



Research Paper

Analysis of variability and trends in medical school clerkship grades

John F. Hoy^{*}, Samuel L. Shuman, Shelby R. Smith, Monica Kogan, Xavier C. Simcock

Rush University Medical Center, Chicago, IL, USA



HIGHLIGHTS

- There is high variability in the distribution of 3rd-year clerkship grades.
- There is evidence of grade inflation in the surgery clerkship from 2015 to 2022.
- Better-ranked medical schools tend to give out more “honors” grades.

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ABSTRACT

Background: Medical school clerkship grades are used to evaluate orthopedic surgery residency applicants, however, high interinstitutional variability in grade distribution calls into question the utility of clerkship grades when evaluating applicants from different medical schools. This study aims to evaluate the variability in grade distribution among medical schools and look for trends in grade distribution over recent years.

Methods: Applications submitted to Rush University's orthopedic surgery residency program from 2015, 2019, and 2022 were collected from the Electronic Residency Application Service. Applications from the top 100 schools according to the 2023–2024 *U.S. News and World Report* Research Rankings were reviewed. The percentage of “honors” grades awarded by medical schools for the surgery and internal medicine clerkships were extracted from applicants' Medical Student Performance Evaluation letters.

Results: The median percentage of honors given in 2022 was 36.0 % (range 10.0–82.0) for the surgery clerkship and 33.0 % (range 6.7–80.0) for the internal medicine clerkship. Honors were given 6.6 % more in the surgery clerkship in 2022 compared to 2015. There was a negative correlation between a higher (worse) *U.S. News and World Report* research ranking and the percentage of honors awarded in 2022 for the surgery and internal medicine clerkships.

Conclusion: There is substantial interinstitutional variability in the rate that medical schools award an “honors” grade with evidence of grade inflation in the surgery clerkship. Residency programs using clerkship grades to compare applicants should do so cautiously provided the variability demonstrated in this study.

Key message

There is substantial interinstitutional variability in the rate that medical schools award an “honors” grade with evidence of grade inflation in the surgery clerkship. Residency programs using clerkship grades to compare applicants should do so cautiously provided the variability demonstrated in this study.

Introduction

The process of selecting medical students for orthopedic surgery

residency in the United States is highly competitive, with a large number of applicants vying for a limited number of positions. In 2023, over 1400 applicants applied for only 899 spots, owing to one of the most selective cycles to date [1]. For residency program directors, selecting appropriate candidates becomes exceedingly complex given the lack of standardization and objectivity of evaluation methods across medical schools. In previous years, the United States Medical Licensing Exam (USMLE) Step 1 exam was used as an unofficial screening tool, despite lacking definitive evidence of its ability to predict success in residency. However, as of the 2023 application cycle, the USMLE Step 1 exam numerical score is no longer reported, and program directors must rely

^{*} Corresponding author at: Rush University Medical Center, Department of Orthopaedic Surgery, 1611 W. Harrison St., Chicago, IL 60612, USA.

E-mail address: john.hoy.research@gmail.com (J.F. Hoy).

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more heavily on alternative metrics when evaluating applicants [2,3]. Letters of recommendation have been utilized as a valuable tool but are subjective and prone to bias. Third-year clerkship grades, reported on the Medical Student Performance Evaluation (MSPE), are consistently cited as a significant factor in the applicant assessment. While they seem to be a logical alternative for objective evaluation, they may be far more unreliable than they appear [2,4].

The MSPE is a summary letter of evaluation provided by an applicant's medical school dean, providing program directors with comparative data about students' performance in medical school courses [5]. It serves as an important tool to assess student performance and professionalism in the medical setting; however, studies have reported significant inter- and intraschool grading variability, particularly for clerkship grades [2]. Currently, each medical school independently devises a grading system for its students, placing the responsibility on application reviewers to interpret these systems [4]. Residency programs may have to compare a student in a class where only 5% receive a grade of "honors" compared to a student from a school where 50%

receive a grade of "honors." [6] This lack of standardization raises concerns about the accuracy and reliability of clerkship grades, thus calling into question their utility in applicant evaluation [2]. While previous studies have assessed third-year clerkship grades, they are limited to a single application cycle year [6,7].

This study aims to investigate the variability and trends in grades in the surgery and internal medicine clerkships across three recent years for medical students applying to orthopedic surgery residency. We hypothesize that there is wide variability in clerkship grades and that the percentage of students receiving a grade of "honors" is increasing.

