Explaining a Potential Interview Match for Graduate Medical Education

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Residency and fellowship candidates are applying to more programs to enhance their chances of securing interviews and matching favorably. The COVID-19 pandemic has shifted interviews to video formats, which lowers interview-associated costs for applicants but may further increase application numbers.[1] While a candidate's application to a training program communicates some interest in the program, the relative amount of interest is obscured when candidates apply to large numbers of programs. We suspect that, as a result, programs host large numbers of low-yield interviews.

The number of interviews is steadily increasing, and there is widespread agreement on the need to ease congestion in the pre-Match evaluation process.[2] Proposals to reduce this burden include signaling (organized, centrally-controlled protocol for limited communication of interest),[3–5] capping the number of applications or the number of interviews,[6,7] and an early acceptance matching program as in college admissions.[8,9]

We propose another solution, an "interview match" to address the expanding number of interviews.[10] An interview match enables candidates and programs to express preferences privately by ranking their interview choices individually or in tiers. This may ease congestion in the "marketplace," reduce costs for candidates, favor interviews that are more likely to lead to a match in the final Match, and avoid interviews unlikely to convert to a match. An interview match algorithm would match based on the same "deferred-acceptance" algorithm currently used by the National Resident Matching Program but adapted to a "many-to-many" setting where candidates and programs receive multiple interviews.[11,12] In brief, the algorithm assigns candidates to their top preference interview positions, and the programs temporarily retain those assigned candidates who coincide with their preferred (top) candidates, while rejecting those candidates who exceed the program's interview capacity. The "rejected" interview match candidates are then assigned to their next most preferred program on their interview match ranking lists, and so on.

In this Perspective, we present 2 simplified scenarios to illustrate the potential to minimize low-yield interviews and some of the challenges to be considered when implementing an interview match. We then briefly discuss the advantages of an interview match over other proposals.

Scenario 1

The first scenario considers 4 candidates who appear equally qualified to the 4 programs to which they apply (FIGURE 1). Each program has 1 position to fill. However, applicants have unstated heterogeneous regional preferences: half prefer Region 1 and half prefer Region 2. Since programs would be equally happy with all candidates, they rank them within 1 tier. The algorithm assigns each candidate to interview at the 2 programs within the preferred region. Without an interview match, programs would feel pressure to interview all 4 candidates resulting in 16 total interviews, since they have no sense of the likelihood that the candidate would come to their program. Likewise, candidates would feel pressure to interview at all 4 programs to maximize their chances of being highly ranked and matching to a position. Therefore, the implementation of an interview match would reduce the total number of interviews from 16 to 8. One of the many simplifications of Scenario 1 is that only the candidates have preferences. In this scenario, programs are agnostic as to whom they interview as long as they interview equally qualified candidates.

Scenario 2

Our second scenario is more complex: candidates *and* programs have preferences for which the interview match needs to account when assigning interview slots. Consider a situation in which 4 candidates apply to 3 programs, each with 1 position (FIGURE 2). Programs and applicants have pre-interview preferences they express through a tiered ranking. Candidates agree that P1 and P2 are the top 2 programs and

