Residency Selection:
Can applicant data predict residency performance?

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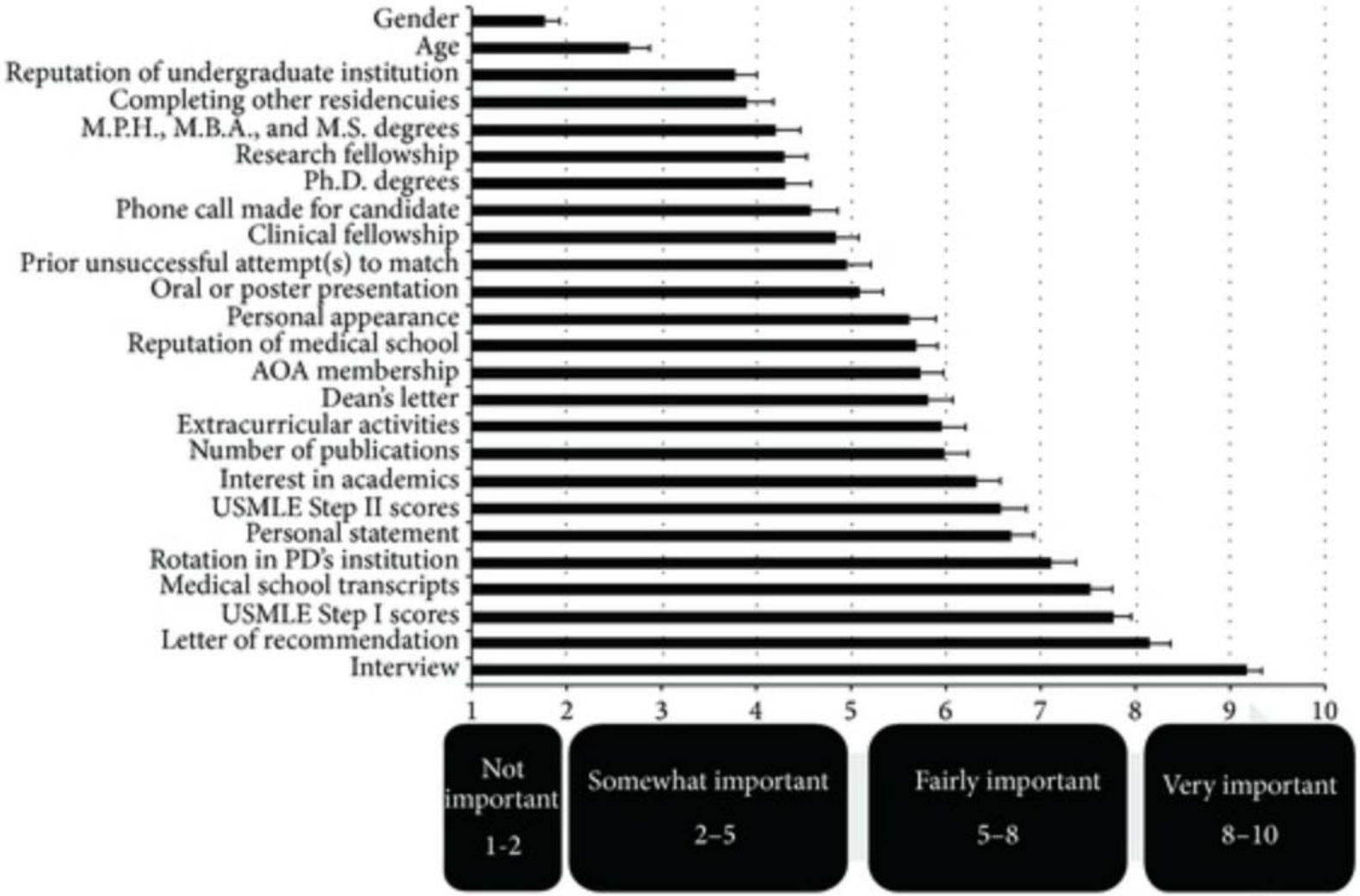
Applicant Data

- Medical School Transcripts
- USMLE Scores
- Honor Societies
- Research Experiences
- Personal Statement
- Dean’s Letter / MSPE
- Letters of Recommendation
- Special Skills
- Interview

PD Perceptions:
Dermatology Residency Selection Criteria



Gorouhi et al. Dermatology Res Pract. 2014

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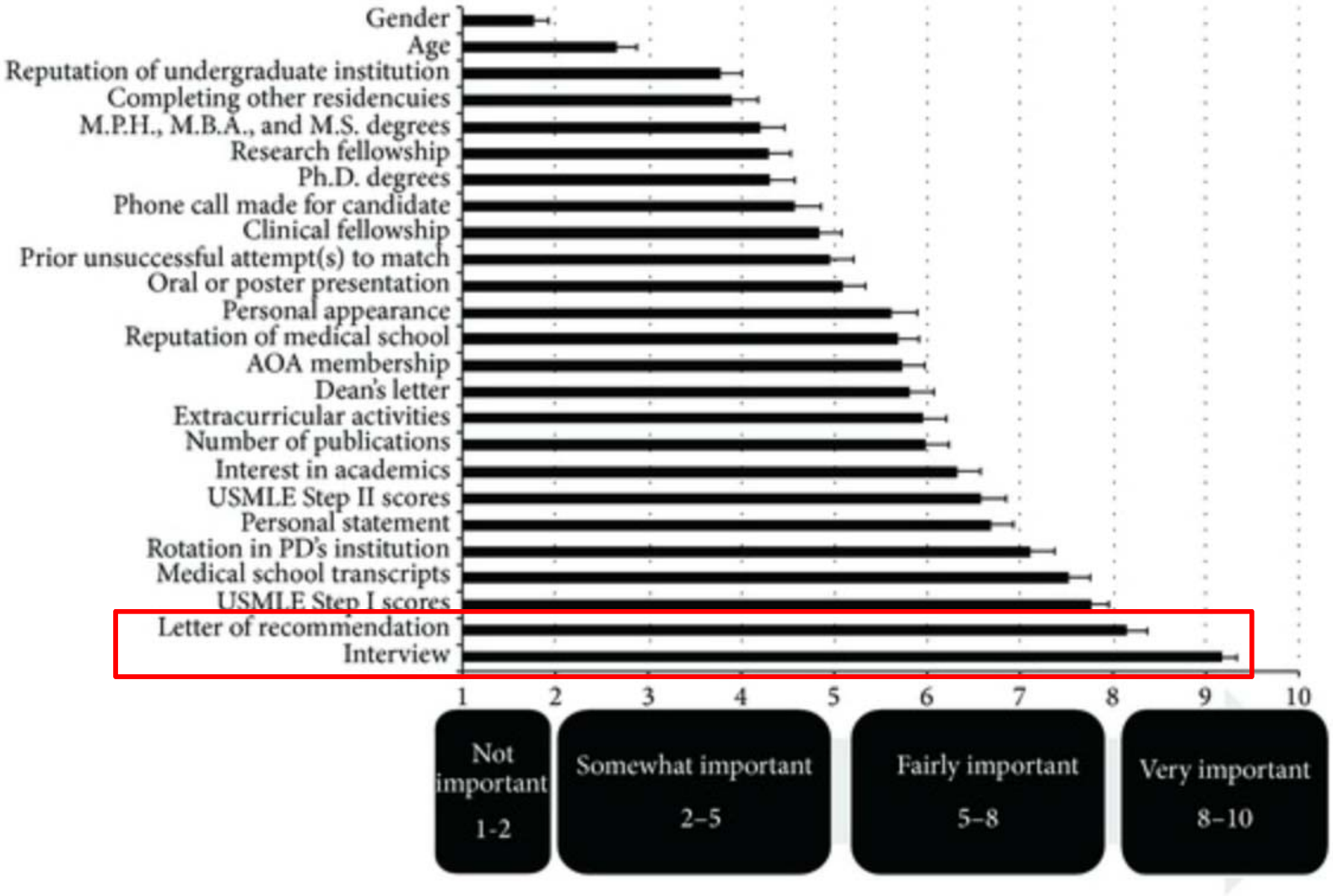

