

The Role of Finances on Student Success: The Overwhelming Influence of Unmet Need

DRAFT as of 10/7/2015



Associate Director for Institutional Research, **Craig Rudick**
with

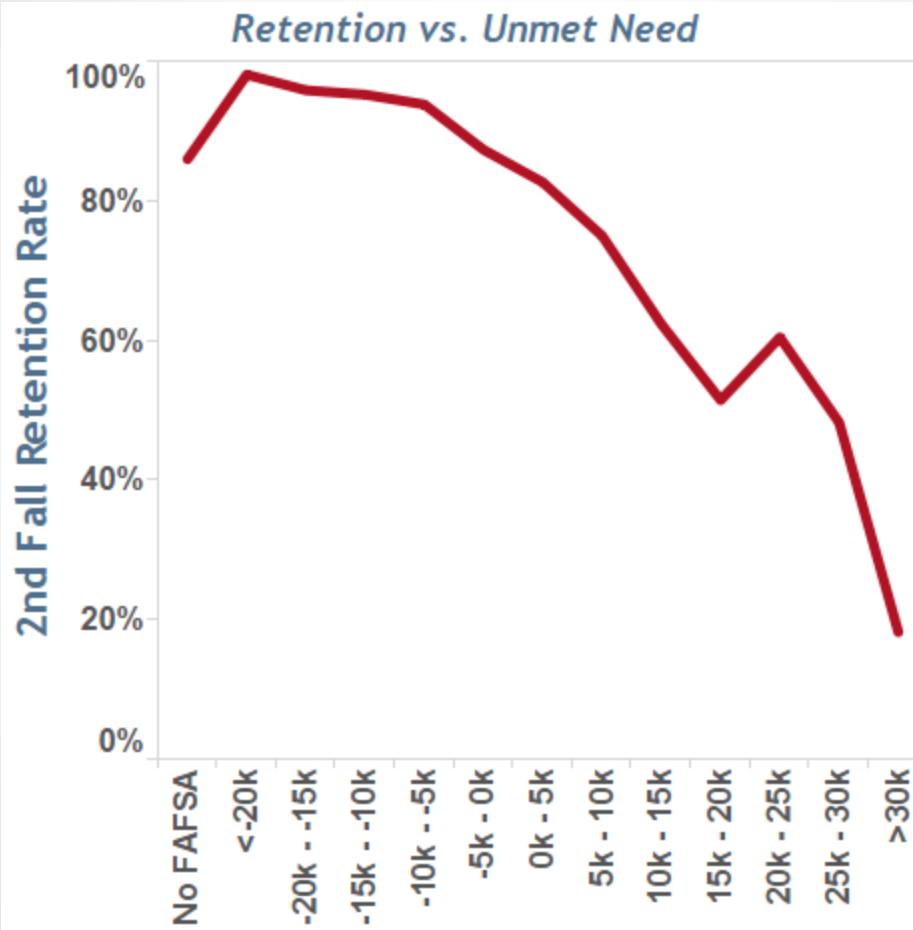
Director of Institutional Research, Roger Sugarman

Senior Vice Provost, Analytics and Technologies, Vince Kellen

Data Scientist, Adam Lindstrom

Institutional Research
& Advanced Analytics

The Punchline



Outline

1. Unmet Need and other Financial variables
2. Predictors of Student Success
3. Attrition Timing
4. The increasing Unmet Need burden
5. Need-based aid to improve retention

FAFSA Financial Variables

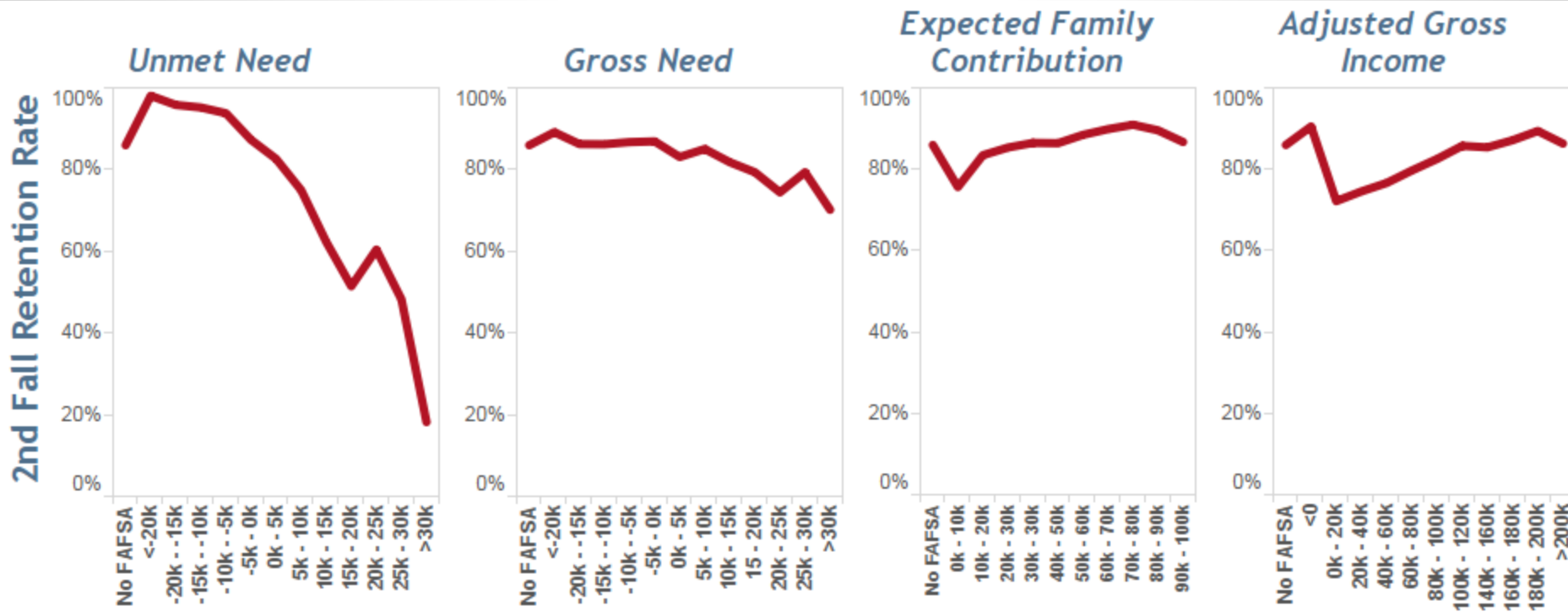
- **Adjusted Gross Income (AGI)**: the student's family income, adjusted for specific deductions.
- **Expected Family Contribution (EFC)**: the Government estimate of the amount a student's family can pay for college.
- **Gross Need**: Cost of Attendance minus Expected Family Contribution; the total amount of aid a student needs receive in order to afford college.
- **Unmet Need**: Gross Need minus total aid package; the amount of need left over after aid has been received.