Methods

Applications submitted to our institution's orthopedic residency from the years 2015, 2019, and 2022 were collected from the Electronic Residency Application Service. 2015 and 2019 were selected to assess trends in applications before the COVID-19 pandemic, and 2022 was selected to see if COVID-19 had an accelerating effect on grade

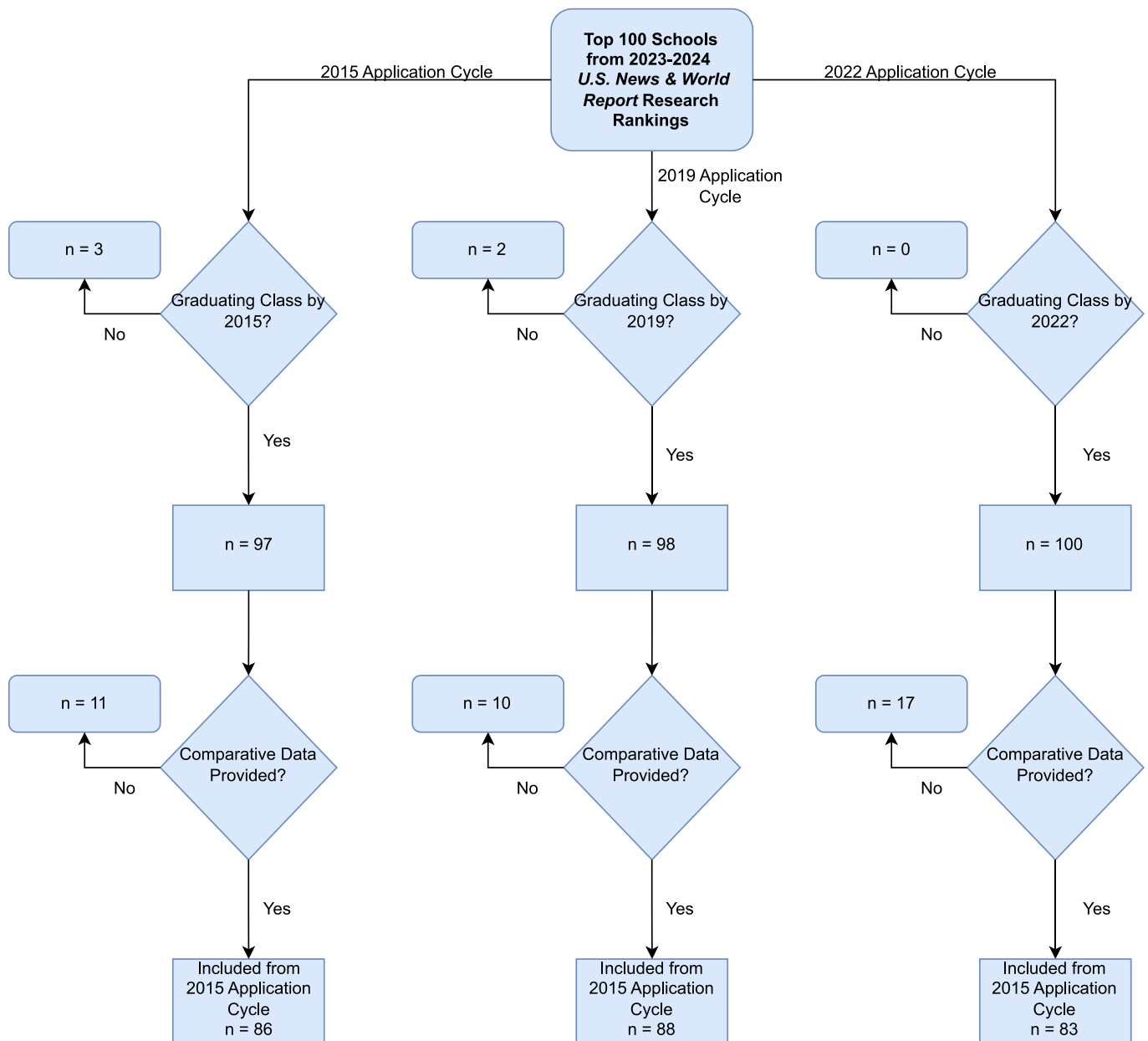


Fig. 1. Medical schools included in analysis.

distribution changes. Applications from the top 100 schools, based on the 2023–2024 *U.S. News and World Report* Research Rankings [8], were reviewed. Of these medical schools, three schools did not have a graduating class by 2015, and two did not have a graduating class by 2019 (Fig. 1).

