

**Electronic Health Records, Clinical Experiences and Interprofessional Student Perceptions | 1****Abstract**

*This study evaluates changes in interprofessional attitudes and perceptions for students exposed to shared electronic health records (EHR) and students not exposed to shared EHR. A longitudinal study was conducted with 70 New England College of Optometry students. The Interprofessional Education Perception Scale survey was administered three times during the second and third year of training. Optometry student perceptions of how other health professionals perceive optometry were significantly more negative for the group who experienced early shared EHR than for the group without that experience. Optometric educators should be aware of the possible clinical impact on perceptions when assessing interprofessional educational programs and consider these findings when designing a clinical curriculum.*

**Key Words:** *interprofessional education, clinical education, electronic health record*

**Background**

Interprofessional education (IPE) is defined as “when students from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes.”<sup>1</sup> The pedagogical implementation of IPE has steadily gained traction within the academic community in the past decade, markedly so since the Interprofessional Education Collaborative released its Core Competencies for Interprofessional Collaborative Practice in 2011.<sup>2</sup> As such, graduate health professional schools have begun to incorporate interprofessional education objectives as part of their accreditation standards.<sup>2,3</sup> The endorsement of IPE by the Institute of Medicine has been a driving force behind IPE initiatives, with the intended goals of safer and higher quality care, delivered with increased efficiency and cost effectiveness.<sup>2,3,4</sup>

Many institutions of higher education have integrated specific didactic activities to train students in IPE. Among graduate professional programs with clinical training, students may also be required to complete clinical assignments with interprofessional components. These assignments may require interprofessional activities such as referral coordination, communication with other providers, and other actions necessary for patient care. These various modes of communication are even more likely given the introduction of technology and electronic health records (EHR). There is evolving acknowledgement that health information technology plays an important role in providing team-based care, which should be integrated into IPE programs.<sup>5,6,7</sup> Recently proposed models include a blending of EHR use and team-based activities, with the aim of delivering “technology enhanced collaborative care.”<sup>7</sup>

The effectiveness of didactic and clinical IPE training programs is typically assessed through changes in perception as measured by surveys.<sup>8-11</sup> While traditional clinical experience and EHR use are pervasive in the training of healthcare professionals, there is a paucity of literature regarding whether these activities can also change perceptions in the absence of a formal didactic training component. Rather, the published literature typically includes structured IPE interventions and/or clinical experiences in which interprofessional interactions are deliberate and purposefully planned.<sup>8,12-17</sup> Additionally, the use and impact of EHR alone, when shared among several different healthcare professionals does not appear among the IPE literature.

The impact that clinical assignments have on IPE perceptions is not known. A better understanding of how clinical experiences and use of EHR impact student interprofessional perceptions may allow us to improve the design of IPE programs and influence clinical training for healthcare professionals.

The purpose of this study was to determine whether the clinical experience, without a planned IPE component, impacts student professional perceptions and whether the use of interprofessionally shared EHR plays a role. For the purposes of this study, an interprofessionally shared EHR setting was defined as a system that allows providers of different disciplines, i.e., primary care providers, pediatricians, behavioral health providers, etc., to review a mutual patient’s comprehensive health record and communicate in real time.

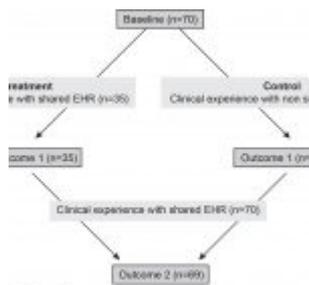
**Methods**

A longitudinal study was conducted over a 22-month period, from 2015-2017, with second-year students (n=70) at New England College of Optometry (NECO). All study protocols conformed to the Declaration of Helsinki and were approved by the Internal Review Board at NECO. Approximately half the class was randomized into two groups at the beginning of second year (**Figure 1**). The control group (n=35) was given a clinic assignment without interprofessionally shared EHR. These assignments were based at NECO owned and operated optometry clinics and private solo and group practices. The treatment group (n=35) was given a clinical assignment with interprofessionally shared EHR. These assignments were

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based in community health centers where multidiscipline care was occurring. Students were assigned for the entire second year (approximately 35 weeks), during which time the focus was on building technical and communication skills. During clinical assignments, students are required to perform any combination of the following: automated pre-testing, case history, entrance testing, retinoscopy, refraction, slit lamp biomicroscopy, Goldmann tonometry and dilated fundus exams.

Students were not recruited for this study and there was no additional benefit or incentive to participation. All students received the Interdisciplinary Education Perception Scale (IEPS) survey. Only students with clinical assignments at sites meeting the eligibility criteria (year-long assignments during second year in a shared or non-shared EHR site) were included for analysis.



