

Revisiting the *Barriers and Opportunities* Study: Continued Efforts to Improve Pathways to Undergraduate STEM Degrees

Roundtable on Systemic Change in
Undergraduate STEM Education



Land Acknowledgement

Although we are gathering virtually today, we acknowledge that the National Academies buildings sit on the traditional land of the **Nacotchtank** and **Piscataway People** past and present, and honor with gratitude the land itself and the people who have stewarded it throughout the generations. We honor and respect the enduring relationship that exists between these peoples and nations and this land. We thank them for their resilience in protecting this land; and aspire to uphold our responsibilities to their example.

Welcome from the Roundtable on Systemic Change in Undergraduate STEM Education!



OUR MISSION

*With an **intentional focus on diversity, equity, and inclusion**, the Roundtable on Systemic Change in Undergraduate STEM Education works to advance efforts to **improve learning experiences for undergraduate students in STEM courses and programs.***

*The Roundtable helps the field anticipate how best to **serve learners** considering the rapidly changing social and economic environment, including dramatic shifts in student demographics, modes of learning, technology, STEM knowledge, commitments to equity and inclusion, and how we think about work.*

Roles of the Roundtable

**Levers for
Change**

Identify actions to spur systemic change.

Share high quality information, models, and other evidence-based practices.

**Hub for
Knowledge**

**New
Projects**

Develop work in areas where additional evidence and guidance are needed.

Imagine what society will look like. Analyze the implications for STEM Education.

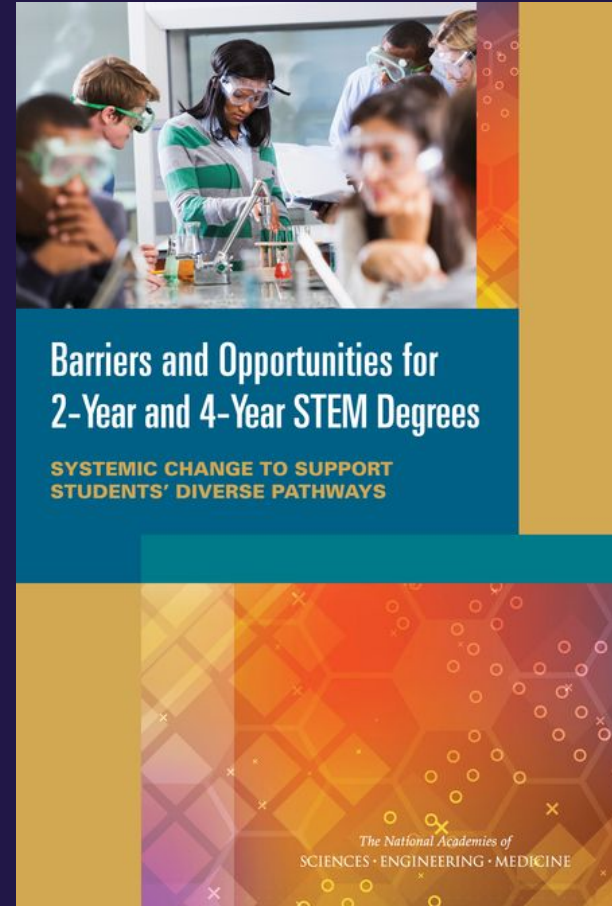
**Futuristic
Thinking**

Preview of Today's Panels

- Importance of community colleges
- Importance of transfer policies
- Importance of supports for transfer students

MAY 2024

Overview of the *Barriers and Opportunities* Report



MAY 2024

Reflections on *Barriers and Opportunities* and the Current State of Student Experiences Navigating STEM Degrees



Reflections on *Barriers and Opportunities* and the Current State of Student Experiences Navigating STEM Degrees

Moderator:



Susan Rundell Singer
St. Olaf College
(Roundtable Member)

Panelists:



Sylvia Hurtado
University of California, Los Angeles



Rajeev Darolia
U.S. Department of Education (on leave from University of Kentucky)



Shirley Malcom
AAAS



Josh Wyner
Aspen Institute

MAY 2024

Research on Transfer Students and Transfer Models



Research on Transfer Students and Transfer Models

Moderator:



Mark Mitsui
*Portland Community
College (Retired)*
(Roundtable Co-Chair)

Panelists:



Davis Jenkins
*Teachers College,
Columbia University*



Bruk Berhane
*Florida International
University*



Lois Miller
*University of
Wisconsin–Madison*

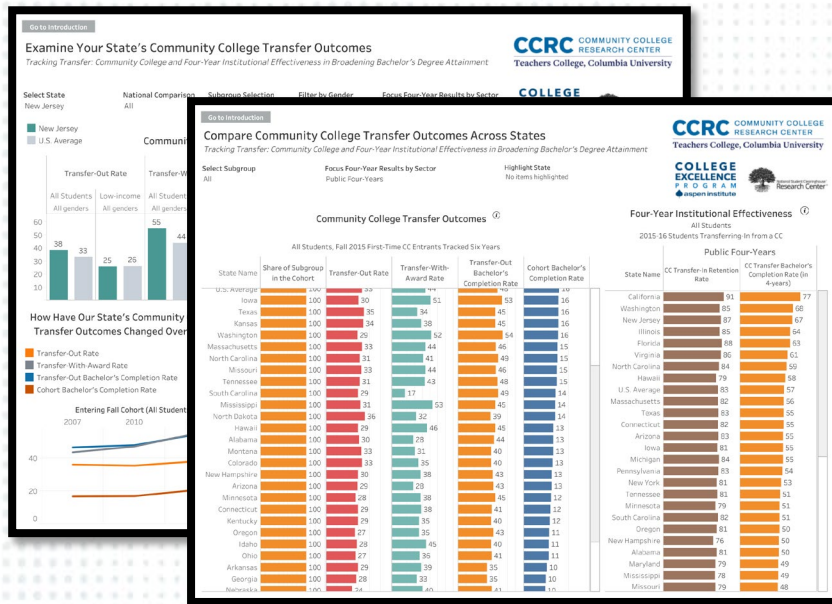
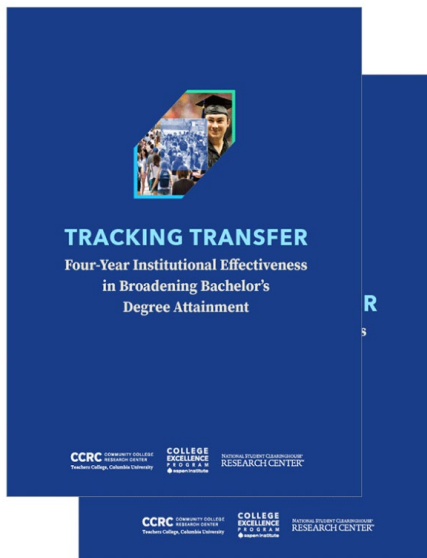
Barriers and Opportunities to Strengthen STEM Transfer Pathways for Community College Students

NASEM Roundable on Systemic Change in STEM Education

Davis Jenkins

Senior Research Scholar and
Research Professor in Education and Social Policy

Tracking Transfer: Community College and Four-Year Institutional Effectiveness in Broadening Bachelor's Degree Attainment

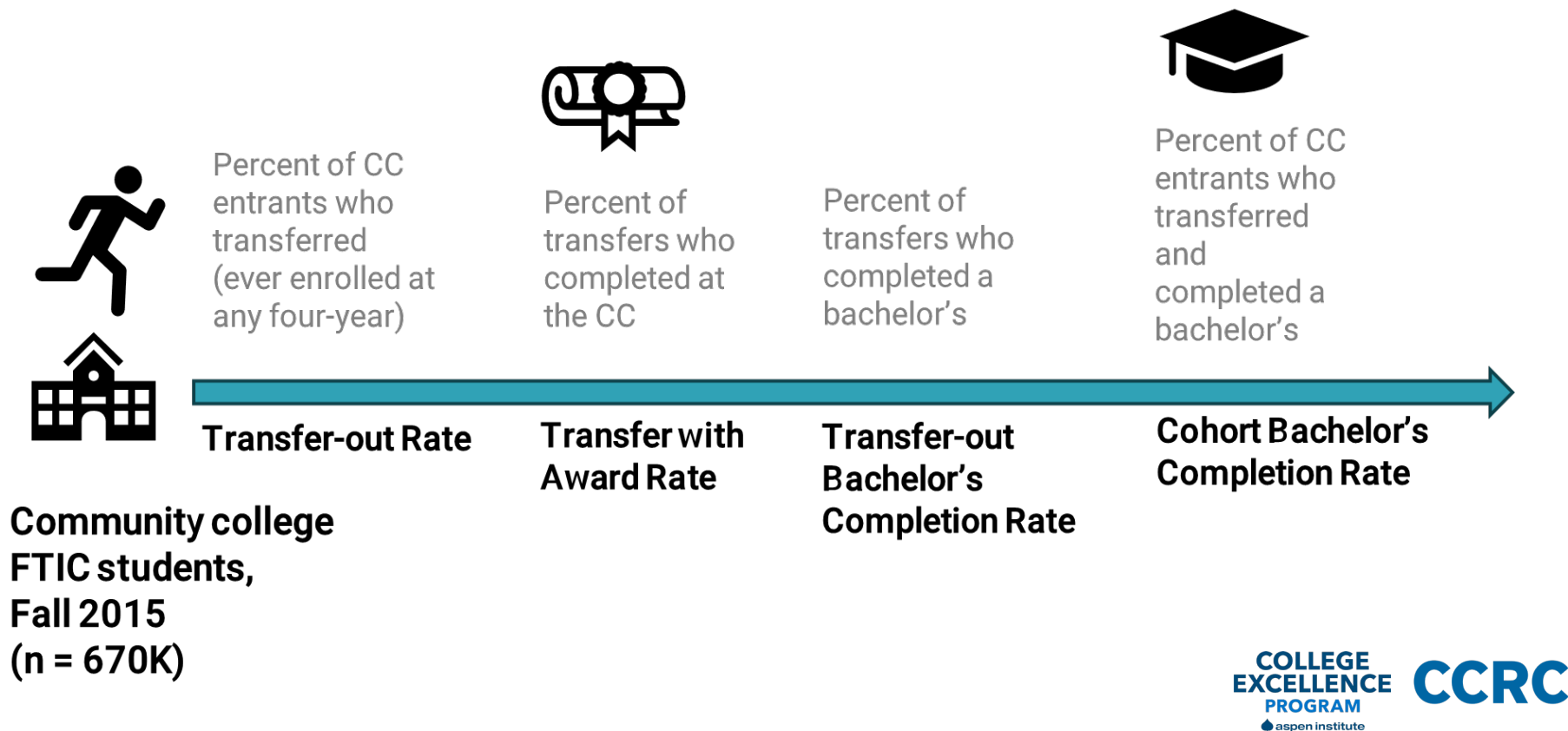


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Community College Tracking Transfer Metrics



The promise of transfer as an accessible and affordable route to a bachelor's remains unfulfilled.

