# Using JMP® to discover the drivers of research project grants success rate in academic research institution

Rossi Evans[1], Annie Dudley Zangi[2], Joanna Downer[1], Billy Newton[1] and Ellen McCarthy Steinour[1]

[1]Finance and Resource Planning, Duke University School of Medicine, Durham, NC 27710

[2]JMP Group, SAS Institute Inc., Cary, NC ZIP 27513

**Duke** University School of Medicine
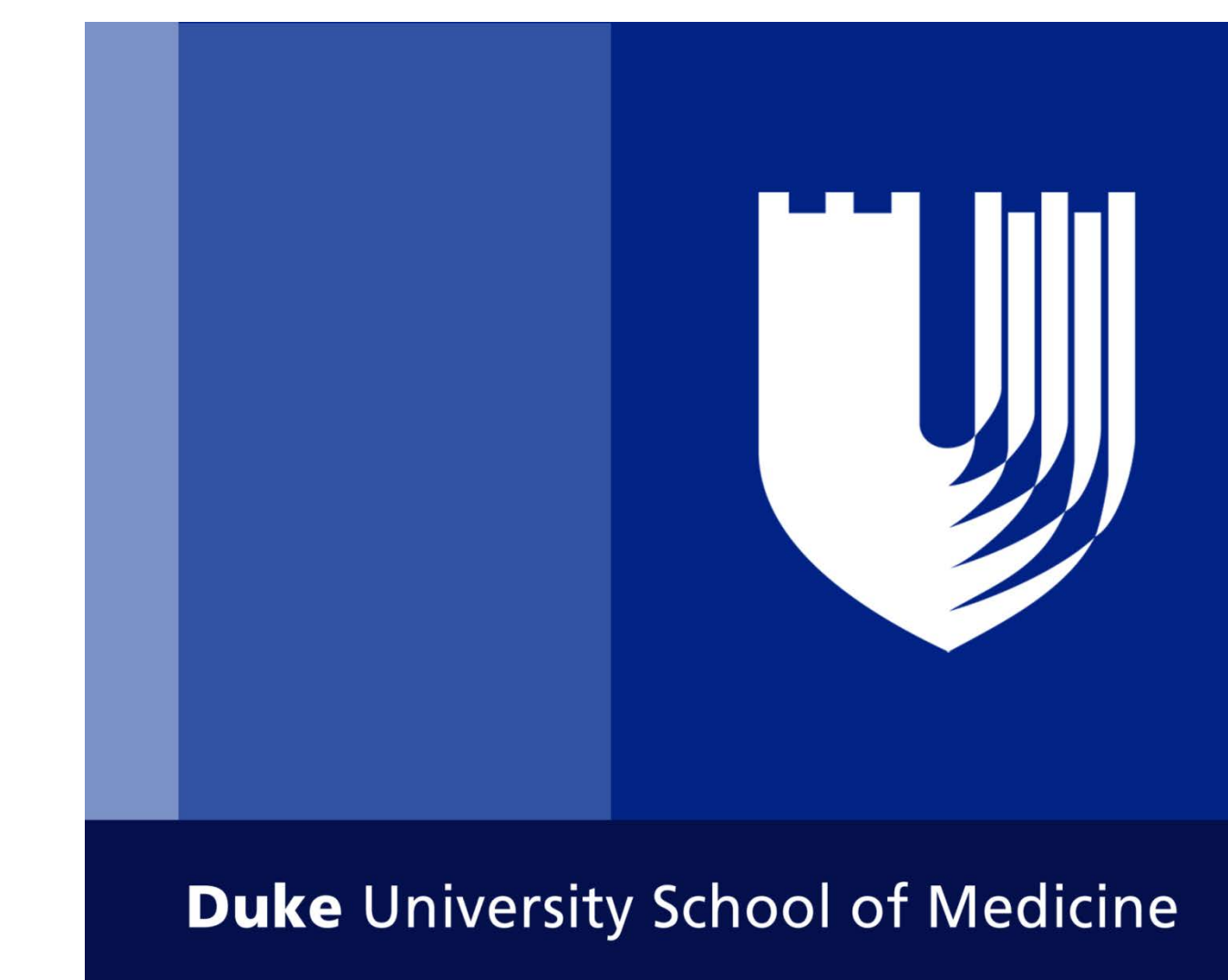
PURPOSE

At the Duke University School of Medicine, federal grant funding from the National Institute of Health (NIH) accounts for approximately 60% of revenue for research activities, making the process of securing federal dollars vital to current and future operations and to strategic investments.

