Student Success, by Pell-eligibility, first-generation college student status, and underrepresented minority student status.

Ronald D. Thompson, PhD, Sr. Insti Rsrch Analyst

Office of Institutional Research

University of Missouri System

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Abstract:

This session will describe my attempt to model student success as a function of Pell-eligibility, first-generation college student status, and underrepresented minority student status, using data from recent cohorts of FTC undergraduate students from the campuses of a Midwest system of research universities. I present preliminary results generated using logistic regression models and indicate future research.

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Outline:

Student Success

OBJECTIVE: Model 4th-year "success" (Success4Yr_Di: Y, N) of full-time, (Bachelor's) degree-seeking, first-time-college undergraduate students as a function of:

- Attending Residential vs. Commuter Campus (ResidCamp: Y or N)
- Pell eligibility (Pell_Eligible_This_AidYr: Y or N)
- First-generation student status (ENTRY_FIRST_GEN: Y or N)
- Underrepresented minority student status (URM4_Ext: Y or N)

QUESTION: Is 4th-year "success" impacted by these student characteristics?

Student Success

```
   ***** Define URM variables for MidAIR 2024 talk. *****;
   if um_raceb_nra = 'Y' then do;
      URM4_Ext = 'I';      *** Let 'I' connote "International" (NRA) student. ***;
   end;

   else do;
      if  um_racea_hispa = 'Y'
       or um_racec_amind = 'Y'
/*     or um_raced_asian = 'Y'    */
       or um_racee_black = 'Y'
       or um_racef_pacif = 'Y'
/*     or um_raceg_white = 'Y'    */
/*     or um_raceh_other = 'Y'    */
      then do;
         URM4_Ext  = 'Y';
         iURM4_Ext =  1;
      end;
      else do;
         URM4_Ext  = 'N';
         iURM4_Ext =  0;
      end;
   end;
```

Student Success

OBJECTIVE: Model 4th-year "success" (Success4Yr_Di: Y, N) of full-time, (Bachelor's) degree-seeking, first-time-college undergraduate students as a function of:

- Attending Residential vs. Commuter Campus (iResidCamp: 1 or 0)
- Pell eligibility (iPell_Eligible_This_AidYr: 1 or 0)
- First-generation student status (iENTRY_FIRST_GEN: 1 or 0)
- Underrepresented minority student status (iURM4_Ext: 1 or 0)

QUESTION: Is 4th-year "success" impacted by these student characteristics?

Refer to Handout #1 – design matrix and observed data for Success4Yr_Di (dichotomous data).

Student Success: Fall FTC Cohorts

	A	B	C	D	E	F
1	ACADEMIC_LOAD	F	N = 22,509		(No change.)	
2	UM_DEG_SEEKING	Y	Degree-seeking		(No change.)	
3	ADMIT_TYPE	FTC	Full-time College.		(No change.)	
4	UM_CLEVEL_DESCR	(All)	Frosh, Soph, Jr, Sr.		(No change.)	
5	UM_AUDIT_ONLY	N	Remove Exclusive Auditors.		(No change.)	
6	UM_RACEB_NRA	N	Remove International stu's.		Reduce N to 22,158 (from 22,509).	
7	iArchiB	(blank)	Remove Pre-Architechture stu's.		Reduce to 22,113 (from 22,158).	
8	iMedB	(blank)	Remove 6-yr Med stu's.		Reduce to 21,811 (from 22,113).	
9	iPharmB	(blank)	Remove Pre=PharmD stu's.		Reduce to 21,564 (from 21,811).	
10	ENTRY_FIRST_GEN	(Multiple Items)	Remove stu if 1st-gen status is unknown.		Reduce to 17,423 (from 21,564).	
11	REC_HS_GRAD	(All)				
12	AGE	(All)				
13						
14	**Count of EMPLID**		**Success4Yr_Di**			
15	**iResidCamp**	**DESCR_TERM**	**N**	**Y**	**Grand Total**	
16	**0**	FS2016	882	464	1,346	
17		FS2017	904	525	1,429	
18		FS2018	874	525	1,399	
19	**0 Total**		**2,660**	**1,514**	**4,174**	
20	**1**	FS2016	2,089	2,523	4,612	
21		FS2017	1,774	2,294	4,068	
22		FS2018	2,026	2,543	4,569	
23	**1 Total**		**5,889**	**7,360**	**13,249**	
24	**Grand Total**		**8,549**	**8,874**	**17,423**	
25						

