Iowa's Public Health-Based Infant Oral Health Program: A Decade of Experience

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Abstract: The American Academy of Pediatric Dentistry recommends that children have their first dental visit no later than age one. However, not all dental schools have made hands-on infant oral health programs a reality in their predoctoral programs. To target high-caries risk infants/toddlers and provide dental students more hands-on experience with this age group, the University of Iowa Department of Pediatric Dentistry established an Infant Oral Health Program (IOHP) affiliated with the local Special Supplemental Food Program for Women, Infants, and Children (WIC) clinic. This article reports the IOHP activities and describes how this program is integrated into a dental school curriculum. Most of the children served were around age one, from racial and ethnic minority groups, and had never been to the dentist. More than 600 fourth-year dental students received hands-on experience providing preventive dental care for infants and toddlers. A 2004 survey of dentists who graduated from the University of Iowa suggested that those who rotated at the IOHP while in dental school were more willing to see very young children when compared to dentists who did not rotate at the IOHP. These findings suggest that community-based IOHPs can provide an important community resource for preventive dental care for high-caries risk young children, while complementing the pediatric dental experience in a dental school curriculum.

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Keywords: infant oral health, age one dental visit, WIC, dental education, dental school curriculum

Submitted for publication 4/30/09; accepted 2/12/10

While the American Academy of Pediatric Dentistry (AAPD) recommends that children have their first dental visit by age one, not all dental schools in the United States have made hands-on infant oral health programs a reality in their predoctoral programs. With a relatively small number of pediatric dentists to care for young children's dental needs, it is crucial that dental schools provide hands-on experience treating young children to better prepare general dentists to provide dental care for this population. In their report of infant oral health education in U.S. dental school curricula, McWhorter et al. reported that the average didactic curricular time devoted to the topic of infant oral health is two hours and twenty minutes (median time is one hour and forty-five minutes).[1] In addition, these authors reported that 51 percent of predoctoral programs provide no hands-on experience in infant oral health examinations, 21 percent provide some opportunities (i.e., not for all students), and only 28 percent reported that all students have a chance to examine an infant. For the predoctoral programs that provide hands-on clinical experience, approximately three-quarters reported providing this experience in the dental schools, while 28 percent of them listed sites like the Special Supplemental Food Program for Women, Infants, and Children (WIC) clinics, hospital clinics, Head Start centers, community health centers, or community vans.

More recently, it has been suggested that a relative lack of hands-on experience treating young children in predoctoral pediatric dentistry programs may negatively impact access to care in the United States.[2] In their 2001 survey of pediatric dentistry predoctoral program directors, Seale and Casamassimo expressed their concern that on average the assigned patients for predoctoral students were older children (≥four years of age) who generally were well behaved and with low levels of caries.[2] They found only 6 percent of this patient pool were children three years of age or younger. They suggested that such lack of training in treating young children during

dental school inevitably impacts the ability of future general dentists to feel comfortable and competent to treat this population in their private practices. Interestingly, these same authors in a later report of a nationwide survey of general dentists' practice patterns involving child patients found that those who had had hands-on oral examination experiences with infants and children aged one to three years in dental school were significantly more likely to very often or often treat these children, compared with those who did not have such experiences.[3] This finding was also observed at the University of Michigan School of Dentistry, which in 1994 introduced the Young Patient and Preventive Clinic (YPPC) as part of its senior pediatric dentistry curriculum.[4] The objective of the YPPC was to equip graduating dental professionals with a foundation and clinical experience in oral care, diagnostic, and preventive needs of very young children. To evaluate the impact of the YPPC program on dental graduates, a questionnaire was sent to all predoctoral graduates from the preceding four years, which included the two most recent groups that had rotated through the YPPC. This study found that those who rotated at the YPPC were more likely to feel prepared to examine younger patients; address dietary, oral hygiene, and caries risk for the young patient; and believe that the first dental exam should occur before age two.

The University of Iowa's Department of Pediatric Dentistry first established an Infant Oral Health Program (IOHP) in the fall of 1984.[5] The goal of this IOHP was to provide early dental evaluation of infants and toddlers and provide parent education with the ultimate goal of "providing children with the opportunity to grow up experiencing optimal oral health." Although the program was available for children up to three years of age, the preferred age of the first dental visit was between six and twelve months. Following Iowa's lead, infant oral health programs were implemented in other settings nationwide and internationally based on the belief in the importance of early first dental visits.[4,6-9] While the rationale for Iowa's early IOHP was valid, the reality was that few high-risk infants and toddlers presented for early preventive dental visits at the dental school site. As a result, relevant hands-on experiences with infants for predoctoral dental students were few and far between.

