Surgeons are Born

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Disclosures:

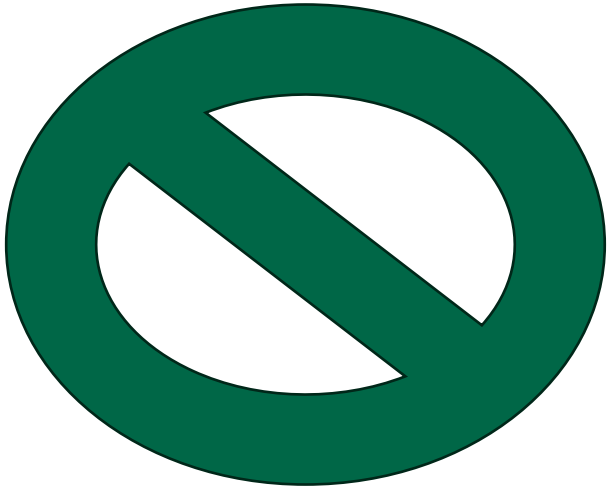
I have the following financial relationships to report with ACCME defined ineligible companies.

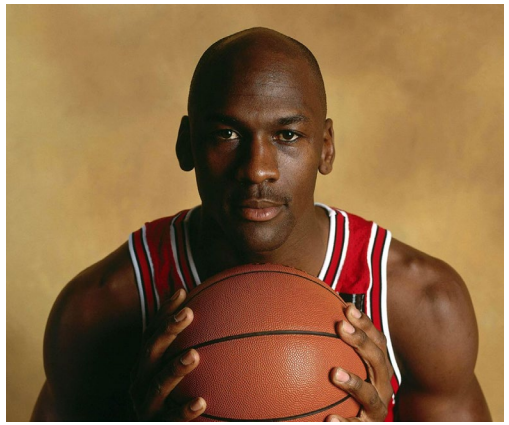
Name of Company	Nature of Relationship	Current Status
UroGen®	Speaker, Consultant	Active
Baxter®	Speaker, Consultant	Active
Intuitive®	Consultant	Active

I will not be discussing unlabeled/investigational uses of medical devices or pharmaceuticals during this presentation.

8th Grade and Basketball Dreams

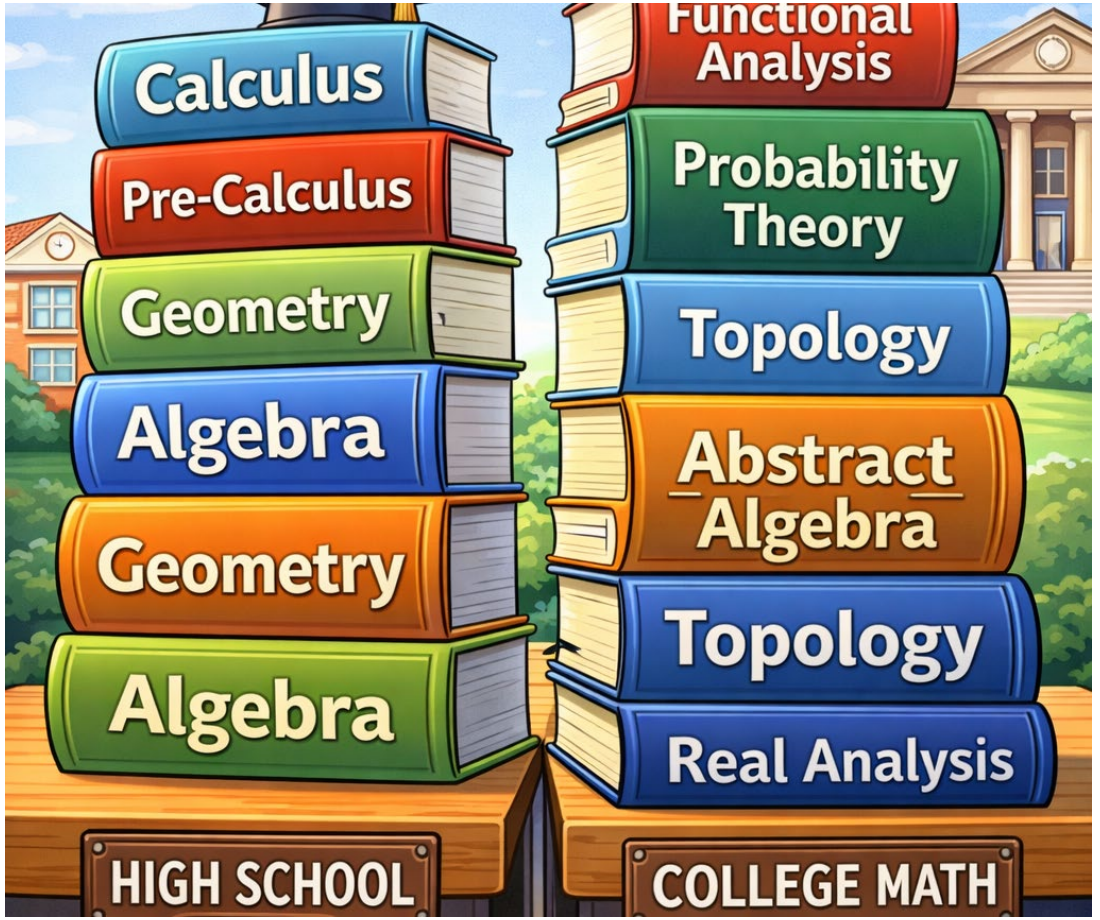
8th Grader Dreams of Joining High School Basketball team

