Medical student awareness of and interest in clinical informatics

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ABSTRACT

Objective We aimed to investigate medical students’ attitudes about Clinical Informatics (CI) training and careers.

Materials and Methods We distributed a web-based survey to students at four US allopathic medical schools.

Results Five hundred and fifty-seven medical students responded. Interest in CI training opportunities (medical school electives, residency electives, or academic fellowships) surpassed respondents’ prior awareness of these opportunities. Thirty percent of student respondents expressed at least some interest in a CI-related career, but they were no more aware of training opportunities than their peers who did not express such an interest.

Discussion Almost one third of medical students who responded to our survey expressed an interest in a CI-related career, but they were generally unaware of CI training and mentoring opportunities available to them. Early outreach to such medical students, through elective classes, professional society incentives, or expert partnerships, may positively influence the size and skill set of the future CI workforce.

Conclusion We should work as a field to increase the quantity, quality, and publicity of CI learning opportunities for interested medical students.

Key words: education, medical, undergraduate; students, medical; career choice; fellowships and scholarships

BACKGROUND AND SIGNIFICANCE

In the past decade, clinical informatics (CI) has transformed from a field of circumscribed relevance to an established, board-certifiable medical subspecialty.1 Physicians are using information technology more extensively,2–4 and residents are spending significant amounts of time in front of computers.5,6 Medical educators and informatics experts have, accordingly, called for increased incorporation of informatics into undergraduate medical education.7–11 The rigor of informatics education varies widely between medical schools, and most medical students are not subjectively or objectively ready for the CI-related expectations of the future.12–14 Challenges to delivering an adequate informatics education at the undergraduate medical level include a lack of curricular time, curricular standards, and trained informatics specialists.15,16–18 Encouragingly, though, CI-related competencies for medical students have recently been published.19

To sustain CI’s upward trajectory, our field must also motivate a cohort of today’s physicians to become the trained informaticians of tomorrow. In its 2014 list of public policy priorities, the American Medical Informatics Association (AMIA) has highlighted its support of educational opportunities for the future CI workforce.15 Unfortunately, for current medical students contemplating CI-related careers, the way forward may be unclear. A handful of CI-related courses for interested medical students have been described;20–24 however, these electives are site-specific, enrollment-limited, and do not measure student perspectives regarding CI as a career path. This finding is disappointing, given that elective courses have been shown to boost student recruitment both into particular subspecialties25–29 as well as into broader career paths (for example, clinician-educator or physician-scientist roles).30–33 The case of maritime medicine, a discipline comparable to CI in terms of novelty, has demonstrated that optional courses may be helpful with regard to students’ attitudes toward the field.34,35

Professional societies provide an alternative venue for medical students to find mentors and explore relevant fields; for example, AMIA hosts annual Student Design Challenges and Student Paper Competitions geared at trainees. However, unlike the professional societies of other board-certifiable specialties — such as the Undersea & Hyperbaric Medical Society, for diving and hyperbaric medicine, or the American College of Occupational and Environmental Medicine, for occupational medicine — AMIA student membership is not currently free. Furthermore, AMIA’s website does not, at this time, provide a dedicated resource page for medical students interested in the informatics field (unlike the Aerospace Medical Association’s or the American College of Medical Toxicology’s website).36,37 Little is known about whether more intensive outreach to
medical students, by AMIA or the CI field in general, would be appreciated by students or efficacious from a recruitment standpoint. Indeed, despite the rapid proliferation of opportunities for the development of the CI workforce, little is known about whether current medical students are even interested or aware of CI-related mentoring opportunities and careers.

OBJECTIVE
We sought to gauge medical students’ awareness of and attitudes toward CI-related training opportunities and careers. Specifically, our study’s goal was to survey medical students at multiple institutions, in order to investigate whether student interest in CI-related training and careers would exceed student awareness of such opportunities.

MATERIALS AND METHODS
We developed a 14-question, web-based, anonymous survey (available as Supplement A) in consultation with medical educators and informatics experts. After inquiring about basic demographic information, the survey provided definitions and examples of CI electives for medical students, CI electives during residency, and CI academic fellowships. We then asked students to rate their previous awareness and their potential interest (“yes”/“no”/“unsure”) in each of these opportunities. We summarized several potential avenues by which physicians may fully or partially incorporate CI into their future careers, including via application development (eg, working for electronic medical record [EMR] vendors), application implementation (eg, consulting with physician groups regarding Meaningful Use requirements), and application management (eg, serving as a Chief Information Officer). Students were subsequently asked to rate their interest in CI career integration in any form and at any level of commitment using a Likert scale ranging from 1 (not at all interested) to 5 (very interested) or by indicating they were unsure, with responses of 4 or 5 being deemed to demonstrate at least some career interest in CI. All questions were optional.