FAFSA Completion (GRS Cohort)

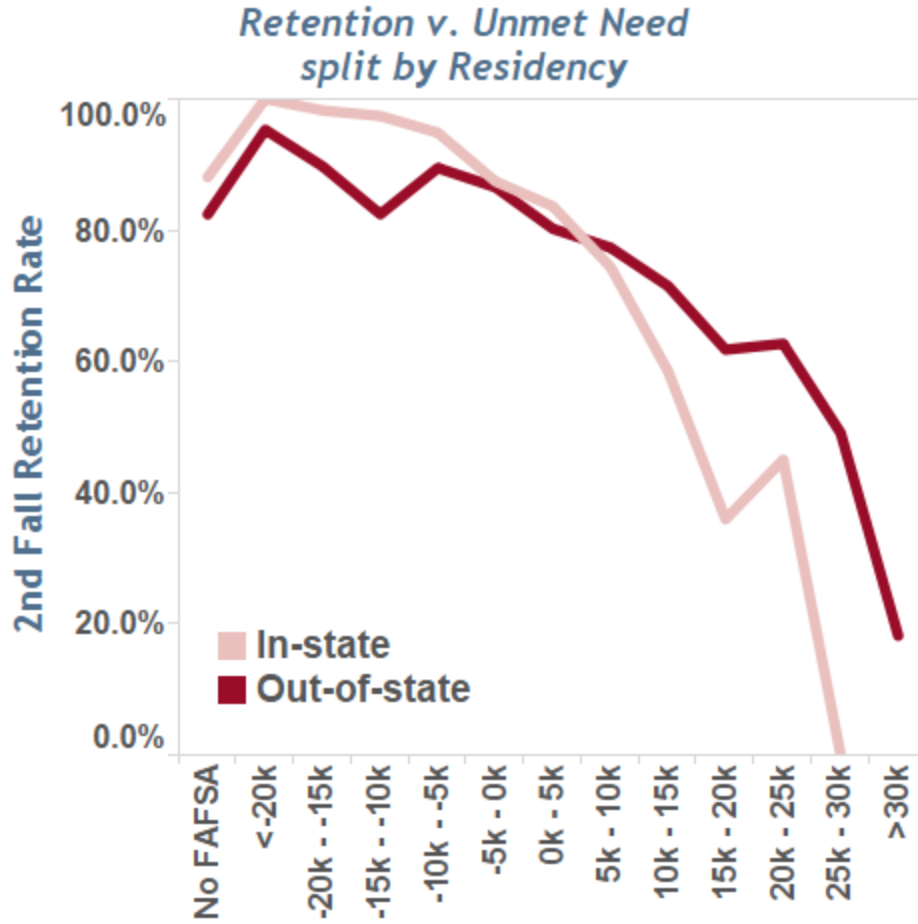
	No FAFSA	FAFSA
Fall 2011	21.8%	78.2%
Fall 2012	21.0%	79.0%
Fall 2013	19.6%	80.4%
Fall 2014	20.5%	79.5%
Overall	20.7%	79.3%

Retention vs. Financial Variables

- Unmet Need has by far the strongest association with Retention.



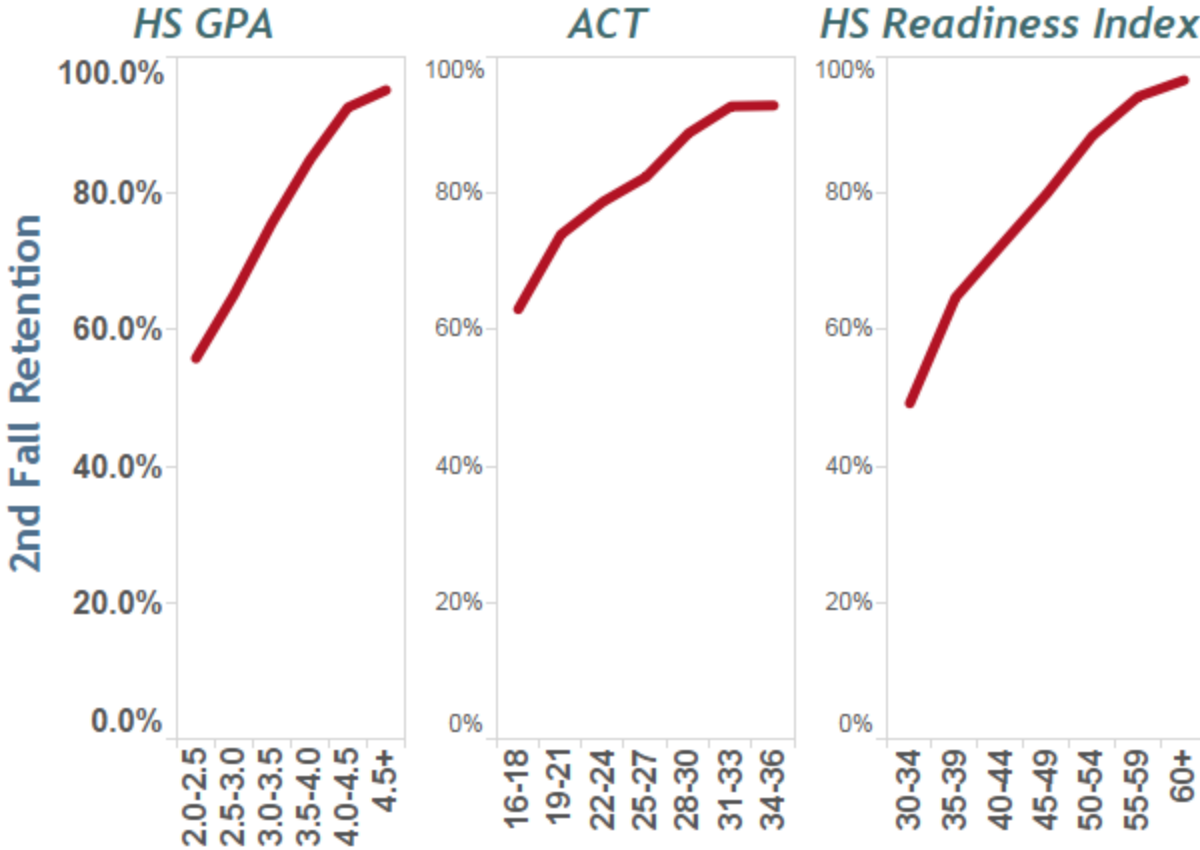
Residency



- In-state students are more strongly affected by Unmet Need than Out-of-state students.

Academic Readiness

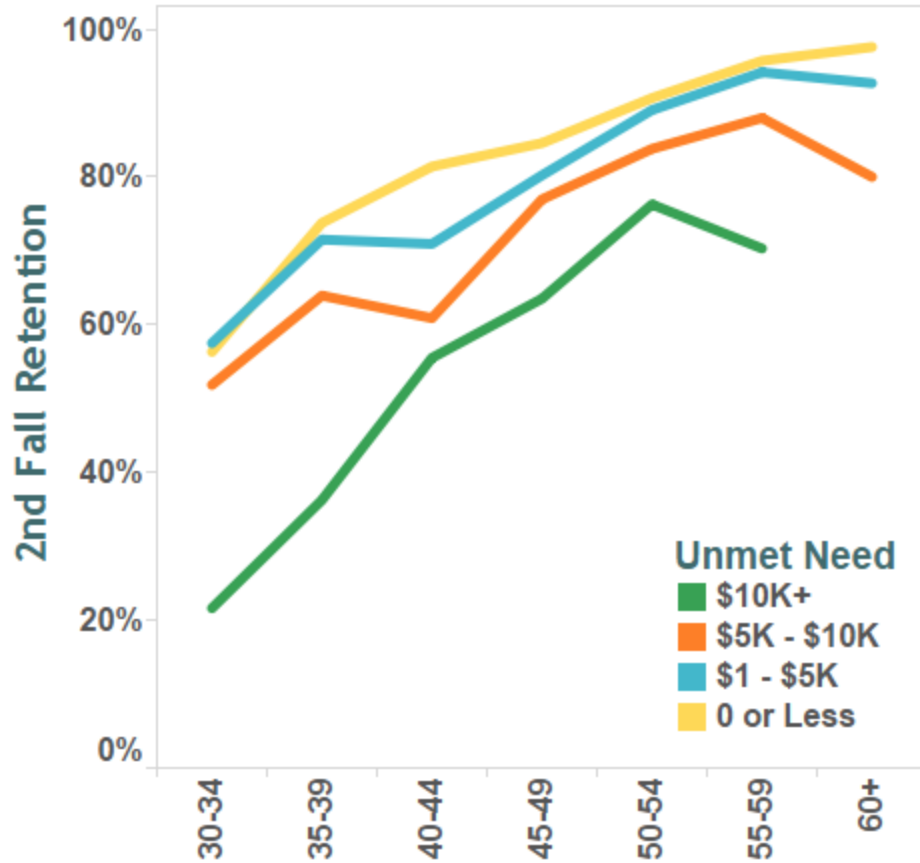
Retention vs. Readiness Variables



- HS GPA is a better predictor than ACT
- *HS Readiness Index* combines the two to maximize predictive power
 - $HSRI = HS\ GPA * 10 + ACT / 2$

