What Are The Effects of a Match?
Evidence from Internal Medicine

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Abstract:

**Background:** A recently filed lawsuit has raised questions about what would be the effects on residents and prospective residents if the resident match were discontinued. The lawsuit contends that the match suppresses wages.

**Methods:** Evidence can be found by examining closely related markets, such as fellowship matches for Internal Medicine subspecialties, only some of which use a match. Gastroenterology, in particular, had a match until the late 1990’s, but has since operated without one. So the effects of a match can be assessed by comparing internal medicine specialties that presently use a match to those that do not, and by comparing the Gastroenterology market now to when the match was operating.

**Results:** Average salaries in Gastroenterology, and in other Internal Medicine subspecialties that do not presently use a match, are no higher than salaries in subspecialties that do use a match. But since the demise of the Gastroenterology match, appointments to Gastroenterology fellowships have moved earlier, are often made by exploding offers that limit applicants’ ability to compare multiple offers, and Gastroenterology fellows have become less mobile.

**Conclusions:** The fellowship markets suggest that abandonment of the resident match would not benefit residents. On the contrary, the evidence suggests that some of the ills that the match successfully solved (early, exploding offers) would likely return, without any compensating increase in wages.
Debate about reform of medical residencies has been enlivened by a lawsuit against various medical organizations, including the National Resident Matching Program.\(^1\) Regarding the NRMP, the suit contends that the match works to the disadvantage of residents by restraining competition for their services, and suppressing wages. The legal issues have been discussed by Miller and Greaney\(^2\) and by Chae\(^3\), who frames the question “Is the Match Illegal?” The basic economic question the suit raises about the match is: \textit{If the match were abandoned, would residents be helped, or harmed?}

One way to address this question is to compare similar markets operating with and without a match. The various subspecialties of Internal Medicine offer opportunities for such a comparison, since some of them participate in the Medical Specialties Matching Program (operated by the NRMP), while other internal medicine subspecialties operate in a decentralized manner, without the use of a match. Furthermore, Gastroenterology allows a before-and-after comparison, since Gastroenterology fellowship programs participated actively in the MSMP from 1986 through 1996, with participation rapidly falling off from 1997, leading to formal abandonment of the match in 2000.\(^4\)

**Historical Background**

The resident match originated in response to difficulties the market for residents experienced when it operated in a decentralized way.\(^5,6\) Before the beginning of the match in the early 1950’s, offers to interns (as they were then called) were made at different times by different hospitals, often via exploding offers that required applicants to make a final decision to accept or reject an offer without knowing what other offers might be forthcoming. This is a problem that other markets have experienced in various times and places; e.g. in the market for clerks for appellate judges\(^7\), for college admissions (increasingly done via “early decision”)\(^8\), and in other medical and health care markets, not to mention the processes by which fraternities and sororities “rush” to recruit their members,\(^9\) and the scramble by which college football teams were matched to postseason bowl games (before the advent of the Bowl Championship Series).\(^10,11\)

A number of markets have adopted clearinghouses, to establish a uniform time for the market to operate, and protect applicants from being forced to accept exploding offers
without being able to consider other offers that might be forthcoming (or sometimes without even being able to interview for other positions). For example, regional medical markets in Britain for “pre-registration house officers” adopted clearinghouses like the American match. Experience with matches has shown that they can be effective at creating a uniform time for the market to operate, so participants’ preferences for all their potential options may play a role in determining the outcome. The main requirement seems to be that the outcomes should be “stable” in the sense that no resident and residency program who are not matched to one another would both prefer to be matched to one another.

**The Effects of a Match**

Like the market for residents, the markets for more advanced positions also suffered from exploding offers made at different times by different programs, and these markets too attempted a number of solutions prior to adopting a centralized match. In 1986 the Medical Specialties Matching Program (MSMP) was initiated by the NRMP at the request of the Association of Professors of Medicine, the Association of Program Directors in Internal Medicine and the Council of Sub-Specialty Societies of the American College of Physicians. From 1989 the match was conducted for Gastroenterology, Cardiovascular Disease, Pulmonary Disease and since 1994 also for Infectious Disease (all are internal medicine subspecialties.) The objective was to establish a uniform appointment date for fellowship positions, which would permit applicants to complete at least two years of residency before having to make decisions about subspecialties. The fellowship clearinghouse was conducted a year in advance, i.e. after two years of internal medicine residency, and one year before employment would begin. The MSMP uses the same procedures and matching algorithm as does the NRMP. (Since 1998 they both use the Roth-Peranson algorithm that seeks a stable matching as favorable as possible to applicants.)