In an effort to reach a larger number of high-risk infants and toddlers and to provide dental students more hands-on experience with this age group, the University of Iowa Department of Pediatric Dentistry established a new Infant Oral Health Program in September 1998 affiliated with the local WIC program at the Johnson County Department of Public Health. The purpose of this article is to report program activities and findings during the first ten years of its existence. An additional purpose is to describe how IOHPs can be integrated into dental school curricula.

Program Goals and Overview

The main goals of the IOHP are to 1) increase dental access and provide preventive dental care to low-income infants and toddlers; 2) prevent and intercept early childhood caries (ECC) in a high-risk population; 3) serve as a resource for research in the area of early dental intervention; and 4) provide an opportunity for senior dental students to gain hands-on experience examining infants and toddlers in a community-based setting.

After rotation at the IOHP, students should feel better prepared to 1) identify ECC and its early signs; 2) understand risk factors associated with ECC; 3) conduct infant and toddler oral exams in a knee-to-knee position; 4) perform caries risk assessment for infants and toddlers; 5) provide anticipatory guidance and preventive care planning for infants and toddlers; and 6) provide preventive dental care for a high-risk population in a public health setting.

The IOHP at the Johnson County Department of Public Health was established in September 1998 as a result of a cooperative effort between the University of Iowa College of Dentistry and the WIC program. Initial funding for the clinic was obtained under a $5,000 grant from the Pierre Fauchard International Foundation. The IOHP operates on a one-full day per week basis and is promoted by the WIC staff, as well as through a brochure describing the program that is mailed to every new WIC client. The program was also introduced to the public through an article in the local newspaper and two television spots at one local news channel.

The Johnson County Department of Public Health WIC clinic located in Iowa City is responsible for providing space for the IOHP, promoting the clinic to the parents of children up to three years attending their program, and providing one staff member who performs the following tasks for the IOHP: schedules and reschedules children for the

IOHP clinic, confirms appointments one day prior to clinic, assists with paperwork involved with registering in the IOHP, follows up on cancelled and failed appointments, and provides care coordination for children enrolled in the Medicaid program, including follow-up of referrals as well as finding transportation and funding when needed. The University of Iowa Department of Pediatric Dentistry provides all instruments and materials used at the IOHP and provides residents and/or a faculty member who provide preventive dental care for children up to three years of age and supervision of senior dental students during the preventive dental care of children enrolled in the IOHP. The University of Iowa Department of Family Dentistry (which operates the fourth-year comprehensive clinic) provides senior dental students for one-half day rotations at the IOHP and is responsible for scheduling their rotations.

Rotation at the IOHP by the fourth-year dental students was on a voluntary basis until July 2000, when it became mandatory that all senior students rotate there. Most often, students go to the IOHP in pairs for a one-half day rotation and see an average of three patients each. As part of their pediatric dentistry curriculum and prior to their rotation at the IOHP, students receive approximately six hours of instruction on the topic of early dental intervention. In their preclinical pediatric dentistry course during their sophomore year, students receive two hours of didactic information on this topic and two hours of live oral health exam demonstrations using the knee-to-knee position in children up to three years of age. In their pediatric dentistry clerkship during the junior year, excluding infant patient care contact, students receive two hours of didactic information. Students are formally tested in all materials received in both sophomore and junior years, including a competency exercise in the third year. Regarding patient care contact during their third-year pediatric dentistry clerkship, students see an average of 1.6 infants each (range=1 to 4).