Logistic Regression

Y: "Success" or "Failure"

x_1: Independent variable #1

x_2: Independent variable #2

x_3: Independent variable #3

x_4: Independent variable #4

$$p = pr(\text{"Success"}) = \frac{exp[(\quad)]}{1+exp[(\quad)]} = \frac{1}{1+exp[-(\quad)]} \text{ and}$$

$$q = 1 - p = pr(\text{"Failure"}) \text{ , where, e.g.,}$$

$$(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$$

$$+ \beta_{12} x_1 x_2 + \beta_{13} x_1 x_3 + \beta_{14} x_1 x_4 + \beta_{23} x_2 x_3 + \beta_{24} x_2 x_4 + \beta_{34} x_3 x_4$$

$$+ \beta_{123} x_1 x_2 x_3 + \beta_{124} x_1 x_2 x_4 + \beta_{134} x_1 x_3 x_4 + \beta_{234} x_2 x_3 x_4 + \beta_{1234} x_1 x_2 x_3 x_4)$$

Student Success: Log. Reg. – Model 1 (Full Model)

```
***** 1.  Success4Yr_Di, full model (all interactions). *****;
proc logistic data=study_pop;
   model Success4Yr_Di (descending) =   iResidCamp
                                      | iPell_Eligible_This_AidYr
                                      | iEntry_First_Gen
                                      | iURM4_Ext / cl;
   output out=Model_01_Di pred=phat lower=L95 upper=U95;
   title  '1.  Success4Yr_Di, full model (all interactions).';
run;
```

Student Success: Log. Reg. – Model 1 (Full Model)

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	961.6402	15	<.0001
Score	936.4542	15	<.0001
Wald	878.2142	15	<.0001

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	-0.1474	0.0533	7.6354	0.0057
iResidCamp	1	0.5883	0.0581	102.5338	<.0001
iPELL_Eligible_This_	1	-0.3722	0.1077	11.9363	0.0006
iResidCam*iPELL_Elig	1	0.00713	0.1252	0.0032	0.9546
iEntry_First_Gen	1	-0.1919	0.1062	3.2655	0.0708
iResidCam*iEntry_Fir	1	-0.1456	0.1223	1.4180	0.2337
iPELL_Eli*iEntry_Fir	1	-0.0842	0.1703	0.2447	0.6209
iResid*iPELL_*iEntry	1	0.1098	0.2022	0.2951	0.5870
iURM4_Ext	1	-0.5350	0.1380	15.0377	0.0001
iResidCamp*iURM4_Ext	1	0.2403	0.1556	2.3848	0.1225
iPELL_Elig*iURM4_Ext	1	-0.1851	0.2110	0.7695	0.3804
iResid*iPELL_*iURM4_	1	-0.0678	0.2537	0.0713	0.7894
iEntry_Fir*iURM4_Ext	1	-0.1655	0.2572	0.4142	0.5198
iResid*iEntry*iURM4_	1	-0.0689	0.3022	0.0520	0.8197
iPELL_*iEntry*iURM4_	1	0.3577	0.3353	1.1382	0.2860
iRes*iPEL*iEnt*iURM4	1	0.0222	0.4059	0.0030	0.9563

Student Success: Log. Reg. – Model 2 (No higher-order interactions)

```
***** 2.  Success4Yr_Di, model w/o higher-order interactions. *****;
proc logistic data=study_pop;
   model Success4Yr_Di (descending) =   iResidCamp | iPell_Eligible_This_AidYr
                                        iResidCamp | iEntry_First_Gen
                                        iResidCamp | iURM4_Ext

                                        iPell_Eligible_This_AidYr | iEntry_First_Gen
                                        iPell_Eligible_This_AidYr | iURM4_Ext

                                        iEntry_First_Gen | iURM4_Ext / cl;
   output out=Model_02_Di pred=phat lower=L95 upper=U95;
   title  '2.  Success4Yr_Di, model w/o higher-order interactions.';
run;
```

Student Success: Log. Reg. – Model 2 (No higher-order interactions)

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	957.0416	10	<.0001
Score	930.9613	10	<.0001
Wald	871.9792	10	<.0001