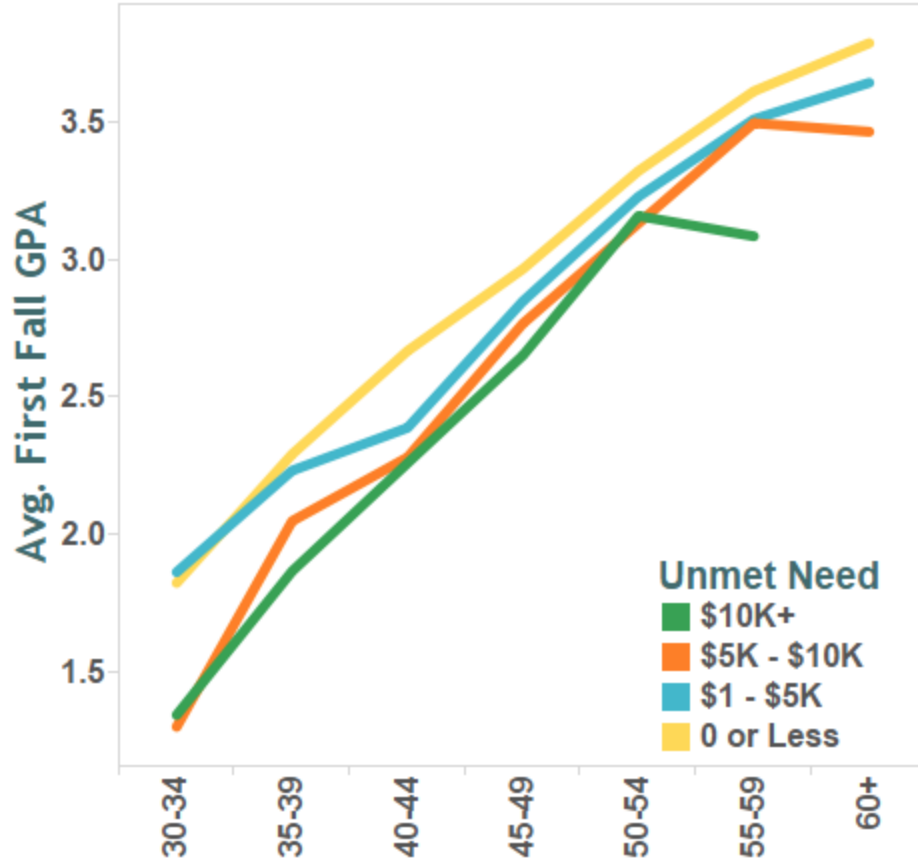
Unmet Need and HSRI

Retention vs. HSRI split by Unmet Need



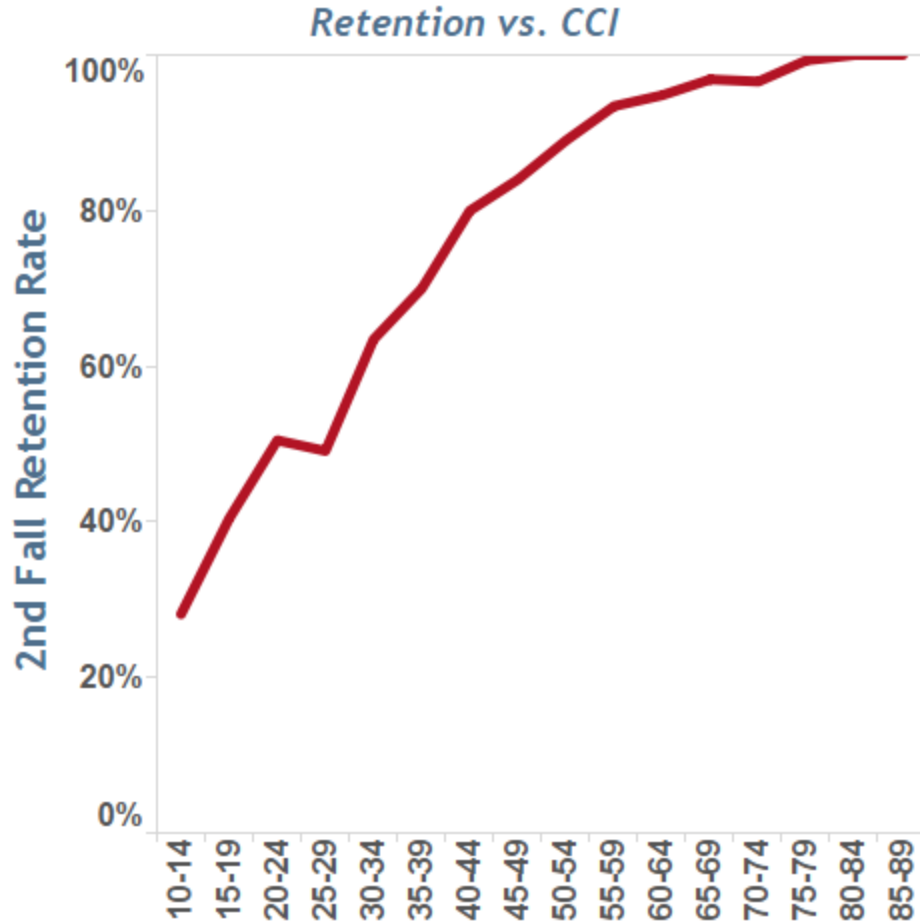
- High Unmet Need students are retained at lower rates than lower Unmet Need peers at all levels of academic readiness.

First Fall GPA vs. HSRI split by Unmet Need



- High Unmet Need students also under-perform lower Unmet Need peers in the classroom.