**Figure 1.** Study design with baseline, outcome 1, and outcome 2 of surveys.  
[Click to enlarge](#)

At the conclusion of the second year, the control and treatment groups were mixed before commencing third-year assignments. Throughout third year (approximately 40 weeks), all students rotated through 1-2 semesters in a community health center, 1-2 semesters in a NECO owned and operated clinic, and a small percentage of students were assigned to Veterans Affairs or hospital-based settings. This clinical year focused on primary care with increasing responsibility for patient diagnosis and management. Competencies assessed represented a more comprehensive skill set at this time, including the ability to analyze exam data and develop differential diagnoses and treatment and management plans.

The IEPS survey, an 18-item psychometrically validated instrument that has been widely used in the published literature,<sup>18,19</sup> was administered via Qualtrics before the start of second year (baseline, B), at the end of second year (outcome 1, O1), and at the end of third year (outcome 2, O2). Qualtrics is an online subscription software used for the detailed control of survey development, distribution and analysis. The IEPS assesses “competency and autonomy, perceived need for cooperation, and perception of actual cooperation.”<sup>20</sup> Each item utilizes a 7-point scale with three subcategories, as developed by this study’s investigators. The three subcategories are as follows: OD student perceptions of the optometric profession (OD-OD), OD student perceptions of other health professions (OD-Ot), and other health profession perceptions of optometry (Ot-OD). **Table 1** shows the IEPS with the subcategories.

Item	Item Description
1	Individuals in the profession are well treated
2	Individuals in the profession are able to work closely with individuals in other professions
3	Individuals in the profession demonstrate a great fear of authority
4	Individuals in other professions respect the work done by my profession
5	Individuals in the profession are very positive about their goals and objectives
6	Individuals in the profession tend to cooperate with other professions
7	Individuals in the profession are very positive about their contributions and accomplishments
8	Individuals in the profession must depend upon the work of people in other professions
9	Individuals in other professions think highly of my profession
10	Individuals in my profession trust each other's professional judgment
11	Individuals in my profession have a higher status than individuals in other professions
12	Individuals in my profession make every effort to understand the capabilities and needs of other professions
13	Individuals in the profession are extremely competent
14	Individuals in the profession are willing to share information and resources with other professions
15	Individuals in the profession have good relations with people in other professions
16	Individuals in my profession think highly of other related professions
17	Individuals in the profession work well with individuals in other professions

**TABLE 2**  
Demographic and Academic Variables for Control and Treatment

	Control		Treatment	
	N	M	N	M
23-29 years	35	25.82	35	25.51
4.00-4.83	35	3.03	35	3.00
Female	25		23	
Male	10		12	
Asian	13		5	
Black	1		0	
Hispanic	1		1	
Non-Hispanic White	12		19	
Unknown	0		10	

Number of participants; M = mean

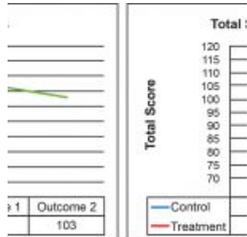
**Table 1.** [Click to enlarge](#) **Table 2.** [Click to enlarge](#)

A 2-sample t-test was used to compare demographic and academic variables between treatment and control groups. A 2x3 mixed ANOVA analysis was conducted with groups (control and treatment) used as the between-subjects variable and three subcategories (OD-OD, OD-Ot, and Ot-OD) used as the within-subjects variable. Follow-up univariate tests were conducted. A p-value of <0.05 was used as the threshold for statistical significance.

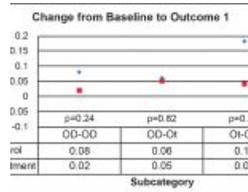
**Results**

The survey was completed by 70 participants at baseline and O1 and 69 participants at O2. One student dropped out of the study due to a leave of absence from NECO. **Table 2** shows the demographic and academic variables for all study participants. No statistically significant differences were found between treatment and control groups for age (p=0.44), sex (p=0.61), race/ethnicity (p=0.06), or GPA (p=0.81).

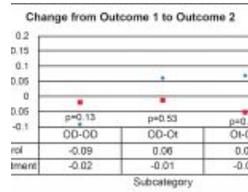
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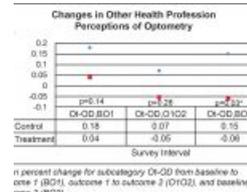
**Figure 2.** Total survey scores for all participants and by group at baseline, outcome 1, and outcome 2. [Click to enlarge](#)



**Figure 3.** [Click to enlarge](#)



**Figure 4.** [Click to enlarge](#)



**Figure 5.** [Click to enlarge](#)

Total survey scores for all participants and total survey scores by group did not yield statistically significant differences from baseline to O1, or O1 to O2 (**Figure 2**). All p-values were >0.05 for this analysis.

