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## Advantages of the Dental Practice-Based Research Network Initiative and Its Role in Dental Education

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### Abstract

Practice-based research networks (PBRNs) provide a novel venue in which providers can increase their knowledge base and improve delivery of care through participation in clinical studies. This article describes some aspects of our experience with a National Institute of Dental and Craniofacial Research-supported PBRN and discusses the role it can play in dental education. PBRNs create a structured pathway for providers to advance their professional development by participating in the process of collecting data through clinical research. This process allows practitioners to contribute to the goals of evidence-based dentistry by helping to provide a foundation of evidence on which to base clinical decisions as opposed to relying on anecdotal evidence. PBRNs strengthen the professional knowledge base by applying the principles of good clinical practice, creating a resource for future dental faculty, training practitioners on best practices, and increasing the responsibility, accountability, and scope of care. PBRNs can be the future pivotal instruments of change in dental education, the use of electronic health record systems, diagnostic codes, and the role of comparative effectiveness research, which can create an unprecedented opportunity for the dental profession to advance and be integrated into the health care system.

## Keywords

practice-based research network; dental education; core knowledge; evidence-based dentistry

In 2005, the National Institutes of Health's National Institute of Dental and Craniofacial Research (NIDCR), in its largest initiative to date to influence the profession of dentistry, funded the concept of a dental practice-based research network (PBRN).<sup>1</sup> The dental PBRN is an extension of the medical PBRNs, first established at Dartmouth College and now comprising over 110 active networks mainly funded on a per study basis through the U.S. Agency for Healthcare Research and Quality (AHRQ).<sup>2</sup> The novelty of the dental PBRNs was in providing for sufficient operational funding to keep the dental practitioners engaged for a period of up to seven years, the length of the granting period.

New York University College of Dentistry (NYUCD), the recipient of one of three funded PBRNs, formed the PEARL (Practitioners Engaged in Applied Research and Learning) Dental Network. The PEARL Network, which has completed its fifth year of operation, has developed specific goals and metrics for its practitioner-investigators (P-I's) as well as in the performance of its clinical studies. The network tethers P-I's to the NYUCD. Presently, the PEARL Network has 200-plus members in thirty-five states, representing more than thirty dental schools and extending from Vermont to Florida and as far west as Colorado and Arizona. PEARL conducts a range of clinical studies from surveys to randomized clinical trials. The mission of the dental PBRNs is to conduct studies that are relevant to private practice and to answer everyday questions to optimize the delivery of dental care, which ultimately will be reflected in dental curricula. The ultimate goal of the PBRNs, as stated by the director of the NIDCR, is for practitioners to be able to conduct pharmacogenomic studies.<sup>3</sup> This goal positions dentistry side by side with medicine in the advancement of technology and transfer of knowledge into clinical care. This article surveys the many ways dental PBRNs can benefit both dentistry and dental education.

One of the current challenges facing the profession is a workforce issue, manifested as a high vacancy rate for academic dental faculty positions.<sup>4</sup> In addition, the dental education model has been challenged by the access to care issue, the translational gap, the rise of the mid-level provider, and increased cost of dental education. PBRNs may provide a pathway to help improve the workforce problem, as well as provide supplemental financial resources for dental faculty members and academic dental institutions. In these and other ways, the PBRN concept may be added to the list of improvements that can help to revitalize academic dentistry.<sup>5</sup>

## EBD and Clinical Education

Basic and clinical research—the hallmark of universities designated as research-intensive institutions—has increased the core knowledge base in dentistry and advanced the profession. There has been consensus that there is a need for change in dental education, with options for a number of ways forward.<sup>5</sup> The practice of dentistry is multifaceted in that it has both procedural and cognitive components. Balancing these two skill sets has been a discussion in the profession since the Gies report.<sup>6</sup> This dilemma is often manifested at the

critical juncture at which students enter the clinic to provide patient care. According to the Institute of Medicine report *Dental Education at the Crossroads*, “To move successfully into a new century, dental educators and the larger dental community need greater agreement on common purposes and directions for the field.”<sup>7</sup> Dental education and in particular dental school curricula have been a continuing work in progress. The clinical outcomes in dentistry can be achieved by many different procedural pathways, and the application of knowledge about the biology of the oral system is only now being appreciated and applied to clinical treatment by P-I’s in a PEARL Network-initiated study.<sup>8</sup> It would enhance the use of evidence-based dentistry (EBD) if more schools tried to achieve a balanced relationship between clinical and basic research. Clinical competence is often aimed on a linear plane towards passing state board exams at the expense of increasing the academic core knowledge base, practicing EBD, and building a scientific base to enhance research education.

