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Measuring the Impact of Practice-based Research Networks on Member Dentists in the Collaboration on Networked Dental and Oral Health Research, CONDOR

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For the CONDOR Collaborative Group

Abstract

Objectives—The National Institute of Dental and Craniofacial Research funded three practice-based research networks (PBRNs), NW-PRECEDENT, PEARL and DPBRN to conduct studies relevant to practicing general dentists. These PBRNs collaborated to develop a questionnaire to assess the impact of network participation on changes in practice patterns. This report presents results from the initial administration of the questionnaire.

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Methods—Questionnaires were administered to network dentists and a non-network reference group. Practice patterns including caries diagnosis and treatment, pulp cap materials, third molar extraction, dentin hypersensitivity treatments and endodontic treatment and restoration were assessed by network, years in practice, and level of network participation. Test-retest reliability of the questionnaire was evaluated.

Results—950 practitioners completed the questionnaire. Test-retest reliability was good-excellent ($\kappa > 0.4$) for most questions. Significant differences in responses by network were not observed. The use of caries risk assessment forms differed by both network participation ($p < 0.001$) and years since dental degree ($p = 0.026$). Recent dental graduates are more likely to recommend third molar removal for preventive reasons ($p = 0.003$).

Conclusions—Practitioners in the CONDOR research networks are similar to their US colleagues. As a group, however, these practitioners show a more evidence-based approach to their practice. Dental PBRNs have the potential to improve the translation of evidence into daily practice. Designing methods to assess practice change and the associated factors is essential to addressing this important issue.

Keywords

dental practice-based research networks; behavior change; practice impact

INTRODUCTION

The ultimate goal of dental practice-based research networks (PBRNs) is to impact the practice of dentistry by improving patient care.¹ Potentially, this can be accomplished through PBRNs if activities and findings of practice-based research can shorten the knowledge translational gap, estimated in biomedical research to be between 17-20 years.² This translational gap – the time between identifying effective procedures or care protocols and the adoption and sustained use of that information in routine practice – consists of many barriers.^{3,4,5} For example, it has been documented that passive dissemination of knowledge (i.e. solely through publications) is unlikely to substantially change professional behavior.⁶ More interactive strategies to engage clinicians in obtaining and integrating new information into their practices are critically needed. It has been suggested that the likelihood of translating research into practice would be higher if dentists were involved in research and if the research were relevant to their clinical practice and the well-being of their patients.⁷ The diversity of studies available in the research portfolio of a PBRN presents multiple opportunities to attract broad practitioner participation and provide ‘practice-based evidence’ most relevant to clinicians and enhance generalizability. In addition, group interaction, positive staff attitudes, inter-organizational collaboration, and networks have been identified as facilitators of research translation in dental practice.⁸

In 2005, the National Institute of Dental and Craniofacial Research (NIDCR), National Institutes of Health (NIH) funded three dental practice-based research networks (PBRNs) known as NW PRECEDENT, DPBRN, and PEARL.^{1,9} These PBRNs are known collectively as the Collaboration on Networked Dental and Oral Health Research (CONDOR). Northwest Practice-based Research Collaborative in Evidence-based Dentistry (NW PRECEDENT) consists of approximately 250 practitioners in Washington, Oregon, Idaho, Montana, and Utah.¹⁰ The Dental Practice-Based Research Network (DPBRN) is administered by the University of Alabama at Birmingham and includes over 1,100 dental practitioners mainly from five regions in the United States and Scandinavia.¹¹ The Practitioners Engaged in Applied Research and Learning (PEARL) Network consists of almost 200 practitioners from 23 states, administered through New York University.¹²

This study represents a joint effort of the PBRNs that comprise CONDOR to develop a strategy for assessing the impact of practice-based dental research on the PBRN practices. The Practice-Impact Research Group (PIRG) of CONDOR developed a questionnaire to assess practice patterns in caries risk assessment and management, including use of special forms to assess caries risk, use of pulp cap materials, diagnosis and treatment of dentin hypersensitivity, endodontic treatment and restoration, and third molar extraction. This study presents data on dentists' practices from the first administration of the questionnaire. Subsequent administrations will provide an opportunity to detect practice changes as results from PBRN studies are disseminated.

METHODS

Questionnaire Development

Each PBRN contributed questions to a questionnaire that represented topics under research investigation by the respective PBRN. The survey included questions on how respondents obtain information and on how that information influences their practice of dentistry. Responses to these latter questions are reported in a separate publication¹³. In total, the questionnaire included 16 items. The questionnaire was pre-tested for clarity and readability among all networks and revised accordingly. Questions related to methods used to diagnose primary caries lesions had been used in a prior survey conducted by the DPBRN¹⁴. The protocol for questionnaire content and administration was reviewed and approved by an independent panel advisory to the NIDCR and was approved or received a waiver from each Network IRB.

