Pain Physician 2026; 29:245-250 • ISSN 1533-3159

Perspective

Match Program Signaling in Pain Medicine Fellowship Applications: Association with Interview Outcomes and Implications for a Shrinking Applicant Pipeline

Alexander Bautista, MD[1], Meredith Barad, MD[2], Trent Emerick, MD[3], Yashar Eshraghi, MD[4], Prentiss Lawson, MD[5], Saba Javed, MD[6], Tolga Suvar, MD[7], Christine Oryhan, MD[8], Thelma Wright, MD, JD[9], and Kristen Noon, MD[10]

From: [1]University of Louisville, Louisville, KY; [2]Stanford Hospital and Clinics, Stanford, CA; [3]University of Pittsburgh Medical Center, Pittsburg, PA; [4]Oschner Health, New Orleans, LA; [5]University of Alabama at Birmingham, Birmingham, AL; [6]University of Texas MD Anderson Cancer Center, Houston, TX; [7]Rush University, Chicago, IL; [8]Virginia Mason Medical Center, Seattle, WA; [9]University of Maryland School of Medicine, Baltimore, MD; [10]Ohio State University, Columbus, OH

Address Correspondence:
Alexander Bautista, MD
Department of Anesthesiology and Perioperative Medicine, University of Louisville
Louisville, KY
E-mail:
alexbmdusmle@yahoo.com

Disclaimer: There was no external funding in the preparation of this article.

Conflict of interest: Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

Article received: 02-03-2026
Accepted for publication: 04-10-2026

Free full article:
www.painphysicianjournal.com

Background: Pain Medicine fellowship programs have reported increasing numbers of unfilled positions in recent match cycles, accompanied by a growing perception that the applicant pipeline is shrinking. In response to concerns regarding application volume and applicant–program fit, the Electronic Residency Application Service® (ERAS) introduced program signaling for the Pain Medicine fellowship in the 2024–2025 application cycle. Of note, Pain Medicine was the first fellowship across all medical specialties to utilize signaling, with further plans by ERAS to expand access to signaling to other fellowships in the future. However, the effectiveness of this intervention in the context of fewer applications to the field remains unclear.

Objective: To evaluate the association between ERAS program signaling and interview invitation rates in Pain Medicine fellowship applications, and to contextualize signaling outcomes alongside longitudinal National Resident Matching Program® (NRMP) match trends and unfilled positions.

Methods: Our study integrated data from 3 sources: NRMP Specialties Matching Service reports (2019–2025), Association of American Medical Colleges ERAS signaling dashboards (2024–2025), and a post match survey distributed to all 442 applicants in the 2025 cycle. Primary outcomes included interview invitation rates by signal status and applicant type (MD, DO, international medical graduate [IMG]). Secondary outcomes included match rates at signaled vs nonsignaled programs and applicant perceptions of signaling.

Study Design: Cross-sectional.

Results: Sixty-five applicants responded (14.7% response rate), 86.1% matched. Applicants utilized a mean of 4.6 of the 5 available signals. Interview invitation rates were substantially higher for signaled applications than for nonsignaled applications across all applicant types. Among applicants who sent signals, interview rates were 70.3% for MDs, 58.3% for DOs, and 34.1% for IMGs, compared with 39.7%, 32.3%, and 18.0%, respectively, among nonsignaled applications. The signal-associated increase in interview rate was greatest for MD applicants (30.6 percentage points), followed by DOs (26.0 percentage points) and IMGs (16.1 percentage points). Of matched respondents, 70.7% matched at a program they had signaled. Applicant perceptions of signaling were mixed, with 64.1% reporting it as useful and 35.9% reporting it as useless.

Conclusions: Program signaling is strongly associated with increased interview invitation rates in Pain Medicine fellowship applications and appears to improve applicant–program alignment, particularly for MD applicants. However, the differential benefits across applicant types raise equity concerns, and signaling cannot address the fundamental workforce changes driving a reduced applicant pool. Sustainable recruitment strategies must extend beyond match optimization to address the structural factors underlying declining interest in Pain Medicine fellowships.

