BRIEF
REPORTS

Interprofessional Primary Care Course Impact on Knowledge, Attitudes, and Careers

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BACKGROUND AND OBJECTIVES: Our innovative, highly rated, interprofessional Primary Care Course (PCC) engaged learners in dentistry, medicine, nursing, physician assistants, pharmacy, public health, and social work. PCC used a low-resource, flexible classroom format, earned 99% high student ratings, and increased PC career plans in 56% of students. This study assessed changes in PC knowledge and attitudes and tracked PC career outcomes over 5 years.

METHODS: We conducted before-and-after surveys of PCC students at baseline, 1-year, and 5-year follow-up, using anonymous online surveys. An additional controlled study compared PCC students with similar students from the course waitlist.

RESULTS: Surveys yielded responses from 100% (84) at baseline, 81% (68) at 1 year, 57% (48) at 5 years, and 34% (28/83) among waitlist students at year 5. Before-and-after matched pairs analyses documented significant increases at year 1, sustained through year 5, in knowledge of PC training and referral patterns and attitudes toward PC value and role in future US health care. Precourse, 56% of students planned PC careers. At year 5, PCC graduates reported working in PC (74%, 29/39), delivering direct PC patient care (48%, 19/39), and working with underserved communities (74%, 29/39). The PC knowledge and attitudes of waitlist students at year 5 were similar to PCC student baseline scores and were significantly lower at year 5. Only 27% (7/26) of waitlist students reported working in PC at year 5.

CONCLUSIONS: PCC was associated with sustained increases in PC knowledge, attitudes, and careers across health professions. This low-resource, flexible format can contribute to building PC knowledge, attitudes, and workforce.

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Personal and population health depends upon recruiting, training, and sustaining an adequate primary care (PC) workforce.[1-3] Unfortunately, medical and other health professions students often choose careers in other specialties. Even those voicing early interest in PC often switch to other fields.[4,5]

Many programs aim to encourage students into PC. Although personal values and beliefs guide career choice, curricula can be influential.[6] Some medical schools invest substantial resources in longitudinal mentorships and clinical experiences, but program evaluations typically measure short-term changes in attitudes; some track specialty choice at graduation.[6-10]

No published studies report longitudinal impact on PC knowledge, attitudes, and careers among learners in other health professions.

Our Primary Care Course (PCC) is a simple, flexible, low-cost classroom elective.[11] Taught from a family medicine foundation, this interprofessional course engaged learners at all levels across seven health professional schools: dentistry, medicine, nursing, physician assistants, pharmacy, public health, and social work.

We described the PCC curriculum and evaluation in an earlier report (Table 1).[11] Our end-of-course evaluation was positive: 99% of students rated it high value, 93% recommended it to others, and 41% advocated it be required for all students. Participants called the course "a life-changing experience," and 56% reported it influenced them to plan PC careers.[11]

Three questions remain:

1. Was the PCC associated with positive changes in PC knowledge and attitudes?
2. Were observed changes sustained through training and into professional careers?
3. Did early self-reported plans become PC careers?

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Table 1: Primary Care Course Curriculum Content and Class Activities

Course Format	Classroom course, 10 weeks, one meeting/week Elective, one credit, ungraded Each cohort balanced with of three to five students from each group: dentistry, medicine, nursing, physician assistants, pharmacy, public health, social work.		
Module	**Content**	**Activity**	
Interprofessional Exercise—"Reaching common ground."		Online discussion	Post three reflections
Definitions of PC	IOM, Alma Atta Declaration, WHO. What PC is not.		
Principles of PC	Comprehensive, continuity, community, context		
Interprofessional Exercise—"Building a PC team from the ground up."			
Populations served	Underserved, vulnerable, urban, rural		
Practice Observation. Half-Day Visit to Family Medicine Practice Structured Observation of Patients, Problems, Tasks			
Visit debriefings	Review composite data. Post a personal reflection.		
Clinical content of PC	Acute, chronic, prevention, mental health Specialize in common problems vs diagnoses Multiple problems and patients at one visit		
Comprehensive care	Cradle to grave, family care, coordination of care Patient-centered care. Relationship-centered care		
PC in the health of Individuals, populations	Access, quality, outcomes, patient experience, cost. USA, international data. Quadruple aim.		
PC clinicians	Training, scope of practice, options for focus		
PC delivery models	Chronic care model. Patient-centered medical home		
Teamwork - PC speakers	Patient, DDS, MD/DO, PA, NP, PharmD, MPH, MSW		
PC in context	Value of generalism and specialism, PC Paradox, Inverse Care Law, Ecology of Medical Care		
PC research	Practice-based research networks Community-based participatory research		
Future of PC	PC in the US health care system, challenges, reforms		

Abbreviations: IOM, Institute of Medicine; WHO, World Health Organization; PC, primary care.