Survey Administration and Data Collection

Letters of invitation and route of questionnaire administration differed by network. The questionnaire was administered the same way (electronic or paper) at each administration within each PBRN. Because the questionnaire includes pictures of teeth with specific dental conditions, particular care was taken to assure adequate resolution of these pictures in paper or electronic questionnaires.

PEARL invited 186 Practitioner-Investigators (P-Is) to complete the questionnaire via a secure online application. The questionnaire was open for completion in April 2009 and follow-up with non-responders continued via e-mail, telephone, and facsimile until March 2010. The response rate was 79% (147 respondents). To measure test-retest reliability, the questionnaire was completed twice by 34 PEARL members between April 20 and April 25, prior to the opening session of the annual PEARL meeting. The median test-retest timeframe for data capture was 2 days (range 1-4 days); 75% of the participants completed the re-test within 3 days of the first administration.

DPBRN mailed printed questionnaires to 1,013 enrolled dentists who had provided descriptive practice-level data, and were either general dentists, pediatric dentists, or indicated they performed at least some restorative dentistry. Reminders were sent 2-3 times to non-responders at the discretion of each regional PI and according to local IRB approvals. In the US, 595 dentists responded (66% response rate) and 62 responded from Sweden (90% response rate). Only US respondents are included in the current analysis. To measure test-retest reliability, the questionnaire was completed twice by 18 DPBRN practitioners, who completed the second questionnaire a mean (S.D.) of 62.9 (30.1) days after the first questionnaire. Median time between administrations was 50 days and 75% of dentists completed the questionnaire 92 days after first completion.

NW-PRECEDENT invited 195 PIs via e-blast to complete the questionnaire via a secure online application. In addition, 59 "Friends" of PRECEDENT, were invited. Friends are

practitioners who have expressed interest in practice-based research, but are not trained to participate in clinical studies. They participate in surveys such as the PIRG survey and receive network newsletters. The questionnaire was open for completion June 25, 2009 and follow-up with non-responders continued via e-mail, telephone, and facsimile for 4 weeks. In total, 208 dentists responded (82% response rate). To measure test-retest reliability, NW-PRECEDENT re-administered the survey to 17 randomly selected practitioners an average of 237 days after first administration; 25% completed it within 232 days of first administration, 75% within 246 days.

Statistical Methods

Eleven items from the PIRG questionnaire are included in this analysis. (See Appendix for full questionnaire.) All questions used a closed-ended, multiple response format. Question format included clinical scenarios with or without photographs, with response categories as behavior frequencies and/or materials or procedures.

Demographic variables were previously reported on network-specific enrollment forms. The level of a respondent's participation in network activities was constructed from tracking databases maintained by each Network Chairman's office, as follows:

- **Full participant:** a fully trained practitioner who participated in one or more studies with patient recruitment.
- **Partial participant:** a fully trained practitioner who had not participated in a study with patient recruitment, but may have attended one or more network meetings, and/or completed surveys.
- **Reference:** an inactive network member who had not received training, and had not participated in studies or network meetings, e.g. "Friends of PRECEDENT". Responses from this reference group are used for comparison to the responses of those participating in network studies in the present analysis as well as in follow-up administrations of the questionnaire.

Two survey questions presented pictures of molars with varying degrees of caries and choices for restorative treatments. Respondents were given 13 discrete options from which they could choose one or more responses. To simplify the analyses, these options were recoded as follows.¹⁵

- **No Treatment or Further Diagnoses:** No treatment or further diagnoses (e.g. Diagnodent, explorer, or radiograph)
- **Preventive treatment only:** In-office fluoride, nonprescription fluoride, prescription fluoride, sealant or chlorhexidine treatment
- **Minimally invasive treatment** with or without preventive treatment: Minimal drilling and sealant, minimal drilling and preventive resin restoration, air abrasion and sealant or air abrasion and preventive resin restoration $\pm$ preventive treatment.
- **Restorative treatment** with or without preventive treatment: Amalgam restoration, resin-based composite restoration or indirect restoration $\pm$ preventive treatment.

Summary statistics for demographic variables are presented overall and by network. Survey responses are presented overall; by years since first dental degree; and by overall level of participation in the PBRN as defined above.

All analyses presented here are considered exploratory. The sample size for the study was based on having adequate power to detect changes in responses on repeat administrations, which will be reported in future publications. Chi-square or Fishers Exact statistic, as

appropriate, was used to compare categorical variables among comparison groups. Kappa statistics were used to describe the extent of change in response in the test-retest samples, with weighted kappas used for ordinal response categories. Responses with kappa values greater than 0.75 are considered to have excellent agreement between the two administrations, values between 0.4 and 0.75 have good agreement and values <0.4 have marginal agreement.¹⁶ SAS version 9.2 was used and all p-values are presented without adjustment for multiple comparisons.