Schools that did not provide comparative data, meaning that they did not provide information on grade distributions, were excluded from the analysis. 11/97 schools did not provide comparative data for clerkship grade distribution in 2015, 10/98 schools did not provide comparative data in 2019, and 17/100 schools did not provide comparative data in 2022. (Fig. 1). For schools that gave letter grades, “A+” and “A” were considered equivalent to honors. For schools that gave numerical grades out of 100, a score greater or equal to 90 was considered equivalent to honors. The percent “honors” grades awarded by each school for the surgery and internal medicine clerkship were extracted from figures and tables from applicants' Medical Student Performance Evaluation letters. Including both the surgery and internal medicine clerkships was performed increase generalizability and provide insights to various specialties involved in the residency selection process.

SPSS Statistics (Version 29.0.1.0, IBM Corp., Armonk, New York) was used for descriptive and inferential analysis. The mean percentage of honors grades for included schools was calculated, median and interquartile ranges were identified, and descriptive statistics were performed. The grade distributions were treated as continuous variables. The Kolmogorov-Smirnov test was used to assess the data for normality. Paired 2-sample *t*-tests were used to assess differences in the percentage of honors given between individual schools across application cycle years. Pearson's correlation was calculated to assess for a relationship between research ranking and the percentage of “honors” awarded for 2022 applicant cycle data. Pearson's Chi-Squared test was used to assess for differences in the rate that comparative data was omitted for the top 25 ranked schools versus schools ranked 26–100 for 2022 data. A sub-analysis was performed to evaluate for a difference in the percent “honors” awarded for schools ranked 1–25, 26–75, and 76–100 for the 2022 application cycle. One-way analysis of variance (ANOVA) was performed, and post-hoc analysis was performed using the Tukey test. A *P* value <0.05 was considered statistically significant.

Results

The median percentage of honors given in 2015 was 30.5 % (IQR 24.0–40.0, range 4.0–73.0) for surgery and 31.4 % (IQR 22.8–40.3, range 6.0–58.0) for medicine. The median percentage of honors given in 2019 was 32.0 % (IQR 24.0–45.0, range 6.0–66.0) for surgery and 35.0 % (IQR 28.0–44.0, range 9.0–70.0) for medicine. The median percentage of honors given in 2022 was 36.0 % (IQR 26.3–50.0, range 6.7–80.0) for surgery, and 33.0 % (IQR 24.2–45.0, range 6.7–80.0) for medicine (Table 1).

Table 1
Percent “honors” distribution by clerkship and year.

Application cycle year and clerkship	n	Mean	SD	Median	Interquartile range	Range
2015						
Surgery	86	31.9	13.1	30.5	16.1	69.0 (4.0–73.0)
Medicine	86	32.5	11.4	31.4	17.5	52.0 (6.0–58.0)
2019						
Surgery	88	34.6	13.8	32.0	21.0	54.0 (6.0–60.0)
Medicine	88	35.8	12.2	35.0	16.0	61.0 (9.0–70.0)
2022						
Surgery	83	38.6	16.6	36.0	23.7	72.0 (10.0–82.0)
Medicine	83	35.3	15.0	33.0	20.8	73.3 (6.7–80.0)

10.0–82.0) for surgery, and 33.0 (IQR 24.2–45.0, range 6.7–80.0) for medicine (Table 1).

When comparing the difference in the percentage of honors in the surgery clerkship awarded in 2019 versus 2015 via paired samples *t*-test, honors were given 2.9 % more on average in 2019 (CI 0.2–5.7, *P* = 0.036) in surgery and 3.3 % more on average in 2019 (CI 0.7–5.9, *P* = 0.015) in the internal medicine clerkship. For 2022 versus 2019, honors were given 4.4 % more on average (CI 1.0–7.88, *P* = 0.013) in surgery and 0.7 % less (CI 3.6–2.2, *P* = 0.626) in the internal medicine clerkship. When comparing 2022 versus 2015, honors were given 6.6 % more on average in the surgery clerkship in 2022 (CI 3.0–10.2, *P* < 0.001) and 2.5 % more on average (CI –0.7–5.6, *P* = 0.123) in the internal medicine clerkship.

