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The *Journal of Dental Hygiene* is the refereed, scientific publication of the American Dental Hygienists' Association. It promotes the publication of original research related to the profession, the education, and the practice of dental hygiene. The Journal supports the development and dissemination of a dental hygiene body of knowledge through scientific inquiry in basic, applied and clinical research.

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Runner-Up: 2013 Best Paper Award

Extending Oral Health Care Services to Underserved Children through a School-Based Collaboration: Part 3 - A Cost Analysis

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The Journal of Dental Hygiene Best Paper Award was created this year to recognize the most outstanding research paper published from the previous year (2013). All original research papers published in 2013 were evaluated by a panel of judges, using specific criteria, to make the final selection. This manuscript first appeared in Volume 87, Issue Number 5 of the October 2013 issue of the Journal of Dental Hygiene.

Introduction

Dental care has recently been recognized as the most prevalent unmet health care need for children in the U.S. While the issue is not often in the spotlight, millions of American adults and children lack access to preventive, routine dental care.^{1,2} If the challenges that underserved and vulnerable populations encounter when trying to access oral health care are not addressed, the burden of oral disease these populations experience will continue to grow.³ Furthermore, the cost and impact associated with health disparities place complex economic burdens on the nation. A report on the economic burden of health disparities in the U.S. estimated that 30.6% of direct health care costs for African Americans, Asian Americans and Hispanics from 2003 to 2006 were excess costs associated with health inequalities.⁴ Premature loss of life, increased burden of disease and inadequate access to quality care continue to pervade the health care system.⁴

Eliminating health disparities remains a monumental challenge. According to a 2011 survey conducted by Lake Research Partners for W.K. Kellogg Foundation, those most likely to not have a place to receive regular dental care include those with incomes less than \$30,000, who lack dental insurance, who have a high school diploma or less education, or who are Latino or African American.¹

Abstract

Purpose: The purpose of this manuscript was to conduct a cost analysis of the Miles of Smiles Program, a collaboration between the University of Missouri-Kansas City School of Dentistry and the Olathe School District in Kansas. This preventive program was implemented to improve the access to oral health care for low income children within the school district.

Methods: An inventory list and de-identified patient records were used to determine the costs associated with operating the program to serve 339 elementary school students during the 2008 to 2009 school term. Costs related to equipment, supplies and personnel were included. The costs were then compared to the amount of Medicaid reimbursement obtained for the services provided. Additionally, the cost of operating a similar program, if staffed by dental professionals rather than supervised dental hygiene students, was estimated.

Results: The cost of operating the program during the 2008 to 2009 school term was \$107,515.74. The program received Medicaid reimbursement for approximately 1.5% of the total operating cost of and approximately 6.3% of the total billable services, however, challenges with submitting and billing Medicaid claims for the first time contributed to this low rate of reimbursement. If a similar program that utilized dental professionals was implemented and treated the same number of patients, the cost would be approximately \$37,529.65 more due to higher expenses associated with personnel and supplies.

Conclusion: The program is not self-sustainable based on Medicaid government-funded insurance reimbursement alone, and therefore continuous external sources of funding or a change in the program design would be necessary for long-term sustainability of the program.

Keywords: access to care, dental hygiene education, community-based dental education, dental care for children, oral healthcare for the underserved, portable equipment, school-based oral health, cost analysis, dental medicaid program

This study supports the NDHRA priority area, **Health Services Research:** Investigate how alternative models of dental hygiene care delivery can reduce health care inequities.

The current structure of dental practice further complicates access to care issues. Unlike medical care, most dental services are provided in

private practices with 1 or 2 oral health care providers, and are often located in metropolitan areas.²

Strategies to Address Access and Disparity Issues in Oral Health Care

Upon reviewing evidence that indicates millions of Americans have unmet oral health needs due to barriers in access to care, the Institute of Medicine and National Research Council committee prepared the "Vision for Oral Health Care in the United States," outlining how public and private providers should address oral health care for these populations. The vision stated that "to be successful with underserved and vulnerable populations, an evidence-based oral health care system will: eliminate barriers that contribute to oral health disparities, prioritize disease prevention and promotion, provide oral health services in a variety of settings, rely on a diverse and expanded array of providers competent, compensated, and authorized to provide evidence-based care, include collaborative and multidisciplinary teams working across the health care system, and foster continuous improvement and innovation."³

