

Evaluation of an interprofessional education program in pediatric dentistry, medicine, and nursing

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Abstract

Purpose: The purpose of this study was to assess whether the Strategic Partnership for Interprofessional Collaborative Education in the Pediatric Dentistry (SPICE-PD) program at the UCLA School of Dentistry positively affected interprofessional experiences and practice patterns of pediatric and general dentistry residents, pediatric medical residents, and pediatric nurse practitioner students (PNPs).

Methods: Data collection included a year-end online survey given to participants in the interprofessional program upon graduation from their UCLA dental/medical/nursing programs. Of the 318 participants who were recruited into SPICE-PD, 208 (65%; 208/318) completed the survey. Chi-square tests were used to assess differences in key outcome variables by dental/medical specialty.

Results: Most dental, medical, and nursing participants thought SPICE-PD helped them learn to work more effectively with interprofessional colleagues and reported knowing more about the abilities and contributions of other health professionals as a result of the program. While most pediatric medical residents and PNPs thought SPICE-PD improved their skills to screen for early childhood caries ($N = 91\%$ and $N = 100\%$), PNPs were more likely than pediatric medical residents to report SPICE-PD improved their skills to apply fluoride varnish (98% versus 72%; $p < 0.001$). Almost all pediatric medical residents and PNPs thought primary care providers should incorporate oral health into routine patient care and provide referrals to dental professionals when necessary.

Conclusion: Increased interprofessional education and coordination of care through programs such as SPICE-PD can help bridge the gap between dental

and medical care and lead to improved oral health outcomes and more comprehensive and preventive patient care.

KEYWORDS

childhood caries, interprofessional education, oral health, pediatric nurse practitioner, primary care providers, underserved populations

1 | INTRODUCTION

Childhood caries is the most common chronic childhood disease in the United States.¹ As of 2016, approximately one-quarter (22%) of US children between 2 and 5 years of age and 50% between 6 and 11 years of age have childhood caries.^{1–5} While childhood caries is highly infectious and easily transmitted, it is preventable.⁶ The key to prevention is early intervention (beginning before 1 year of age) and regular preventive dental care based on risk assessment and disease management. Establishing a collaborative partnership between dental and medical health care providers is crucial to meeting the growing oral health needs of children.^{6,7}

1.1 | The role of primary care providers in oral health prevention

A young child will visit a primary healthcare provider approximately 10 times by the time they reach 3 years of age, thus it is vital primary care providers be knowledgeable about the disease process of dental caries, its prevention, and interventions available to maintain and restore the overall health of children.^{8,9} A primary care provider familiar with the science of dental caries, capable of assessing caries risk, comfortable with applying various strategies of prevention and intervention, and connected to dental resources in the community, can contribute considerably to the overall health of his or her patients.¹⁰ Additionally, children who have had oral health services performed during a well-child visit are more likely to have a preventative dental visit, but it takes training, awareness, and systems change to make this happen.¹¹

Primary care providers are well positioned to ameliorate this disease burden with appropriate risk assessment, recommendations, referral, and fluoride application; however, many lack the training necessary to provide this preventive care. Studies have shown pediatricians receive little training in oral health. For example, a 2014 American Academy of Pediatrics (AAP) study showed that during medical school or residency, oral health training for most recipients (70.4%) consisted of less than 3 h during a seminar, lecture, grand rounds, or continuity clinic.^{12,13} Additionally, studies have shown that PNPs,

who also provide primary care services to children, lack competence in performing oral health assessments and counseling, indicating PNPs need additional oral health training during their nursing school programs.^{14,15}

1.2 | Interprofessional education

Supporting interprofessional education (IPE) and encouraging collaborative practice between dental, medical, and other pediatric primary care providers is critical to increasing access to and utilization of oral health care services for children.^{6,7} Dental, medical, and nursing collaboration and integration is one of the main goals of the Strategic Partnership for Interprofessional Collaborative Education in the Pediatric Dentistry's (SPICE-PD) 2015–2020 supplemental residency curriculum at the University of California, Los Angeles (UCLA) School of Dentistry.⁶ SPICE-PD cross-trains pediatric dental residents, pediatric medical residents, PNP students, and advanced education general dentistry residents/general practice residents (AEGDs/GPRs) in the basic principles of prenatal, infant, and toddler oral health. The overall aim of the SPICE-PD IPE program is to improve primary care provider's knowledge, confidence, and clinical performance in the prevention of early childhood caries (ECC) and to prepare pediatric dental and medical residents, AEGD/GPR residents and PNP students to provide care to children, especially those from underserved and special needs populations, in their professional practice.