Students also receive a five-page review handout two weeks prior to their IOHP rotation on the following topics: objectives and services provided at the IOHP, early childhood caries, normal and healthy dietary habits for infants and toddlers, oral hygiene, fluorides, caries risk assessment for the young patient, knee-to-knee oral exam technique, and topics related to anticipatory guidance for this age group. When students rotate at the IOHP, they are supervised by the IOHP director, a faculty member from the University of Iowa Department of Pediatric Dentistry, or a pediatric dentistry resident. For approximately five years out of the ten years of the program, the IOHP director was the only one supervising the students. However, to provide an opportunity for pediatric dentistry residents to be involved with clinical teaching, residents have been successfully involved with the supervision of dental students for five years. Each year, the IOHP director and an average of two to four residents (depending on class size) are assigned to work side-by-side with senior dental students during the care of infants and toddlers at the IOHP. The pediatric dentistry residents are trained by the IOHP director prior to supervising the fourth-year dental students. Training involves twelve hours of both didactic and clinical teaching of aspects of infant oral health care and the criteria used for recording dental caries based on the $d_1d_{2\text{-}3}$ caries criteria protocol described by Warren et al.[10]

During their rotation at the IOHP and while being closely supervised, students have the opportunity to conduct by themselves the steps involved during an infant oral health visit through the services provided at the IOHP. These services include oral/dental exams, preventive services (fluoride-varnish treatment and sealants of noncavitated deep/stained pits and fissures of primary molars), limited restorative treatment ("Alternative Restoration Technique"), one-on-one educational interventions for parents of participating children, and appropriate referral for children with more complex dental needs. All services are provided free of charge. However, if children are enrolled in the Medicaid program, the dental services are billed, and payment is transferred to the WIC clinic to help fund the services provided by their staff. By age three, all children are referred to a local dentist in the community or to the University of Iowa College of Dentistry to establish routine dental care.

The dental education provided at the IOHP is facilitated and reinforced on an individual basis using various materials and approaches, including one-on-one counseling facilitated by an educational flip chart developed by the University of Iowa Department of Pediatric Dentistry, videos, and distribution of brochures on distinct areas of dental health care for infants and toddlers. Most of the educational materials and forms used at the IOHP are available both in English and Spanish. Registration, health history, dental, and clinical forms developed for the IOHP were critiqued by experts in the area of early dental intervention and improved over the years. A caries risk assessment instrument designed for infants and toddlers was also developed based on risk factors

reported in the scientific literature[11,12] and is used to identify children at higher risk for dental caries in order to determine appropriate preventive measures and timing for follow-up appointments (Table 1). The IOHP caries risk assessment instrument includes only two categories of risk (low and high), eliminating the "moderate risk" category used in many other caries risk assessment tools.[13,14] The decision on eliminating the moderate risk category was based on the fact that our preventive measures would be the same for both high and moderate caries risk categories, as well as on the fact that caries can quickly progress among the very young especially from lower-income families like the ones attending the WIC programs. Children classified as high-caries risk are seen on a three-month recall basis, while those classified as low-caries risk are seen every six months.

Oral examinations and preventive measures of children aged one to three years attending the IOHP are done using the knee-to-knee position (Figures 1 and 2), while infants up to twelve months are placed on a "Macri" (Figures 3 and 4). The Macri is a piece of equipment used to facilitate clinical examination of very young children, developed by a group of researchers at the Baby Clinic of the Department of Pediatric Dentistry at the State University of Londrina, Paraná, Brazil. This sling/chair-like device does not require the cooperation of the child but provides a comfortable position with minimal restraint as well as excellent visualization of the oral cavity.[7] The oral examinations are done using a cordless DenLite disposable illuminated mirror (Figure 3). The criteria used for recording dental caries are based on the $d_1d_{2\text{-}3}$ caries criteria protocol described by Warren et al.[10] Because the presence of visible dental plaque on the maxillary incisors has been reported to be strongly associated with both future risk and presence of dental caries among very young children,[15,16]