RESULTS

Demographics

A total of 950 practitioners from the US responded to this initial administration of the survey: 595 from DPBRN, 147 from PEARL and 208 from NW-PRECEDENT. The majority of the respondents were white (78%), non-Hispanic (97%), and male (81%) (Table 1). PEARL had a larger proportion of respondents with 26 or more years of experience (57%, compared to 33% overall), likely due to PEARL's initial participant criterion of 10 or more years practice experience. A total of 378 (40%) participated in at least one non-survey network study (i.e. Full Participants). An additional 346 (36%) had previously completed a survey or attended at least one network meeting, (i.e. Partial Participants). The reference group included the remaining 226 respondents. PEARL had a higher percentage of Full Participants contribute to this survey (48%) compared to 35% among DPBRN respondents and 47% of PRECEDENT respondents. A greater proportion of women practitioners (33.9%) are among recent dental graduates compared to 12.6% among the most experienced group. ($p < .001$; Table 2).

Test-Retest Reliability—Test-retest reliability was assessed separately by network. Among PEARL respondents there was good to excellent agreement ($\text{kappa} = 0.41 - 0.91$) between responses for all but two questions: question 11 regarding use of fluoride containing materials to treat dentin hypersensitivity ($\text{kappa} = 0.09$) and use of toothpaste or rinse to treat dentin hypersensitivity ($\text{kappa} = 0.10$). Among NW PRECEDENT there was marginal to excellent agreement ($\text{kappa} = 0.34 - 0.77$) on all but question 11 ($\text{kappa} = 0.22$), similar to PEARL. For DPBRN, agreement was good to excellent ($\text{kappa} = 0.44 - 0.95$) on all questions except the option for use of chemical treatment (e.g. potassium nitrate) for dentin hypersensitivity ($\text{kappa} = 0.22$).

Caries Diagnosis and Treatment—The majority of respondents (59%) always use a dental explorer to diagnose primary occlusal caries lesions (Table 3); most (78%) use air-drying at least 50% of the time. Fewer full participants use a dental explorer all of the time (53%) compared to the others ($p = 0.04$, Table 4). A majority (83%) report assessment of caries risk for individual patients, but only 23% use a special form for assessment. Among those who assess caries risk, more full participants use a specific form (32%) compared to partial participants (18%) or the reference group (13%) ($p < 0.001$).

Treatment recommendations were requested for two molars in a 30 year old female patient with no other teeth with dental restorations or caries. For the tooth shown in Figure 1A, 29% chose no treatment or further diagnostic testing, while 56% recommended minimally invasive and/or preventive treatment (Table 3). These numbers were consistent across provider experience but not across levels of network participation ($p = 0.006$). Full participants were more likely to recommend preventive or minimally invasive care (60%) compared to partial participants (50%) or the reference group (55%, Table 4). For the second tooth (Figure 1B), 48% recommended minimally invasive and/or preventive

treatment. Again, full participants were more likely to make this recommendation than partial participants or those in the reference group ($p=0.055$).

Deep Caries Treatment—A case presentation with radiograph described a patient with visible cavitation into the dentin in the central fossa of tooth #30 (Figure 2). Respondents were asked what they would do when they realized that the lesion was deeper than anticipated and may involve the mesial buccal pulp horn. Forty-six percent would continue and remove all of the decay, 34% would stop removing decay near the pulp horn and remove it elsewhere and 20% would temporize and treat or refer the tooth for endodontics (Table 3). Observed differences across number of years post dental degree did not show a clear trend, while responses were consistent across level of involvement with the network.

Pulp Cap Materials—Almost half of respondents use calcium hydroxide as a pulp capping material (49%, Table 3), while 33% use glass ionomer. Use of mineral trioxide aggregate is more prevalent in NW-PRECEDENT (10%) compared to other networks (2-3%, data not shown). Dentin bonding systems are used by 9% and other materials by 5%. More (52%) experienced practitioners use calcium hydroxide compared to the least experienced (40%). Fewer experienced practitioners use glass ionomer (29%) compared to more recent dental graduates (46%, $p<0.001$). Material preferences were consistent across level of involvement with the network (Table 4).

Recommendations Regarding Third Molar Extraction—Half of respondents refer patients for third molar extraction by the age of 20, 60% or more of the time (Table 3). Most (74%) recommend removal if the molar has a poor eruption path or insufficient space for eruption (Table 3). Recent graduates recommended removal for preventive reasons more frequently (25%) compared with more experienced practitioners ($p=0.003$). There was no difference based on level of network participation.

Treatments for Dentin Hypersensitivity—Respondents reported using a wide variety of treatments for dentin hypersensitivity including, dentin bonding agents (65%), fluoride containing materials (85%), toothpaste or rinse (80%) and some chemical treatment (43%) (Table 3). Oxalate and dentin bonding agents were used more frequently by more experienced practitioners. Treatment patterns were consistent across level of involvement.