80% of community college students want a bachelor's degree



33% of community college students transfer to a four-year institution



16% of community college students will graduate with a bachelor's degree within six years of starting college



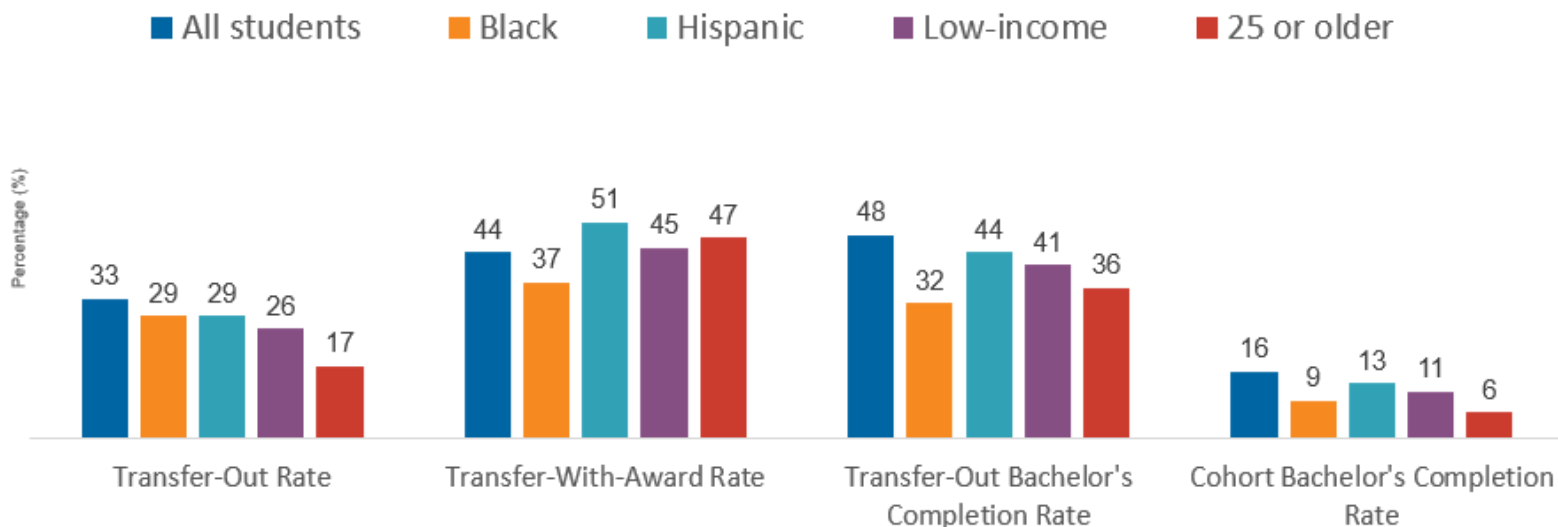
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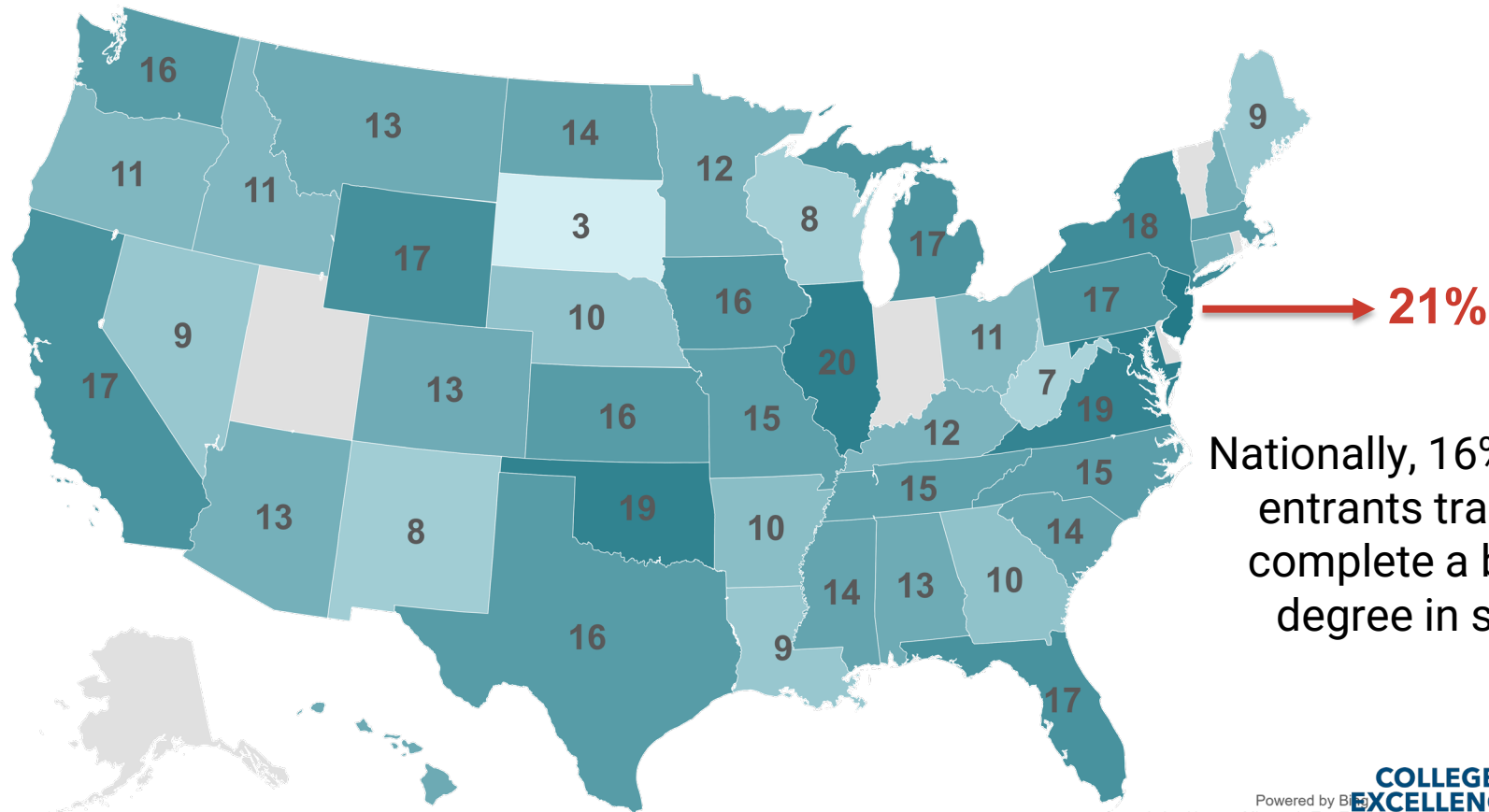
Transfer outcomes are even lower among low-income, Black, Hispanic and older students

Six-Year Transfer Outcomes, Fall 2015 Community College Entrants



Cohort Bachelor's Completion Rate

3 21

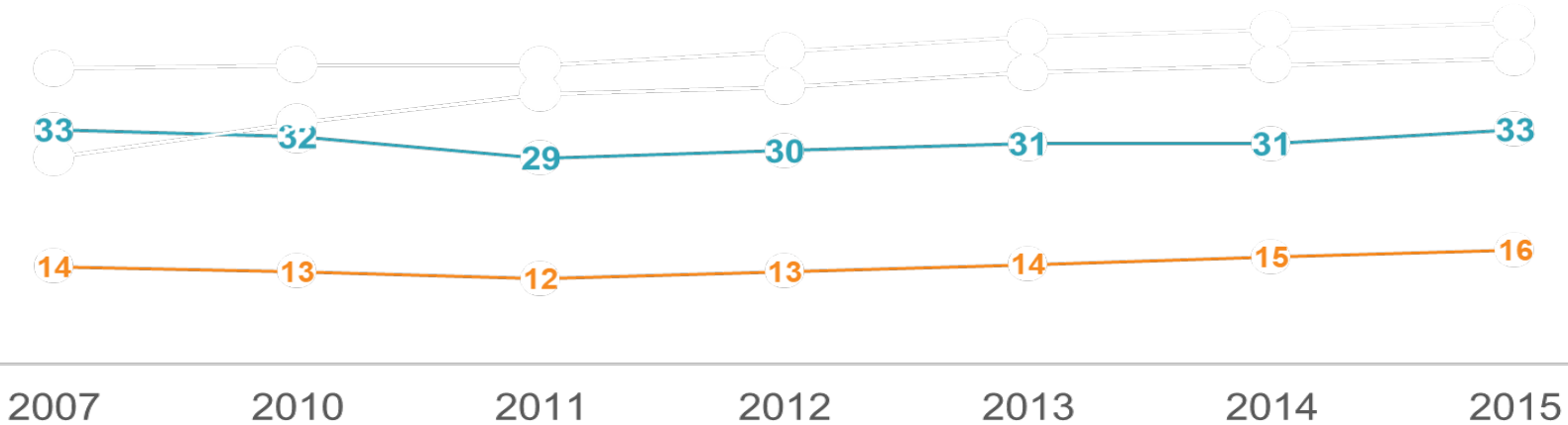


21%

Nationally, 16% of FTIC cc entrants transfer and complete a bachelor's degree in six years.