**The effect of a match on wages:**

We purchased from the AMA the GMED 2002-2003 dataset of fellowship wages by program, and below we compare all internal medicine specialty fellowships in the US that require 3 years of prior residency (we exclude Clinical Cardiac
Electrophysiology and Interventional Cardiology, which require 5 and 6 years respectively). We also exclude data from Puerto Rico. We use Freida online\textsuperscript{19} to determine the length of programs, and divide the program size by the length of the program to determine the number of residents per year for each hospital and each program. Of the 1249 data points, only 1178 include wages, for 14 specialties in 209 hospitals. Internal sports medicine is excluded from the table, as there are only 2 programs.

These internal medicine subspecialties provide us with the opportunity to test whether the presence or absence of a match is a determining factor in fellowship wages.

As the table shows, subspecialties of internal medicine that use the MSMP do not experience different average wages than specialties that do not use a centralized match. (Of the 13 subspecialties listed in the table, in descending order of average wage, those that use the match are in positions 1, 5, 7, and 8.) The average compensation of specialties that use a centralized match is 41,963 (or 41,357 when taking an average weighted by the number of first year fellows) while it is 41,171 (or 41,248) for specialties that do not use a centralized match. Furthermore the median, minimum and maximum wage, as well as the standard deviation of the distribution of wages of subspecialties that use the MSMP is (marginally) higher than of those that do not use the match. (That the average wages of fellowships that use a match do not differ from those that do not is readily confirmed by a Mann Whitney U test, \( p = 0.28 \). The same test on all other variables also yields insignificant differences.)
### Table 1: 2001 starting wage statistics for internal medicine subspecialties that require 3 years of prior residency (ordered in descending order of average starting wage).

<table>
<thead>
<tr>
<th>Specialty Name</th>
<th>Average</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>St.dev</th>
<th>Programs (w. wage)</th>
<th>program years</th>
<th>fellows/year</th>
<th>Match?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary Disease</td>
<td>43,978</td>
<td>42,318</td>
<td>36,000</td>
<td>56,000</td>
<td>5,839</td>
<td>31 (27)</td>
<td>2</td>
<td>57</td>
<td>MSMP</td>
</tr>
<tr>
<td>Critical Care Medicine</td>
<td>41,998</td>
<td>41,795</td>
<td>30,504</td>
<td>50,000</td>
<td>4,220</td>
<td>32 (32)</td>
<td>1 / 2</td>
<td>83</td>
<td>No</td>
</tr>
<tr>
<td>Geriatric Medicine</td>
<td>41,798</td>
<td>41,067</td>
<td>28,200</td>
<td>57,107</td>
<td>4,658</td>
<td>96 (90)</td>
<td>1</td>
<td>405</td>
<td>No</td>
</tr>
<tr>
<td>Hematology and Oncology</td>
<td>41,654</td>
<td>40,547</td>
<td>32,000</td>
<td>70,900</td>
<td>5,009</td>
<td>113 (110)</td>
<td>3</td>
<td>350</td>
<td>No</td>
</tr>
<tr>
<td>Infectious Disease</td>
<td>41,490</td>
<td>40,477</td>
<td>30,000</td>
<td>65,000</td>
<td>5,354</td>
<td>136 (122)</td>
<td>2</td>
<td>321</td>
<td>MSMP</td>
</tr>
<tr>
<td>Nephrology</td>
<td>41,267</td>
<td>40,402</td>
<td>30,000</td>
<td>54,450</td>
<td>4,495</td>
<td>126 (122)</td>
<td>2</td>
<td>369</td>
<td>No</td>
</tr>
<tr>
<td>Cardiovascular Disease</td>
<td>41,220</td>
<td>40,486</td>
<td>26,749</td>
<td>70,000</td>
<td>4,445</td>
<td>174 (164)</td>
<td>3</td>
<td>702</td>
<td>MSMP</td>
</tr>
<tr>
<td>Pulmonary Disease and Critical Care Medicine</td>
<td>41,163</td>
<td>40,537</td>
<td>26,916</td>
<td>70,000</td>
<td>5,335</td>
<td>119 (112)</td>
<td>3</td>
<td>354</td>
<td>MSMP</td>
</tr>
<tr>
<td>Oncology</td>
<td>41,150</td>
<td>41,706</td>
<td>28,200</td>
<td>52,808</td>
<td>5,104</td>
<td>27 (27)</td>
<td>2</td>
<td>107</td>
<td>No</td>
</tr>
<tr>
<td>Gastroenterology</td>
<td>41,145</td>
<td>40,691</td>
<td>26,000</td>
<td>75,000</td>
<td>5,738</td>
<td>154 (146)</td>
<td>3</td>
<td>357</td>
<td>No</td>
</tr>
<tr>
<td>Hematology</td>
<td>40,797</td>
<td>40,300</td>
<td>28,200</td>
<td>52,808</td>
<td>6,216</td>
<td>20 (19)</td>
<td>2</td>
<td>48</td>
<td>No</td>
</tr>
<tr>
<td>Endocrinology, Diabetes, and Metabolism</td>
<td>40,545</td>
<td>40,000</td>
<td>24,000</td>
<td>75,000</td>
<td>5,303</td>
<td>115 (106)</td>
<td>2</td>
<td>237</td>
<td>No</td>
</tr>
<tr>
<td>Rheumatology</td>
<td>40,183</td>
<td>39,500</td>
<td>28,824</td>
<td>65,000</td>
<td>5,119</td>
<td>104 (99)</td>
<td>2</td>
<td>187</td>
<td>No</td>
</tr>
</tbody>
</table>