Endodontic Treatment and Restoration—In a fourth case presentation, respondents provided a recommendation regarding endodontic treatment in a patient presenting with pain in tooth #13 (details in Table 3, Question 13). Most recommended initiating endodontic treatment leading to a post, core and full crown (65%) (Table 3). Some (21%) recommended extirpation of the pulp, temporizing and referring for endodontic treatment; 14% chose an option that included an implant. Recommendations were consistent across years of experience. Slightly more reference respondents recommended extirpation of the pulp (27%) or options that included an implant (16%) compared with network practitioners ($p=0.016$, Table 4).

DISCUSSION

Progress towards improving the oral health status of Americans has been impeded at least in part due to reliance on passive methods to disseminate the latest scientific evidence into daily clinical practice.¹⁷ PBRNs provide an excellent opportunity to close the gap between research and practice, while generating important and relevant knowledge that can be applied in daily clinical dental practices.^{18,19,20} The active participation of dental

practitioners in PBRNs could enhance the much needed translation and implementation of evidence-based research into practice.^{22,23,21}

This survey provides an important baseline from which to measure practice changes as studies from the PBRNs are completed, published and results disseminated. Results are confined to US practices. Because the three PBRNs span the nation, the sample provides an opportunity to identify regional differences in practice patterns and changes in practice patterns over time. Dentists who joined the PBRNs are a self-selected population with specific interest in research and may be more willing to alter clinical practice to reflect outcomes suggested in research studies. The reference group will help delineate differences, if any, in research-focused practitioners compared to a more general practitioner population; however, even they may differ from the general dentist because they have expressed some interest in a research network.

A comparison of the baseline characteristics with survey results from the American Dental Association (ADA) suggests PBRN dentists have some similar demographics compared to the practitioners who participated in the ADA survey. Across the networks, 81% of dentists are male consistent with ADA survey data showing 78.6% of practicing dentists are male.²⁴ However, PBRN dentists tend to have been practicing for fewer years than the general practitioner population with 48% of PBRN dentists practicing less than 20 years compared to 30.5% nationally.²⁴ This may reflect an age-dependent trend in which more recent graduates have an increased belief in the value of participating in and implementing high-quality scientific evidence into daily practice.²⁵ Interestingly, applicants for the ADA's Evidence-based Dentistry Champions Conference in 2010 averaged 20.7 years of practice experience, similar to PBRN participants.^{26,27} Perhaps not surprisingly, there is a highly significant shift in gender distribution associated with years in practice. A higher proportion of women (66.1%) are represented in the group practicing 15 or fewer years which is to be expected considering there has been a 47.6% increase in female dental graduates since 1999.

Although the survey was piloted for understanding and completion time, dentists may have been inconsistent in their interpretation of some of the items. For example, pulp capping may have been interpreted as either indirect or direct pulp capping for which different materials may be indicated.^{28, 29} The assessments of consistency in responses by the same dentists over a period of time where real change is not expected, found poor reliability of responses for treatment of dentin hypersensitivity with fluoride containing materials, toothpaste, or chemical treatment. Good to excellent reliability was found for most of the remaining items suggesting that this survey could be a useful measure for detecting change in practice in the targeted areas of caries diagnosis and treatment, third molar extraction, and endodontic treatment. Because of the number of comparisons, these conclusions must be considered exploratory, requiring further verification.

Although there has been a recent trend in recommendations against the prophylactic removal of third molars^{30,31} newer dental graduates were more likely to recommend removal of third molars for this reason. The reasons for this trend are not immediately evident.

Dentists with more than 15 years in practice were less likely to use a special form to record caries risk. But, full participants in network research were nearly twice as likely to record caries risk assessments data on a special form. This trend may reflect the network participants' intellectual interest in the concept of scientific inquiry. Full and partial participants were more likely to initiate endodontic therapy to address irreversible pulpitis compared to the reference group. Full participants were more likely to recommend preventive or minimally invasive treatment for presented examples of caries in a low risk individual compared to partial participants and reference groups perhaps reflecting full

participants' knowledge of current PBRN studies of caries treatment approaches and/or their willingness to consider alternatives.

In summary, the demographic characteristics of the CONDOR research network practitioners are similar to their US colleagues, but our data suggest they show a more evidence-based approach to their practice. This could be due to the emphasis within the network of engaging the dental practitioners in each step of the research process including what to study, how to study it, how to evaluate the results, and presentation of the results to colleagues; an approach used by others.^{32,33,34,35} One of the objectives of the repeated administration of this survey is to identify if those most involved in the research enterprise are the most likely to be early adopters of new practices identified through research. In addition, among full participants we plan to investigate whether those enrolling subjects in a study whose results are compelling enough to change practice will be more likely to change practice than those who did not participate in that study. These investigations may offer information on characteristics associated with faster translation of research results into practice³⁶; a goal that is important across many public health disciplines.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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a

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Figure 1.
A & B Caries Treatment