Practicing minimally invasive dentistry to address oral health disease at an early stage is another main focus of the SPICE-PD IPE program. This focus brings an innovative systems approach to improving the oral health care needs of the pediatric and underserved populations through greater prevention and disease management by conducting risk assessments and obtaining a greater awareness in oral health literacy, cultural competency, and infrastructure development.

Previous research on pediatric interprofessional oral health programs has been mixed. While many dental-medical interprofessional studies have shown improvement in pediatric primary care providers' oral health knowledge and increased confidence and motivation regarding providing oral health care services

TABLE 1 SPICE-PD interprofessional (IPE) participants by year (total $N = 318$)

SPICE-PD participants	2015–2016	2016–2017	2017–2018	2018–2019	2019–2020	Total
Pediatric dental residents	7	7	7	7	7	35
Pediatric medical residents	16	27	31	27	17	118
Pediatric nurse practitioner students	15	13	15	17	15	75
AEGD/GPR residents	18	18	18	18	18	90
Total	56	65	71	69	57	318

Abbreviations: AEGD, advanced education general dentistry residents; GPR, general practice residents.

to children,^{2,6,14–19} other studies have shown little or no improvement in oral health-related knowledge and skills.^{20,21} Our study adds to the current literature on pediatric interprofessional oral health programs, thus making an important contribution.

This study has three aims. First, to examine attitudes regarding the SPICE-PD IPE program and course curriculum among pediatric and AEGD/GPR dental residents, pediatric medical residents, and PNP students. Second, to assess knowledge and skills gained on oral health core competencies among pediatric medical residents and PNP students. Third, to examine perceptions regarding the role of primary care providers in children's oral health care among pediatric medical residents and PNP students.

2 | MATERIALS AND METHODS

2.1 | SPICE-PD program and participants

Between 2015 and 2020, SPICE-PD provided interprofessional prenatal and children's oral health training to a total of 318 participants, including pediatric dental residents ($N = 35$), AEGD/GPR residents ($N = 90$), pediatric medical residents ($N = 118$), and PNP students ($N = 75$) (see Table 1). Seven pediatric dental residents and 18 AEGD/GPR residents are enrolled into the UCLA SPICE-PD Residency Program each year. SPICE-PD trains between 16 and 31 UCLA pediatric medical residents each year. The UCLA Pediatric Residency Training Program is a 3-year medical residency. The medical residents participating in SPICE-PD are generally second- and third-year residents. Between 13 and 17 PNP students from the UCLA School of Nursing are admitted into the SPICE-PD program each year.

This study was approved by the UCLA IRB (IRB # 16-000185).

2.1.1 | SPICE-PD curriculum for pediatric dental residents

The SPICE-PD program for pediatric dental residents includes a 2-year curriculum. The curriculum includes

nine evidence-based training modules designed to align with the Commission on Dental Accreditation (CODA) Standards for advanced education in pediatric dentistry (see Table 2 for a description of each module).²² The nine SPICE-PD modules supplement the existing pediatric dental residency clinical curriculum. Each of the mandatory training modules includes approximately 10–20 h of didactic and/or hands-on/workshop training. Pediatric dental residents receive approximately 90–180 h of training during their 2-year residency as part of the SPICE-PD program.

2.1.2 | SPICE-PD curriculum for pediatric medical residents and PNP students

The SPICE-PD program for the pediatric medical residents and PNP students emphasizes training in the basics of prenatal and children's oral health. The three-part course includes the following components:

1. Approximately 10 h of required readings, including completion of Smiles for Life online courses that provide education that integrates oral health and primary care²³; a short video on performing a caries risk assessment; and a webinar on “The art of perinatal and infant oral health.”
2. Four lectures (approximately 6 h) that introduce pediatric medical residents and PNP students to oral-systemic health and knowledge of the nature, prevalence, and consequences of oral manifestations of chronic diseases across a lifespan. They learn how to obtain an oral health history, including baseline oral health, risk factors, chronic disease implications, and acute/episodic problems are presented and discussed. They also learn their role in preventing oral disease, addressing frequently encountered oral health-related problems, providing referrals to a dental home, and promoting oral health among their patients.
3. Four hands-on clinical training sessions (approximately 5 h) where pediatric medical residents and PNP students learn how to assess a patient's oral health, identify basic healthy versus abnormal oral conditions, apply

TABLE 2 Description of SPICE-PD training modules

Topic	Description
Community partners	Gives residents a systems perspective for improving the oral health of children and lays the foundation for understanding the oral health care delivery system, including its relationships with local community organizations, public and private sector payers, and policymakers. ⁷
Interprofessional education and training	Provides cross-training in the oral manifestations of chronic disease for nondental providers. Residents engage in academic and clinical activities with nondental providers to foster mutual learning in how oral health and systemic health interact across the lifespan as well as how to recognize the oral manifestations of systemic disease. ⁷
Quality improvement	Enhances residents' ability to continuously improve oral health care services and health status of their targeted patient groups. ⁷
Cultural competency	Residents learn to think broadly about how one's culture influences attitudes, behavior, and oral health. Addressing the needs of populations different from one's own helps develop a greater understanding of and empathy for diverse groups. ⁷
Special needs	Focuses on how to treat medically complex and special needs patients and includes clinical rotations at the early childhood partial hospitalization program (ECPHP) at the Resnick Neuropsychiatric Hospital at UCLA which provides services to children (2–6 years old) who are diagnosed with autism spectrum disorders (ASDs) and related comorbidities. ⁷
Ethics & professionalism	Emphasizes placing the patient's best interests ahead of competing interests. This course encourages residents to choose strategies that will have the greatest impact on reducing oral disease rather than those that merely maximize compensation. ⁷
Disease management and risk assessment	Provides residents with a background in early and minimally invasive pediatric dentistry, individual oral health assessment and treatment for pregnant women, infants, children, and caregivers. ⁷
Policy and advocacy	Exposes residents to the legislative process and advocacy strategies to promote oral health at the local, state, and national levels of government. ⁷
Statistics & research methods	A longstanding requirement of the pediatric residency program has been updated to include dental public health principles for research design and statistics. This course culminates in a research project that gives residents a chance to delve into a topic inspired by their coursework, clinical training, or applied learning experience. ⁷

the concept of caries risk assessment, and perform the clinical portions of a caries management by risk assessment (CAMBRA six-step protocol) including fluoride varnish application.²⁴ The clinical training is accomplished in close collaboration with the pediatric dental residents. The pediatric medical residents and PNP students are expected to gain confidence in performing the six-step caries risk assessment and an oral exam on infants and toddlers, while collaborating with pediatric dental residents.

2.1.3 | SPICE-PD curriculum for AEGD/GPR residents

The SPICE-PD program for the AEGD/GPR residents introduces them to the basics of children's oral health with a focus on risk-based diagnosis and treatment planning. They receive a combination of didactics and hands-on training. The didactics portion teaches them about the unique oral health needs of pediatric patients and introduces them to minimally invasive dentistry, pulp therapy, and trauma management in primary dentition, and space

management. The hands-on training teaches them how to utilize behavioral management concepts for treating children and requires them to perform a six-step caries risk assessment. They receive approximately 20 h of training during their 1-year residency.

2.2 | Data collection

2.2.1 | Year-end participant survey

The year-end oral health survey was conducted at the end of each academic year with participants who completed the SPICE-PD interprofessional program. An e-mail was sent to all graduating participants explaining the purpose of the survey along with a link to the online survey using Survey Monkey, an online survey development cloud-based software program.²⁵ The survey includes 22 questions that capture participants' ratings regarding attitudes toward the SPICE-PD IPE program and course curriculum, program effectiveness and satisfaction, self-reported improvements in knowledge/skills regarding oral health and interprofessional competencies, perceptions

TABLE 3 Differences among SPICE-PD participants by specialty who strongly agreed or agreed with statements regarding interprofessional education (IPE) (total $N = 176$)*