A big reason transfer bachelor's completion is low is that transfer-out rates have been flat since 2007

Community College Transfer Metric Trends

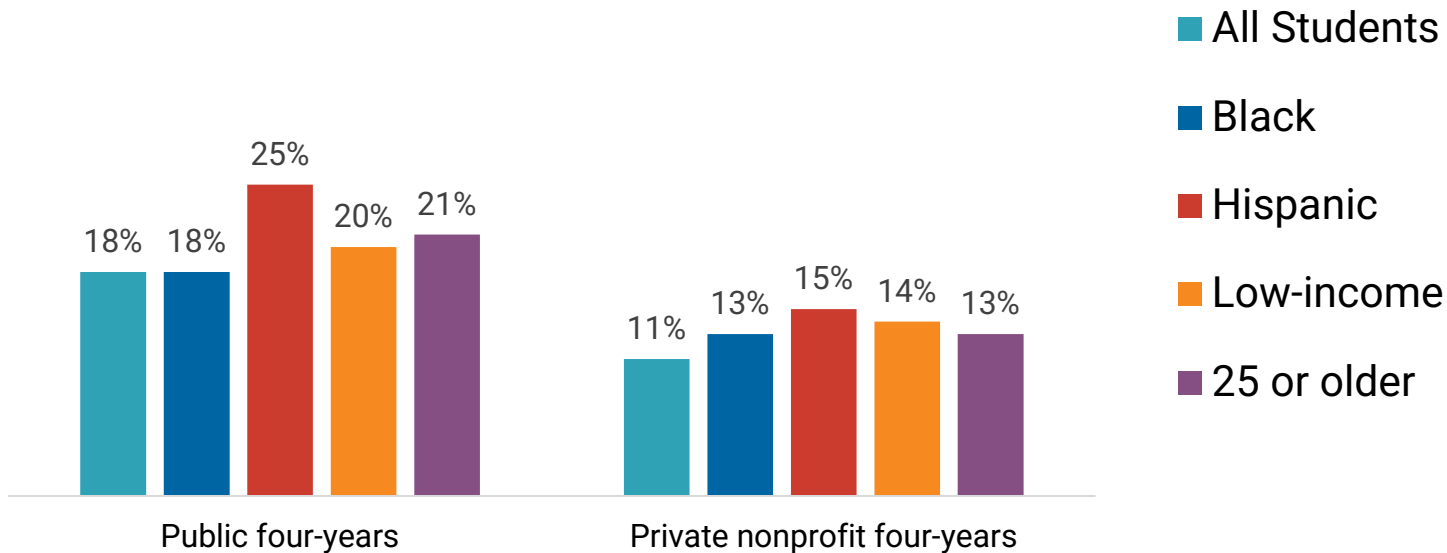


Transfer-out rate

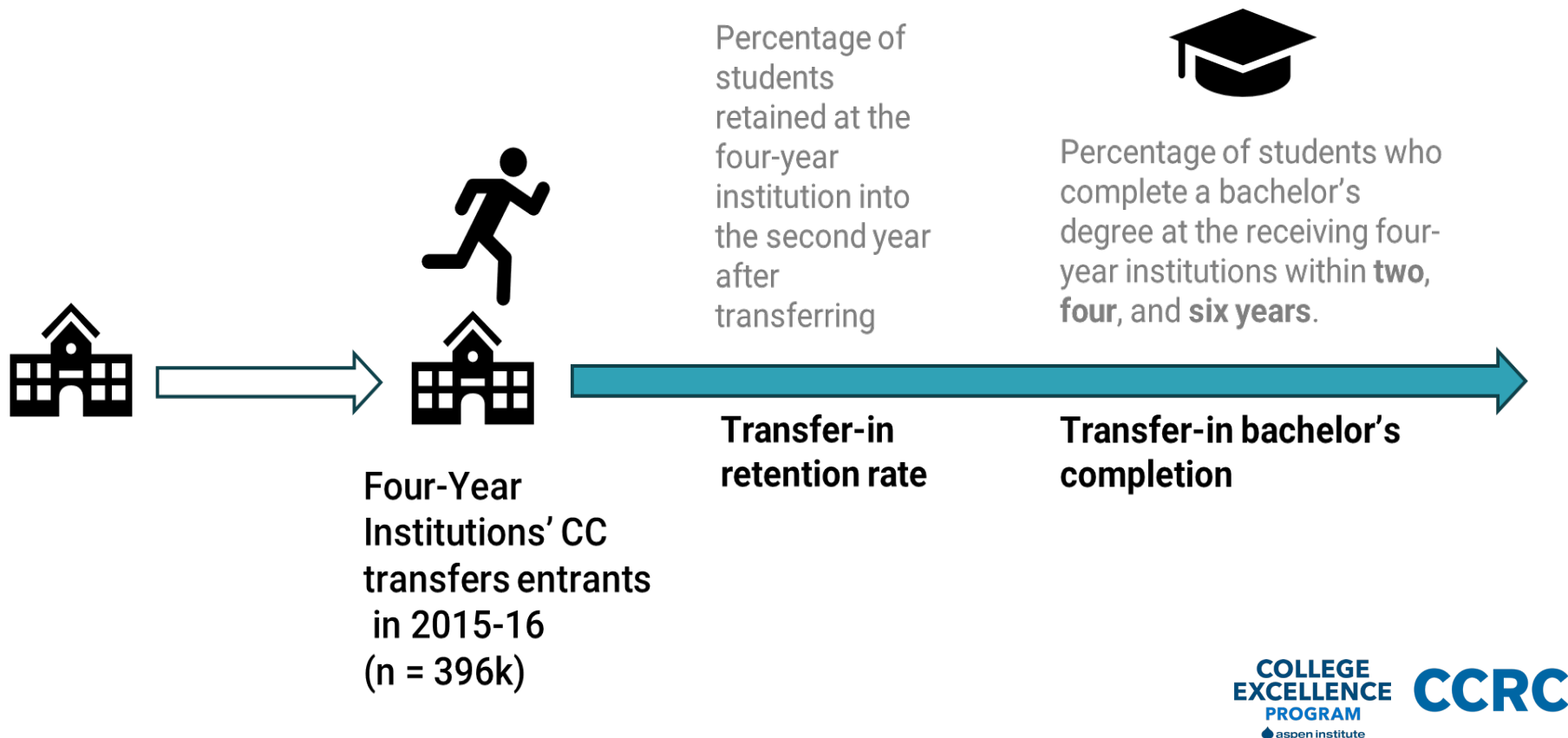
Cohort bachelor's
completion rate

Community college transfer pathways are a major source of enrollment and diversity at four-year institutions.

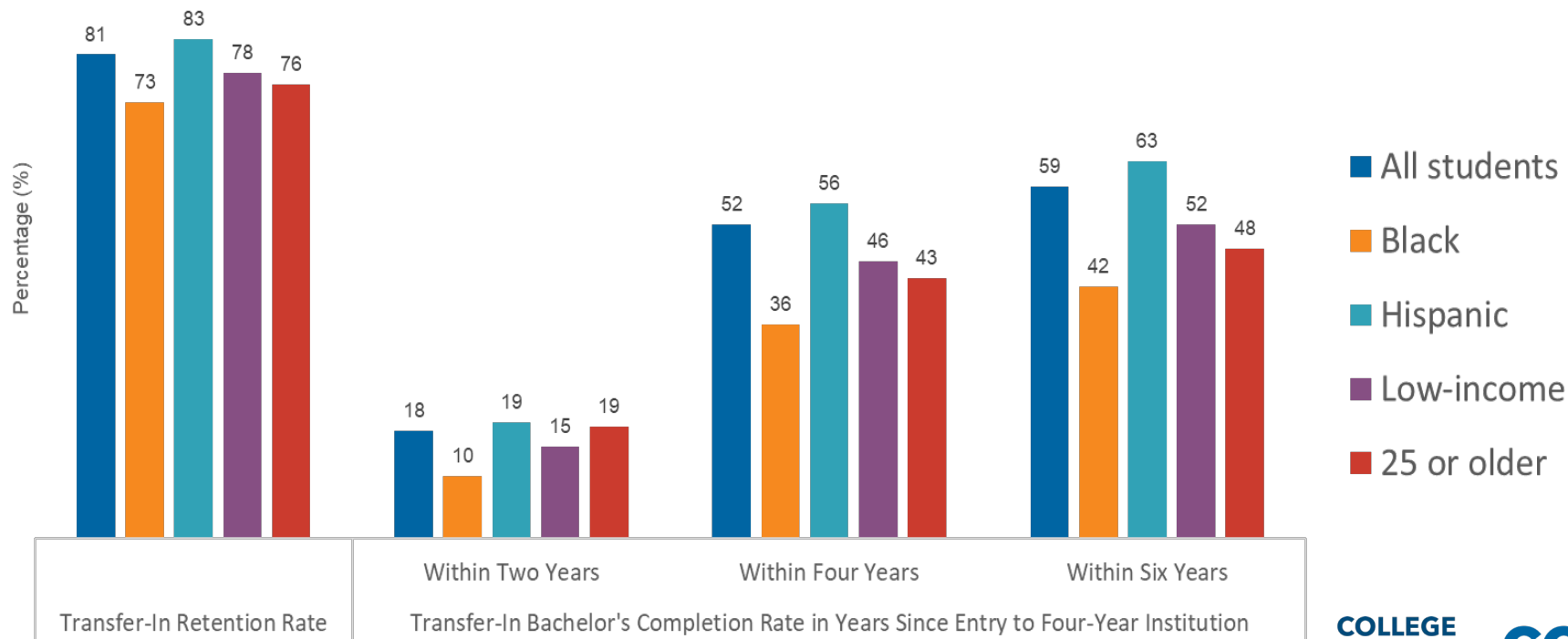
Four-Year Institutions:
Percent of Entering Students who are CC Transfers



Four-year Institution Post-Transfer Metrics



Most community college transfers persist into their second year, but only about half complete in four years.



Select State
U.S. Average

Subgroup Selection
(Multiple values)

Gender
All genders

Focus Four-Year Results by Sector
Public Four-Years

Bachelor's Degree Field

- Public services and administration
- Education
- Agriculture and natural resources
- Social and behavioral sciences
- Arts, humanities, and English
- Business
- Health professions
- Applied technology
- Engineering
- Computer science
- Science and mathematics

Fields of Study of Bachelor's Degree Completers Within Six Years After Four-Year Institution Entry

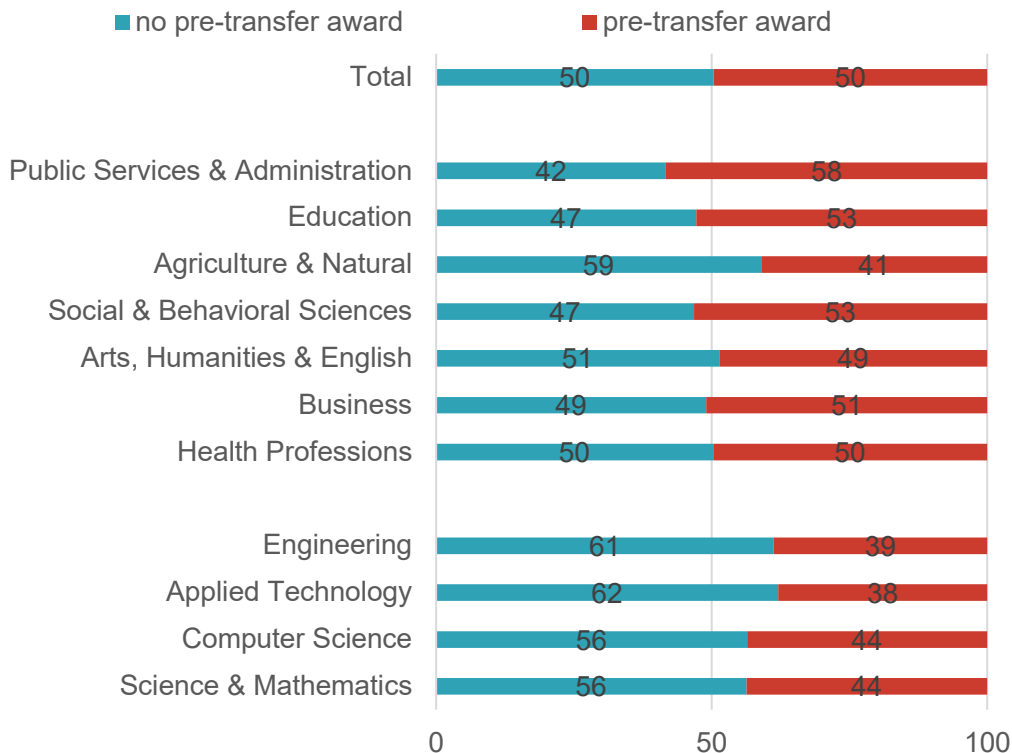
U.S. Average Public Four-Years



Among bachelor's completers, community college transfers are underrepresented in STEM compared to non-transfers