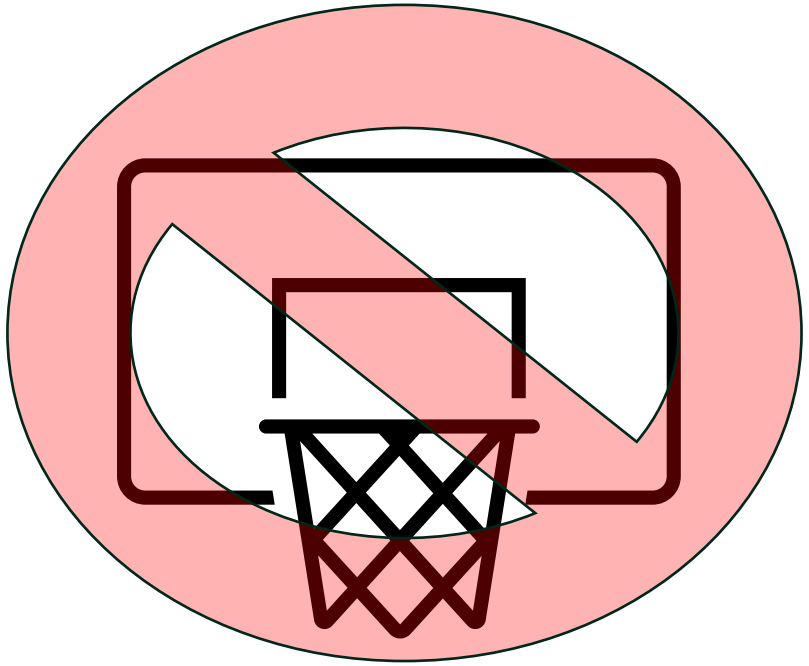




High School


√169 = ?
3.14 x 27 = ?
2x - 3 = 11
sin x + cos x = ?


Calculus
Pre-Calculus
Geometry
Algebra
Geometry
Algebra
Functional Analysis
Probability Theory
Topology
Abstract Algebra
Topology
Real Analysis
HIGH SCHOOL
COLLEGE MATH