SPICE-PD IPE curriculum satisfaction statements	Pediatric dental residents $N = 29n$ (%)	Pediatric medical residents $N = 44n$ (%)	Pediatric nurse practitioner students $N = 49n$ (%)	AEGD/GPR residents $N = 54n$ (%)	Chi-square p -value for cohort differences
The SPICE-PD program helped me learn to work effectively with interprofessional colleagues.	19 (66)	38 (86)	40 (82)	25 (46)	<0.001
Through the SPICE-PD program, I learned with, from and about interprofessional colleagues.	23 (79)	42 (95)	43 (88)	35 (65)	<0.01
Because of the SPICE-PD program, I know more about the abilities and contributions of other health professionals working together for patient health.	19 (66)	42 (95)	47 (96)	36 (67)	<0.001
An interprofessional approach to oral health enhances patient care.	29 (100)	43 (98)	48 (98)	48 (89)	<0.05

*Due to missing data on some questions, the total N does not equal 208 (the total number of pediatric and AEGD/GPR dental residents, pediatric medical residents, and pediatric nurse practitioner students who completed the survey).

Abbreviations: AEGD, advanced education general dentistry residents; GPR, general practice residents; IPE, interprofessional education; SPICE-PD, Strategic Partnership for Interprofessional Collaborative Education in the Pediatric Dentistry.

regarding the role of primary care providers in oral health care for children, and preparedness to serve special needs and vulnerable populations. The questions pertaining to self-reported improvements in knowledge/skills regarding oral health core competencies were asked only of the pediatric medical residents and PNP students. Since these skills are part of a dental resident's daily practice, they were not asked these questions. The questions pertaining to the role of primary care providers in oral health care were also only asked of the pediatric medical residents and PNP students (i.e., primary care providers in SPICE-PD). Questions were created by the SPICE-PD IPE dental and medical staff in collaboration with the evaluator prior to the start of the project and were based on the content and objectives in the SPICE-PD curricula. Questions were formatted as yes/no, Likert-type scales (strongly agree, agree, neutral, disagree, and strongly disagree response categories), and open-ended questions. The survey takes approximately 10–15 min to complete.

2.3 | Data analysis

Data for the year-end survey, which was cumulative for all 5 years of the project as samples sizes for the different participant groups were too small for analyzing results by year, were exported from Survey Monkey into Excel and then transferred into Stata Version 14 (via Stat Transfer) to conduct univariate and bivariate analyses. Chi-square tests were used to assess differences in IPE experiences and program satisfaction among pediatric dental residents, pediatric medical residents, AEGD/GPR residents, and PNP students and differences in knowledge and skills gained on

oral health core competencies between pediatric medical residents and PNP students.

3 | RESULTS

A total of 208 pediatric and AEGD/GPR dental residents, pediatric medical residents, and PNP students completed the survey (65%; 208/318) between 2015 and 2020. The highest survey completion rate was for the pediatric dental residents (91%; 32/35), followed by the AEGD/GPR residents (81%; 73/90), PNP students (72%; 54/75), and pediatric medical residents (42%; 49/118).

3.1 | Attitudes toward the SPICE-PD program and course curriculum

Table 3 presents the results for differences among SPICE-PD participants by dental/medical specialty who *strongly agreed/agreed* with statements regarding IPE. Pediatric medical residents and PNP students were more likely than pediatric and AEGD/GPR dental residents to strongly agree/agree that an interprofessional approach to oral health enhances patient care (86% and 82% vs. 66% and 46%; $p < 0.001$). Pediatric medical residents, PNP students, and pediatric dental residents reported knowing more about the abilities and contributions of other health professionals as a result of SPICE-PD than AEGD/GPR residents (95%, 88%, and 79% vs. 65%; $p < 0.01$). Pediatric medical residents and PNP students reported learning more from interprofessional colleagues than pediatric and AEGD/GPR dental residents (95% and 96% vs. 66% and

TABLE 4 Differences among SPICE-PD participants who strongly agreed or agreed with statements regarding satisfaction with the SPICE-PD interprofessional education (IPE) course curriculum (total $N = 198$)*