There was a negative correlation between a higher (worse) *U.S. News and World Report* research ranking and percentage of honors awarded in 2022 for the surgery clerkship (*r* = –0.401, *P* < 0.001) and the internal medicine clerkship (*r* = –0.366, *P* < 0.001). One-way ANOVA showed a significant difference in percent honors for the surgery clerkship for the 2022 application cycle for schools ranked in categories 1–25, 26–75, and 76–100 (*P* < 0.001) (Fig. 2). Post hoc analysis showed a significant difference between the top 25 schools and both the middle 50 schools and schools ranked 76–100 (*P* < 0.001), but did not reveal a significant difference between schools ranked 26–75 and 76–100 (*P* = 0.270). Similarly, one-way ANOVA showed a significant difference in percent honors for the internal medicine clerkship in the 2022 application cycle for schools ranked in categories 1–25, 26–75, and 76–100 (*P* < 0.001) (Fig. 3). Post hoc analysis showed a significant difference between the top 25 schools and both the middle 50 and 76–100 (*P* < 0.001), but did not reveal a significant difference between schools ranked 26–75 and 76–100 (*p* = 0.615). There was a significant difference in the proportion of schools that chose to omit comparative data in the top 25 schools (nine schools with no comparative data) versus schools ranked 26–100 (eight schools with no comparative data) (*P* = 0.003) for the 2022 application cycle.

Discussion

The main findings of our study are as follows: 1) There is significant interinstitutional variability in the rate at which schools award a grade of “honors” to their students. 2) There is evidence of grade inflation in the surgery clerkship from 2015 to 2022. 3) Schools with more favorable *U.S. News & World and Report* rankings are more likely to award their students a grade of “honors.”

The median percentage of honors given in 2022 was 36.0 (IQR 26.3–50.0, range 10.0–82.0) for surgery, and 33.0 (IQR 24.2–45.0, range 6.7–80.0) for medicine. This median and range are similar to Vokes et al. who, when analyzing data from orthopedic residency applicants in 2017, found a median percent “honors” awarded of 32.5 % (range 5–67) in the surgery clerkship and 32.0 % (range 7–80) in the internal medicine clerkship [6]. Earlier data from the 2005 application cycle demonstrated the percentage of honors awarded in the surgery clerkship ranged from 2 % to 75 % of students depending on the medical school [9]. This persistent variability in the rate of honors awarded across medical schools poses a significant challenge to applicant reviewers when considering clerkship grades in the resident selection process.

Metrics available for the applicant have changed in recent years, as many schools move to a “pass” or “fail” preclinical curriculum and are phasing out the Alpha-Omega Alpha (AOA) honor society [10]. In addition, the change in scoring of USMLE Step 1 to “pass” or “fail” in January of 2022 marks the loss of a metric historically ranked among the most important by orthopedic program directors [11]. With increasingly limited data to evaluate applicants, programs will be forced to rely more heavily on other metrics such as the United States Medical Licensing Examination (USMLE) Step 2, research experience, and third-year clerkship grades to evaluate applicants. However, due to the variable

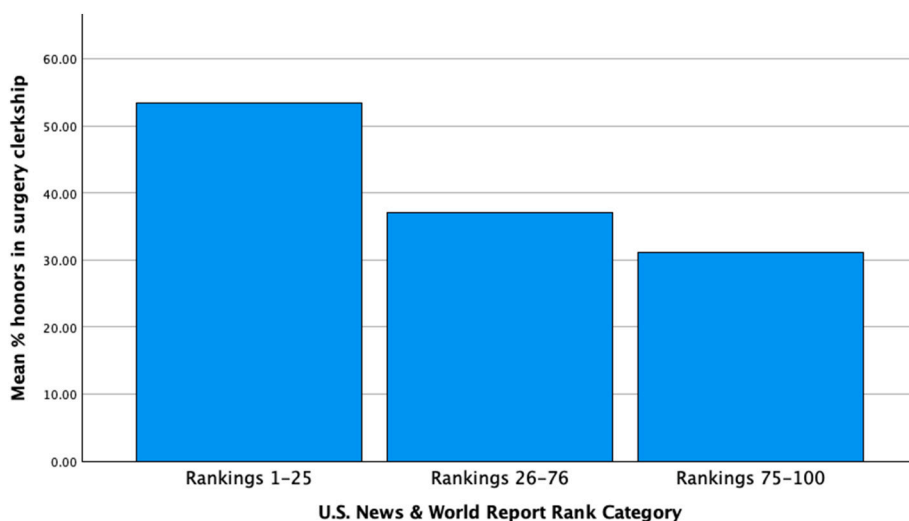


Fig. 2. % honors in surgery clerkship by U.S. News and World Report ranking.