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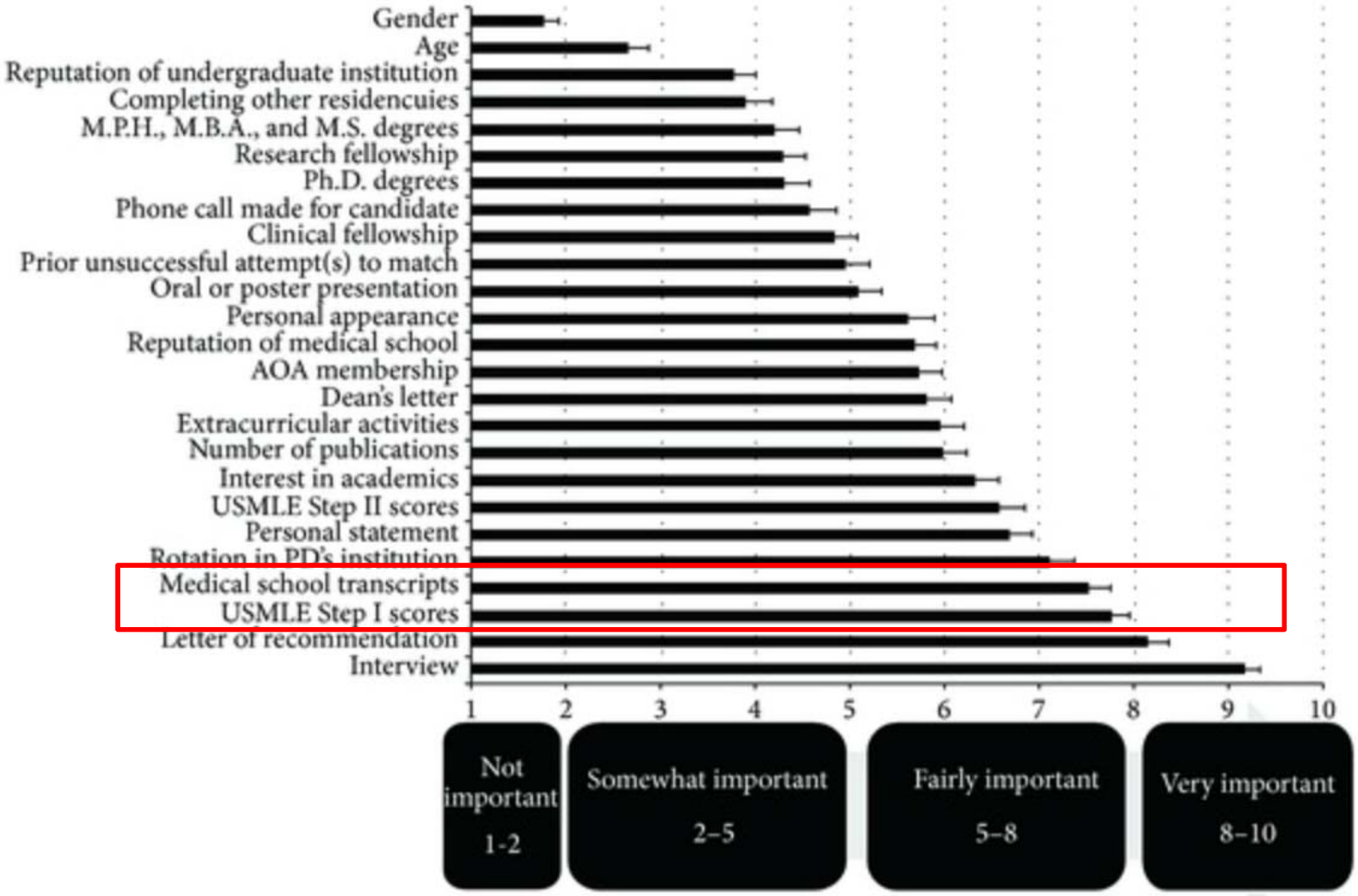

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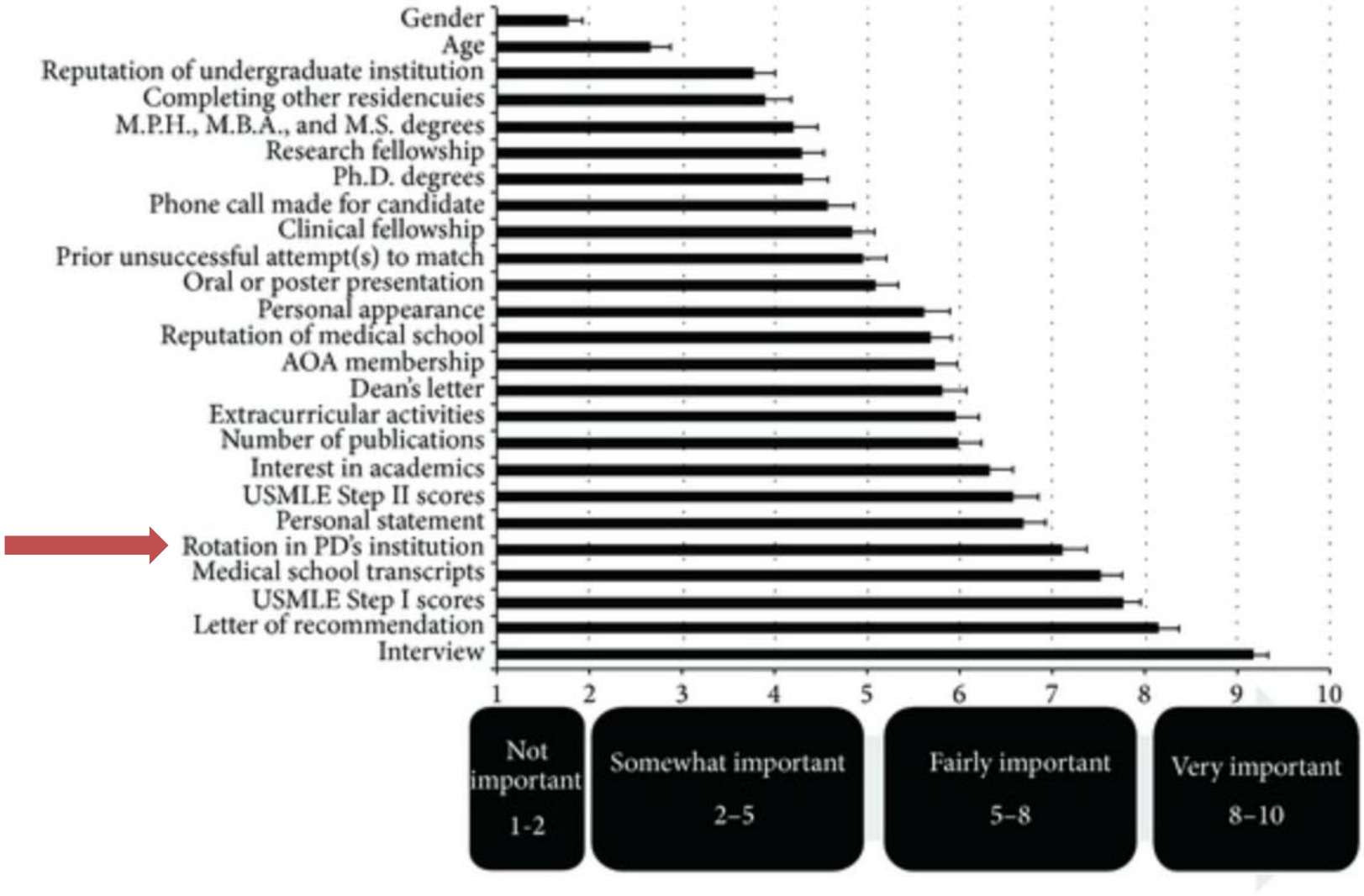

