

Time and Financial Costs for Students Participating in the National Residency Matching Program (the Match[®]): 2015 to 2020

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ABSTRACT

Introduction. The purpose of this study was to provide information to assist students, faculty, and staff in making critical career-determining decisions regarding the residency NRMP “Match[®]” process.

Methods. A 47-item survey questionnaire was developed and piloted on a regional medical school campus in 2015. The revised questionnaire was distributed each year from 2016 to 2020 to fourth-year medical students after rank lists had been submitted. The questionnaire incorporated a request for comments about the interviewing experience and suggestions to improve the process. This narrative feedback was coded using a thematic analysis.

Results. The overall response rate was 86.1% (897/1,042). Annual response rates ranged from 70.0% in 2020 to 97.0% in 2018. Respondents' average age was 27.3 (\pm 2.7) years and 50.0% (448/897) were male. Most applied to family medicine (164/897; 18.2%) and internal medicine (140/897; 15.6%). Eight specialties had fewer than ten applicants over the six-year period. The number of students applying to individual specialties fluctuated annually, but no specialty showed a consistent upward or downward trend over the study period.

Conclusions. This study found huge differences in numbers of applications, expenses, and days interviewing. Students crave more guidance, a more efficient system, transparent communication with programs, and less pressure during the process. Reducing escalating volumes of applications is central to improving the system. Despite efforts to inform applicants better, student behavior is unlikely to change until they feel safe in the belief that lower and more realistic numbers of applications and interviews are likely to result in securing an appropriate residency position. *Kans J Med* 2021;14:53-63

INTRODUCTION

Concerns about the national residency matching program (NRMP) subsequently referred to as “the Match[®]” are reported by students throughout medical school.¹ Fourth-year medical students are preoccupied with success in the Match[®] and report the process as their dominant source of stress.¹⁻³ Several authors have criticized the curricular time lost and detriment to learning from students absent on interviews or distracted by Match[®] concerns during coursework.⁴⁻¹² Serious concerns have been raised about expenses incurred by students, especially those most heavily burdened with debt.¹³⁻²⁴ In addition to students, residency programs report “drowning in applicants” and struggling with escalating financial and time demands to process applications.^{16,24-49} These demands have fueled multiple calls for reform of the process.^{7-11,16,17,21,26-59}

Until the Spring of 2020, the demands on students and residency programs were expected to increase due to rising numbers of Match[®] participants and the trend for individuals to apply to more programs.^{16,25-40} The impacts of the dramatic changes to the Match[®] process due to the COVID-19 pandemic are difficult to predict. While applicant expenses are likely to fall due to the ban on in-person interviews, students could apply to more programs and/or consider programs across a broader geographical area, placing even greater burdens on residency programs. Those specialties that previously were associated with the highest applicant Match expenses could see a disproportionate increase in applications as they now appear more accessible to students who are disadvantaged economically and/or have high debt. All students could spend considerably more time arranging and participating in remote interviews. Applicants will continue to incur costs associated with application fees and possibly other expenses. An understanding of the previous patterns of costs and time expenditures is necessary to prepare students for the upcoming year and to provide the baseline data necessary to evaluate the impact of the proposed changes. We sought to provide updated comprehensive data on the time and financial costs incurred by University of Kansas School of Medicine (KUSM) students participating in the Match[®] over the past six years, including sources of funding and financial contributions from residency programs.

At least 20 studies have published cost estimates from different groups of Match[®] applicants (Table 1).^{3,17-22,47-58} The studies have limited generalizability due to the heterogeneous groups studied and results reported. Most studied applicants to highly competitive specialties; information on primary care specialties was limited. Some studies only covered interviewing expenses, whereas others attempted to capture all costs. Few studies included any contribution to applicant expenses by programs. All studies were surveys based on participant recall and several were limited by low response rates. Results were presented in different formats and some focused on specific aspects, such as comparing costs for matched and unmatched applicants, among specialties, or between United States allopathic graduates and other groups. Data also quickly became outdated in the dynamic Match[®] process. The most recent comprehensive study (2016), reported average costs of about \$3,500 with much higher spending for some specialties than others.¹⁹ This was generally consistent with other studies (Table 1).

Eleven of the identified studies provided information on how students funded interviews and related expenses.^{18-21,23,24,49,51,54,55,59} No single funding source dominated, but personal and/or additional student loans, savings, family gifts or loans, and credit cards consistently were reported. In several studies, students reported limiting the number of interviews due to expense, validating concerns that Match[®] expenses could limit career choices for students with limited resources.^{16,17,19,21,24} In the six studies reporting either total estimated time or “time away from clinical duties” for interviewing, students reported around 20 days for interviewing with a range of 1 to 90 days (Table 1).^{20,49,50,54,58,59}

All published studies provided “snapshot” information on different groups of students. By monitoring the entire KUSM graduating class over several years, we sought to add insights on trends in the time and costs of the Match[®] process for students. Our primary purpose was to provide information to assist KUSM students, and the faculty and staff who support them, in making critical career-determining decisions, but our findings could be useful to students and others in similar institutions.

METHODS

Participants. The participants were all fourth-year medical students of the University of Kansas School of Medicine (KUSM) who participated in the Match[®] to secure first year residency positions from 2016 to 2020, as well as a pilot completed in 2015. Every year, approximately 190 KUSM students use the Match[®] for nationwide application to residency programs in all specialties (Table 2).