SPICE-PD IPE curriculum satisfaction statements	Pediatric dental residents $N = 31$ n (%)	Pediatric medical residents $N = 46$ n (%)	Pediatric nurse practitioner students $N = 50$ n (%)	AEGD/GPR residents $N = 71$ n (%)	Chi-square p -value for cohort differences
In general, the SPICE-PD courses were well taught.	18 (58)	41 (89)	50 (100)	68 (96)	<0.001
The SPICE-PD faculty provided important perspectives on oral health that I did not receive elsewhere in my graduate education.	19 (61)	42 (91)	49 (98)	48 (68)	<0.001
The SPICE-PD program has prepared me well to address the oral health needs of vulnerable populations.	17 (57)	39 (85)	50 (100)	44 (62)	<0.001
Overall, the SPICE-PD courses have been beneficial to my continuing education.	16 (52)	41 (89)	50 (100)	62 (87)	<0.001

*Due to missing data on some questions, the total N does not equal 208 (the total number of pediatric and AEGD/GPR dental residents, pediatric medical residents, and pediatric nurse practitioner students who completed the survey).

Abbreviations: AEGD, advanced education general dentistry residents; GPR, general practice residents; IPE, interprofessional education; SPICE-PD, Strategic Partnership for Interprofessional Collaborative Education in the Pediatric Dentistry.

67%; $p < 0.001$). Pediatric medical residents, pediatric dental residents, and PNP students were more likely to report SPICE-PD helped them learn to work more effectively with interprofessional colleagues than the AEGD/GPR residents (98%, 100%, 98% versus 89%; $p < 0.05$).

Table 4 presents results for differences among SPICE-PD participants by dental/medical specialty who *strongly agreed/agreed* with statements regarding satisfaction with the SPICE-PD course curriculum. Pediatric medical residents, PNP students, and AEGD/GPR residents were more likely than pediatric dental residents to strongly agree/agree SPICE-PD courses were well-taught (89%, 100%, 96% vs. 58%; $p < 0.001$) and beneficial to their continuing education (89%, 100%, 87% vs. 52%; $p < 0.001$). Pediatric medical residents and PNP students were more likely than pediatric and AEGD/GPR dental residents to strongly agree/agree the SPICE-PD faculty provided them with important perspectives on oral health which they did not receive elsewhere in their graduate education (91%, 98% vs. 61%, 68%; $p < 0.001$) and prepared them well to address oral health needs of special needs and vulnerable populations (85%, 100% vs. 57%, 62%; $p < 0.001$).

3.2 | Knowledge and skills gained on SPICE-PD oral health core competencies: Pediatric medical residents and PNP students

Table 5 presents the differences between pediatric medical residents and PNP students who *strongly agreed/agreed* with statements regarding knowledge and skills gained on oral health core competencies through SPICE-PD. PNP

students were more likely than pediatric medical residents to strongly agree/agree the SPICE-PD program improved their skills to provide anticipatory guidance to prevent dental caries (100% vs. 89%; $p < 0.05$). Additionally, PNP students were more likely than pediatric medical residents to strongly agree/agree SPICE-PD improved their skills to screen for early childhood caries (100% vs. 91%; $p < 0.05$). PNP students were more likely than pediatric medical residents to strongly agree/agree SPICE PD improved their skills to apply fluoride varnish (98% vs. 72%; $p < 0.001$) and increased their sense of responsibility to apply fluoride varnish on children's teeth (94% vs. 72%; $p < 0.01$).

3.3 | Perception regarding the role of primary care providers in oral health care for children: Pediatric medical residents and PNP students

Table 6 presents differences between pediatric medical residents and PNP students who *strongly agreed/agreed* with statements regarding the role of primary care providers in oral health care for children. There were no statistically significant differences between pediatric medical residents and PNP students regarding strongly agreeing/agreeing that primary care providers should incorporate oral health into routine patient care (96% versus 100%; $p = 0.14$), the belief that providing referrals to dental professionals should be part of a primary care provider's routine (98% versus 100%; $p = 0.30$), accreditation and certification bodies should integrate oral health and clinical competencies into primary care practitioner standards (83% vs. 94%; $p = 0.08$) and the belief that

TABLE 5 Differences between pediatric medical residents and pediatric nurse practitioner (PNP) students who strongly agreed or agreed with statements regarding knowledge and skills gained on oral health core competencies through the SPICE-PD IPE program (Total $N = 96$)*

