

Source: Journal of Dental Hygiene, Vol. 79, No. 2, Spring 2005

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Should Dental Hygienists Replace Dental Directors in Screening High-Needs Children?

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Purpose. The purpose of this research was to determine whether dental hygienists are as effective as dental directors in screening high-needs children who require emergency care.

Methods. In 2000, the Community Dentistry Health Services Research Unit (CDHSRU) at the University of Toronto completed a prospective cohort study to determine whether care proposed by dental directors exposed to evidence-based practices was significantly different from the care provided by dental hygienists who screened children enrolled in the provincially mandated Children in Need of Treatment (CINOT) program.

Results. The dental directors and dental hygienists each prepared a treatment plan for the 71 children enrolled in this study. These plans were analyzed using a paired t-test model after being translated into relative value units (RVU). It was determined that there was no statistically significant difference between the overall dental treatment proposed by the dental hygienists and the treatment proposed by the dental directors ($p=.749$). A similar analysis stratified by subject site and by service type also showed no significant differences.

Conclusions. The results suggest that dental hygienists are equally as effective as dental directors in screening high-needs children and may be capable of assuming the role of first point of contact for children within high-need dental programs.

Keywords: Screening, high-need patients, emergency care, children, CINOT, dental hygienists, public health, dentistry

Introduction

Public health dental hygienists (henceforth referred to as PHDH) are an integral part of the dental screening programs in Ontario schools. As part of the Province's Health Promotion and Protection Act, Public Health Units (PHUs) are mandated to screen all junior and senior kindergarten entrants (five- and six-year-olds), as well as provide screening in high-need elementary schools and at the PHU itself.

While the general screening is performed by a licensed PHDH and a certified dental assistant, screening to determine the eligibility of a high-need child for treatment under the Children in Need of Treatment (CINOT) program is the responsibility of the PHU dental director. This is a resource-intensive responsibility often held by one person within each PHU.

Review of the Literature

There is limited but encouraging evidence in the literature that dental hygienists can be as effective as dentists in screening patients. In Sweden, where dental hygienists are licensed to practice independently, a study comparing dental hygienists' capabilities at diagnosing dental decay relative to dentists' showed that there was no significant difference in the identification and recording of dental decay, with the exception of initial lesions, which were identified more frequently by the dental hygienists.¹ A US study also demonstrated that dentists and dental hygienists had good inter-examiner reliability when screening for dental caries among children in the first and fifth grades.²

A 2000 Swedish study in a nursing home setting also showed that there was "acceptable" inter-examiner agreement between dentists and dental hygienists.³ The authors noted that the difference was often due to a dental hygienist's propensity to err on the side of caution, thereby over-reporting oral conditions as compared to dentists.

Conversely, a British study measuring the validity of having dental hygienists perform school screenings following a standard training program showed that the dental hygienists did not achieve the required levels of sensitivity and specificity. The authors concluded that this training was insufficient for the dental hygienists.⁴

The limited evidence provided by the literature seems promising, and there is also literature to support community-based interventions by dental hygienists,⁵ but the current body of evidence is insufficient in determining whether or not the role of Canadian PHDH should be expanded. Furthermore, the available evidence does not necessarily apply to the very specific conditions that surround children enrolled in the CINOT program. With these limitations in mind, this study's objective was to determine whether PHDH would be as effective as dental directors in screening high-need children, thereby decreasing the current burden on dental directors.

Methods and Materials

In 2000, the Community Dentistry Health Services Research Unit (CDHSRU) at the University of Toronto completed a 12-month prospective cohort study to determine whether care proposed by dental directors exposed to evidence-based practices was significantly different from the care provided by private practitioners treating children enrolled in the CINOT program. A secondary research question of this study was whether the care that PHDH would propose significantly differed from the care proposed by dental directors and, if this was the case, what were the differences in treatment cost. This paper looks specifically at the partial data collected for the purpose of addressing the secondary research question.

The subjects under study were PHDH who were part of the screening program for children enrolled in the Ontario CINOT program. Each participating PHU had one PHDH and dental director team. Subject pairings were therefore not random. In Ontario, PHDH hold the same credentials as registered dental hygienists, but have opted to work in a public health setting. Working in this setting does not require additional certification.

Children enrolled in CINOT are routinely screened by dental directors from their local PHU and, if they require urgent care, are eligible for coverage through CINOT, sent to a practitioner in the community to receive treatment. In this study, the children themselves were not the actual subjects, but they were used to compare practice patterns of different private practitioners. Children for this study were recruited by the dental directors of four PHUs who agreed to participate in this study. Prior to participating in this study, all the dental directors completed a one-day training course on a number of evidence-based guidelines that were devised by the CDHSRU at the University of Toronto.⁶ Topics covered included topical fluoride use, dental prophylaxis, and sealant use. Details on these guidelines are available elsewhere in the literature.^{7,8} The participating PHDH also attended these training courses. The trained dental directors approached parents of CINOT-eligible children to recruit them as part of this study. Parents agreeing to enroll their children were required to sign an informed consent form.