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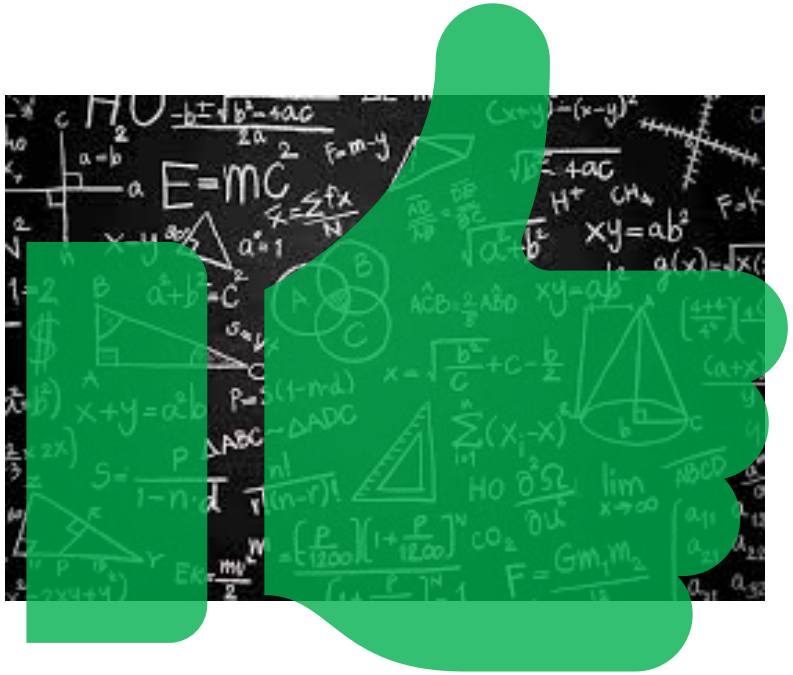
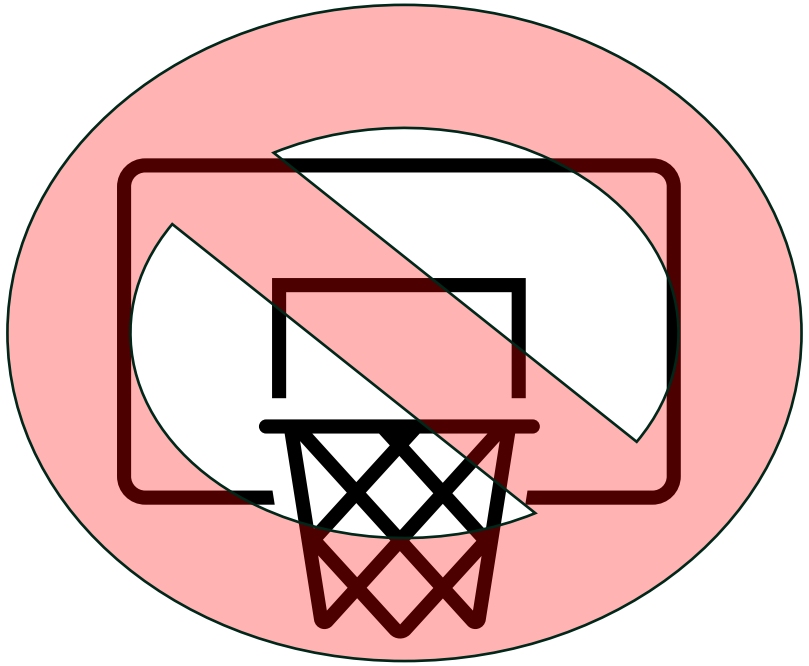
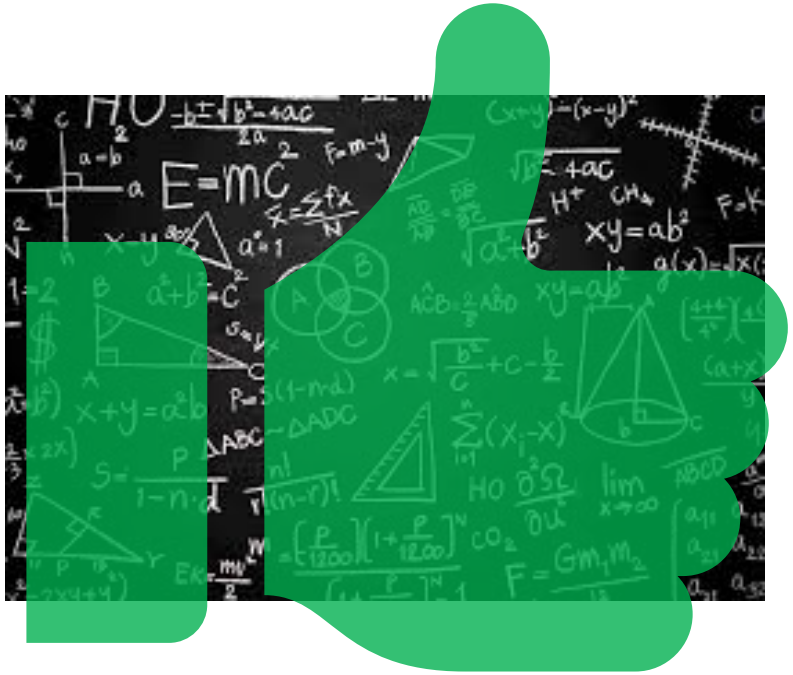




Talent



Surgeons are Born = Talent

Must be a “Dirty” Word In Surgical Education

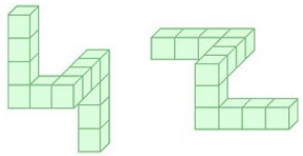
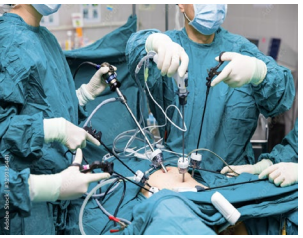
How do you define/measure or identify talent?