Process. The research team consisted of faculty members involved in both medical student and graduate medical education, plus students from the third- and fourth-year classes during each survey year. The survey questionnaire was developed based on literature reviews and piloted on a regional campus in 2015.⁵⁴ The resulting 47-item questionnaire was reviewed each year and updated based on feedback from students and others, developments in the literature, and changes in the Match[®]. The questionnaire incorporated a request for student comments about the interviewing experience and suggestions to improve the process. The electronic questionnaire was distributed by e-mail weekly for four weeks in late February to early March, after rank lists had been submitted but before announcement of Match[®] results. Class leaders sent social media reminders two to three times weekly encouraging students to complete the questionnaire. As an incentive, a donation proportional to the response rate was offered to the student graduation celebration fund. This study was approved by the University of Kansas School of Medicine Institutional Review Board as Non-Human Subjects.

Statistical Analysis. Descriptive analyses provided demographic information about participants in all years (age, graduation year, gender); survey responses regarding specialty choice; number of residency program applications and interviews (offered and completed); time spent interviewing (in whole days); cost of residency interviews (in whole dollars); sources of funding (student loans, personal savings, credit cards, monetary gifts, private loans, and other sources); and any contribution to travel, lodging, and meal expenses from programs (as reported on a scale of 0 = 0% contribution and 4 = 100% contribution).

Chi-square tests were used to determine any statistical differences by specialty choice, and t-tests were used to compare the average costs of interviewing by specialty choice and year. All data analyses were performed using SPSS version 26.0 (SPSS Inc., Chicago IL).

Narrative responses from two open-ended questions at the end of the survey were analyzed independently by two investigators (KN, AW) to identify themes using a thematic analysis approach, a method to identify and interpret patterns of meaning across qualitative data.⁶⁰ Thematic analysis followed an inductive process of becoming familiar with the data, generating initial codes, then identifying and refining common patterns or themes. Both investigators independently coded the narrative comments and reached consensus on an agreed coding framework. One investigator (AW) completed the remaining coding and recursively refined a thematic structure in discussion with the second investigator (KN). Patterns of commonality and divergent views were identified. The two investigators then came to a consensus on the names of the themes and identified illustrative quotations to defend each theme identified. Any differences in interpretation were resolved by discussion.

The thematic findings were reviewed by all members of the research team (comprising of students, faculty, and leaders of the graduate medical education and student affairs offices) to confirm the themes from multiple informed perspectives. The final themes were determined by consensus of the team. Formal member-checking was conducted by presenting results to students who had completed the NRMP Match[®] process, medical student advisors and faculty, directors and faculty of residency programs, and staff of the Office of Student Affairs. This enabled the team to determine the trustworthiness of the themes and take the appropriate perspectives into account.

RESULTS

Participants. The overall response rate was 86.1% (897/1,042). Annual response rates ranged from 70.0% in 2020 to 97.0% in 2018. Respondents’ average age was 27.3 (\pm 2.7) years and 50.0% (448/897) were male. The largest numbers applied to family medicine (164/897; 18.2%) and internal medicine (140/897; 15.6%). Eight specialties had fewer than ten applicants over the six-year period. The number of students applying to individual specialties fluctuated year to year, but no specialty showed a consistent upward or downward trend over the study period.

Numbers of Applications and Interviews. Students applied to an average of 42.3 (\pm 25.7) programs (Table 3). This varied from 27.4 (\pm 24.0) in family medicine to 79.2 (\pm 46.5) in dermatology. In ten specialties, students reported averages of 50 or more applications. Specialties showed year-to-year variation in the average number of applications per student. Some specialties (e.g., family medicine, internal medicine, and pediatrics) remained stable, whereas others, such as obstetrics/gynecology and emergency medicine, showed a steady increase. Specialties with small numbers of applicants (e.g., neurology and dermatology) had large differences year to year, with

very high numbers (i.e., over 100 applications per student) in recent years. Within each specialty, individual students reported a wide range in the number of applications. The greatest range (10 to 250 programs) was in internal medicine and the smallest (60 to 75 programs) in thoracic surgery.

Table 1. Review of literature on costs and time reported by NRMP Match® applicants.