Figure 2.
Deep Caries Bitewing Radiograph

Table 1

Demographic Characteristics of Survey Respondents by Network

		DPBRN (N=595)	PEARL (N=147)	PRECEDENT (N=208)	Overall (N=950)
Sex	N	522	147	189	858
	Male	428 (82%)	110 (75%)	155 (82%)	693 (81%)
	Female	94 (18%)	37 (25%)	34 (18%)	165 (19%)
Race	White	471 (79%)	113 (77%)	157 (75%)	741 (78%)
	Black	23 (4%)	9 (6%)	3 (1%)	35 (4%)
	Asian	19 (3%)	18 (12%)	18 (9%)	55 (6%)
	Native American	2 (< 1%)	2 (1%)	6 (3%)	10 (1%)
	Hawaiian or Pacific Islander	0 (0%)	0 (0%)	1 (< 1%)	1 (< 1%)
	Other or mixed racial	0 (0%)	4 (3%)	3 (1%)	7 (1%)
Ethnicity	N	519	140	158	817
	Not Hispanic	506 (97%)	130 (93%)	154 (97%)	790 (97%)
	Hispanic	13 (3%)	10 (7%)	4 (3%)	27 (3%)
Years since first post baccalaureate dental degree	N	494	147	189	830
	5 or fewer	76 (15%)	4 (3%)	32 (17%)	112 (13%)
	6 - 15	103 (21%)	24 (16%)	50 (26%)	177 (21%)
	16 - 20	76 (15%)	11 (7%)	21 (11%)	108 (13%)
	21 - 25	94 (19%)	24 (16%)	37 (20%)	155 (19%)
	26+	145 (29%)	84 (57%)	49 (26%)	278 (33%)
Global level of involvement	N	595	147	208	950
	Full participant	209 (35%)	71 (48%)	98 (47%)	378 (40%)
	Partial participant	239 (40%)	47 (32%)	60 (29%)	346 (36%)
	Control(Inactive or outside network)	147 (25%)	29 (20%)	50 (24%)	226 (24%)

* Full participant: respondent has participated in at least one network study recruiting patients

Partial participant: respondent is a fully trained member of the network or has attended at least one meeting or participated in other survey studies

Reference: inactive member of the network (not trained, no participation in studies or meetings) or is outside the network, e.g. Friends of PRECEDENT

Table 2

Demographics by Years Since First Dental Degree

		5 (N=112)	6-15 (N=177)	>15 (N=541)	P-value
Sex	N	112	177	541	<.001
	Male	74 (66%)	120 (68%)	473 (87%)	
Race	Female	38 (34%)	57 (32%)	68 (13%)	
	White	92 (82%)	138 (78%)	484 (89%)	
	Black	3 (3%)	7 (4%)	24 (4%)	
	Asian	12 (11%)	30 (17%)	13 (2%)	
	Native American	2 (2%)	0 (0%)	8 (1%)	
Ethnicity	Hawaiian or Pacific Islander	0 (0%)	0 (0%)	1 (< 1%)	
	Other or mixed racial	2 (2%)	1 (1%)	4 (1%)	
	N	108	172	509	0.376
	Not Hispanic	103 (95%)	164 (95%)	495 (97%)	
Global level of involvement	Hispanic	5 (5%)	8 (5%)	14 (3%)	
	N	112	177	541	0.381
	Full participant	44 (39%)	71 (40%)	251 (46%)	
	Partial participant	50 (45%)	72 (41%)	198 (37%)	
	Control(Inactive or outside network)	18 (16%)	34 (19%)	92 (17%)	

*Full participant: respondent has participated in at least one network study recruiting patients

Partial participant: respondent is a fully trained member of the network or has attended at least one meeting or participated in other survey studies

Reference: inactive member of the network (not trained, no participation in studies or meetings) or is outside the network, e.g. Friends of PRECEDENT