SPICE-PD IPE curriculum satisfaction statements	Pediatric medical residents $N = 46n$ (%)	PNP students $N = 50n$ (%)	Chi-square p -value for cohort differences
SPICE-PD has improved my skills to provide anticipatory guidance to prevent dental caries.	41 (89)	50 (100)	<0.05
SPICE-PD has improved my skills to screen for early childhood caries.	42 (91)	50 (100)	<0.05
SPICE-PD has improved my skills to apply fluoride varnish.	33 (72)	49 (98)	<0.001
SPICE-PD has increased my sense of responsibility to screen children for early childhood caries.	42 (91)	49 (98)	0.14
SPICE-PD has increased my sense of responsibility to provide parents/caregivers with appropriate anticipatory guidance related to oral health.	41 (89)	49 (98)	0.07
SPICE-PD has increased my sense of responsibility to apply fluoride varnish on children's teeth.	33 (72)	47 (94)	<0.01

*Due to missing data, the total N does not equal 103 (the total number of pediatric medical residents and PNP students who completed the survey).

Abbreviations: IPE, interprofessional education; PNP, pediatric nurse practitioner; SPICE-PD, Strategic Partnership for Interprofessional Collaborative Education in the Pediatric Dentistry.

TABLE 6 Differences between pediatric medical residents and pediatric nurse practitioner students who strongly agreed or agreed with statements regarding the role of primary care providers in oral health care for children (total $N = 96$)*

SPICE-PD IPE curriculum satisfaction statements	Pediatric medical residents $N = 46n$ (%)	PNP students $N = 50n$ (%)	Chi-square p -value for cohort differences
Primary care professionals should incorporate oral health into routine patient care.	44 (96)	50 (100)	0.14
Providing referrals to dental professionals should be part of a primary care provider's routine.	45 (98)	50 (100)	0.30
Accreditation and certification bodies should integrate oral health and clinical competencies into primary care practitioner standards.	38 (83)	47 (94)	0.08
Meaningful information exchange should occur among different healthcare providers to identify and implement appropriate, high-quality oral health care for patients.	43 (93)	50 (100)	0.07

*Due to missing data, the total N does not equal 103 (the total number of pediatric medical residents and PNP students who completed the survey).

Abbreviations: IPE, interprofessional education; PNP, pediatric nurse practitioner; SPICE-PD, Strategic Partnership for Interprofessional Collaborative Education in the Pediatric Dentistry.

meaningful information exchange should occur among different healthcare providers to identify and implement appropriate, high-quality oral health care for patients (93% vs. 100%; $p = 0.07$).

3.4 | Strengths of the SPICE-PD program and suggestions for improvement

3.4.1 | Strengths of the SPICE-PD program

Many of the pediatric medical residents and PNP students reported the SPICE-PD course curriculum as being a

strength of the program. They thought the curriculum provided lots of good information not taught elsewhere during their education or training. They liked the variety of oral health-related topics covered, thought the lectures were well organized, and enjoyed the oral presentations and videos. The interactive experiences in the dental clinic with the pediatric dental residents where they viewed dental cleaning in children and were able to help with fluoride varnish application and conducting an oral health risk assessment was also a highlight of the program for both the pediatric medical residents and PNP students. The pediatric dental residents thought that the interprofessional component of the SPICE-PD curriculum was the

major strength of the program. They liked working with pediatricians, nurses, and behavioral therapists. They also liked the speech therapy, autism, motivational interviewing, and diet/nutrition lectures. The AEGD/GPR residents thought the clinical-based lectures were most helpful, including lectures on risk assessment, minimally invasive dentistry, pulp therapy, space maintenance, and behavior guidance. They also liked the interprofessional component where they learned about topics from different health professionals.

3.4.2 | Suggestions for improvement of the SPICE-PD program

The pediatric medical residents and PNP students would have liked more patient interaction/clinical time with the pediatric dental residents. Some of the pediatric medical residents reported not having a chance to apply fluoride varnish during their oral health clinical rotations with the pediatric dental residents. The pediatric dental residents thought some of the lectures and pre-reading assignments were a little repetitive as some of the topics were covered in their dental residency training program and dental school. They also suggested adding more opportunities to reinforce interprofessional learning and wanted more clinical time with medically complex children and those with autism and other behavioral disabilities. The AEGD/GPR residents suggested more pediatric dentistry courses, more hands-on activities in the clinic setting, more “real-life” case studies, and more interaction with other health professionals from different specialties.