Table 1. IOHP caries risk assessment instrument

HISTORY (determined by interviewing the parent/primary caregiver)		
Child has special health care needs	☐ Yes	☐ No
Saliva-reducing factors are present: meds (e.g., some for hyperactivity) and/or medical factors (e.g., cancer treatment)	☐ Yes	☐ No
Child has irregular dental care (NA for children younger than 12 months of age)	☐ Yes	☐ No
Mother/primary caregiver or sibling(s) have active dental decay	☐ Yes	☐ No
Parent or caregiver has low SES (e.g., child is on XIX)	☐ Yes	☐ No
Parent or caregiver has low dental health literacy	☐ Yes	☐ No
Between-meal cariogenic snacks >2 times a day	☐ Yes	☐ No
Cariogenic beverages >2 times a day (independent of time consumed: meals and/or between meals)	☐ Yes	☐ No
Night-time consumption of cariogenic drinks/foods	☐ Yes	☐ No
Night-time on-demand breastfeeding	☐ Yes	☐ No
Teeth brushed <1 time per day: applicable when maxillary primary incisors are fully erupted	☐ Yes	☐ No
Inadequate fluoride (e.g., no regular use of fluoride toothpaste and/or drinking water is not fluoridated)	☐ Yes	☐ No
CLINICAL EVALUATION (determined by examining the child's mouth)		
Frank caries	☐ Yes	☐ No
White spot lesions (decalcification)	☐ Yes	☐ No
Previous restorations:		
1. In primary dentition—any previous restoration	☐ Yes	☐ No
2. In mixed dentition—restoration(s) of carious lesion(s) within last 24 months	☐ Yes	☐ No
Enamel defects (e.g., hypoplasia, pitted enamel)	☐ Yes	☐ No
Poor oral hygiene (for infants/toddlers: visible plaque on maxillary anterior teeth without disclosing solution)	☐ Yes	☐ No
Child wears braces or oral appliances	☐ Yes	☐ No
SUPPLEMENTAL ASSESSMENT		
Radiographic enamel caries (NA for the IOHP)	☐ Yes	☐ No
High or moderate levels of Streptococcus mutans	☐ Yes	☐ No
CLINICIAN'S IMPRESSION	☐ High Risk	☐ Low Risk

Figure 1. Oral hygiene of a twenty-month-old child using a toothbrush with the child positioned in the knee-to-knee position

Figure 2. Lifting the upper lip of a twenty-four-month-old child for visualization of visible plaque on the maxillary anterior teeth with the child positioned in the knee-to-knee position

presence of plaque is inspected visually by the naked eye, or with the aid of a dental explorer, and without disclosing solution on each facial surface of the four maxillary incisors for all children (Figure 2). Definitions of ECC and Severe ECC (S-ECC) are used as described by the AAPD guidelines.[17] ECC is defined by those guidelines as "the presence of 1 or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces" in any primary tooth in a child seventy-one months of age or younger. In children younger than three years of age, any sign of smooth-surface caries is indicative of S-ECC. From ages three through five, "one

Figure 3. Oral examination of a three-month-old using a cordless DenLite disposable illuminated mirror with the child lying on the Macri

Figure 4. Oral cleaning of edentulous six-month-old infant using gauze with child lying on the Macri

or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled score of ≥4 (age 3), ≥5 (age 4), or ≥6 (age 5) surfaces constitutes S-ECC."

Program Results

During the first ten years of its existence, the IOHP has served 1,478 children. The majority of children seen were three years of age or younger (90 percent) with the highest percentage (35 percent) being around one year of age. Fifty-one percent of the children enrolled in the IOHP were males, and most of them (87 percent; n=1,242) had their first dental visit at the IOHP. Thirty-eight percent of the children receiving dental care at the IOHP did not have any type of dental insurance, and the majority of them (56 percent) were from racial and ethnic minority groups (Table 2).

In their first dental visit at the IOHP, 35 percent of the children were classified as being at high risk for dental caries, and 23 percent had visible plaque on their maxillary incisors. Also during their first visit, 20 percent (n=266) of the 1,326 children seventy-one months of age or younger with teeth present in their mouths were diagnosed as having noncavitated and/or cavitated lesions on their teeth. Of these 266 children, 16 percent were diagnosed with early childhood caries and 84 percent with severe early childhood caries (Table 2). Twenty-eight percent of all children (n=416) returned for one recall visit, 11 percent (n=166) for two recall visits, 5 percent (n=74) for three recall visits, 2 percent (n=33) for four recall visits, and 1.8 percent (n=26) for five or more recall visits. These recall visits occurred at an interval of three or six months depending on each child's individual caries risk assessment. Because the IOHP operates only one day per week, our program is rarely able to provide dental care for children on the day they are also scheduled for their WIC appointments. However, parents are encouraged to schedule their children's IOHP appointments back-to-back with their WIC appointments in order to improve their attendance rates. Typically on a given day, the IOHP no-show rate is approximately 35 percent; to compensate for this failure rate, patients are scheduled at every twenty minutes (approximately sixteen patients scheduled per day).