The findings and conclusions from the Institute of Medicine and National Research Council's report on improving access to oral health care for vulnerable and underserved populations support the fact that no single setting of care will meet the needs or overcome the barriers of these populations.³ For several years, researchers have suggested that alternative practice models could meet the oral health needs of target populations, demonstrating a role for both public and private sectors to get involved.⁵⁻⁷

School-Based Safety-Net Clinics

When considering access to care issues for low-income and minority children, the School-Based Safety-Net Clinic model has been suggested as a viable option. This model of providing care for children in the community in which they live can provide quality health care services by reducing financial, language, familial and cultural barriers.⁸ If school based safety net clinics are to be considered an effective method for delivering preventive dental care to target populations, the issue of funding and financial support should be explored. A 1997 investigation conducted by Albert et al evaluating school-based oral health care programs found that 27% of the clinics were sponsored by health departments, 27% by hospitals/medical

centers, 27% by community-based organizations and private agencies, 17% by community health centers, and 2% from other sources.⁹

Existing models of sponsorship and collaboration include the Forsyth Kids program, a Massachusetts school-based caries prevention program sponsored by the Forsyth Institute. The institute developed the program to ensure that it meets national oral health goals for high risk populations.^{10,11} Another school-based program, The Apple Tree Dental organization, utilizes a mobile delivery system that travels to patient populations with special access needs and provides a variety of dental services. The program is supported by individual donors, foundation grants and corporate sponsors.¹²

As the dental hygiene scope of practice increases with changes to supervision requirements, underserved populations may benefit from services provided by dental hygienists in school-based clinics. An example is a bill passed in Kansas in 2003 that allows dental hygienists to earn an Extended Care Permit (ECP) to provide a wide range of preventive services in community settings under the sponsorship of a dentist. This permit allows dental hygienists to provide preventive services without being under the direct supervision of a dentist if the services are provided to vulnerable populations and/or in public health or community-based clinics.¹³ School-based safety-net dental clinics utilizing an expanded scope of practice dental hygienist, such as an ECP dental hygienist, appear to be a promising solution to address access to care issues related to personnel and cost of care. However, one of the key considerations in making these clinics sustainable and replicable is whether additional financial support from an external source is necessary to maintain program viability.

The Miles of Smiles Program

Miles of Smiles is a collaborative program between the University of Missouri-Kansas City (UMKC) School of Dentistry, elementary schools within the Olathe School District (located in Olathe, Kansas – a suburb of Kansas City), an Extended Care Permit Dental Hygienist (ECP-I), and the REACH Healthcare Foundation. These organizations partnered together to provide preventive oral health services to disadvantaged children in 4 schools with a high proportion of low income population.^{14,15} The services were provided 2 days per week by senior dental hygiene students enrolled at the UMKC School

of Dentistry and are supervised by a faculty member who currently holds a Kansas dental hygiene license and an ECP-I. The ECP-I dental hygiene faculty member serves as the project manager on the Miles of Smiles project.

The program began during the 2008 to 2009 school term. During the first year of operation, 389 students were enrolled in the program, and services were provided to 339 students. The demographic information for the participants is documented in Table I. More information about the operation of the Miles of Smiles Program is provided in part one and part two of this series.^{14,15}

Purpose and Research Questions

The purpose of this study was to conduct a thorough cost analysis of the Miles of Smiles program during the 2008 to 2009 school year. The following research questions guided the analysis:

- What are the costs of operating the program?
- How does the cost of operating the program compare to the amount of Medicaid reimbursement received for the services provided?
- What would a similar program cost if staffed by paid dental professionals only?

Methods and Materials

Data Sources

Data related to the services provided in the Miles of Smiles program during the 2008 to 2009 school term were obtained from an existing database. The database was previously created by extracting de-identified information from the electronic patient records. A list of the equipment and supplies necessary to run the program were provided by the program manager and the prices of all items listed were obtained by contacting sales representatives of dental supply companies.

Data Compilation

To begin the analysis of the direct costs associated with the program, all equipment and supplies necessary to run the program were separated into 2 categories: fixed costs and variable costs. Unless otherwise noted, all durable equipment and instruments were assumed to have a useful life of 5 years and were depreciated over the same period using the straight-line depreciation method.