Duke School of Medicine has consistently ranked among the top 10 academic institutions receiving federal grant and contract funding for over 10 years. However, widespread concerns of tighter NIH funding (Figs. 1, 2), federal budget cuts, and slower than expected economic recovery has precipitated need for **deeper understanding of factors affecting faculty members' success in obtaining federal awards**.

Currently published research on award success rate is sparse, [1,2] and internal analyses done at Duke have examined various influences but have not resulted in a comprehensive predictive model.

> In 2011, for the first time in NIH history, the national success rate for research grants dropped below 20%.
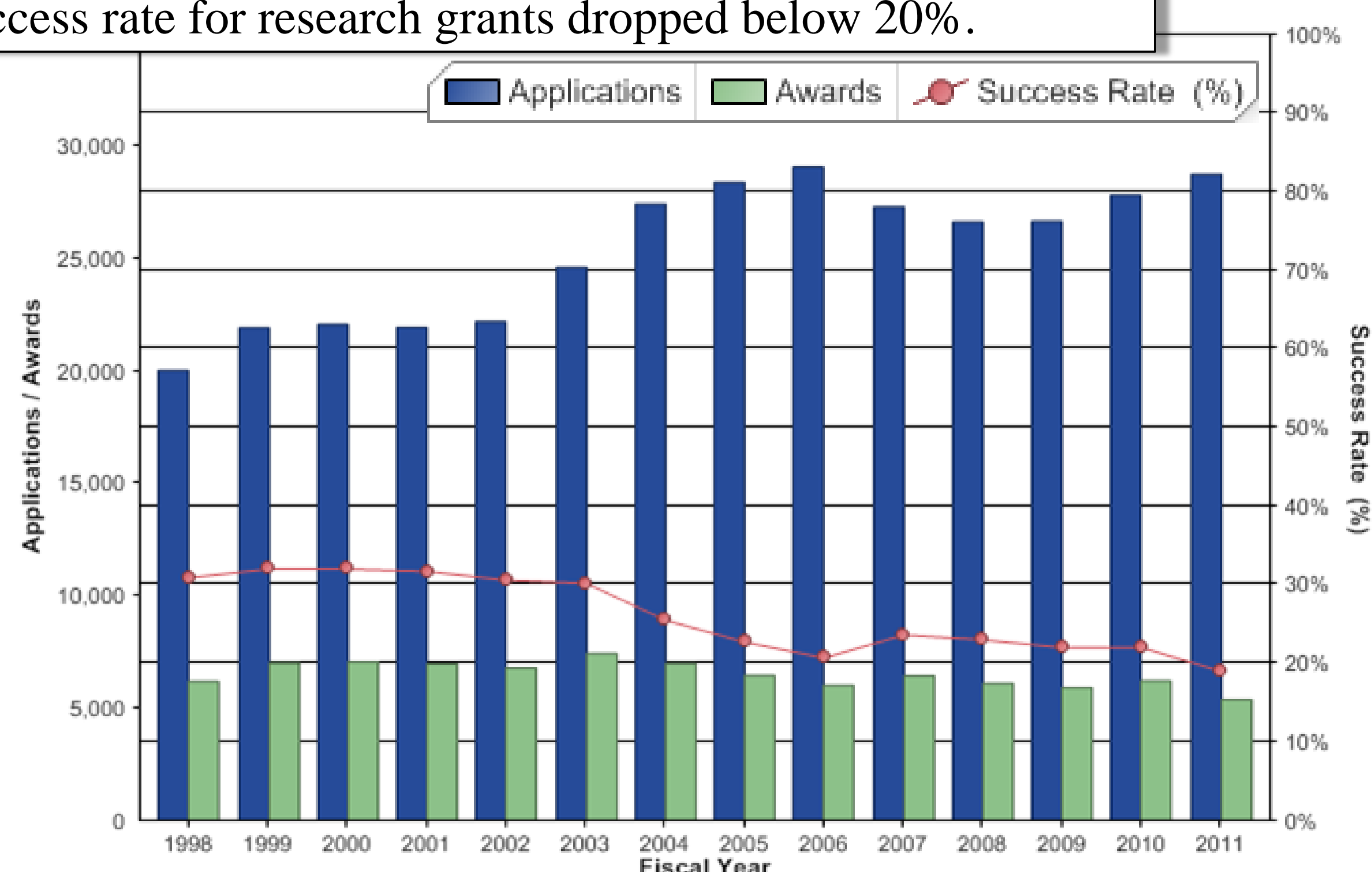
Fig.1. R01-Equivalent grants applications, awards, and success rates. Excludes American Recovery and Reinvestment Act (ARRA) awards. [5]