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	-0.1397	0.0491	8.0930	0.0044
iResidCamp	1	0.5848	0.0527	123.2321	<.0001
iPELL_Eligible_This_	1	-0.4263	0.0820	27.0600	<.0001
iResidCam*iPELL_Elig	1	0.0377	0.0852	0.1954	0.6584
iEntry_First_Gen	1	-0.2430	0.0816	8.8617	0.0029
iResidCam*iEntry_Fir	1	-0.1164	0.0845	1.8971	0.1684
iURM4_Ext	1	-0.5425	0.0948	32.7239	<.0001
iResidCamp*iURM4_Ext	1	0.1937	0.0945	4.1957	0.0405
iPELL_Eli*iEntry_Fir	1	0.0811	0.0800	1.0270	0.3109
iPELL_Elig*iURM4_Ext	1	-0.0891	0.0913	0.9526	0.3291
iEntry_Fir*iURM4_Ext	1	-0.0237	0.0934	0.0647	0.7993

OMIT

Formal hypothesis test (likelihood ratio test) for eliminating several (higher-order) interactions *simultaneously*.

Student Success: Log. Reg. – Model 3 (w/ select 2-way interaction)

Y: "Success" or "Failure" — Earn 1st bach w/in 4 yrs.

x_1:	Independent variable #1	iResidCamp
x_2:	Independent variable #2	iPell_Eligible_This_AidYr
x_3:	Independent variable #3	iEntry_First_Gen
x_4:	Independent variable #4	iURM4_Ext

$$p = pr(\text{"Success"}) = \frac{exp[(\quad)]}{1+exp[(\quad)]} = \frac{1}{1+exp[-(\quad)]}, \text{ where}$$

$$(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_{14} x_1 x_4), \text{ and}$$

Student Success: Log. Reg. – Model 3 (w/ select 2-way interaction)

```
***** 3.  Success4Yr_Di, model w/ select 2-way interaction, only. *****;
proc logistic data=study_pop;
   model Success4Yr_Di (descending) =    iResidCamp                          /*** Redunda
                                         iPell_Eligible_This_AidYr
                                         iEntry_First_Gen
                                         iURM4_Ext                           /*** Redunda

                                         iResidCamp | iURM4_Ext / cl;        /*** Include
   output out=Model_03_Di pred=phat lower=L95 upper=U95;
   title  '3.  Success4Yr_Di, model w/ select 2-way interaction, only.';
run;
```

Student Success: Log. Reg. – Model 3 (w/ select 2-way interaction)

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	951.5816	5	<.0001
Score	924.7847	5	<.0001
Wald	866.4429	5	<.0001

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	-0.1190	0.0408	8.5183	0.0035
iResidCamp	1	0.5592	0.0430	169.1155	<.0001
iPELL_Scholar_This_A	1	-0.3905	0.0385	102.8147	<.0001
iEntry_First_Gen	1	-0.3014	0.0380	63.0131	<.0001
iURM4_Ext	1	-0.5962	0.0767	60.4492	<.0001
iResidCamp*iURM4_Ext	1	0.2025	0.0903	5.0326	0.0249

Student Success: Log. Reg. – Model 3 (w/ select 2-way interaction)

OMIT:

Formal hypothesis test (likelihood ratio test) for eliminating several (two-way) interactions *simultaneously*.

Student Success: Log. Reg. – Model 3 (w/ select 2-way interaction)

$$\text{Odds Ratio} = \frac{pr(\text{"Success"})}{pr(\text{"Failure"})} = \frac{p}{1-p} = exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_{14} x_1 x_4)$$

$$= exp(\beta_0) \cdot exp(\beta_1 x_1) \cdot exp(\beta_2 x_2) \cdot exp(\beta_3 x_3) \cdot exp(\beta_4 x_4) \cdot exp(\beta_{14} x_1 x_4)$$

$$\widehat{\text{Odds Ratio}} = \frac{\hat{p}}{1-\hat{p}} = e^{\hat{\beta}_0} \cdot e^{\hat{\beta}_1 x_1} \cdot e^{\hat{\beta}_2 x_2} \cdot e^{\hat{\beta}_3 x_3} \cdot e^{\hat{\beta}_4 x_4} \cdot e^{\hat{\beta}_{14} x_1 x_4}$$

$$= e^{-0.1184} \cdot e^{0.5591 x_1} \cdot e^{-0.3923 x_2} \cdot e^{-0.3011 x_3} \cdot e^{-0.5958 x_4} \cdot e^{0.2032 x_1 x_4}$$

$$= 0.8883 \cdot 1.7491^{x_1} \cdot 0.6755^{x_2} \cdot 0.7400^{x_3} \cdot 0.5511^{x_4} \cdot 1.2253^{x_1 x_4}$$

