Original Research Paper

Pre-clerkship Exploration of Underrepresented Specialties: Participant Perceptions

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Abstract

Background: Background:
Exposure to specialties significantly influences medical student career decisions; however, many students feel they are not adequately introduced to particular specialties until the end of their undergraduate training, if at all. Therefore, the Pre-clerkship Residency Exploration Program (PREP) was established. PREP was designed to reduce concerns regarding career decisions, while increasing exposure to specialties that traditionally receive less exposure in medical school curricula.
Methods: PREP was a two-week elective available to second year medical students (n = 40) comprising five components: clinical electives, panel discussions, procedural skills circuits, simulations, and specialty-specific workshops. Participants rotated through ten electives and engaged in panel discussions focused on career choices and decisions. Skills circuits and simulations introduced students to procedures and scenarios they could encounter during PREP elective rotations. Specialty-specific workshops were held by several departments to build interest and introduce students to under-represented specialties. **Results**: PREP was assessed using the Kirkpatrick model, a framework that evaluates the effectiveness of training. PREP significantly increased students' comfort with making career decisions, while reducing concerns related to a lack of exposure to various specialties ($p < 0.0001$) and time constraints with determining career options ($p < 0.0001$). Furthermore, PREP directly impacted career aspirations with 80.6% of participants changing their top-three career choices after completing the program. PREP is a valuable addition to medical school education and offers a novel approach to supporting students' informed career decisions as well as increase their exposure to specialties which are underrepresented in medical school curricula.
Discussion: We are currently in discussion with several Canadian medical schools about implementing PREP at their universities. Future research will analyze if participation in PREP translates to increased application rates to underrepresented specialties. To accomplish this objective, we will follow cohorts of PREP participants through the residency matching process and compare outcomes with historical data.

Keywords: Social accountability, Parallaxic Praxis, medical education, community engagement, arts and medicine, healthcare workforce

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Background

Selecting a future specialty is one of the most intimidating and difficult choices a medical student will face in their career. Influences affecting a medical student's career decisions are multifactorial, with mentorship[1] and exposure to specialties [2] exerting a significant influence. Despite this, many students feel they are not adequately exposed to particular specialties in a timely manner.[3] Indeed, Brane et al., (2017) noted that many students lacked awareness of physical medicine and rehabilitation, which contributed to them ultimately choosing different careers.[4] Likewise, Ford (2010) demonstrated that the second

most common reason for rejecting a career in pathology was inadequate contact with pathologists during medical school.[5]

A recent report from The Association of American Medical Colleges indicates that 49.9% of medical students change their preferred specialty prior to the completion of medical school.[7] However, the window for influencing medical student's career choices is relatively small, as 69% of medical students accurately predict their career choice prior to their third year of study.[6] If exposure and mentorship are two driving factors for career decisions, then underexposed specialties are decidedly disadvantaged. A lack of formal curriculum, or structured exposure and mentorship in the early years of medical school can lead to inappropriate career selection and thus, contribute to attrition rates.

To support informed career decisions, several institutions have integrated programs outside of medical school curricula. Structured elective programs have effectively increased exposure and opportunities for experiential learning in: emergency medicine, geriatrics, physiatry,[4] pathology, internal medicine, radiation oncology, and surgery as a whole.[8] However, while these programs provide exposure to their specialty, they are subject to self-selection bias by students with preconceived interest. Independently, these programs do not address the underexposure to the numerous other career options.

To improve medical student exposure to the breadth of medical specialties, and to provide opportunities for mentorship earlier in education, we designed the Pre-clerkship Residency Exploration Program (PREP). PREP is a unique, student-led, extracurricular two-week intensive elective that provides experiential and didactic learning opportunities with the goal of educating introductions to a broad range of specialties to support medical students in making informed career decisions.

Approach

Context

PREP was implemented as a two-week summer elective, at Dalhousie Medical School, Halifax, Nova Scotia, Canada from May 28, 2018 to June 8, 2018. In total, 74 of 110 possible second year medical students applied for 40 program spots. Participants were selected through a blinded and randomized lottery orchestrated by the Student Affairs Office at Dalhousie Medical School. PREP was completely funded by a $150 participant entrance fee. This fee covered food and drinks for the two-weeks, as well as equipment, instructor fees and other associated costs.