> NIH is made up of 27 Institutes and Centers, each with a specific research agenda and different award success rates.
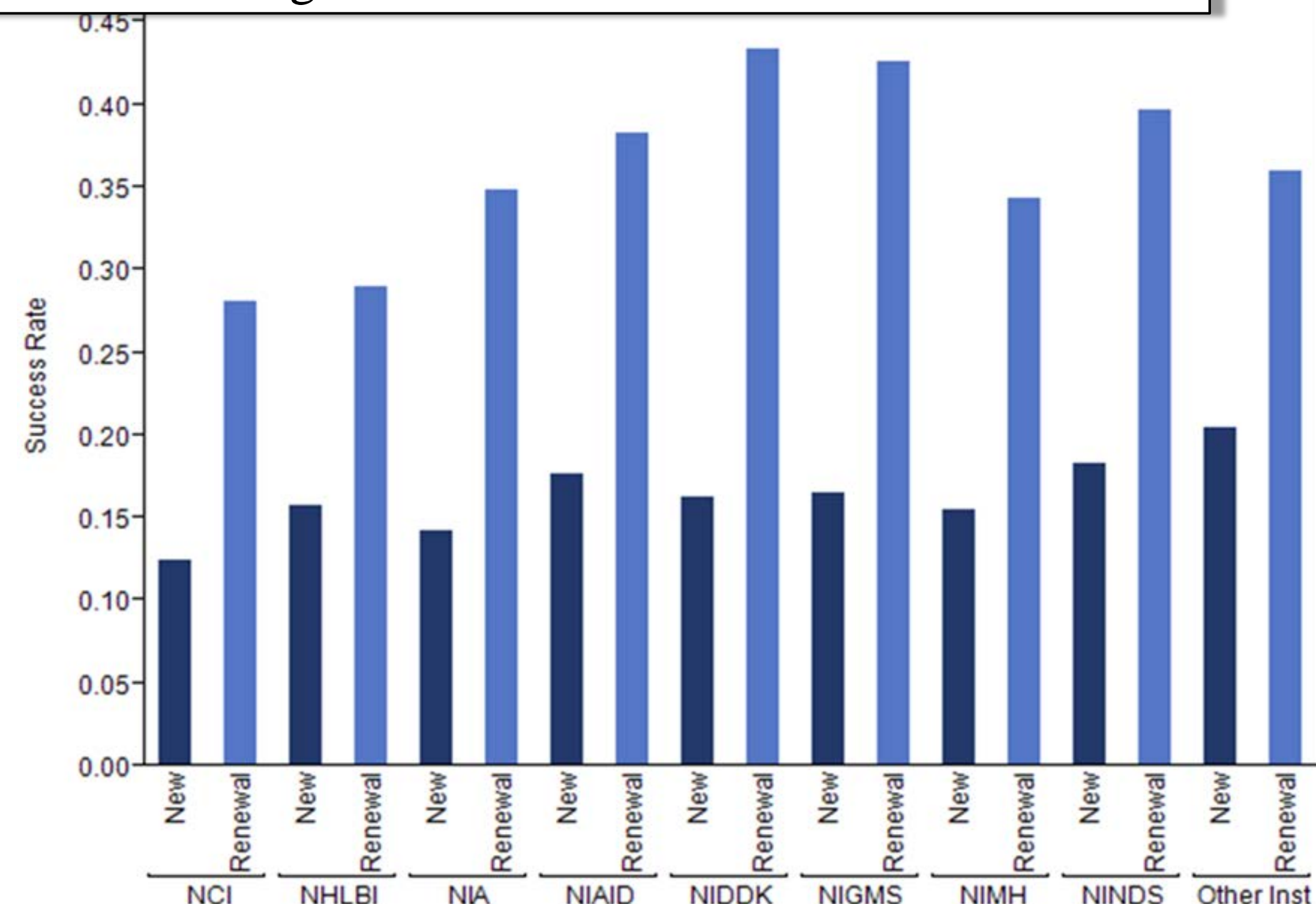