In addition to requesting treatment information and x-rays, dental directors were also responsible for conducting a clinical exam on each child and preparing a treatment proposal, which included both Ontario Dental Association (ODA) procedure and tooth codes (henceforth referred to as Plan B). The same was expected of the PHDH who screened the enrolled children

(henceforth referred to as Plan A). Each study participant was allowed as much time as they deemed necessary for screening each individual child. However, no data were collected on the amount of time required for each screening. Participants (both PHDH and dental directors) did not work with other staff during their screenings, but children were screened by both the PHDH and dental director during the same visit. It is unknown, although likely, that the PHDH and dental director discussed their findings following the completion of the screening forms.

The following inclusion and exclusion criteria were used to select children for participation in this study:

Inclusion:

- Child had been identified as needing urgent care;
- Parents did not have dental insurance;
- Parents had declared that dental care would create a financial burden for them;
- Child was an Ontario resident up to/including age 13 or on last school day of eighth grade, whichever came later;
- Parents consented to have their child included in the study;
- The invoice for complete dental care under CINOT was received;

Exclusion:

- Children for whom consent was not given;
- Children who were still receiving care at the end of the study period, as determined from the submitted CINOT claim form.

The different treatment plans were recorded using relative value units (RVU). RVU is a formula developed by the ODA which permits the calculation of relative values of different services. Each service is assigned an estimated time factor required to perform the service (measured in 15-minute increments), as well as a measure of its difficulty or responsibility. The product of these two variables are then used to calculate the RVU. The basic unit of service used to calculate an RVU is an occlusal amalgam restoration on a bicuspid tooth.⁹ The rationale behind the RVU system is that this "system embodies information respecting current methods and practices in the delivery of dental care which have a bearing on the resulting time and responsibility."¹⁰

RVUs were used because they allowed the researchers to standardize collected information across all dentists; determine a composite measure of time and complexity or responsibility of procedures; establish a monetary value for the services rendered; and compare similar and dissimilar services. This was done using an Statistical Package for Social Scientists (SPSS v. 10, Chicago, IL) syntax file designed specifically for this purpose.

All procedures were classified into one of eight categories according to the ODA's classification system: diagnostic, preventive, restorative, surgical, endodontic, periodontic, orthodontic, and adjunctive. The dependent variable in this study was the individual difference in RVUs for each child enrolled in the study-overall, by PHU, and by service category. The child was used as a proxy for each subject pair (PHDH versus dental director) involved in this study.

Based on the results collected, five analyses were conducted:

RVU for all cases by plan;

RVU by service type and plan;

RVU by plan, stratified by PHU;

RVU by service type and plan, stratified by PHU;

Procedure counts by service type and plan, stratified by PHU.

A paired t-test analysis was performed in order to look at the difference in care proposed by the dental director (Plan B), and the care proposed by the PHDH for each individual (Plan A). As the dental directors were trained in evidence-based practices targeted specifically at this subset of the population, their treatment plans were considered to be the gold standard with which PHDH treatment plans were to be compared. Data were determined to be normally distributed, and a level of significance of $p < 0.05$ was used for all analyses.

Results

Analysis of RVU for all cases by plan

A total of 71 children were recruited to participate in this study, with an unequal distribution of cases between PHUs. PHU A recruited eight cases, PHU B recruited 25 cases, PHU C recruited 24 cases, and PHU D recruited 14 cases. Using a paired t-test model, comparing Plan A and Plan B for each child, it was determined that there was no statistically significant difference between the overall treatment proposed by the PHDH (Plan A) and the treatment proposed by the dental directors (Plan B) ($p = .749$).

Analysis of RVU by service type and plan

Table I shows a comparison of RVUs by service type and plan. All of the paired t-tests in Table I included all 71 children. None of the service types displayed a statistically significant difference. Endodontic services approached significance ($p = .06$).

Table I. Mean RVUs of Dental Services Provided to Children by Service Type and Plan

Service	Plan A – Mean RVU	Plan B – Mean RVU	P-value
Diagnostic	0.48	0.45	.457
Preventive	1.03	0.98	.614
Restorative	7.78	7.94	.702
Surgical	0.62	0.60	.877
Adjunctive	0.09	0.00	.159
Endodontic	0.65	0.85	.060
Total	10.65	10.81	.749

Analysis of RVU by plan, stratified by PHU

Despite the small number of cases for each PHU (especially PHU A), a comparison of total RVUs for Plan A and Plan B, stratified by PHU, resulted in no statistically significant differences within PHUs (Table II). Although Plan B overall is moderately more RVU-intensive than Plan A, this is primarily due to PHU B. All other PHUs had more RVU-intensive Plan As than Plan Bs, although this was not statistically significant.