For a 2x3 mixed ANOVA, the treatment and control groups served as the between-subjects variable, and the three subcategories (OD-OD, OD-Ot, Ot-OD) served as the within-subjects variable. Results indicated a statistically significant group x subcategory interaction effect,  $F(2, 66) = 3.36, p = .04, \eta^2 = .09$  (a moderate effect). Follow-up univariate tests detected a significant change,  $F(1, 67) = 4.68, p = .03, \eta^2 = .065$  (a moderate effect), between baseline and O2 on “other health profession perceptions of optometry.”

There were no significant change differences between the groups concerning “OD student perceptions of the optometric profession” or “OD student perceptions of other health professionals.” **Figures 3 and 4** show the mean percentage change by subcategory from baseline to O1, and O1 to O2. **Figure 5** shows the mean percentage change for subcategory Ot-OD from baseline to O1, O1 to O2, and baseline to O2. While the treatment group scores attenuated by .06 (-6%), the control group scores increased by .15 (+15%).

**Discussion**

This study investigated the evolution of optometry student professional perceptions throughout the second and third year of optometry school at New England College of Optometry. Overall, student professional perceptions changed very little during this time period. Furthermore, it was found that during the second year of the OD program, perceptions of those assigned to a shared EHR setting did not significantly change compared to those assigned to a clinic without shared EHR. However, at the completion of the third year, when all students had assignments with shared EHR, students whose exposure to shared EHR was delayed until the third year maintained consistently more positive perceptions of how others view optometry. Conversely, those who were exposed to shared EHR earlier thought that other professions viewed optometry more negatively than those who did not have early exposure to a shared EHR setting.

This calls into question whether there is something inherent in the clinical experience that impacts the way students perceive other professions’ view of optometry. Perhaps students with early exposure to more integrated clinical environments experience negative or mixed first impressions with other health professionals, resulting in negatively shifting perceptions. Furthermore, students in siloed clinical environments may be more likely to be protected from positive and negative interactions with other health professionals, allowing a steadily positive perception to persist. In other words, students in an isolated clinical environment may be more positive about the profession because they do not have the opportunity to experience the contrary.

A study among nurses and physicians by Foronda et al. noted that “Egos, lack of confidence, lack of organization and structural hierarchies hindered relationships and communications.”<sup>21</sup> We posit that similar mechanisms may affecting second- and third-year optometry student professional perceptions, particularly when they are exposed early to interprofessionally shared EHR settings. Additionally, the year in which students are exposed to the type of clinical environment could be an additional factor shaping their perceptions. Perhaps the nature and amount of clinical responsibility placed on a student in the second year vs. the third year cultivates more or less confidence when working with other professionals.

Importantly, the results of this study raise questions about the role of formal didactic IPE instruction in optometric education. Specifically, would professional perceptions shift if students were better prepared to handle the interprofessional components of a clinical assignment? Although this study was not designed to answer this question, this has been identified as an area of future research.

Among the strengths of this study is the use of natural observation of the clinical educational process. The participants in

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this study were not specifically educated or primed with respect to IPE prior to survey administration. Additionally, the IEPS survey was chosen specifically because it did not use the term “interprofessional” or ask about shared learning or team work. This allowed for an unbiased assessment of interprofessional perceptions. Second, there was no intentionally designed didactic component in this study, as is the case with the majority of the IPE literature. A common approach in the IPE literature involves a didactic intervention with students of several disciplines learning about IPE and taking surveys before and after intervention. Because our study did not include this exercise, it allowed for a more focused evaluation of the clinical experience and how it impacts perceptions during the second and third year of optometric training.

There were several limitations to this study. It reflects only two years of data collection, which does not include the fourth year of optometry school. The investigators plan to collect a third year of survey data to determine whether these short-term shifts in perception persist through the final year of the program. It is possible that perceptions are more easily impacted with students earlier in their optometric tenure but equalize by graduation. Additionally, student clinical grades were not factored into the analysis of this study. It is, therefore, unknown how student clinical performance and grades impact the evolution of interprofessional perceptions. Furthermore, the findings of this study do not address how student perceptions impact performance or patient outcomes/perceptions. It would be beneficial to know whether the positive or negative shift in perceptions affect student performance and, ultimately, patient care, but data was not gathered to address this important question.

### Conclusion

While the overwhelming majority of IPE literature includes a specifically structured interprofessional intervention, this study offers some evidence of the shift in student perceptions during more traditional clinical exposure. Overall, student perceptions changed very little during clinical assignments. However, students whose exposure to interprofessionally shared EHR was delayed tended to have more positive perceptions of how other professionals view optometry, while those exposed earlier in their education tended to have more negative perceptions of how other professionals view optometry. The long-term impact and whether it affects clinical performance requires further investigation.

### Acknowledgments

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