We studied changes in PC knowledge, attitudes, and practice placements among PCC learners over 5 years into their professional careers.

Methods

We conducted a before-and-after study of the 84 students enrolled in the PCC over 3 years, 2013-2015, surveying each three times: at baseline (Y0), at 1 year following the course (year 1), and 5 years (year 5). Using Catalyst online survey software (Catalyst, University of Washington, Seattle), we contacted students by email with one reminder at 2 weeks and an incentive chance to win a $50 gift card. Responses were voluntary, anonymous, and required informed consent.

Questions based on the course outline addressed PC knowledge and attitudes. Students responded on 7-point Likert scales. We also asked about PC career plans and practice.

We compared each student's responses in matched pairs across survey stages. For before-and-after change, we compared baseline to year 1; for sustained change, we compared baseline to year 5.

We tested for differences in paired categorical data with the Wilcoxon matched-pairs signed-rank test, a nonparametric test appropriate for nonequidistant Likert scales and non-Gaussian distributions. We tested for differences in paired analyses of continuous data with paired *t* tests. Based on matched-pairs design and positive course evaluations,[11] we report *P* values and confidence intervals (CIs) without adjustment for multiple comparisons.

To confirm findings and address limitations of before-and-after design, we also conducted a separate controlled study, using these same methods, that compared PCC students with similar students who signed up and were waitlisted but never enrolled. We surveyed waitlist students just once at 5 years following the course. We tested differences between the waitlist and other groups with nonpaired analyses,

using t tests for continuous data and Fisher's exact test or χ^2 test for categorical data.

To limit the popular class to a maximum of 35 students and balance participation across professional groups, we admitted students from a registration waitlist stratified by group. The mechanism was not statistically random; it differed slightly across groups and years to meet diversity goals. Course popularity led some students to reserve a spot early but later withdrew as their academic schedules finalized. Thus, there was no clear preference for early registration, but students in the course may have represented those with more persistent interest in PC.

This research was exempted by the University of Washington Human Subjects Division.

Results

Our PCC student survey response rates were 100% (84) at baseline, 81% (68/84) at year 1, and 57% (48/84) at year 5 (Table 2). Waitlist response rate was 34% (28/83) overall and included all groups (range 8%-100%) except dentistry.

To check for responder bias, we compared response rates at year 5 and found no differences by gender or by initial plans for PC careers. PCC student knowledge increased

Table 2: Primary Care Course and Waitlist Students and Respondents Over 5 Years

Students		Survey Respondents Respondents/N (Response Rate for Group) % All Respondents for Survey Year			
		Primary Care Course Students N=84 students Over 3 Course Years			Waitlist Students N=83 Students
Student Profession	**Academic Programs**	**Precourse Baseline Respondents N (%)[1] % Survey Year**	**Postcourse Year-1 Respondents N (%)[1] % Survey Year**	**Postcourse Year-5 Respondents N (%)[1] % Survey Year**	**Waitlist Students Year-5 Respondents N (%)[2] % Waitlist Responses**
Dentistry	DDS, MSD-Pedodontics	7 (100%) 8%	6 (86%) 9%	4 (57%) 8%	0/2 (0%) 0%
Medicine	MD, MD/MPH MD/PhD	16 (100%) 19%	10 (63%) 15%	8 (50%) 17%	6/20 (30%) 21%
Nursing	BSN, MN, NP DNP, PhD	11 (100%) 13%	8 (73%) 12%	6 (55%) 12%	1/12 (8%) 4%
Pharmacy	PharmD	14 (100%) 17%	11 (79%) 16%	7 (50%) 15%	5/18 (28%) 18%
Physician assistant	PA, BCHS, MCHS	9 (100%) 11%	9 (100%) 13%	6 (67%) 12%	1/1 (100%) 4%
Public health	MPH, MHA, PhD	17 (100%) 20%	15 (88%) 22%	9 (53%) 19%	5/13 (38%) 18%
Social work	MSW, MSW/MPH	8 (100%) 10%	8 (100%) 12%	8 (100%) 17%	9/16 (56%) 32%
Others	Global health, MBA	2 (100%) 2%	1 (50%) 1%	0 (0%) 0%	1/1 (100%) 4%
Gender	Women	54 (100%) 64%	48 (71%) 89%	32 (67%) 59%	18/59 (30%) 64%
	Men	30 (100%) 36%	20 (29%) 67%	16 (33%) 53%	10/24 (42%) 36%
Total (Response rate) Response rate 95% CI[3] % of all respondents		**84 (100%)** 0.948-1.000 100%	**68/84 (81%)** 0.712-0.880% 100%	**48/84 (57%)** 0.465-0.672% 100%	**28/83 (34%)** 0.242-0.440% 100%

