Increasing College-Readiness: High school reform in North Carolina

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Outline

- Background
- Methodology
  - Data and Sample
  - Pipeline Progression
- Effect Estimates
  - Mathematics and Science
- Student subgroup effects (preliminary)
  - Early College High School on mathematics
- Next Steps
North Carolina Policy Context

- 2003: New Schools Project launched
  - Create over 100 new and redesigned high schools

- 2006: Turnaround Initiative
  - Talent Development, America’s Choice, redesigned high school

- Concerns driving initiative:
  - Increase college-preparatory course-taking
  - Increase college attendance rates
  - Reduce college remediation course-taking
  - Prepare workers for knowledge-based economy
High School Pipeline Study

- Evaluate three reform models
  - Redesigned high schools and Early College High Schools (ECHS)
    - implemented through state initiative with external financial support
  - High Schools That Work (HSTW)
    - implemented through local initiative and supported by SRB

- Incorporate state longitudinal data on students into a mixed methods evaluation
  - Impact analysis (preliminary results today)
  - Survey of policies, programs, and practice (fielded May/June 2009 – early days yet)
  - Site visits (Fall 2010)
High Schools That Work

- Began in 1987 and is supported by Southern Regional Education Board
  - Currently there are >1,200 HSTW high schools
- Emphasizes high expectations, rigorous curriculum, extra student services, post-secondary preparation, transition between levels of schooling
- Evidence-to-date: weak evidence of positive impact
- Methodology Preview
  - School-level matching (3)
  - Difference-in-difference analyses
Redesigned High Schools

- Supported by NSP with external finance support
- Create small ($\leq 400$ students) theme-based schools
  - Complete redesign: series of small schools
  - Partial redesign: one small school plus a reduced-sized conventional school
- Two treatments of interest
  - Attending a redesigned high school site (one treatment)
  - Attending a specific school at a redesigned high school site (multiple treatments)
- Evidence-to-date: Moderate of some positive impact
- Methodology Preview
  - School-level matching (3); propensity score reweighting
  - Difference-in-difference analyses
Early College High Schools

- Created in 2002 and overseen by Jobs for the Future
  - Supported by NSP in NC
  - Currently there are >200 ECHS campuses

- Brand new schools partnering with local college/university
  - Small (≤ 400 students) schools
  - Students earn high school diploma plus 2 years of college credit in 4 or 5 years

- Evidence-to-date: moderate of some positive impacts

- Methodology Preview
  - Student-level matching within-district (10)
  - Survival analyses
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Data

- Longitudinal data on all students in North Carolina public schools between 1997 and 2009

- Observe course-taking and exam performance as progress through high school
  - End-of-course exams

- Previous academic preparation
  - 8th grade math score; Algebra I in 8th grade
  - Time on homework; Teacher judgment of reading ability

- Characteristics
  - Race/ethnicity, parental education, gender, over-age
  - Free/reduced lunch status, LEP status
Defining Pipeline Progression

- Each pipeline consists of three courses; aligned with state graduation requirements; flexible to any one-course-per-year sequence
  - Math: algebra I, geometry, algebra II
  - Science: biology plus any 2 of 3 – physical science, chemistry, physics

- 2 progression measures: course-taking and persistence

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<thead>
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<th>By the end of…</th>
<th>Student taken courses/demonstrated mastery in…</th>
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<td>At least one subject</td>
</tr>
<tr>
<td>10th grade</td>
<td>At least two subjects</td>
</tr>
<tr>
<td>11th grade</td>
<td>All three subjects</td>
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<tr>
<td>12th grade</td>
<td>All three subjects</td>
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</table>

- Mastery = proficiency levels 3 and 4
Science Pipeline Progression Rates, 1998-2008
Reform School Sample

- 64 reform sites; 93 schools
- Little overlap in implementation of three models
  - Local history effects complicates comparative judgments

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<td>37</td>
<td>8</td>
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Sample ~ 9th grade cohorts

- 11 cohorts of 9th grade
  - Assignment to treatment v. control varies across and within reform models