Student Success: Log. Reg. – Model 3 (w/ select 2-way interaction)

	A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q
1	iResidCamp	iPELL_Eligible_This_AidYr	iEntry_First_Gen	iURM4_Ext	Success4Yr_Di	COUNT	PERCENT			phat	L95	U95		CI Width		%Rel Error
2	0	0	0	0	Y	655	46.3	0.4632		0.4704	0.4506	0.4904		0.0398		1.56
3	0	0	0	1	Y	93	33.6	0.3357		0.3287	0.2990	0.3598		0.0608		-2.11
4	0	0	1	0	Y	203	41.6	0.4160		0.3966	0.3738	0.4200		0.0462		-4.65
5	0	0	1	1	Y	35	26.1	0.2612		0.2659	0.2383	0.2955		0.0572		1.82
6	0	1	0	0	Y	182	37.3	0.3730		0.3750	0.3526	0.3981		0.0455		0.56
7	0	1	0	1	Y	77	22.4	0.2245		0.2485	0.2236	0.2752		0.0516		10.71
8	0	1	1	0	Y	162	31.1	0.3109		0.3075	0.2875	0.3283		0.0408		-1.10
9	0	1	1	1	Y	107	21.0	0.2102		0.1966	0.1761	0.2189		0.0428		-6.47
10	1	0	0	0	Y	4,813	60.8	0.6085		0.6084	0.5985	0.6183		0.0197		-0.01
11	1	0	0	1	Y	463	53.7	0.5365		0.5120	0.4882	0.5358		0.0477		-4.56
12	1	0	1	0	Y	672	52.6	0.5258		0.5349	0.5161	0.5535		0.0374		1.72
13	1	0	1	1	Y	98	39.5	0.3952		0.4371	0.4105	0.4640		0.0535		10.61
14	1	1	0	0	Y	589	51.9	0.5189		0.5121	0.4929	0.5313		0.0385		-1.32
15	1	1	0	1	Y	146	38.4	0.3842		0.4148	0.3896	0.4404		0.0508		7.96
16	1	1	1	0	Y	383	44.1	0.4412		0.4372	0.4172	0.4574		0.0402		-0.92
17	1	1	1	1	Y	196	34.6	0.3457		0.3441	0.3213	0.3676		0.0463		-0.47
18																
19	TOTAL					8,874										

Student Success: Log. Reg. – Model 3 (w/ select 2-way interaction)

	A	B	C	D	G	H	I	J	K	L
1							Log. Reg. Model 3			
3	iResidCamp	iPELL_Eligible_This_AidYr	iEntry_First_Gen	iURM4_Ext	TOTAL	Tot Successful	Est. Tot Successful		Diff	% Rel Diff
4	0	0	0	0	1,414	655	665.2		10.20	1.56
5	0	0	0	1	277	93	91.0		-1.96	-2.11
6	0	0	1	0	488	203	193.6		-9.44	-4.65
7	0	0	1	1	134	35	35.6		0.64	1.82
8	0	1	0	0	488	182	183.0		1.02	0.56
9	0	1	0	1	343	77	85.2		8.24	10.71
10	0	1	1	0	521	162	160.2		-1.78	-1.10
11	0	1	1	1	509	107	100.1		-6.92	-6.47
12	1	0	0	0	7,910	4,813	4,812.7		-0.27	-0.01
13	1	0	0	1	863	463	441.9		-21.11	-4.56
14	1	0	1	0	1,278	672	683.5		11.55	1.72
15	1	0	1	1	248	98	108.4		10.40	10.61
16	1	1	0	0	1,135	589	581.3		-7.75	-1.32
17	1	1	0	1	380	146	157.6		11.63	7.96
18	1	1	1	0	868	383	379.5		-3.53	-0.92
19	1	1	1	1	567	196	195.1		-0.91	-0.47
20										
21	TOTAL				17,423	8,874	8,874			
22										