The survey was reviewed and deemed exempt by the Institutional Review Board of Brown University in Providence, Rhode Island. We sent the survey link to students at four medical schools: the Alpert Medical School (AMS) of Brown University in Providence, Rhode Island; the Oregon Health & Science University (OHSU) School of Medicine in Portland, Oregon; the University of Alabama at Birmingham (UAB) Medical School in Birmingham, Alabama; and the University of Arkansas for Medical Sciences (UAMS) in Little Rock, Arkansas. We collected survey responses through a de-identified secure database and analyzed them after the survey link had been available for two months. We used Microsoft Excel, chi-squared analysis, and a pre-determined α value of 0.05 to evaluate our data.

RESULTS
A total of 557 respondents from four institutions completed the survey (response rate: 22%). Forty-five percent of the respondents were male. Fifty-two percent of respondents were under the age of 26, and thirty-seven percent were between the ages of 26 and 30. In terms of education level, 30% of respondents identified themselves as first-year students, 27% as second-year students, 21% as third-year students, and 22% as fourth-year students. The breakdown of respondent institutions was as follows: 39% of respondents came from AMS, 27% from OHSU, 24% from UAB, and 10% from UAMS. Students who were unsure of their chosen specialty comprised 26% of the respondents; of the remainder, 67% stated interest in a medical specialty versus 33% who expressed interest in a surgical specialty.

Thirty percent of respondents expressed at least some interest in incorporating CI into their future career, and thirteen percent specified that they were “very” interested. In contrast, 37% of students were neutral, 29% were not interested, and 4% were unsure. Results regarding respondent interest and awareness in CI training opportunities are described in Table 1. As shown in the table, 58% of medical students we surveyed expressed potential interest in student electives, 59% in residency electives, and 39% in academic fellowships. The distribution of respondent interest in academic fellowships was significantly different ($P < .01$) from their reported interest in either student or residency electives. We performed a subset analysis of the students who expressed at least some career interest in CI. Compared to their peers, these students were significantly more likely ($P < .01$) to express potential interest in pursuing either of the training opportunities. As demonstrated with the broader population of medical students, students in this subset also rated interest in academic fellowships significantly differently ($P < .01$) than their interest in either student or residency electives.

With regard to awareness, 32% of respondents were previously aware of student electives, 24% were aware of residency electives, and 28% were aware of academic fellowships. Of these proportions, only the difference between student electives and residency electives reached statistical significance ($P < .01$). For all three types of training opportunities, respondent interest exceeded their awareness. We again performed a more detailed analysis of the students who expressed at least some career interest in CI. As demonstrated in Table 1, these students were no more likely than their peers to be aware of CI training opportunities. No statistically significant differences in CI career interest, CI training interest, or CI training awareness were noted between institutions.

DISCUSSION
Our data demonstrated that 30% of student respondents showed at least some interest in incorporating CI into their future careers; even more encouragingly, 13% of those respondents were “very” interested in doing so. Despite various types of supplemental CI opportunities for interested students offered by the institutions we surveyed (as outlined in Table 2), responses between students from different medical schools did not vary significantly. An overall majority of respondents expressed an interest in pursuing informatics electives as students or residents, although less than one third of students
were aware of CI training opportunities available to them as students and early-career physicians. Ultimately, while previous studies have shown that medical students desire broader training in informatics, our data further demonstrate that a subset of students are interested in more intensive training, to learn about what CI has to offer as a field and a career path. Unfortunately, awareness of such training opportunities universally lags behind interest, even in the population of students who specifically evince a career interest in CI.

Medical students appear to consider academic fellowships significantly less appealing than other options; this pattern persists in the subset of students who express a specific interest in a CI-related career. Student preferences regarding fellowship decisions are, admittedly, somewhat hypothetical, especially given that over half of our study participants were in their preclinical years of medical school. Nevertheless, students may weigh the opportunity cost of a two-year fellowship as impracticable, compared to that of a briefer elective course. Alternatively, medical students may not associate the concept of a fellowship with the broad, multidisciplinary nature of CI, a subspecialty described as “fundamentally different from all prior subspecialties.” In any case, AMIA has specifically focused on supporting “biomedical and health informatics fellowships” in its listing of 2014 public policy priorities.

Reaching out to physicians — particularly those who may have some interest in informatics career integration, but are not yet aware of CI training opportunities available to them as students and early-career physicians. Ultimately, while previous studies have shown that medical students desire broader training in informatics, our data further demonstrate that a subset of students are interested in more intensive training, to learn about what CI has to offer as a field and a career path. Unfortunately, awareness of such training opportunities universally lags behind interest, even in the population of students who specifically evince a career interest in CI.

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In the Career Interest column, “+” signifies the population of respondents who stated that they were “somewhat” or “very” interested in incorporating clinical informatics (CI) into their future careers; “0/-/?” signifies the population of respondents who were neutral, uninterested, or unsure regarding incorporating CI into their future careers. For the Previous Awareness and Potential Interest columns, “+” signifies a positive response, while “0/-/?” signifies a negative or unsure response. P-values were calculated using chi-squared analyses; starred values are significant at an α value of 0.05.