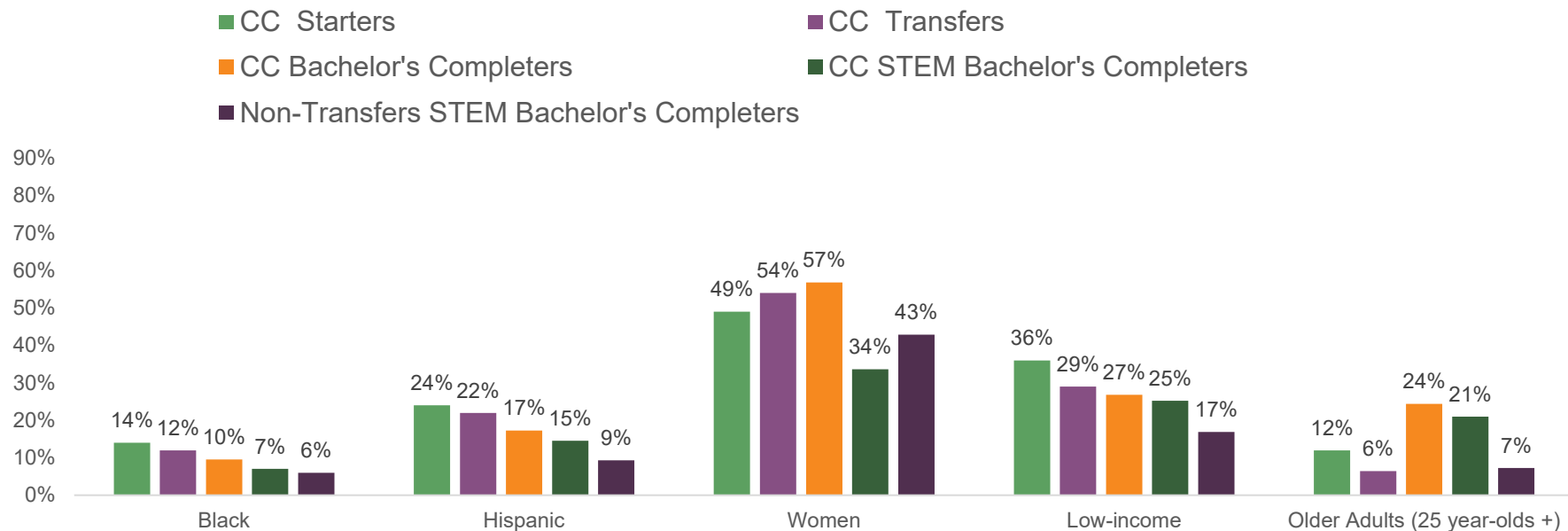
The pathway to a bachelor's degree in STEM is less likely to include a pre-transfer award

CC Bachelor's Completers by Field

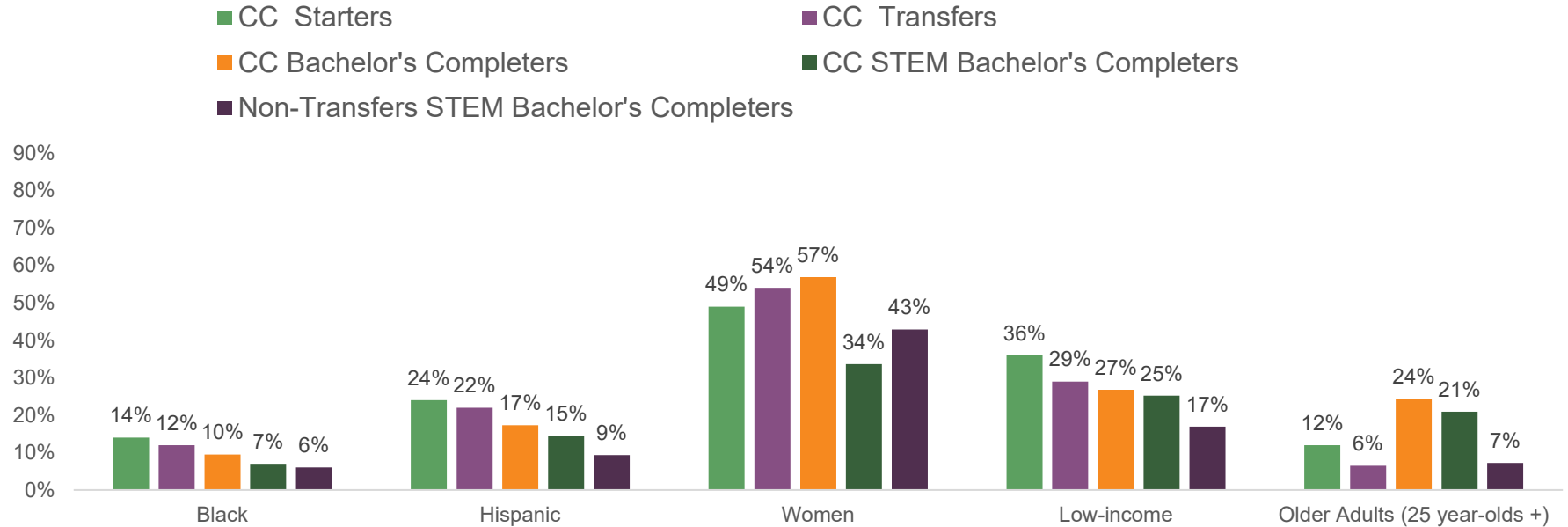


STEM
Completers are
less likely to
have a pre-
transfer award

CC STEM completers tend to be less diverse than CC bachelor's completers, but **more diverse than non-transfer STEM completers**



Women are underrepresented among CC STEM bachelor's completers, relative to non-transfer STEM completers

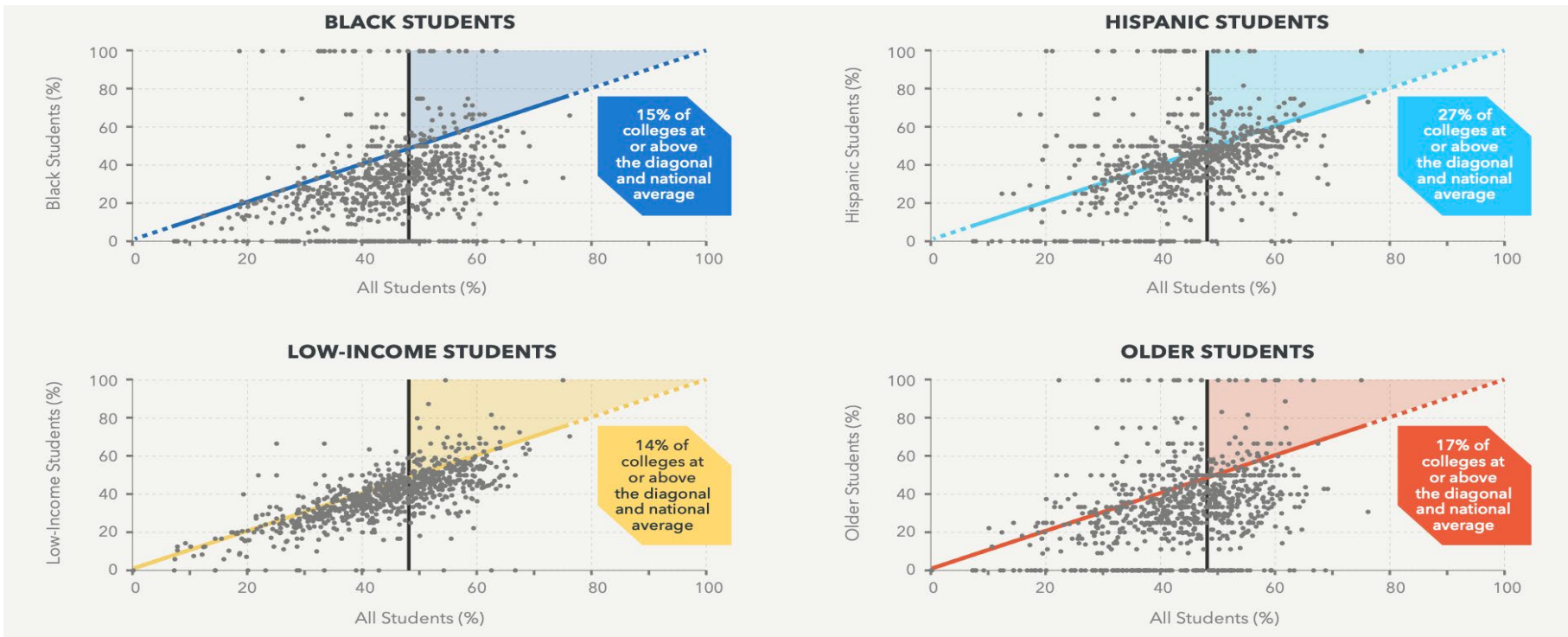


CCRC research highlights the many college-created systemic barriers to transfer student success.

- Students not helped to explore career/college options, and develop a plan—and their progress isn't monitored
- Transfer paths unclear, “get your gen eds out of the way” misleads students
- Early momentum matters: Too many entering students weeded out through dev ed, poorly resourced instruction in uninspiring gen ed; too few experience high-quality active learning
- Unreceptive transfer cultures upon arrival at the four-year, exclusionary practices limit access to HIPs
- Dual enrollment offerings not designed to help students actively explore interests and develop goals for college and careers

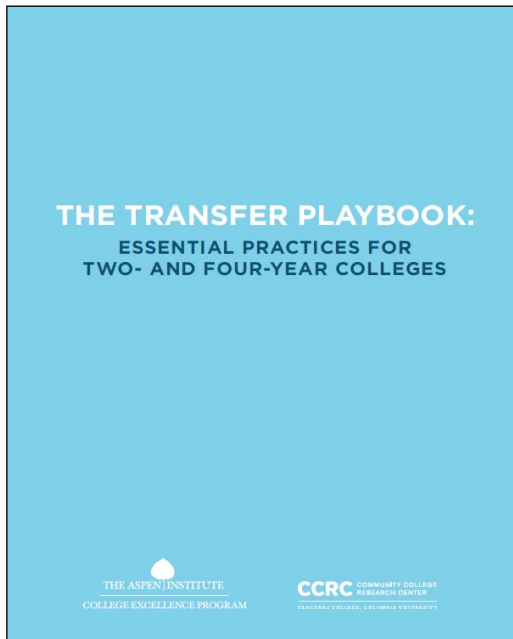


Some cc-university partnerships have achieved more equitable outcomes for students from underserved groups.