DOI: http://dx.doi.org/10.4300/JGME-D-20-01422.1

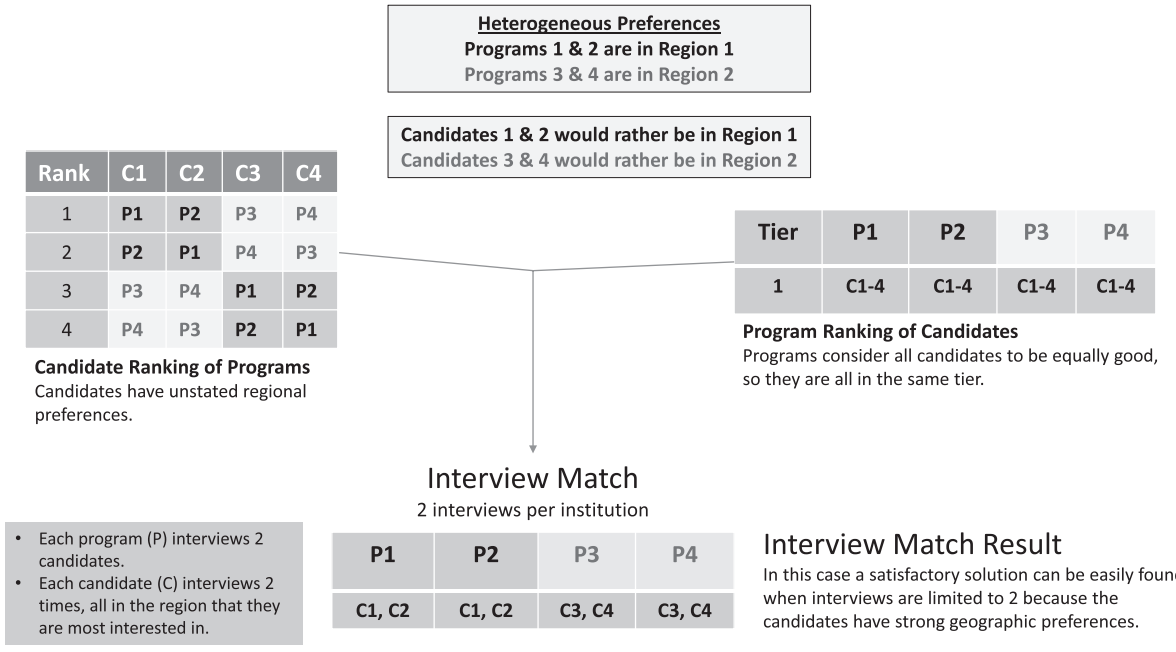

FIGURE 1
Programs Are Equally Impressed by All Candidates, and Candidates Have Heterogeneous Regional Preferences
Abbreviations: C, candidate; P, program.

that P3 is the least desirable program. Programs agree that C1 is the best candidate, followed by C2, C3, and then C4. When candidates and programs are limited to 2 slots, candidate C1 interviews at P1 and P2, and candidates C2 and C3 each interview in one of their top choices (P1 or P2, respectively) as well at their third choice P3. C4 does not interview at all (FIGURE 2, option 1). Note that when interviews are limited to 2, candidates and programs may regret not having more interviews. For example, if C1 matches with P1 and C3 matches with P3, then P2 and C2 remain unmatched. If programs can interview 3 candidates while each candidate is still limited to 2 interviews, the top 3 candidates would each interview in P1 and P2, while C4 would only interview at P3 (FIGURE 2, option 2). In this option, one of the candidates among C1 to C3 will not match for a training position, while C4, the less preferred candidate, will likely match. To address this undesired outcome, a third option would assign candidates 3 interviews; thus, C1 through C3 would interview at all 3 programs, leaving C4 without an interview (FIGURE 2, option 3).

Challenges and Benefits

These scenarios reveal multiple points of discussion. First, the interview match aggregates information from both candidates and programs to avoid unproductive interviews. Second, constraints on the number of interviews can create an imbalance between supply and demand that may lead to the regret of foregoing an interview. Third, when candidates and programs have heterogeneous preferences, fewer interviews may be needed (FIGURE 1). Fourth, if impressions formulated during interviews affect the rank order list, by candidates or programs, for the final match list, more interviews are needed. For instance, the more likely that a program will find an interviewed candidate unacceptable for a final ranking, the more likely a position will remain unfilled. Fifth, tiered rankings capture the preferences of programs and candidates before interviews. However, if the preferences and grouping of these preferences in tiers are very similar, the interview match algorithm is forced to break ties when trying to limit the number of interviews.[13] Alternatively, programs and candidates could submit a ranked order interview match list without tiers, which effectively resolves ties in advance, for the algorithm. These concerns should be tested with simulation models, using historical data, to determine the optimal algorithm that would reduce the number of interviews without disadvantaging candidates and programs.

Other proposals have been made to address interview challenges. A key feature of the interview match is that it aggregates information by eliciting preferences from both candidates and programs. This is absent from other proposals. Capping applications simply shifts the decisions from whom to interview to where to apply. Signaling may help programs for screening purposes, but candidates may still receive