Can you teach talent?

Can you tell a trainee that they do or don’t have talent?

What defines Innate Talent in the OR?

Technical/Psychomotor Abilities	**Visuospatial ability** **Manual Dexterity** **Bimanual Coordination**
Cognitive abilities	**Pattern Recognition** **Decision – Making**
Neurophysiology	**Stress Tolerance** **Cognitive Resilience**

	Human Capacity	Application in Surgery
 **Visuospatial Ability**	• Understand 3-dimensional relationships • Mentally rotate objects • Judge depth, angles, distance, and orientation • Predict how structures move when manipulated	• How easily you understand Anatomy • Ability to know where you are • Where you're going • What will happen next—without seeing everything directly
 **Bimanual Coordination**	• Use both hands simultaneously • Perform Different Tasks with each hand	• Non dominate retracts while the other dissects • On hand stabilizes while the other sutures
 **Manual Dexterity**	• Make precise controlled movements • Apply appropriate force • Perform fine motor tasks smoothly and efficiently	• Knot tying • Micro-dissection • Needle control • Tissue respect (too much force = injury)
 **Stress Tolerance**	• Maintain cognitive clarity, motor precision, and decision-making under conditions of acute psychological and physiological stress	• Management of Acute Major Bleeding • Difficult Anatomical Dissection • Prolonged Surgery

Hegarty et al. Cogn Pysch 2007
van der Wiel et al. Annal Surg 2019
Gallagher et al. Anal Surg 2003

Are Surgeons Different?

Association for Surgical Education

When surgeons decide to become surgeons: new opportunities for surgical education

Mark S. Hochberg, M.D.*, Jessica Billig, B.A., Russell S. Berman, M.D., Adina L. Kalet, M.D., Sondra R. Zabar, M.D., Jaclyn R. Fox, B.A., H. Leon Pachter, M.D.

Department of Surgery, New York University School of Medicine, New York, NY, USA

- **62%** of surgical residents were "fairly certain" of surgery before medical school
- Compare to only **40%** aggregate for other 5 specialties

Are students identifying some inherit aptitude in themselves that may portend success in a surgical field?

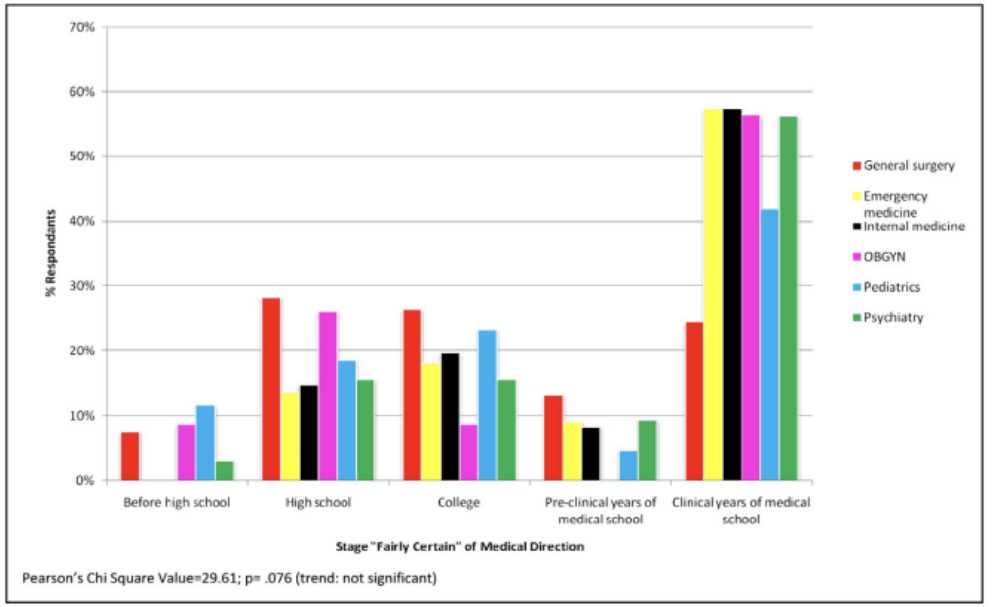


Figure 2 Stage at which students were "fairly certain" of medical direction.