Table 3

Survey Responses Overall and by Years Since First Dental Degree

Caries Diagnosis and Treatment		Overall US (N=830)				5 (N=112)	6-15 (N=177)	>15 (N=541)	P-value
1. When you examine patients to determine if they have a primary occlusal caries lesion, on what percentage of these patients do you use a dental explorer to help diagnose the lesion?									
	N	829				111	177	541	0.135
	Never					1 (1%)	0 (0%)	3 (1%)	
	< 50%					15 (14%)	22 (12%)	38 (7%)	
	50-99%					36 (32%)	59 (33%)	175 (32%)	
	Every time					59 (53%)	96 (54%)	325 (60%)	
2. When you examine patients to determine if they have a primary caries lesion, on what percent of these patients do you use air-drying to help diagnose the lesion?									
	N	829				112	176	541	0.725
	Never					1 (1%)	2 (1%)	11 (2%)	
	< 50%					24 (21%)	41 (23%)	110 (20%)	
	50-99%					49 (44%)	87 (49%)	255 (47%)	
	Every time					38 (34%)	46 (26%)	165 (30%)	
a. If you air-dry at least some, approximately how long do you dry the tooth surface?									
	N	812				111	174	527	0.039
	1 to 2 seconds					54 (49%)	66 (38%)	224 (43%)	
	3 to 4 seconds					52 (47%)	79 (45%)	234 (44%)	
	5+ seconds					5 (5%)	29 (17%)	69 (13%)	
3. Do you assess caries risk for individual patients in any way?									
	N	791				103	170	518	0.069
	Yes					88 (85%)	151 (89%)	422 (81%)	
	No					15 (15%)	19 (11%)	96 (19%)	
a. If YES:									
	N	639				87	147	405	0.026
	Record the assessment on a special form that is kept in the patient chart					29 (33%)	43 (29%)	87 (21%)	
	Do not use a special form to make the assessment					58 (67%)	104 (71%)	318 (79%)	
12. Do you use any in-office tests to assess caries risk?									
	N	814				109	175	530	<.001
	Yes					20 (18%)	48 (27%)	78 (15%)	
	No					89 (82%)	127 (73%)	452 (85%)	

		Overall US (N=830)	5 (N=112)	6-15 (N=177)	>15 (N=541)	P-value
7. Upon opening the tooth and during excavation of the caries you realize that the lesion is deeper than anticipated and may involve the mesial buccal pulp horn. You would usually						
N		812	111	176	525	0.039
Continue and remove all the decay		372 (46%)	51 (46%)	73 (41%)	248 (47%)	
Stop removing decay near the pulp horn and remove it elsewhere		285 (35%)	45 (41%)	56 (32%)	184 (35%)	
Temporize and treat or refer the tooth for endodontics		155 (19%)	15 (14%)	47 (27%)	93 (18%)	
Caries Treatment (see Figure 1 & 2)						
4. How would you treat the tooth shown above?						
N		830	112	177	541	0.291
No Treatment or Further Diagnosis		237 (29%)	27 (24%)	42 (24%)	168 (31%)	
Preventive only		172 (21%)	29 (26%)	40 (23%)	103 (19%)	
Minimally invasive ± preventive		293 (35%)	40 (36%)	68 (38%)	185 (34%)	
Restoration ± preventive		118 (14%)	13 (12%)	26 (15%)	79 (15%)	
Other		10 (1%)	3 (3%)	1 (1%)	6 (1%)	
N		830	112	177	541	0.259
No Treatment or Further Diagnosis		105 (13%)	10 (9%)	19 (11%)	76 (14%)	
Preventive only		81 (10%)	14 (3%)	19 (11%)	48 (9%)	
Minimally invasive ± preventive		321 (39%)	54 (48%)	66 (37%)	201 (37%)	
Restoration ± preventive		315 (38%)	33 (29%)	72 (41%)	210 (39%)	
Other		8 (1%)	1 (1%)	1 (1%)	6 (1%)	
Pulp Capping						
8. Which of the following pulp capping materials do you use most often in your practice (choose one)?						
N		810	108	172	530	<.001
Mineral Trioxide Aggregate (MTA)		34 (4%)	7 (6%)	7 (4%)	20 (4%)	
Calcium Hydroxide		393 (49%)	43 (40%)	76 (44%)	274 (52%)	
Glass Ionomer		274 (34%)	50 (46%)	73 (42%)	151 (28%)	
Dentine Bonding System		71 (9%)	3 (3%)	11 (6%)	57 (11%)	
Other		38 (5%)	5 (5%)	5 (3%)	28 (5%)	
Third Molars						
9. What percentage of your patients do you refer for third molar extraction by the age of 20?						
N		759	100	163	496	0.320
< 20%		96 (13%)	11 (11%)	13 (8%)	72 (15%)	