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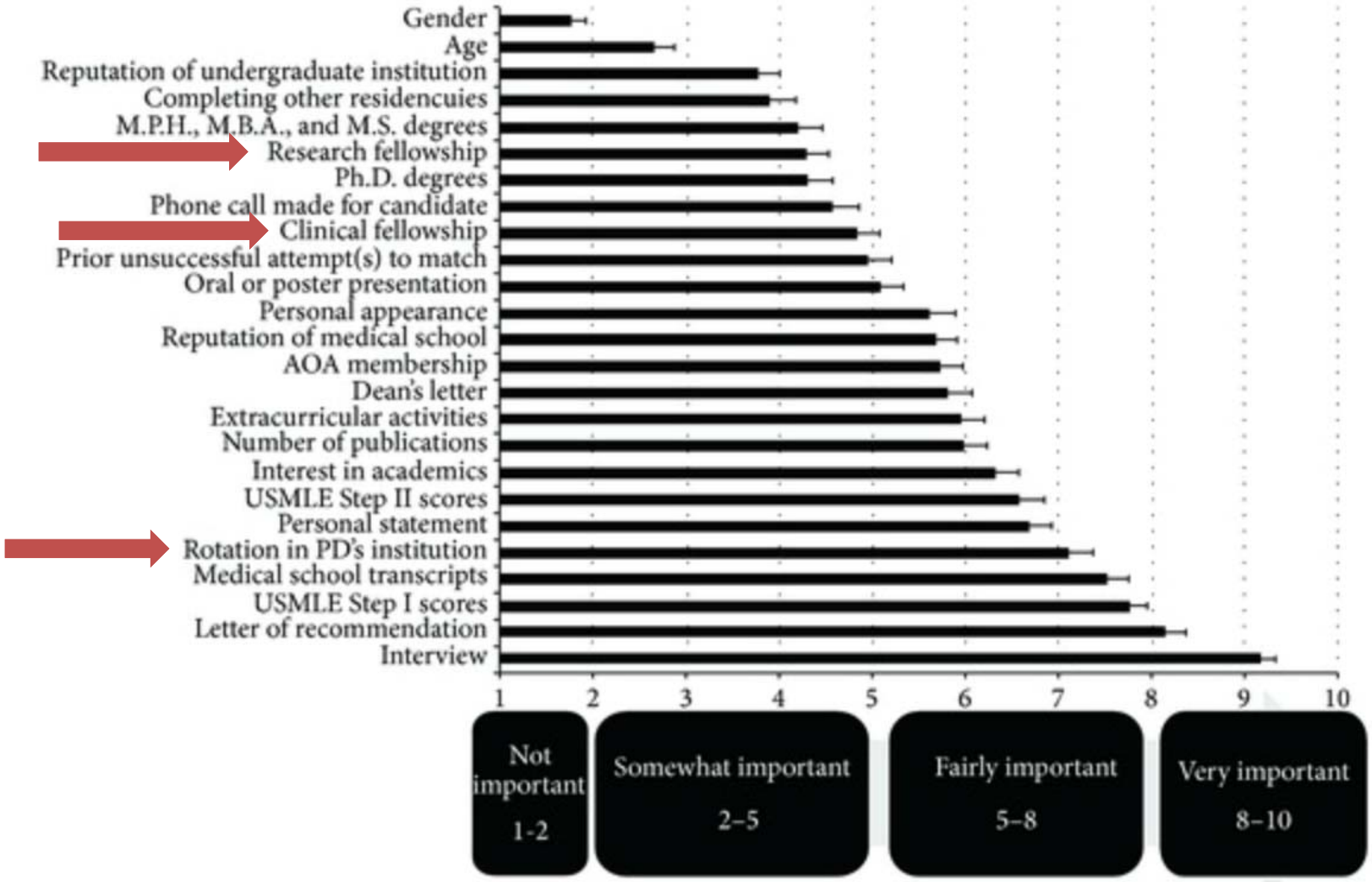


Gorouhi et al. Dermatology Res Pract. 2014

Defining Success in Residency

- Definitions varied per study
- Objective criteria:
  - ITE and Certifying exam performance
  - Completion of residency (Surgery)
- Subjective criteria:
  - Overall rating by clinical faculty (ENT, ortho, urology)
  - Program director rating (neurology)
  - Faculty ranking residents and placing in quartiles (OB-GYN)
  - Placement in the top 1/3 of the graduating class in the final semi-annual evaluation (EM)

Interview allows assessment of non-cognitive factors

- Interpersonal and communication skills
- Professionalism
- Enthusiasm for Dermatology
- Honesty
- May identify negative characteristics such as anxiety or aggression
- Allows for faculty and applicants to have a “gut feeling”

- Risks
  - Poor inter-rater reliability, idiosyncratic rapport, bias
  - Lack of standardization
  - Standard interview questions are highly “prepable”
  - Potential for “Halo effect” - prior knowledge of the applicant academic record affect outcome
  - Illegal questions – reproductive plans, marital status, inquiry about other programs

Sbicca et al; J Am Acad Dermatol. 2012; 67(3):429-35.

Does the interview predict subsequent resident performance?

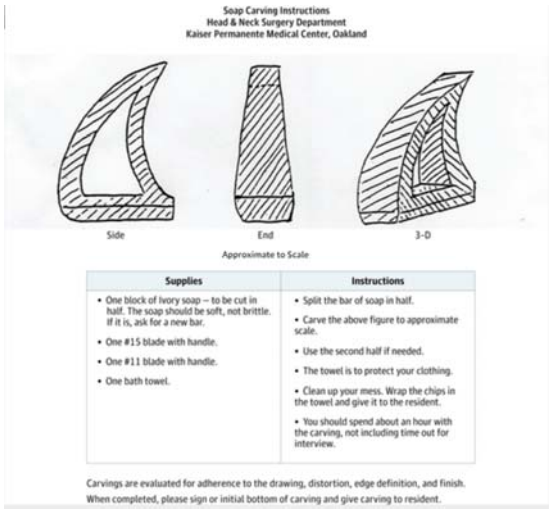
- Meta-analysis of 34 studies (n=3,793)
  - Outcomes studied
    - Clinical evaluations during residency
    - Global evaluation or ranking of residents
    - In-training Examination Results
    - Attrition
    - Problems with professionalism
  - 11 studies found the interview moderately predicted subsequent clinical performance in internship or residency (r=0.37-0.6)
  - 17 found no association between the interview and performance (r= -0.27 to +0.27)
  - Attrition was not consistently predicted by interview (6 studies)
  - Professionalism / problem residents / or future referral to impaired physician program could not be predicted by the interview (2 studies)

Stephenson-Famy et al; J Grad Med Educ. 2015; 7:539-48

Certain interview formats may be more predictive

- Traditional, unstructured interviews were the least predictive
  - Halo effect and other biases

- Interviews that included an assessment of surgical skills found mixed results (7 studies total)
  - Surgical station (ENT) correlated with future faculty ratings (R^2= 0.55; p<0.0001)
  - Soap carving station (ENT) was not predictive of manual dexterity, visuospatial ability, decision making, cognitive knowledge or overall resident performance at time of graduation



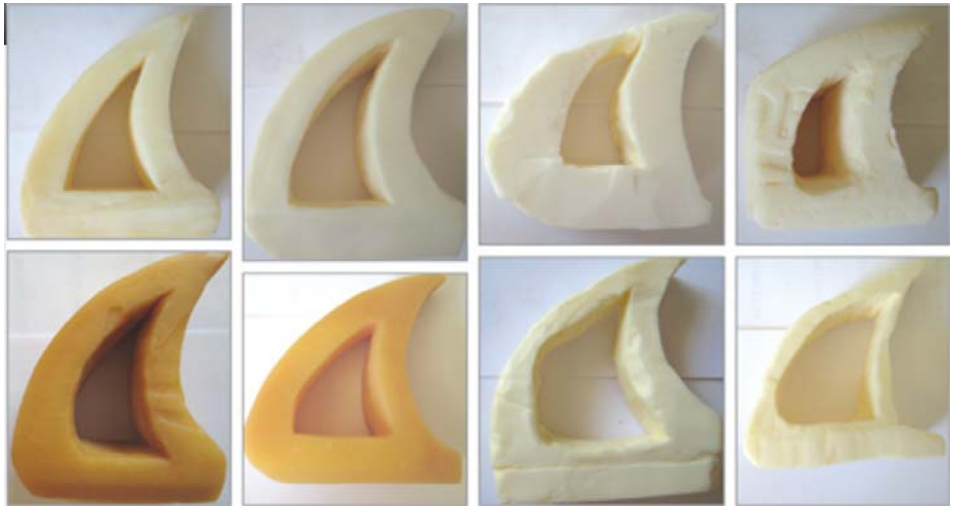
Soap Carving Instructions
Head & Neck Surgery Department
Kaiser Permanente Medical Center, Oakland

Side End 3-D

Approximate to Scale

Supplies	Instructions
• One block of Ivory soap – to be cut in half. The soap should be soft, not brittle. If it is, ask for a new bar. • One #15 blade with handle. • One #11 blade with handle. • One bath towel.	• Split the bar of soap in half. • Carve the above figure to approximate scale. • Use the second half if needed. • The towel is to protect your clothing. • Clean up your mess. Wrap the chips in the towel and give it to the resident. • You should spend about an hour with the carving, not including time out for interview.