At their first dental visit, 476 out of the 1,478 children seen at the IOHP were referred either to the University of Iowa Department of Pediatric Dentistry or to a local general/pediatric dentist for dental treatment or routine care. Of these 476 children, 189 (40 percent) were referred for treatment, while 287 (60 percent) were referred for routine dental care since they were three years of age or older (Table 2). Two hundred and twenty-one children seen at the IOHP over the years have established a dental home at the University of Iowa Department of Pediatric Dentistry. However, the number of IOHP children who have established a dental home with local general/pediatric dentists in the community is unknown. The IOHP has 316 children younger than three years of age still active in the program.

During the ten years of its existence, more than 600 fourth-year dental students have rotated at the IOHP, and thirteen pediatric dentistry residents have worked in this clinic. In the years 2004 and 2005, a voluntary Likert-type scale survey ranging from strongly disagree to strongly agree was sent to senior students following their IOHP rotation and prior to their graduation to assess the impact of the IOHP on their perceived feelings regarding infant oral health care. Results showed that most of the students agreed that, after their rotation, they were able to better understand the importance of providing dental care for a child at age one and felt more comfortable to 1) perform an infant oral examination, 2) provide dental care for children under three years of age in their future dental practice, and 3) be involved with the dental care of low-income children in the community.

Discussion

The uniqueness of the University of Iowa IOHP lies in the fact that it is a preventive program located in a public health setting. The rationale for establishing this program within a WIC clinic is similar to the response given by infamous bank robber Willie Sutton when asked by a reporter why he robbed banks. The response attributed to Sutton—"because that's where the money is"[18]—can be amended to "because that's where the high-risk children are" in the case of the IOHP.

The partnership between an educational institution (University of Iowa College of Dentistry) and a social service agency (Johnson County Department of Public Health WIC Clinic) has not only greatly enhanced dental students' learning of concepts related to early dental intervention, but also produced a community resource for oral health services to a high-caries risk young population. Without this

program, these children would probably not have the opportunity to establish a dental home at such an appropriately young age. Early preventive oral health care targeted to high-risk populations can lower overall dental costs and yield better oral health outcomes. Reports of preschool-aged, Medicaid-enrolled children have shown that the earlier a preventive dental visit occurred, the more likely these children were to use subsequent preventive services and experience lower dentally related costs.[19,20]

A key reason why the IOHP was established is the fact that there are not enough pediatric dentists to care for the dental needs of all children, particularly young children. Consequently, general dentists must treat these children or at least alleviate the burden of their dental disease by providing measures for Early Childhood Caries prevention. However, it is not realistic to expect general dentists to provide early dental intervention if dental school programs do not make an effort to adequately train and increase their students' learning experiences treating high-caries risk young children, especially in terms of providing the students with hands-on experiences. As reported by Seale and Casamassimo in a survey of general dentists, "practitioners who reported having dental school educational experiences that involved both hands-on procedures and lecture were significantly more likely to perform those procedures than practitioners who had only lecture/laboratory-only or no educational experience."[3]

This fact is well observed through data collected from a 2004 survey of 715 Iowa general dentists regarding the age one dental visit.[21] Chi-square test was used to analyze data from a subsample of eighty-one general dentists from the 2004 survey who graduated from the University of Iowa College of Dentistry between the years of 1998 and 2003. Results showed that there were statistically significant differences between the graduating dental students who rotated at the IOHP and those who did not. The results indicated that graduating dental students of the years 2001 to 2003 (n=39) who participated in the IOHP were more likely to believe that children should have their first dental visit before twenty-three months of age (81 percent) and more likely to be willing to see children before twenty-three months of age (92.5 percent) than the graduating dental students of years 1998 to 2000 (n=42) who did not participate in the program (48.7 percent and 75.7 percent, with p-values of 0.0023 and 0.0420, respectively). Although not statistically significant ($p>0.05$), Iowa general dentists who rotated at the IOHP saw a higher proportion of children younger than twenty-three months of age (78.6 percent) than those who did not (76.9 percent). This result is particularly important because it demonstrates the impact of the IOHP on

Table 2. Summary of selected variables of IOHP children (n=1,478) at their first dental visit, by frequency and percentage in each variable category