### Table 1: Student Awareness and Interest in CI Electives/Fellowships

<table>
<thead>
<tr>
<th>Category</th>
<th>Career interest</th>
<th>Previous awareness of training opportunity</th>
<th>Potential interest in training opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>+</td>
<td>-/?</td>
</tr>
<tr>
<td>Student electives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>51</td>
<td>95</td>
<td>35%</td>
</tr>
<tr>
<td>0/-/?</td>
<td>110</td>
<td>244</td>
<td>31%</td>
</tr>
<tr>
<td>Overall</td>
<td>161</td>
<td>339</td>
<td>32% aware</td>
</tr>
<tr>
<td>Residency electives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>36</td>
<td>111</td>
<td>24%</td>
</tr>
<tr>
<td>0/-/?</td>
<td>82</td>
<td>270</td>
<td>23%</td>
</tr>
<tr>
<td>Overall</td>
<td>118</td>
<td>381</td>
<td>24% aware</td>
</tr>
<tr>
<td>Academic fellowships</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>43</td>
<td>104</td>
<td>29%</td>
</tr>
<tr>
<td>0/-/?</td>
<td>99</td>
<td>254</td>
<td>28%</td>
</tr>
<tr>
<td>Overall</td>
<td>142</td>
<td>358</td>
<td>28% aware</td>
</tr>
</tbody>
</table>

### Table 2: Selected Elective CI Opportunities for Medical Students

<table>
<thead>
<tr>
<th>Medical School</th>
<th>CI Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpert Medical School of Brown University</td>
<td>Four-year individualized scholarly concentration for students interested in Informatics or in Medical Technology &amp; Innovation</td>
</tr>
<tr>
<td>Oregon Health &amp; Science University School of Medicine</td>
<td>Student-run Medical Informatics Interest Group, with lectures by faculty experts from the Department of Medical Informatics &amp; Clinical Epidemiology</td>
</tr>
<tr>
<td>University of Alabama at Birmingham</td>
<td>Division of Informatics within the Department of Pathology, with elective classes, including “This Is Your Brain on Informatics”</td>
</tr>
<tr>
<td>University of Arkansas for Medical Sciences</td>
<td>Graduate program in bioinformatics, with periodic clinical informatics-related guest lectures, eg, Learning Patterns and Anomalies of Healthcare from Electronic Medical Records or Big Data to Knowledge</td>
</tr>
</tbody>
</table>
motivated enough to pursue a dedicated CI fellowship — at earlier points in their careers may also be valuable.

For the sake of brevity, we did not ask respondents about their prior informatics experience and, therefore, cannot comment on our population’s baseline informatics knowledge. Although this fact raises the possibility of selection bias, given our limited response rate, a substantial proportion of our student respondents openly expressed a lack of interest in informatics training or careers — while not conclusive, this suggests we reached more than just the population of students with a previous interest in CI. Multi-institution surveys of medical students often face obstacles, due to the depersonalized nature of web-based invitations and students’ sensation of being “oversurveyed”; indeed, our response rate is comparable or superior to that of several other studies that used web-based surveys to poll medical students at multiple institutions regarding technology-related issues.39,45–49 Regardless of response rate, in our study, an average of 16 students per school expressed that they were “very interested” in integrating CI into their future careers. Further outreach to these types of students will likely help bolster their enthusiasm. Our study was not designed to investigate the best methods by which to actually engage these students; future research into this issue, using outcome measures such as post-intervention student attitudes toward CI or CI-related productivity after targeted interventions, will be of great value to the field.

CONCLUSIONS

There is little doubt that future physicians will be practicing in a digital world, in which CI training will be of paramount importance.11,18 Medical educators have already taken myriad steps to train medical students in the use of CI applications; however, to maintain a robust culture of CI-related innovation, we must also work as a field to attract interested medical students and provide them with opportunities to build their CI skill sets and curricula vitae. This may come in the form of elective courses, professional society incentives, or online or in-person forums to bring interested parties together. Medical students can also explore the field by forming partnerships with informatics experts, whether clinical (for example, fellows or faculty affiliated with CI fellowship programs) or multidisciplinary (for example, faculty involved with translational informatics or public health informatics). Given the limited availability and awareness of these types of offerings, we hope that the quantity, quality, and publicity of CI learning opportunities continue to grow in subsequent years. Medical students are, evidently, interested in such opportunities, and we as a field will benefit from providing them with the tools to advance CI into its next generation.

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COMPETING INTERESTS

None.

CONTRIBUTORS

All four authors contributed to study design and manuscript preparation. All four authors have reviewed the final manuscript and vouch for its accuracy.

SUPPLEMENTARY MATERIAL

Supplementary material is available online at http://jamia.oxfordjournals.org/.

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REFERENCES


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