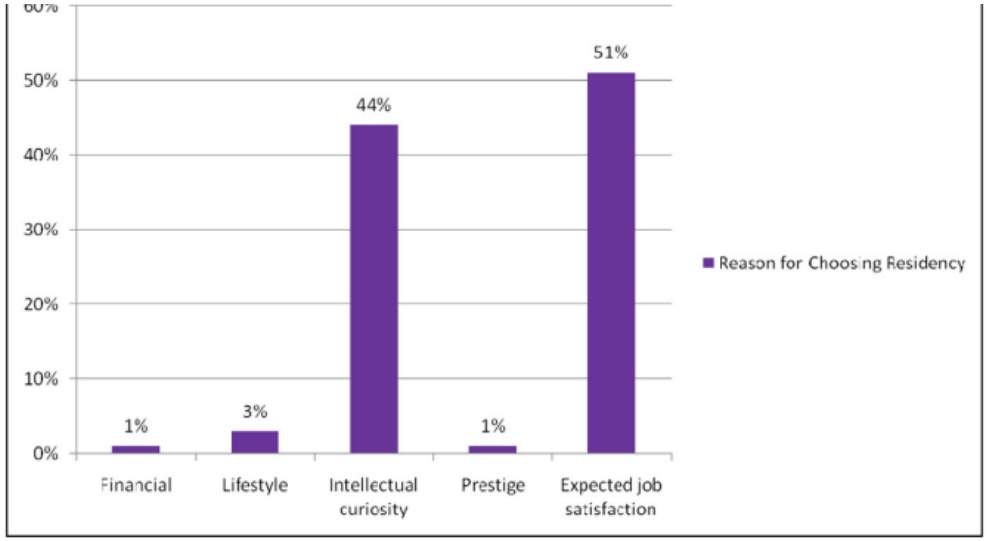


Figure 5 Primary reason for choosing residency (percentage).

Hochberg MS et al. *Am J Surg*, 2014

Association for Surgical Education

The impact of aptitude on the learning curve for laparoscopic suturing

Christina E. Buckley, M.B., B.Ch., B.A.O.*, Dara O. Kavanagh, M.Ch., F.R.C.S.I., Emmeline Nugent, M.D., M.R.C.S., Donncha Ryan, M.Sc., Oscar J. Traynor, M.Ch., F.R.C.S.I., Paul C. Neary, M.D., F.R.C.S.I.

Innate Aptitude and Learning Curves

- **20 medical students** divided into HIGH vs. LOW aptitude groups
  - Aptitude measured: **visuospatial ability**, **depth perception**, **psychomotor ability**
- Task: Suturing on a Laparoscopic Simulator until proficiency achieved

	High Aptitude	Low Aptitude
Achieved proficiency	**100%**	**30%**
Mean attempts to proficiency	7 (range 4–10)	14 (range 10–16)
Improved but never proficient	0%	40%
Failed to progress at all	0%	**30%**

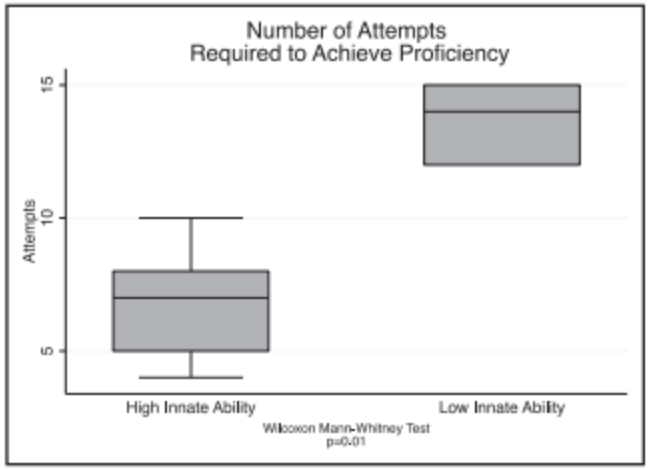


Figure 3 Difference in the number of attempts required to achieve proficiency.