Abbreviations: DDS, doctor of dental surgery; MSD, master of science in dentistry; MD, doctor of medicine; MPH, master of public health; PhD, doctor of philosophy; BSN, bachelor of science in nursing; MN, master of nursing; NP, nurse practitioner; DNP, doctor of nursing practice; PharmD, doctor of pharmacy; PA, physician assistant; BCHS, bachelor of clinical health services (PA degree); MCHS, master of clinical health services (PA degree); MHA, master of health administration; MSW, master of social work; MBA, master of business administration.

1. Student respondents (% response rate) in each professional group

2. Waitlist respondents/students (% response rate) in each professional group

3. Confidence interval for proportion by modified Wald method at 95%.

from baseline to year 1 and was sustained through year 5 (Table 3).

PCC student attitudes and estimates of PC value increased from baseline to year 1 and were sustained through year 5 (Table 4).

Waitlist students scored significantly lower on both PC knowledge and attitudes at year 5 (Tables 3 and 4); their year-5 scores were not significantly different from PPC students at baseline (data not shown).

At baseline, 56% (47/84) of PCC students said they planned PC careers. At year 5, significantly more (74%) reported working in PC settings (29/39, 95% CI 0.588-0.856%, $P<.033$; Table 5). At year 5, 49% (19/39) reported providing clinical PC services directly to patients, and 74% (29/39) reported working in settings that serve predominantly underserved, rural, or vulnerable patients.

Compared to PCC students, waitlist students were less likely to report working in PC settings, delivering direct PC clinical services, or working with underserved, rural, or vulnerable patients (Table 5).

Discussion

PCC students across professions and levels demonstrated increased PC knowledge and attitudes sustained over 5 years. Our waitlist study

Table 3: Primary Care Course and Waitlist Student Knowledge About Primary Care Over 5 Years

Knowledge Questions	Survey Phase			
	Primary Care Course Students			Waitlist Students
	Precourse Baseline N=84	**Postcourse Year 1** N=68	**Postcourse Year 5** N=48	**Year 5** N=28
Comparing Student Groups		Baseline vs Year 1 Matched	Baseline vs Year 5 Matched	Course Students Year 5 vs Waitlist Students Year 5 Unmatched
What percent of FP patients get referred to other physicians?				
Mean (mode) Range *P* value[1]	37% (30) 5%-80%	12% (10) 3%-15% *P*<.001	14% (10) 5%-30% *P*<.001	31% (30) 15-90 % *P*<.001[1]
How many years of postbachelors degree professional training is required for PC careers?				
	Percent of Respondents With Correct Answer[2]			
Clinician Group	**95% CI[3]** ***P* Value[4]**			**95% CI[3]** ***P* Value[5]**
All PC clinicians	14% (12/83) 0.083-0.238%	67% (44/66) 0.546-0.769% *P*<.001	54% (26/48) 0.403-0.674% *P*<.001	11% (3/27) 0.030-0.289% *P*<.001
All physicians	31% (26/83) 0.223-0.412%	79% (54/68) 0.682-0.874% *P*<.001	75% (36/48) 0.611-0.852% *P*<.001	39% (11/28) 0.235-0.576% *P*<.001
NPs and PAs	40% (33/83) 0.299-0.505%	75% (50/67) 0.630-0.836% *P*<.001	60% (29/48) 0.463-0.730% *P*=.086	18% (5/27) 0.077-0.372% *P*<.001
Believe FM training is fewer years than GIM or GPeds	39% (32/83) 0.2880-0.493%	9% (6/68) 0.038-0.183% *P*<.001	18% (9/48) 0.997-0.322% *P*=.02	32% (9/28) 0.178-0.508% *P*<.001

Abbreviations: PC, primary care; NP, nurse practitioner; PA, physician assistant; FM, family medicine; GIM, general internal medicine; GPeds, general pediatrics.