Carvings are evaluated for adherence to the drawing, distortion, edge definition, and finish.
When completed, please sign or initial bottom of carving and give carving to resident.



Moore et al. Laryngoscope. 2015; 125(2):E57-61
Tang et al. JAMA Otolaryngol Head Neck Surg. 2014; 140(3):243-9

Certain interview formats may be more predictive

- Multiple mini-interviews (MMI) tended to correlate best with future clinical performance
  - Behavioral based, structured interview
  - Multi-station circuit designed to assess characteristics important to the field –
    - Relationship-building
    - Team skills
    - Integrity
    - Recognition of limitations
    - Communication skills
  - Types of stations:
    - Scenario with questions
    - Role Play
    - Simple task
    - Traditional Interview

Stephenson-Famy et al; J Grad Med Educ. 2015; 7:539-48

Interview aspects to improve reliability

BOX

Attributes of the Resident Interview That Improve Reliability

1. Explicit written description of the desired traits in an applicant/resident
2. Standardized questions to every applicant
3. Provision of behavior-specific anchors for rating scales for interviewers and using a scoring rubric to improve interrater and intrarater scoring
4. Use of multiple observers rather than a single interviewer
5. Training of interviewers in the format and scoring and including unethical and "illegal" question rules
6. Blinding of the interviewer to cognitive application data to minimize bias[107]

Stephenson-Famy et al; J Grad Med Educ. 2015; 7:539-48

Cost of Dermatology Application

- US Medical graduates enter residency with a median debt of $170,000
- 2014 estimation
  - $10K / applicant
  - $5 million total

	US medical school senior applicants	
	Matched	Unmatched
Number of applicants *	352	111
Median number of applications to programs *	72	81
Minimum number of applications to intern year programs based on prior median interview acceptance data †	6	6
Estimated overall application cost		
ERAS: $95 + ($10 × 10) + ($16 × 10) + ($26 × ((72 or 81) − 30) + 95)	$1,682	$1,916
USMLE fee: $75		
NRMP fee: $65		
Average number of interviews accepted (sum of both preliminary † and dermatology averages *)	15	10
Estimated overall interview cost ($500 per interview) ‡	$7,500	$5,000
Estimated away rotation cost	$2,142	$2,142
Estimated overall cost per applicant		
Application, interview, and away rotation costs	$11,324	$9,058
Estimated overall cost	$3,986,048	$1,005,438
Estimated overall total cost for all applicants	$4,991,486	

Mansouri et al. J Am Acad Dermal. 2016, 74(4):754-6

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Cost of Dermatology Application

- Mansouri has suggested to reduce application costs:
  - Limit the number of programs to which applicants can apply
  - Limit competition for limited number of spots
  - May also reduce the burden of reviewing the applications for the program

Mansouri et al. J Am Acad Dermal. 2016, 74(4):754-6

Letters of Recommendation

- Designed to provide a unique perspective on the student's strengths and abilities not found in other performance measures

- Shortcomings –
  - Selection bias
  - Inconsistencies between grades and written comments

Letters of Recommendation (LOR) are rated as the #1 factor in selecting candidates for interview

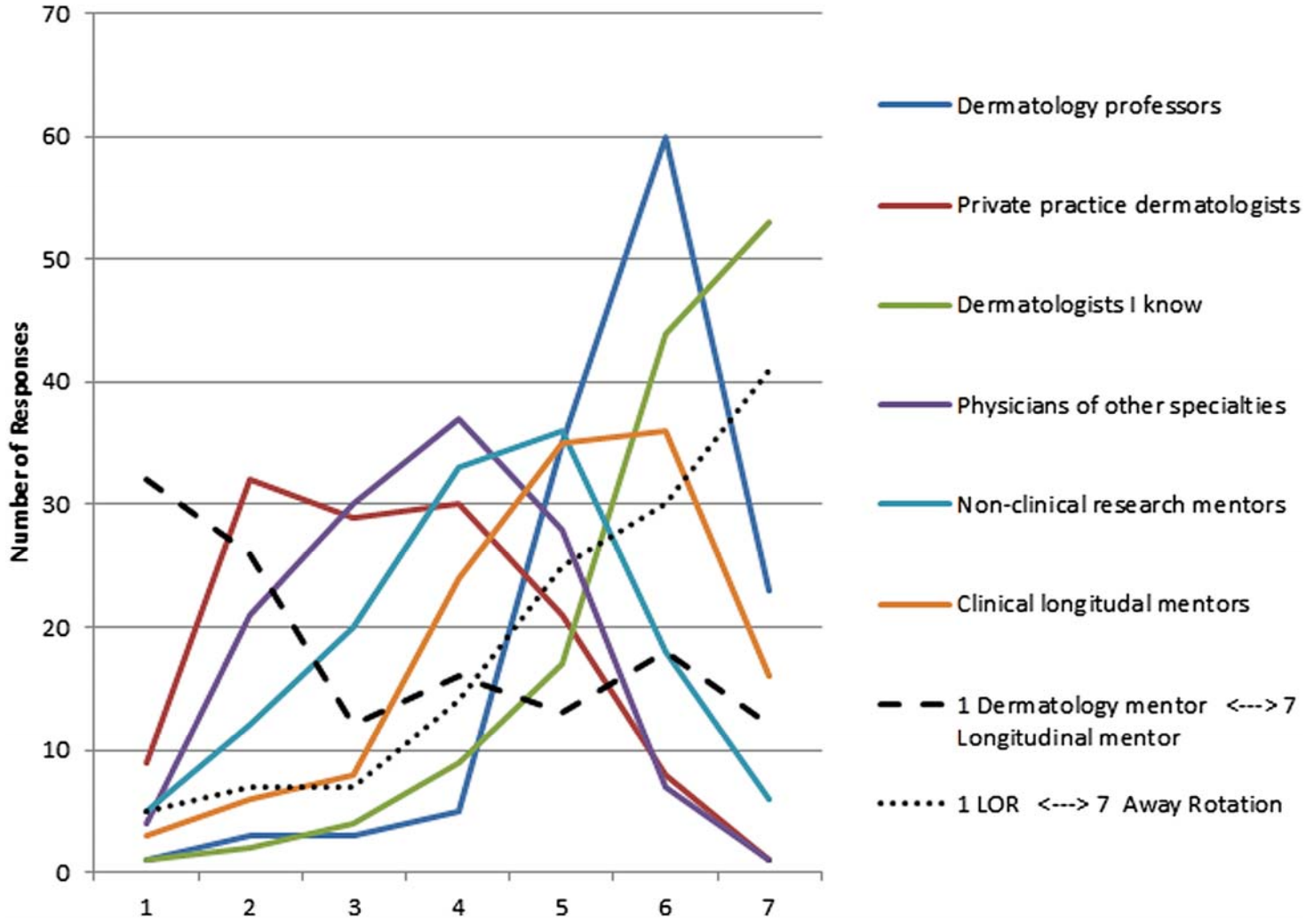
- Survey of the APD (2013)
  - 129 surveys were returned from 352 active members (37%).
  - LORs found to be more important in deciding which applicants to interview rather than determining the final rank list ($p < 0.0001$)

- IM survey (2009)
  - 110 institutions surveyed with a 75% response rate
  - 78% agreed LORs were important for trainee selection
  - Few believed it could discern marginal performance (31%) or predict future performance (25%)

Kaffenberger et al. J Am Acad Dermatol. 2014 Aug; 71(2): 395-6.

DeZee et al. Teach Learn Med. 2009; 21(2):153-8.