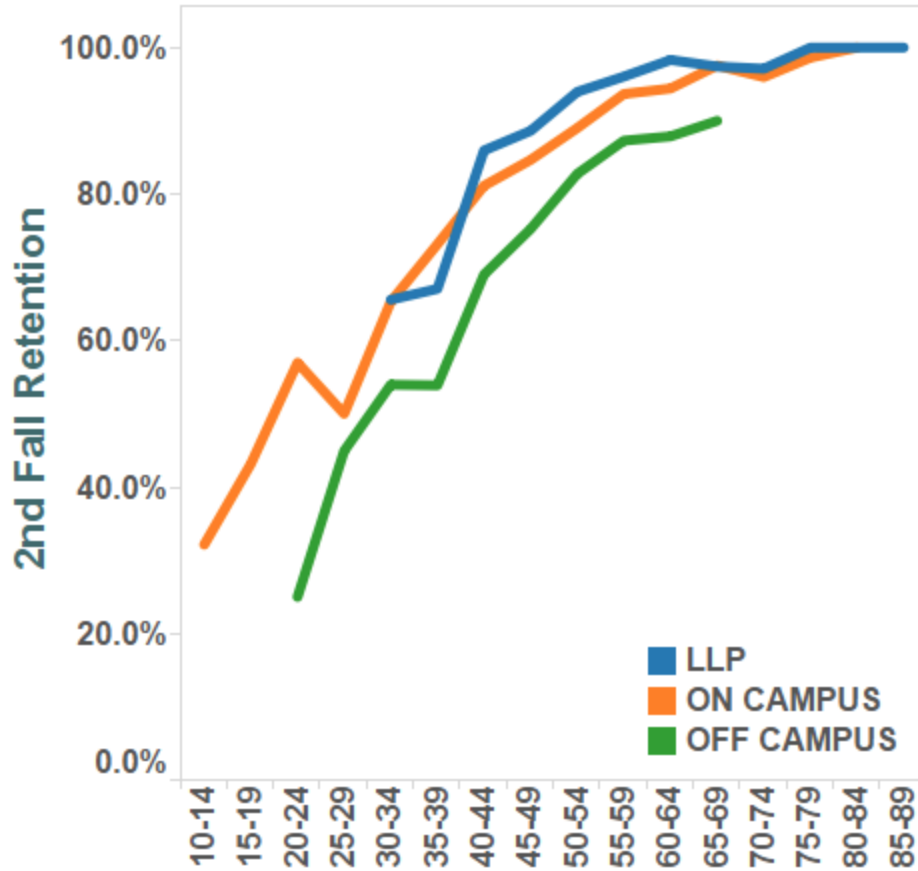
College Capability Index



- College Capability Index is a single variable optimally combining HSRI plus Unmet Need.
- $CCI = HSRI + \text{Unmet Need} / \1000

CCI In The Wild

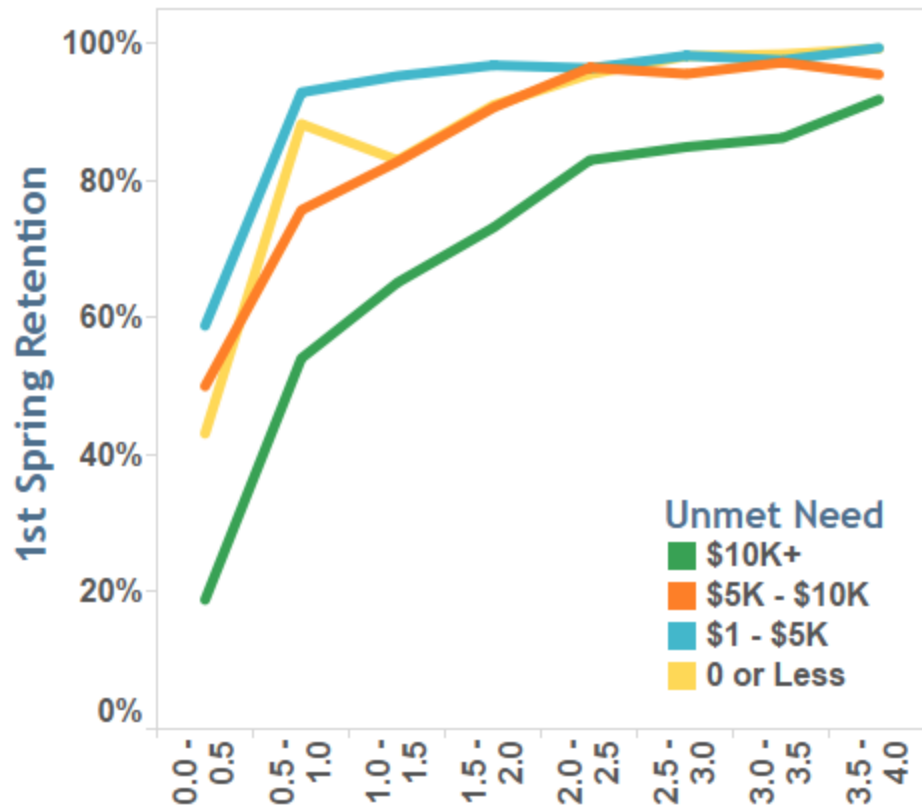
Retention vs. CCI split by Housing



- CCI is ideal for program effectiveness studies.
- CCI is NOT for program selection!
 - FAFSA data can only be used for financial aid decisions
 - Post-hoc analyses are implicitly comparing programs to need based aid

First Spring Retention

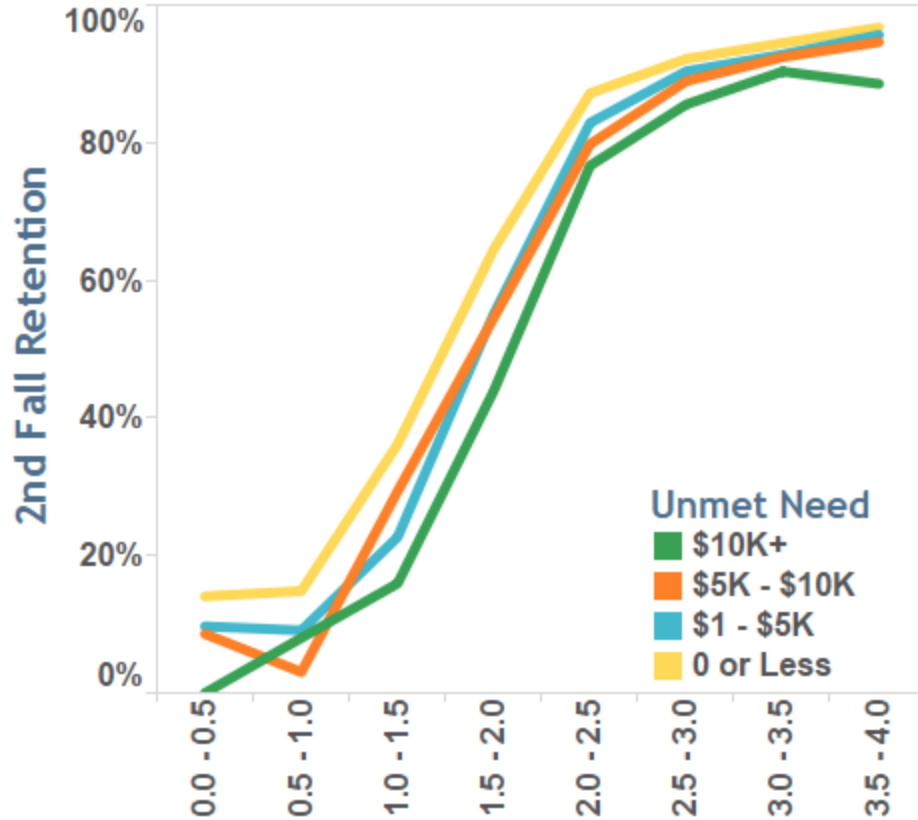
*1st Spring Retention vs. 1st Fall GPA
split by Unmet Need*



- Unmet Need has a particularly strong impact on 1st Spring Retention.