1. Matched pairs analysis with two-sample paired *t* test, two-tailed, α=.05.

2. Percent of respondents correct on years of training for all five PC clinician groups: FP—7 yrs, GIM—7 yrs, GPeds—7 yrs, NP—2-3 yrs, PA—2 yrs.

3. Confidence interval for proportion by modified Wald method at 95%.

4. Wilcoxon matched-pairs signed-rank test, two-tailed, a=.05.

5. Two-samples paired *t* test, two-tailed, a=.05.

Table 4: Primary Care Course and Waitlist Student Attitudes Toward Primary Care Over 5 ears

Attitude Questions	Survey Phase			
	Primary Care Course Students			Waitlist Students
	Precourse Baseline N=84	Postcourse Year 1 N=68	Postcourse Year 5 N=48	Year 5 N=28
Comparing Student Groups		Baseline vs Year 1 Matched	Baseline vs Year 5 Matched	Course Students Year 5 vs Waitlist Students Year 5 Unmatched
Please rate your estimate of the value of PC to the:	Percent of Respondents Rating Item 7-Very High[1] (n) Mean Likert Scale Score (Range)			
		P Value[2]		*P* Value[3]
Health of individual patients	62% (52) 6.37 (1-7)	88% (60) 6.86 (6-7) *P*<.001	88% (42) 6.86 (5-7) *P*<.001	50% (14) 6.11 (2-7) *P*=.0001
Health of the population	64% (53) 6.28 (2-7)	93% (63) 6.91 (5-7) *P*<.001	92% (44) 6.89 (5-7) *P*<.001	54% (15) 6.32 (2-7) *P*<.001
Health of vulnerable populations	66% (55) 6.37 (2-7)	91% (62) 6.89 (4-7) *P*<.001	94% (45) 6.89 (5-7) *P*<.001	64% (18) 6.36 (4-7) *P*=.0029
Efficient use of health care resources	66% (55) 6.35 (2-7)	79% (54) 6.81 (4-7) *P*=.0041	92% (44) 6.91 (5-7) *P* =.0004	79% (22) 6.71 (5-7) *P*=.158
Accessibility of health care	68% (57) 6.39 (2-7)	85% (58) 6.87 (5-7) *P*<.001	98% (47) 6.94 (4-7) *P*<.001	64% (18) 6.46 (4-7) *P*<.001
Quality of care	55% (46) 6.28 (4-7)	79% (54) 6.7 (5-7) *P*=.003	81% (39) 6.81 (6-7) *P*<.001	57% (16) 6.43 (5-7) *P*=.034
Prevention and health promotion	70% (59) 6.44 (2-7)	93% (63) 6.91 (6-7) *P*<.001	94% (45) 6.91 (5-7) *P*=.013	57% (16) 6.29 (4-7) *P* <.001
Care of patients with chronic illnesses	52% (44) 6.15 (2-7)	87% (59) 6.15 (6-7) *P*<.001	92% (44) 6.87 (5-7) *P*<.001	54% (15) 6.04 (1-7) *P* <.001
Care of patients with acute illnesses	38% (32) 5.76 (2-7)	75% (51) 6.68 (5-7) *P*<.001	73% (35) 6.51 (3-7) *P*<.001	32% (9) 5.61 (3-7) *P*<.001
Care of patients with mental health problems	39% (33) 5.69 (2-7)	59% (40) 6.49 (4-7) *P*<.001	60% (29) 6.44 (3-7) *P*<.001	36% (10) 5.39 (1-7) *P*=.057
What percent of all physicians should be primary care physicians?				
Mean (mode) Range *P* value	56% (50) 25%-100%	58% (50) 45%-60% *P*=.21[4]	58% (50) 10%-80% *P*=.26[4]	55% (50) 20%-95% *P*=.53[3]
In the future of the US health care system, the role of primary care will:				
Increase Stay about the same Decrease Other Don't know *P* value[5]	81% (68) 11% (9) 6% (5) 0% (0) 2% (2)	97% (66) 3% (2) 0% (0) 0% (0) 0% (0) *P*=.0036[5]	85% (41) 4% (2) 6% (3) 0% (0) 4% (2) *P*=.83[5]	55% (15) 18% (5) 7% (2) 21% (6) 0% (0) *P*=.011[5]