Dental PBRNs can help to sustain clinical data transfer over time and can ensure a level of consistency concerning translating current research findings to the clinical faculty. When fully functional and accepted by the dental community, PBRNs should be one of the primary engines of the EBD initiative. Historically, it has been very difficult to recruit dentists to conduct research even in environments rich in both basic and clinical research. The essential core knowledge base enables professionals to understand and interpret the changing dynamics of their field. This is essential to the definition of a profession. Academic dental institutions may be enhanced by a partnership with a PBRN as exemplified by the PEARL Network and NYUCD. PEARL presently acts as a tool for the recruitment of and an academic resource for the advancement of clinical faculty members.

## The Translational Gap

A dental PBRN, such as the PEARL Network, which has defined metrics, can create a pathway within a dental education program to reach out to practitioners. This pathway may reduce the barriers in our current system that can delay adoption of acceptable treatments and standards of care; this delay in the transfer of knowledge from supportive data to clinical practice is known as the translational gap. A barrier to adoption in many states can be the state practice act itself, which can anchor dental education and standards of care in dated legislation and policy. This also contributes to the lag time before new treatment procedures, devices, and/or pharmacological treatments are incorporated into mainstream practice.

The PBRN provides a novel venue in which providers can increase their knowledge base, hopefully reducing the translational gap. Models have been suggested to reduce the translational gap for a variety of audiences from the point of knowledge to implementation.<sup>9</sup> It has been reported that dentistry, like medicine, has a lag time of seventeen to twenty years before new technologies and/or procedures are incorporated into the mainstream of the profession.<sup>10</sup> This translational gap exists in dental schools themselves and is reflected in the diversity of curricula. As an example, while sealant technology was first reported over fifty years ago, it is not yet the standard of care treatment according to national statistics on sealant placement, which show that only 32 percent of children receive this effective intervention.<sup>11</sup> Advances in medicine and dentistry are further hindered by third-party

payers, both public and private, and their unwillingness to reimburse for new treatments. New technologies must go through a process of code review, revision, and approval. The approval is made by a committee consisting of representatives from the American Dental Association and the payer sector of the dental community.<sup>12</sup> The new procedures may or may not be adopted by individual plan benefit packages to be part of the contracted benefit for subscribers. This current system of review can add years to the translational gap and can limit access by delaying acceptable treatment as “standard of care.” Thus, the translational gap is caused by a number of components consisting of the acceptance of the new science by the dental community and academic acceptance, as well as regulatory and reimbursement approval.

In some cases, dental schools and dental hygiene programs may be restricted by outdated state practice acts, which thus hinder the advancement of the profession. For example, in New Hampshire, the practice act had hindered the natural evolution of the profession through outdated rules because students had been required to have a prescription from a dentist prior to placement of dental sealants. In addition, public health dental hygienists were required to obtain an examination and a prescription from a dentist for preventive pit and fissure sealant placement prior to sealant placement. This requirement was amended in 2009 to require authorization by a supervising dentist through an annual chart review.<sup>13</sup> Outdated requirements like this place a significant administrative burden on both students and nonprofit school-based sealant programs. Although there may be a benefit to engaging volunteer dentists at all levels of these community-based projects, it interferes with the purpose of prevention. It creates a barrier to direct sealant placement in public health settings, and it diminishes the direct cost savings of prevention if there are not enough volunteers. It also hinders the learning process by institutionalizing a disease-based care delivery system rather than allowing for emergence of prevention-based delivery systems. Traditional methods of disease-based treatment need to evolve into prevention-based strategies as our understanding of the disease process and our ability to identify disease risk improve. Otherwise, regressive thought processes hinder advancement. Continuing on this pathway, the translational gap would be further increased by the addition of regression. PBRN studies addressing such issues should add data for a balanced discussion to reach an equitable outcome.

## Clinical Research and Good Clinical Practice

PBRNs can offer dental schools an additional depth of inclusion into medicine and health care, which can only enrich their environments and create opportunities. The concept of research is critical to the growth of the profession through the incorporation of new knowledge. The principles of research educate practitioners to be discriminating in their treatments based on the scientific method, the cornerstone of an academic education.