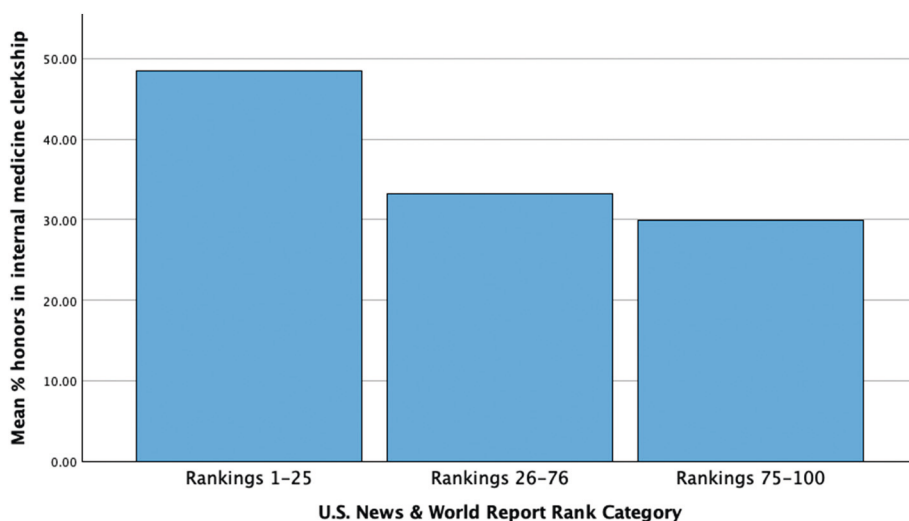


Fig. 3. % honors in internal medicine clerkship by U.S. News and World Report ranking.

“honors” distribution in third-year clerkships among medical schools, whether a student receives a grade of “honors” or not should be interpreted cautiously. Consider a hypothetical scenario with two applicants, one from Medical School “A” and one from Medical School “B”. The applicant from Medical School “A” received a grade of “high-pass” in the surgery clerkship while the applicant from Medical School “B” received a grade of “honors.” When you investigate the grade distribution at these schools from the 2022 application cycle, Medical School “B” gave 79 % of their students a grade of “honors” in the surgery clerkship, while Medical School “A” only awarded 18 % of their students a grade of “honors” in the surgery clerkship. It may be of value for schools to develop a system to account for the percentage of honors awarded at a school in addition to the grade the individual applicant received. However, this is not possible with all medical schools, as there were 17 out of the top 100 schools in the 2022 application cycle that elected to not provide comparative data for students. Of note, schools that omit comparative data tend to be schools ranked more favorably in the *U.S. News and World Report* rankings. Of schools in the top 25 of these rankings, nine did not provide comparative data, while eight schools ranked from 26 to 100 did not provide comparative data. The lack of comparative data makes it even harder for programs to determine the relative magnitude of receiving (or not receiving) a grade of “honors” in

each clerkship. Creating a reasonable solution to this problem is challenging, as grading policies differ widely among medical schools, and implementing a standardized grading system across all medical schools would be an arduous task. Most clerkships require students to pass the National Board of Medical Examiners (NBME) subject exam to pass each clerkship [12]. Encouraging medical schools to provide the score and percentile that each student achieved on these standardized exams would give an objective data point that may add more context to an individual student's performance in that clerkship.

In addition to interinstitutional variability, there was a trend of chronologically increasing “honors” awarded in surgery clerkships across the three years evaluated. There was a significant increase from 2015 to 2019 (2.9 %), as well as an even larger increase (4.4 %) from 2019 to 2022. Harris et al. found a median percentage of awarded honors of 25 % in the 2005 application cycle, which is markedly lower than what was found in the three years in this study [9]. This finding was also consistent with the Vokes et al. analysis of the 2017 application cycle [6]. Grade inflation has been previously described in third-year clerkships and has been noted to be a concern of clerkship directors [13]. The inflation of grades and the variability across institutions diminishes the reliability and utility of this metric to compare applicants.