Innate technical abilities do exist and create fundamentally different learning trajectories for individuals

Buckley et al. Am J Surg 2014

Baseline Assessments of Psychomotor Aptitude Are Associated With the Future Operative Performance of Surgical Trainees

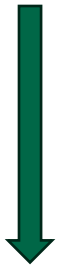
A Prospective Observational Cohort Study

Conor Toale, MSc, MRCSI,✉ Marie Morris, PhD, MSc, PGDipHEd,* Donncha M. Ryan, MSc,* Fiona Boland, PhD,† Eva M. Doherty, DClinPsych,* Oscar J. Traynor, MCh, FRCSI,* and Dara O. Kavanagh, MCh, FRCSI**

Measuring innate surgical ability before training begins - Does baseline aptitude predict future OR performance?

242 Surgical Residents on Interview Day:

1. **Perceptual Ability** – interpreting 3D orientation from 2D images (PicSOr test)
2. **Visuospatial Ability** – spatial reasoning and mental rotation (paper-based tests)
3. **Manual Dexterity** – fine motor control (grooved pegboard)



2,085 assessments over 2 years IN the OR by Attending Surgeons

- Operative Performance P = 0.002
- Simulation Performance P = 0.03

First Study to show that Higher Baseline Aptitude Scores predicts - Higher OR Performance

Independent of undergraduate grades and operative experience

"Surgeons are born": Innate psychomotor abilities exist before training and can influence performance in the OR

Toale C et al., Annals of Surgery, 2023

Differential Expertise Acquisition

Variation in Outcomes Across Surgeons Meeting the Leapfrog Volume Standard for Complex Oncologic Surgery

Christopher T. Aquina, MD, MPH [1,2]; Adan Z. Becerra, PhD [3]; Fergal J. Fleming, MD, MPH[2]; Jordan M. Cloyd, MD [1]; Allan Tsung, MD[1]; Timothy M. Pawlik, MD, MPH, PhD [1]; and Aslam Ejaz, MD, MPH[1]

All High-Volume Surgeons at All High-Volume Hospitals

- Whipple Procedure
  - 16% (Best) vs 35% (Worst)
- Esophagectomy
  - 28% (Best) vs 55% (Worst)

2-fold difference in complication rates between best- and worst-performing surgeons

Differences exist in how surgeons acquire expertise even in identical environments—suggests that innate ability plays a significant role in surgical outcomes