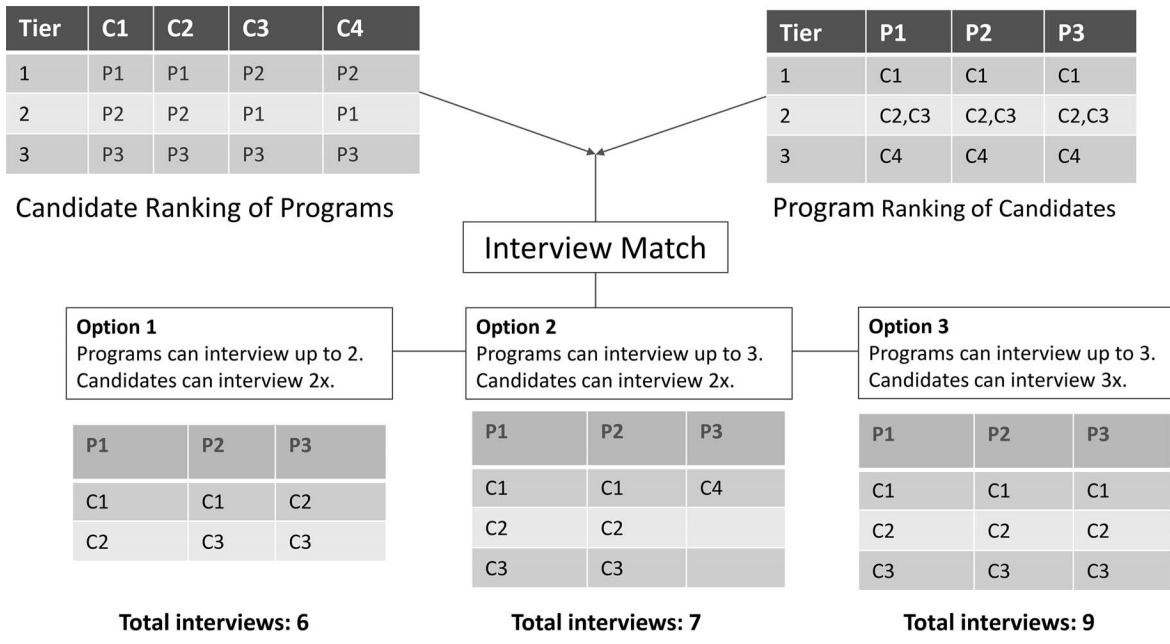

FIGURE 2
Effects of Adjusting the Numbers of Interview Slots

and accept many interview invitations. Capping the number of interviews alone does not convey to programs any information about which interviews are more likely to convert into a match.

After simulation models with historical data, an interview match could be explored through a nonbinding pilot, in parallel with the current process, to measure how outcomes may change. After the final match occurs, the effectiveness of the interview match could be assessed by how many of the matched candidates were assigned an interview at their matched institution by the interview match. A high overlap would suggest that the interview match was effective in assigning interviews. In other words, the interview match can initially be thought of as a recommendation system. Trust in this process will gradually increase if both the interview recommendations and the final matches are aligned.

A key factor for consideration is the role of virtual interviews in the application and recruitment process. For the 2021–2022 cycle, video interviews will persist. While video interviews reduce applicant travel costs and may increase program efficiency, the low commitment required to participate is likely to lead to more applications from applicants with low interest in programs.

Conclusions

Matching of interviews is complex, and multiple solutions are possible. Interest in specialties, the number of programs, and the size of the applicant pool vary greatly from year to year. Therefore, complex models will need to be built to develop and test proposed algorithms. However, the examples presented here illustrate how an interview match algorithm could match candidates and programs for multiple interviews. An interview match based on a novel matching algorithm could be a powerful tool to ease the burden of excessive interviewing in medical training programs.

References

1. Gadepalli SK, Downard CD, Thatch KA, et al. The effort and outcomes of the pediatric surgery match process: are we interviewing too many? *J Pediatr Surg*. 2015;50(11):1954–1957. doi:10.1016/j.jpedsurg.2015.06.008
2. Haque WZ, Taub PJ, Hammoud MM. Congestion in the coming residency Match: it is time for an interview cap. *Acad Med*. 2021;96(2):163–164. doi:10.1097/ACM.0000000000003838
3. Chang CD, Pletcher SD, Thorne MC, Malekzadeh S. Preference signaling for the otolaryngology interview market. *Laryngoscope*. 2021;131(3):e744–e745. doi:10.1002/lary.29151
4. Salehi PP, Salehi P, Michaelides E. Preference signaling in the National Resident Matching Program—reply. *JAMA Otolaryngol Head Neck Surg*. 2018;144(10):951–952. doi:10.1001/jamaoto.2018.1559
5. Coles P, Cawley J, Levine PB, Niederle M, Roth AE, Siegfried JJ. The job market for new economists: a

market design perspective. *J Econ Perspect*. 2010;24(4):187–206. doi:10.1257/jep.24.4.187
6. Morgan HK, Winkel AF, Standiford T, et al. The case for capping residency interviews. *J Surg Educ*. 2021;78(3):755–762. doi:10.1016/j.jsurg.2020.08.033
7. Chen AF, Secrist ES, Scannell BP, Patt JC. Matching in orthopaedic surgery. *J Am Acad Orthop Surg*. 2020;28(4):135–144. doi:10.5435/JAAOS-D-19-00313
8. Hammoud MM, Andrews J, Skochelak SE. Improving the residency application and selection process: an optional early result acceptance program. *JAMA*. 2020;323(6):503–504. doi:10.1001/jama.2019.21212
9. National Resident Matching Program. NRMP Position Statement On The Feasibility Of An Early Match. https://www.nrmp.org/statement-early-match-2021/. Accessed August 24, 2021.
10. Melcher ML, Ashlagi I, Wapnir I. Matching for fellowship interviews. *JAMA*. 2018;320(16):1639–1640. doi:10.1001/jama.2018.13080
11. Roth AE. The origins, history, and design of the resident Match. *JAMA*. 2003;289(7):909–912. doi:10.1001/jama.289.7.909
12. Roth AE, Peranson E. The redesign of the matching market for American physicians: some engineering aspects of economic design. *Am Econ Rev*. 1999;89(4):748–780. doi:10.1257/aer.89.4.748
13. Ashlagi I, Nikzad A. What matters in school choice tie-breakings? How competition guides design. http://afshin-nikzad.com/pdfs/What-matters-in-TB.pdf. Accessed August 24, 2021.

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Conflict of interest: Alvin E. Roth, PhD, has been a member of the Board of Directors of the National Resident Matching Program (NRMP) since 2020. The opinions expressed here do not represent any position of the NRMP.

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