Development

PREP is a student-run initiative developed to address the career exploration needs of medical trainees. The idea was conceived by Todd Dow, the founding student, following completion of a similar program, the Surgical Exploration and Discovery Program (SEAD), which aimed to introduce students to surgical specialties.[8] The program was developed to fill an observed gap in exploratory opportunities for underexposed specialties throughout the pre-clerkship medical curricula. Underexposed specialties were defined as specialties which were not included in mandatory medical school rotations. A team of three second-year medical students, with unique, and complementary areas of expertise were assembled to spearhead designing and executing PREP. The team worked closely with the Department of Student Affairs who aided with liaising the program idea to 12+ departments to secure participation and support. Available faculty or staff physicians interested in teaching were identified as mentors for one-on-one half-day electives. Emphasis on the importance of the program in fulfilling a need in pre-clerkship medical education was essential in convincing stakeholder involvement.

The team's objective for selecting participating specialties was to target those that received limited exposure in the pre-clerkship curriculum, or were not offered universally through clerkship. All specialties that met these criteria were approached, however not all could accommodate the large number of participating students. Specialties included in the program were: pathology, ophthalmology, physical medicine and rehabilitation, anesthesia, radiation oncology, radiology, medical oncology, nephrology, and hematoma; all of which do not have formal medical school rotations. The remaining spots were thus filled by more general specialties that covered a wide breadth of knowledge, including general internal medicine, cardiology, and neurology. Curriculum development was based on the adult learning theories model proposed by Taylor and Hamdy, and aimed to incorporate aspects of knowledge dissonance, refinement, organization, feedback, and consolidation into the program components.[9] A mixture of didactic and

experiential learning was used to offer diverse learning styles, multiple ways to address knowledge gaps, and ample opportunities to ask further questions and strengthen skill sets.

The implementation of PREP was a significant challenge for the student leaders. Often it was met with resistance, objection and criticism. This feedback was often presented by individuals who did not want to additional work added to their regular duties, or from individuals who did not feel the issue this program wanted to address was real. These obstacles were overcome through strategic planning, obtaining supportive data from medical student focus groups on the desire for more exposure, and from buy-in from faculty in underexposed specialties who recognized the problem at hand.

Curriculum

The full-time program was composed of five main components: half-day electives, lunchtime seminars and panel discussions, procedural skills circuits, simulations, and specialty-specific workshops. The program was conducted Monday to Friday for two weeks. Individual schedules were prepared for participants (example schedule in Supplementary Table 1). All participants rotated through ten half-day electives of 14 possible specialties while assigned to a staff physician. This allowed opportunities to gain insight into the day-to-day life of their mentor and to ask career-related questions. Information and advice on career decision and planning was offered through lunchtime seminars or panel discussions. Three procedural skills circuits introduced basic techniques. Two simulation workshops introduced participants to procedures and situations of a real-world process handled by a variety of specialties. Lastly, workshops on underexplored specialties used lectures and skills sessions to provide insight. Detailed information on the make-up of these five components are outlined in Supplementary Table 2.

Program Evaluation

We evaluated PREP using the Kirkpatrick's framework.[10] Pre-program and post-program surveys utilized a Likert scale, and short-answer questions and multiple-choice answers were distributed to 37 participants. Surveys were distributed through Opinio (Object Planet, Oslo, Norway). Student IDs were blinded and the data was analyzed following the completion of PREP.

The study was reviewed and approved by the Dalhousie Health Sciences Research Ethics Board. Participants completed the pre-program survey on the first morning of PREP and completed the post-program survey following program completion.

Table 1: Assessment of learner satisfaction (Kirkpatrick level 1) following completion of the Pre-clerkship Residency Exploration Program (PREP) program

Description	Survey Response	% (N, SD)
Learner satisfaction (Kirkpatrick Level 1; 0-1: Not valuable, Valuable)	9 Lunchtime Discussions	89.5% (282/ 315, 0.31)
	7 Specialty Workshops	92.8% (234/252, 0.27)
	Would recommend to other students (0-1: No, Yes)	100% (35/35, 0.00)
Description	Survey Response	Mean (N, SD)
Learner satisfaction (Kirkpatrick Level 1; 1-5; minimal value, low value, neutral, some value, high value)	Felt properly prepared for electives	3.51 (35, 0.74)
	Comfort with group learning environment	3.86 (35, 0.69)
	Rate PREP compared to other electives	3.91 (35, 0.74)

PREP: Preclerkship residency exploration program, SD: Standard deviation

GraphPad Prism software (version 2018, La Jolla, San Diego, California) was used to assess descriptive statistics (frequency, mean, standard deviation) and to evaluate pre- and post-program differences via a Paired student's T-test. A p-value < 0.05 was considered statistically significant.