Study	Match® Year	Specialty/ Applicant Group Studied	Number of Respondents (response rate)	Mean Expense \$ (range)	Average Days Interviewing (range)	Comments
Teichman JMH, Anderson KD, Dorrough CR, et al. ⁴⁷	1998 - 99	Urology - national survey	230 (44%)	75% spent \$1,000 - 5,000 (not provided)	-	Focuses on ethical issues in Match® process
Little DC, Yoder SM, Grikscheit TC, et al. ⁴⁸	2002 - 03	Pediatric surgery - single program	36 (80%)	\$6,974 (not provided)	21 ¹	Interview costs only (26% credit card)
Kerfoot BP, Asher KP, McCullough DL ²⁰	2005 - 06	Urology - All U.S. programs	287 (61%)	\$4,000 (\$2,000 - \$5,000)	20 (14 - 30)	Interview cost only
Tichy AL, Peng DH, Lane AT ⁵⁰	2009 - 10	Dermatology - single program	125 (31%)	\$4,500 (not provided)	21	Application and interview costs
Claiborne JR, Crantford JC, Swett KR, et al. ¹⁷	2011 - 12	Plastic surgery - one program	127 (65%)	\$6,073 (not provided)	-	Interview costs only
Guidry J, Greenberg S, Michael L ⁵¹	2012 - 13	All Texas allopathic MS-4	274 (20.4%)	\$4,783 (\$127- \$20,000)	-	All costs
Oladeji LO, Raley JA, Smith S, et al. ²²	2013 - 14	22 specialties - U.S. allopathic seniors	834 (4.8%)	\$4,420 (not provided)	12 - 24	Interview costs only
Benson NM, Stickle TR, Raszka WV Jr ³	2013 - 14	All MS-4 at 20 selected institutions	1,362 (47.4%)	33% spent > \$4,000	-	-
Nikonow TN, Lyon TD, Jackman SV, et al. ²¹	2013 - 14	Urology - 18 programs	173 (not provided)	\$7,000 (\$3,000 - \$9,000)	-	Interview costs only
Agarwal N, Choi PA, Okonkwo DO, et al. ⁵²	2013 - 14	Neurological surgery - all U.S. programs	130 (64.4%)	\$7,180 +/- \$3,880 (\$4,500 - \$10,000)	-	Interview costs only
Camp CL, Sousa PL, Hanssen AD, et al. ⁵³	2014 - 15	Orthopedic surgery - 4 programs	408 (37%)	\$5,415 (\$450 - \$25,000)	-	Interview costs only
Fried JG ¹⁹	2014 - 15	All U.S. allopathic MS-4	953 (not provided)	\$3,423 +/- \$2,853 (\$80 - \$25,000)	-	Interview travel & lodging only
Callaway P, Melhado T, Walling A, et al. ⁵⁴	2014 - 15	Regional campus MS-4	-	29% spent > \$5,000	-	All costs
Fogel HA, Finkler ES, Wu K, et al. ⁵⁵	2014 - 15	Orthopedic surgery - single program	43 (90%)	\$7,119 (\$2,500 - \$15,000)	-	Interview costs only
Van Dermark JT, Wald DA, Corker JR, et al. ²⁴	2015 - 16	Emergency Medicine (EMRA members ²)	180 (12.6%)	\$4,159 (not provided)	-	Interview costs only
Fogel HA, Liskutin TE, Wu K, et al. ¹⁸	2015 - 16	All U.S. allopathic MS-4	759 (not provided)	30% spent > \$5,000	-	-
Blackshaw AM, Watson SC, Bush JS ⁵⁶	2015 - 16	Emergency Medicine - single program	66 (81%)	\$8,312 (not provided)	-	-
Polacco MA, Lally J, Walls W, et al. ²³	2015 - 16	Otolaryngology - two programs	103 (35%)	\$6,400 (\$1,200 - \$20,000)	-	-
Chang PS, Rezkalla J, Beard M ⁵⁷	2015 - 16	Single institution	40 (68.3%)	\$6,596.51 (not provided)	-	Includes Sub-Internship, interview, second look costs
Susarla SM, Swanson EW, Slezak S, et al. ⁵⁸	2015 - 16	Plastic surgery - single program	48 (90.5%)	63% spent > \$5,000	35% missed > 12 days	-
Walling A, Nilsen K, Callaway P, et al. ⁵⁹	2015 - 16	Single institution	163 (84%)	\$3,500 (\$20 - \$12,000)	26 (1 - 90)	-

¹Days away from clinical duties. Does not include vacation and other time used for interviewing.

²Emergency Medicine Residents Association

Table 2. Study participants by specialty: 2015 to 2020.

Specialty	2015 ^a	2016	2017	2018	2019	2020	Total (%)
Anesthesiology	2	10	6	19	12	10	59 (6.6)
Dermatology	0	3	0	2	4	0	9 (1.0)
Emergency Medicine	4	7	14	11	15	9	60 (6.7)
Family Medicine	13	31	24	46	28	22	164 (18.2)
General Surgery	6	10	20	12	13	8	69 (7.7)
Internal Medicine	5	28	30	29	30	18	140 (15.6)
Medicine/Psychiatry	0	0	1	1	0	1	3 (0.3)
Medicine/Pediatrics	2	4	5	2	1	1	15 (1.7)
Medicine/Primary	0	1	0	2	2	0	5 (0.6)
Neurology	0	2	1	0	3	3	9 (1.0)
Neurosurgery	0	4	5	7	6	1	23 (2.6)
Obstetrics & Gynecology	7	9	16	9	16	9	66 (7.3)
Ophthalmology	0	2	5	2	3	3	15 (1.7)
Orthopedic Surgery	2	11	4	5	4	6	32 (3.6)
Otolaryngology	1	2	3	1	2	2	11 (1.2)
Pathology	1	3	2	3	3	2	14 (1.6)
Pediatrics	3	13	15	19	12	19	81 (9.0)
Plastic Surgery	0	0	3	0	4	3	10 (1.1)
Preventive Medicine ^b	0	1	0	0	0	0	1 (0.1)
Psychiatry	0	6	5	6	5	6	28 (3.1)
Radiation Oncology	0	1	0	0	2	0	3 (0.3)
Radiology	1	7	10	13	11	5	47 (5.2)
Rehabilitation Medicine	0	0	3	4	3	2	12 (1.3)
Thoracic Surgery ^c	0	0	2	0	0	0	2 (0.2)
Urological Surgery	1	2	1	1	2	1	8 (0.9)
Urology	0	6	2	0	1	2	11 (1.2)
Missing	0	2	0	0	0	0	2 (0.2)
Total	48	163	177	194	182	133	897
Response Rate	78.6%	84.0%	92.0%	97.0%	93.3%	70.0%	86.1%

^aPilot study with one campus

^bResidency not available in State or Kansas City metro area

^cPotential outlier as many students apply to general surgery for the first three years of residency

Table 3. Applications, completed interviews, estimated costs, interview time by specialty (combined 2016 to 2020).