	Overall US (N=830)	5 (N=112)	6-15 (N=177)	>15 (N=541)	P-value
20-40%	113 (15%)	12 (12%)	26 (16%)	75 (15%)	
40-60%	171 (23%)	21 (21%)	45 (28%)	105 (21%)	
60-80%	195 (26%)	32 (32%)	40 (25%)	123 (25%)	
> 80%	184 (24%)	24 (24%)	39 (24%)	121 (24%)	
N	820	109	175	536	0.003
10. Which statement best describes your philosophy on third molar referrals?					
Recommend removal of most third molars for preventive reasons	120 (15%)	27 (25%)	32 (18%)	61 (11%)	
Recommend removal if they have poor eruption path or do not have sufficient space for eruption	598 (73%)	70 (64%)	120 (69%)	408 (76%)	
Recommend removal if a patient presents with symptoms or pathology associated with 3rd molars	102 (12%)	12 (11%)	23 (13%)	67 (13%)	
Dentin Hypersensitivity					
11. What type of dentin hypersensitivity treatments do you routinely use or recommend for your patients? (check all that you use)					
a. Dentin bonding agents	543 (65%)	63 (56%)	109 (62%)	371 (69%)	0.021
b. Oxalate or bioglass containing material	132 (16%)	8 (7%)	21 (12%)	103 (19%)	0.002
c. Fluoride containing material	711 (86%)	94 (84%)	156 (88%)	461 (85%)	
d. Chemical treatment (e.g. potassium nitrate)	343 (41%)	35 (31%)	80 (45%)	228 (42%)	
e. Toothpaste or rinse	663 (80%)	78 (70%)	143 (81%)	442 (82%)	
f. Other	86 (10%)	12 (11%)	18 (10%)	56 (10%)	
Endodontic Treatment					
13. One of your regular patients presents with pain in tooth #13. Upon clinical inspection the lingual cusp has fractured to just below the gingival margin and there is extensive decay beneath the large MOD composite restoration.					
You are able to diagnose a condition of irreversible pulpitis but there is no radiographic evidence of periapical pathosis. You would at this point recommend to your patient that you:					
N	812	110	175	527	0.943
Initiate endodontic treatment leading to placement of a post and core followed by a full crown	526 (65%)	71 (65%)	116 (66%)	339 (64%)	
Extirpate pulp, temporize, refer for endodontic treatment and place a post, core and full crown	174 (21%)	24 (22%)	31 (18%)	119 (23%)	
Extract tooth and place an immediate implant fixture and later restore with a crown	34 (4%)	4 (4%)	8 (5%)	22 (4%)	

	Overall US (N=830)	5 (N=112)	6-15 (N=177)	>15 (N=541)	P-value
Extirpate pulp, temporize, refer for extraction and placement of implant, and restore with crown	38 (5%)	6 (5%)	9 (5%)	23 (4%)	
Extract tooth, refer patient for placement of an implant fixture, and restore with crown	40 (5%)	5 (5%)	11 (6%)	24 (5%)	

Note: 120 respondents did not provide information about number of years since first dental degree. Overall reflects all US respondents.

Table 4

Survey Responses by Global Level of Involvement

Caries Diagnosis and Treatment		Full participant ¹ (N=378)	Partial participant ² (N=346)	Reference ³ (N=226)	P-value
1. When you examine patients to determine if they have a primary occlusal caries lesion, on what percentage of these patients do you use a dental explorer to help diagnose the lesion?					
	N	377	345	225	0.042
	Never	5 (1%)	1 (< 1%)	0 (0%)	
	< 50%	41 (11%)	25 (7%)	17 (8%)	
	50-99%	131 (35%)	102 (30%)	70 (31%)	
	Every time	200 (53%)	217 (63%)	138 (61%)	
2. When you examine patients to determine if they have a primary caries lesion, on what percent of these patients do you use air-drying to help diagnose the lesion?					0.002
	N	378	344	225	
	Never	11 (3%)	0 (0%)	4 (2%)	
	< 50%	92 (24%)	67 (19%)	39 (17%)	
	50-99%	175 (46%)	155 (45%)	119 (53%)	
	Every time	100 (26%)	122 (35%)	63 (28%)	
a. If you air-dry at least some, approximately how long do you dry the tooth surface?					0.888
	N	367	341	220	
	1 to 2 seconds	159 (43%)	145 (43%)	88 (40%)	
	3 to 4 seconds	162 (44%)	147 (43%)	102 (46%)	
	5+ seconds	46 (13%)	49 (14%)	30 (14%)	
3. Do you assess caries risk for individual patients in any way?					0.096
	N	365	322	217	
	Yes	307 (84%)	276 (86%)	171 (79%)	
	No	58 (16%)	46 (14%)	46 (21%)	
a. If YES:					<.001
	N	299	264	164	
	Record the assessment on a special form that is kept in the patient chart	95 (32%)	48 (18%)	22 (13%)	
	Do not use a special form to make the assessment	204 (68%)	216 (82%)	142 (87%)	
12. Do you use any in-office tests to assess caries risk?					0.922
	N	373	338	222	