Outcomes

Given differences in student interests, and previous elective exposures, pre- and post-program surveys were used to assess the direct impact of PREP and therein normalize against participants' prior experiences.

Learner Satisfaction

Learner satisfaction data is provided in Table 1. Feedback on the workshops (including the point-of-care ultrasound simulation workshop) and the panel discussions were received by 97.3% (36/37) and 94.6% (35/37) participants, respectively. Across all workshops, 92.8% of participants found the workshops to be valuable for providing career exposure (234/252 responses, seven for each of the 36 respondents). Similarly, a strong majority of participants, 89.5% (282/315 responses, nine from each of the 35 respondents) stated that the panel discussions were valuable for providing career exposure. The appropriateness of PREP was rated by 94.6% (35/37) of participants using a 5-point Likert scale. On average, participants responded favorably to feeling properly prepared for PREP (mean 3.51), feeling comfortable with the group learning environment (mean 3.86) and rated PREP highly compared to other formal electives (mean 3.91). A full 100% of the respondents would recommend PREP to other second-year medical students.

Learner Attitudes/Perceptions

In comparing pre- (36/37) and post-program responses (35/37), PREP significantly reduced concerns with respect to: lack of exposure to various specialties ($p = 0.0001$), time restraint to weigh career options ($p = 0.0001$), lack of information about various specialties ($p = 0.0074$), and having the skills needed for clinical clerkship ($p = 0.0136$). Respondents also demonstrated a non-significant reduction in concern regarding identifying a career prior to Canadian Resident Matching Service (CaRMS) applications ($p = 0.0978$) (Table 2).

Learner Knowledge

We mainly consider it to be minimal because only a couple of students had prior exposure to any of the g

When comparing pre-program and post-program questionnaires, there was a significant increase in self-reported "understanding the daily responsibilities of a [specialty] enough to make a career-based decision" in all en specialities. ect. We mainly consider it to be minimal because only a couple of students had prior exposure to any of the gparticipating specialties, except cardiology (Table 3).

Eleven skills stations (joint injections, suturing, IV access, IO access, punch biopsy, intubation, endoscopy, Foley catheter placement, chest tube insertion, central line placement, and primary survey) were assessed. Pre-program, students were asked if they had previously performed the technique and if so, how comfortable they were performing it. All participants (100%, 37/37) responded to the survey; only three skills (suturing, punch biopsy, and intubation) had previously been performed by more than five of the participants. The mean comfort to perform assessed skills was 2.43 on a 5-point scale by the participants who had previously performed them. 97.3% (36/37) of participants completed the follow-up survey upon completing the program. The lowest mean score for comfort was 2.31 for endoscopy, and the highest was 3.86 for performing a primary survey. The overall average comfort to perform any of the techniques post-program was 3.19, a significant increase ($p = 0.0001$, Table 2).

Survey questions regarding the five hands-on workshops (hematopathology, anatomical pathology, ophthalmology, anesthesia and ultrasound) received responses from 97.3% (36/37) of participants. Across all specialty workshops, 94.4% (170/180 responses, five for each of the 36 respondents) responded "yes" to the question regarding developing valuable skills that will be taken forward into clerkship.

Learner Behavior

Responses on participants' future plans and preferences was received by 35–37 participants. Of the respondents, 68.6% (24/35) indicated that PREP introduced them to a staff physician that they would like to work with in the future. Prior to PREP, 27.8% (10/36) of respondents stated they would pursue an elective in one of the specialties covered in this program. Following completion of PREP, this number increased significantly (66.7%, 24/36, $p = 0.0001$). Moreover, 80.6% (29/35) of respondents

reported at least one change in their pre-PREP top-3 residency choices (Table 2).

Organizational Changes

Some specialties remain underexposed for a variety of reasons: insufficient room in the medical school curriculum; not enough clinical space for all students to formally rotate through the specialty; or even lack of recognition by the medical school. Furthermore, career advising is commonly an optional component of medical education managed by student affairs, career councillors or informal discussions. The lack of uptake of career advising in the formal curriculum may be in part due to the daunting task of curriculum reform. Student-run initiatives such as PREP offer a relatively simple

Table 2: Assessing changes in learner attitudes, perceptions, knowledge and behaviour per Kirkpatrick's Levels as a result of the Pre-clerkship Residency Exploration Program (PREP) program.