Source: Velasco et al., 2024: [Tracking Transfer: Community College and Four-Year Institutional Effectiveness in Broadening Bachelor's Degree Attainment](#)

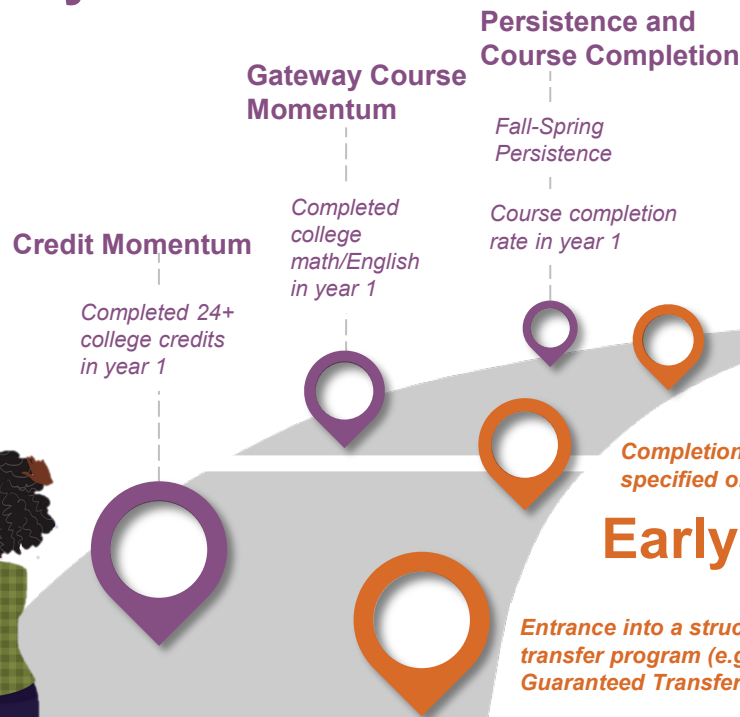
High-performing transfer cc and university partners collaborate to eliminate systemic barriers.



- ✓ Backward map paths to transfer in majors and career opportunities in fields of regional importance
- ✓ Help all new students explore career/academic options and develop a full-program plan by end of term 1
- ✓ Monitor student progress on plan and share data on prospective students
- ✓ Track transfer outcomes disaggregated by race/ethnicity, income, sending/receiving institution, and student major
- ✓ Embed active/experiential learning into every program
- ✓ Build pathways into high schools, starting with dual enrollment

Metrics for Improvement: Momentum as Leading Indicator

Early Academic Momentum



Measuring STEM Momentum Early Indicators of STEM Transfer Success for Community College Students

By John Fink, Taylor Myers, David Sparks, and Shanna Swick Jaggers

Community colleges across the country are working to implement college-wide reforms—to improve student success. Given that such reforms are difficult to evaluate, and their effects on transfer or graduation rates may take years to manifest, college leaders need to know whether changes they make in the short run are associated with longer-term student success. Accordingly, college leaders have turned to “early momentum” metrics, which research suggests are leading indicators of longer-term student outcomes (Jenkins & Bailey, 2015).

However, early momentum metrics have not been consistently used. For the benefit of community colleges adopting guided pathways, a whole-institution reform model designed to improve how students enter and navigate through programs of study, early momentum metrics have helped these colleges track improvements and provide formative assessments of student success reforms associated with the guided pathways framework.

However, early momentum metrics are program-specific. In one example of a widely used metric, first-year credit accumulation, a student may earn a substantial number of college credits in their first year, but those credits may or may not apply to a degree in their field of interest. This is a substantial limitation in the utility of such metrics, as program-specific coursework may be the strongest indicator of transfer to and graduation from a four-year institution (Jenkins, 2016; Jenkins & Cho, 2012, 2014). Moreover, institutional improvement aimed at greater student success requires the involvement of faculty and academic advisors within specific academic areas; those stakeholders often want to know whether new reforms are benefiting students within their own programs (Bailey et al., 2015).

Overview

This brief summarizes findings from a study in which we examined postsecondary college transfer and degree records from hundreds of thousands of transfer-outstanding community college students in three states. Our aim was to explore and test metrics that could be useful in the formative assessment of efforts to improve STEM transfer outcomes. Our findings show that first-year completion of a calculus course and first-year completion of a three-credit science, technology, or engineering (STE) course specified on statewide STEM transfer pathways are both reliable indicators of subsequent STEM transfer success across a wide range of state and institutional contexts. These two metrics are also robust predictors of outcomes among subgroups of students by race/ethnicity and gender. In general, community colleges have relatively low rates of completion of these key STEM courses, and disparities in completion of these courses by race/ethnicity and gender are common. The STEM momentum metrics identified in this study may therefore be useful for colleges seeking to strengthen STEM transfer outcomes and close equity gaps in STEM bachelor's degree attainment.

Capturing Early Community College “STEM-Mentum”

STE Course Type (Excluding Math)

STE Transfer – State Pathways
(e.g., Chem I/II; Bio I/II)

STE Foundation
(Pre-Reqs to STEM Transfer,
e.g., intro chem/bio courses)

Other STE, Likely Transferable

Other STE, Likely Terminal

Any STEM



Math Course Type

Calculus

Foundations to Calculus
(Pre-Calculus, Trigonometry/
Geometry, College Algebra)

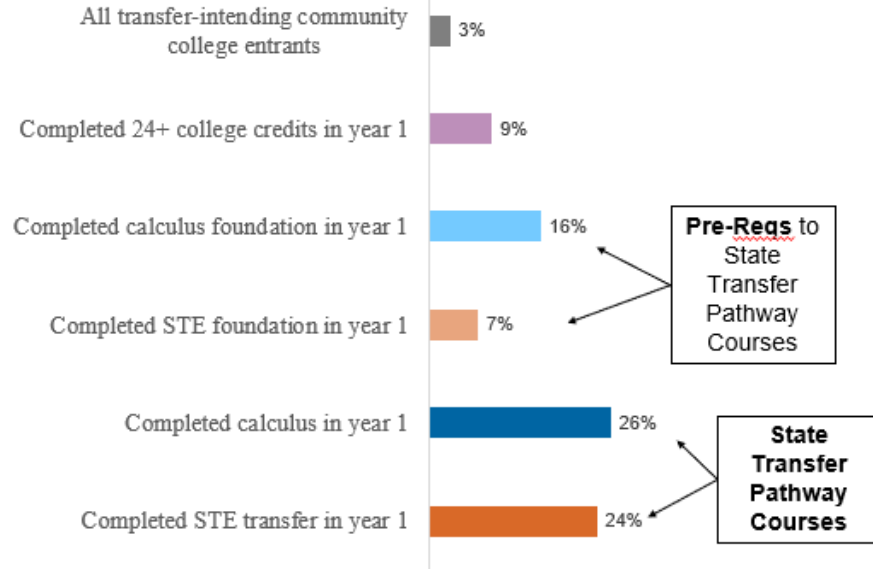
Statistics

**Other Math Subjects (College
Level)**

Developmental Math

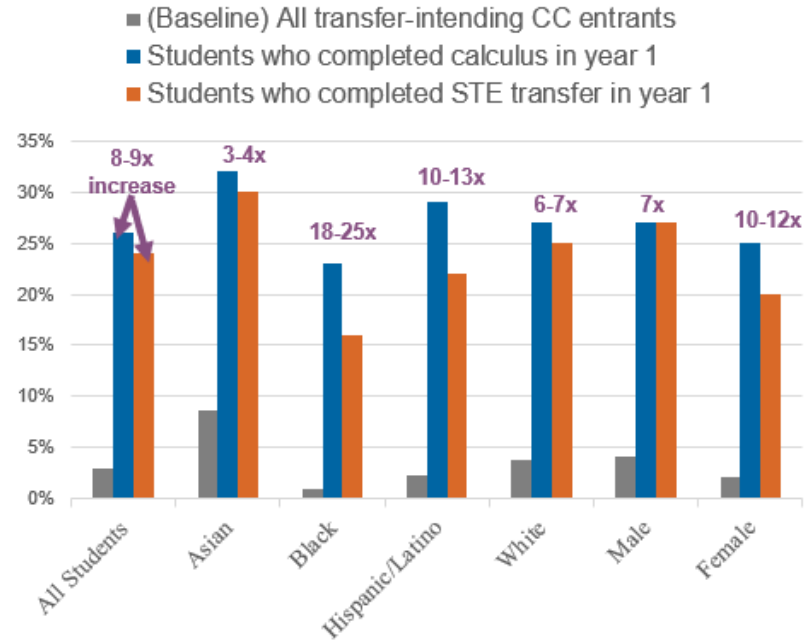
Transfer Pathway Courses Can Capture Program Momentum

STEM Bachelor's Completion Rates in 6 years (State A)