The researcher observed the daily operation of the program for 3 days to determine the aver-

Table I: Demographic Information of 2008 to 2009 Miles of Smiles Program Participants

Category	Number (n)	Percentage (%)
Age		
0 to 5 years	4	1
6 to 8 years	165	42.4
9 to 14 years	215	55.3
Unknown	5	1.3
Gender		
Male	213	54.8
Female	176	45.2
Race/Ethnicity		
Hispanic	193	49.6
Caucasian	117	30.1
Black	49	12.6
Asian/Pacific Islander	19	4.9
Two or More Reported	9	2.3
Unknown	2	0.5

age quantities of disposable supplies and materials needed for each procedure. This information was utilized to prepare standard cost profiles associated with each billable service provided. Since the design of the Miles of Smiles Program utilizes supervised senior dental hygiene students to provide the services as part of their service-learning curriculum, the cost associated with the program manager's salary and benefits was the only direct personnel cost for this program. The benefits were determined using the customary formula of 35% of the annual salary.¹⁶

Facilities and Administration cost equal to 50% of the direct costs were added to fully account for indirect operating costs. The indirect operating cost rates are based on the policies of the UMKC Office of Research Services.¹⁶ Indirect operating costs include expenses such as utilities associated with operating the program, storage for the equipment, transportation of equipment to the various sites, and data management for statistical purposes and Medicaid claims. Personnel within the Patient Accounts office at the UMKC School of Dentistry assisted with the program by submitting and processing all Medicaid claims for patients treated within the program.

The amount of Medicaid reimbursement received for each patient encounter was also documented in the database and utilized to make the comparisons. In addition, the average hourly salary of dental hygienists in the state of Kansas was obtained from the Bureau of Labor Statistics to compare the cost of this program to a similar program staffed by dental professionals only.

Table II: Fixed Costs – Equipments and Instruments

Equipment and Instruments	Quantity	Price Per Unit	Total Price	Life Span (in years)	2008 to 2009 Cost
Portable operatory	2	\$4,355.00	\$8,710.00	5	\$1,742.00
Portable light	2	\$1,104.00	\$2,208.00	5	\$441.60
Portable chair and carrying case	2	\$3,270.00	\$6,540.00	5	\$1,308.00
Operator Stool	4	\$574.00	\$2,296.00	5	\$459.20
Operator Stool - Carrying Case	4	\$190.00	\$760.00	5	\$152.00
Handheld Extraoral X-ray	1	\$7,495.00	\$7,495.00	5	\$1,499.00
Positioning Stand w/ Remote Activation	1	\$750.00	\$750.00	5	\$150.00
Carrying Case	1	\$465.00	\$465.00	5	\$93.00
Digital Scanner, Eraser, and Phosphor Plates	1	\$19,000.00	\$19,000.00	5	\$3,800.00
Child-size Lead apron	2	\$77.99	\$155.98	5	\$31.20
Laptop Computers w/ software	4	\$2,400.00	\$9,600.00	5	\$1,920.00
Printer	1	\$249.00	\$249.00	5	\$49.80
Ethernet cord	1	\$8.99	\$8.99	5	\$1.80
Extension cord/Surge Protector	2	\$18.00	\$36.00	5	\$7.20
Rubbermaid organizers	6	\$37.00	\$222.00	5	\$44.40
Rubbermaid storage totes	10	\$10.00	\$100.00	5	\$20.00
Autoclave w/ cassette	1	\$4,299.99	\$4,299.99	5	\$860.00
Sterilization Maintenance/Service and Strips (monthly)	12	\$16.67	\$200.04	1	\$200.04
Ultrasonic Cleaner w/ powder	1	\$349.99	\$349.99	5	\$70.00
Child Blood pressure cuffs	2	\$109.00	\$218.00	5	\$43.60
Stethoscope	2	\$5.99	\$11.98	5	\$2.40
Ultrasonic	2	\$2,629.00	\$5,258.00	5	\$1,051.60
Ultrasonic inserts (sets of 3 S,L,R)	4	\$409.00	\$1,636.00	1*	\$1,636.00

*Life span determined by contacting manufacturer and determining the average lifespan of instruments/cavitation inserts used 2 to 4 times per week

Results

Operating Costs

The fixed costs for the 2008 to 2009 school year were determined from the program inventory list. Because all equipment except certain dental hygiene instruments were assumed to have useful lives of 5 years, annual cost was determined by dividing the purchase/market price of each by 5. Given the amount of expected use in the program, the dental hygiene instruments were expected to last approximately 1 year, therefore, the entire purchase price of all instruments was included in the calculation. The sum of these prices totaled \$19,990.61. This figure represents the total fixed costs for the Miles of Smiles Program for the 2008 to 2009 term (Table II).