The fact that average wages are not different depending on the presence or absence of a match implies that, from the point of view of wages, fellows are not uniformly helped or hurt by a match. The possibility remains that the match has some effect on the distribution of salaries. Specifically, the match could result in more uniform wages, i.e. a match might help some fellows and hurt others compared to the market that would prevail in the absence of a match. However, the standard deviation of the distribution of wages of specialties that use the MSMP and those that do not, are not significantly different from one another, and if anything are a bit higher for specialties that use the match.
The following simple regression using wage data from each hospital for each internal medicine specialty confirms our results. Using all 1178 wage data, the regression

\[
\text{wage} = \text{constant} + \beta_1 \delta(\text{MATCH}) + \varepsilon
\]

with \(\delta(\text{MATCH})=1\) if the specialty uses the MSMP match and 0 otherwise, yields a constant of $41,134.5 (with a t-statistic of 221.72 and a p-value of 0.00) and a match effect of $323.42 (t: 1.05, p = 0.295) on wages. That is, in this test the effect of a match on wages is not statistically significant.

The failure to find a significant effect of the match on wages might be driven by the fact that different specialties are distributed differently across hospitals. Specialties that use the match have a larger average number of fellowship programs than those that do not, and hence are represented at more hospitals. So it is possible that a difference in wages due to a match might be masked by differences in wages at different hospitals. We therefore want to determine whether, within hospitals, wages for specialties that use the match are different than wages for specialties that do not. In the next regression we include a dummy variable for each hospital (hence we have a vector of dummies \(\beta_2\)), so that MATCH represents all the variation in wages within hospitals for specialties that use the MSMP and those that do not (that is \(\delta(\text{MATCH})=1\) if the specialty uses the MSMP match and 0 otherwise). Of the 209 hospitals, 169 have both specialties that use, and specialties that do not use the match. The remaining 40 hospitals will not affect \(\beta_1\) as their effect is summarized by their respective hospital dummy.

\[
\text{Wage} = \text{constant} + \beta_1 \delta(\text{MATCH}) + \beta_2 \delta(\text{Hospital}) + \varepsilon
\]

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
<th>t-statistics</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>42,650</td>
<td>18.06</td>
<td>0.000</td>
</tr>
<tr>
<td>(\beta_1)</td>
<td>368</td>
<td>2.45</td>
<td>0.014</td>
</tr>
</tbody>
</table>

The adjusted R-square of the regression is 0.7849, we have 1178 observations overall.

We find that hospitals that offer both specialties that do and do not use the match, pay $368 more for specialties in the MSMP than for those outside the match. Regressions that use log salaries as opposed to salaries yield similar results. As an alternative test, we compute for each hospital the average wage for specialties that use the MSMP, and for those that do not use the match. Using a Wilcoxon matched-pairs signed-ranks test for the
169 hospitals that offer both specialties that use and do not use the match, we cannot reject the null hypothesis that the wages are the same in favor of the alternate hypothesis that the wage is lower for specialties that use the match, the p-value is 0.960. (Testing equality of wages against the hypothesis that the match increases wages yields a p-value of 0.056.)

Our results thus indicate that specialties that use the match do not have lower wages than those that do not use the match (and indeed appear to have slightly higher wages).