Academic dermatologists prefer LORs written by dermatology professors and “Dermatologists I know”



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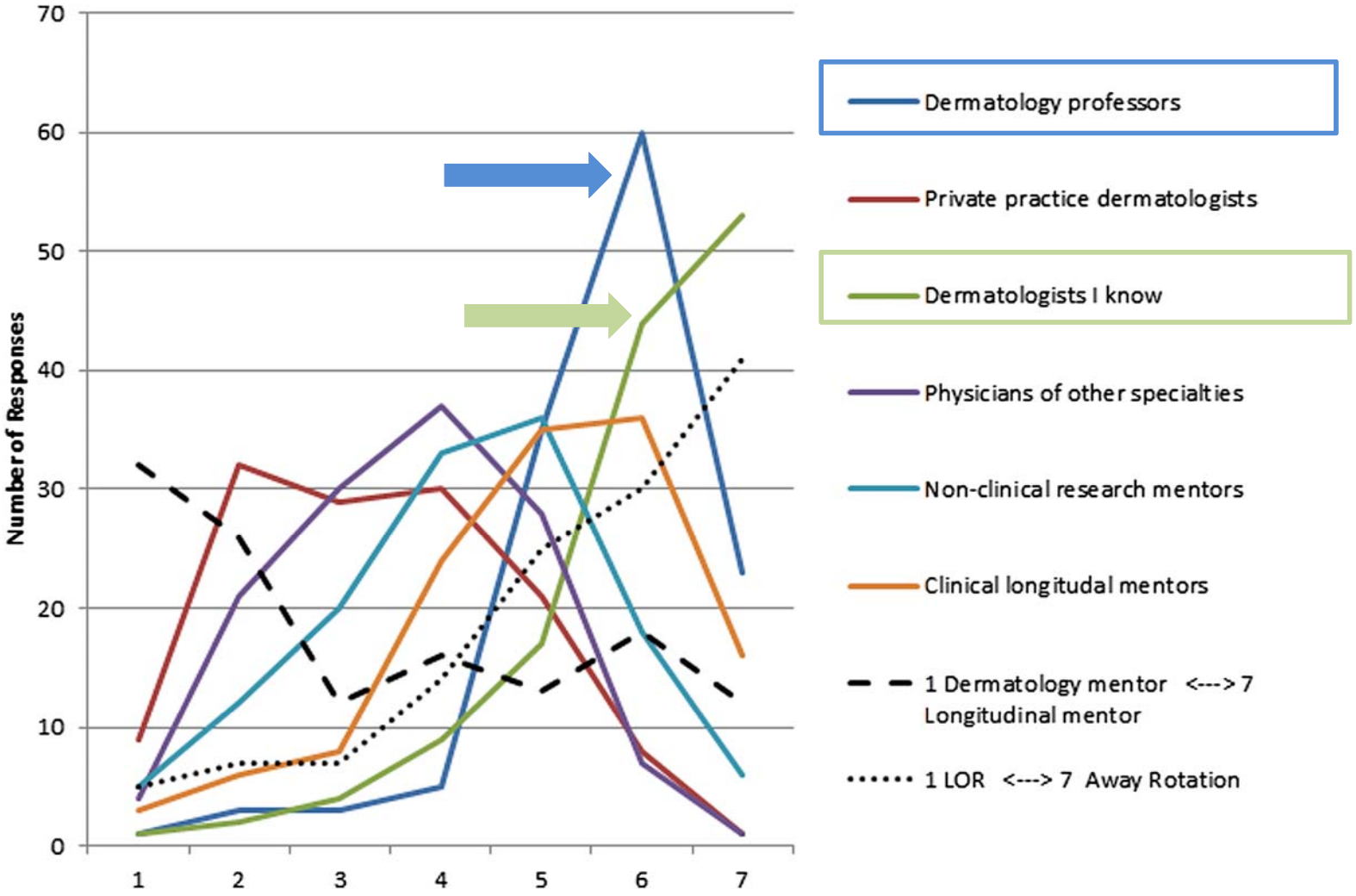

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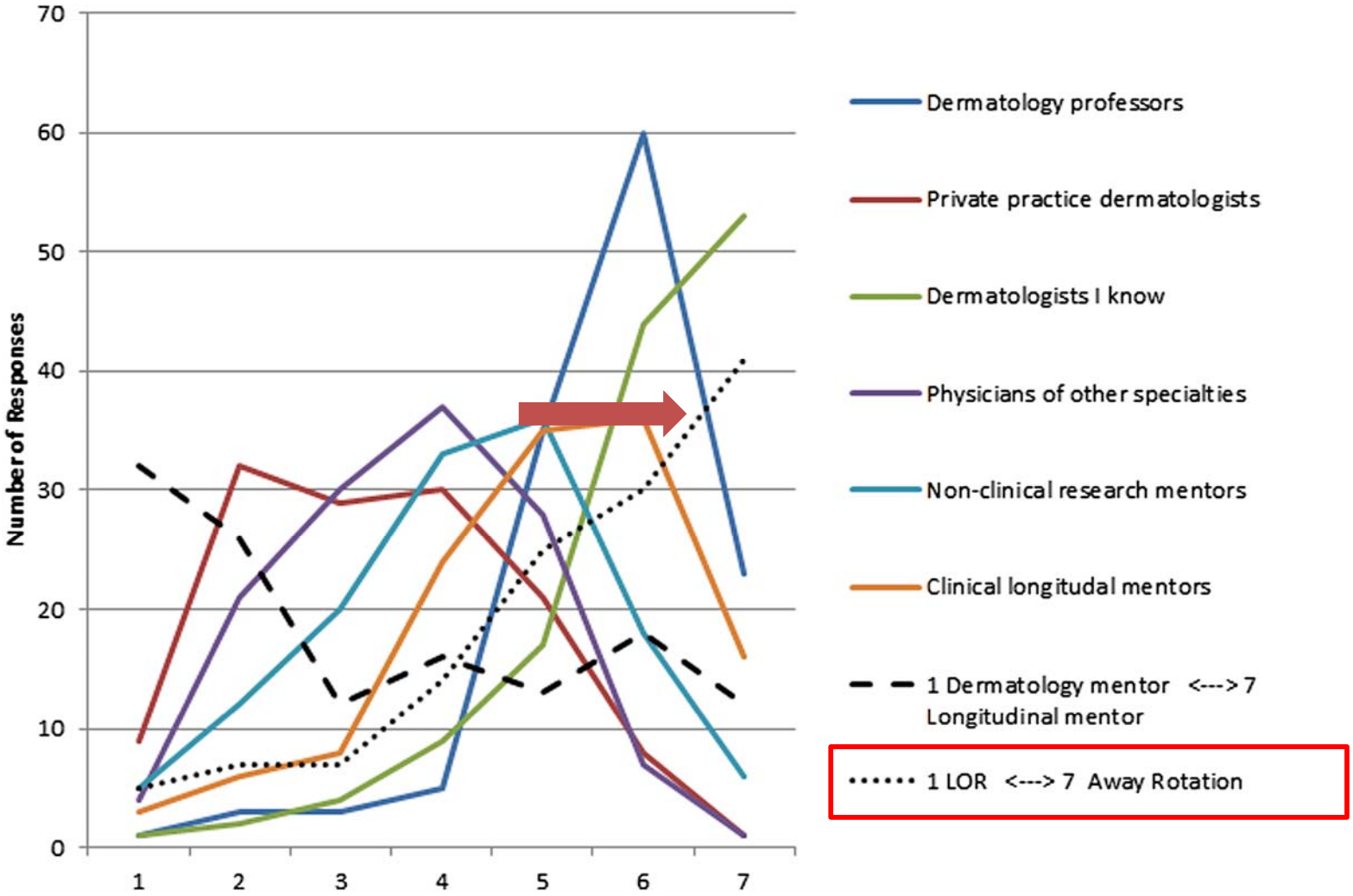

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LOR – Mixed predictor of success

- No data in dermatology looking at the association of letters of recommendation and resident success
- No association was found in OB-GYN, ENT, radiology, ortho, psych
- Quality of LOR associated with better clinical evaluations (urology, p=0.018)
- LOR weakly correlated with workplace based assessments and examinations (surgery, r = 0.15-0.35)
- IM study found that strongly favorable comparative statements in LOR were the only variable associated with professionalism scores during internship (p=0.001)
- Emergency Medicine found that “global rating” and “competitiveness” on standardized letter of recommendation (SLOR) from nonprogram leadership associated with placement in the top 1/3 of a resident’s graduating class (p= 0.03; 0.015)

Grewal et al. J Surg Educ. 2013. 70: 138-43.
Brothers and Wetherholt. J Surg Educ. 2007; 64:378-85.
Cullen et al. Mayo Clin Proc. 2011;86(3)197-202.
Bhat et al. J Emerg Med. 2015; 49(4): 505-12.