In addition, it is interesting to compare grade distributions that

occurred prior to and after the start of the COVID-19 pandemic. COVID-19 had a dramatic impact on medical education, including the replacement of in-person clerkships with virtual clerkships, as well as the shortening or cancellation of clerkships [14]. In this setting, it is difficult for students to be evaluated in a similar fashion to years prior. Those who were part of the 2022 application cohort in this study had their clerkships after the start of the COVID-19 pandemic, while the 2015 and 2019 application cycle cohorts had finished their third-year clerkships [15]. This gives insight into how grade distributions may have changed in light of the pandemic. We found that in 2022, honors in surgery were given at the highest rate of all three years (mean, 38.6 %), and the increase from 2019 to 2022 (4.4 %) was greater than the increase from 2015 to 2019 (2.9 %). It is unclear if COVID-19 and its effect on medical education led to an increase in the rate of grade inflation, or if this is part of a larger trend of inflation across many years.

We also found a correlation between the *U.S. News & World Report* Rankings and the percentage of “honors” awarded in both internal medicine ($r = -0.366, P < 0.001$) and surgery clerkships ($r = -0.401, P < 0.001$), indicating that a student at a top school is more likely to receive a grade of honors. When performing a sub-analysis comparing the top 25 ranked schools, the middle 50, and schools ranked 76–100, there was a statistically significant difference in the percent honors assigned by the top 25 schools when compared to the other two categories ($P < 0.001$).

There are limitations to this study. Only the top 100 medical schools from *U.S. News and World Report* Research Rankings were included and evaluated. It is possible that the distribution of grades for medical schools outside this range differs from that of the top 100 medical schools. In addition, there were several schools that did not provide comparative data for clerkship grades, ranging from 11 schools in 2015 to 17 schools in 2022. There were also a handful of schools that did not use the more typical “honors,” “high-pass,” and “pass” pass grading scheme. These schools were still included in the analysis by categorizing a grade of A+/A or $\geq 90\%$ as honors. This conversion yielded a percentage of honors similar to that of schools with the standard clerkship grading scheme, and these schools were included to reduce the chance of

selection bias that would be caused by excluding them from the analysis.

Conclusions

There is high interinstitutional variability in the rate that medical schools award a grade of “honors” with evidence of grade inflation in the surgery clerkship. Schools with more favorable *U.S. News & World Report* rankings are more likely to award a student a grade of “honors” in surgery and internal medicine clerkships. Residency programs using clerkship grades to compare applicants from different schools should do so cautiously. As the selection of medical residents in the United States continues to evolve, there is an increasing need for standardized comparative performance reporting to ensure fairness and accuracy in applicant selection.

Funding sources

None.

Ethics approval

This research did not involve human subjects and thus did not require ethical approval from the institutional review board.

CRediT authorship contribution statement

John F. Hoy: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. **Samuel L. Shuman:** Investigation, Writing – original draft. **Shelby R. Smith:** Investigation, Writing – review & editing. **Monica Kogan:** Conceptualization, Supervision, Writing – review & editing. **Xavier C. Simcock:** Conceptualization, Investigation, Methodology, Supervision, Writing – review & editing.

Declaration of competing interest

None.

Appendix A

Table A.1

Percentage of students receiving an honors grade in the surgery and internal medicine clerkships from 2022 application cycle data.

U.S. News and World Report ranking 2023–2024	Medical school	Percentage of students receiving an honors grade in surgery clerkship	Percentage of students receiving an honors grade in internal medicine clerkship
1	Harvard University	No comparative data	No comparative data
2	Johns Hopkins University	No comparative data	No comparative data
3	University of Pennsylvania (Perelman)	No comparative data	No comparative data
4	Columbia University	No comparative data	No comparative data
5	University of California – San Francisco	No comparative data	No comparative data
5	Duke University	52	36.4
5	Stanford University	No comparative data	No comparative data
5	Washington University in St. Louis	64	80
5	Vanderbilt University	No comparative data	No comparative data
10	New York University (Grossman)	56.3	52.1
10	Yale University	No comparative data	No comparative data
10	Cornell University (Weill)	No comparative data	No comparative data
13	University of Washington	45	45
13	Mayo Clinic School of Medicine	65.3	55.2
13	University of Pittsburg	45	45
13	Northwestern University (Feinberg)	79	74
13	University of Michigan – Ann Arbor	30	26
18	Icahn School of Medicine at Mount Sinai	82	60
18	University of California – Los Angeles (Geffen)	71	71
18	University of Chicago (Pritzker)	62	54
21	University of California – San Diego	40	23
22	Baylor College of Medicine	25	28
23	Emory University	60	41.8
24	University of Texas Southwestern Medical Center	35	45