Aquina et al. Cancer 2021

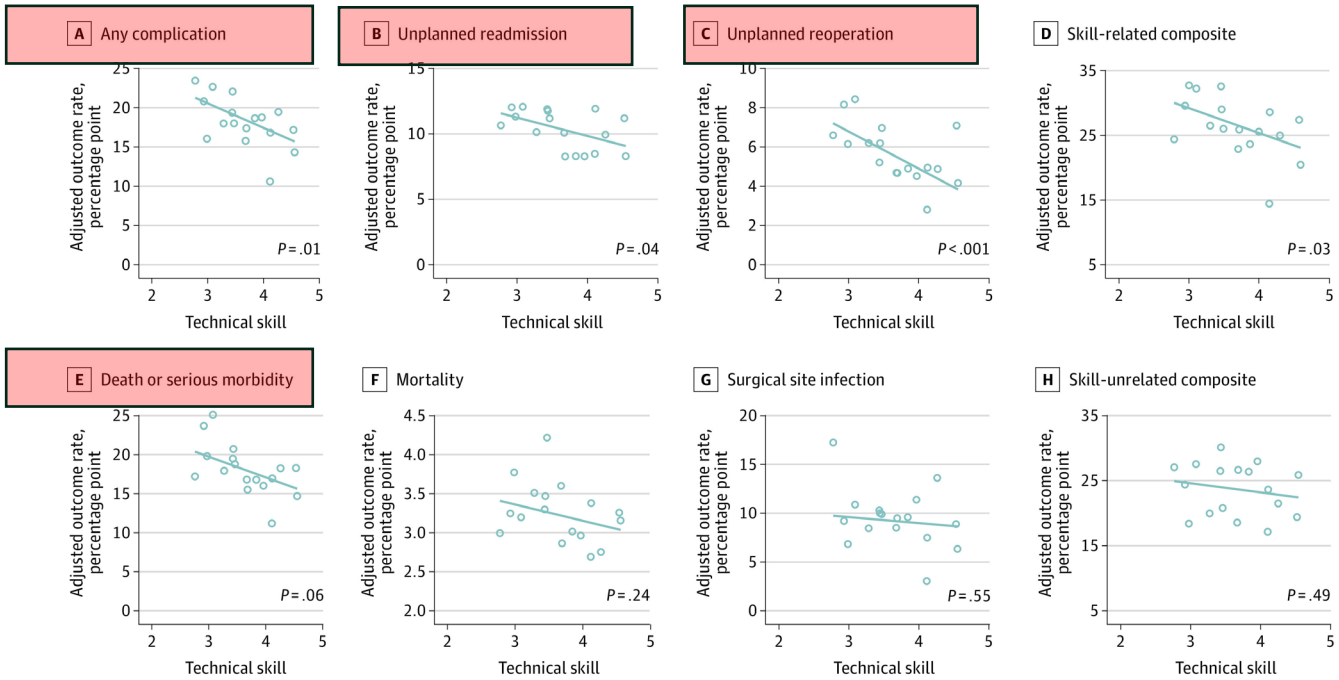
Technical Skills and Clinical Outcomes

Original Investigation

Association Between Surgeon Technical Skills and Patient Outcomes

Jonah J. Stulberg, MD, PhD, MPH[1,2]; Reiping Huang, PhD[1,2]; Lindsey Kreutzer, MPH[1,2] ; et al

- **Participants:** 17 surgeons from the Illinois Surgical Quality Improvement Collaborative
- **Assessment:** One video per surgeon of a laparoscopic right hemicolectomy by >10 blinded reviewers (Technical skill scored using OSATS)
- **Outcomes:** Postoperative outcomes obtained from the ACS NSQIP registry



Low-skill vs. high-skill surgeons ~ 2x higher mortality, complications, reoperation, readmission

Stulberg et al. JAMA Surg 2020

Initial surgical performance in robot-assisted radical prostatectomy is associated with clinical outcomes and learning curves

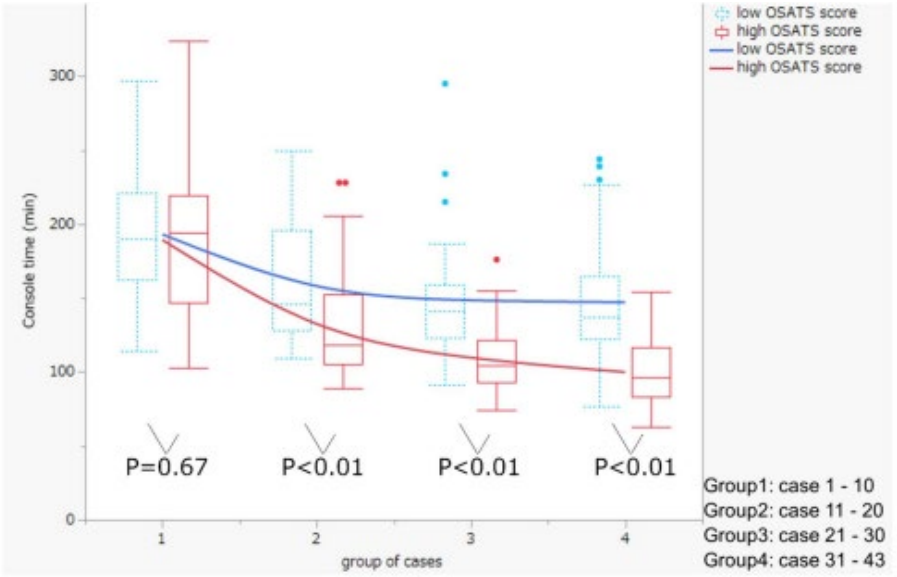
Masahiro Yamazaki[1,2] · Hiroshi Kawahira[3] · Yoshitaka Maeda[3] · Kosuke Oiwa[4] · Hirotaka Yokoyama[2,5] · Tomohiro Kameda[2,5] · Jun Kamei[2] · Toru Sugihara[2] · Satoshi Ando[2] · Tetsuya Fujimura[2]

Six Surgeons Training – RALP Formal Mentoring Program → OSATS Evaluation of 10th RALP → High Performer / Low Performer → 43 RALPs per Surgeon Evaluated

High Performers

- Shorter OR times
- Higher continence rates at 3 months

- **Training can refine skills, *but* does not equalize them**
- **Innate abilities create different performance ceilings that training and experience may not fully overcome**



Yamazaki et al. Surg Endo 2024

The Case for Innate Talent
"Surgeons are Born"

- **Initial technical skill and Aptitude testing can predict who will achieve higher proficiency and who will learn faster –** *suggests innate talent exists*

- **Surgeons reach different performance plateaus** despite similar training, volume, and experience

- **Wide variation in outcomes** even among high-volume surgeons meeting identical standards

- **Practice is necessary but not sufficient**—practice can optimize potential but cannot overcome fundamental limitations

There are No Superbowls of Surgery!