Student Success: Log. Reg. – Model 4 (w/ select 2-way interaction, and ACT)

```
***** 4.  Success4Yr_Di, model w/ select 2-way interaction, and ACT covariate. *****;
proc logistic data=study_pop;
   model Success4Yr_Di (descending) =   iResidCamp                        /*** Redundant, but okay. ***/
                                        iPell_Eligible_This_AidYr         /*** Redundant, but okay. ***/
                                        iEntry_First_Gen                  /*** Redundant, but okay. ***/
                                        iURM4_Ext                         /*** Redundant, but okay. ***/

                                        iResidCamp | iURM4_Ext            /*** Include select 2-way interaction. ***/

                                        Max_All_ACTs                      /*** Redundant, but okay. ***/
                                        Max_All_ACTs | iResidCamp
                                        Max_All_ACTs | iPell_Eligible_This_AidYr
                                        Max_All_ACTs | iEntry_First_Gen
                                        Max_All_ACTs | iURM4_Ext
                                        Max_All_ACTs | iResidCamp | iURM4_Ext  / cl;

   output out=Model_04_Di pred=phat lower=L95 upper=U95;
   title  '4.  Success4Yr_Di, model w/ select 2-way interaction, and ACT covariate.';
run;
```

Student Success: Log. Reg. – Model 4 (w/ select 2-way interaction, and ACT)

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	1130.1375	11	<.0001
Score	1089.4420	11	<.0001
Wald	1000.6043	11	<.0001

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.1677	0.2819	59.1404	<.0001
iResidCamp	1	1.3609	0.2985	20.7802	<.0001
iPELL_Eligible_This_	1	-0.1976	0.2588	0.5831	0.4451
iEntry_First_Gen	1	-0.4675	0.2601	3.2304	0.0723
iURM4_Ext	1	-0.6929	0.4978	1.9378	0.1639
iResidCamp*iURM4_Ext	1	0.2319	0.5974	0.1507	0.6979
Max_All_ACTs	1	0.0803	0.0110	53.4403	<.0001
iResidCam*Max_All_AC	1	-0.0335	0.0116	8.3294	0.0039
iPELL_Eli*Max_All_AC	1	-0.00569	0.0102	0.3102	0.5775
iEntry_Fi*Max_All_AC	1	0.00946	0.0104	0.8302	0.3622
iURM4_Ext*Max_All_AC	1	0.0139	0.0212	0.4316	0.5112
iResid*iURM4_*Max_Al	1	-0.00784	0.0251	0.0974	0.7549

Student Success: Log. Reg. – Model 6 (Final Model, w/ select 2-way interaction, and ACT)

```
***** 6.  Success4Yr_Di, final model w/ ACT covariate. *****;
proc logistic data=study_pop;
   model Success4Yr_Di (descending) =   iResidCamp                      /*** Redundant, but okay. ***/
                                        iPell_Eligible_This_AidYr
                                        iEntry_First_Gen
                                        iURM4_Ext

/*                                      iResidCamp | iURM4_Ext          /*** Include select 2-way interaction. ***/

                                        Max_All_ACTs                    /*** Redundant, but okay. ***/
                                        Max_All_ACTs | iResidCamp  / cl;

   output out=Model_06_Di pred=phat lower=L95 upper=U95;
   title  '6.  Success4Yr_Di, final model w/ ACT covariate.';
run;
```

Student Success: Log. Reg. – Model 6 (Final Model, w/ select 2-way interaction, and ACT)

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	1128.1730	6	<.0001
Score	1088.1320	6	<.0001
Wald	1006.0845	6	<.0001

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.3230	0.2193	112.1850	<.0001
iResidCamp	1	1.4872	0.2453	36.7546	<.0001
iPELL_Eligible_This_	1	-0.3419	0.0389	77.3205	<.0001
iEntry_First_Gen	1	-0.2325	0.0385	36.5090	<.0001
iURM4_Ext	1	-0.3280	0.0435	56.8129	<.0001
Max_All_ACTs	1	0.0861	0.00868	98.4904	<.0001
iResidCam*Max_All_AC	1	-0.0381	0.00975	15.2649	<.0001

Student Success: Log. Reg. – Model 6 (Final Model, w/ select 2-way interaction, and ACT)

OMIT:

Formal hypothesis test (likelihood ratio test) for eliminating several (two-way) interactions *simultaneously*.