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LOR – Negative comments are meaningful

- Case control study of psychiatry residents found that any negative comment in the Dean's letter was associated with identifying a "problem resident." ($p<0.01$)

- Medical School Application LOR
  - Being rated "the best" among peers was associated with future AOA induction. ($p=0.01$)
  - Any non-positive comment was associated with being in the bottom of the class. ($p=0.005$)

Brenner et al. Acad Med. 2010; 85:1147-51.
DeZee et al. Acad Med. 2014; 89(10);1408-15.

USMLE Step 1 cited as an important factor in the selection process

- 91% of derm PDs cited USMLE Step 1 scores as important for selecting for interview (4.3 – 1-5 scale)
  - 2nd most important factor (#1 was LOR)
- Average USMLE Score of dermatology matched US Senior was the among the highest of all specialties
  - USMLE Step 1 – 249
  - USMLE Step 2 – 257
- 82% of dermatology programs have a “target score”
- 100% of dermatology programs seldom or never consider applicants who failed on the first attempt

Charting Outcomes in the Match for U.S. Allopathic Seniors. Sept 2016 www.nrmp.org
Result of the 2014 NRMP Program Director Survey. June 2014 www.nrmp.org

USMLE score has a moderate correlation with dermatology ITE score

Table III. Mean in-training examination scores and SD for residents scoring in 4 different ranges on the United States Medical Licensing Examination Step 1

USMLE Step 1 score	Mean first year ITE percentile ± SD	Mean second year ITE percentile ± SD	Mean third year ITE percentile ± SD
<225	32.28 (20.059)	37.67 (24.91)	37.73 (25.156)
226-240	41.65 (19.523)	51.70 (22.017)	53.87 (16.075)
240-255	56.15 (23.385)	62.15 (22.115)	60.67 (25.700)
>256	74.00 (27.604)	87.29 (11.870)	79.86 (19.056)

ITE, In-training examination; *USMLE*, United States Medical Licensing Examination.

- Correlation coefficients with USMLE were 0.48, 0.54, and 0.53 for ITE in years 1, 2, and 3, respectively ($p<0.001$)
- IM, Peds, OBGYN, ER, ENT, ortho, radiology, psych, & surgery found a similar correlation between USMLE and ITE scores
- NBME part I correlated with ABD Board exam scores

Fening et al. J Am Acad Dermatol. 2011; 64(1):102-6.
Case and Swanson. Acad Med. 1993; 68; S51-6.

USMLE does not predict overall resident quality

- USMLE scores do not correlate well with subjective performance as a dermatology resident (faculty rankings, evaluations, standardized patient encounters)
- Psych, Neurology, OB/GYN, Ortho, ENT, Peds Radiology had similar findings
- ER – USMLE score correlated with graduating the top 1/3 of the class (OR=1.02 (1.01-1.04); p=0.004)
- Surgery – Mixed results
- Multicenter review concluded USMLE scores are not correlated with clinical skill acquisition

Fening et al. J Am Acad Dermatol. 2011; 64(1):102-6.
Bhat et al. J Emerg Med. 2015; 49(4): 505-12.
McGaghie et al. Acad Med. 2011; 86(1) 48-52.

USMLE

- Predicts cognitive competence – MK
  - May predict future performance on exams
- NOT predictive of non-cognitive performance
  - Studies involving residents do not find a correlation to subjective performance
  - Few studies following cohorts of entire graduating classes of medical students tend to find correlations

Harfmann and Zirwas. J Am Acad Dermatol. 2011; 65:1010-1022.

3rd Year Clerkship Performance

- Medical School Grades rated as fairly important (7.5/10) in selecting dermatology residents (4th most important)
- Combination of examinations and supervisor evaluation
- Evidence that clerkships grades reflect both cognitive and non-cognitive performance
- Low clerkship GPA predicted poor knowledge ratings and was the only predictor of low professionalism ratings during internship (OR=7.29, 95% CI=4.1-13.0)
- Two prospective studies of medical students found clinical GPA correlated with PD ratings of overall performance during internship (r=0.49, p<0.005) (r=0.46, p<0.0001)

Paolo and Bonaminio. Acad Med 2003; 78:90-5.
Taylor et al. Acad Med 2005; 80:496-501.
Greenburg et al. 2007. J Gen Intern Med. 2007; 22; 22:1711-7.
Gorouhi et al. Dermatology Res Pract. 2014

3rd Year Clerkship Performance

- Clerkship Grades
  - Correlated with faculty rating – IM, PMR
  - No correlation with faculty rating – urology, OB-GYN, ENT, radiology, surgery
  - Mixed – ER, ortho
- Most studies that failed to find an association between grades and non-cognitive performance tended to examine specialty-specific grade rather than overall performance
- Students who were referred to a committee for review following completion of their internal medicine clerkship are more likely to receive poor ratings medical expertise and professionalism in internship and fail USMLE Step 3.

Dirschl et al. Clin Orthop Relat Res. 2002; 399:265-71.
Hemann et al. Mil Med. 2015; 180:71-6.

Clerkship Comments

- Contain qualitative comments designed to give feedback about professional behavior
- Most comments are positive, negative comments should be taken seriously
- U Michigan Study – 1 medical school class (n=153)
- Clerkship written comments evaluated
  - 1845 professionalism comments (2997 total)
  - Coded positive, negative, equivocal
  - 1721 positive, 106 negative, 18 equivocal
  - # of positive comments correlated with the student's clerkship Likert-type professionalism score
  - Negative comments and equivocal comments correlated with a lower professionalism score ($r= -0.45$, $p<0.001$)($r=-0.25$, $p=0.002$)

Frohna and Stern. Med Educ. 2005; 39: 763-8.

MSPE (Dean's Letter)

- Few studies found that the MSPE ranking of medical students had a low correlation with PD evaluations
- Most studies found no significant relationship to resident performance measures – radiology, OB-GYN, pediatrics, ortho, ER, urology, ENT

Lurie et al. 2007 Teach Learn Med. 19(3):251-6.

MSPE – Negative comments predict problems

- Case control study examined problem residents from 1987-2007 in a psychiatric program
- Defined as any difficulty that directly affected performance to below minimum standards of the program – in residency or post residency
- Strong correlation between negative comments in the Dean's letter and having problems ($\chi^2 = 7.5$, $p<0.01$)
- No correlation between interview or letters of recommendation

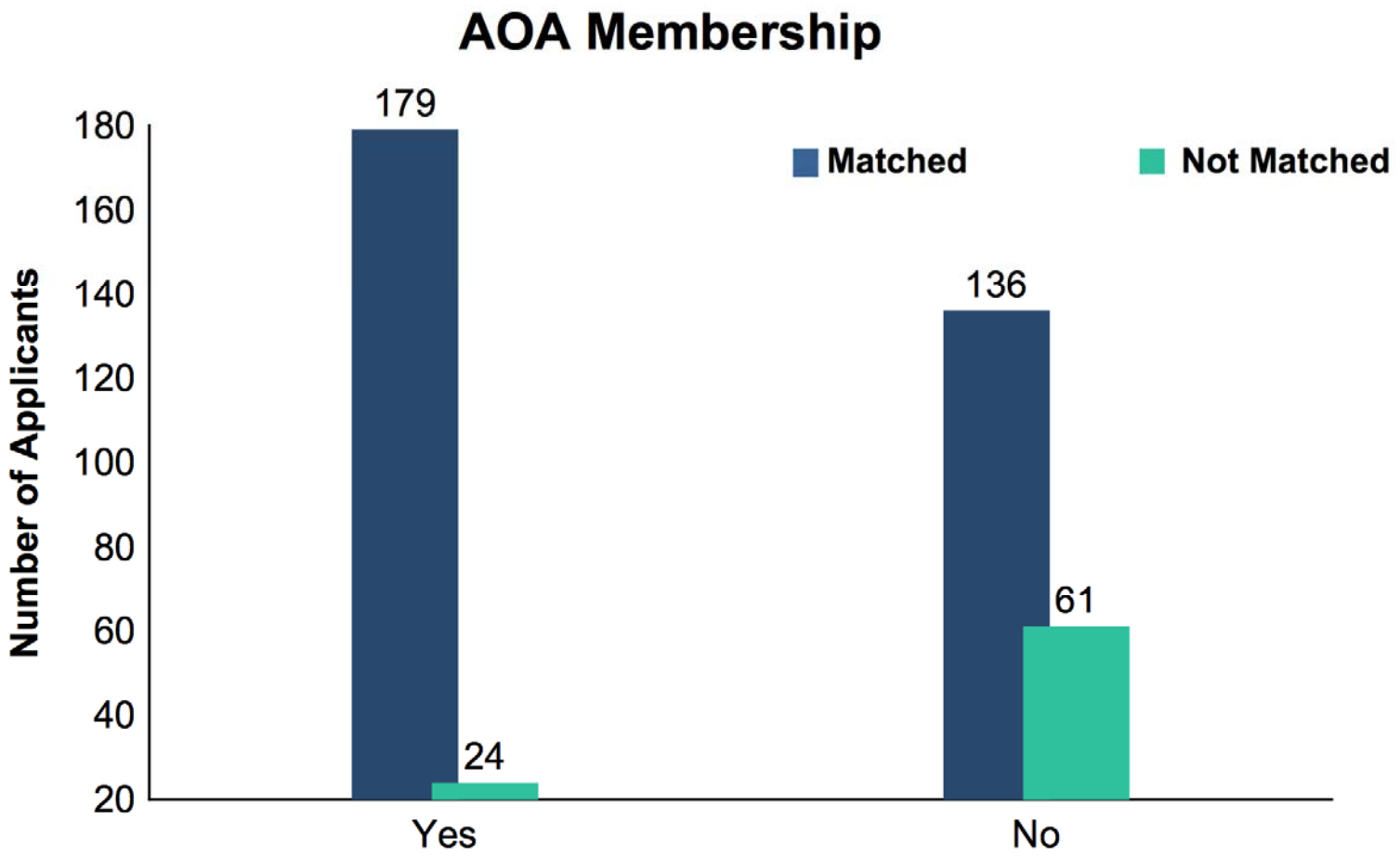
Brenner et al. Acad Med. 2010; 85:1147-51.