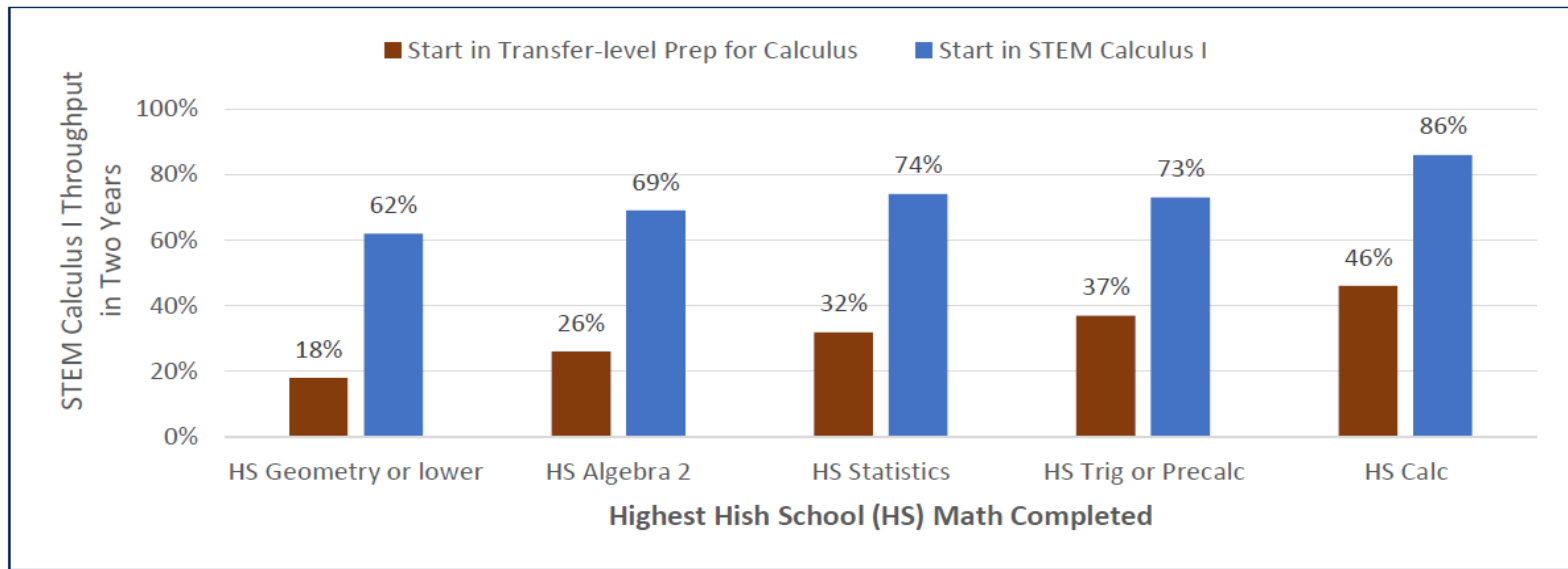
Benefits of Early STEM Momentum Reliable across Student Groups

STEM Bachelor's Completion Rates in 6 years (State A)



Stop using Sputnik-era math sequence to divert talented students from STEM education and careers.

Figure 2. STEM Calculus 1 Two-Year Throughput, STEM Students Disaggregated by Starting Level and Highest High School Math Completed



Source: California Community Colleges and RP Group, Preparatory Pathways and STEM Transfer Completion, Feb 2024.

For more information, contact us at:

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ccrc.tc.columbia.edu



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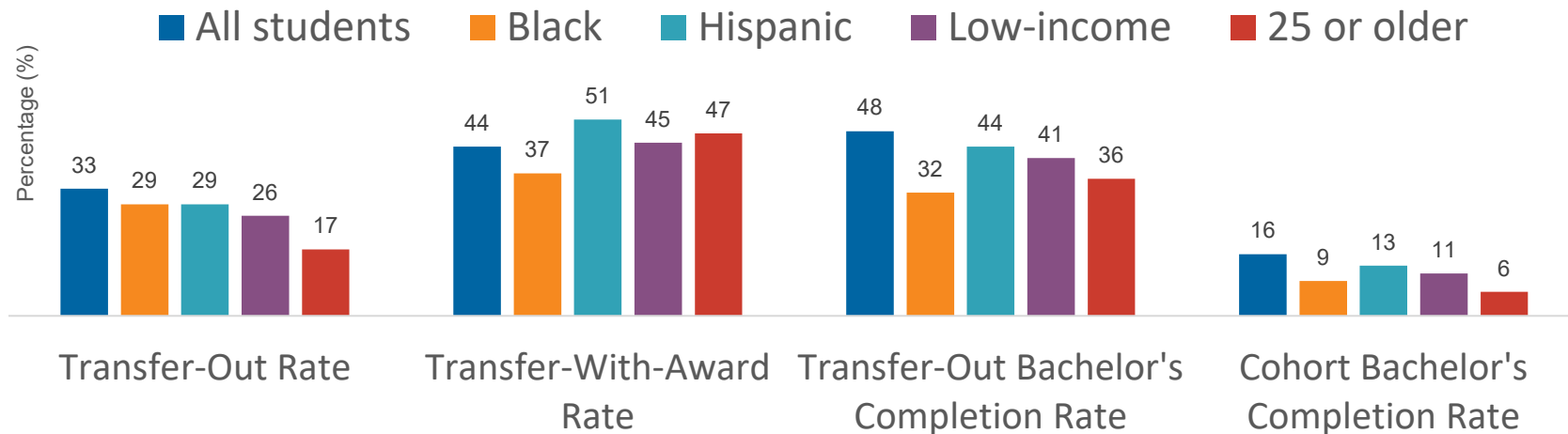
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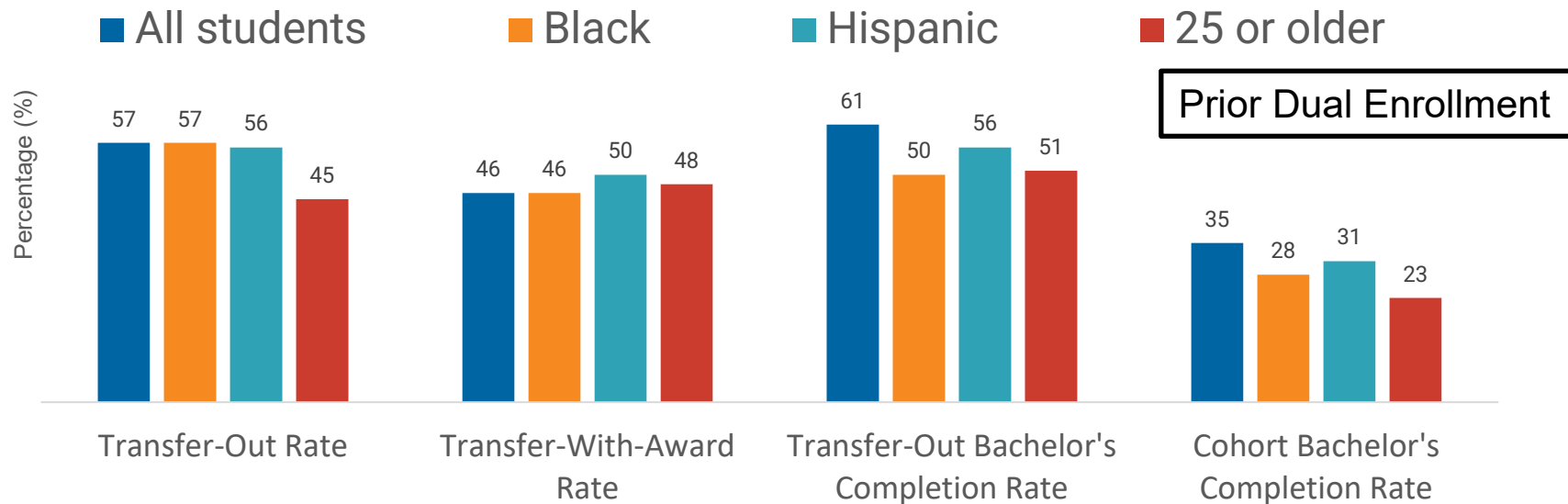
Recall... transfer outcomes are even lower among low-income, Black, Hispanic and older students

Six-Year Transfer Outcomes, Fall 2015 Community College Entrants



Many students enter CCs with prior dual enrollment, and their transfer outcomes are much better

Six-Year Transfer Outcomes Fall 2015 Community College Entrants with Prior Dual Enrollment