Table II. Mean RVUs and Range of Dental Services Proposed/Provided to Children by PHU

PHU	Plan A – Mean RVU (Range)	Plan B – Mean RVU (Range)	P-value
A (n=8)	9.29 (3.39-18.14)	9.23 (3.14-18.14)	.966
B (n=25)	14.47 (1.0-41.42)	15.31 (1.25-40.17)	.385
C (n=24)	8.11 (3.0-29.95)	7.89 (1.25-34.33)	.742
D (n=14)	8.98 (3.64-20.04)	8.69 (2.89-27.39)	.835
Total (n=71)	10.65 (1.0-41.42)	10.81 (1.25-40.17)	.749

Analyses of Procedure Count and RVU by service type and plan, stratified by PHU

Table III highlights mean RVUs of dental services by service type and plan. With respect to Plan A, three of the four participating PHUs did not propose diagnostic care. Also, three of the four PHUs did not propose adjunctive care. Finally, one PHU did not prescribe any preventive care, and another PHU did not prescribe any endodontic care.

Table III. RVUs of Dental Services Provided to Children by PHU, Service Type and Plan

PHU	Service	Plan A	Plan B	P-value
		Mean RVU per Child	Mean RVU per Child	
A	Diagnostic	0	0	1.0
(n=8)	Preventive	0.95	1.10	.563
	Restorative	5.90	6.63	.455
	Surgical	1.50	0.56	.140
	Adjunctive	0	0	1.0
	Endodontic	0.94	0.94	1.0
	SUBTOTAL	9.29	9.23	.966
B	Diagnostic	0	0	1.0
(n=25)	Preventive	1.65	1.31	.126
	Restorative	11.05	11.64	.389
	Surgical	0.36	0.66	.327
	Adjunctive	0.25	0	.161
	Endodontic	1.15	1.7	.02
	SUBTOTAL	14.47	15.31	.385
C	Diagnostic	0	0	1.0
(n=24)	Preventive	1.02	1.18	.346
	Restorative	6.75	6.37	.552
	Surgical	0.34	0.34	1.0
	Adjunctive	0	0	1.0
	Endodontic	0	0	1.0
	SUBTOTAL	8.11	7.89	.742
D	Diagnostic	2.42	2.27	.474
(n=14)	Preventive	0	0	1.0
	Restorative	4.78	4.74	.976
	Surgical	1.07	0.96	.671
	Adjunctive	0	0	1.0
	Endodontic	0.71	0.71	1.0
	SUBTOTAL	8.98	8.69	.835
OVERALL	Diagnostic	0.48	0.45	.457
(n=71)	Preventive	1.03	0.98	.614
	Restorative	7.78	7.94	.702
	Surgical	0.62	0.60	.877
	Adjunctive	0.09	0	.159
	Endodontic	0.65	0.85	.06
	TOTAL	10.65	10.81	.749

While the paired t-test analysis stratified by service type (Table I) demonstrated that there were no significant differences in the treatment plans drawn up by PHDH and by dental directors for any service type (Table III), the paired t-test analysis stratified by PHU and by service showed a statistically significant difference in the RVU intensity reported for endodontic services prescribed in PHU B ($p=.02$). Furthermore, the difference in the procedure count for endodontic services was also statistically significant ($p=.036$), while none of the other subgroups was statistically significant, both in terms of RVUs and procedure counts (Table IV).

Table IV. Count of Dental Services Procedures Provided to Children by PHU, Service Type and Plan

PHU	Service	Plan A	Plan B	P-value
		Total Count	Total Count	
A (n=8)	Diagnostic	0	0	1.0
	Preventive	12	14	.563
	Restorative	22	4=26	.227
	Surgical	8	3	.140
	Adjunctive	0	0	1.0
	Endodontic	6	6	1.0
	SUBTOTAL	48	49	.732
B (n=25)	Diagnostic	0	0	1.0
	Preventive	48	44	.356
	Restorative	95	89	.387
	Surgical	8	16	.327
	Adjunctive	2	0	.161
	Endodontic	19	28	.036
	SUBTOTAL	172	177	.744
C (n=24)	Diagnostic	0	0	1.0
	Preventive	39	45	.341
	Restorative	87	79	.363
	Surgical	6	6	1.0
	Adjunctive	0	0	1.0
	Endodontic	0	0	1.0
	SUBTOTAL	132	130	.862
D (n=14)	Diagnostic	65	56	.309
	Preventive	0	0	1.0
	Restorative	40	34	.082
	Surgical	13	12	.671
	Adjunctive	0	0	1.0
	Endodontic	5	5	1.0
	SUBTOTAL	123	107	.205
OVERALL (n=71)	Diagnostic	65	56	.295
	Preventive	99	103	.626
	Restorative	244	228	.181
	Surgical	35	37	.825
	Adjunctive	2	0	.159
	Endodontic	30	39	.060
	TOTAL	475	463	.597

Discussion

There is very limited literature on the clinical appropriateness of relying on dental hygienists to screen patients for oral health and treatment. Moreover, the available evidence does not address screening in communities with very specific needs, such as those of the children enrolled in this study. Therefore, the results presented below provide new evidence that should be considered in the debate.