Key words: Pain Medicine fellowship, Electronic Residency Application Service (ERAS), program signaling, fellowship match, interview invitations, National Resident Matching Program (NRMP), graduate medical education, applicant selection, workforce pipeline

Pain Physician 2026: 29:245-250

Pain Medicine fellowship training occupies a unique multidisciplinary space, drawing candidates from a variety of specialties, including Anesthesiology, Physical Medicine and Rehabilitation, Neurology, Psychiatry, Radiology, Emergency Medicine, and Internal Medicine. Despite this breadth, recent match cycles have revealed concerning trends. From 2020 through 2025, major changes occurred in the total number and specialty training of applicants to Pain Medicine fellowships. Importantly, the total number of applicants declined by approximately 14%, with Anesthesiology applicants, traditionally the largest feeder specialty, decreasing by 65%, continuing a downward trajectory compounded by shifts in the anesthesiology job market. Co-occurring, there have been major increases in applications from Emergency Medicine and Physical Medicine and Rehabilitation candidates. To address growing application volumes and improve applicant-program fit, the Electronic Residency Application Service® (ERAS) introduced program signaling for Pain Medicine in the 2024-2025 cycle.

Program signaling is indicated by the applicant at the time of application and is intended to serve as one of many data points programs may consider when selecting applicants for an interview. The number and structure of signals vary by specialty; some specialties use a standard single-tier signal, whereas others use tiered gold and silver signals. In Pain Medicine, applicants in the 2024–2025 cycle were allowed to send 5 standard single-tier program signals. In this way, candidates and programs are better able to understand who is truly interested in a program. During the COVID-19 pandemic, training programs largely flipped to virtual rather than in-person interviews. This led to a significant increase in the sheer volume of applications that a program must review prior to offering an interview. Many program directors have reported they now need to interview more candidates to fill their program, given the relative ease of virtual interviews compared to in-person interviews.

Applicants in our study were allowed to send 5 program signals to programs of genuine interest. The Association of Pain Program Directors sought to understand how signaling affects interview rates and explore why fellowship positions remain unfilled despite strong overall match rates. Our study examined the association between program signaling and interview outcomes using ERAS data, National Resident Matching Program® match statistics, and direct applicant feedback from an Association of Pain Program Directors survey conducted in December 2025.

Literature Review

Although Pain Medicine is the first fellowship to utilize signaling, program signaling is not new within graduate medical education. The Association of American Medical Colleges introduced signaling to 4 residency specialties for the 2021-2022 application cycle, and anesthesiology residency was included in 2022-2023 (1). The goal was to counteract the growing volume of applications as interviews shifted to virtual formats during and after the COVID-19 pandemic, which decreased financial barriers and logistical limitations for applicants to submit more applications and attend more interviews. Some specialties have since developed tiered signaling systems, including gold, silver, and bronze signals (1). Analyses of signaling from the program perspective have been published in peer-reviewed literature (2).

One multispecialty review documented potential benefits of signaling in reducing application volumes in certain primary specialties, though some fields—including anesthesiology and obstetrics-gynecology—experienced increases in applicants despite signaling implementation (2). However, concerns have emerged regarding signaling's unintended consequences. These include increased applicant stress in prioritizing signals, potential inequities when home programs or those offering away rotations advise applicants to save their signals, and the challenge of selecting signals months before rank lists are finalized, when preferences may naturally evolve (1).

Methods

Data were obtained from 3 primary sources: the National Resident Matching Program Specialties Matching Service match outcomes from 2019–2025, including applicant numbers, match rates, and unfilled positions; the Association of American Medical Colleges ERAS Dashboards program signaling data from the 2024-2025 cycle, including signal distribution by applicant type and interview rates by signal status; and an Association of Pain Program Directors Applicant Survey distributed to 2025 match cycle applicants in December 2025, collecting data on match outcomes, signaling utility, and applicant perceptions.

Our descriptive observational study analyzed aggregate data to identify associations between signaling behavior and interview outcomes (3,4). The survey component included both quantitative rating scales and open-ended qualitative responses. Primary outcomes included interview invitation rates stratified by

signal status (sent vs not sent) and applicant type (MD, DO, IMG [international medical graduate]), as well as the distribution of signals sent by applicants and received by programs. Secondary outcomes included match rates among signaled vs nonsignaled programs, applicant satisfaction with the signaling process, and application behavior patterns including applications per applicant and signals utilized.