The variable costs were determined from the standard cost profiles for each billable procedure (Table III). The majority of the patient encounters were multi-procedure encounters, therefore, the procedure-specific standard cost profiles were combined to represent the expense for the entire encounter. The number of each multi-procedure encounter performed was then multiplied by the cost per encounter to determine the total cost associated with disposable supplies (Table IV).

The total direct cost associated with operating the Miles of Smiles Program during the 2008 to 2009 school term was determined by adding the fixed and variable costs of equipment and supplies and personnel expenditures, totaling \$71,677.16

Table II: Fixed Costs – Equipments and Instruments (continued)

Equipment and Instruments	Quantity	Price Per Unit	Total Price	Life Span (in years)	2008 to 2009 Cost
Slow speed handpieces	6	\$785.00	\$4,710.00	5	\$942.00
Roto Quicks handpieces	3	\$210.00	\$630.00	5	\$126.00
Napkin Clip/Metal chain	10	\$4.49	\$44.90	5	\$8.98
Mirror (price figured by adding handle + mirror)	10	\$4.71	\$47.10	1*	\$47.10
Shepherd's Hook Explorer	10	\$12.99	\$129.90	1*	\$129.90
11/12 Explorer	10	\$16.99	\$169.90	1*	\$169.90
Nebraska Sickle Scaler	10	\$32.99	\$329.90	1*	\$329.90
204 S Posterior Scaler	10	\$32.99	\$329.90	1*	\$329.90
Columbia 13/14 Curette	10	\$32.99	\$329.90	1*	\$329.90
Air/Water Syringe tips	10	\$6.15	\$61.50	1*	\$61.50
Gracey 1/2 Curette	3	\$32.99	\$98.97	1*	\$98.97
Probe	3	\$21.99	\$65.97	1*	\$65.97
Curing light Unit	4	\$494.99	\$1,979.96	5	\$395.99
Intraoral Camera Dock	1	\$2,265.00	\$2,265.00	5	\$453.00
Intraoral Camera	1	\$3,815.00	\$3,815.00	5	\$763.00
Digital Camera w/ lenses and flashes	1	\$499.00	\$499.00	5	\$99.80
Sealant applicator handle	4	\$7.99	\$31.96	5	\$6.39
Mouth props	4	\$19.50	\$78.00	5	\$15.60
Patient mirrors (handheld)	2	\$8.99	\$17.98	5	\$3.60
Fans	2	\$15.00	\$30.00	5	\$6.00
Safety glasses	6	\$6.99	\$41.94	5	\$8.39
Storage unit for supplies	1	\$80.00	\$80.00	5	\$16.00
Total Fixed Costs			\$86,356.75		\$19,990.61

*Life span determined by contacting manufacturer and determining the average lifespan of instruments/cavitation inserts used 2 to 4 times per week

(Table V). The total direct cost was then multiplied by 150% to account for the standard Facilities and Administration Rate, and therefore calculate the total costs associated with operating the program. The total indirect costs were \$35,838.58 (Table V). Therefore, the total cost associated with operating the Miles of Smiles Program during the 2008 to 2009 school term was \$107,515.74 (Table V).

Medicaid Reimbursement for Services Provided

The Miles of Smiles Program provides services to any child that qualifies for the Free and Reduced Fee Lunch program, regardless of Medicaid coverage. The only form of reimbursement the program receives is from Medicaid claims for children with coverage. Of the 339 participating children, 144 (42.5%) had Medicaid coverage. The total amount of Medicaid reimbursement during the 2008 to

2009 term was \$1,618, representing 1.5% of the total costs (\$107,515.74) of operating the program.