4 | DISCUSSION

Our study showed participants thought SPICE-PD helped them learn to work more effectively with interprofessional colleagues and reported knowing more about the abilities and contributions of other health professionals as a result of the program. Participants also thought the SPICE-PD courses were well-taught and beneficial to their continuing education. Significantly more pediatric medical residents and PNP students than dental residents thought SPICE-PD faculty provided them with important perspectives on oral health which they did not receive elsewhere in their graduate education. This may be reflective of the fact that pediatric medical residents and PNP students receive little oral health training in medical or nursing school,^{12–15,26,27} so they found SPICE-PD to be very informative, while the dental residents receive an abundance of oral health-related education in dental school and dental residency programs. Additionally, significantly more pedi-

atric medical residents and PNP students than dental residents thought SPICE-PD prepared them well to address oral health needs of special needs and vulnerable populations. Dental residents reported wanting more clinical time with medically complex children and those with autism and other behavioral disabilities. Enhancing the special needs component of the program and adding more clinical time with special needs populations will be incorporated into the curriculum for future IPE cohorts.

For the questions asked only of the primary care providers (pediatric medical residents and PNP students), almost all thought the SPICE-PD program improved their oral health skills and sense of responsibility to provide anticipatory guidance to prevent dental caries (i.e., providing practical and developmentally appropriate information about children’s oral health to families)²⁸ and screen for early childhood caries. A greater percentage of PNP students than pediatric medical residents thought SPICE-PD improved their skills and sense of responsibility to apply fluoride varnish. While both groups thought the interactive experiences in the dental clinic with the pediatric dental residents where they were able to help with fluoride varnish application was a highlight of the program, some of the pediatric medical residents reported not having a chance to apply fluoride varnish during their clinical rotation. Ensuring pediatric medical residents have ample opportunity to apply fluoride varnish to children’s teeth will be a priority when scheduling the clinical component of SPICE-PD in the future.

Almost all pediatric medical residents and PNP students thought primary care providers should incorporate oral health into routine patient care, provide referrals to dental professionals when necessary, and that meaningful information exchange should occur among different healthcare providers to identify and implement appropriate, high-quality oral health care for patients. Additionally, both pediatric dental residents and PNP students thought accreditation and certification bodies should integrate oral health and clinical competencies into primary care practitioner standards. These findings are promising as they show primary care providers in our study support IPE and coordination of education and practice, which can help bridge the gap between dental and medical care, thus leading to enhanced interprofessional practice and more comprehensive patient care.^{6,7,16}

There were limitations to this study. First, this study was a cross-sectional study, thus we were unable to assess a causal relationship between the SPICE-PD program and the main outcomes of the study. Next, self-reported data might result in social desirability bias. Finally, due to inherent issues with online surveys, such as selection bias and low response rate, generalizability might be impacted as the participants who completed the survey may have

had different experiences from those who chose not to complete the survey.^{29–32} While the survey response rate was high for the pediatric and AEGD/GPR residents and PNP students, it was under 50% for the pediatric medical residents.

5 | CONCLUSION

The SPICE-PD program provides a much-needed medical/dental integrated comprehensive IPE training program for dentists and pediatric primary care providers to gain knowledge and skills necessary to serve children and vulnerable and at-risk populations. The findings in this study support results from previous research on the positive effects of IPE programs on pediatric primary care provider's oral health-related knowledge and skills.^{2,6,14–16} The IPE framework for this study is based on more than 10 years of collaborative effort among the UCLA dental, medical, and nursing schools and continues to evolve based on feedback from IPE participants and program collaborators. In the next phase of the study, we will identify other cross-sector partnerships (e.g., partnering with family practice primary care providers, nutrition and social work programs, and community health workers) to provide more opportunities for residents/students to practice in an integrated setting and help drive forward a more coordinated system of care. It is hoped the UCLA IPE framework can serve as a model for other IPE programs. More interprofessional programs are desperately needed as they play a unique role in preparing dentists and primary care providers for a paradigm shift in patient care, which emphasizes effective collaboration and coordinated systems of care, thus leading to increased access to care and improved oral health outcomes, especially among low-income and underserved communities.

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