AOA Status

- AOA members are usually in the top quartile academically and selected based on additional demonstrations of leadership, professionalism, and service to the community
- AOA status –
  - Standardized tests
    - One ortho study - ITE
    - Correlated with USMLE Step 3 score & board passage
  - Faculty rating
    - Correlated - ER, ortho (esp ICS), surgery (PC, PBL, ICS)
    - No correlation - OB-GYN, pediatrics, radiology
    - Mixed - ENT

Tolan et al. J Surg Educ. 2010; 67(6):444-8..
Daly et al. J Am Coll Surg. 2006; 202(4):649-54.
Raman et al. Clin Orthop Relat Res. 2016; 474(4):908-14.
Bhat et al. J Emerg Med. 2015; 49(4): 505-12.

57% of dermatology matched US Seniors were AOA (compared to 28% of unmatched)



Charting Outcomes in the Match for U.S. Allopathic Seniors. Sept 2016 www.nrmp.org

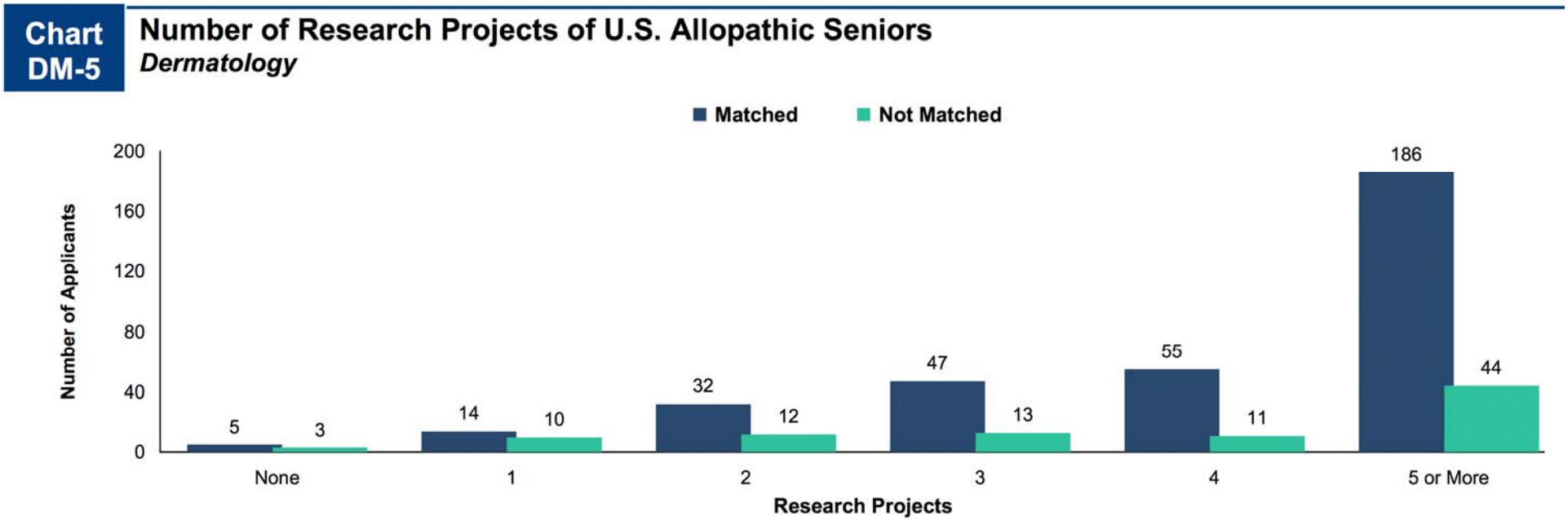
Research Experience

- EM study found that applicants with 5 or more publications were more likely to be placed in the top 1/3 of the graduating residency class.
- Ortho study found that student research may predict resident research productivity.
- Most studies found no correlation with number of publications as a student with success as a resident (neuro, OB-GYN, ortho, surgery)
- Some studies found evidence of students misrepresenting their research experience (derm, ortho, family med, radiology)

Wang and Keller. Dermatol Online J. 2016; 22(3).
Spitzer et al. J Bone Joint Surg A. 2009; 91(11): 2750-5.
Egol et al. J Am Acad Orthop Surg. 2011; 19(2):72-80.
Bhat et al. J Emerg Med. 2015; 49(4): 505-12.

High percentage of dermatology applicants list 5+ research projects

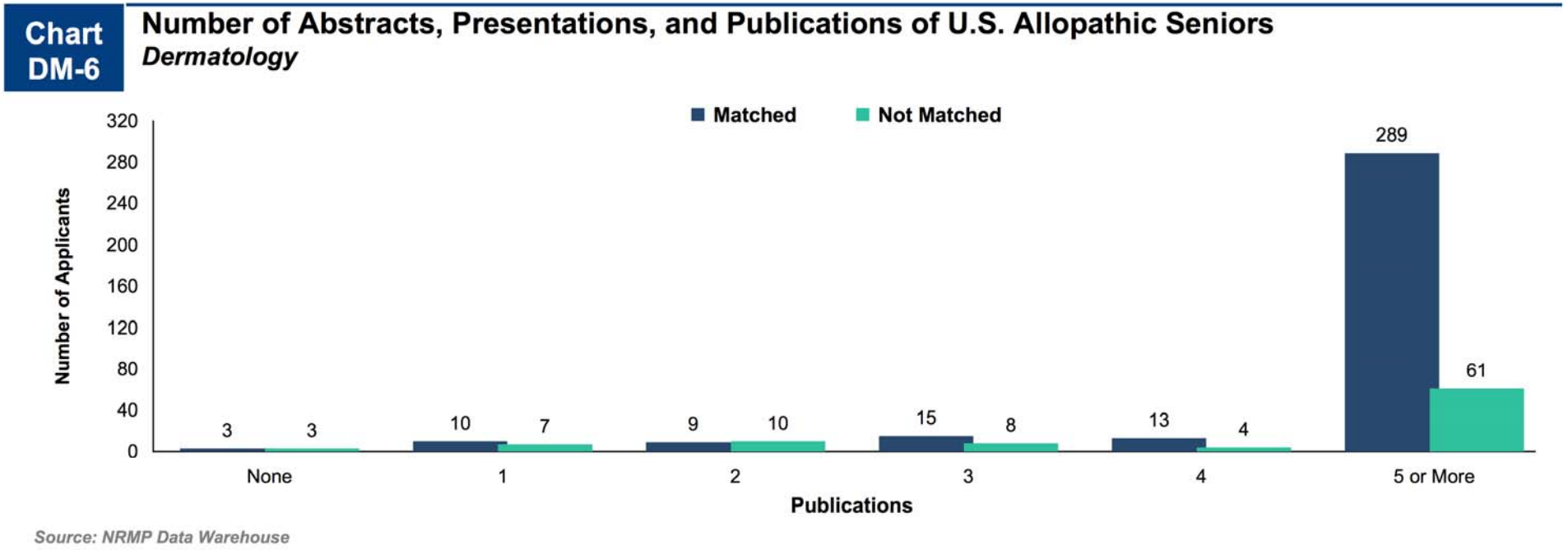
- Matched US Seniors averaged 4.7 projects compared to unmatched seniors with 3.8