First Spring to Second Fall

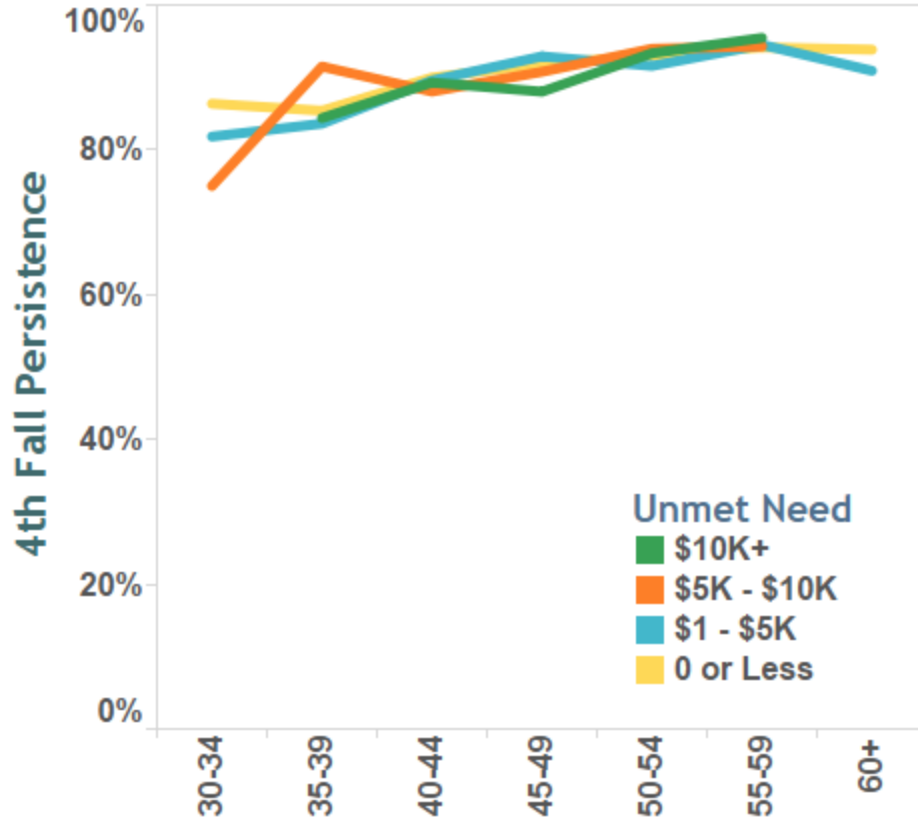
*1st Spring to 2nd Fall Retention
vs. 1st Spring GPA split by Unmet Need*



- Academic performance has a much stronger influence on retention behaviour after the 1st Spring term.

The Survivor Effect

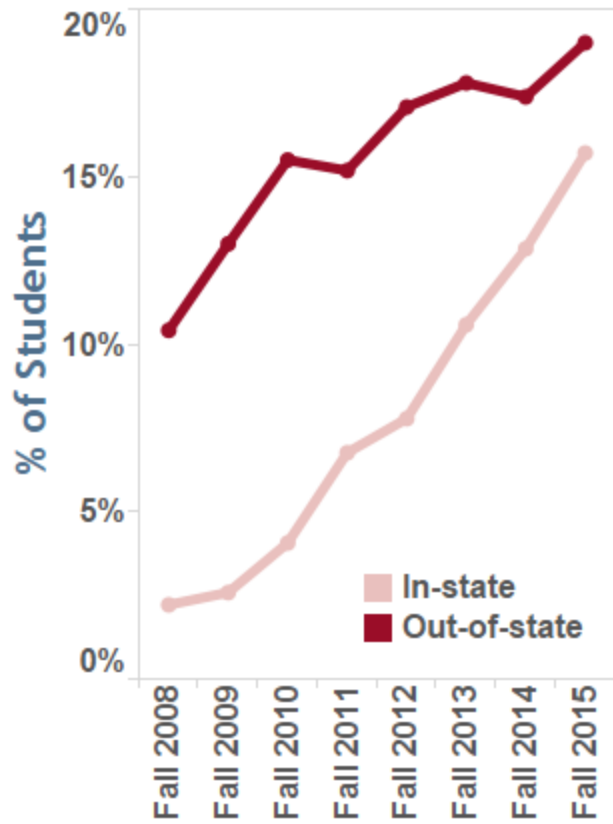
*3rd Fall to 4th Fall Retention vs. HSRI
split by Unmet Need*



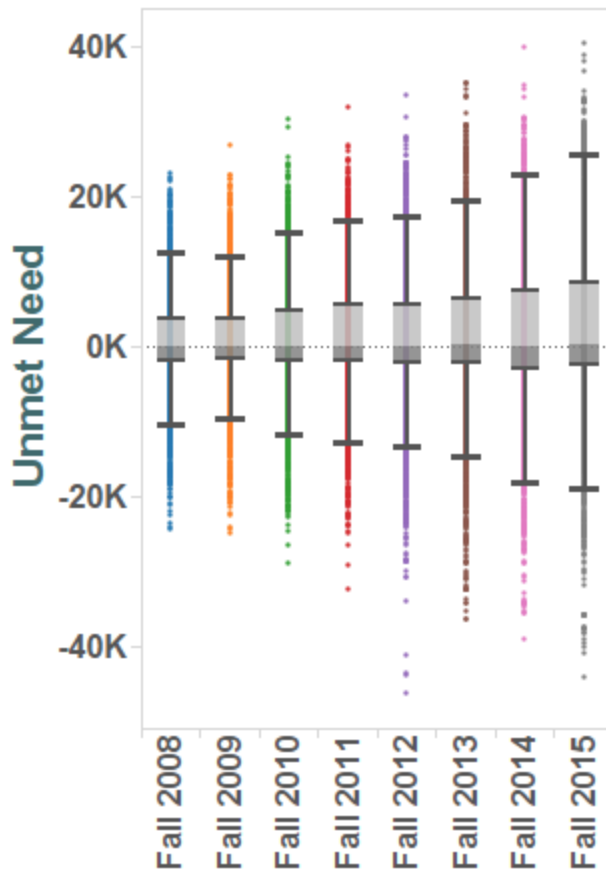
- In general, we see a “survivor effect”, whereby Unmet Needs exerts less influence on progression and persistence for upper division students.

Unmet Need is Growing

Students with at least \$10K in Unmet Need



Distribution of Unmet Need



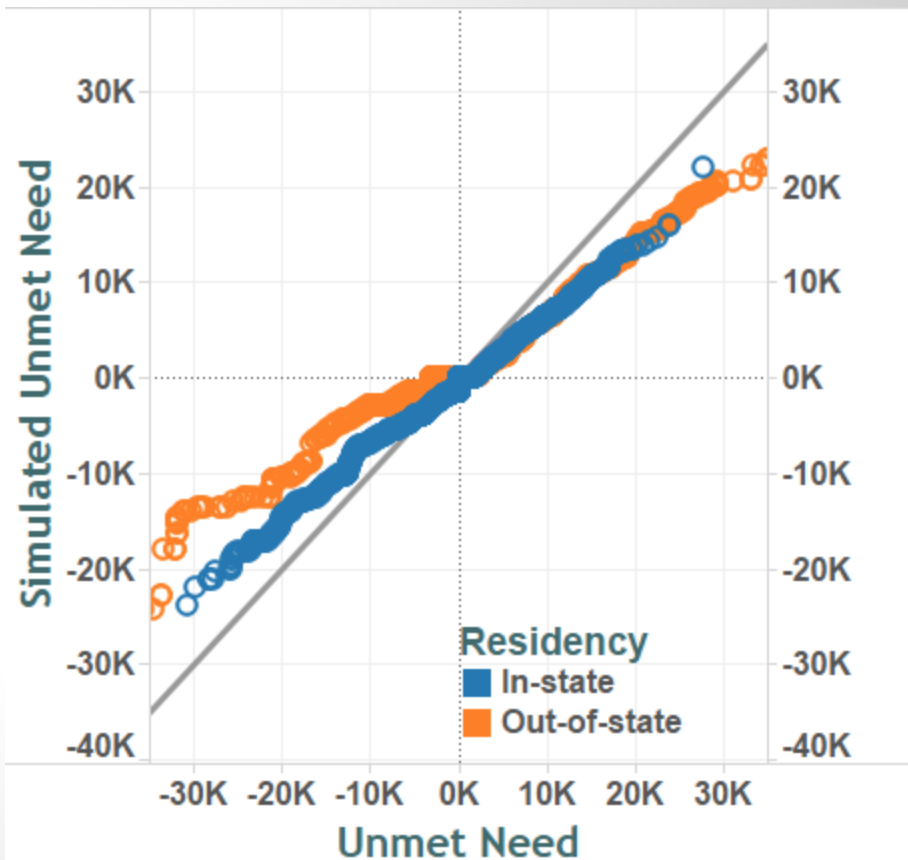
- The number of students with high unmet need is growing rapidly.
 - The distribution of unmet need is widening (more at high and low)

Unmet Need Driving Attrition

- The increasing Unmet Need burden is likely to be leading to lower retention rates.
- We can create “what-if” models to measure the retention rate given changes to the Unmet Need distribution
 - Assumes that Unmet Need is a cause, not a symptom, of attrition.
 - Without more direct tests of causation, it is possible that Unmet Need co-varies with other hidden variables which are the true drivers of attrition

Retention Losses from Unmet Need

- Simulate retention of Fall 2013 class, if Unmet Need matched that of Fall 2008.
 - Use rank-matching to assign a “Simulated Unmet Need” to each Fall 2013 cohort student
- Use L.R. to calculate new “simulated” retention probability for each student.