Results

Our survey was distributed to all 442 applicants in the 2025 Pain Medicine match cycle. Sixty-five responses were collected, representing a 14.7% response rate. Response rates to ERAS signaling by applicant type were 92.8% of MD applicants (207 of 223), 94.7% of DO applicants (126 of 133), and 79.2% of IMGs (76 of 96). Among respondents to the Association of Pain Program Directors survey, 86.1% (56 of 65) successfully matched into a Pain Medicine program.

Applicants utilized their signals efficiently, with a mean of 4.6 signals sent per applicant (median 5) across all applicant types. This pattern was consistent for MDs (mean 4.6), DOs (mean 4.6), and IMGs (mean 4.5), indicating that most applicants used nearly all available signals. Programs received signals in a pattern that reflected applicant pool composition and preferences. The mean number of signals received per program was 17.5 overall, with substantial variation by applicant type. MDs sent a mean of 9.6 signals per program (median 7), DOs sent 5.5 (median 4), and IMGs sent 3.5 (median 2). The maximum number of signals received by any single program was 84.

The effect of signaling on interview invitation rates was substantial and consistent across applicant types, though effect sizes varied. Among applicants who sent signals, interview rates were 70.3% for MDs (median 70.7%), 58.3% for DOs (median 50.0%), and 34.1% for IMGs (median 33.3%), with an overall interview rate of 62.9% (median 58.1%). In contrast, applicants who did not send signals received interviews at rates of 39.7% for MDs (median 34.9%), 32.3% for DOs (median 28.6%), and 18.0% for IMGs (median 15.6%), with an overall interview rate of 32.1% (median 29.7%). The signal advantage—defined as the difference in interview rates between signaled and nonsignaled applications—was 30.6 percentage points for MDs, 26.0 percentage points for DOs, and 16.1 percentage points for IMGs. This represents a near-doubling of interview rates when signals were sent, with the effect most pronounced among MD applicants. Variability in interview rates was notable, particularly among applicants who signaled. Standard deviations ranged from 0.23 for MDs with signals to 0.37 for IMGs with signals, reflecting heterogeneity in both programs' signaling practices and applicant competitiveness.

Of the 56 survey respondents who successfully matched, 70.7% matched at a program they had signaled, while 29.3% matched at a program they had not signaled. This indicates that while signaling strongly predicts interview invitations, postinterview impressions and mutual interest significantly influence final match outcomes. Applicant opinions on signaling utility were divided. When asked to rate the usefulness of signaling, 21.9% found it very useful, 42.2% found it somewhat useful, 20.3% found it somewhat useless, and 15.6% found it very useless. When asked if they believed their signals influenced interview invitations, 46.2% responded yes, 47.7% said no, and 6.2% did not receive interviews or offers. When asked if 5 gold signals were appropriate, 60.9% of applicants felt it was just right, 31.3% felt it was too low, and 7.8% felt it was too high.

Open-ended survey responses revealed several themes. Positive perspectives came from applicants who reported matching at their targeted programs and found the process useful for indicating genuine interest. One respondent noted that signaling decreased the need to apply more widely and that signals were a positive development. Another emphasized that the process helps both applicants and programs in a virtual interview environment. However, concerns and criticisms were also prominent. Several respondents questioned the utility of signaling, with some stating it appeared to benefit program directors more than applicants. One respondent commented that signals became less meaningful after interviews when impressions changed, while another noted that everyone seemed to signal the same programs, limiting signaling's utility. Multiple applicants requested greater transparency about how programs use signals in decision-making, with one stating it would be helpful to know ahead of time which programs actually use signals so applicants would not waste them on programs that ignore them. Constructive suggestions included requests for more signals or the ability to adjust signals after interviews, as well as concerns about selecting signals months before rank lists were finalized, when preferences naturally evolved.

Our analysis of applicant geographic preferences revealed variations by applicant type. Among MDs,

43.5% had no geographic preference, 37.2% preferred suburban or urban settings, and 9.4% preferred urban locations. DOs had more geographic flexibility, with 65.4% indicating no preference and 24.1% preferring suburban or urban areas. IMGs had the most geographic flexibility, with 62.8% having no preference and only 15.1% expressing suburban or urban preferences.