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Table 4: Continued

Attitude Questions	Survey Phase			
	Primary Care Course Students			Waitlist Students
	Precourse Baseline N=84	Postcourse Year 1 N=68	Postcourse Year 5 N=48	Year 5 N=28
Comparing Student Groups		Baseline vs Year 1 Matched	Baseline vs Year 5 Matched	Course Students Year 5 vs Waitlist Students Year 5 Unmatched
	Percent of Respondents Rating Item 7-Very High[1] (n) Mean Likert Scale Score (Range)			
Training primary care physicians need compared to other specialties is:				
More	20% (17)	33% (22)	35% (17)	21% (6)
The same	49% (41)	66% (44)	50% (24)	57% (16)
Less	30% (25)	0% (0)	10% (5)	14% (4)
Other/don't know	1% (1)	1.5% (1)	4% (2)	7% (2)
P value[5]	(Year 1 n=67)	*P*=.001[5]	*P*=.0052[5]	*P*=.607[5]

1. Student ratings on a 7-point Likert scale: 1=Very Low to 7=Very High.

2. Wilcoxon matched-pairs signed-rank test, two-tailed, α=.05.

3. Unpaired *t* test, two-tailed, α=.05.

4. Matched pairs analysis with two-sample paired *t* test, two-tailed, α=.05.

5. Unmatched analysis with χ^2 test, two-tailed, α=.05.

Table 5: Primary Care Course and Waitlist Student Careers at 5-Year Follow Up

Career Questions	Survey Phase		
	Primary Care Course Students		Waitlist Students
	Precourse Baseline N=84	Postcourse Year 5 N=48	Year 5 N=28
Comparing Student Groups		Baseline vs Year 5 Matched	Course Students Year 5 vs Waitlist Students Year 5 Unmatched
Do you plan a career (or currently work) in primary care?			
Yes - % (n) 95% CI[2] *P* value	56% (47/84) 0.453%-0.661%	74% (29/39)[1] 0.588%-0.856% *P*=.033[3]	27% (7/26)[1] 0.135%-0.463% *P*=.004[4]
Do you currently provide clinical primary care services directly to patients?			
Yes - % (n)[1] 95% CI[2]	NA	49% (19/39)[1] 0.339%-0.638%	19% (5/26)[1] 0.080%-0.383% *P*=.005[4]
Do you currently work in a setting that serves predominantly underserved, rural, or vulnerable patients?			
Yes - % (n)[1] 95% CI[2]	NA	74% (29/39) 0.588%-0.856%	46% (12/26) 0.288%-0.646% *P*=.035[4]

1. Yes responses/all respondents, excluding students still in training: Course students (48–9 trainees=39), waitlist students (22–2 trainees=26).

2. Confidence interval for proportion by modified Wald method at 95%.

3. Matched pairs comparisons by paired sign test, two-tailed, α=.05.

4. Fisher's exact test, two-tailed, α=.05.

shows these gains did not occur in a comparison group of similar students who registered but did not attend.

We are unaware of previous reports of similar experience. Our PCC was a simple 10-week class that enrolled balanced cohorts of learners from seven professions. Our evaluation also assessed student career plans and outcomes at 1 and 5 years and added a controlled waitlist study. Our findings document increases in student entry into PC careers, not a falloff in student interest, as documented among medical students.[4,5]

Interpretation must consider study limitations. The course ran 3 years across multiple professional schools but only one institution. Influences on career choices are more complex than course experiences. Selection bias might influence which students choose the course, though our waitlist study offers some reassurance. We measured limited PC knowledge and attitudes. Likert scales cannot fully assess complex issues. Student answers skewed high on scales creating ceiling effects. Despite our high response rates, response bias was possible, particularly at the year-5 follow-up surveys, with 57% response rate for PCC students and 34% for waitlist students. The PCC highlighted positive attributes of PC, so social desirability bias might have influenced student responses. The questionnaire did not define "PC career" and relied on student self-report of their work settings, which may have differed between professional groups or over time. Survey anonymity prevented collection of detailed respondent information, and numbers were too small to allow subgroup analysis.

Further research should examine trajectories into PC careers for health professions students, especially nonphysicians. Longer follow-up studies should track graduates further into careers.

These findings document the potential of this interprofessional PCC model, which requires few resources and is more adaptable to educational challenges and opportunities than most clinical PC training programs. It is appropriate for all health professionals at all levels of training. We recommend this alternative to help recruit and prepare the PC workforce necessary to meet the needs of our patients and communities.

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