Simulation Results

- Because students with high Unmet Need have a lower “simulated” Unmet Need, their retention probability increases.
- The net effect is a 1.6% point increase in the overall retention rate.



Targeting Need-Based Aid at Retention

- If Unmet Need is driving retention losses, then need-based aid could amend this.
 - How much money does retention cost?
 - What is the most efficient way to disburse aid?

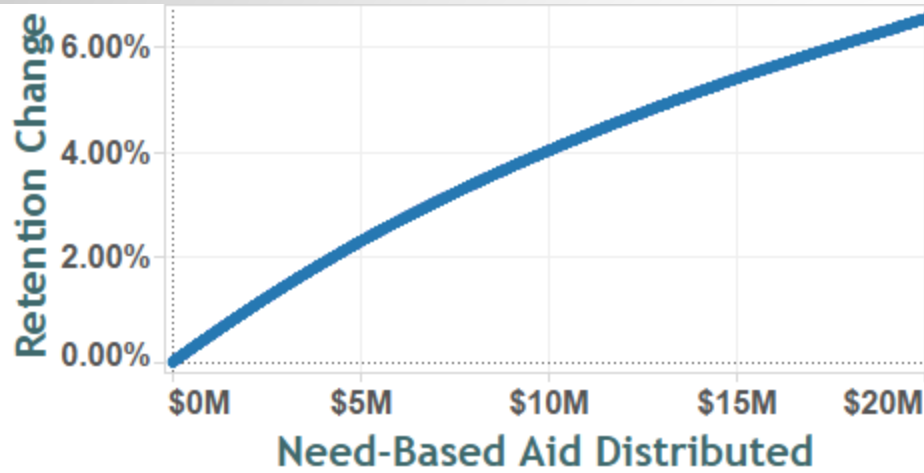
- **Eliminating Unmet Need**
 - Set all students with positive Unmet Need to 0, and re-calculated predicted retention rate

Cohort Term	Actual Retention Rate	Predicted Change in Retention Rate	Cost of Eliminated Unmet Need
Fall 2009	81.8%	2.4%	\$7,270,762
Fall 2010	81.5%	2.9%	\$9,569,360
Fall 2011	81.3%	3.4%	\$10,521,664
Fall 2012	82.5%	3.5%	\$12,619,187
Fall 2013	82.2%	4.3%	\$14,858,680

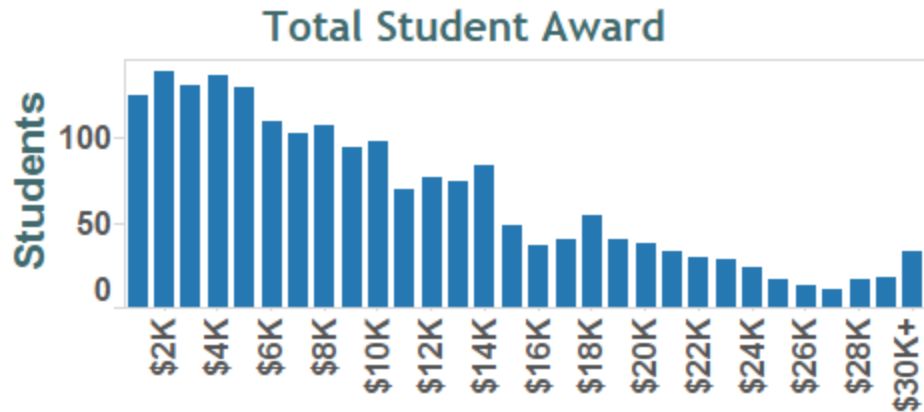
Optimizing Need-Based Aid

- If we want to maximize the impact on retention, how would we distributed Need-Based aid?
 - Simulate decreasing each student's Unmet Need and determining the predicted effect on retention.
 - In order to find the optimal distribution of aid, we iterate:
 - Increase the aid package of each student by \$1000
 - Find the student whose predicted retention is increased by the largest amount
 - Apply the \$1000 to the student's simulated aid package
 - Repeat the process, simulating starting from the new simulated aid packages.

Optimizing Need-Based Aid Results



- \$1M buys about 0.5% points of retention
 - \$20M buys about 6.5% points



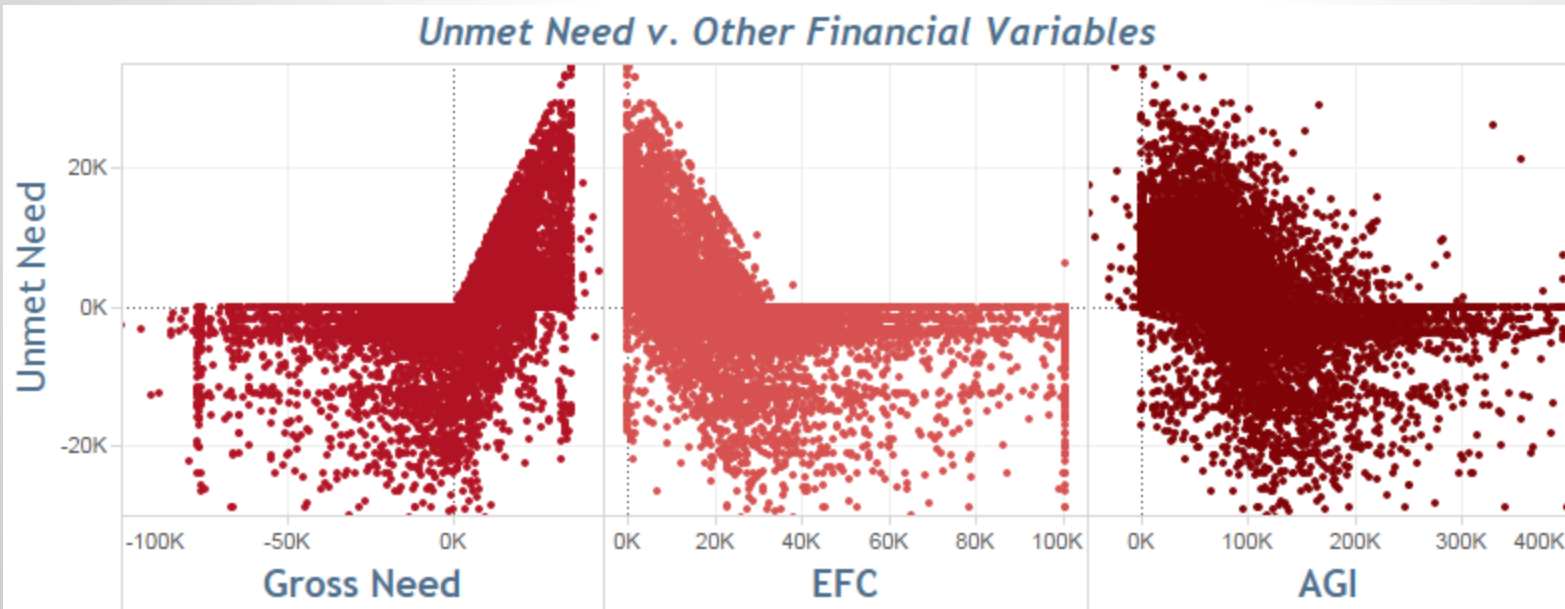
Conclusions

1. Unmet Need is a strong driver of retention.
 - a. At least as predictive as pre-college academic readiness.
 - b. Particularly important for 1st semester attrition.
2. The number of students with high Unmet Need burdens is growing rapidly.
3. Shifting resources to need-based financial aid may be necessary to improve retention.
 - a. Draft UK Strategic Plan: “Align institutional scholarship and financial aid awards... to minimize students' unmet financial need”.