Applicants submitted an average of 40 to 50 applications each, while programs received 250 to 300 applications on average. This created a competitive environment in which signals served as a meaningful differentiator for program directors who manage large applicant volumes.

Discussion

The data demonstrate that program signaling substantially improves interview invitation rates across all applicant specialty types in Pain Medicine fellowship applications. The magnitude of this effect—with interview rates nearly doubling among signaled applications—suggests that programs value signals as indicators of genuine interest. However, the signal effect varied considerably by applicant type. MD applicants experienced the largest signal advantage at 30.6 percentage points, followed by DOs at 26.0 percentage points and IMGs at 16.1 percentage points. This observed differential effect may reflect multiple factors, including differential program preferences by applicant type, variation in how programs weight signals relative to other application components, and differences in baseline competitiveness across applicant pools.

Program-level variability was substantial. Some programs heavily weighted signals in interview decisions, while others used them as secondary or tie-breaking factors. The lack of transparency about how individual programs use signals was a recurring theme in applicant feedback, creating strategic uncertainty for applicants allocating their limited signals. Given the individual variability in how training programs utilize signals, it may be hard for applicants to have the transparency they seek. However, there is reasonable evidence that most programs utilize signals in some meaningful way during their selection process.

An important finding is that 70.7% of matched respondents ultimately matched at programs they signaled, while 29.3% matched elsewhere. This indicates that signaling does allow more serious candidates to align with their intended programs. Although signals strongly predict interview invitations, they are imperfect predictors of final match outcomes. Several factors likely contribute to this discordance. First, timing plays a role, as signals must be submitted with ERAS applications, often by late December, while rank lists are finalized in late September—a window during which preferences naturally evolve. Second, interview impressions matter, as postinterview impressions can substantially alter applicant and program preferences. Third, strategic signaling may lead applicants to signal programs they perceive as competitive or "reach" programs rather than those they ultimately rank highest. As one survey respondent noted, signaling may help convey initial interest, but applicants may not know whether a program is a mutually beneficial fit until after interviewing with program leadership, faculty, and fellows.

The different signal effects by applicant type raise important equity concerns. IMG applicants, who already face structural disadvantages in the match process, derived the least benefit from signaling. While their interview rates improved with signals (34.1% vs 18.0% without), they remained substantially lower than MD rates even among signaled applications. This disparity may be compounded by information asymmetries. Applicants from smaller institutions or without access to insider knowledge about program signaling practices face additional disadvantages. There is also evidence that signaling may amplify prestige effects, with applicants potentially concentrating signals on well-known programs.

Survey responses highlighted several concerns about implementing signaling. Added applicant stress was evident, as multiple respondents described signaling as an additional burden in an already complex process. The need to prioritize preferences months before rank lists are finalized created strategic anxiety. Asymmetric information was another concern, as programs have full visibility into which applicants signaled them, but applicants lack information about how programs weigh signals, thus creating strategic uncertainty. Anecdotal evidence suggests that some home programs or those offering away rotations advise applicants to save signals for use elsewhere, potentially creating inequities based on institutional guidance (1). Psychological effects were also apparent, as some applicants viewed signaling negatively, interpreting it as a mechanism by which programs filter out candidates rather than a tool for a mutual fit.

While signaling improves interview efficiency, it cannot fully address the fundamental workforce challenges facing Pain Medicine. The 14% decline in appli-

cants from 2020 through 2025 reflects macrolevel drivers including labor market dynamics; reimbursement and regulatory pressures; and changes in the anesthesiology job market that preceded many applicants' career decisions. Signaling optimizes matching within the existing applicant pool but does not expand that pool. Programs continue to report unfilled positions despite strong match rates among participants, suggesting that the core challenge is a shrinking applicant pool rather than matching inefficiency.