We next consider effects of a match apart from wages, using the demise of the gastroenterology match to compare outcomes when the match was in operation to outcomes when there was no match, i.e. both before and after Gastroenterology participated in the MSMP

**The demise of the GI Fellowship match:**

The demise of the Gastroenterology match seems to have been set in motion in 1993-1994, when, in the midst of general discussions of health care reform, Gastroenterology subjected itself to a manpower analysis. The resulting study was published in 1996. Its main conclusions were that the US health care system and gastroenterologists would benefit from a reduction in Gastroenterology Fellowship programs. The Gastroenterology Leadership Council endorsed a goal of 25% to 50% reduction in the number of GI fellows over 5 years. Furthermore, an additional year of training was mandated: starting in the summer of 1996, three years of training were required to be board eligible, instead of two.

This triggered an even sharper reduction in the number of residents who applied for GI fellowship positions. In 1996, for the first time, and despite the reduction in the number of positions offered, there were fewer applicants for GI fellowship positions than there were positions offered in the match. This seems to have caused a scramble among fellowship programs that led to the demise of the match. Dr. David Brenner, then Chair
of the AGA’s Manpower and Training Committee, in an interview in Spring 1999 described that demise in part as follows:

“Last year, several applicants complained because many training programs did not use the match. Many applicants were unaware of this change and they felt that they had missed opportunities. Training-program directors who used the match felt that they had lost applicants to programs that had secured fellows before the match. Many applicants and a large percentage of the fellowship programs stopped using the match, which made choices more difficult for the remaining applicants and programs and created a vicious circle. Many training directors were very disappointed a few years ago when they didn’t fill their slots because the applicants they thought were interested accepted positions before the match.”

That is, with the demise of the match, the uniform date of appointments was lost. As in the days before a match was in use, this presented prospective fellows with difficult strategic decisions. For example, GI Fellows Bauer, Fackler, Kongara, Matteoni, Shen and Vaezi comment on the effects of the loss of the match.

“Of recent concern is the deterioration of the match process for candidates applying for fellowship positions over the past two years. Our junior colleagues are concerned that they may not be able to wait safely to interview with the institution of their choice while a position is offered elsewhere early in the decision process. The absence of the match benefits the programs a great deal more than their applicants.”

So, with the demise of the match, we see the return of early, exploding offers from fellowship programs to applicants. By making exploding offers, firms can limit the ability of applicants to consider alternative offers. The market also experienced some of the other “typical” costs associated with unraveling, apart from mismatching. The first is that when the time comes to begin employment, some applicants fail to fulfill their obligation, made two years in advance, to join the program whose offer they have accepted. Second, internal medicine residents may not want to consider Gastroenterology, because they are not willing to commit to a subspecialty this early. Interviews now take place before residents have the opportunity to explore other subspecialties.

To investigate whether the use of the match increased the scope of the Gastroenterology market, we purchased from the American Medical Association (via Medical Marketing Service, Inc.) a dataset that includes all living physicians who completed a residency in
the US and subsequently a GI fellowship in the US after 1977. The data from Gastroenterology show that the demise of the match resulted in reduced mobility of Fellows. As the following graph shows, as the Gastroenterology match started to decline, so did the likelihood that a successful Fellowship applicant would move to a different hospital, city, or state than the one in which he or she had been a resident in Internal Medicine. (A more detailed analysis of these and related data will be presented elsewhere.25)

![Share of mobility of GI fellows for each year](graph)

**Figure 1:** Percentage of GI Fellows who move between residency and fellowship. The vertical lines indicate the beginning and the end of the use of the centralized match, measured in year of Fellowship completion.

The differences that appear in the graph are significant: Mobility increases significantly at the hospital, city and state level immediately after the match was introduced, and continues to significantly increase as the match became more established. (This gradual impact of the match is replicated by experiments.21) Once the match was abandoned, mobility decreased (significantly at the hospital and city level) and is not significantly different from levels before the introduction of the match (two-sided Mann Whitney U test, with the proportion of mobility in each year as observations).
Conclusions

The antitrust lawsuit involves, along with other things, a hypothesis about the effect of the match, namely that it reduces wages. We have proposed a test of that hypothesis. Different fellowship matches for Internal Medicine subspecialties turn out to have essentially the same wages, despite the fact that some use matches and some do not. And, in the case of Gastroenterology, the loss of the match significantly reduced the mobility of residents who became gastroenterology fellows. The loss of the match also resulted in the market unraveling, so that hospitals start making offers almost a year earlier than when they used a match.

Other aspects of the medical marketplace seem to be more important for determining wages for fellows than the presence or absence of a match. The evidence from the fellowship markets strongly suggests that abandonment of the resident match would not benefit residents. On the contrary, the evidence suggests that some of the ills that the match successfully solved (early, exploding offers) would likely return, without any compensating increase in wages.