Charting Outcomes in the Match for U.S. Allopathic Seniors. Sept 2016 www.nrmp.org

Most dermatology applicants list 5+ abstracts, presentations, or publications

- Matched US Seniors averaged 11.7 compared to unmatched seniors with 8.7



Charting Outcomes in the Match for U.S. Allopathic Seniors. Sept 2016 www.nrmp.org

Interest in Academics

- Study of the Harvard Combined Dermatology Residency program reviewed residency applications of former residents from 1991-2005 (n=89)
  - 37% of graduates worked in an academic setting
  - Factors correlating with an academic career:
    - # of research publications as a student (5.2 vs. 1.9 articles)
    - Advanced degree in addition to MD
    - # of volunteer experiences
- MD/PhDs were 1.63x more likely than MDs to choose a career in academics and remain academics

Lim and Kimball. Arch Dermatol. 2009; 145:943-944.
Wu et al. Dermatol Online. 2008; 14(1):27.

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Program characteristics may influence interest in academics

- One study found that dermatology residents interested in academic careers at the time of application often lost interest during residency
- Lack of mentorship shown to be associated with a loss of interest in academic careers
- Program characteristics may influence pursuit of academic careers
  - # of full time faculty members
  - # of full-time faculty publications

Reck et al. Arch Dermatol. 2006; 142:855-858
Wu et al. Arch Dermatol. 2006; 142:845-850

Table 1.

Dermatology Residency Program Variables Affecting the Ratio of Full-time Faculty Members Graduated to Estimated Total No. of Graduates

Variable	Spearman Rank Correlation Coefficient	*P* Value
Ratio of faculty to residents in 2008	0.60	<.001
Total no. of full-time faculty in 2008	0.54	<.001
No. of full-time faculty publications in 2008	0.45	<.001
No. of full-time faculty lectures given at annual society meetings in 2008	0.42	<.001
No. of full-time faculty on editorial boards in 2008	0.37	<.001
Presence of NIH funding in 2008	0.34	<.001
Presence of DF funding in 2008	0.28	<.05
Total no. of residents in 2008	0.19	<.05
Department vs division[a]	N/A	.92

Abbreviations: NIH, National Institutes of Health; DF, Dermatology Foundation; N/A, not applicable.
[a]Two-sample *t* test.

Aquino et al. Cutis 2015; 94(4):231-6

Predermatology fellowship may increase chance of matching for dermatology

- Survey of preresidency fellowships directors and fellows

  Fellowship Directors: 57% response rate (26/46)

  – 92% of 190 past fellows obtained dermatology residency position

  Fellows: 63% response rate (29/46)

  – 24 had unsuccessfully attempted to match prior to the fellowship
  – Of the 27 who attempted to match, 24 were successful (89%)

- In a study of previous graduates from medical school applying for dermatology (2006):
  – 16% (31/191) completed postgraduate fellowship following medical school
  – Nearly all fellowships were non-ACGME accredited (97%; 30/31)
  – 35% of applicants pursuing fellowship matched in dermatology (11/31), which was significantly increased compared to those without fellowship (OR 2.38, p= 0.4)

Wasong et al. J Am Acad Dermatol. 2008; 59(3):535-6
Stratman and Ness. JAMA Dermatol. 2011; 147(2);196-202

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Quality of the medical school attended does not predict performance as a resident

- EM and ENT studies found very weak association between the rank of the medical school and faculty rating of the resident
- No correlation found in other EM, ENT, radiology, OB-GYN, or neurology studies
- Likely more indicative of performance in college and experiences prior to medical school
- Medical school attended may relate to the culture and expectations of the applicant

Burish et al. Clin Neurol Neurosurg 2015; 135:69-72.
Stohl et al. J Grad Med Educ 2010 2(3):322-6.
Boyse et al. Acad Radiol 2002; 9:437-45.
Daly et al. J Am Coll Surg 2006; 202(4):649-54.
Chole and Ogden. Arch Otolaryngol Head Neck Surg 2012; 138(8):707-12.
Hayden et al. Acad Emerg Med 2005; 12(3) 206-10.
Bhat et al. J Emerg Med 2015; 49(4): 505-12.

SKILL

- High performance accomplishments outside the medical field – performing arts and collegiate athletics
- Predicted successful completion of general surgery residency
- Excelling in a team sport, but not musical excellence, correlated with higher faculty ratings (ENT) (R^2=0.32, p<0.001)
- ENT study found that having an exceptional trait in a nonacademic pursuit predicted faculty rating in the top 1/3 of the class (57% vs 10%; p<0.01)

Alterman et al. J Surg Educ 2011; 68(6); 513-8..
Daly et al. J Am Coll Surg 2006; 202(4):649-54.
Chole and Ogden. Arch Otolaryngol Head Neck Surg 2012; 138(8):707-12.

Personal Statement

- 332 personal statements from applications to the UC Davis Dermatology Residency Program in 2012

- Themes emphasized by matched applications ($p \leq 0.05$)
  - Study cutaneous manifestations of systemic disease (34% vs. 23%)
  - Contribute to the literature gap (8% vs. 1%)
  - Study pathophysiology of disease (8% vs. 2%)
- The authors state:
  - Describing “why dermatology” trended positively (75% vs. 70%) (p=0.15)
  - Stating a personal story trended negatively (64% vs. 73%) (p=0.28)

Olazagasti et al. Dermatol Res Pract 2014;934874.

Take home points

- USMLE score may predict future cognitive performance, such as medical knowledge, ITE, and ABD certifying exam performance
  - Should not be used to predict noncognitive performance
- Clerkship GPA may predict future cognitive and non-cognitive performance
- Equivocal or negative narrative comments should be taken seriously
- Strongly positive comparative statements in the LOR are associated with higher professionalism scores
  - Some data supporting standardized LOR as more predictive
- Interviewers blinded to applicant data may more accurately assess non-cognitive performance
- Slight trend for prior dermatology research or Ph.D to indicate an academic career

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Influence on applicant selection

- Residency selection committees may use this data to tailor their selection process, however there are a few caveats:

- Some applicant selection criteria is not well measured by ERAS data, including:
  - Performance during elective / away rotation in the department
  - Applicant “fit” with program culture and training experience
  - Applicant “fit” with current resident group
  - Research projects and interests that may be continued
  - If members of the selection committee would actually enjoy training the applicant

- “Success” in residency and beyond is not best measured through criteria such as ITE score, faculty rating as “the top 1/3 of their residency class”, or ability to simply complete residency.
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From: **Factors Influencing Applicants' Ranking of Dermatology Residency Programs in the National Resident Matching Program**

JAMA Dermatol. 2015;151(12):1378-1380. doi:10.1001/jamadermatol.2015.3363

Table 2. Factors in Determining Rank-Ordered Lists

Factor	Score, Mean (SD)
Perceived happiness of current residents	4.63 (0.69)
Personal interactions with faculty during interview	4.44 (0.75)
Personal interactions with residents during interview	4.30 (0.86)
Interview experience	4.25 (0.82)
Geographical location	4.10 (1.11)
Impression after medical student rotation at an institution	3.98 (1.72)
Impression of program director	3.96 (0.93)
Proximity of program to family, friends, or significant other	3.94 (1.26)
Advice by mentor or other trusted source	3.83 (1.29)
Successful placement of residents in desired fellowships	3.78 (1.12)
Didactic curriculum	3.75 (0.92)
Amount of surgical experience	3.68 (1.06)
Amount of dermatopathologic experience	3.66 (0.98)
University-based program vs community-based program	3.63 (1.37)

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