Comparison to Programs Staffed by Paid Dental Professionals

If a similar program staffed by paid dental professionals was to be developed, cost differences would primarily arise from 2 sources: salaries/wages and the time it takes to perform the procedures. To determine the costs associated with employing a paid ECP-I registered dental hygienist, the hourly salary listed on the Bureau of Labor Statistics website was utilized. For the state of Kansas, the mean hourly salary for a registered dental hygienist is \$30.92.¹⁷ Assuming that the registered dental hygienist works the standard 2,000 hours per year, the annual salary would be \$61,840, and the total benefits package would equal \$21,644, using the

Table III: Standard Cost Profiles for Billable Procedures

Procedure	Cost	Items Included in Cost Calculation
Child Prophylaxis	\$9.85	Prophy Angle, Prophy Paste, 2x2 Gauze, Floss, Saliva Ejector, Patient Napkin, Infection Control Barrier Wraps, Sterilization Bags, Clinician Mask and Gloves, Toothbrush, Toothpaste, Floss, Disclosing Solution, Medicine Cups for Disclosing Solution
Two Bitewing Radiographs	\$0.41	Phosphor Plate Film Sleeves, Disposable Bitewing Tabs
Fluoride Varnish Treatment	\$1.56	Fluoride Varnish*
Sealants (per tooth)	\$2.87	Cotton Rolls/Dri-Angles, Sealant Material (single dose), Etchant Material (single dose)

*All students received fluoride varnish at the time of Child Prophylaxis so no additional supplies were needed for the application

Table IV: Cost of Supplies Used in Multi-Procedure Encounters

Multi-Procedure Encounter Category	Cost Per Encounter	Quantity	2008 to 2009 Total Cost
Prophy + Bitewings + Fluoride Varnish + Sealants + Oral Hygiene Instruction	\$11.82(86)+2.87(246)	86	\$1722.54
Prophy + Bitewings + Fluoride Varnish + Oral Hygiene Instruction	\$11.82	171	\$2021.22
Prophy + Fluoride Varnish + Oral Hygiene Instruction	\$11.41	28	\$319.48
Prophy + Fluoride Varnish + Sealants + Oral Hygiene Instruction	\$11.41(4)+2.87(12)	4	\$80.08
Prophy + Bitewings + Oral Hygiene Instruction	\$10.26	2	\$20.52
Prophy + Oral Hygiene Instruction	\$9.85	3	\$29.55
Prophy + Bitewings + Fluoride Varnish	\$9.58	9	\$86.22
Prophy + Fluoride Varnish	\$9.17	1	\$9.17
Oral Hygiene Instruction Only	\$2.59	3	\$7.77
Total Costs of Disposable Supplies			\$4,296.55

n=number of sealants placed for all Multi-Procedure Encounters in that category

customary 35% rate.¹⁶ This suggests that an additional \$10.82 should be added to the hourly wages to account for benefits as well, for a total of \$41.74.

Since the program does not operate 2,000 hours per year, the program manager’s 1,456 hour contract plus additional time for administrative duties was used for this calculation. It was estimated that approximately 8 hours per week would be spent performing administrative tasks. Since the program provided services approximately 30 weeks during the 2008 to 2009 school year, an additional 240 hours were added to account for administrative duties. This suggests that \$70,791.04 (\$41.74 multiplied by 1,696 hours) should be allocated for salary and benefits if a paid dental hygienist provided services for a program in operation the same amount of hours as Miles of Smiles. This figure is \$23,401.04 higher than the \$47,390.00 allocated for salary/benefits for the program manager and unpaid dental hygiene students (Table VI).

In addition, all ECP-I dental hygienists are required to carry a Professional Liability Insurance policy. Although a variety of liability insurance policies exist, the cost of the policy sponsored by the American Dental Hygienists’ Association was used for the calculation. The annual policy is \$77; therefore, \$77 was added to the personnel costs for a program staffed by a paid dental hygienist (Table VI).¹⁸

When services were provided, the time required to complete them was documented in 15 minute increments. The average time spent per encounter was 3.18 units, or approximately 48 minutes. Although the literature does not provide a definite average time per encounter for registered dental hygienists, it can be assumed that a licensed professional with experience will likely perform procedures faster than a dental hygiene student that must have an instructor verify the accuracy of the treatment provided at many stages throughout the encounter. The American Dental Association’s

Survey of Dental Practice states that the number of patient visits per hour by pediatric dentists that employ part-time or full-time dental hygienists increases by 1 to 2 patients when including hygienist visits.¹⁹ This suggests that the time per encounter by a dental hygienist likely ranges from 30 to 60 minutes. Since a dentist is not present to perform an exam (minimizing the amount of appointment time needed), an estimate of the amount of time it would take for a registered dental hygienist to perform preventive services is 30 minutes.