The results described above showed that there was no overall statistically significant difference in the quantity and types of services prescribed by PHDH relative to what was deemed appropriate by dental directors, based on evidence-based practice guidelines. However, a few observations are worth noting and discussing.

Despite a small sample size (n=70), the overall differences reported here were clearly non-significant. The only service type that approached statistical significance was endodontic service (p=.06). However, this difference does not represent a large absolute difference in the amount of RVUs recommended by each group (0.20 RVUs); the difference is primarily due to the large relative difference due to the small values of the actual totals prescribed (0.65 versus 0.85 RVUs).

Furthermore, when the analysis was stratified both by service type and by PHU, the differences remained strongly non-significant, with the notable exception again of endodontic services. In many instances, there were no differences at all between the paired values for Plans A and B, resulting in p-values of 1. Ten subgroups (services stratified by PHU) had p-values of 1; of those, eight were due to both Plans A and B having no RVUs prescribed. However, two subgroups (endodontic services in PHU A, and surgical services in PHU C) both prescribed services of the same magnitude. A further investigation into the prescribed procedure codes and the related tooth codes showed the following.

With respect to endodontic services in PHU A, the total and average RVUs were the same for both plans, and each plan included four children. In addition, both plans reported the same number of recommended procedures. However, of the four children who were proposed for endodontic care, two were given slightly different treatment plans, while the other two children were prescribed identical endodontic care. With respect to the two children with disparate treatment plans, the first one was due to an additional tooth being prescribed endodontic care by the dental director, and the second one was due to an additional tooth being prescribed endodontic care by the PHDH. In both cases, both children were prescribed some endodontic care by both groups, but evidently there was some discrepancy in the amount prescribed by each group.

In the case of surgical services prescribed by both the PHDH and dental directors in PHU C, a closer investigation of tooth and procedure codes show that both plans were identical. In the case of endodontic services in PHU B, it appears that the differences in both RVUs and in the number of procedure codes were statistically significant. Closer inspection shows that, while both PHDH and dental directors prescribed more treatment for some disparate cases, overall, the majority of additional procedures were prescribed by the dental directors than by the PHDH. Overall, this translated into an additional nine procedures, equal to an average of an extra 0.55 RVUs (CAN\$16.50) per child.

How do these results translate in terms of practice? Despite the sample size and subsequent power being insufficient to justify a policy change, this study's results are encouraging enough to warrant further research. Given this study's population and its very specific needs, this limited evidence suggests that it may be sufficient to train PHDH to identify these needs, thereby reducing the screening burden that is currently placed on dental directors, and potentially reducing costs.

Given that the study group included only children who required emergency dental care, it was not possible to calculate kappa coefficients for the two groups under study, as this would have required the enrollment of children with varying degrees (including absence) of oral health conditions. Further studies should include children with varying dental health to truly test inter-examiner agreement.

Those who argue that there would be a significant difference in the quality of screening and in the resulting amount of care recommended need only look at the results from this study and from studies mentioned previously.^{1,2} Differences in the magnitude of RVUs across PHUs were not systematically in the same direction, nor were differences in the total procedure counts. However, it should be noted that endodontic services, which were not covered in the one-day course, were the services that seemed to display the most discrepancy between PHDH and dental directors, with the difference being systematically due to additional care being prescribed by the dental director. It is plausible that this was due to the additional post-secondary education required for dental directors. While this observation is of clinical importance and may warrant additional PHDH endodontic education, the total difference in the value of mean treatment per child was under \$5 (one RVU equals \$30), which was not statistically significant.

Conclusion

The potential cost savings resulting from shifting the screening responsibility from the dental directors to the PHDH could be considerable. Given that CINOT financing is a municipal burden, shifting the screening responsibility could result in important cost savings and potential resource redistribution at the municipal level. This study also demonstrates the skill set that dental hygienists can bring to promoting oral health in their communities, provided that they are offered additional training in certain services, such as endodontics.

Acknowledgements

The author acknowledges the support of the Community Dentistry Health Services Research Unit (CDHSRU) at the University of Toronto in all stages of this study.

Notes

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