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Sample ~ 9th grade cohorts

- Reform implemented in 2002
  - Cohorts 2002 onward get full treatment
  - Cohorts 1999-2001 get partial treatment

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Sample ~ 9th grade cohorts

- Reform implemented in 2007
  - Have not yet observed any cohort complete the pipeline

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Sample Characteristics

- Majority of schools are rural
  - 72% HSTW; 62% Redesigned; 52% ECHS

- Principal turnover higher in HSTW than Redesigned
  - 50% versus 33% -- any time in 2 years prior

- Teacher turnover higher in Redesigned than HSTW
  - 20% versus 16% - over 2 years prior

- ECHS students have characteristics associated with high on-track probabilities
  - Highest 8th grade test scores, lowest retention rate, highest % female

- Redesigned students have characteristics associated with low on-track probabilities
  - Lowest 8th grade test score, highest FRLunch status, highest % minority, highest retention rate
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Matching Strategies

- School-level matching for HSTW and Redesign HS
  - Iterative Mahalanobis distance matching after Rubin and Thomas (2000)
  - Key covariates: school-level % on-track
  - 3 matches for each reform school

- Student-level matching for ECHS
  - Propensity score matching
  - Key covariates: time on homework and teacher judgment
  - 10 nearest-neighbor matches from same district
    - With replacement (26) and without replacement (7)
Analytic Model: Difference-in-Difference

- High Schools That Work and Redesigned High Schools
- Two-level model logistic regression
  - Students in school-by-cohorts (Snipes, 2004)
  - Estimated separately by grade-subject-progression measure triplet
  - Level-2 model of the intercept includes difference-in-difference estimator
    - Separate estimator for each school group (reform-by-implementation year)
    - *post-by-treatment* variable split into (1) *post-by-full* and (2) *post-by-partial*
  - Treatment effect estimated according to Puhani (2008)
Analytic Model: Survival Analysis

- Early College High Schools
- Two-level hazard model
  - Students in cohort-by-schools
  - Estimated separately by year school opened-subject-progression measure triplet
  - Level-2 models of each of the grade indicators (baseline hazard) includes treatment variable
  - Treatment effect = Pr(ECHS) – Pr(comparison)
Propensity Score Weights

- Correcting for bias threats
  - Censoring
  - Non-Compliance
    - Thus using the efficacy subsample
  - School selection at redesigned high school site

- Idea is to equate the student characteristics between groups

- HSTW and ECHS: weight correct for censoring and non-compliance

- RHS: weights also correct for within-site school selection
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HSTW Math Reform Effect

% On-Track Progression

- 9
- 10
- 11


persistence course-taking
Redesign Math Effect

% On-Track Progression

<table>
<thead>
<tr>
<th>9</th>
<th>10</th>
<th>11</th>
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<tbody>
<tr>
<td>2006 LARGE</td>
<td></td>
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<td>2007</td>
<td></td>
</tr>
<tr>
<td>2006 SMALL</td>
<td></td>
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persistence course-taking
Redesign Science Effect

% On-Track Progression

2006 2007

2006 2007

---LARGE---

persistence
course-taking

---SMALL---
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ECHS reform effect: mathematics

by race, 2006 implementers

on-track survival rate (%) for mathematics by race, 2006 implementers.
ECHS reform effect: mathematics
by parental education, 2006 implementers

on-track survival rate (%)
persistence
coursetaking

no HS HS some coll. BA+

9                      10                      11                           9                      10                      11
ECHS reform effect: mathematics
by 8th grade math score, 2006 implementers

on-track survival rate (%)
by 8th grade math score, 2006 implementers

quintile 1
quintile 2
quintile 3
quintile 4
quintile 5

persistence
coursetaking

on-track survival rate (%)

9 10 11
9 10 11
Next Steps
~ toward policy implications ~

- Preliminary:
  - New schools (ECHS and the small at RHS) helping with math, but not with science; capacity issues?
  - Subgroups: ECHS closing gaps in course-taking but persistence

- Incorporate SY2008-09 data
  - Full picture of math pipeline for all school groups

- Complete student subgroup analyses

- Unpacking the black box
  - Principal survey of practices, programs, and policies
  - Site visits