Variable	Frequency	Valid %
Age		
<1 year	330	22%
1 year	513	35%
2 years	291	20%
3 years	196	13%
4 years	97	7%
≥5 years	49	3%
Gender		
Male	739	51%
Female	729	49%
Dental insurance		
None	558	38%
Medicaid	830	56%
Other	85	6%
Race		
Caucasian	608	44%
Hispanic or Latino	326	23%
Black or African American	279	20%
Asian	113	8%
Multiracial[a]	50	4%
American Indian or Alaska Native	8	.5%
Native Hawaiian or Other Pacific Islander	5	.5%
First dental visit findings		
Caries risk classification[b]		
Low	942	65%
High	515	35%
Visible plaque on maxillary incisors[c]		
Absent	988	77%
Present	288	23%
Caries status of children 71 months of age or younger[d]		
Caries-free	1060	80%
Severe-ECC	224	17%
ECC	42	3%
Reason for referring children at their first visit		
Need for dental treatment	189	40%
Routine dental care (child older than 3 years of age)	287	60%

[a]More than one race was indicated by the child's caregiver.
[b]Includes edentulous children who were automatically classified as low risk for dental caries.
[c]Excludes children with unerupted maxillary incisors.
[d]Excludes edentulous children.

the practice behaviors of Iowa general dentists. Although in private practice for a shorter period of time (one and one-half to three and one-half years), the IOHP dentists reported a higher number of younger children seen when compared to those who did not rotate at the IOHP but were in practice for a longer period of time (four and one-half to six and one-half years). In addition, results on the greater willingness to see children younger than twenty-three months of age among dentists who rotated at the IOHP is quite encouraging since accumulated evidence supports that people's willingness (intention) to engage in a behavior is a reliable predictor of that behavior.[22,23]

When compared to other U.S. dental schools,[1] the University of Iowa Department of Pediatric Dentistry has provided dental students with more didactic hours on infant oral health (six hours) and an opportunity for all students to see an infant. However, students' hands-on experience examining infants is not homogeneous among all students during their third-year pediatric dentistry clerkship (average=1.6 infants; range=1 to 4 infants). For this reason, in addition to providing a valuable preventive service to high-caries risk young children, integrating the IOHP into the dental school curriculum during the senior year has guaranteed that all students obtain more hands-on experience before graduation. The costs involved with the IOHP need to be taken into consideration. Because dental services provided at the IOHP are free of charge and payments of dental services billed under Medicaid are transferred to the WIC clinic to help fund services provided by their staff, the IOHP does not generate any income for the dental school. On the contrary, there is actually loss of revenue since once a week a faculty member or resident along with four dental students are scheduled to be at the IOHP and, consequently, are not generating income when treating patients at the College of Dentistry. However, both University of Iowa Departments of Pediatric Dentistry and Family Dentistry strongly believe that the educational value of increasing the exposure of dental students to infant oral health is priceless and much needed to allow future general dentists to feel more comfortable providing dental care for a younger population. Another important fact to consider is that although the feedback from students regarding their IOHP experience is quite positive and many have voiced their interest in increasing their rotation, competing outreach programs and heavy load of patient care during the senior year have made an increase in the IOHP rotation not possible at this point.

It is hoped that the University of Iowa Department of Pediatric Dentistry's IOHP will serve as a model for other dental schools to integrate such a program into their curricula through partnerships with public health agencies in order not only to serve low-income, high-caries risk young children, but also to adequately train future general dentists to provide early dental intervention for this population in their private practices. Lastly, it is hoped that research projects in the area of ECC/infant oral health care continue with data collected at the IOHP.

Conclusions

The conclusions of this study are as follows:

1. The majority of children served at the IOHP were around one year of age, had never had a dental visit before, and were from racial and ethnic minority groups.
2. More than 600 fourth-year dental students received hands-on experience providing preventive dental care for infants and toddlers at the IOHP.
3. Iowa general dentists who rotated at the IOHP were more likely to believe that children should have their first dental visit prior to twenty-three months of age and more likely to be willing to see children younger than twenty-three months of age in their private practices.
4. Community-based IOHPs can be integrated into the dental school curricula as a means of increasing training of future general dentists on infant oral health care, while providing important preventive dental care for high-caries risk young children.
5. The IOHP can be a source for data collection and research in the areas of ECC and infant oral health care.

Acknowledgments

The authors would like to thank Drs. Amanda S. Spitz and Cameron L. Perigo for their many hours of data entry while in their dental school training. We also gratefully acknowledge the support of the University of Iowa College of Dentistry Departments of Family Dentistry and Pediatric Dentistry, as well as crucial support from the Johnson County Department of Public Health WIC Clinic towards our Infant Oral Health Program.

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