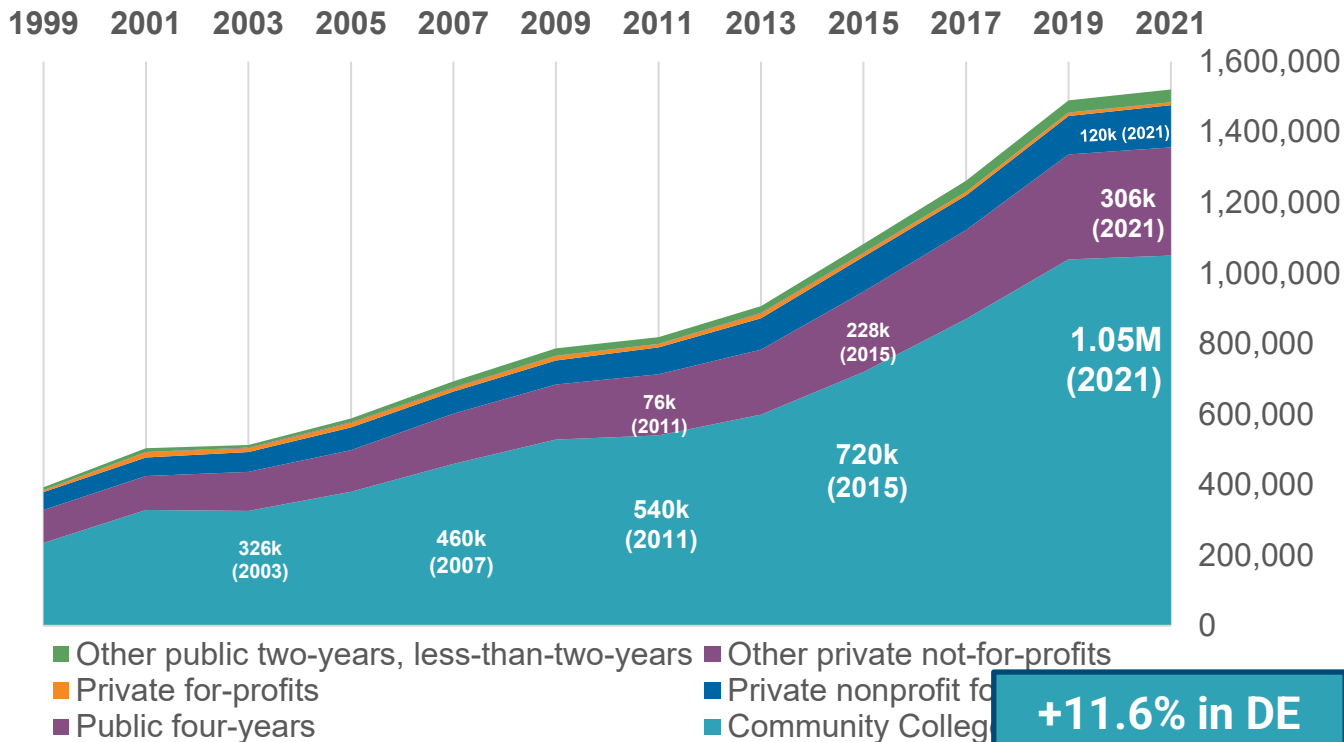


Dual Enrollment by Sector

1999-2021

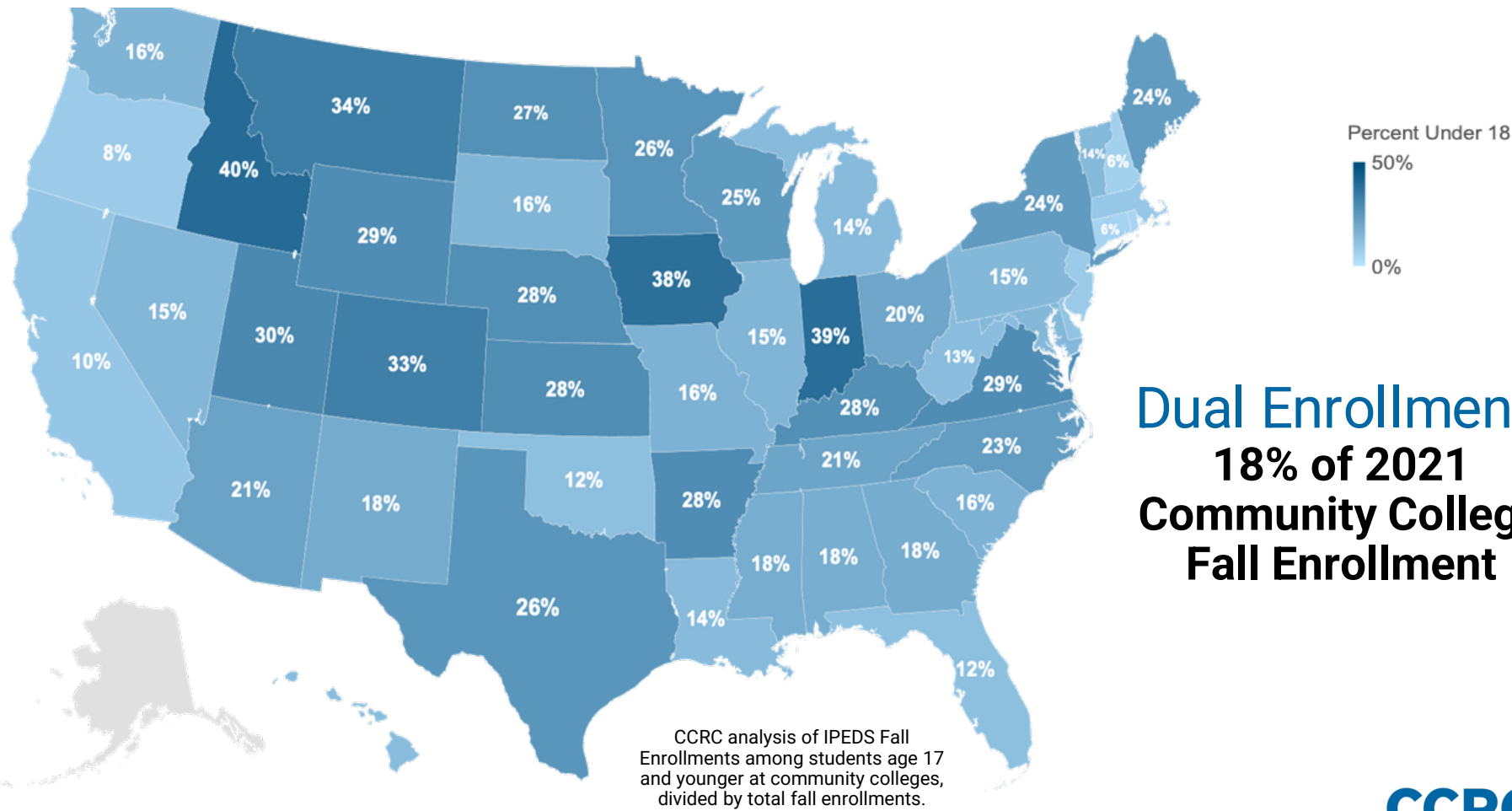
IPEDS Fall Enrollments

Fall Undergraduate Enrollments among
Students Aged 17 or Younger



**+11.6% in DE
2021-2023
(NSC)**

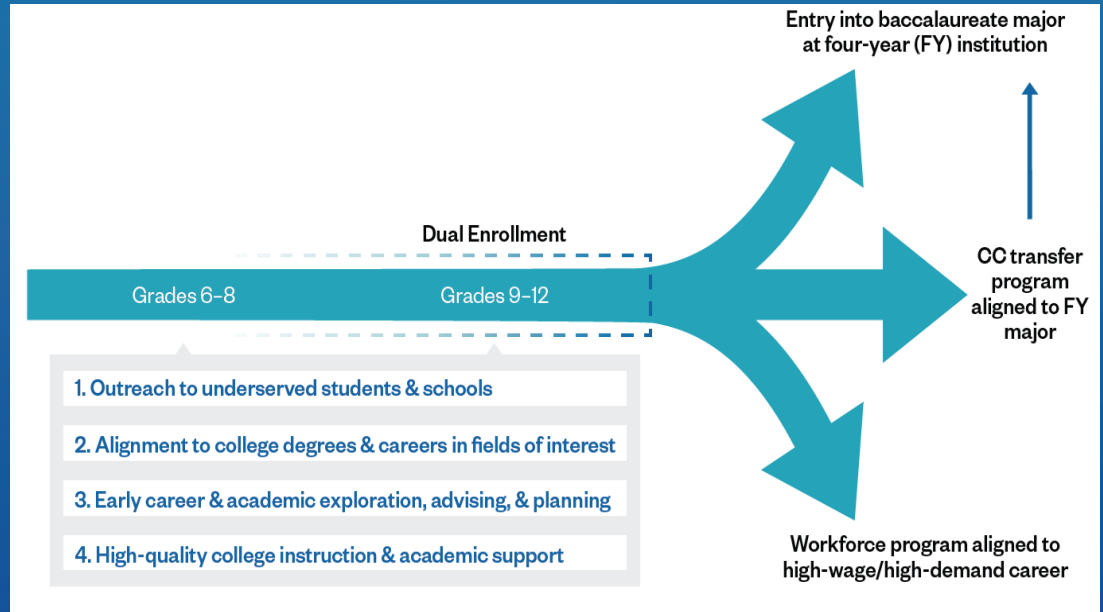
Enrollment by high school dual enrollment students boomed nationally for more than two decades.



Dual Enrollment: 18% of 2021 Community College Fall Enrollment

Dual Enrollment Equity Pathways (DEEP)

*Framework for building equitable **onramps to debt-free, career-path degree programs after high school** (while increasing yield of recent high school grads)*



DEEP Practices

1

Outreach to underserved students and schools

- Focus outreach on underserved high schools, students, and communities.
- Start outreach before high school.
- Leverage community connections to build awareness.
- Build trust with and educate parents and families.

2

Align DE course offerings to college degrees and careers

- Inventory current DE offerings.
- Map DE offerings to college degree programs in fields of interest.
- Embed DE offerings in career-connected high school programs.

3

Advise students to explore interests and develop plans

- Use DE to showcase college programs and support exploration.
- Help students develop a college program plan and provide checkpoint advising.
- Coordinate advising roles across sectors.

4

Support students by delivering high-quality instruction

- Scaffold coursework and frontload supports.
- Respond quickly when students are struggling.
- Provide additional, structured support for online classes.
- Support DE instructors and monitor quality.

Approaching Dual Enrollment with a DEEP Mindset

CONVENTIONAL MINDSET

DE courses **made available** to students who are already college bound

Focus mainly on strengthening students' **academic preparedness for college**

Offerings mainly emphasize **general education courses**

Focus on achievement of **academic content standards**

High school CTE focused mainly on **immediate post-high-school employment**

DEEP MINDSET

Active outreach and support for underrepresented students and families starting in middle school

Focus also on building **motivation for college** by helping students explore interests and begin to develop an education/career plan

Offerings also introduce students to high-opportunity postsecondary pathways through **program foundation courses**

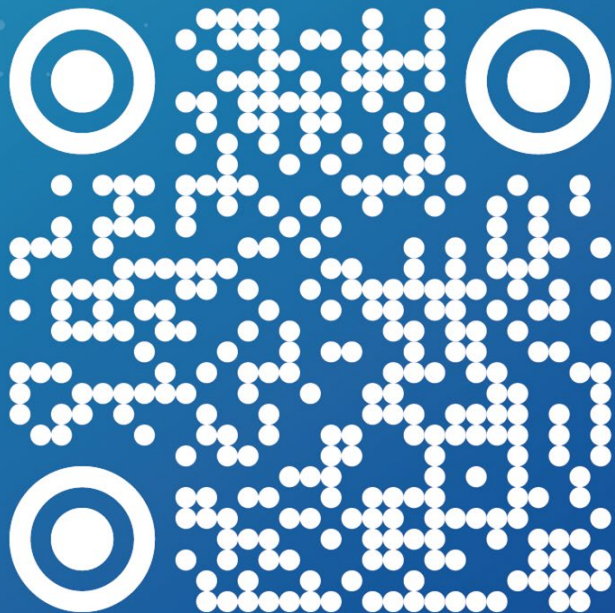
Added focus on helping students become **confident college learners** through active teaching/learning

Students motivated and supported to **apply high school CTE credits toward college degree programs** in high-opportunity fields



DEEP@CCRC

Resources on dual enrollment equity pathways for K-12 and college practitioners.



CCRC COMMUNITY COLLEGE
RESEARCH CENTER
TEACHERS COLLEGE, COLUMBIA UNIVERSITY

OCTOBER 2023

Rethinking Dual Enrollment as an Equitable On-Ramp to a Career-Path College Degree Program After High School

By John Fink and Davis Jenkins

In this report, we present a model for rethinking dual enrollment—through which over 1.5 million high school students take courses for college credit each year—as a more equitable on-ramp to college degree programs that prepare students to secure well-paying, career-path employment in their 20s. We describe the emergent efforts by early adopter institutions of whole-college guided pathways reforms to expand access to dual enrollment for students from groups underrepresented in college and to redesign dual enrollment offerings and supports so that students can more readily pursue a postsecondary degree program in a field they are interested in directly after high school. This model, which we call dual enrollment equity pathways (DEEP), reflects a change in mindset from colleges' and high schools' conventional approach to dual enrollment. Conventional dual enrollment programs are sometimes described as "programs of privilege" because of uneven access and barriers to participation or as "random acts" because of insufficient intentionality (and advising) in terms of how the coursework can fit into postsecondary pathways aligned to students' interests.

We present a conceptual model for DEEP and cite research to support its four main areas of practice: (1) outreach to underserved students and schools; (2) alignment to college degrees and careers in fields of interest; (3) early career and academic exploration, advising, and planning; and (4) high-quality college instruction and academic support. It is worth noting that DEEP practices reflect the curricular coherence and holistic supports evident in early college high schools, which research has shown to be effective in increasing college-going and completion among students from underrepresented groups. The DEEP approach applies these elements to the much more common à la carte form of dual enrollment coursework, with the potential to benefit hundreds of thousands of students each year. We conclude by pointing to growing incentives and opportunities for colleges, schools, and state systems to implement DEEP practices at scale and by identifying costs associated with DEEP implementation.