		Full participant ¹ (N=378)	Partial participant ² (N=346)	Reference ³ (N=226)	P-value
7. Upon opening the tooth and during excavation of the caries you realize that the lesion is deeper than anticipated and may involve the mesial buccal pulp horn. You would usually	Yes	67 (18%)	57 (17%)	38 (17%)	0.097
	No	306 (82%)	281 (83%)	184 (83%)	
	N	374	336	220	
	Continue and remove all the decay	169 (45%)	158 (47%)	102 (46%)	
8. Which of the following pulp capping materials do you use most often in your practice (choose one)?	Stop removing decay near the pulp horn and remove it elsewhere	144 (39%)	108 (32%)	66 (30%)	0.006
	Temporize and treat or refer the tooth for endodontics	61 (16%)	70 (21%)	52 (24%)	
	N	378	346	226	
	No Treatment or Further Diagnosis	109 (29%)	102 (29%)	68 (30%)	
9. How would you treat the tooth shown above?	Preventive only	92 (24%)	59 (17%)	39 (17%)	0.055
	Minimally invasive ± preventive	135 (36%)	117 (34%)	85 (38%)	
	Restoration ± preventive	39 (10%)	64 (18%)	27 (12%)	
	Other	3 (1%)	4 (1%)	7 (3%)	
10. How would you treat the tooth shown above?	N	378	346	226	0.832
	No Treatment or Further Diagnosis	50 (13%)	44 (13%)	35 (15%)	
	Preventive only	48 (13%)	24 (7%)	22 (10%)	
	Minimally invasive ± preventive	153 (40%)	132 (38%)	83 (37%)	
11. Which of the following pulp capping materials do you use most often in your practice (choose one)?	Restoration ± preventive	124 (33%)	144 (42%)	81 (36%)	0.832
	Other	3 (1%)	2 (1%)	5 (2%)	
	N	371	336	217	
	Mineral Trioxide Aggregate (MTA)	20 (5%)	10 (3%)	8 (4%)	
12. Which of the following pulp capping materials do you use most often in your practice (choose one)?	Calcium Hydroxide	177 (48%)	165 (49%)	112 (52%)	0.832
	Glass Ionomer	122 (33%)	114 (34%)	65 (30%)	
	Dentine Bonding System	32 (9%)	31 (9%)	22 (10%)	
	Other	20 (5%)	16 (5%)	10 (5%)	

		Full participant ¹ (N=378)	Partial participant ² (N=346)	Reference ³ (N=226)	P-value
9. What percentage of your patients do you refer for third molar extraction by the age of 20?	N	375	341	224	0.161
	< 20%	45 (12%)	35 (10%)	30 (13%)	
	20-40%	55 (15%)	48 (14%)	20 (9%)	
	40-60%	92 (25%)	62 (18%)	42 (19%)	
	60-80%	83 (22%)	82 (24%)	60 (27%)	
	> 80%	70 (19%)	89 (26%)	53 (24%)	
10. Which statement best describes your philosophy on third molar referrals?	No pediatric patients	3 (1%)	5 (1%)	4 (2%)	
	Cannot provide a meaningful estimate	27 (7%)	20 (6%)	15 (7%)	
	N	374	339	223	0.558
	Recommend removal of most third molars for preventive reasons	47 (13%)	53 (16%)	30 (13%)	
	Recommend removal if they have poor eruption path or do not have sufficient space for eruption	276 (74%)	250 (74%)	169 (76%)	
	Recommend removal if a patient presents with symptoms or pathology associated with 3rd molars	51 (14%)	36 (11%)	24 (11%)	
Dentin Hypersensitivity					
11. What type of dentin hypersensitivity treatments do you routinely use or recommend for your patients? (check all that you use)	a. Dentin bonding agents	244 (65%)	245 (71%)	132 (58%)	0.009
	b. Oxalate or bioglass containing material	63 (17%)	52 (15%)	35 (15%)	0.825
	c. Fluoride containing material	326 (86%)	293 (85%)	194 (86%)	
	d. Chemical treatment (e.g. potassium nitrate)	164 (43%)	127 (37%)	113 (50%)	
	e. Toothpaste or rinse	305 (81%)	273 (79%)	180 (80%)	
	f. Other	42 (11%)	34 (10%)	21 (9%)	
Endodontic Treatment and Restoration	g. Nothing	3 (1%)	0 (0%)	0 (0%)	
	13. One of your regular patients presents with pain in tooth #13. Upon clinical inspection the lingual cusp has fractured to just below the gingival margin and there is extensive decay beneath the large MOD composite restoration.				

		Full participant ¹ (N=378)	Partial participant ² (N=346)	Reference ³ (N=226)	P-value
You are able to diagnose a condition of irreversible pulpitis but there is no radiographic evidence of periapical pathosis. You would at this point recommend to your patient that you:	N	372	336	220	0.016
	Initiate endodontic treatment leading to placement of a post and core followed by a full crown	253 (68%)	222 (66%)	125 (57%)	
	Extirpate pulp, temporize, refer for endodontic treatment and place a post, core and full crown	64 (17%)	73 (22%)	60 (27%)	
	Extract tooth and place an immediate implant fixture and later restore with a crown	18 (5%)	9 (3%)	11 (5%)	
	Extirpate pulp, temporize, refer for extraction and placement of implant, and restore with crown	23 (6%)	10 (3%)	12 (5%)	
	Extract tooth, refer patient for placement of an implant fixture, and restore with crown	14 (4%)	22 (7%)	12 (5%)	

¹ Full participant: respondent has participated in at least one network study recruiting patients

² Partial participant: respondent is a fully trained member of the network or has attended at least one meeting or participated in other survey studies

³ Reference: inactive member of the network (not trained, no participation in studies or meetings) or is outside the network, e.g. Friends of PRECEDENT