Fig.2. Success rates for major NIH Institutes for new and competitive renewal awards in Federal Fiscal Year 2011. Excludes ARRA. [3]

METHOD

We used JMP® **NOMINAL LOGISTIC REGRESSION** to explore factors affecting success of Duke School of Medicine faculty in obtaining NIH research project grants (RPG) and to form a predictive model to identify and explain drivers of award success rate.

> Duke Full Professors have an award success rate 8.7 percentage points higher than that of Assistant Professors.
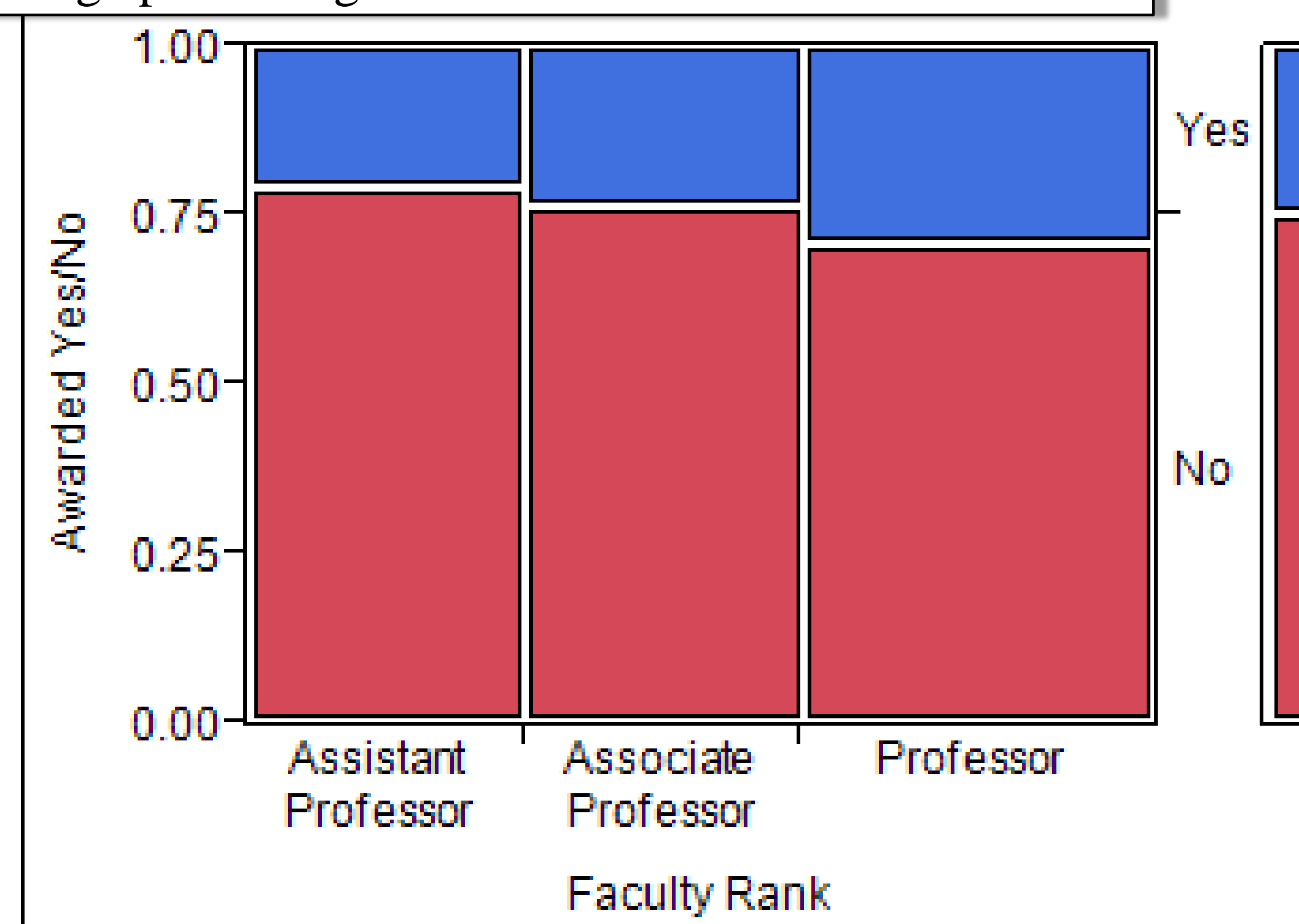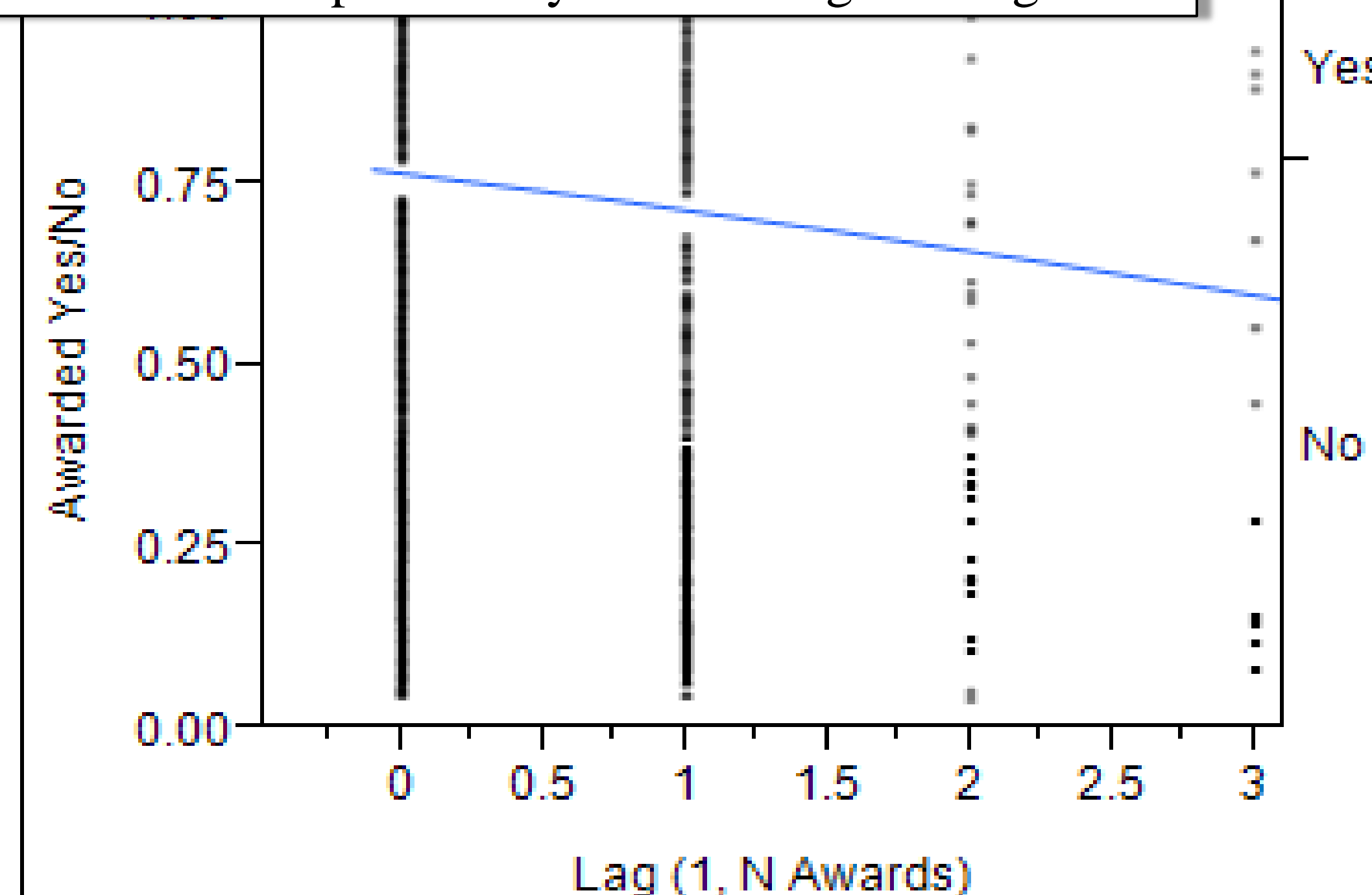