Specialty	N	Applications (n)			Completed Interviews (n)			Estimated Cost (\$)			Interview Time (# days)		
		M	SD	Range	M	SD	Range	M	SD	Range	M	SD	Range
Anesthesiology	59	39.9	17.8	12.0 - 90	11.7	3.2	5.0 - 18	4,083	2,793	800 - 15,000	27.7	12.8	2 - 70
Dermatology	9	79.2	46.5	11.0 - 120	9.6	3.8	6.0 - 19	7,022	6,015	500 - 20,000	34.6	24.4	12 - 90
Emergency Medicine	60	49.2	23.1	10.0 - 130	13.2	5.2	3.0 - 30	5,508	3,350	150 - 15,000	31.0	14.7	5 - 60
Family Medicine	164	27.4	24.0	3.0 - 183	10.4	4.0	2.0 - 28	2,688	2,197	20 - 11,000	26.6	15.8	2 - 120
General Surgery	69	47.3	18.1	1.0 - 102	11.0	4.0	1.0 - 22	5,826	4,350	300 - 30,000	31.4	19.7	1 - 90
Internal Medicine	140	42.3	27.3	10.0 - 250	11.1	4.0	2.0 - 24	4,352	3,191	100 - 20,000	28.0	14.5	2 - 90
Medicine/Psychiatry	3	40.7	13.0	28.0 - 54	11.7	4.5	7.0 - 16	5,500	707	5,000 - 6,000	37.5	10.6	30 - 45
Medicine/Pediatrics	15	36.0	24.1	12.0 - 108	11.9	4.0	6.0 - 20	3,923	2,130	1,000 - 8,000	35.3	14.9	12 - 60
Medicine/Primary	5	48.0	35.0	25.0 - 100	10.5	3.4	6.0 - 14	4,375	5,218	1,000 - 12,000	34.8	17.3	22 - 60
Neurology	9	51.8	27.6	26.0 - 114	11.6	4.0	4.0 - 18	6,214	3,053	1,000 - 10,000	29.5	15.4	8 - 60
Neurosurgery	23	37.7	22.5	15.0 - 105	11.2	2.8	6.0 - 18	4,105	2,916	300 - 12,000	29.4	12.8	8 - 60
Obstetrics & Gynecology	66	48.8	23.6	8.0 - 105	11.0	4.2	2.0 - 21	4,465	2,791	200 - 12,000	29.3	17.2	2 - 60
Ophthalmology	15	61.0	30.5	15.0 - 95	13.3	4.4	7.0 - 24	7,371	5,123	1,000 - 10,000	36.1	14.6	13 - 60
Orthopedics	32	55.6	29.5	7.0 - 110	9.1	3.4	4.0 - 17	3,678	2,338	500 - 10,000	21.3	13.0	6 - 60
Otolaryngology	11	64.8	21.5	25.0 - 100	14.1	4.8	7.0 - 20	6,611	3,180	3,000 - 11,000	34.0	14.9	15 - 60
Pathology	14	30.5	17.0	10.0 - 71	10.8	4.5	3.0 - 20	3,767	1,838	500 - 7,557	27.2	13.7	6 - 60
Pediatrics	81	33.5	15.9	10.0 - 81	11.8	3.8	1.0 - 25	3,874	2,716	100 - 12,000	28.9	14.4	3 - 90
Plastic Surgery	10	68.8	24.0	30.0 - 102	13.6	3.6	5.0 - 18	8,250	5,277	3,000 - 20,000	34.2	13.9	10 - 60
Psychiatry	28	44.0	20.6	10.0 - 81	9.3	3.0	3.0 - 15	4,438	2,914	700 - 10,000	24.7	15.5	8 - 90
Radiation Oncology	3	68.0	16.0	52.0 - 84	16.3	3.8	12.0 - 19	9,833	4,646	4,500 - 13,000	38.3	10.4	30 - 50
Radiology	47	50.7	24.1	20.0 - 120	13.6	4.7	6.0 - 30	5,962	3,680	1,500 - 20,000	32.5	16.3	12 - 90
Rehabilitation Medicine	12	41.3	21.7	18.0 - 97	11.5	3.5	6.0 - 16	5,263	2,871	1,500 - 10,000	31.3	10.2	15 - 51
Thoracic Surgery	2	67.5	10.6	60.0 - 75	15.5	0.7	15.0 - 16	6,750	2,475	5,000 - 8,500	33.5	4.9	30 - 37
Urological Surgery	10	62.4	44.9	4.0 - 124	12.3	8.2	4.0 - 27	5,400	5,241	500 - 15,000	26.9	17.8	2 - 53
Urology	9	43.3	18.6	6.0 - 61	12.6	5.0	5.0 - 20	4,900	2,902	200 - 8,000	27.3	11.8	12 - 45
Total/Overall	897	42.3	25.7	1.0 - 250	11.4	4.2	1.0 - 30	4,454	3,361	20 - 30,000	28.9	15.4	1 - 120

The average number of completed interviews was 11.4 (\pm 4.2), ranging from 9.1 (\pm 3.4) in orthopedics to 16.3 (\pm 3.8) in radiation oncology. In contrast to the number of applications, the average number of completed interviews per student remained largely unchanged for each specialty throughout the study period. Within each specialty, individual students reported large differences in the number of completed interviews. The largest ranges were in emergency medicine (3 to 30) and family medicine (2 to 28), but the range in number of completed interviews was 20 or more in seven specialties.