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Table A.1 (continued)

U.S. News and World Report ranking 2023–2024	Medical school	Percentage of students receiving an honors grade in surgery clerkship	Percentage of students receiving an honors grade in internal medicine clerkship
25	Case Western Reserve University	42	39
26	University of North Carolina – Chapel Hill	40	40
26	University of Colorado	36	40
28	University of Southern California (Keck)	22.6	24.2
28	Ohio State University	18	16
30	University of Virginia	48	32
30	Oregon Health and Science University	No comparative data	No comparative data
32	University of Maryland	15	24
32	Boston University (Chobanian & Avedisian)	65	30
32	University of Rochester	26.3	23.4
35	University of Alabama – Birmingham	30	28
35	Brown University (Alpert)	38	30
35	University of Utah	27	21
35	University of Florida	50	48
35	University of Wisconsin – Madison	No comparative data	No comparative data
35	University of Cincinnati	30	28
35	University of Minnesota	38	66
42	Albert Einstein College of Medicine	55	44
42	Indiana University – Indianapolis	30.4	37.4
44	University of Iowa (Carver)	13	24
44	University of Miami (Miller)	60	45
44	University of Massachusetts Chan Medical School	24	44
44	University of California – Irvine	49	25
48	Dartmouth College (Geisel)	No comparative data	No comparative data
48	Wake Forest University	54	31
50	University of South Florida (Morsani)	50	30
50	University of Texas Health Science Center – San Antonio	51.5	70
50	University of California – Davis	24	24
53	Georgetown University	50	33
53	Tufts University	32	37.5
53	University of Connecticut	21	33
56	University of Texas Health Science Center – Houston (McGovern)	20	20
56	Medical University of South Carolina	35	20
58	Stony Brook University – SUNY (Renaissance)	40	50
58	University of Nebraska Medical Center	30.6	25.6
58	Thomas Jefferson University (Kimmel)	60	25
58	University of Illinois	58	42
58	George Washington University	10	22
63	University of Arizona – Tucson	No comparative data	No comparative data
64	Virginia Commonwealth University	56	50
64	University of Kentucky	No comparative data	No comparative data
64	University of Vermont (Larner)	No comparative data	No comparative data
64	Texas A&M University	33	14.3
68	Hofstra University/Northwell Health (Zucker)	42	41
68	Rush University	26.5	26.5
68	Rutgers Robert Wood Johnson Medical School – New Brunswick (Johnson)	30	25
71	Temple University (Katz)	36	34
71	University of Tennessee Health Science Center	59.6	59.8
71	Wayne State University	27	20
71	Rutgers New Jersey – Newark	30	25
75	University of Kansas Medical Center	39.2	34.8
76	University at Buffalo – SUNY (Jacobs)	40	25
76	University of Arkansas for Medical Sciences	46.6	51.6
76	University of Oklahoma	70	48
79	Augusta University	No comparative data	No comparative data
79	Hackensack Meridian School of Medicine	32	20
81	University of Hawaii – Manoa (Burns)	40.5	36.11
81	Virginia Tech Carillion School of Medicine	22.2	27.3
81	University of Louisville	20	18
81	University of New Mexico	No comparative data	No comparative data
85	Saint Louis University	31	32
85	University of Missouri	13	17
87	West Virginia University	15	15
88	Drexel University	34	38
88	SUNY Upstate Medical University	18	14
88	Michigan State University College of Human Medicine (Broad)	39	26
88	University of Missouri – Kansas City	30	37
92	New York University – Long Island	56.3	52.1
93	Geisinger Commonwealth School of Medicine	13.33	6.67
94	University of South Carolina	13	33

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Table A.1 (continued)

U.S. News and World Report ranking 2023–2024	Medical school	Percentage of students receiving an honors grade in surgery clerkship	Percentage of students receiving an honors grade in internal medicine clerkship
95	University of Nevada – Reno	31.14	36.49
96	Texas Tech University Health Sciences Center	26	25
96	University of California – Riverside	20	20
98	University of Central Florida	45	48
98	Florida State University	24	23
100	Eastern Virginia Medical School	35	40

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