogosa, D. R. (2003, October). *California's AMOs are more formidable than they appear*. Sacramento, CA: California Department of Education, Policy and Evaluation Division. Retrieved May 26, 2005, from http://www.cde.ca.gov/ta/ac/ap/researchreports.asp

[3] Observed proportions are also affected by measurement error, though the high reliability if commercially-available assessments minimizes the impact of this error source. When true proficiency exceeds 50 percent measurement error slightly attenuates the likelihood of meeting AMO targets; disregarding the effect of measurement error in these cases provides an upper bound on likelihoods of meeting AMOs. This analysis assumes no effect of measurement error. For more detail, see:

Rogosa, D. R. (2003, October). *California's AMOs are more formidable than they appear*. Sacramento, CA: California Department of Education, Policy and Evaluation Division. Retrieved May 26, 2005, from http://www.cde.ca.gov/ta/ac/ap/researchreports.asp

[4] *Ibid*, p. 6.

[5] Council Of Chief State School Officers (2002, December). Making valid and reliable decisions in determining adequate yearly progress. A Paper In The Series: *Implementing The State Accountability System Requirements Under The No Child Left Behind Act Of 2001* (ISBN 1-884037-80-1). ASR-CAS Joint Study Group on adequate yearly progress, Scott Marion and Carole White, Co-Chairs. Retrieved May 26, 2005, from http://www.ccsso.org/content/pdfs/AYPpaper.pdf

"Confidence interval approach" in Chapter 3)

Executive summary retrieved May 26, 2005, from http://www.ccsso.org/content/pdfs/AYPpapersummary.pdf

[6] Rogosa, D. R. (2003, October). *California's AMOs are more formidable than they appear*. Sacramento, CA: California Department of Education, Policy and Evaluation Division, p. 6. Retrieved May 26, 2005, from http://www.cde.ca.gov/ta/ac/ap/researchreports.asp

[7] The details of the state accountability programs were taken from the Consolidated State Accountability Workbook for each state. The workbooks and supplementary documentation are available online at the U.S. Department of Education website, but can only be obtained by conducting a search on its website. Visit http://ed.gov and in the search text field, type in “workbook” and the name of the state. The workbooks used for this study were retrieved May 1, 2005.

[8] For Illinois, Indiana, Ohio, and Wisconsin, school and subgroup enrollment and proficiency levels were taken from publicly available downloadable files for 2003-2004 available on the respective department of education websites, retrieved May 27, 2005:

Illinois: http://www.isbe.net/pdf/2004_assessment_results.pdf

Indiana: http://www.doe.state.in.us/istep/2004/welcome.html see “Public Schools: Data files.”

Ohio: http://www.ode.state.oh.us/proficiency/results.asp

Wisconsin:
http://data.dpi.state.wi.us/data/questions.asp?ORGLEVEL=ST&FULLKEY=ZZZZZZZZZZZZ&DN=None+Chosen&SN=None+Chosen

Minnesota: http://education.state.mn.us/html/intro_data_assessments.htm

Because Minnesota data provided proficiency by school only (not by subgroup), starting proficiency levels of all subgroups were set to the school-level proficiency.

The Michigan data was provided directly by the Michigan Department of Education.

[9] For schools with tested grades spanning across more than one type (e.g., elementary and middle school), projected growth was weighted relative to enrollment across tested grades within each subgroup.