Time Spent Interviewing by Specialty. Students reported an average of 28.9 (\pm 15.4; range 1 to 120) days for interviewing and related travel (Table 3). The greatest average time commitment was reported by applicants to radiation oncology (38.3 days, \pm 10.4), whereas the smallest was for orthopedic surgery (21.3 days, \pm 13.0). In 13 specialties, students reported an average of more than 30 days. Within specialties, individual students reported a wide range of time commitment to interviews. The largest range was two to 120 days in family medi-

cine, but in 16 specialties the range in reported interview time among students was 50 days or more.

The average time increased from 25.2 (\pm 15.1, range 1 to 90) in 2016 to 28.9 (\pm 13.8, range 2 to 90) in 2020, with a peak of 31 (\pm 15.3, range 2 to 90) in 2019 [$t(324) = -3.4$, $p = 0.001$]. The largest increases were reported by dermatology from 2016 to 2019 (14.3 to 53.3 days; a 273% increase), and neurosurgery from 2016 to 2020 (from 17 to 51 days, a 200% increase). Several specialties showed large increases from 2016 to 2019 that were somewhat reduced in 2020. Eleven specialties reported decreased time between 2019 and 2020. Most of these one-year decreases were small, but obstetrics/gynecology decreased from 38 to 22 days (42%), and otolaryngology from 51 to 15 days (70%). Overall, seven specialties reported fewer days in 2020 than 2016: otolaryngology (29 to 15 days, 43.8%), psychiatry (26 to 18 days, 30.8%), medicine/pediatrics (42 to 30 days; 28.6%), obstetrics/gynecology (27 to 22 days; 18.5%), ophthalmology (29 to 15 days; 14.3%), and pathology (35 to 31 days; 14.3%).

Cost for Interviews. The average student-estimated interviewing expenses rose from 2016 to 2017 (\$3,506 to \$4,784) and from 2018 to 2019 (\$4,001 to \$5,423), but dropped between 2017 and 2018 (\$4,784 to \$4,001), and 2019 and 2020 (\$5,423 to \$4,529; Tables 3 and 4). Across the five years 2016 - 2020, average cost reported by all students dropped slightly from \$4,784 (\pm \$3,175, range \$150 to \$20,000) in 2016 to \$4,529 (\pm \$2,915, range \$400 to \$12,000) in 2020. This was not statistically significant [$t(277) = -0.69, p = 0.49, 95\% \text{ CI } -\$986 \text{ to } -\$476$].

The highest average costs were reported by applicants to radiation oncology (\$9,833), plastic surgery (\$8,250), and preventive medicine (\$8,000). The lowest costs were for family medicine (\$2,688), orthopedic surgery (\$3,678), and pathology (\$3,767). Individuals reported a wide range of expenses within each specialty. The highest costs reported by individuals were in general surgery (\$30,000), followed by dermatology, internal medicine, ophthalmology, plastic surgery, and radiology (each \$20,000).

In nine of the 20 specialties with applicants in both years, average costs rose between 2016 - 2020. The largest increases were in neurosurgery (\$7,750), ophthalmology (\$7,158), and neurology (\$6,500), but the increase only reached statistical significance for ophthalmology (Table 5). Seven of the eleven specialties reporting decreases from 2016 to 2020 had drops of more than \$1,000. The largest decreases were in rehabilitation medicine (\$3,217), urological surgery (\$2,800), and otolaryngology (\$2,667).

Funding Sources for Match[®] Expenses. New or additional student loans were the principal funding source for interview expenses, used by over 30% of students each year (Table 5). Credit cards increased as the principal funding source from around 17% to 27% during the study, while use of savings declined from 28.5% to 20%. In each study year, around 60% of students added to personal debt by using loans or credit cards to finance Match[®]-related expenses. Cost was reported as a limiting factor in interviewing 430 of 699 (61.5%) respondents, of whom 117 (16.7% of the total) reported cost as a very limiting factor.

Contributions to Travel Expenses by Residency Programs. Students reported a wide range of assistance with travel, lodging, and meals expenses by programs (Table 6). Results were inconsistent across the three years that this topic was included in the survey, especially for lodging. Programs were least likely to provide any contributions to travel costs. Radiation oncology provided the most travel assistance, but no programs in medicine/psychiatry, medicine/pediatrics, medicine/primary, ophthalmology, plastic surgery, psychiatry, thoracic surgery, and urological surgery covered any travel expenses. More than half of the students reported that all or nearly all programs contributed to the cost of meals during interviews. Neurology was reported to pay for 100% and the lowest contributions were from radiation oncology and thoracic surgery that covered 25 - 50% of applicant meals. Family medicine programs were most likely to pay or reimburse applicants for lodging with urology providing the least assistance.

Student Narrative Feedback. Three hundred and eleven students (34.6%) provided 329 narrative comments (Table 7). The largest number (79/311; 25.4%) expressed frustrations with inefficiencies and/or problems in scheduling interviews, mainly the use of multiple scheduling systems, random announcement of interview invitations, urgency

to accept interviews, and difficulties in planning. Several students mentioned using interview brokers or assistants. Forty-seven students (15.1%) recommended limiting students in the number of applications, but only seven (2.5%) called for programs to limit or correlate the number of interviews with the available positions. The 49 (15.8%) comments regarding student advising focused on need for earlier, more individualized, and more specialty-specific information from residents and faculty in their specialty of interest. Excessive cost was mentioned in 37 comments (11.9%), including difficulty using student loans for Match[®] costs. The 27 (8.7%) comments regarding the time requirement focused on two periods, the long duration of the interviewing season and the delay between submission of rank order lists and announcement of residency Match[®] results. Twenty-four comments (7.7%) discussed travel-related issues including expense, difficulties of winter travel, and calls for regional coordination of interviews or greater use of video triage of applicants.