The principles of Good Clinical Practice (GCP) would be an asset to dental education programs, and GCP principles could serve as a foundation for developing tools to measure quality of care. GCP is an international standard for the design, conduct, performance, monitoring, auditing, recording, analyses, and reporting of clinical trials. GCP is the standard that government agencies use to assess drug development clinical trials for

approval and is the new metric of the NIDCR in developing its Office of Clinical Trials and Operations Management (OCTOM). The GCP process documents every step of a procedure and creates an audit trail. Clinical practice parallels the principles of clinical research; however, the general practitioner's dental record, for the most part, falls far short of what would be expected for a clinical study.<sup>14</sup> We are not advocating that practitioners practice to the level of a clinical trial, but knowing and applying the principles of GCP would improve both record-keeping and the ability to evaluate clinical outcomes. While many practitioners use their own shorthand terminology for their records, with GCP the terminology would be standardized through a process of curation for acceptability of terms. In the case of a dentist providing treatment, the dental record would be enhanced, and an audit trail would be provided for the documentation of the treatment. This process provides a defensive shield to the practice of dentistry as well as providing the basis for dentists to participate in the process of electronic health records (EHR), which requires some level of quality assurance.

One of the goals of the PEARL Network is to take dental practitioners who are inexperienced in clinical research and teach them the principles of conducting clinical studies in their office. The PEARL Network, through the use of GCP, provides assurance that the data and reported results are valid and accurate. GCP-trained clinicians are a substantial resource for the dental schools in terms of additional workforce, both for clinical and research faculty members. The current workforce issue regarding the shortage of trained clinical faculty could be partially addressed by faculty trained with the metrics of the PEARL Network.

PEARL also provides benchmarking for practitioners, allowing them to compare how they performed in the clinical study to others in the network. This is done anonymously. This added benefit is a powerful motivator for improving clinical skills and is the basis for potential faculty development. Dental schools draw upon private practitioners to fill the ranks of the clinical faculty leaving the traditional dilemma between the clinical and academic faculty in core knowledge.<sup>4</sup> The issue of filling this void in core knowledge and bringing the clinical faculty in concert with the latest teachings still poses a major challenge to dental educators. It is proposed that the PBRNs can close that void and bring both the clinical and academic faculties together concerning core knowledge. PEARL has, to date, a number of practitioners who have now become part-time faculty members at NYUCD. One such part-time faculty member, designated the NYUCD educational liaison, now oversees the dental education component of PEARL. This faculty member has participated in a number of PEARL studies and is the principal investigator of PEARL's first randomized clinical trial. As the educational liaison, this faculty member serves on the NYUCD Undergraduate Curriculum Committee, and is assisting in the creation of a real time curriculum that is reflective of evidence-based clinical practice with the goal of closing the translational gap. The educational liaison is the faculty champion for evidence-based dental concepts and has taken an active role in disseminating our work beyond our own school, including making a presentation on the PBRN EBD concept at the American Dental Education Association's Annual Session & Exhibition.<sup>15</sup>

PBRNs create a structured pathway for education by generating clinical data to support evidence-based dentistry (EBD). EBD challenges the current learning process in which

practitioners are presented with anecdotal evidence such as “in my hands” or “in my office.”<sup>16</sup> Results of PEARL clinical studies will be presented to the faculty and forwarded to the curriculum committee to ensure consistency with the academic core knowledge base supporting any clinical change. PEARL operates within the confines of the NYUCD and has had a positive effect on some of the clinical departments that have recognized the potential benefit of using the PBRN model for the promotion of the research interests of their clinical faculty. This permeation of interest by the faculty of a dental school can only lead to further scholarship and a more substantive clinical faculty. The novelty of integrating a PBRN into a dental school curriculum and allowing clinical research and GCP principles to be the critical drivers of change may add a new dimension to dental education. Having a functioning PBRN within the university that allows faculty members and practitioners to participate in clinical studies and see didactic knowledge directly put into action makes for a dynamic learning environment. In addition, clinical research capabilities can function as a link to other health care disciplines.