If a program was in operation 248.75 hours (14,925 minutes) per school year (the approximate amount of time the Miles of Smiles Program was in operation according to the time per encounter documented in the database), a dental hygienist could potentially have 497 patient encounters (14,925 minutes, 30 minutes per encounter) as compared to the 313 patient encounters of the Miles of Smiles Program. The price per encounter varies depending upon the procedures performed and supplies needed, but the average cost per encounter during the 2008 to 2009 school term was \$11.82. If a dental hygienist has 184 more encounters the cost of supplies will increase by approximately \$2,174.88 (Table VI).

On the other hand, increased numbers of patient encounters results in increased production. According to the database, the average production per encounter for the Miles of Smiles Program in 2008 to 2009 was \$81.93. This was calculated using Medicaid reimbursement rates for each procedure performed within the encounter. Whenever possible, a typical encounter included radiographs, prophylaxis, fluoride treatment, patient education and sealants. An additional 184 encounters could result in an approximate \$15,075.12 increase in production. Since the program's only form of reimbursement for services provided is through Medicaid, the additional production does not necessarily suggest additional reimbursement. Of the \$25,643 that was produced by the Miles of Smiles Program, only \$1,618 was reimbursed by the Kansas Medicaid Program. This equals approximately 6.3% of the total amount produced. It has been determined, however, that the program was not able to collect the entire amount of billable services for children with Medicaid coverage due to issues with transferring the data in a timely manner, therefore, that figure does not accurately represent the reimbursement potential. Since the data does not provide an accurate comparison of the expected reimbursement for additional production, no conclusions can be drawn based on the additional amounts of reimbursement expected. Assuming all other expendi-

Table V: Total Cost of Operating the Program During the 2008 to 2009 Term

Expenditure	Associated Cost
Fixed costs for equipment and instruments (Table II)	\$19,990.61
Variable costs – supplies utilized during patient encounters (Table IV)	\$4,296.55
Personnel expenditures	\$47,390.00
Total Direct Costs	\$71,677.16
Standard facilities and administration rate	
50% of total direct costs	\$35,838.58
Total Indirect Costs	\$35,838.58
Total Cost	\$107,515.74

Table VI: Comparison of Costs for Miles of Smiles to a Program Staffed by an Extended Care Permit Registered Dental Hygienist

Expenditure	Cost for Miles of Smiles	Cost for a School-Based Program Staffed by ECP Dental Hygienist
Fixed costs – equipment and instruments	\$19,990.61	\$19,990.61
Variable costs – supplies utilized during patient encounters	\$4,296.55	\$4,296.55 + \$2174.88 = \$6,471.43
Personnel expenditures	\$47,390.00	\$70,791.04 + \$77.00 = \$70,868.04
Total Direct Costs	\$71,677.16	\$97,330.08
Standard facilities and administration rate (50% of total direct costs)	\$35,838.58	\$48,665.04
Total Indirect Costs	\$35,838.58	\$48,665.04
Total Cost	\$107,515.74	\$145,995.12

tures are the same, the cost of operating a similar program staffed by a licensed dental professional rather than supervised dental hygiene students is \$145,995.12, a total of \$38,479.38 more than the cost of the Miles of Smiles Program.

Discussion

Although this study supports the contribution that the program has made in improving access to care for vulnerable populations, it also highlights

the financial challenges in long-term sustainability of such a program.

Sustainability

When reviewing the cost of operating the Miles of Smiles program, it is evident that the costs associated with operating the program far exceeded the minimal amount of reimbursement received. Such a significant gap between the amount of reimbursement and cost highlights that funding from external sources is necessary for the program to continue long-term. It should be noted, however, that challenges associated with transferring data and billing contributed to the significant reimbursement gap. The program manager reports that during the first year of operation, the program was using a "store and forward" method of data collection and tracking as opposed to "real time" data collection, therefore, the data was often not transferred to the Patient Accounts office in a timely manner. According to an estimate, a total of \$17,104 could have been reimbursed for services provided to Medicaid eligible children, however, only \$1,618 was billed and collected due to aforementioned challenges. If the entire amount of \$17,104 was collected from Medicaid reimbursement, that figure would represent approximately 67% of the total production and approximately 16% of the overall costs of operating the program during the 2008 to 2009 school year. This figure is more closely aligned with Byck's findings discussed previously.⁵ Recognizing this difference, the process has since been addressed and the program currently has a more effective method of transferring this data between the treatment site and the business office in "real time."