The 27 (8.7%) comments regarding communication with programs focused on two stages of the process: confusion over post-interview communication, and uncertainty about status after submitting applications, especially if an interview was not offered or offered with very little notice. The students provided 18 positive comments (5.8%) about the scheduled time provided for interviewing in the fourth-year curriculum, but 21 (6.8%) comments critical of restrictions on interviewing at other times.

DISCUSSION

This was the first study to track the Match[®] experiences of students from a single institution over several years. In addition to longitudinal changes in costs and time requirements, it drew attention to the large differences among classmates applying to the same specialty in number of applications, costs and time, and added insights on funding sources, program contributions to expenses, and student perspectives. The findings highlighted the need for attention to the contribution of Match[®] expenses to student debt, the time consumed by the process throughout the senior year, and the lack of information of program contribution to applicant cost. The high response rates, volume of comments, and active involvement of students emphasized the importance of this topic for students.

The study confirmed and updated previous reports of the substantial cost to applicants of the Match[®] and the wide differences across specialties. Contrary to popular belief, overall interview costs did not rise steadily over time, but large increases were reported by students applying to certain specialties. The largest component of applicant cost was the interview and related travel. Some of the cost reduction in 2020 could reflect national and local initiatives counseling students to apply to more realistic numbers of programs, as well as extensive efforts by students to exchange cost-reduction information. While the small numbers of applicants limited the interpretation of our results, students in certain specialties appeared to be spending more time and money on roughly the same number of interviews. As national travel

and accommodation costs did not vary greatly over the study period, this suggested they travelled farther and/or spent more time on each interview. An additional factor could be expensive “last minute” travel if interviews were offered at short notice (e.g., cancellation slots).

Table 4. Increase in costs by specialty between 2016 and 2020.

Specialty	2016				2020				Cost Difference				
	N	M	SD	Range	N	M	SD	Range	Difference	t	df	p	95% CI
Anesthesiology	6	\$3,783	\$3,577	\$800 - \$10,000	8	\$4,088	\$2,175	\$1,750 - \$8,000	\$305	0.2	12	0.85	-\$3,042 to \$3,652
Emergency Medicine	13	\$5,604	\$3,461	\$150 - \$13,200	9	\$5,056	\$2,391	\$1,500 - \$10,000	-\$548	-0.4	20	0.69	-\$3,332 to \$2,236
Family Medicine	23	\$2,708	\$1,740	\$200 - \$6,000	20	\$2,350	\$1,919	\$400 - \$7,000	-\$358	-0.6	41	0.52	-\$1485 to \$769
General Surgery	17	\$6,421	\$3,384	\$2,000 - \$13,000	6	\$6,250	\$2,444	\$3,000 - \$10,000	-\$171	0.1	21	0.91	-\$3,317 to \$ 2,975
Internal Medicine	28	\$5,379	\$4,078	\$800 - \$20,000	17	\$3,994	\$2,492	\$500 - \$10,000	-\$1,385	-1.3	43	0.21	-\$3,360 to \$829
Medicine/ Pediatrics	5	\$4,000	\$2,449	\$1,000 - \$7,000	1	\$3,500	---	---	-\$500			---	---
Neurology	1	\$1,000	---	---	2	\$7,500	\$3,536	\$5,000 - \$10,000	\$6,500			---	---
Neurosurgery	4	\$4,250	\$2,062	\$2,000 - \$6,000	1	\$12,000	---	---	\$7,750			---	---
Obstetrics & Gynecology	13	\$3,777	\$2,574	\$500 - \$7,500	7	\$5,214	\$2,233	\$2,000 - \$8,000	\$1,437	1.2	18	0.23	-\$991 to \$3,865
Ophthalmology	4	\$3,175	\$2,030	\$1,200 - \$6,000	3	\$10,333	\$1,528	\$9,000 - \$12,000	\$7,158	5.1	5	0.004	\$3,534 to \$10,782
Orthopedics	4	\$3,625	\$1,887	\$1,500 - \$6,000	6	\$5,333	\$3,869	\$1,500 - \$10,000	\$1,708	0.8	8	0.44	-\$3,159 to \$6,575
Otolaryngology	3	\$6,167	\$4,193	\$3,500 - \$11,000	2	\$3,500	\$707	\$3,000 - \$4,000	-\$2,667	-0.8	3	0.46	-\$12,683 to \$7,349
Pathology	2	\$4,000	---	---	2	\$5,279	\$3,222	\$3,000 - \$7,557	\$1,279	0.6	2	0.63	-\$8,524 to \$11,082
Pediatrics	14	\$4,987	\$3,141	\$400 - \$10,000	17	\$3,609	\$2,489	\$700 - \$8,500	-\$1,378	-1.4	29	0.18	-\$3,444 to \$689
Plastic Surgery	3	\$4,167	\$764	\$3,500 - \$5,000	3	\$8,333	\$2,887	\$5,000 - \$10,000	\$4,167	2.4	4	0.07	-\$621 to \$8,953
Psychiatry	5	\$5,900	\$2,793	\$2,500 - \$10,000	5	\$4,200	\$4,006	\$700 - \$9,000	-\$1,700	0.78	8	0.46	-\$6,736 to \$3,336
Radiology	8	\$5,750	\$2,726	\$3,500 - \$12,000	4	\$4,375	\$1,797	\$3,000 - \$7,000	-\$1,375	0.9	10	0.39	-\$4,764 to \$2,014
Rehabilitation Medicine	3	\$6,667	\$3,055	\$4,000 - \$10,000	2	\$3,450	\$1,061	\$2,700 - \$4,200	-\$3,217	-1.4	3	0.26	-\$10,679 to \$4,244
Urological Surgery	1	\$9,800	---	---	1	\$7,000	---	---	-\$2,800			---	---
Urology	1	\$6,000	---	---	2	\$8,000	---	---	\$2,000			---	---
Total/Overall	160	\$4,784	\$3,175	\$150 - \$20,000	119	\$4,529	\$2,915	\$400 - \$12,000	-\$255	-0.69	277	0.49	-\$986 to \$476