Student Success: Log. Reg. – Model 6 (Final Model, w/ select 2-way interaction, and ACT)

	A	B	C	D	E	F	G	H	I	J	K
1	iResidCamp	iPELL_Eligible_This_AidYr	iEntry_First_Gen	iURM4_Ext	Max_All_ACTs	_LEVEL_	phat	L95	U95		CI Width
2	0	0	0	0	13	Y	0.2308	0.1948	0.2713		0.0765
3	0	0	0	0	14	Y	0.2464	0.2112	0.2854		0.0741
22											
25	0	0	0	0	35	Y	0.6660	0.6232	0.7064		0.0832
26	0	0	0	0	36	Y	0.6849	0.6395	0.7270		0.0875
27											
28											
29											
30	0	0	0	1	15	Y	0.2043	0.1756	0.2363		0.0607
31	0	0	0	1	16	Y	0.2187	0.1906	0.2496		0.0590
47											
49	0	0	0	1	33	Y	0.5474	0.5022	0.5918		0.0895
50	0	0	0	1	34	Y	0.5686	0.5202	0.6158		0.0956
51											
52											
53											
306	1	1	1	1	15	Y	0.2653	0.2414	0.2907		0.0493
307	1	1	1	1	16	Y	0.2748	0.2514	0.2994		0.0480
322											
324	1	1	1	1	32	Y	0.4495	0.4193	0.4802		0.0609
325	1	1	1	1	33	Y	0.4614	0.4295	0.4937		0.0643
326											

Student Success: Log. Reg. – Model 6 (Final Model, w/ select 2-way interaction, and ACT)

	A	B	C	D	G	H	I	J	K	L
1							Log. Reg. Model 6			
3	iResidCamp	iPELL_Eligible_This_AidYr	iEntry_First_Gen	iURM4_Ext	TOTAL	Tot Successful	Est. Tot Successful		Diff	% Rel Diff
4	0	0	0	0	1,407	652	669.1		17.11	2.62
5	0	0	0	1	275	92	97.3		5.30	5.76
6	0	0	1	0	487	203	191.4		-11.64	-5.74
7	0	0	1	1	133	35	36.2		1.19	3.41
8	0	1	0	0	486	182	180.4		-1.58	-0.87
9	0	1	0	1	342	77	86.0		8.96	11.64
10	0	1	1	0	515	161	150.7		-10.28	-6.38
11	0	1	1	1	502	107	97.9		-9.06	-8.46
12	1	0	0	0	7,907	4,813	4,800.1		-12.85	-0.27
13	1	0	0	1	863	463	440.0		-23.00	-4.97
14	1	0	1	0	1,278	672	686.0		13.98	2.08
15	1	0	1	1	248	98	107.9		9.92	10.12
16	1	1	0	0	1,133	589	587.9		-1.07	-0.18
17	1	1	0	1	380	146	153.1		7.13	4.89
18	1	1	1	0	866	383	389.3		6.34	1.65
19	1	1	1	1	567	196	195.6		-0.45	-0.23
20										
21	TOTAL				17,389	8,869	8,869			
22										

Student Success: Log. Reg. – Model 6 (Final Model, w/ select 2-way interaction, and ACT)

*** CORRECTED 2024.11.07 ***

	B	C	D	E	F	G	H	I	J	K	L	M
2									Log. Reg. Model 6			
3	DESCR_TERM	iResidCamp	iPELL_Eligible_This_AidYr	iEntry_First_Gen	iURM4_Ext	_TYPE_	TOTAL	Tot Successful	For. Tot Successful		Diff	% Rel Diff
4	FS2019	0	0	0	0	0	513	220	242.3		22.30	10.14
5	FS2019	0	0	0	1	0	81	27	29.8		2.79	10.33
6	FS2019	0	0	1	0	0	118	48	45.7		-2.31	-4.81
7	FS2019	0	0	1	1	0	42	9	10.6		1.60	17.78
8	FS2019	0	1	0	0	0	191	67	69.4		2.43	3.62
9	FS2019	0	1	0	1	0	107	38	25.7		-12.30	-32.37
10	FS2019	0	1	1	0	0	146	47	41.0		-6.00	-12.77
11	FS2019	0	1	1	1	0	156	34	29.4		-4.60	-13.53
12	FS2019	1	0	0	0	0	3,181	2,056	1,945.8		-110.20	-5.36
13	FS2019	1	0	0	1	0	330	183	169.4		-13.60	-7.43
14	FS2019	1	0	1	0	0	441	241	237.1		-3.90	-1.62
15	FS2019	1	0	1	1	0	91	38	40.2		2.20	5.79
16	FS2019	1	1	0	0	0	462	257	241.4		-15.60	-6.07
17	FS2019	1	1	0	1	0	154	66	64.1		-1.90	-2.88
18	FS2019	1	1	1	0	0	428	193	193.9		0.90	0.47
19	FS2019	1	1	1	1	0	242	80	83.1		3.10	3.87
20												
21	TOTAL						6,683	3,604	3,469			
22												

Student Success: Log. Reg.