Description	Survey Response	Pre-Program Mean (N, SD)	Post-Program Mean (N, SD)	p-value
Changes in learner attitudes and perceptions (Kirkpatrick Level 2a; 1-5; minimal value, low value, neutral, some value, high value)	Concerned about lack of exposure to various specialties	4.00 (36, 1.04)	2.89 (35, 0.76)	0.0001
	Concerned about time restraint to weigh career options	3.97 (36, 0.84)	3.14 (35, 0.81)	0.0001
	Concerned about lack of information about specialties	3.69 (36, 1.17)	3.00 (35, 0.94)	0.0074
	Concerned about identifying a career prior to CaRMS	2.89 (36, 1.24)	2.43 (35, 1.07)	0.0978
	Concerned about having the skills needed for clerkship	3.31 (36, 1.06)	2.71 (35, 0.89)	0.0136
Gains in learner's knowledge (Kirkpatrick Level 2b, 1-5; minimal value, low value, neutral, some value, high value)	Understanding the daily responsibilities of various specialties	See Table 3		
	Average comfort in performing 10 skills covered in PREP	2.43 (60, 1.31)	3.19 (360, 1.02)	0.0001
	Developed skills from 5 specialty workshops they will take to clerkship [Yes/No, % (N,SD)]	N/A	94.4% (170/180, 0.23)	N/A
Changes in learner's behavior (Kirkpatrick Level 3, Yes/No, % (N, SD))	Identified future mentors	N/A	68.6% (24, 0.47)	N/A
	Will pursue an elective in a specialty covered in PREP	27.8% (10, 0.45)	66.7% (24, 0.45)	0.0001
	Change in top 3 career choices	N/A	80.6% (29, 0.40)	N/A

SD: Standard deviation, N/A: Not available, PREP: Preclerkship residency exploration program, CaRMS: Canadian resident matching service

Table 3: Pre-Program and post-program participant responses to the question "Do you understand the daily responsibilities of [specialty] enough to make a career-based decision" and a list of specialty involvement in PREP

Specialty	Pre-program Understanding, Mean (N, SD)	Post-program Understanding, Mean (N, SD)	p-value	Involvement of specialty in the program
Anesthesia	3.00 (36, 1.10)	3.58 (36, 0.65)	0.0076	- Elective rotations - Skills stations - Specialty workshop - Resident lifestyle panel discussion
Cardiology	3.08 (36, 0.84)	3.39 (36, 0.69)	0.0959	- Elective rotations
Endocrinology	2.33 (36, 0.86)	3.36 (36, 0.83)	0.0001	- Elective rotations
General internal Medicine	2.72 (36, 0.94)	3.42 (36, 0.65)	0.0005	- Elective rotations - Skills stations - Resident lifestyle panel discussion
Ophthalmology	2.75 (36, 1.00)	3.81 (36, 0.86)	0.0001	- Elective rotations - Specialty workshop - Resident lifestyle panel discussion - Career advice seminar
Pathology	2.67 (36, 1.17)	4.11 (36, 0.46)	0.0001	- Elective rotations - Specialty workshop - Resident lifestyle panel discussion
Radiation Oncology	2.14 (36, 0.83)	3.53 (36, 0.84)	0.0001	- Elective rotations - Specialty workshop
Physical Medicine and Rehabilitation	2.43 (21, 1.08)	3.81 (21, 0.40)	0.0001	- Elective rotations - Skills stations - Specialty Workshop - Resident lifestyle panel discussion - Career advice seminar
Hematology	2.35 (17, 0.86)	3.41 (17, 0.80)	0.0008	- Elective rotations
Neurology	2.71 (17, 0.77)	3.53 (17, 0.62)	0.0017	- Elective rotations - Resident lifestyle panel
Nephrology	2.84 (19, 1.01)	3.53 (19, 0.61)	0.0164	- Elective rotations
Neonatology	2.11 (9, 1.36)	3.44 (9, 0.88)	0.0255	- Elective rotations

SD: Standard deviation

and low-resource alternative for providing experiential learning opportunities. In parallel, PREP will continue to generate insights into effective career advising strategies for pre-clerkship education. It will further provide data to inform curricular adaptations. Goals for future changes and sustainability efforts are outlined in the following "Next Steps".

Next Steps

This study shows that PREP increased participants' understanding of the daily responsibilities of 12 specialties. Furthermore, PREP was effective in reducing concerns related to career decisions, providing a platform for meeting future mentors, identifying new career interests and providing familiarity with commonly performed procedures. Collectively, this may help participants feel prepared to make career decisions, which in turn, may translate to improved overall career-satisfaction and decreased attrition rates during residency training.