Table 5. Funding sources for interview expenses.¹

	Year											
	2015		2016		2017		2018		2019		2020	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Student Loans	32	(37.6)	102	(35.1)	123	(37.7)	128	(33.0)	117	(32.6)	76	(30.3)
Savings	24	(28.2)	71	(24.4)	65	(19.9)	89	(22.9)	80	(22.3)	64	(25.5)
Credit Cards	14	(16.5)	69	(23.7)	73	(22.4)	89	(22.9)	94	(26.2)	64	(25.5)
Gift	12	(14.1)	37	(12.7)	45	(13.8)	58	(14.9)	51	(14.2)	31	(12.4)
Private Loans	2	(2.4)	9	(3.1)	16	(4.9)	12	(3.1)	8	(2.2)	9	(3.6)
Other ²	1	(1.2)	3	(1.0)	4	(1.2)	12	(3.1)	9	(2.5)	7	(2.8)
Total	85		291		326		388		359		251	

¹All funding sources identified by students.

²Airline/credit card points and other unidentified income used.

Table 6. Student-reported contributions to travel expenses by residency programs.*

Type of Expense	Percent of Programs Paying	Number (%) of Students Reporting Payments							
		2017		2018		2019		2020	
Travel	0%	139	(84.2)	130	(67.7)	156	(89.1)	107	(86.3)
	25%	14	(8.5)	56	(29.2)	11	(6.3)	7	(5.6)
	50%	7	(4.2)	1	(0.5)	0	(0.0)	4	(3.2)
	75%	4	(2.4)	5	(2.6)	7	(4.0)	4	(3.2)
	100%	1	(0.6)	0	(0.0)	1	(0.6)	2	(1.6)
Total		165		192		175		124	
Lodging	0%	34	(20.6)	23	(12.0)	55	(31.4)	34	(27.4)
	25%	55	(33.3)	54	(28.1)	53	(30.3)	37	(29.8)
	50%	23	(13.9)	21	(10.9)	0	(0.0)	14	(11.3)
	75%	33	(20.0)	61	(31.8)	51	(29.1)	24	(19.4)
	100%	20	(12.1)	34	(17.7)	17	(9.7)	15	(12.1)
Total		165		193		176		124	
Meals	0%	12	(7.3)	9	(4.7)	22	(12.6)	17	(13.8)
	25%	18	(10.9)	17	(8.9)	8	(4.6)	14	(11.4)
	50%	12	(7.3)	16	(8.3)	0	(0.0)	8	(6.5)
	75%	30	(18.2)	33	(17.2)	49	(28.0)	19	(15.4)
	100%	93	(56.4)	117	(60.9)	97	(55.4)	65	(52.8)
Total		165		192		176		123	

*All funding sources identified by students. Question added in 2017.

Table 7. Student narrative feedback.

Major Theme	Illustrative Quotations (Selected from 329 total comments)
Inefficiencies/frustrations with scheduling system (79)	• Using multiple scheduling programs is ludicrous, the most stressful part of the whole process.
	• Impossible to predict where or when slots will be available. Offers come in randomly.
	• Glued to your computer/phone for two to three months to respond quickly to interviews.
	• Had to use an interview broker.
	• At multiple interviews there were cancellations and the spots didn't get filled.
	• The process was a nightmare to be honest.
Improve information and assistance on process (49)	• Need more counseling on appropriate number of applications.
	• Felt unprepared in October without mock interviews.
	• Needs explained by specialty as experiences are so different.
Limit number of applications per student (47)	• There should be a max number of applications allowed per specialty.
	• Give students a max of 25 - 30 applications.
	• Limit the number of applications. I applied to programs I wasn't interested in to reach a total number.
	• I wish there was a limit in the number of programs we can apply to and a limit in the number of programs we can interview at.
Excessive cost (37)	• The cost is WAY too high.
	• Take away ridiculous fees.
	• Too much money for student with lot of debt.
	• Increase MS-4 cost of attendance to allow for greater financial aid awards.
	• Money was the biggest limiting factor. I had to take out extra loans and was constantly stressing out about how to pay for things.
	• Applications should be free. It is criminal to charge \$26 for each additional application which costs nothing to send digitally.
Excessive time demands (27)	• Time period greater than people realize.
	• Interviews were so spread out. I needed more than two months to interview.
	• Decrease time from rank list due and Match® day to allow more time for SOAP or to relocate.
	• Tell us where we Match® earlier. The algorithm takes literally seconds.