The DEEP model expands access to dual enrollment for underserved students and redesigns offerings and supports so that students can pursue a postsecondary degree program directly after high school.

REPORT | OCTOBER 2023

CCRC COMMUNITY COLLEGE
RESEARCH CENTER
TEACHERS COLLEGE, COLUMBIA UNIVERSITY

DEEP Insights

Redesigning Dual Enrollment as a Purposeful Pathway to College and Career Opportunity

John Fink • Sarah Griffin • Aurely Garcia Tulloch • Davis Jenkins • Maggie P. Fay •
Cai Ramirez • Lauren Schudde • Jessica Steiger

CCRC

Revisiting our Broadening Participation in Engineering Agenda by Expanding our Target Demographic

Monday, May 20th, 2024

Dr. Bruk Berhane, Assistant Professor of Engineering Education

SUCCEED + STEM Transformation Institute

Typical framing for BPE/BPC in literature



Findings from a systematic literature review on assessment-related articles on BPE/Broadening Participation in Computing with a focus on Black students

<i>Population</i>	<i>Number of Articles</i>
K-12 Focus	9
Undergraduate Focus	20
Graduate Focus	1
Participants at Multiple Levels	3
Community College/Workforce Focus	0



BLACK ENGINEERING STUDENT TRANSFER (BEST) PROJECT

Three-Year Broadening
Participation in Engineering Study

PI: Dr. Bruk Berhane

This material is based upon work supported by the National
Science Foundation under Award No. 1828619



Research Questions

- What do ethnically and culturally diverse Black students at three points in the transfer process from community college into four-year engineering departments identify as key factors that shape their transfer and persistence/retention experiences?
- To what extent do within-group differences influence the factors shared by and the experiences of these students?



Research Methods

- Demographic surveys
- Interviews/focus groups at three points
 - 1) Community college prior to transfer
 - 2) Initial transfer to the four-year university
 - 3) Nearing four-year degree
- Longitudinal approach adapted during COVID-19 to review snapshots in time



Selected Findings from Data Collection

Support of the Community College

- Extremely supportive faculty
- Knowledgeable advisors
- Different faculty/staff “norms” than in the four-year context



“I was like, ‘I have a question about where I should transfer.’ [The advisor] was like, ‘Anywhere. Where do you want to go?’ And then, that sort of things [sic] coming from people like [name of advisor] who went to the good schools...it motivates you to work hard.”
- Aman

Selected Findings from Data Collection

Exploring the Transfer Process

- Some participants navigated the transfer process without much institutional assistance; they encountered confusing websites and incorrect information
- Other participants benefitted from supported faculty, staff, and minority-focused (non-STEM/engineering) programs



“A bunch of my friends went to the [four-year university that initially denied them transfer admission]...and I’m just like, ‘...How do you make mistakes like that?’...”
– Douglas

Selected Findings from Data Collection

Acclimating to the New Environment (course differences)

- The size and scope of the four-year campus required unexpected learning
- Information gaps that students encountered in what faculty seemed to expect them to already know
- Students found the four-year school to be more “intense” than the two-year school.



“I felt very overwhelmed when I transferred here. Everything is bigger and different. Some of the challenges that I had – [in] my first week, I didn't even know how to access [the learning management system], so, [laughs] yeah, so that was something I had to figure out.” - Lelia

Selected Findings from Data Collection

Acclimating to the U.S. *and* to the four-year institution (cultural differences)

- Students' accents and their command of American English made them feel othered, before and after transfer
- After transfer, students encountered racism



“I identifi[ed] myself as an engineering student [before I transferred], and when I transferred...I saw myself as a Black engineering student.” - Uchie

CAREER: Better Together: Leveraging the Shared Commitment of Community Colleges and HBCUs to Optimize Black Engineering Student Pathways



Community Colleges (CCs)



Historically Black Colleges and Universities (HBCUs)

Five-Year Broadening Participation in Engineering Study

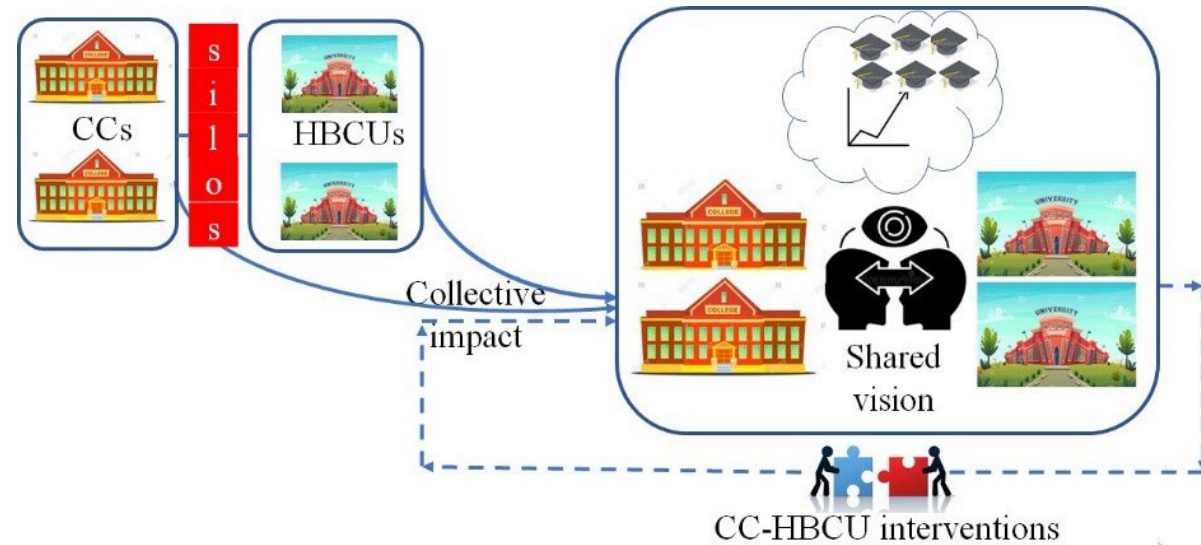
PI: Dr. Bruk Berhane



Selected Research Questions

What are the current challenges, opportunities, and trends in the existing CC-HBCU engineering pathway space?

How can CCs and HBCUs work together to develop a shared vision for optimizing Black engineering student pathways, using collective impact as a guiding strategy?



Switching Schools: Effects of College Transfers

Lois Miller

University of South Carolina, Department of Economics

May 20, 2024

Disclosure: The conclusions of this research do not necessarily reflect the opinions or official position of the Texas Education Agency, the Texas Higher Education Coordinating Board, the Texas Workforce Commission or the State of Texas.

Motivation

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 - ▶ Often find larger effects for low-income students

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 - ▶ Often find larger effects for low-income students
- ▶ This paper studies the returns to transfer, with a focus on students transferring to better-resourced institutions

Research Question

What are the effects on BA completion and earnings of transferring

- ▶ from a 2-year college to a 4-year college?
- ▶ from a nonflagship 4-year college to a flagship college?

Direction of effects not clear

- ▶ Loss of credits; transfer “shock” could negatively affect outcomes
- ▶ Increase in college resources and match could have positive effects

Data

Administrative data from Texas Education Research Center, 1994-2021

- ▶ Detailed background characteristics; HS enrollment and test scores
- ▶ Semester-by-semester enrollment and graduation from all TX colleges
- ▶ Applications and admissions to TX public 4-years
- ▶ Quarterly earnings from unemployment insurance records

Regression Discontinuity (RD) Design

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- ▶ I estimate transfer admission cutoffs from applications and admissions data from all TX 4-year public colleges [Details](#)
 - ▶ Cutoffs are “fuzzy”: some students below accepted and some above rejected
- ▶ Results give average effects for students near the cutoff, not all transfer students
 - ▶ Most cutoffs are low (avg = 1.9 GPA)
 - ▶ Comparison is to students who *applied* to transfer and were barely rejected

Results: First Stage Effect of Being Above Cutoff on Transfer

Table: First Stage, 2-Year Applicants

	Accept	Transfer
$\mathbb{1}(GPA_i \geq T_{ct})$	0.15*** (0.0069)	0.12*** (0.0088)
Obs	54,194	54,194
F Stat	485.9	170.1

Students with GPAs **just above** the cutoff are **15 pp** more likely to be **accepted** and **12 pp** more likely to **transfer** than those **just below** the cutoff [4-Year Applicants](#)

Students above and below discontinuity appear similar [Balance Table](#) [Density](#)

Results: Effects of Transfer on Earnings

	2-year to 4-year	4-year to Flagship
<i>TransferTarget</i>	-9,176** (3,741)	-11,695* (6,870)
$E[Y_0 C]$	46,123	51,946
Observations	417,026	88,765

- ▶ Earnings losses are persistent and increasing over time By Time Since Transfer
- ▶ Similar results using different measures of earnings Other Earnings Measures

Relevance to STEM and Major Choice

- ▶ Substitution into lower-paying majors is a mechanism for earnings decreases for 4-year to 4-year flagship transfers
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- ▶ Very few transfer applicants from 2-year colleges in my sample pursue STEM degrees (whether they transfer or not)
- ▶ Transfer is decentralized in Texas: each university sets its own requirements that may vary by major/department (Schudde et al., 2021a, 2021b; Bailey et al., 2017)
- ▶ Transfer students' major choice may be limited by how credits transfer

Other Mechanisms for Earnings Decreases

- ▶ Decreases in employment and loss of experience Emp Exp
- ▶ Loss of networks Dist from Home
- ▶ Difficulty adjusting to new environment; lack of support for transfers students (Flaga, 2006; Packard et al., 2011; Handel and Williams, 2012; Ellis, 2013; Elliott and Lakin, 2021)

Decreases in earnings are *not* explained by

- ▶ Selective out-migration from Texas Out-Migration
- ▶ Substitution into lower-paying industries Pred Earn by Ind
- ▶ Decreases in final GPA or relative rank based on GPA GPA

Policy Implications

In principle, transfer could be cost-effective way to obtain BA degree

- ▶ Especially with rise of free community college “promise” programs
- ▶ Findings from this paper caution that transfer can have negative effects on marginal students' earnings
- ▶ Care must be taken in structuring transfer system + designing policy

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In principle, transfer could be cost-effective way to obtain BA degree

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Possible policy responses

- ▶ Raise GPA cutoffs for admission
- ▶ Provide better info to prospective transfer students
- ▶ Increase transfer student supports
 - ▶ 4-years often devote more resources to first-time-in-college students than transfers
 - ▶ Comprehensive support systems have had positive effects at 2-year colleges

Thank you!

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Changes to FAFSA and their Implications for Pathways to Undergraduate STEM Degrees



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Moderator:

Panelists:



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St. Olaf College
(Roundtable Member)



Liz Clark
*National Association of
College and University
Business Officers*



Justin Monk
*National Association of
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and Universities*



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