Appendix: Supplemental Data and Statistical Results

Correlations Between Variables

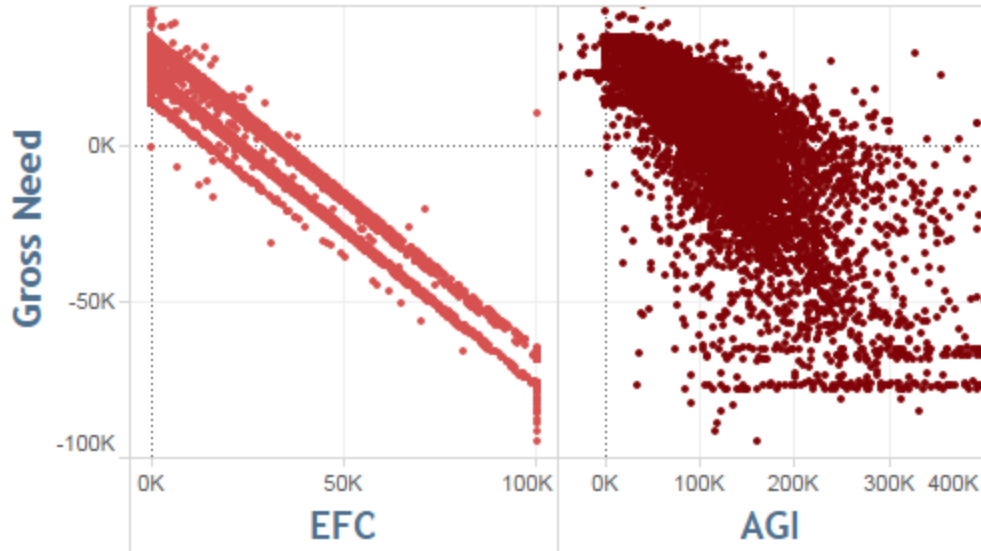
- Students with low Gross Need or high EFC cannot have positive Unmet Need.
- Although all the financial variables are correlated, Unmet Need is a uniquely strong predictor of Retention.



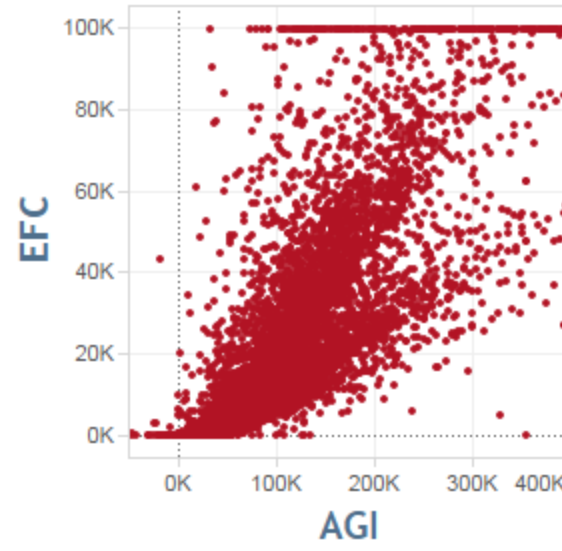
Correlations Between Variables, cont.

- Gross Need, EFC, and AGI are all highly correlated.
- Gross Need is particularly correlated with EFC. The upper locus contains out-of-state students; in-state students fall in the lower loci.

Gross Need v. EFC & AGI



EFC v. AGI



Univariate Financial Variable Models

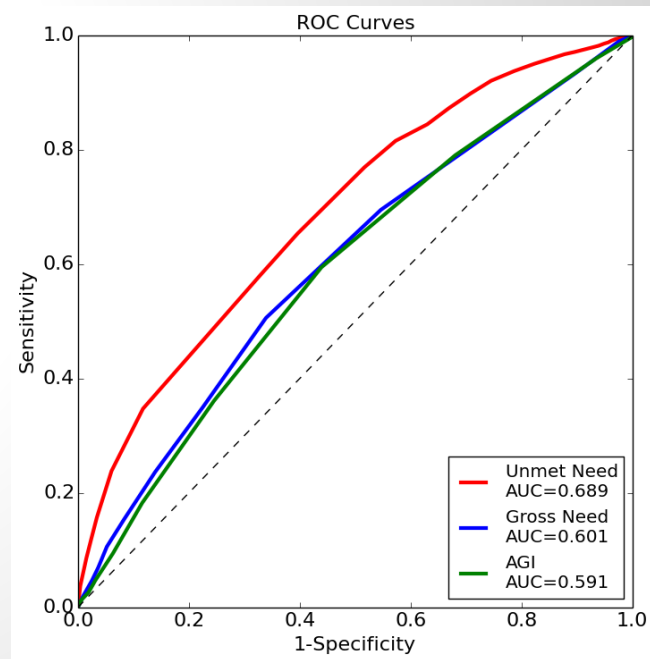
- Each of these models uses a single financial variable as the independent variable and 2nd Fall Retention as the dependent variable in a logistic regression analysis.

Univariate Logistic Regression Results

Financial Variable	Beta*	Odds Ratio*	pseudo-R ²	AUC
Unmet Need	-0.70	0.50	0.073	0.689
Gross Need	-0.51	0.60	0.016	0.601
Adjusted Gross Income	0.36	1.44	0.011	0.591