Fig.3. Probability of NIH RPG by Faculty Rank, Federal Fiscal Year 2007 - 2011 (N = 2319). Based on data from Duke University Sponsored Project System. $P < 0.0002$.

> Duke faculty members' past success with NIH awards is a good indicator of future success.
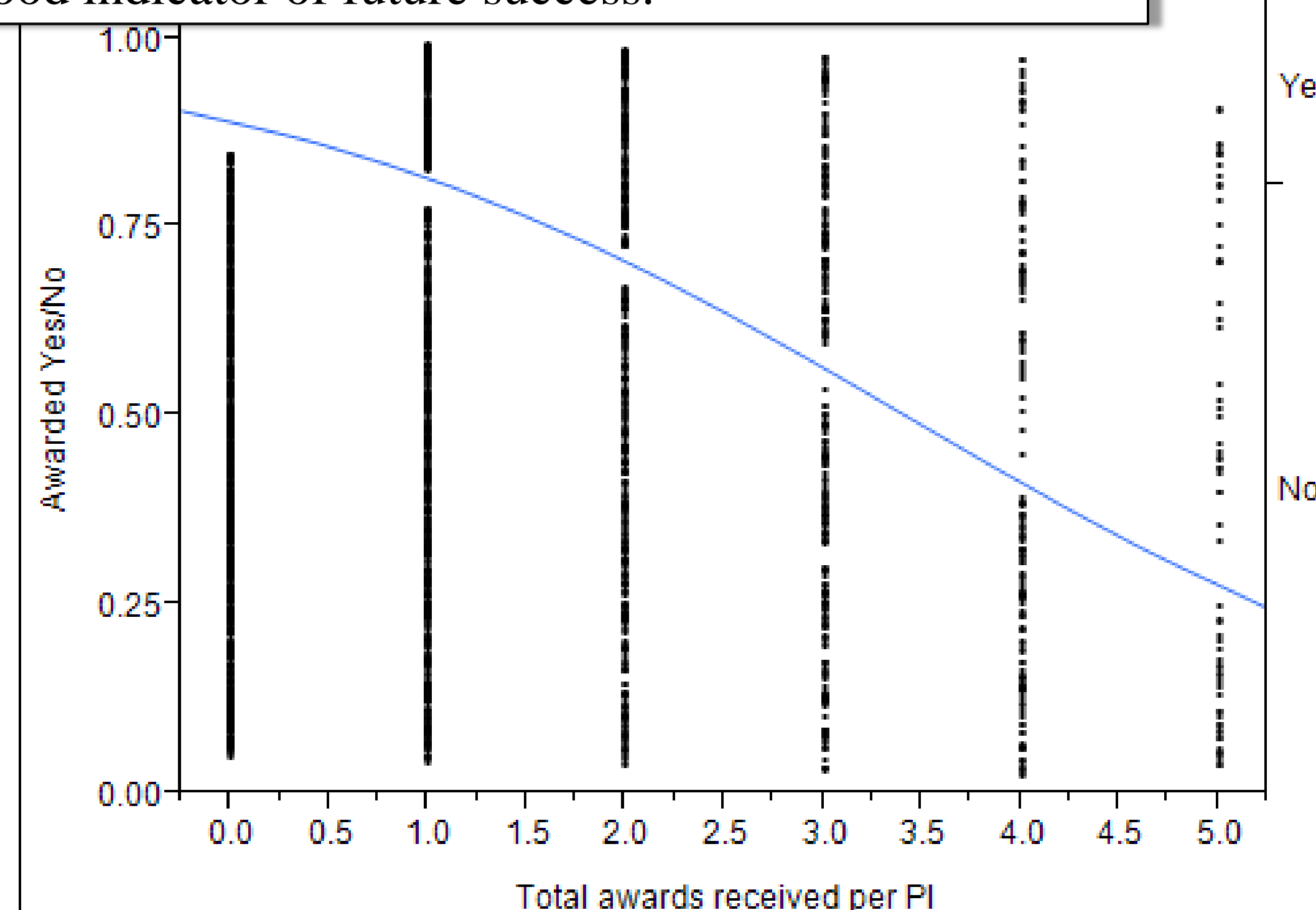
Fig.4. Probability of NIH RPG by total number of awards per Principal Investigator, Federal Fiscal Year 2007 - 2011 (N = 2347). Based on data from Duke University Sponsored Project System. $P < 0.0001$.