Table 7. Student narrative feedback. *continued.*

Major Theme	Illustrative Quotations (Selected from 329 total comments)
Communication problems with programs (27)	• Multiple programs that I never heard from- even a wait list or rejection.
	• It feels very dishonest and secretive due to expressed or unexpressed interest.
	• Clarify post-interview communications.
	• Enforce post-interview communication regulations.
	• Increase transparency from programs regarding their selection criteria.
Travel difficulties (24)	• It was a huge hassle flying across the country multiple times.
	• Winter travel is expensive and disrupted by weather and holidays.
	• Difficult to schedule interviews by location. Regional programs could coordinate.
	• Should have online or video interviews first with optional visit.
Limits on time out of courses for interviews (21)	• Administration needs to be more relaxed about students taking time off to interview.
	• Limiting to two days per rotation is ridiculous.
	• Interviewing should take priority over possibly missing a few days of a rotation.
	• Forcing students to break the rules and hope you don't get caught.
Support for two month scheduled interview time (18)	• At least two months needed. We had great opportunities compared to other students.
	• Having two months [off for interviews] was extremely helpful.
	• Keep the interview months- it gives our students a huge advantage.

Previous suggestions to curtail Match[®] costs for students have focused almost exclusively on rationalizing the number of programs to which each student applies. Our data showed that increasing the number of applications did not result in more interviews, confirming the Association of American Medical Colleges report that “shot-gun” applications are inefficient and costly for students and place huge burdens on residency programs to triage large numbers of applicants.⁶¹ Nevertheless, narratives confirmed that students are prepared to do “whatever it takes” regardless of data or advice.⁴⁷ The high stakes incentivize students to over-apply, leading to pressures on programs to identify the most appropriate applicants, and setting up a “vicious circle” of ever-escalating time and cost demands on both applicants and residency programs. With greater uncertainty in 2021 and the removal of distance barriers, students could increase the number of applications, further increasing demands on residency programs. The removal of travel expenses could result in especially large increases in applications to those specialties that previously had the highest costs.

This was the first study to compare interviewing time by specialty. The reported average interviewing time rose significantly between 2016 and 2019 from 25 days to 31 days, then declined to 28 days in 2020, which was not a significant difference from either 2016 or 2019. The highest reported times of nearly 40 days (otolaryngology and radiation oncology) were almost double those for the lowest specialties. The low times for some highly competitive programs, such as orthopedics and neurosurgery, could reflect local availability of positions, students receiving few interview invitations, or programs clustering interviews by time and/or location. Within all specialties, individual students reported a wide range of time spent interviewing, again supporting the need for individualized expert advising. Our students were allocated eight weeks in the fourth year for inter-

viewing. Obtaining permission for additional time was regarded as a major challenge that regularly was circumvented and could inhibit reporting of high interviewing times. Despite the regulations, individuals reported up to 120 days. The true interviewing times could be much longer.

Match[®]-related activities are the priority of the fourth-year medical student, far out-weighting any course or curricular requirements. Importantly, our study did not capture time invested in away rotations, learning about the Match[®] process, preparing and submitting applications, and negotiating interviews. The period when interview offers were made was particularly time-demanding and stressful. During this period, usually early in the senior year, students are distracted from other responsibilities and hypervigilant for interview offers that require immediate action. The negative impact of the entire Match[®] process on medical education, especially in the fourth year, merits greater attention.

The move to video interviewing paradoxically could increase time requirements, especially at the beginning of the fourth year and possibly earlier, not just during the “interview season” of September to January. Potential time savings from the removal of travel and in-person interviews may be negated by the time required to arrange and prepare for interviews and possibly participate in more than one interview per program.

The study findings emphasized the need for intensive assistance for students in making decisions about numbers of applications and selection of interviews. Individualized, specialty-based assistance appeared especially necessary for those highly competitive specialties with few applicants per year, but even in the most popular specialties, the wide range in numbers of applications and costs indicated a need for assistance in navigating the Match[®] process more efficiently.

Limitations. Our study had several limitations, most notably limited generalizability to other institutions, especially non-state medical schools outside the region. Student responses could be inaccurate or biased by faulty recall. Such bias was likely to be minimal due to the high student investment in the project, response rates, narrative comments, and consistency of results over time. In data analysis, each student was allocated only to his/her top-ranked specialty. Small numbers in individual specialties and year-to-year variation limited attributing statistical significance to some trends and we did not address situations where students applied to more than one specialty or potential differences by gender, regional campus, or other variables. Class rank, Step 1 scores, or other measures of student “competitiveness” also were not considered.

CONCLUSIONS

Our study draws attention to the huge difference in numbers of applications, expenses, and days interviewing among individual students even among classmates applying to the same single specialty. The Match[®] is a crucial and intensely personal experience. Students crave more guidance, a more efficient system, transparent communication with programs, and less pressure on them and their families during the process. Reducing the escalating volume of applications is central to improving the system and may become even more critical with the move to remote interviewing. Despite efforts to inform applicants better, student behavior is unlikely to change until they feel safe in the belief that lower and more realistic numbers of applications and interviews are likely to result in securing an appropriate residency position. The upcoming 2020 - 2021 academic year presents a unique opportunity to document the impact of the sudden change to remote interviewing and to provide guidance on strategies to improve this crucial process. Further research and discussion are needed at both the medical school and residency program level to determine the future direction of the Match[®].

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