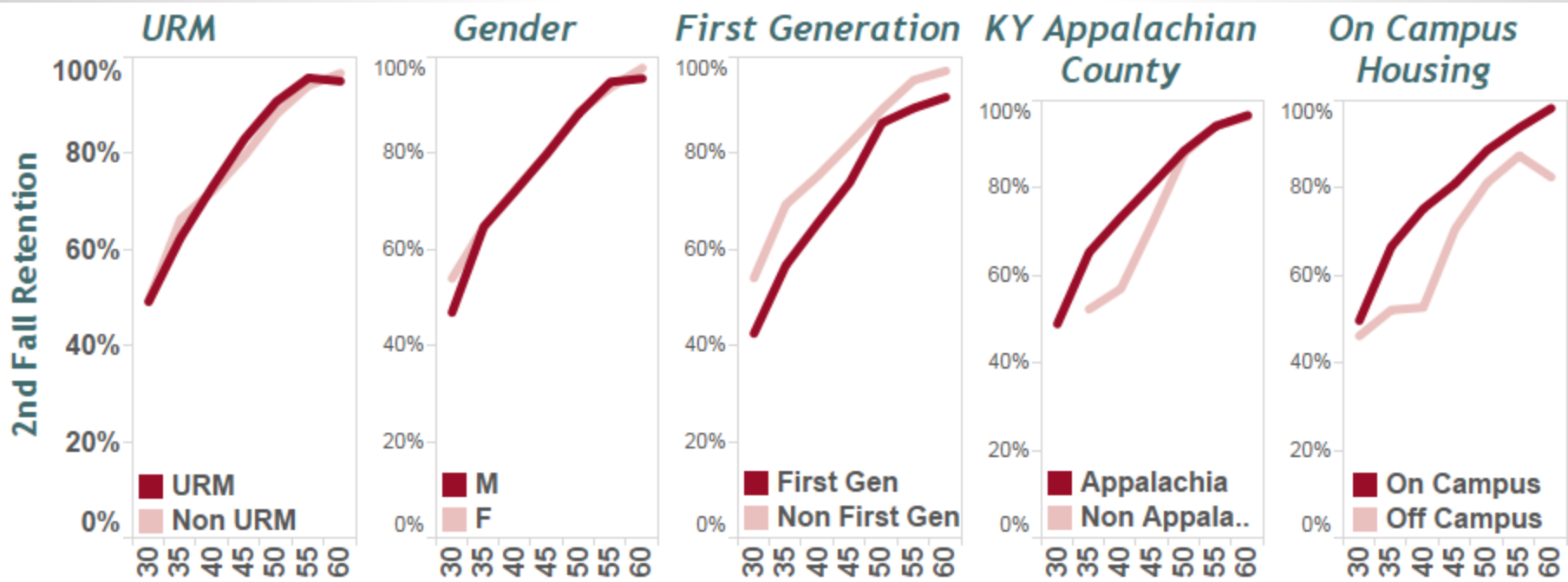
*Standardized

** Students without FAFSA information have been removed.

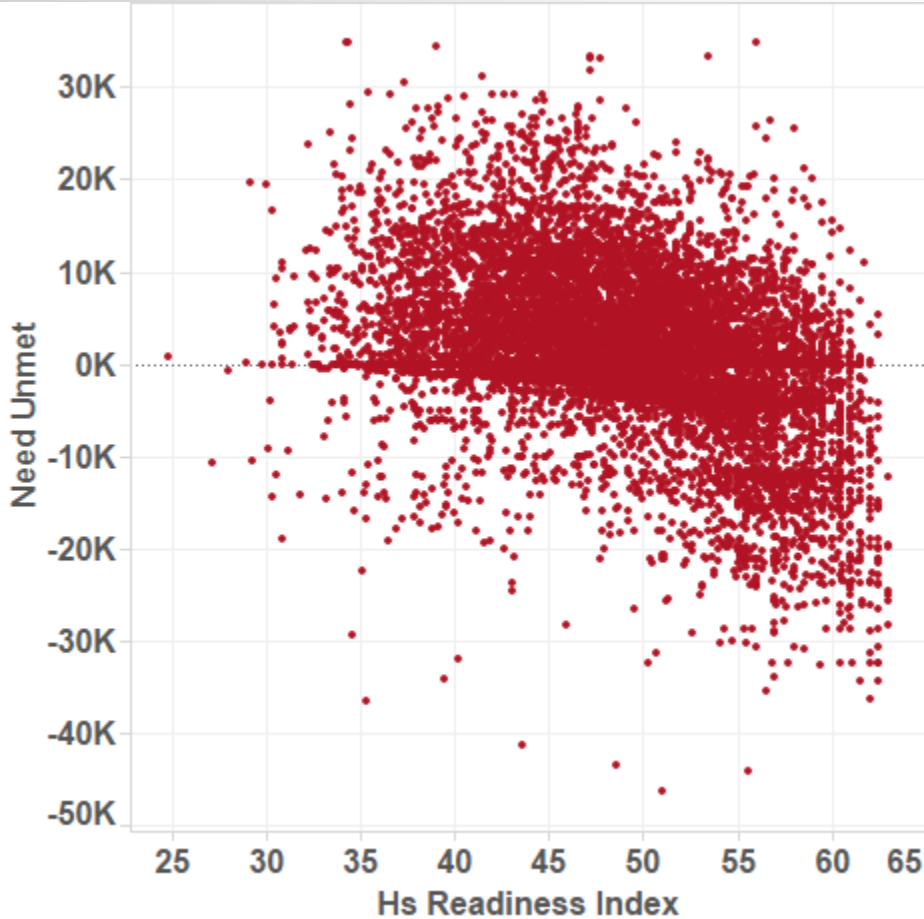


Demographics with HSRI

- HSRI is useful to see the effects of demographics
- First Generation, Appalachian County and On Campus Housing all are significantly associated with retention



Unmet Need vs. HSRI



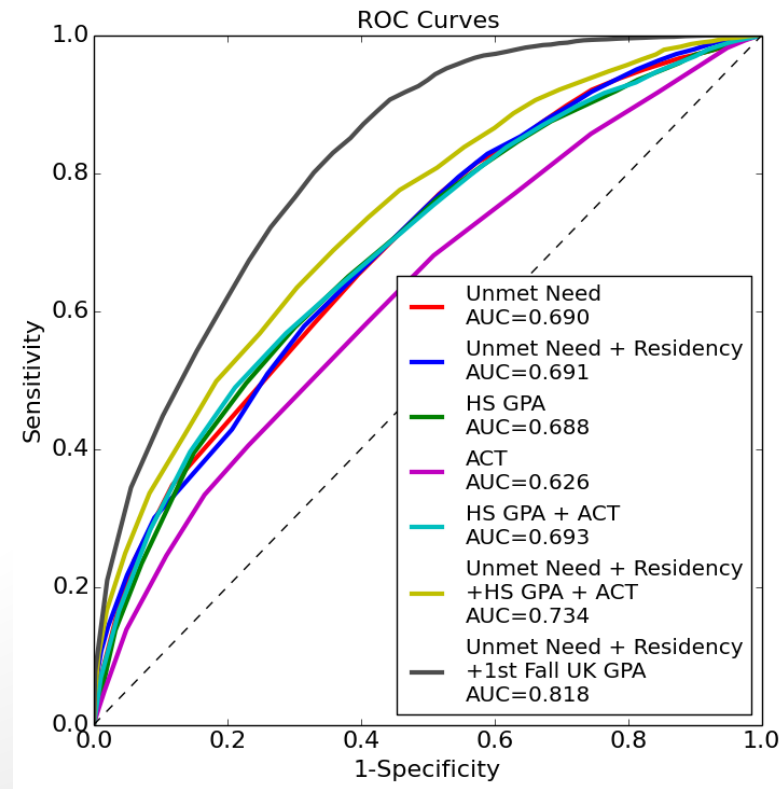
- Unmet Need is somewhat correlated with HSRI
- Low readiness students are much more likely to have high Unmet Need than higher readiness students
 - This is likely to be due to merit-based financial aid

Summary of Logistic Regression Models

- Each model uses a different set of independent variables, with 2nd Fall Retention as the dependent variable

Model	pseudo-R ²	AUC
Unmet Need	0.073	0.689
Unmet Need + Residency*	0.083	0.691
HS GPA	0.069	0.688
ACT	0.032	0.626
HS GPA + ACT (HS Readiness Index)	0.073	0.693
Unmet Need + Residency* + HS GPA + ACT	0.121	0.734
Unmet Need + Residency* + 1st Fall UK GPA	0.268	0.818

*Includes interaction term



Multivariate Logistic Regressions

HS Academics plus Unmet Need[†]

pseudo-R² = 0.121
AUC = 0.734

Variable	p-value	Odds Ratio
HS GPA*	<0.001	1.68
ACT*	0.059	1.07
Unmet Need**	<0.001	0.91
Residency*** (out-of-state)	0.015	0.85
Unmet Need, Residency interaction	<0.001	1.06
intercept	<0.001	6.11

1st Fall GPA plus Unmet Need[†]

pseudo-R² = 0.268
AUC = 0.818

Variable	p-value	Odds Ratio
1st Fall UK GPA*	<0.001	3.28
Unmet Need**	<0.001	0.92
Residency*** (out-of-state)	<0.001	0.58
Unmet Need, Residency interaction	<0.001	1.04
intercept	<0.001	8.26

[†]Using 2nd Fall retention as the dependent variable.

* standardized

** per \$1000

*** Default is in-state