> At Duke, the number of awards received in the prior year increases the probability of receiving a new grant.

Fig.5. Probability of NIH RPG by number of awards from previous year, Federal Fiscal Year 2007 - 2011 (N = 2347). Based on data from Duke University Sponsored Project System. $P < 0.0001$.

RESULTS

Variables found to have significant effect on the success in obtaining federal grant funding:

- Number of total awards Principal Investigator (PI) had received,
- Faculty rank (Title) – success rate increases with seniority,
- Race – on average African American Duke faculty have 5 percentage points lower success rate than White, Asian, or Hispanic Duke faculty,
- NIH institutes' success rates – significant effect was observed for new awards only, but little to no effect on competitive renewals,
- Number of awards PI received in the previous 1 or 2 years (Lag),
- Type of award – new grants exhibit lower success rate than competitive renewals.

A stepwise-like model building method was used, which included both interactions and some quadratic terms, to form a starting model.

Effect Likelihood Ratio Tests

Source	DF	L-R ChiSquare	Prob>ChiSq
Total Awards per PI	1	459.996815	<.0001*
Total Awards per PI*Total Awards per PI	1	123.399046	<.0001*
Lag (2, N Awards)	1	37.0134383	<.0001*
Lag (1, N Awards)	1	32.9473794	<.0001*
Federal Fiscal Year	4	31.4375918	<.0001*
NiH Inst_AvgSR	1	11.3381899	0.0008*
Total Proj Costs Req	1	10.0337117	0.0015*
6 Digit Org Desc*Degree	8	24.9499715	0.0016*
NiH Inst_AvgSR*NiH Inst_AvgSR	1	9.16848677	0.0025*
RACE	3	12.6998779	0.0053*
Type	1	1.82469084	0.1768
TITLE	3	1.97007348	0.5786

Fig.6. Snapshot of the full model as of August 1, 2012

NEXT STEPS

- Explore the relationship between faculty publications and grant success rate. A strong correlation between grant success and research publications has been hypothesized.
- Quantify the effect of the number of submission attempts to grant success rate. Based on prior analyses and NIH national data, this is expected to be a strong predictor of awards success.
- Consider a Neural Net model.

REFERENCES

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