Observations (Conclusions):

1. Based on logistic regression models of FS2016, FS2017, and FS2018 cohorts, the five independent variables ResidCamp, Pell_Eligible_This_AidYr, ENTRY_FIRST_GEN, URM4_Ext, and Max_all_ACTs significantly impact the probability of earning a first Bachelor's degree within four years (significantly impact the odds ratio); …

2. … moreover, the two-way interaction between ResidCamp and Max_all_ACTs impacts this success probability (significantly impacts the odds ratio).

3. However, we should avoid using Model 6 (and any of the models presented here) for forecasting or predicting 4-year success numbers of future FTC cohorts (as seen with the FS2019 cohort example).

Student Success

Next Steps:

1. Replace ACT Composite Score with ACT Percentile Rank.
2. Investigate effect of HS AP/Adv Credit.
3. Investigate restricting to “recent HS grads.”
4. Investigate whether there is a longitudinal effect.
5. Investigate effect of HS Core Course GPA.
6. Investigate other URM specifications (e.g., using IPEDS Race-Ethnicity categories).
7. Investigate 6-Yr Success.

8. Investigate 4-Yr and 6-Yr Success using *Multinomial* Logistic Regression for the outcomes “earn first Bachelor’s degree within 4 years” and “continue as an U/G student the next Fall term following the Summer term ending the 4th year” (i.e., continue “Progressing”).

OMIT

II. Multinomial Logistic Regression

Student Success: Multinomial Log. Reg.

OBJECTIVE: Model 4th-year "success" (Success4Yr: Y, P, N) of full-time, (Bachelor's) degree-seeking, first-time-college undergraduate students as a function of:

- Attending Residential vs. Commuter Campus (iResidCamp: 1 or 0)
- Pell eligibility (iPell_Eligible_This_AidYr: 1 or 0)
- First-generation student status (iENTRY_FIRST_GEN: 1 or 0)
- Underrepresented minority student status (iURM4_Ext: 1 or 0)
- ACT Composite Score (Max_all_ACTs)

QUESTION: Is 4th-year "success" impacted by these student characteristics?

Student Success: Multinomial Log. Reg.: FTC Cohorts

	A	B	C	D	E	F
1						
2	UM_RACEB_NRA	N	Remove NRA.		Reduce N to 22,158 (from 22,509).	
3	ACADEMIC_LOAD	F			(No change.)	
4	UM_DEG_SEEKING	Y			(No change.)	
5	ADMIT_TYPE	FTC	First-time College		(No change.)	
6	UM_CLEVEL_DESCR	(All)	Frosh, Soph, Jr., Sr.		(No change.)	
7	UM_AUDIT_ONLY	N	Remove Exclusive Auditors		(No change.)	
8	iArchiB	(blank)	Remove Pre-Archi stu's.		Reduce to 22,113 (from 22,158).	
9	iMedB	(blank)	Remove 6-yr Med stu's.		Reduce to 21,811 (from 22,113).	
10	iPharmB	(blank)	Remove Pre-PharmD stu's.		Reduce to 21,564 (from 21,811).	
11	iEntry_First_Gen	(Multiple Items)	Remove Missing 1st Gen.		Reduce to 17,423 (from 21,564).	
12	REC_HS_GRAD	(All)				
13	AGE	(All)				
14						
15	**Count of EMPLID**		**Success4Yr**			
16	**iResidCamp**	**DESCR_TERM**	**N**	**P**	**Y**	**Grand Total**
17	**0**	FS2016	633	249	464	1,346
18		FS2017	641	263	525	1,429
19		FS2018	635	239	525	1,399
20	**0 Total**		**1,909**	**751**	**1,514**	**4,174**
21	**1**	FS2016	1,196	893	2,523	4,612
22		FS2017	994	780	2,294	4,068
23		FS2018	1,210	816	2,543	4,569
24	**1 Total**		**3,400**	**2,489**	**7,360**	**13,249**
25	**Grand Total**		**5,309**	**3,240**	**8,874**	**17,423**

Student Success: Multinomial Log. Reg.

Refer to Handout #2 – design matrix and observed data for Success4Yr (multinomial data).

Q&A

END

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