Despite these challenges, the potential amounts of reimbursement that could have been collected still suggest that the program does not generate enough revenue to sustain itself without external funding. Although grant funding was available initially to purchase a majority of the equipment and instruments and to help with personnel expenses, for the program to continue to operate in this capacity, securing additional and constant sources of external funding would be necessary. This is consistent with other school-based programs discussed in the literature that have been in operation for several years and rely on external funding from a variety of sources.^{11,12}

If the program were to become self-sustainable, significant modifications to the design of the program would be necessary. In 2008 to 2009, the program recorded a total of 248.75 hours providing services. According to the Kansas Depart-

ment of Education, all elementary schools within the school district must be "open for business" for 1,116 hours per year.²⁰ Therefore, services were provided during only 22% of the time that school was in session. It is possible that if the program were operating at a higher capacity, more reimbursement could be generated to help offset the expenditures. Furthermore, the possibility of adding a restorative component to the program could be explored. Adding this component would not only allow the program to operate at a higher capacity, but could also result in higher amounts of reimbursement as restorative procedures are reimbursed at a higher rate.

Limitations

The limitations of this study include the potential bias associated with performing the cost analysis on the program's first year of operation. Most new programs experience challenges in defining the procedures and policies associated with daily operation. As the program has continued to operate, these processes have been refined and contributed to the program running more efficiently. The program manager reported making changes to the enrollment processes to increase the number of students in the program. A higher volume of students suggests that the program has become more efficient in providing treatment and generating patient encounters to verify that all the children enrolled in the program receive treatment.

Several assumptions were made in making the comparisons between the Miles of Smiles Program and a similar program staffed by a dental professional, as there is no published literature related to the average amount of time dental hygienists spend providing preventive services for children. It was assumed that a program staffed by paid dental hygienists would use identical equipment and amounts of supplies and that all patient encounters would take an average of 30 minutes. Despite the assumptions, the results do provide an estimated cost prediction for professionals that are interested in implementing a school-based program.

Directions for Future Research

This study lends itself to several opportunities for future research. Now that the Miles of Smiles program has been in operation for several years, the processes have been refined and resulted in increased productivity and an improved system for filing insurance reimbursement claims. An updated, identical cost analysis of the Miles of Smiles Program would allow for valuable comparisons of productivity as the program has evolved. This

would eliminate any bias associated with analyzing the program's first year of existence.

Since the Miles of Smiles Program operated only 22% of the time that school was in session during 2008 to 2009, it is worth exploring the change in costs if the program were operating at various increased capacities and its effect on the program's sustainability. Operating at a higher capacity will result in an increase in variable costs and personnel expenses so the impact that a change in program design would have is unclear.

It is recommended that further research take place to compare the cost-analysis to a school-based preventive oral health program already established that utilizes paid dental professionals. As stated previously, several assumptions were made when answering Research Question #3, so having exact data related to the time allotted per procedure, the supplies used and administrative duties would provide a more precise comparison to the Miles of Smiles program. In addition, some existing school-based programs provide both preventive and restorative treatment by employing a dentist and a dental hygienist. Making comparisons between the costs associated with these programs and reimbursement rates to that of a preventive program only could provide support in determining if the program can minimize costs and increase reimbursement rates if restorative procedures are provided as well.

Conclusion

Within the limitations of this analysis, the following conclusions can be drawn:

- The cost of operating the Miles of Smiles Program in 2008 to 2009 was \$107,515.74.
- The amount of Medicaid reimbursement for services provided in 2008 to 2009 was \$1,618.00. This represents 6.3% of the total amount produced and 1.5% of the program's total annual operating cost. A total of \$17,104 could have been reimbursed for services provided to Med-

icaid-eligible children, but challenges associated with data transfer and billing procedures resulted in a much lower reimbursement rate. These challenges have been addressed and the data is being transferred in "real time" to facilitate billing. The data suggests that even if the entire \$17,104 would have been collected, the program is not self-sustainable and additional sources of funding for long-term operation need to be secured.

- If a similar program staffed by dental professionals was implemented, the program would cost approximately \$38,479.38 per year more. This increase is attributed to higher salaries/wages, more supplies used, and the costs associated with administrative duties. Although more reimbursement is predicted, it will not off-set the additional costs.
- There have been several lessons learned for the Miles of Program since its first year of operation in 2008 to 2009. Since the program has had time to refine the processes and procedures, it is likely that some of this data may vary if a current analysis was performed on the program.

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