## Integrating Dentistry into the Health Care System

The PBRN concept, from the global perspective of health care, can provide a means for professional oversight of the profession of dentistry. A feature distinguishing medicine from dentistry is this concept of oversight in which, for the most part in medicine, a patient's record undergoes some form of quality assurance review. Dental practitioners who see patients in hospitals are familiar with medical records and the consequences of not abiding by quality assurance review, which can lead to a suspension of clinical privileges. By Congressional mandate, medicine and dentistry will eventually converge in the form of the electronic health record (EHR), as reflected in the recent stimulus bill intended to impact the medical system by having the government establish computerized medical records that would follow each American from birth to death.<sup>17</sup> One comprehensive health record incorporating all the patient's health information and being held to a quality assurance standard will challenge the present “cottage industry” philosophy of dentistry. Herein lies the need for dental informatics and its role in contributing to improved patient care.<sup>18</sup>

The EHR is the visible endpoint of what has been discussed in the past as comprehensive care, total patient care, or inclusive models of care. Currently, “comprehensive care is more an ideal than a reality in clinical education, and instruction still focuses too heavily on procedures rather than on patient care.”<sup>19</sup> The EHR may bring further transparency to the practice of dentistry, and this transparency may give rise to some form of dental oversight, whereby the PBRN provides a suitable alternative to governmental agencies. Oversight of an EHR in the form of quality assurance will be a necessary component of any new health care model to control cost. The PBRN concept offers the profession an alternative to state and/or federal forms of oversight. PBRNs can act to strengthen the professional knowledge base through GCP principles, preparing future dental faculty, training practitioners in best clinical practice procedures, and increasing the accountability and scope of oral care.<sup>20</sup>

One way to control health care is to commodify medicine and dentistry. We define the commodification of dentistry as the process by which a procedure reaches a point in its development where one provider has no features that differentiate it from other types of

providers and consumers purchase procedures based on price alone. This may have been the driving force in the creation of a mid-level provider. While the learning of a procedure is not the basis of a profession, understanding the knowledge base behind the procedure is. The Forsyth experiment demonstrated the effectiveness of training expanded function dental auxiliaries in the early 1970s in the United States.<sup>21</sup> Other countries have successfully used dental nurses since the 1920s.<sup>22</sup> These dental nurses were the prototype for the dental health aide therapist (DHAT) program, which is primarily procedure-based. Additionally, DHATs are credentialed with a two-year training program with 400 hours in preceptorship training under the direct supervision of a dentist. Upon completion of the training and preceptorship, the DHAT is permitted to extract teeth with minimal supervision.<sup>23</sup> Many mid-level practitioner initiatives are developing in the United States based on these historical developments,<sup>24</sup> and the structures of the programs are developing.<sup>25</sup>

Health professions schools in universities distinguish themselves by conducting research and adding to the pool of knowledge to advance a field or profession. Without that drive to expand the profession through the incorporation and translation of new data, the future of the profession may be limited.<sup>26</sup> If a dental professional does not have the opportunity to learn the principles of research while undergoing professional education, then how is that provider going to be able to incorporate new technologies into his or her practice? With the prospect of new genomic bio-based therapies and technologies emerging, graduates need an intellectual basis to understand these innovations. There is a potential for lack of use or even misuse without such an intellectual framework.<sup>27</sup> If the profession is not prepared to evaluate and utilize the technology generated by research investigators, then that technology and those procedures become closeted, and any benefit gained from public support will be wasted. It is this in-depth knowledge base that will distinguish dentists from the technicians and will assist consumers in making an educated decision about who performs their treatment. This situation is further complicated by the fact that approximately 70 percent of dentists are solo practitioners detached from any kind of clinical oversight.<sup>28</sup> The PEARL Network acts as a connector by linking dentists together via common study protocols, training, annual meetings, and the connection to the dental school itself. The PEARL Network can act to improve the system of education and delivery of care, moving dentistry from a “cottage industry” to an integrated health care system. The network formation is a critical component to integrating professionals into a system and creating a sense of relatedness, with improved patient care being the desired outcome. In addition to the use of electronic data capture to integrate research with participants' care, the system improves the communication between network members and the greater dental community, including dental schools. A cornerstone of the new health care paradigm is the use of electronic health information. In the PEARL Network, over 70 percent of our members are currently using electronic dental record systems, and almost 90 percent use some form of electronic billing system. However, a challenge to integrating electronic dental records is the variation in office software platforms.