Several improvements could enhance the effectiveness and equity of signaling. Programs should clearly communicate whether and how they use signals in interview decisions. Allowing signal adjustments after interviews could better align signals with evolved preferences. While 60.9% of respondents felt 5 signals were appropriate, 31.3% wanted more. Evidence from other specialties suggests that too many signals dilute their meaning, but too few create excessive strategic stress. Greater consistency in how programs interpret and weigh signals would reduce information asymmetries. Finally, clearer guidance on strategic signal allocation would benefit applicants from smaller programs who do not have insider knowledge. One suggestion to improve this inequity is for the Association of Pain Program Directors to create a webinar to teach the meaning and purpose of signaling to all prospective fellowship applicants.

Limitations

Our study has several significant limitations. First, our analysis relied on National Resident Matching Program and ERAS aggregate data, which are subject to timing discrepancies, self-reporting bias, and heterogeneity in data across years. Variations in how programs and applicants report information may have introduced inconsistencies affecting longitudinal comparisons. Both datasets lack granular demographic variables such as specific geographic locations, socioeconomic status, and medical school characteristics, limiting our ability to account for potential confounding factors.

Second, while we included data from 2019 through 2025 to examine broader trends, changes in reporting structure, program participation, and match processes over time—including the introduction of signaling—may influence observed outcomes independent of applicant or program characteristics.

Third, the survey component achieved only a 14.7% response rate, introducing a substantial risk of response bias. Respondents may differ systematically from nonrespondents in their attitudes toward signaling, match satisfaction, or program preferences. The sample size of 65 respondents also limits statistical power for subgroup analyses. Furthermore, the survey was conducted post match, introducing recall bias and potentially confounding satisfaction with match outcomes with satisfaction with the signaling process itself.

Fourth, the study's scope was limited to aggregate match outcomes and self-reported survey data; there was no direct link to objective performance metrics such as board scores, letter-of-recommendation strength, interview invitation timing, or long-term career outcomes. This limits both generalizability and causal inference about signaling's true effect.

Finally, we cannot distinguish between the effect of signaling itself vs temporal trends or other changes in the 2025 match cycle. The absence of a true control group or pre-post comparison with matched characteristics prevents definitive causal claims about signaling's effect.

Conclusion

Program signaling was associated with substantially higher invitation rates among Pain Medicine fellowship applicants, with the effect most pronounced among MD applicants (30.6 percentage-point increase) followed by DOs (26.0 percentage points) and IMGs (16.1 percentage points). Among survey respondents who matched, 70.7% matched at a program they had signaled, demonstrating that signals predict but do not determine final match outcomes. Applicant perceptions of signaling were mixed, with 64.1% finding it useful and 35.9% finding it useless. Key concerns included added stress, lack of program transparency about signal usage, and the challenge of allocating signals months before preferences crystallized through interviews. While signaling enhances interview efficiency and may improve applicant-program fit, it does not address the fundamental workforce challenges facing Pain Medicine. Programs continue to report unfilled positions despite strong match rates, indicating that pipeline expansion, not matching optimization, is the primary recruitment challenge.

To maximize signaling's benefits and minimize unintended harms, we recommend increased program transparency about signal weighting in interview decisions, consideration of signal timing adjustments or flexibility to allow postinterview updates, standardized guidance for applicants—particularly those without

access to insider knowledge—and continued monitoring of equity effects across applicant types and institutional backgrounds. Signaling represents a meaningful incremental improvement in the Pain Medicine match process, but broader strategies—including multidisciplinary outreach, workforce development initiatives, and advocacy for sustainable practice models—remain essential for addressing the specialty's recruitment challenges.

References

1. Sherwin MA, Smith S, Abramowicz AE. Navigating a moving target: Students forced to play the ERAS signaling game with ever-changing rules. *ASA Monitor* 2025; 89:29.
2. Elemosho A, Sarac BA, Janis JE. Preference signaling: Does it work? A multispecialty review of the data. *Plast Reconstr Surg Glob Open* 2025; 13:e6981.
3. Association of American Medical Colleges. ERAS Statistics. Association of American Medical Colleges; updated December 4, 2025. Available at: www.aamc.org/data-reports/publication/eras-statistics. Accessed May 14, 2026..
4. National Resident Matching Program. Match Results Statistics: Pain Medicine - 2025. Appointment Year 2026. Report run date September 24, 2025. Available at: www.nrmp.org/wp-content/uploads/2025/10/2025-Pain-Medicine-Report.pdf. Accessed May 14, 2026.