We Win when our Patients Win!
Patient outcomes is our Superbowl

What Drives Outcomes in "MY" order of Priority (IMO)

1. Patient overall Heath
2. Identifying and performing the correct indicated operation
3. ***Technical Quality of the surgery***

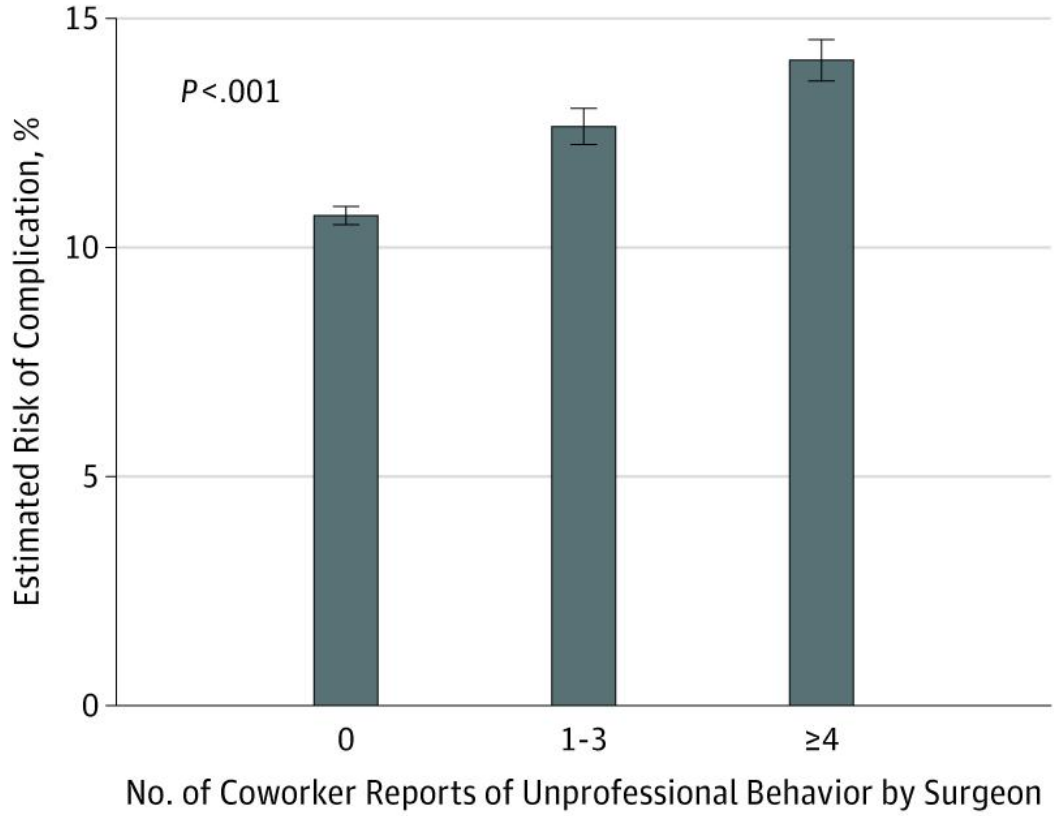
4.(Distant) Postoperative Management of Patient

Non-Technical Skills in Surgery

NTS represent a distinct talent domain beyond technical skill

Excellence in Technical skill alone is insufficient for optimal outcomes

Modifiable/Teachable factors that directly impact patient outcomes



Norton J et al., British Journal of Surgery, 2026

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Non-Technical Skills	**Empathy** **Communication** **Leadership** **Situational Awareness** **Integrity** **Humility** **Open-mindedness – Lifelong Learning**

Conclusions:

- **So Yes** - Surgeons at the highest level of technical skill are born!
  - *Not all determinants of surgical outcomes are innate—some skills and traits can be developed through training and mentorship*

- Regardless of whether surgeons are "born" or "made," educators have a responsibility:
  - To identify early interest
  - Nurture innate strengths
  - Deliberately cultivate the evolving competencies for modern-day surgery

Thank you

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