The formation of public use data sets is on the horizon, and the FDA is forming a Sentinel Initiative to monitor FDA-approved medical products.<sup>29</sup> This knowledge reservoir can be supplemented at the state level. For example, in New Hampshire, public and private dental claims data are gathered and deidentified for public use.<sup>30</sup> The ability to query claims data is

limited by the lack of diagnosis code utilization in dentistry. In medicine, every hospital emergency department encounter for dental needs is coded with the International Classification of Diseases, 9<sup>th</sup> revision, clinical modifications (ICD-9-CM) system.<sup>31</sup> That means that professionals know what the illness was and what medical procedures were performed. In dentistry, the only known information is about which dental procedures were performed. Having limited data makes it difficult to analyze dental claims data to study emerging diseases such as osteonecrosis of the jaw. Requiring diagnosis codes in dentistry will open up a wealth of information as well as opportunities to address them. PBRNs are ideally constructed to evaluate incorporation of diagnostic codes into dental practice. As an example, the PEARL Network is working with the ADA on evaluation of a Caries Classification System in dental practices where there are codes for stages of the caries process.<sup>32</sup> These examples may enhance dental education, provide a foundation for training, and improve the core knowledge for diagnosis and treatment planning.

PBRNs have a fundamental mission to conduct relevant studies for its members but also to conduct comparative effectiveness research (CER) as a means of identifying efficacious and cost-effective treatments. CER is the hallmark of the approval process in countries with socialized medicine as a way of limiting drugs and/or treatments to the national formulary.<sup>33</sup> CER is also part of the new health care model recently passed by the U.S. Congress in the Health Care and Education Reconciliation Act of 2010.<sup>34</sup> One of the cornerstones of the new health care paradigm will be CER studies to identify a linear treatment pathway, which will represent optimal and cost-effective treatment. Many policymakers believe CER may be the key to aligning payments with evidence-based treatments.<sup>35</sup> Dental schools should be positioned to readily adopt effective care models to ensure financial solvency. Dental school curricula not current to CER findings may find themselves teaching outdated techniques and procedures, which may add to the cost of dental education. Considering the commodification of dentistry, where services are purchased on price alone, it is important for dental education to stay relevant. Currently, there is no single venue that can offer clinical faculty the many opportunities offered by a PBRN. The opportunities to learn skills that can be applied to treatment alternatives, benchmark their practice and skill set, advance their educational knowledge base, and create options for dental education participation are rather unique for the profession.

## Conclusions

The objective of the PBRN initiative is to accelerate the development and conduct of clinical trials and other clinical studies of important issues concerning oral health care related to general dental practice.<sup>1</sup> The PBRN concept gives dentists an opportunity to participate in newer clinical trial designs, such as cluster randomized trials in which groups of patients are randomly assigned to different therapeutic interventions as conducted in medicine.<sup>36</sup> Directed by Congress, the Institute of Medicine released a report recommending a portfolio of 100 study topics that are important to the health of the U.S. population for the Department of Health and Human Services to consider as it implements a new agenda for comparative effectiveness research.<sup>37</sup> Recent reviews of practitioners from medical PBRNs have described the benefits of being a participant. Briefly, these benefits include improvement of preventive service delivery, reliability of diagnostic measures, practice variation, disease



prevention, systems of care coordination, improved clinical care and quality improvement, and increased relevance of research to clinic/community.<sup>38,39</sup> PEARL Network dental practitioner-investigators have noted additional benefits to being involved in a dental PBRN, which include learning to utilize EBD, improving the bottom line, gaining authority, making it easier to stay up-to-date, and enhancing patient care.<sup>40</sup>

If the dental profession is to incorporate new technologies, it needs to be supported by an academic knowledge base that provides an understanding of how to interpret clinical results as a means to identify cost-effective and efficacious treatments. Health care currently lacks an efficient business model associated with its structure. Dental schools find themselves in an ever more difficult situation to successfully operate without a profitable business model to control costs and create a revenue stream. PBRNs may be able to offer health care and health care education a concept for optimization of delivery of care while aiding education. The PBRNs can also contribute to the advancement of clinical faculty as well as to the development of future clinical faculty, can be an integral component of the continuing education department, can contribute to optimizing treatment that can be cost-effective, can create an atmosphere of professional collegiality, and can provide a mechanism for oversight through benchmarking for both faculty and students. No other venue for change currently exists in dentistry that offers the profession possible solutions to the many challenges it now faces. From its inception, PEARL has positioned itself to prepare the many components of dentistry for future changes. Dental PBRNs may be the stimulus for change the profession has awaited, and only time, creativity, and acceptance by all stakeholders, including dental schools, will determine its fate. The hypothesis will be further tested in the next iteration of the PBRN initiative as the National Advisory Council voted unanimously that the PBRNs should seek ways to interact with schools of dentistry to gain wider acceptance of the concept earlier in the educational program.<sup>41</sup>

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