THE PIPELINE FOR PHYSICIAN-INVESTIGATORS: MAINTENANCE OR OPPORTUNITY FOR GROWTH?

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Workforce Calculations

- 14,000 physician-scientists in the US
- 8000 have NIH grants
- ~1000 individuals will need to enter the pipeline each year, assuming 50% will not succeed.
- Currently, 500 enter the pipeline with MD-PhD
  They have a much higher success rate.

http://acd.od.nih.gov/reports/PSW_Report_ACD_06042014.pdf

Three Pathways for Physician-Scientists

- Major pathways - not the only pathways
- Data from private foundations and non-profits hard to obtain and confirm.
- **MD-PhD Programs**
- **Research Intensive Residencies**
- **K Award Programs -- then K to R transitions**

MD-PhD Programs

- NIGMS started funding MSTP in 1964.
- 44 institutions currently have MSTP funding
- 111/131 medical schools offered a joint MD-PhD program in 2011
- $127M in funding in 2011 for MD-PhD programs

Jeffe DB et al Acad Med 89:1; 2014

Analysis 1995-2000 MD-PhD Matriculants:

n = 2582

- 73% PhD degree completion rate compares to 42-57% for PhD only candidates in biomedical science.*
- MD-PhD program enrollment has increased (2002-2012) from 3632 to 5097.#
- Currently approximately 520 receive an MD-PhD/year.

*http://grants.nih/training/biomedical_sciences.pdf

https//aamc.org/download/321554/data/2012factstables36-2.pdf

ABIM Physician-Scientist Pathway

- 2 years of medical residency
- 1-2 years of subspecialty clinical training
- 3 years of research training (or just research training without subspecialty clinical training)
- Total period of training after medical school: 5-7 years

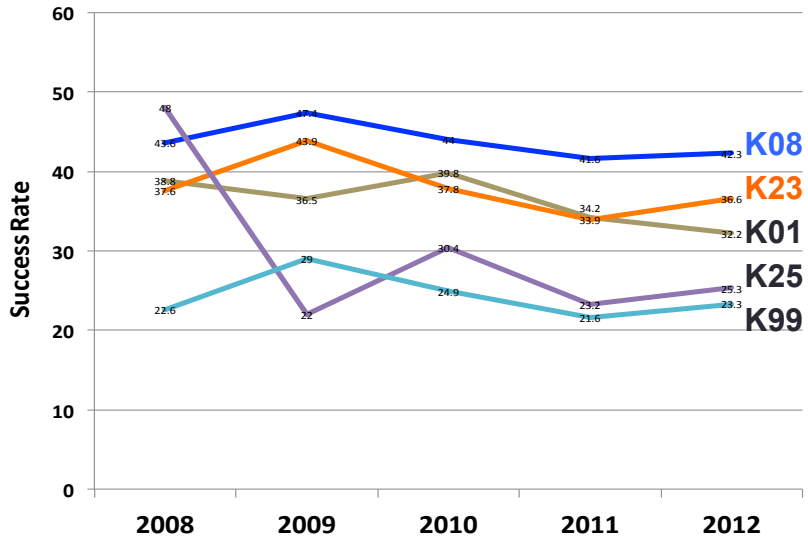
Demographics

- Survey under the auspices of Association of Academic Internal Medicine
- Response rate 47%
- For those who completed in 1995-2007
  - 880 completed **(~67/year)**
  - 23.8% women; 76.2% men

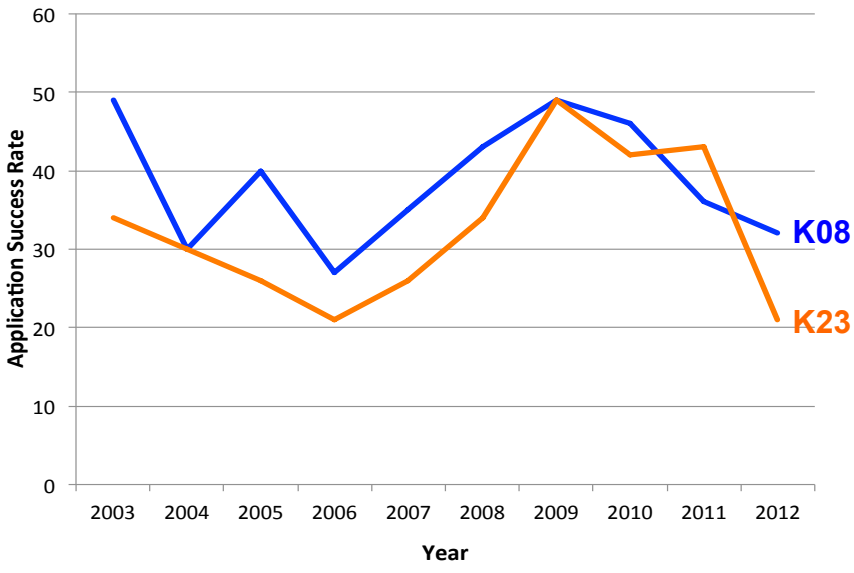
From Todd RF et al. Academic Med 88:1747-1753, 2013

NIH K AWARDS

NIH Total K Award Success Rates



NHLBI K08 and K23 Success Rates



Number of K Awardees:

- Awardees 1999-2008:
  - 3240 MDs;
  - 2978 PhDs
- Average ~622 per year

http://acd.od.nih.gov/reports/PSW_Report_ACD_06042014.pdf

K Awardees: Prime entrants into the Physician-Investigator pipeline

- In this cohort (1999-2008): ~85% applied for RPG (R01 or similar)
- First time applicant pool for R01:
  - Only ~14% are MD or MD-PhD with prior K award.
  - Their success rate on first application is **~ 60%**

http://acd.od.nih.gov/reports/PSW_Report_ACD_06042014.pdf

Current K-R transition: K08 and K23

All Institutes and Centers

- Funding initiated 2006
- Stratified by award type
- Queried by NIH Reporter
- 3 years following award completion (2014)

Marsh JD and Todd RF, *Am. J. Med* 2015; 128(4):431-6

Current K-R transition: K08 and K23

All Institutes and Centers

- **K08** awardees: 37.5% received independent NIH funding
- **K23** awardees: 21.3% received independent NIH funding
- **NOTE**: these rates are lower than reported in 1999-2008 cohort

Marsh JD and Todd RF, *Am. J. Med* 2015; 128(4):431-6

WHAT IS SUCCESS FOR PHYSICIAN-SCIENTIST TRAINING PROGRAMS

What is success for physician-scientist training programs?

- Outcomes that are easily measured are too narrow. e.g., receiving an R01 grant as PI.
- What about team science?
- Major research institutions now have <50% of their research portfolio from NIH (E. Nabel, personal communication)
- Outcomes data from foundations are often closely held (Sarnoff, Doris Duke, AHA)
- Ultimately we are training physician-scientists not to get grants but to make and publish high impact discoveries.

Is getting an R01 too generous a measure of success?

- Some get an R01 and go on to 25 years of continuous funding
- Some spend 24 years of preparation, from entering medical school to average age (46) for first R01.
- They get the first R01 and work on it for 4 years. And then that is the end.
- Is that success?
- A comparison - jet fighter pilot training.
  24 years of training and 4 years active duty. Success?

K award cost to a Department

AAMC salaries	25th percentile	Median
Cardiology (NI)	$203	$253
Pulmonary	$163	$191
Heme-Onc	$170	$201

- Discount 10%; break even on clinical time
- Salary deficit/year:
  - $35-$72K/year;
  - Avg: $53.5K
- Salary deficit for 5 years = $267

Investment by the Department
Start up costs

- $50,000/year x 3 years: $150K
- Assume lab space - no marginal cost
- Three years of 70% salary+ fringe support after K award concludes = $468K

Total: ~$885,000 invested per K awardee

Investment by the Department
Potential Total Costs & Risks

- Chance of successful K to R transition: 35% perhaps 60% for MD-PhD
- If ~50% success rate in getting R01, the direct cost is **$1.77M for each K start up and successful transition (a most conservative estimate!).**
- **For 10 faculty: $17- $20M**

FUTURE NIH FUNDING PROSPECTS

Future NIH Funding Prospects

21st Century Cures Act

- Bill passed by House 7-10-2015 by 344 to 77 vote with wide bipartisan support (HR 6)

- The House Energy and Commerce Committee unanimously approved H.R. 6, the "21st Century Cures Act," on May 21, 2015, after reaching a bipartisan agreement to fund the legislation (Cures bill)

Future NIH Funding Prospects

21st Century Cures Act

- Importantly, the bill (Title I, Subtitle A) proposes to **increase funding** for the National Institutes of health, starting with $31.8 billion in 2016, and increasing to $33.3 billion and $34.8 billion in 2017 and 2018, respectively.
- NIH is presently funded at $30.3 billion. **(14.8% increase over 3 years)**

Future NIH Funding Prospects

21st Century Cures Act

- In addition, the bill establishes what is to be called the "**NIH Innovation Fund**," which would be funded with $2,000,000 each year from 2016 through 2020.
- The innovation money would be used to advance several as-yet undefined programs, including ones supporting **precision medicine and "young emerging scientists.**"

KEY CONSIDERATIONS

Is it time for a more focused strategy for physician-scientist development?

- Consider setting the tough filter at the beginning of the pipeline (not after 20 years of preparation to see funding at the 8th percentile).
- How about MD-PhD for all aspiring bench-scientists and MD-MS for all aspiring clinical scientists?
- How about a clinical fast track residency for all who are clinically capable?
- How about a K08/K23/R00 for physician-scientists?
- **These approaches may be cost-effective**.

THE PROBLEMS

1. There will be no real growth in NIH or Foundation funding for physician-investigators for the foreseeable future. Industry support for training is negligible.
2. The input to the pipeline will likely sustain but not grow the cadre of physician-investigators.
3. The success of our current processes for selecting and sustaining physician-investigators is at best mediocre; this is where we may have a major opportunity for increasing the number and durability of physician investigators.

SOME QUESTIONS

1. What is the expected/optimal success rate (since it can't be 100%?)
2. Can we identify the characteristics of the individuals most likely to succeed? Can this inform who we pick?
3. What are the forces that make even the right people prone to failure?
4. Is training needed for mentors to help trainees succeed?