We are currently in discussion with several Canadian medical schools about implementing PREP at their universities. Additionally, to further its reach, aspects of PREP were presented at the International Conference of Residency Education in 2018. Future research will analyze if participation in PREP translates to increased application rates to underrepresented specialties such as radiation oncology, physiatry and pathology. Specifically, we aim to follow cohorts of PREP participants through the CaRMS process and compare outcomes with historical data.

The scalability and sustainability of PREP is excellent. The concept of the program is to inform career-decisions through exposure to diverse specialties. By design, the program is modular, and specialties can be removed, added or replaced based on student interest and institutional capacity. The number of registered students can likewise be altered to match interest and capacity. This customizability enhances the capability for PREP to be adopted abroad, and steadily improved in accordance with feedback.

The PREP sustainability plan was designed to ensure the continuation of the program. Each year, three incoming first-year medical students are selected as Junior Directors who subsequently lead the program in their second year. Throughout the year, the Junior Directors assist the three Senior Directors with program logistics, while observing meetings and training sessions. An end-of-program report is prepared for each department, division or person involved in the program. This report provides student feedback as well as qualitative assurance information from the pre-program and post-program surveys to foster improvement. These reports allow the involved specialties to receive direct feedback on student interest and understanding of their specialty. It also provides them with student feedback on their workshops and rotations that they can utilize to customize their involvement moving forward. The sustainability of PREP will ultimately result in expansion to other institutions and therein benefit undergraduate medical trainees on a broader scale.

As PREP and other programs of similar nature continue to positively impact medical student career decisions, we hope similar exposure rotations can be integrated into formal medical school curriculum for definitive reform.

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Supplementary Table 1: Example schedule of the two –week Pre-clerkship Residency Exploration Program (PREP)

Week 1					
Time	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
8:00-12:00 Morning Block	Introduction/ Pre-program Survey	Skills Circuit #1	Elective Slot #3	Skills Circuit #2: Simulation Training	Physiatry Workshop
12:00-13:00 Lunchtime Discussion	Physiatry Career Advice Seminar	Choosing Wisely: Laboratory Tests	Myths about CaRMS	Pharmacology Tips and Tools	Resident Lifestyle Panel Discussion #1
13:00-17:00 Afternoon Block	Elective Slot #1	Elective Slot #2	Elective Slot #4	Elective Slot #5	Critical Care Team Simulations
Week 2					
Time	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
8:00-12:00 Morning Block	Radiology Workshop	Elective Slot #7	Elective Slot #8	Ultrasound Workshop	Elective #10
12:00-13:00 Lunchtime Discussion	Ophthalmology Career Advice Seminar	Infectious Disease and Palliative Care Career Advice	Applicant Ranking from a Program Director Perspective	Resident Lifestyle Panel Discussion #2	MED IV CaRMS Experience Panel Discussion
13:00-17:00 Afternoon Block	Elective Slot #6	Pathology Workshop	Elective Slot #9	Ophthalmology Workshop	Anesthesia Workshop/ Post-program Survey

CaRMS: Canadian resident matching service

Supplementary Table 2: Detailed information on the make-up of the five core components of PREP

Component	Objective	Topics and/or Activities
Half Day Electives	Personalized mentorship	Participate in spectrum of care and daily responsibilities of assigned supervising physician including consultations, patient interviews, and procedures.
Lunchtime Discussion	Career decision and planning	Seminar or panel discussion on: residency matching, resident lifestyle, specialty-specific career advice, residency applicant ranking.
Skills Circuit	Procedural skills introduction	Intravenous (IV) and intraosseous (IO) access, nasogastric (NG) tube insertion, catheterization, ultrasound guided or punch biopsies, central and arterial line, endoscopy, chest tube insertion, CPR and defibrillation, airway management, and primary survey.
Simulation Training	Experiential learning	Critical care team simulation and emergency point-of-care ultrasound (POCUS) simulation.
Specialty Workshop	Specialty exploration	Participating specialties: -Ophthalmology: common eye disease lecture, slit-lamp, Tono-pen, and ophthalmoscope stations. -Pathology: peripheral blood smear, bone marrow morphology, Human Leukocyte Antigen (HLA) testing, brain autopsy, pap smear analysis, and bunch biopsy specimen interpretation. -Anesthesia: IV access and airway management. -Radiology: diagnostic imaging interpretation and case-based learning. -Physiatry: rehabilitation center tour and patient interaction.